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Musical Forces in Claude Vivier's Wo bist du Licht! and Trois airs pour un opéra imaginaire

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Abstract

Claude Vivier's (1947–1983) idiosyncratic and moving composition style often evades traditional, pitch-centred approaches to music-theoretical analysis; however, the somatic and sensual qualities of his style encourage a metaphorical appreciation of his music. This study analyses *Wo bist du Licht!* (1981) and the first two *airs* from *Trois airs pour un opéra imaginaire* (1982), which both feature his *technique sinusoïdale*, from the perspective of conceptual metaphor and musical forces. At the centre of this study are the dominant conceptual metaphors that linguist George Lakoff and philosopher Mark Johnson identify as being integral to our understanding of time, and which music theorist Arnie Cox demonstrates also underlie our concept of motion and change in music.

My approach builds on Steve Larson's theory of musical forces, which qualifies the musical motion metaphor by invoking musical analogues to gravity, magnetism, and inertia. These, Larson demonstrates, operate in a predictable way in tonal music. The post-tonal context of Vivier's music requires modification of Larson's approach. To this end, I incorporate concepts borrowed from Robert Hatten and Matthew BaileyShea. From Hatten, I borrow the notion of a musical agent, and analogues to friction and momentum, only I qualify musical momentum as a combined perception of musical mass (manifested as register, density, and texture) and velocity (manifested as tempo). From BaileyShea, I borrow the concept of water and wind as non-sentient, unpredictable environmental forces. The wave and wind metaphors are particularly adept at conveying the changes in texture and intensity that the *technique sinusoïdale* affords. Because they complement force metaphors, I also include energy and other embodied, non-motion metaphors (e.g., kinetic/potential energy, pressure, timbre). Although not forces-based, timbre metaphors have corporeal connotations that are helpful in converying the changing mental states suggested in the second *air* of *Trois airs*.

These metaphors rely on our intuitive understanding of motion and embodied experience to convey musical change. They enable us to discuss more phenomenological, abstract

musical attributes by drawing on a familiar vocabulary rooted in sensorimotor experience. This approach resonates particularly well with the sensual nature of Vivier's music.

Keywords

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Chapter 1: Introduction to Claude Vivier and an Embodied, Metaphoric Approach

For some composers, their best work stems from the maturity that usually comes with years, when the culmination of experience and crystallized intelligence seems to precipitate brilliance. (Maybe death, which lurks closer on the horizon with each passing year, plays a part in spurring that creativity.) For others, brilliance and creativity exude from the vigour of youth. Although Claude Vivier (1948–83) was denied the opportunity to mature beyond the age of thirty-four, the impressive opus he generated in just ten short years has earned him international recognition. While his gruesome murder may have initially bolstered his reputation (tragedy sells), the steady growth of his posthumous following testifies to his originality and skill as a composer. We can only speculate as to what might have been had Vivier been granted more time.

Critic Harry Halbreich once commented that "[Vivier's] music is unlike any other; it lies entirely outside the ordinary. Direct and deeply moving, only those with dry hearts fail to appreciate his genius. Claude managed to find what so many have searched for (and continue to search for): the secret of a genuine, new simplicity."[1] French composer Gérard Grisey lamented that Vivier's early demise came just as he was developing "so original" a style that was "of tremendous harmonic quality, both primitive and sensual, hieratic in its expression."[2] György Ligeti said "his music touched me by its deeply moving originality. Vivier possessed a fantastic sonic (aural) imagination. He also had a genial gift for large form. He was neither neo, nor retro, but at the same time was totally outside the avant-garde. It is in the seduction and sensuality of the complex timbres that he reveals himself to be the great master that he is."[3]

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[1] Harry Halbreich, cited in Yassen Vodenitcharov, "Claude Vivier, une figure singulière dans le paysage musical contemporain," (mémoire de DEA, École des Hautes Études en Sciences Sociales, Paris, 1997), 144. All translations from the French are mine unless otherwise indicated.

[2] Gérard Grisey, cited in Vodenitcharov, "Claude Vivier," 44, 48.

[3] György Ligeti, "Sur la musique de Claude Vivier: propos recueillis par Louise Duchesneau," *Circuit: Revue nord-américaine de musique du XXe siècle* 2/1–2 (1991): 7–15. The quotation is a paraphrased portion of the interview that appears on the issue's back cover.

Originality and sensuality appear often in descriptions of Vivier's music, as do lyricism, melody, and non-directionality, even stasis. This last characteristic requires a bit of qualification. For Julian Anderson, it refers to Vivier's "strong preference for static, ritualistically block-like forms."[4] For Martine Rhéaume, it refers to the "static melodic outlines" that involve "melodic formulae that imply nothing but themselves or their own continuation and don't create significant musical implications for the listener."[5] Finally, for Vivier, it is the implication that "[u]sually in music, you have some development, some direction, or some aim, which in my music happens less and less. I just have statements, musical statements, which somehow lead nowhere. Also on the other hand, they lead somewhere but it's on a much more subtle basis."[6] Yet, even impressions of stasis often reflect an embodied response to music since they presuppose comparisons with change and motion.

What these quotations seek to impress upon the reader is the immediate and embodied experiential aspect of Vivier's music. Both Grisey and Ligeti stress the sensuality of his timbres, which evoke an immediate response in the listener. Likewise, the melodies, unusually lyrical, captivate the listener without overt prediction of their direction. The interest lies in the musical process, not the goal. Most traditional analytical approaches, which emphasize pitch relations (as abstract patterns), struggle with these more phenomenological qualities. Since these qualities are of vital importance in Vivier's music, analysis of his music requires an approach geared towards capturing the embodied and sensory experience. Such an approach would inquire into the musical experience by asking what features of the music remain constant from one moment to the next, which ones differ, what physical or psychological impact do they have on the listener, why or how do they create the effects that they do, and so on. It invites the analyst to participate in the unfolding of the music by being aware of his or her response to the music's

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[4] Julian Anderson, "A Provisional History of Spectral Music," *Contemporary Music Review* 19/2 (2000): 17.

[5] Martine Rhéaume, "Stylistic Transitions in Vivier's Emergent Musical Style," *British Postgraduate Musicology*, 10 (2009): 3.

[6] Claude Vivier, interview by Susan Frykberg, "Claude Vivier in Conversation," *Musicworks: The Journal of Sound Exploration* 18 (1982): 8–9.

changing qualities. In Vivier's style, these changing qualities have sensual characteristics that strongly allude to a metaphorical appreciation of his music. An analytical approach that builds on this appreciation gives the more phenomenological, interpretive dimensions of his music a voice by framing them in terms of a shared, more familiar, context, like our experience of motion.

This study approaches the analysis of *Wo bist du Licht!* (1981) and *Trois airs pour un opéra imaginaire* (1982) from the perspective that we understand musical change as a metaphorical extension of our experience of spatial relations; that is, we infer musical relations by making correspondences with what we know of spatial relations. The approach centres on linguist George Lakoff and philosopher Mark Johnson's theory of conceptual metaphor, which Arnie Cox extends and develops to explain time, change, and motion in music. My approach combines Cox's spatialization of musical qualities with Steve Larson's theory of musical forces to emphasize the embodied aspect of musical motion, which I adapt for the post-tonal context of Vivier's music with concepts borrowed from Robert Hatten and Matthew BaileyShea. In *Trois airs pour un opéra imaginaire* I also incorporate timbre metaphors to capture the changing mental states that Vivier's music evokes.[7]

My decision to focus exclusively on *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire* is threefold: First, these works feature Vivier's *onde sinusoïdale* (sinusoidal wave) technique, a breakup of the homophonic texture with multiple, simultaneous polyphonic lines that each mimic the repetitive contour of a wave.[8] The technique adds a momentum to his spectra (explained in sections 1.5 and 1.6), or motile quality, that is less common in his previous works; *Wo bist du Licht!* expresses it most strongly. Second,

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[7] George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago: Chicago University Press, 1980); *Philosophy in the Flesh: The Embodied Mind and Its Challenges to Western Thought* (New York: Basic Books, 1999); Arnie Cox, "The Metaphoric Logic of Musical Motion and Space," (Ph.D. diss., University of Oregon, 1999); Steve Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music* (Bloomington, IN: Indiana University Press, 2012); Robert Hatten, "Musical Forces and Agential Energies: An Expansion of Steve Larson's Model," *Music Theory Online* 18/3 (2012); Matthew L. BaileyShea, "Musical Forces and Interpretation: Some Thoughts on a Measure in Mahler," *Music Theory Online* 18/3 (2012); Theo van Leeuwen, *Speech, Music, Sound* (London: Palgrave Macmillan, 1999); Rebecca Leydon, "Clean as a Whistle: Timbral Trajectories and the Modern Musical Sublime," *Music Theory Online* 18/2 (2012).
[8] A Glossary of Vivier's analytical terms is given in Appendix A.

both works veer further away from the melody formula inspired by Stockhausen's *Mantra* (1970), showing a different approach to form. They also derive their melodies from the spectra, whereas in previous works the spectra were derived from the melody. Finally, as the last completed work in Vivier's catalogue, *Trois airs pour un opéra imaginaire* shows the new direction Vivier's music was beginning to take. In a letter to his close friend, Thérèse Desjardins, dated August 10th 1982, he described it as a "rediscovery of counterpoint," that would be "rather sad music" but "probably one of my most beautiful and deepest works."[9] Indeed, this last work possesses a harrowing beauty (especially the end of the second air) that leads the listener through changing mental states with its timbres.

One of the difficulties of this study is the integration of quantitative and qualitative analysis. The phenomenological approach developed here relies heavily on descriptive language to convey an embodied hearing, and while it is indeed highly qualitative, it is not arbitrary. The musical metaphors and narratives are grounded in the structural, quantifiable characteristics of the music, which I initially relate to familiar embodied concepts and experiences, like motion, weight, pressure, etc. By appealing to commonly shared domains of experience, which are tied to recognizable structures in the music, I have tried to bridge the qualitative-quantitative dichotomy and guard against total interpretive relativism. For this reason, the structural aspects of the music are discussed first in the analyses, followed by the metaphoric interpretations.

The remainder of this first chapter establishes the context for Vivier's compositions. It contains a biography, an overview of the influence Stockhausen and the school of French spectralism had on his style, a survey of the secondary literature on Claude Vivier and the conceptual metaphor of musical motion, and finally an introduction to the structural design of Vivier's spectra.

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[9] Claude Vivier, quoted in Bob Gilmore, *Claude Vivier: A Composer's Life* (Rochester, NY: Rochester University Press, 2014), 206.

1.1 Biography[10]

Shortly after his birth in 1948, Claude Vivier was placed in the care of *La crèche Saint Michel*, a Catholic orphanage in Montreal. There, Claude remained until the Viviers, a family of modest means, adopted him during the Christmas holidays of 1950. Jeanne and Armand Vivier already had an eighteen-year-old son (Marcel) and a seventeen-year-old daughter (Gisèle), but the loss of a baby girl in 1930 had left a void. Since the orphanage had no girls in their care (Jeanne wanted a girl), the Viviers took in Claude. Gisèle and Armand were very fond of Claude, but Jeanne never warmed up to him and her lack of maternal love left its mark, as the texts of *Ojikawa* (1968), *Journal* (1977) and *Lonely Child* (1980) attest. In part, Jeanne's health problems impeded her ability to cope with Claude. Although Claude's home was not a happy one, early accounts paint him as an amiable, precocious, imaginative, but very sensitive child.

When Claude was approximately eight years of age, his godfather (his paternal aunt's husband), who lived on the first floor of the Vivier home, raped him while the rest of the family attended church. Claude only disclosed the incident to his mother after a priest forced his hand by denying him forgiveness until he did. Jeanne was reportedly furious with Claude for coming forth and causing a scandal, a scandal which may have precipitated the family's change of address shortly afterwards, and Claude's placement in a boarding school several years later.

Between the ages of thirteen and eighteen, Vivier attended the Catholic boarding schools *Juvénat Inférieur Notre-Dame* and *Juvénat Supérieur Saint-Joseph,* then the *Novicat des Frères Maristes* (1966–67) in preparation for a vocational life with the Catholic Institute of Marist Brothers. Exposure to music, Latin, Greek, and philosophy proved to be an enriching experience; however, shortly after becoming a postulant, Vivier was asked to withdraw. The brothers felt Vivier's keen interest in music and poetry and extreme

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[10] Unless otherwise stated, the biographical information in subheading 1.1 is taken from Gilmore, *Claude Vivier*.

sensitivity made him a poor candidate for the discipline and structure that a vocational life demands.[11]

Although Vivier took the rejection hard, the expulsion enabled him to pursue music. In 1967, he began studies in piano and composition at the Conservatoire de musique de Montréal (CMM). His composition and analysis courses with Gilles Tremblay proved to be the gateway to his musical career. During Vivier's four years at the CMM, he earned several distinctions, including first prize in both analysis and composition in his final year. With the financial aid of the Canada Council for the Arts, Vivier moved to Cologne in June 1971 with the intention of studying with Karlheinz Stockhausen, but was rejected for the 1971–72 academic year. As an alternative, Vivier studied conducting and orchestration with Paul Méfano in Paris (summer 1971) and electronic music with Gottfried Michael Koenig at the Institute of Sonology in Utrecht (fall and winter 1971–72). A second attempt at joining Stockhausen's class proved successful.

At this time (1972–74), Stockhausen had recently composed *Mantra* (1970), the first of his "formula" works whereby all musical material derives from a basic melody, or formula. This new approach to composition also reflects the increasingly mystical turn Stockhausen's spirituality was beginning to take. Possessed with a similar faith, Vivier embraced Stockhausen's mysticism wholeheartedly. At this time, Stockhausen's integral serialism was becoming a source of contention for many of his students (e.g., Clarence Barlow, Kevin Volans, Walter Zimmerman), as was the religious bent of his work;[12] however, Vivier remained devoted to Stockhausen's teachings, which likely resulted in his partial isolation from the Cologne group. In a discussion with Christopher Fox, Kevin Volans described Vivier as being "totally in love with Stockhausen and his method,"

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[11] Although Vivier told his friends Thérèse Desjardins and Clarence Barlow that his expulsion was related to his homosexuality, Gilmore does not find definitive corroborating evidence for this statement. If Vivier's sexual orientation or proclivities played a part (and they could have), it remains conjecture, 19.

[12] In 1974, Gerhard Stäbler, Johannes Vetter, and Jürgen Lösche published a political pamphlet satirizing the spiritual inclinations of Stockhausen's work. The pamphlet was a foretaste of Stockhausen's later removal from Darmstadt courses. Gilmore, *Claude Vivier*, 91–92.

which is why he was "ignored" by many of his classmates.[13] Unusually dedicated, Vivier kept up with the demanding workload in Cologne and attended every one of Stockhausen's rehearsals, classes, and concerts.

Vivier returned to Canada in 1974 where, with the exception of one semester of teaching (Fall 1975), he managed to scrape together a meagre living through composition alone. The following winter (1976–77), Vivier travelled to the Middle East and South-East Asia, including Indonesia. In particular, his time in Bali seems to have awakened him to an Eastern aesthetic. While Vivier may have derived fresh inspiration from his travels,[14] many of the Eastern characteristics in his music were present beforehand (e.g., emphasis on ritual, foreign percussion instruments, cyclic structures, and raga or pelog-like pitch collections). As many have noted, Vivier had ample exposure to such sounds through Stockhausen, Gilles Tremblay, and Messiaen (via Gilles Tremblay).[15] In terms of wholly new sources of inspiration, nothing surpasses Vivier's first-hand interaction with gamelan. After his return, Balinese compositional techniques begin to infiltrate his compositions, particularly *Pulau Dewata* (1977), *Zipangu*, *Orion* (1979), and *Cinq chansons pour percussion* (1980). *Pulau Dewata* represents a kind of juncture in Vivier's oeuvre, the incipience of his own voice as a composer.[16]

Works composed between *Pulau Dewata* and *Lonely Child* (1980) show Vivier was searching for a means to reinvent or verticalize the musical parameter of melody. This endeavour was most likely prompted by the superposition of melodies in gamelan, which

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[13] Kevin Volans, quoted in Christopher Fox, "Where the River Bends: The Cologne School in Retrospect," *The Musical Times* 148/1901 (2007): 40.

[14] Janette Tilley, "Eternal Recurrence: Aspect of Melody in the Orchestral Music of Claude Vivier," *Discourses in Music* 2/1 (2000).

[15] Janette Tilley, "Eternal Recurrence;" Ross Braes, "An Investigation of the *Jeux de Timbres* in Claude Vivier's *Orion* and His Other Instrumental Works 1979–1980," (Ph.D. diss., University of British Columbia, 2003); Jean Lesage, "Claude Vivier, *Siddhartha*, Stockhausen, la nouvelle simplicité et le *râga*," *Circuit: musiques contemporaines* 8/3 (2008): 107–20; Peter Tannenbaum, "Claude Vivier Revisited," *SoundNotes: An Independent Review of New Music in Canada*, 1(1991):12–27; Györgi Ligeti, "Sur la musique de Claude Vivier;" Jacques Tremblay, "L'écriture à haute voix: *Lonely Child* de Claude Vivier," *Circuit* 11/1(2000): 107–120.

[16] Fabrice Marandola, "Dossier enquête: *Pulau Dewata*: des arrangements raisonnables?" *Circuit* 18/3 (2008): 53.

Vivier understood as the generative, inherent properties of melody.[17] This pursuit led to the *jeux de timbres,* i.e., the pre-compositional schemes used to structure harmony and timbre in the instrumental works of 1979–1980.[18] Vivier found the sound he was looking for when he attended French composer Tristan Murail's lecture on spectral techniques (*l'addition des fréquences*) during the summer courses at Darmstadt in 1979. Shortly afterwards, Vivier began incorporating spectra (in the form of combination tone chords) into his compositions, of which the first is *Lonely Child*.

Although Vivier was making inroads in Canada (e.g., the Canada Music Council awarded him the Composer of the Year in 1981, in large part for his opera *Kopernicus*),[19] he felt musically isolated in Montreal. Vivier applied for yet another grant from the Canada Council for the Arts to relocate to Paris, the centre of the spectral movement,[20] to write his second opera, which would be based on the death of Tchaikovsky. As soon as the grant was approved in November 1981, Vivier left Montreal. The opera never saw fruition, for Vivier's career was cut tragically short by his brutal murder on the night of March 7th. After several missed appointments, friends grew suspicious and contacted the police. Police found the thirty-four-year-old composer in his apartment, strangled and stabbed, four days after the attack. Vivier met the murderer, twenty-year-old Pascal Dolzan, earlier in the evening and invited him to his flat. Just three weeks earlier, Dolzan had killed two other gay men in the Marais district. Although Vivier was his last victim, police did not apprehend Dolzan until late October.[21]

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[17] While we often think of harmony as being inherent in melody, Vivier discovers through kotekan that a melody also has inherent complementary melodies. Claude Vivier, "Trois lettres de Bali," *Circuit* 2/1–2 (1991): 77.

[18] See Ross Braes, "An Investigation."

[19] The Canada Music Council (1946–1990) was an umbrella organization for the development of music in Canada (liaison between government, granting agencies, university departments, and musicians), but dismantled due to the overlap with other agencies such as the Canada Council for the Arts and the Canadian Music Centre.

[20] Feedback Studios in Cologne was another centre for spectralism. Anderson, *A Provisional History*, 15.

[21] "Claude Vivier est trouvé étranglé à Paris," *Le Devoir* (Montreal), 14 March 1983; Claude Gingras, "Adieu, Claude Vivier!," *La presse* (Montreal), 14 March 1983; Jacques Longchampt, "Le Compositeur Claude Vivier," *Le Monde* (Paris), 15 March 1983; "Composer found dead," *The Gazette* (Montreal), 14 March 1983; Carol Bergeron, "La disparition d'un grand talent," *Le Devoir* (Montreal), 19 March 1983; René Viau, "La prison à vie pour le meurtrier de C. Vivier," *La Presse* (Montréal), 26 November 1986.

1.2 Review of the Literature

Biographical Sources for Claude Vivier

Bob Gilmore's 2014 well-researched biography, *Claude Vivier: A Composer's Life*, amasses a wealth of information collected from records and interviews with friends, family, acquaintances, and colleagues associated with every stage of Vivier's life, save for the early years in the orphanage.[22] This most welcome source investigates in detail the events and circumstances that shaped Vivier's life and career, thus providing greater context for understanding Vivier's very personal compositional style. It is fortunate that such a biography was written while those having a major influence on his life were able to tell their stories.

Another important source is *Circuit: revue nord-américaine de la musique du XXe siècle* 2/1–2 (1991). The Montreal-based journal published a large selection of Vivier's writings (poems, travel log, essays, magazine articles, and program notes) from the *Archives Claude Vivier* (housed at the Université de Montréal).[23] Alongside Vivier's writings, this issue contains an interview with György Ligeti on Vivier's music (conducted by Louise Duscheneau), an annotated catalogue by Jaco Mijnheer and Thérèse Desjardins, and a critical discography (with extensive commentary) by Johanne Rivest. Also, Lucie Paquin's MA thesis gathers a wide range of source material published between 1960–85, including program notes, press releases, concert notices, concert reviews, newspaper and encyclopaedic articles, and analyses.[24]

Finally, there are two documentaries featuring valuable interview material. The one prepared by Maryse Reicher for Radio-Canada's anthology of selected works by Claude Vivier contains an interview with Gilles Tremblay and clips from a 1981 interview Vivier

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[22] Bob Gilmore made the decision not to pursue the identity of Vivier's birth mother. Gilmore, *Claude Vivier*, 5.

[23] Texts were selected and authorized by Thérèse Desjardins, founder of *Les amis de Claude Vivier*, later known as the *Fondation Vivier*.

[24] Lucie Paquin, "Claude Vivier: Recueil commenté des sources musicologiques (1960–1985)," (Mémoire MA, Université de Montréal, 1990).

had with Radio-Canada producer Claude Cubayner.[25] Cherry Duyn's documentary, added as a bonus feature to *Rêves d'un Marco Polo,* contains interview footage of conductor Reinbert de Leeuw, Thérèse Desjardins, Clarence Barlow, and Gisèle Vivier.[26] (*Rêves d'un Marco Polo* is an *opéra fleuve* in two parts featuring full staged productions of *Kopernikus* (1980), *Prologue pour un Marco Polo* (1981), *Shiraz* (1977), *Lonely Child* (1980), *Zipangu* (1980), *Wo bist du Licht!* (1981) and *Glaubst du an die Unsterblichkeit der Seele* (1983) by the Schöenberg Ensemble, directed by Reinbert Leeuven.)

Analytical Sources for Claude Vivier

Most analytical sources explore the external influences in Vivier's style, with emphasis either on Stockhausen and Eastern music, or techniques associated with electronic music or French spectralism. Peter Tannenbaum, Janette Tilley, Ross Braes, Bob Gilmore, and Jean Lesage all discuss the similarities between Stockhausen's *Mantra* and Vivier's works from the mid-1970s, especially *Lettura di Dante* (1974), *Siddhartha* (1976), and *Orion* (1979). Where Janette Tilley attributes the monadic quality and Eastern elements in Vivier's style primarily to Stockhausen, others like Tannenbaum, Lesage, Ligeti, and Jacques Tremblay also stress the contribution that Gilles Tremblay (and by extension Messiaen, and even Varèse), Gregorian chant, and Catholic Liturgy played in his predilection for melody.[27] The most detailed explanation of how the *Mantra* techniques manifest themselves in Vivier's work comes from Montreal composer Jean Lesage's analysis of *Siddhartha*. He suggests Vivier's penchant for simplicity exemplifies the avant-garde backlash associated with *Neue Einfachheit*. Lesage also highlights the influence of Indian raga and Herman Hesse's novel bearing the same name.[28]

Tilley and Braes also explore the connection between Vivier's superimposed melodies and pitch collections with Balinese gamelan, specifically *kotekan* (interlocking melodies)

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[25] "Documentaire sur Claude Vivier préparé et lu par Maryse Reicher, journaliste," *Claude Vivier – Anthology of Canadian Music*, Radio Canada International ACM36, 1990.

[26] Cherry Duyn, "Claude Vivier (Documentary)," *Rêves d'un Marco Polo*, Opus Arte OA 0943 D(2–DVD), 2006.

[27] See Gilmore, "Claude Vivier and Karlheinz Stockhausen;" and sources cited in footnote 15.

[28] Jean Lesage, "Claude Vivier, *Siddhartha*, Stockhausen."

and *pelog* scales. Classical percussionist and ethnomusicologist Fabrice Marandola succinctly outlines Vivier's use of Balinese techniques in his article comparing arrangements of *Pulau Dewata*.[29] These techniques, which include phasing, kotekan, parallelism, contrary motion, and superposition, define the formal, pitch, and rhythmic structure of *Pulau Dewata*. As Marandola points out, they enable Vivier to evoke the spirit of Bali without resorting to transcription or replication.

In addition to contextualizing Vivier's notes on the techniques (and the Western biases they reflect), Marandola's article explains how the layout of the gamelan instruments influences the pitch structure. Parallelism, for example, does not refer to a sequence of same-size harmonic intervals, but to a parallel displacement on the gamelan "keyboard" (i.e., moving in the same direction by the same degree of separation). Because of the intervallic spacing of the modes, the harmonic intervals that ensue from parallelism will differ in size. Likewise, contrary motion refers to the symmetrical displacement (mirror motion) on the gamelan keyboard.

Jaco Mijnheer's article on the rhythm and durational schemes in *Shiraz* (1977), a work inspired by Stockhausen's *Klavierstück* (1961), also stresses the relationship between instrumental configuration, physical gesture, and structure.[30] The seven formal sections of the piano piece each delineate a different gesture (motion) on the keyboard (e.g., simultaneous divergent motion towards the extremities; simultaneous convergent motion towards the centre; ascending motion from left to right; etc.). This short article is one of the few sources to touch upon Vivier's temporal organization.

Taking a different approach, Martine Rhéaume demonstrates how Vivier's melodic style could be the result of an internally directed, endogenetic process.[31] She traces the evolution of Vivier's melodic style between 1973–75 by conducting a paradigmatic analysis of the vocal works spanning this period, namely *Chants* (1973), *Jesus erbarme*

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[29] Marandola, "Dossier enquête."

[30] Jaco Mijnheer, "Shiraz pour piano de Claude Vivier," *Cahiers de l'ARMuQ* 13(1991): 90–105.

[31] Martine Rhéaume, "Stylistic Transitions in Vivier's Emergent Musical Style," *British Postgraduate Musicology*, 10 (2009): 1–14. This article expands an earlier version, published as "Évolution d'un style musical – Comment Vivier passe-t-il d'une œuvre à l'autre?" *Circuit* 18/3 (2008): 73–88.

dich (1973), *O Kosmos*! (1973), *Lettura di Dante* (1974), and *Hymnen in the Nacht* (1975). Her approach takes as its starting point Leonard B. Meyer's theory of the internal dynamic process of style (i.e., that past compositional choices influence future compositional choices) and applies Claude Levi-Strauss's paradigmatic analysis to tease out and track the transformation of fundamental elements, or formulae, that make up Vivier's melodies.[32] The methodology entails identifying repetitions (the formulae, not to be confounded with Stockhausen's formula), which can apply to motives, cells, ideas, etc., and laying them out in columns to produce a topological map of the formulaic elements of a piece (one column per formula). By comparing the topological maps of the pieces in chronological order, Rhéaume "reconstitute[s] the logic of compositional choices" Vivier made over the course of three years, thereby providing insight into his style.[33] Her findings reveal that the five works stem from eleven formulae, which Vivier modifies over time to show increased complexity followed by greater simplicity. Although the article only presents the formulae for static melodic structures (what Meyer calls "axial melodies"), of which there are three, it nonetheless shows Vivier's economy of means with respect to melodic material.[34]

Ross Braes argues that Vivier's *jeux de timbres* function as a precursor for the *couleurs* that will define his style for the next three years. Braes uses the term *jeux de timbres*, which appears in Vivier's sketches, to describe the "vertical expansion of melody into something quasi-timbral" using "predetermined chords derived from the principal melody (or scale)."[35] By predetermined, Breas means "any systematic arrangement of added pitches applied to the basic melodic or scale pitches." Most often these arrangements

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[32] Paradigmatic analysis was first applied to music by French musicologist Nicolas Ruwet and elaborated by Jean-Jacques Nattiez. Nicolas Ruwet, *Langage, musique, poésie* (Paris: Editions du Seuil, 1972); Jean-Jacques Nattiez, *Fondements d'une sémiologie de la musique* (Paris: Union générale d'éditions, 1975).

[33] Martine Rhéaume, "Stylistic Transitions," 1.

[34] Rhéaume assigns a letter to each formula. Formula A refers to the interval of a minor third; formula B refers to oscillating seconds (both major and minor), and formula D refers to a "constant melody," which can be either sustained or discrete (i.e., a note that is held or repeated).

[35] Ross Braes, "An Investigation," 14.

involve interval classes, harmonics, and mirror inversion.[36] According to Breas, the *jeux de timbres* have their clearest representation in *Orion* (1979).

Yassen Vodenitcharov's analysis of *Orion* derives the chords from pairs of harmonic series (i.e., each eleven-note chord is an amalgam of partials from two separate harmonic series), but allows for octave transpositions of certain partials and the odd "foreign" note.[37] (Vodenitcharov conducts his analysis from the score and program notes alone, not the sketches.) In keeping with Braes, he contends that the chords are timbral in function, not harmonic. This distinction between timbral vs. harmonic function is essential to Vivier's adoption of the aesthetics of French spectralism. Vodenitcharov also includes valuable transcriptions of his interviews with Paul Méfano and Gerard Grisey regarding Vivier's music.

Analytical sources for works composed after *Lonely Child* tend to concentrate on the harmonic dimension of Vivier's combination tone chords, or *couleurs,* as he called them, with particular attention placed on the underlying algorithms.[38] The first of these sources, Jaco Mijnheer's article on the chord structure in *Bouchara* (1981), reconstructs the procedure from Vivier's sketches.[39] Mijhneer concludes that the spectra depend on four factors: the interval between the bass and melody, the number of sum tones in the spectra, the instrumentation, and the algorithm.[40] Ross Braes's dissertation offers partial summaries of Mijnheer's *Bouchara* article and of Peter Tannenbaum's conference paper

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[36] Ibid.

[37] Yassen Vodenitcharov, "Claude Vivier," 110–12.

[38] Jaco Mijnheer, "Het akkoord voorbij," *Maanbld voor Muziek* (January 1998): 10–15; Braes, "An Investigation," Chapter 6, 207–218; Patrick Levesque; "Les voix de Vivier: Langage harmonique, langage mélodique et langage imaginaire dans les dernières oeuvres vocales de Claude Vivier,"(MA thesis, McGill University, 2004); "L'élaboration du matériau musical dans les dernières œuvres de Claude Vivier," *Circuit: musiques contemporaines* 18/3 (2008): 89–106; Bob Gilmore, "On Claude Vivier's 'Lonely Child,'" *Tempo: A Quarterly Review of Modern Music* 16/239 (2007): 2–17; *Claude Vivier*; Bryan Christian, "Combination-Tone Class Sets and Redefining the Role of *les Couleurs* in Claude Vivier's *Bouchara*," *Music Theory Online* 20/2 (2014); "Combination-Tone Class Sets and Redefining the Role of *les Couleurs* in Claude Vivier's *Bouchara*," (Ph.D. diss., Duke University, 2015).

[39] Mijnheer, "Het akkoord voorbij."

[40] Mijnheer, cited in Braes, "An Investigation," 210.

that discusses the chord structure in *Lonely Child*.[41] Literature related to the construction of Vivier's *couleurs* will discussed shortly under subsection 1.6.

As Vivier's best-known work, *Lonely Child* receives more analytical attention than other works.[42] Jacques Tremblay's phenomenological approach places emphasis on sound quality (especially the sensuality of timbre), text setting, and non-retrogradable rhythm. To capture the fusion of melody, harmony, and timbre (and the tension, roughness, and granularity inherent in the *couleurs*), he proposes the term *melodie granulée* (granular melody) in reference to Roland Barthes's *grain de la voix* (grain of the voice).[43]

After an overview of techniques informing Vivier's *couleurs* (which includes Messiaen's chord of resonance, Stockhausen's *Mantra* (form, ring modulation) and Murail's *addition des fréquences*), Bob Gilmore's article concentrates on the formal and textural treatment of the *couleurs,* noting that the "concentration on melody and bass becomes *the* predominant texture;" the dyad "is to [Vivier's] music what the triad is to tonal music."[44] Gilmore includes a transcription of Vivier's "own idiosyncratic description of the form," which lists *Farben*, *haupt Farbe*, *neben Farbe*, *aleatorische Farben*, and *Rythmen* (colour, main colour, neighbouring colour, aleatoric colour, and rhythms) as defining features of each formal section.[45] As will be seen in Chapters 4 and 5, these different manifestations of *couleurs* have an important formal function in *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire* as well.

Patrick Levesque approaches the *couleurs* from a modified Schenkerian perspective. Although the *couleurs* stem from adding frequencies and do not evince the harmonic syntax of tonal music (e.g., I–IV–V–I), the music nonetheless has a tonal or polytonal

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[41] Peter Tannenbaum, "Modernism and Post-Modernism in the Music of Claude Vivier," paper presented at McGill University (1992), cited in Braes, "An Investigation," 210.

[42] Jacques Tremblay, "L'écriture à haute voix;" Gilmore, "On Claude Vivier's 'Lonely Child;" *Claude Vivier*, 166–70; Braes, "An Inverstiation," 210–11; Levesque, "Les voix de Vivier;" "L'élaboration du materiau musical;" Paul Griffiths, *Modern Music Then and After,* 22. Spectralisms (New York; Oxford University Press, 2011), 339–47.

[43] Jacques Tremblay, "L'écriture à haute voix,"47.

[44] Bob Gilmore, "On Claude Vivier's 'Lonely Child,'"12.

[45] Ibid., 11. The German capitalization in this sentence reflects Vivier's notation in the sketches.

quality. The bass notes (or fundamentals) suggest temporary tonal centres (or harmonic poles), which in turn establish pitch hierarchies that lend well to many Schenkerian concepts. In addition to *Lonely Child* and *Bouchara*, Levesque extends this approach to *Prologues pour un Marco Polo*, *Wo bist du Licht!*, and *Trois airs pour un opéra imaginaire*. Aside from Bob Gilmore's biography, the latter three works are not discussed elsewhere.

Conceptual Metaphor and Musical Motion

Although the metaphor of musical motion dates back to antiquity, conceptual metaphor in music, as a subject area, is a more recent phenomenon that gained attention shortly after the publication of linguist George Lakoff and philosopher Mark Johnson's *Metaphors We Live By* (1980). This seminal work, borne out of cognitive science and cognitive linguistics, recasts metaphor as an integral, automatic part of our thought process. It is the principal means by which we understand more abstract concepts, not available through firsthand experience. Since this study centres on the perception of musical motion (i.e., change), musical time, and form in Vivier's *Wo bist du Licht!* and *Trois airs pour un opéra imaginair*e, only sources oriented towards musical motion in music theory of the last century are considered.

In the early twentieth century, energetics (the branch of science concerned with the properties of energy and its redistribution through physical, chemical, and biological processes) inspired new models and theories for the understanding of tonal music. In music theory, energetics refers primarily to the work of August Halm, Heinrich Schenker, Ernst Kurth, Arnold Schering, and Hans Mersmann.[46] These tonal models and theories, which explicate motion in terms of teleological and hierarchical processes, rely on science-based metaphors (e.g., appeals to physical and metaphysical forces, energy, waves, gravity, magnetism, and orbits), and foreshadow contemporary models like Steve Larson's musical forces. The most familiar example of energetic thinking in music is Heinrich Schenker's model of tonality. The *Ursatz*, a structure consisting of a linear

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[46] Lee Rothfarb, "Energetics," in *The Cambridge History of Western Music Theory*, ed. Thomas Christensen (Cambridge: University of Cambridge Press, 2002), 927–955.

melodic descent over a basic progression of I–V–I, serves as the fundamental model of all tonal music. Variety and novelty lie in the elaboration of the middleground and foreground, i.e., the lower structural levels. Musical motion is the realization of this fundamental structure in time. While Schenker's analytical language reflects an overarching organicism, Ernst Kurth's analytical discourse and model derives from mechanics and thermodynamics (which falls under the purview of physics) and metaphysics (which falls under the purview of philosophy). For Kurth, "melody occurs between the tones, in the sweep of kinetic energy that flows through them [as a streaming force] and becomes damned up, as potential energy, in chords [the restrained force]." Influenced by Schopenhauer's notion of psychic forces, Kurth develops a dynamic approach to form that explains the "escalatory and deescalatory undulations that shape the musical flow" in terms of a force-wave.[47]

Victor Zuckerkandl's *Sound and Symbol* (1956), which posits space as a force and music as the manifestation of force (i.e., the manifestation of dynamic relationships) continues the tradition of drawing on physics and psychology; however, unlike previous writings on energetics, it makes the metaphoric origin of musical motion and pitch verticality explicit and argues for the incongruity of musical motion with moving object (objects in space).[48] Instead, musical motion refers to the force that "resides between the tones;" it is "change detached from a thing that changes."[49]

In his study of rhythm, motion, continuity, and phrase structure in post-tonal music, Christopher Hasty establishes a definition of musical motion that applies to all music, not just tonal repertoire.[50] He concludes that motion is a process of unification, or structure formation, that "takes on a special quality of tendency or direction—'toward' or 'away

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[47] Rothfarb, "Energetics," 940, 943.

[48] Victor Zuckelkandl, *Sound and Symbol: Music and the External World*, trans. William Trask (Princeton NJ: Princeton University Press, 1969). Zuckerkandl cites psychologist Max Wertheimer to support this view of musical motion.

[49] Ibid., 136.

[50] Christopher Hasty, "Rhythm in Post-Tonal Music: Preliminary Questions of Duration and Motion," *Journal of Music Theory* 25/2 (1981): 183–216; "Phrase Formation in Post-Tonal Music," *Journal of Music Theory* 28/2 (1984): 167–190; "On the Problem of Succession and Continuity in Twentieth-Century Music," *Music Theory Spectrum* 8 (1986): 58–74.

from.'"[51] It relies on the mutual dependence of change and continuity in continual succession and the psychological phenomenon of the enduring present, which enables us to perceive temporal coherence.[52] Hasty develops many of the same ideas in *Rhythm and Meter*, which proposes the reunification of rhythm and meter as a single process of temporal projection.

In contrast to Hasty's metaphysical concept of musical motion, Justin London's cognitive approach to rhythm and meter (which treats them as separate concepts) associates musical motion with metrical entrainment.[53] London defines entrainment as the capacity to attune to periodicities in our environment in such a way that we accurately anticipate and predict beats. On average, two or more synchronized periodicities are required to induce entrainment, one of which must be a pulse or tactus; however, entrainment is stronger when three or four levels are present.[54]

Judy Lochhead also looks at the dialectic relation between musical motion and temporal flow, noting that the definition and recognition ("determination") of musical structures are "temporal issues related to the problem of how temporal unity itself is possible."[55] Her article begins with an exposition of the logical entailments of the static and dynamic perspectives of time, as outlined in the work of philosopher J.M.T. McTaggart. Musical theories imply aspects of one or both perspectives, which in turn restrict the type of information they reveal.

In their follow-up to *Metaphors We Live By*, *Philosophy in the Flesh*, Lakoff and Johnson devote a chapter to temporal metaphors. They present the static and dynamic perspectives of time as the complementary metaphors MOVING OBSERVER and MOVING TIME.

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[51] Hasty, "Rhythm in Post-Tonal Music," 191.

[52] Philosophers Errol Harris and Henri Bergson inform Hasty's earlier concepts of temporal relations (1981, 1984, 1986), Alfred Whitehead's *Process and Reality* (1929) serves as the metaphysical foundation for his *Meter as Rhythm* (New York: Oxford University Press, 1997).

[53] Justin London, "Temporal Complexity in Modern and Post-Modern Music: A Critique from Cognitive Aesthetics" in *Unfolding Time: Studies in Temporality in Twentieth-Century Music*, ed. Darla Crispin (Ghent, Belgium: Leuven University Press, 2009), 52–53.

[54] Justin London, *Hearing Time* (New York: Oxford University Press, 2004), 25.

[55] Judy Lochhead, "The Metaphor of Musical Motion: Is There An Alternative," *Theory and Practice*, 14/15 (1989/90): 86.

Philosophy in the Flesh avoids the ontological problems raised by McTaggart and Hasty by grounding their approach in embodied realism (this will be taken up in Chapter 2). The sections on primary metaphor, cross-domain mapping, time, and location-event structures are of particular interest to music analysis. Arnie Cox's examination of the logic underlying musical motion and musical time builds on these metaphors. He contends that the spatial, temporal, and musical domains all share the same phenomenology of anticipation, presence, and memory that justifies (or facilitates) our inclination to draw inferences between the three.[56]

Steve Larson's theory of musical forces, which also centres on Lakoff and Johnson's conceptual metaphors, suggests we experience tonal motion as an extension of our embodied experience of motion.[57] Just as physical forces govern our movements and observations of movement, musical analogues to gravity, magnetism, and inertia do the same for tonal melodies. His approach combines the embodied realism of conceptual metaphor with the Schenkerian tonal model. Robert Hatten broadens Larson's theory by adding musical friction, distinguishing between inertia and momentum, and introducing a sentient musical agent as a marker of energy and intention.[58] These modifications help extend the musical forces to non-tonal contexts. By reducing musical forces to a push-pull binary and proposing the inclusion of unpredictable environmental forces, Matthew BaileyShea also helps extend musical forces to a wider range of repertoire.[59] Likewise, Yonatan Malin and Robert Adlington also advocate the use of energy metaphors; however Adlington proposes them (along with other embodied metaphors) as an alternative to motion metaphors since the latter do not always convey the qualities of non-tonal music.[60]

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[56] Cox, "The Metaphoric Logic," chapter 4 "Temporal Motion and Musical Motion," 192–265.

[57] Larson, *Musical Forces*.

[58] Hatten, "Musical Forces and Agential Energies."

[59] BaileyShea, "Musical Forces and Interpretation."

[60] Robert Adlington, "Moving Beyond Motion: Metaphors for Changing Sound," *Journal of the Royal Musical Association*, 128/2 (2003): 297–318; Yonatan Malin, "Metric Analysis and the Metaphor of Energy: A Way into Selected Songs by Wolf and Schoenberg," *Music Theory Spectrum* 30/1 (2008): 61–87.

As a valued analytical tool, conceptual metaphor has applications in almost all areas of music research, including ethnomusicology, music cognition, narratology, semiotics, performance study, gender, musicology, pedagogy, etc. A full account of its breadth falls well beyond the parameters of this project.[61]

1.3 Stockhausen

As a former student of Olivier Messiaen and Pierre Schaffer, and a fixture at Darmstadt, Karlheinz Stockhausen (1928–2007) already had a reputation as a prominent figure of European avant-garde by the time he reached his mid-thirties. Between 1951 and 1971, his compositional philosophy and aesthetic underwent a transformation from what Robert Morgan called "a position of scientific rationalism to visionary mysticism" that is marked by five phases of development: pointillism, group, statistical complexes, moments, and process.[62] When Vivier came to study with him in 1972, Stockhausen was emerging from the latter two. The experimentation and integral serialism that characterise his style in the 1960s extended his reputation (which spread to popular culture) and attracted students from around the world.[63]

From a formal perspective, two related but contrasting developments seem to have emerged simultaneously in Stockhausen's musical thought: moment form and process music (including intuitive music). The former, of which *Moment* (1965) is the only significant example, refers to a theory in which "an event in itself is considered as a temporal phenomenon, rather than a succession of events."[64] Compositions based on moments consist of independent musical events presented in a non-linear, non-directed manner. These musical states, which seem to have an undefined duration, come and go

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[61] For overviews of metaphor's broad application in music analysis, see Lawrence Zbikowski, "Metaphor and Music," in *The Cambridge Handbook of Metaphor and Thought,* ed. Richard Gibbs, Jr. (New York: Cambridge University Press, 2008), 502–24; Michael Spitzer, *Metaphor and Musical Thought* (Chicago: Chicago University Press, 2004).

[62] Robert P. Morgan, "Stockhausen's Writings on Music," *The Musical Quarterly* 75/4 (1991): 203.

[63] For example, Stockhausen appears on the album cover of the Beatles' *Sgt. Pepper's Lonely Hearts Club Band.*

[64] Mark Delaere, "Tempo, Metre, Rhythm: Time in Twentieth-Century Music," in *Unfolding Time: Studies in Temporality in Twentieth-Century Music*, Collected Writings of the Orpheus Institute, ed. Darla Crispin (Ghent, Belgium: Leuven University Press, 2009), 33.

out of nowhere with no clear beginning nor end, and no connection linking one moment to the next. With no causal element, the order and number of the moments can be altered without consequence; their execution is left to the whim of the performer. As Robert Morgan remarks, "if the quality of what was perceived was defined solely by its general character, there could be little sense of a definite, 'causal' connection from one group to the next. One had the impressions of hearing a series of moments—i.e., more or less self-sufficient musical entities of varying length defined by Stockhausen simply as independent ideas with personal and unexchangeable characteristics."[65]

Alternately, Stockhausen's process and intuitive music, e.g., *Mixtur* (1964) and *Plus/Minus* (1963), highlights the transformation between events by emphasizing the "compositional process rather than material itself."[66] These transformations extend serial techniques to a greater range of musical parameters. In short, the 1960s represent a dichotomy: at one extreme, there is the hyper-serialization and highly detailed score notation of all parameters, as in *Mixtur*; at the other, there is the extreme indeterminacy of process pieces like *Plus/Minus* (whose notations consists of "merely symbols indicating types and degrees of change"[67]) or the improvisation of intuitive pieces like *Aus den sieben Tagen* (1968), where musicians just respond to Stockhausen's verbal texts.

By 1972, Stockhausen had adopted a drastic thematic formula style of writing that first appeared in his *Mantra for Two Pianos and Live Electronics* (1970).[68] This style uses a formula (i.e., the melody) to determine all the large and small-scale structural details of the piece.[69] The melody in *Mantra*, reproduced in Figure 1.1a, contains thirteen tones (all

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[65] Morgan, "Stockhausen's Writings," 199.

[66] Ibid., 201.

[67] Richard Toop, "O Alter Duft: Stockhausen and the Return of Melody," *Studies in Music* 10 (1976): 81.

[68] In *Mantra,* each pianist operates a ring modulator and sine wave modulator. The piano signal is picked up by the ring modulator which "modulates" the piano signal with the sine wave (adjusted by the pianist according to specifications in the score) to produce sum and difference tones, which in turn alter the timbre of the piano.

[69] The formal overview of *Mantra* is taken from Richard Toop, "O Alter Duft," 83–85.

twelve pitch classes, with one pitch class repeated) that are divided into four phrases and separated by serially varied rests (in proportions 1:2:3:4). As Richard Toop explains: "Every detail of the melody has a formal function. The articulation, for example, is intended not so much to create variety within the melody as to provide thirteen different types of articulation for the thirteen main sections of the work and the twelve Mantras in each section."[70] These are enumerated in Figure 1.1b.

Figure 1.1a: Formula from Stockhausen's *Mantra*, mm 1–8

1. Regular repetition
2. Accent at the end of the note
3. Normal
4. Grace-note group around the central note
5. Tremolo
6. Chord with note
7. Accent at the beginning
8. Chromatic link
9. Staccato
10. Irregular ("morse") repetitions
11. *Mordent* (bases for trills)
12. *sfz* accent
13. Arpeggio link

Figure 1.1b: Articulations featured in Formula from Stockhausen's *Mantra*

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[70] Ibid., 83.

Each formal section highlights the character of a note from the original melody. In addition to a unique articulation, each note (and its dedicated formal section) is associated with a different intensity level and expanded form of the chromatic scale. The expanded scales strive to include as many pitch classes as possible and increase in range with each formal section. Unlike previous works, which serialise intensity with a dynamic level (e.g., *ppppp–ffffff*), the intensity scale incorporates repetition and crescendi/decrescendi to vary the amplitude. The rhythmic structure consists of similar arithmetic and geometric progressions as Stockhausen's earlier works, e.g., phrases with rhythmic values that decrease by one quarter note with each articulation. In short, the formula represents a set of proportions that governs all spatial and temporal parameters of a work.[71]

We find overt traces of Stockhausen's influence as seen in the example from *Mantra* in Vivier's approach to form and structure, especially in the predetermined material, e.g., tempi scales, additive series, expansion and contraction scales, melodic structure, and large-scale form.[72] However, Stockhausen and Vivier differ in their application of these techniques: where Vivier always maintains a strong aural connection between the transformational processes, Stockhausen's "extreme intellectualization" of them are "esoteric and indiscernible."[73]

Another marker of influence can be seen in Vivier's role as a composer-activist. In the program notes that Vivier wrote for the performance of *Mantra* by the Société de Musique Contemporaine du Québec's (SMCQ), he recounts how Stockhausen would encourage his students to stand up for new music and defend themselves to critics.[74] Vivier's newspaper articles, rebuttal to music critic Claude Gingras,[75] and his co-founding of *les Événements du neuf* (Montreal concert series dedicated to introducing

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[71] Jonathan Cott, *Stockhausen; Conversations with the Composer* (New York: Simon and Schuster, 1973), 264.

[72] See Tilley "Eternal Recurrence;" Jean Lesage, "Claude Vivier, *Siddhartha*, Stockhausen;" Mijnheer, "Shiraz;" Gilmore, "Claude Vivier."

[73] Tilley, "Eternal Reocurrence," http://library.music.utoronto.ca/discourses-in-music/v2n1a3.html.

[74] Claude Vivier, "« Mantra » de Stockhausen," *Circuit* 2/1–2 (1991): 94.

[75] Claude Vivier, "Boudreau ne méritait pas ça!," *La Presse* (Montréal), 29 March 1976.

new music) with José Evangelista and Lorraine Vaillancourt show Vivier took Stockhausen's message to heart.

Because Vivier and Stockhausen shared a similar faith and spiritual-compositional outlook (i.e., as an expression of divine perfection, a symbol of purity), Stockhausen's more esoteric mysticism likely influenced Vivier's beliefs for a time.

1.4 French Spectralism

The term "spectral" was initially given by composer Hugues Dufourt (1943–) to describe music where "the spectrum—or group of spectra—replaces harmony, melody, rhythm, orchestration and form."[76] This new approach to composition, founded by Dufourt, Gérard Grisey (1946–1998) and Tristan Murail (1947–), was born from a combination of forces that emerged between 1967–77, the most important of which was technological advancement (e.g., Fast Fourier Transforms on digital computers). Other contributing factors were, according to Dufourt, "the development of instrumental research; the impact of electroacoustics on musical thought, and above all, the collapse of the social and mental barriers under which the (musical) profession was becoming ossified."[77]

In particular, Dufourt is referring to the post-serial aesthetic that Boulez and other members of the European avant-garde promoted. According to Murail, the serial movement taught Western composers to think of music in terms of permutations of a limited number of symbols (pitch classes or other parameters). Not only did composers consider the pitch classes and other parameters to be the foundation of composition, they came to confuse them for the music itself. As Murail remarked, "sound has been confused with its representation."[78] In an effort to be original, composers became preoccupied with the coherence in the pitch classes' permutations rather than the coherence of the resulting sound. As a result, the music became meaningless in the sense that "there (was) no correspondence between the music perceived by the listener and that

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[76] Viviana Moscovich, "French Spectral Music: An Introduction," *Tempo, New Series* 200 (1997): 22.

[77] Hugues Dufourt, quoted in Moscovich, "French Spectral Music," 21.

[78] Tristan Murail, "Spectra and Sprites," *Contemporary Music Review* 24/2–3 (2005): 137–38.

conceived by the composer."[79] This lack of aural coherence pushed Dufourt, Murail, and Grisey to seek a new aesthetic.

Comparable reactions to post-serialism were being felt in Europe and elsewhere, and spurred similar counter-movements, one of which was American minimalism. Like French spectralism, early American minimalism focused on process, which in turn facilitated listener perception and increased accessibility. In this respect, both movements share a preoccupation for slow, gradual aural processes that maximize the perception of change; however, where American minimalism features "an intentionally simplified rhythmic, melodic, and harmonic vocabulary,"[80] early French spectralism exploits the acoustic properties of sound (sound spectra) and emphasizes durational, non-motivic, non-melodic timbral contrasts. Instead of being a systematic school, Grisey and Murail claim spectral music is more reflective of an attitude towards composition. Joshua Fineberg qualifies this attitude as "sound evolving in time."[81]

Although Vivier did not work with digital sound files as did Grisey and Murail, he adopted combination tone chords and instrumental synthesis in his mature works (1980–1983).[82] As will be seen in the next section, Vivier's combination tones are inspired by ring modulation, an analogue electronic music technique. Vivier's increased interest in time might have been influenced, in part, by French spectralism.[83]

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[79] Ibid., 138.

[80] Keith Potter, "Minimalism" *Grove Music Online, Oxford Music Online*, Oxford University Press, accessed 21 October 2016, http://oxfordmusiconline.com.proxy1.lib.uwo.ca/subscriber/article/grove/music/40603.

[81] Joshua Fineberg, "Spectral Music," *Contemporary Music Review* 19/2 (2000): 2.

[82] Vivier's music does not emphasize very gradual timbral transformations, absence of melody, manipulation of sound files, etc., which we tend to associate with the French spectral movement.

[83] Vivier wrote four reflection pieces on time between 1980–1983, all of which are included in *Circuit* 2/1–2 (1991): "Pour Gödel (1982)," "Cinéma et musique (1981)," "Que propose la musique (1982)."

1.5 Basic Acoustic Concepts

The following describes basic acoustic principles underlying spectra that may be helpful to those with no familiarity with the physics of music.[84] Its sole purpose is to provide a context for the frequency-based chord structures used by Vivier.

Harmonic Series

Our understanding of sound spectra derives from Fourier analysis, which dictates that any function can be mathematically represented as the sum of sine waves having the appropriate amplitude, frequency, and phase. When frequencies of these component sine waves are whole number multiples of a single frequency, they are called harmonic. A set of related harmonics (i.e., having a common denominator) is a harmonic series, with the fundamental (f), the lowest frequency, representing the first harmonic, $2f$ representing the second harmonic, $3f$ the third harmonic, and so on. If the frequencies are not whole-number multiples of the fundamental, they are called inharmonic. Frequency, measured in Hertz (Hz), refers to the number of cycles (periods) per second. While Fourier analysis describes the deconstruction of a function into a series of sine wave elements, Fourier synthesis describes the reversal of this process, i.e., the construction of a function from sine wave elements.

In Figure 1.2, the upper curve shows a complex curve made up of three harmonics; the lower curves show its decomposition into sine waves. Each repetition of the pattern represents a period (or cycle) and can be measured from any point in the curve, i.e., phase. Often, phases are measured in degrees. The vertical lines, for example, mark phases of 0 (or 360) degrees. A period beginning midway through the cycle has a phase of 180 degrees. The three sine waves below the compound curve in Figure 1.2 represent the first three harmonics since their periods are in a ratio of 1:2:3.

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[84] For a detailed discussion on the physics of music, see Neville H. Fletcher and Thomas Rossing, *The Physics of Musical Instruments*, 2ns ed. (New York: Springer, 1998); Gareth Loy, *Musimathics: The Mathematical Foundations of Music,* Volume I (Cambridge, Massachusetts: MIT press, 2006); Gareth Loy *Musimathics: The Mathematical Foundations of Music,* Volume II (Cambridge, Massachusetts: MIT press, 2007); James W. Beauchamp, ed., *Analysis, Synthesis, and Perception of Musical Sounds: The Sound of Music*, Modern Acoustics and Signal Processing (New York: Springer, 2007).
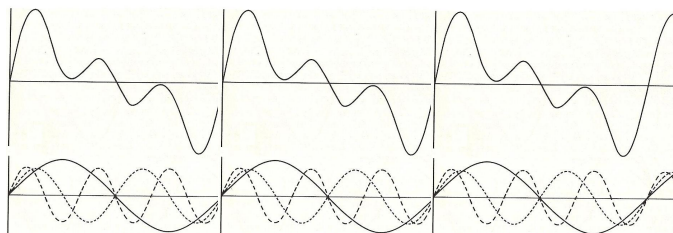
Figure 1.2: Complex curve (above) broken down into harmonics *f*, 2*f*, and 3*f* (below)[85]

Musical Sounds (Envelope and Timbre)

Unlike a mathematical harmonic series (which has an infinite number of harmonics that extend infinitely into the past and future), musical sounds are finite and characterised by a sound envelope, or shape, consisting of an attack (changes that occur as sound reaches its maximum amplitude), a decay (process of decline from the maximum amplitude), steady state (portion of sound when amplitude is sustained), and the release (final decline to zero amplitude). The duration of each stage varies according to the sound, with some stages absent altogether. Among other factors, the instrument, dynamic level, and playing technique will influence the shape of the envelope. In addition to being finite, musical sounds also contain transients that cause them to produce inharmonic overtones (non-integer multiples of the fundamental). Where pitched sounds produce predominantly harmonic overtones (or close to harmonic overtones), unpitched sounds produce inharmonic overtones. In practice, the frequency and amplitude properties of sine waves provide ideal imagery to characterize musical sounds or other patterned noises.[86]

Pitched instruments, especially those that are bowed or blown, produce harmonic overtones resulting in a clear perception of pitch, with the height of the pitch corresponding to the fundamental frequency. What distinguishes one instrumental timbre from another is the waveform it produces, which reflects a specific set of overtones,

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[85] Reproduced (in part) from John Backus, *The Acoustical Foundations of Music* (New York: W.W. Norton, 1977), 111. In the original diagram, the superimposed harmonics *f*, 2*f*, 3*f* is featured above, and the complex curve that results from the addition of the three is featured below. Between the two is a complex curve showing the addition of *f* and 2*f*, which I omitted here. I altered *2f* so that it appears as a broken line.
[86] John R. Pierce, *The Science of Musical Sound*, Revised Edition, (New York: W.H. Freeman and Company, 1992), 44.

amplitudes, and phases over time. Figure 1.3a shows the waveforms of a flute, oboe, and violin playing A4 (left). Although a gross simplification of harmonic spectra, the bar graph in Figure 1.3b shows the contrast in the harmonic amplitudes of the different waveforms.
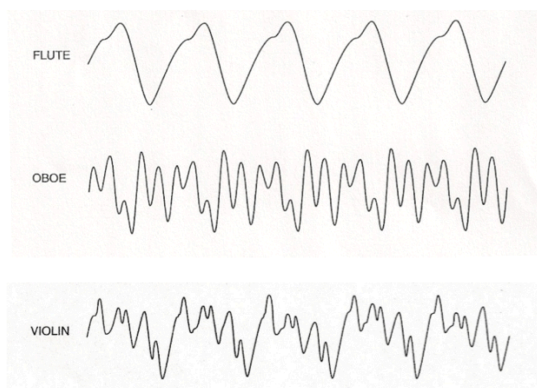
Figure 1.3a: Oscillation traces for flute, oboe, and violin playing A4[87]
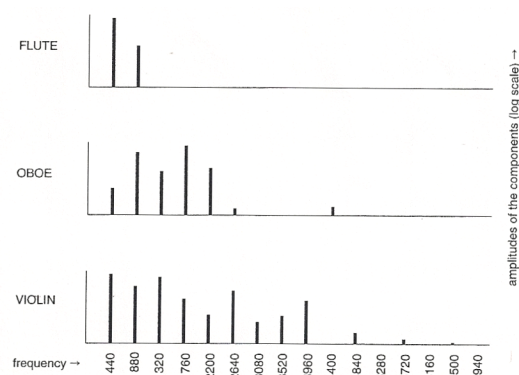
Figure 1.3b: Harmonic spectra of flute, oboe, and violin playing A4[88]

Plucked string instruments are characterised by a sharp attack followed by a decay. Because their distribution of energy is less uniform than instruments that are bowed or blown, they produce overtones that are *almost* harmonic. Tuned idiophones (the only

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[87] Reproduced from Ian Johnston, *Measured Tones: The Interplay of Physics and Music* (New York: CRC Press, 2009), 93–94.
[88] Reproduced from Johnston, *Measured Tones,* 100.

pitched percussion to be considered here) produce *approximately* harmonic overtones.[89] Because of their stiffer material (mainly metal or wood shaped into tubes or bars), the modes of vibration of tuned idiophones require sharper bending (i.e., more energy) and yield higher overtones than the corresponding modes on a string.[90] To refine the perception of pitch, often the bars or tubes are designed and mounted in such a way that the fundamental mode is left to resonate (sometimes amplified with external resonators) while the modes resulting in inharmonic frequencies are dampened.

Unpitched instruments, including most percussion, produce inharmonic overtones. The range in timbre of these sounds is immense, not to mention complex, so only a few points relating to pitch perception will be made. The impression of an undefined pitch is created by the high concentration of overtones over a very short time frame (e.g., the duration of a pulse). The closer the frequencies are to one another, the more noise-like the sound.[91] Figure 1.4 shows the ratio of overtones relative to the fundamental for the first seven modes of vibration of a general drumhead and a uniform metal bar (chime).[92] We see that the frequency range of the drumhead's first seven overtones is narrower than the chime's. The first seven overtones of the chime, by contrast, span a frequency range that is roughly 4.5 times broader than the first seven harmonics; however, because of the approximate harmonic relationship between the chime's third to eighth modes, the ear hears the third mode ($4.5f$) as a virtual fundamental (f) or first harmonic, the fourth mode as the second harmonic, fifth mode as the third harmonic, etc. This virtual fundamental is why the chime generates a sense of pitch and the drumhead does not.

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[89] "What is a Sound Spectrum," Music Acoustics, School of Physics, University of New South Wales, Accessed 24 October 2016, http://newt.phys.unsw.edu.au/jw/sound.spectrum.html.

[90] Modes of vibration refer to the different patterns that a vibrating string or bar can exhibit. Areas that remain motionless when a bar or string vibrates are called nodes.

[91] White noise is defined as the equal distribution of energy throughout all frequencies.

[92] Frequency ratios taken from Johnston, *Measured Tones*, 260, 267.

Mode	*1*	2	3	4	5	6	7
Frequency (Drum)	*f*	1.59*f*	2.14*f*	2.3*f*	2.65*f*	2.92*f*	3.16*f*
Frequency (Chime)	*f*	2.76*f*	5.40*f*	8.93*f*	13.34*f*	18.64*f*	31.87*f*
Perceived Fundamental of Chime	—	—	(4.5*f*)	2 × 4.47*f*	3 × 4.45*f*	4 × 4.66*f*	7 × 4.55*f*

Figure 1.4: Frequency ratios for first seven modes of a uniform metal bar and drumhead[93]

In essence, the sonance or tonal quality of a sound (i.e., not a pure tone) depends on the ratio of the overtones to the fundamental. Ratios consisting of integers produce harmonic sounds of definite pitch. Ratios involving non-integers produce inharmonic sounds of undefined pitch. The perception of pitch depends on how closely a spectrum's overtones mimic the ratios of a harmonic series.

Virtual Pitch

Sometimes fundamentals are perceived even when they are absent from the spectrum, as is the case with the chime shown in Figure 1.4. Instead, the ear infers a fundamental from the pattern of the overtones.[94] This physiological phenomenon, first recognised by psychoacoustician Ernst Terhardt, is known as a virtual pitch and is the result of an auditory Gestalt perception, in analogy to visual Gestalt perception.[95] In visual Gestalt, the brain infers contours from incomplete visual cues. For example, in Figure 1.5 we recognize the word "pitch" even though the letters are not fully outlined. Similarly, when the auditory system encounters an incomplete harmonic sound, it infers the fundamental (i.e., virtual pitch) from the spacing between the overtones. The virtual pitch's degree of perceptibility will depend on the rank and relative strength of the overtones.

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[93] Reproduced, in part, from Pierce, *The Science of Musical Sound*, 201.

[94] Ernst Terhardt, "Pitch, Consonance, and Harmony," *Journal of the Acoustical Society of America* 55/5 (1974): 1061–1068.

[95] Ibid., 1063.

PITCH

Figure 1.5: Visual analogy of virtual pitch[96]

Relevance to Spectral Music: Harmonicity and Inharmonicity

Spectral composers draw on the principles of virtual pitch theory to gauge tension in the spectra they compose and orchestrate. They metaphorically apply Fourier analysis and Terhardt's theory of pitch perception (which Terhardt later extended to chords[97]) to synthetic spectra, even though these spectra are frequency-based, chord-like structures composed of multiple complex tones. They treat the spectral chord as if it consisted of sine waves (overtones and a fundamental) instead of multiple complex tones; however, unlike a complex tone, if the intervallic content of the chord matches or partly matches more than one set of harmonics, more than one prospective virtual pitch is possible.

Although composers have different systems for measuring a spectrum's harmonicity, many rely on the degree with which the ratios between the overtones approximate those of a harmonic series and the height of the fundamental (i.e., the greatest common denominator among the overtones).[98] Higher fundamentals and simple ratios, particularly those that approximate the first seven harmonics, yield more harmonic (i.e., consonant) chords.[99] These factors are not weighed equally by all composers and analysts; most use computer programs to select virtual pitches according to their preferences.

A distinction needs to be made between virtual pitch as an indicator of "rootedness" and virtual pitch as a measure of a spectrum's proximity to either the harmonic series or white noise. The former, a purely phenomenological attribute, describes the level with which

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[96] Reproduced from Terhardt, "Pitch, Consonance, and Harmony," 1063.

[97] See also Richard Parncutt, *Harmony: A Psychoacoustical Approach* (New York: Springer-Verlag, 1989).

[98] Joshua Fineberg, "Guide to Basic Concepts and Techniques of Spectral Music," *Contemporary Music Review* 19/2 (2000): 98.

[99] According to Llorenç Balsach, we can perceive up to the twenty-fourth harmonic, but the first seven are the most critical when it comes to hearing virtual pitches. Llorenç Balsach, "Application of Virtual Pitch," *Journal of New Music Research* 26/3 (1997): 249.

we hear a group of tones as belonging to a common root. The latter, a physical characteristic, describes the structure and spacing of partials. The ambiguity between the two reflects the ambiguity between harmony and timbre, and both are relevant for the analysis of music involving spectra.

Instrumental Synthesis, Harmony, and Timbre

The perception of tension and harmonicity does not hinge solely on the "internal" tension of the chord/spectrum (e.g., the height of the fundamental and the ratios between components); it also depends on orchestration. Instrumental synthesis is a spectral music orchestration technique inspired by additive synthesis.[100] In early spectral music (which would have influenced Vivier), it involved orchestrating a spectrum—usually rounded to the nearest quarter tone—by assigning each overtone to an individual instrument. Each instrument was treated as though it generated a pure tone (a single sine wave) rather than a complex tone with a unique timbre (multiple sine waves). The individual instrumental timbres combine to produce a rich, collective timbre that Tristan Murail calls the multiplication of timbre.[101] (Figure 1.10, an excerpt from *Lonely Child*, is an example of instrumental synthesis.) Spectral techniques have evolved considerably, as have approaches to orchestrating models of spectra, which now take into account how each instrument's individual spectrum influences the resulting sound.

Instrumentation and playing techniques affect the complexity of a collective timbre. While certain instruments produce richer overtones than others (thus producing a denser sound), playing techniques can alter timbre by exciting different overtones. For example, bowing *sul ponticello* excites the higher harmonics thereby producing a richer, brighter sound than bowing *sul tasto*, which minimizes the higher harmonics, producing a softer sound with a stronger fundamental. Different playing techniques create different levels of noise transients that add to a sound's roughness. Like inharmonicity in a spectrum, a rougher sound will often be associated with more tension. When coupled with the use of

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[100] Additive synthesis is an electronic music technique that builds complex sounds by layering numerous sine waves.

[101] Murail, "Spectra and Sprites," 138.

microtones, these playing techniques affect the way we perceive the overall timbre by obscuring our ability to distinguish and isolate the individual tones.[102] The more the individual timbres and notes fuse together, the more likely we are to perceive the sound as a timbre instead of a chord. The opposite holds true when the timbres and notes resist fusion.[103] Although identifying where a sound belongs within the timbre-harmony continuum may be difficult, Robert Erikson gives six guidelines in *Sound Structure in Music*:

1. The duration of simultaneous sounds: shorter sounds are more likely perceived as timbres than harmonies;
2. The degree of familiarity: familiar chords are readily recognized as opposed to unfamiliar pitch collections;
3. The blending of individual voices: if certain tones or voices stand out, the sound is likely to be perceived as a chord;
4. The steadiness of the component pitches: steady pitches promote fusion;
5. The onset and ending: instruments that begin and end together also promote fusion;
6. Seating arrangements, hall acoustics and microphone placements: these factors can either promote or hinder the perception of fusion.

These guidelines help determine whether a sound is heard "as a single fused timbral entity or as discrete pitches of a chord." [104]

1.6 Generation of Vivier's Spectra

Sketches for Vivier's earlier works, including *Lonely Child* (1980), *Prologue pour un Marco Polo* (1981), *Bouchara* (1981)*,* and *Samarkand* (1981) include calculations that make explicit which frequencies are added to create a combination tone, and in what order, thereby revealing an algorithmic process. After the initial algorithm is complete, Vivier transcribes each set of frequencies, or spectrum, into music notation. The spectra may also be indexed with a number or letter, and additional annotations such as brackets or circles to indicate subsets, transposition intervals, and orchestration details. Often the

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[102] Gérard Grisey, "La musique" in "L'Itinéraire," Special edition, *La Revue Musicale* 421–24 (1991): 295.

[103] Robert Erikson, *Sound Structure in Music* (Berkeley, CA: University of California Press, 1975), 46.

[104] Ibid.

orchestration will be particular to an algorithm, and an algorithm will be specific to a section, which again highlights the formal importance of the spectra.[105]

Figures 1.6 to 1.10 show the evolution of four spectra (identified in red in Figures 1.6 and 1.7) as they appear in sketches for *Lonely Child* to their final form in mm. 37–38 of the score. A rudimentary two-part counterpoint determines the generative frequencies. Often the melody (or the modes used for the melody) is composed before calculating the spectra, but later works such as *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire* derive melodic modes directly from the spectra, rendering the melody as an outgrowth of the harmony. Figure 1.6a shows two of Vivier's sketches (a transcription is given in Figure 1.6b): the melody (upper staff) and the two-part counterpoint (lower staff) that determines the generative frequencies for the spectra identified in Figure 1.7. In Figure 1.7, the generative frequencies are always the first two frequencies added. Note the arithmetic errors, circled in blue, in the spectrum identified as number 4 in Figure 1.7: while $174 + 616 = 790$ and $760 + 616 = 1376$, Vivier has the sums written down as 760 and 1576 respectively. Little mistakes like these, which result from working quickly, are not uncommon, but when they occur early in the algorithm, they impact subsequent combination tones (circled in purple in Figure 1.7) and affect the final sonority, as is the case here. Had the frequencies been added correctly, the ensuing combination tones of the fourth spectrum would be as follows:

$$
\begin{array}{lll}
790 \ (= 174 + 616) & \text{and not} & 760 \ (= 174 + 616) \\
964 \ (= 790 + 174) & & 934 \ (= 760 + 174) \\
1406 \ (= 616 + 790) & & 1576 \ (= 616 + 760) \\
1754 \ (= 964 + 790) & & 1694 \ (= 934 + 760) \\
2370 \ (= 964 + 1406) & & 2510 \ (= 934 + 1576)
\end{array}
$$

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[105] In their analyses of *Bouchara*, Mijnheer, Levesque, and Christian identify a relationship between orchestration, algorithm, and form, observing that each section tends to be dominated by one algorithm, and that the orchestration for that algorithm is unique; however, only Christian's harmonic analysis spans the entire piece. Mijnheer, "Het akkoord voorbij," 13–14, cited in Braes, "An Investigation," footnote 7, 210; Lévesque, "Les voix de Vivier," 44–5; Christian, "Combination-Tone Class Sets" (2015), 211.
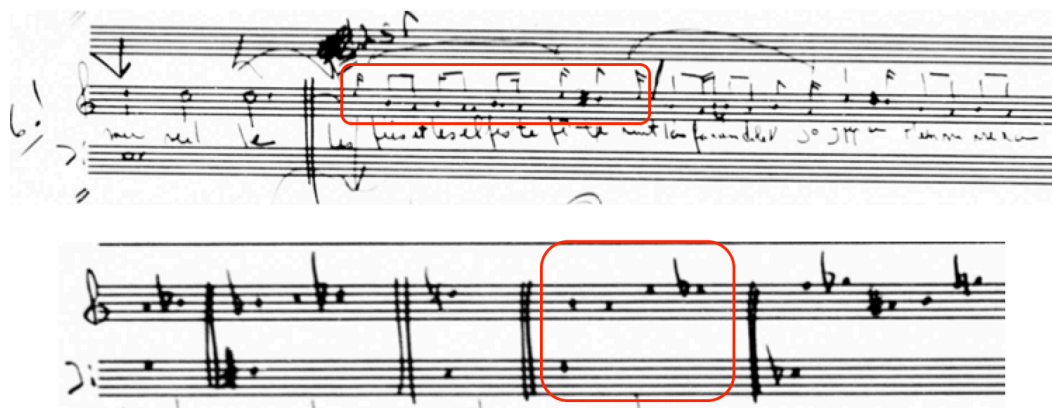
Figure 1.6a: Sketches for melody (upper staff) and two-part counterpoint (lower staff) for
Lonely Child, mm. 37–38[106]

Figure 1.6b: Transcription of sketches in Figure 1.6a

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[106] Division de la gestion de documents et des archives, Université de Montréal, Fonds Claude Vivier (P234) P235/D4, 0025. All sketches included in this study are digital copies of microfiche, not the originals.
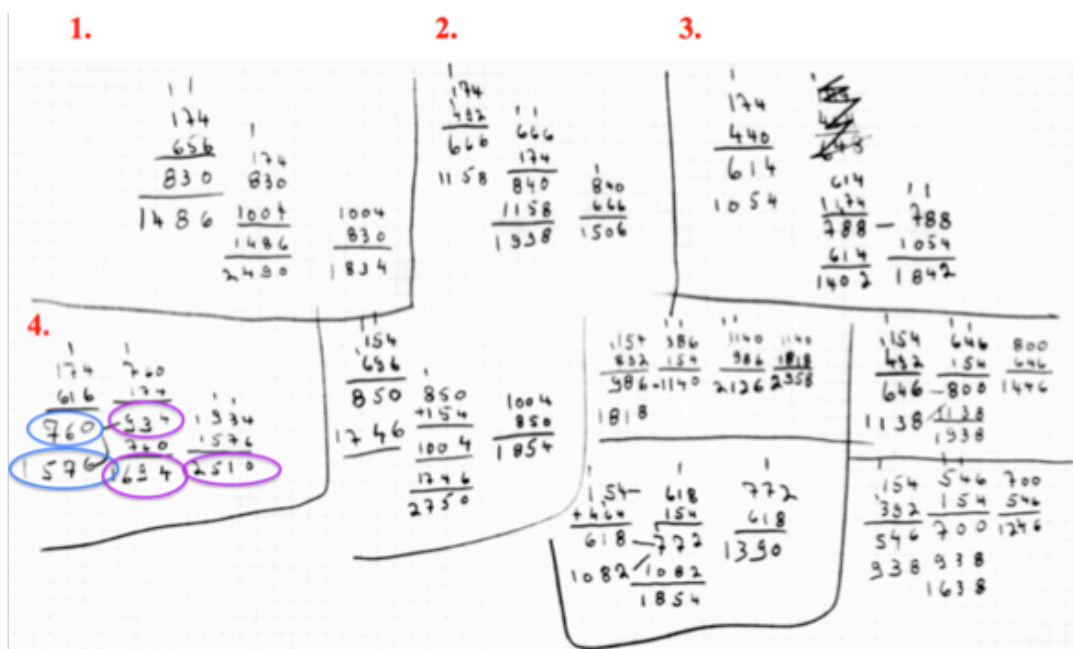
Figure 1.7: Sketch of Vivier's arithmetic for the combination tones in *Lonely Child*, mm. 37–38 (annotations mine)[107]

Figure 1.8 organizes the frequencies from Figure 1.7 into a table, placing them in ascending order (first column) and indicating both their relationship with the generative frequencies (second column) and the two frequencies of which they are the sum (third column). Figure 1.9a shows Vivier's transcription for the frequencies from Figure 1.7 into music notation (a transcription of the sketch is given in Figure 1.9b), while Figure 1.10 shows the score excerpt. With the exception of the two generative frequencies, each combination tone is the sum of two lower frequencies in the spectrum. Most of Vivier's combination tone chords follow a similar process.

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[107] Ibid.

Comparison of Frequencies for Spectra 1–4 in mm. 37–38 *Lonely Child*						
Rank of Frequency	Spectrum 1 Frequencies	Spectrum 2 Frequencies	Spectrum 3 Frequencies	Spectrum 4 Frequencies	b + m	*f*a + *f*b
*f*1 (b)	174	174	174	174	b	
*f*2 (m)	656	492	440	616	m	
*f*3	830	666	614	760 (error)	b + m	*f*1 + *f*2
*f*4	1004	840	788	934	2b + m	*f*1 + *f*3
*f*5	1486	1158	1054	1576 (error)	b + 2m	*f*2 + *f*3
*f*6	1834	1506	1402	1694	3b + 2m	*f*3 + *f*4
*f*7	2490	1998	1842	2510	3b + 3m	*f*4 + *f*5

b = Lower generative frequency (*basse*)

m = Higher generative frequency (*mélodie*)

b + m = Combination tone expressed as the sum of multiples of the generative frequencies, b and m

*f*a + *f*b = Combination tone expressed as the sum of two lower-ranking frequencies in the spectrum

Figure 1.8: Summary table of combination tones for the spectra identified in Figure 1.7

Figure 1.9a: Sketch transcribing the combination tone frequencies from Figure 1.7 into music notation (red numbers not part of original sketch)[108]
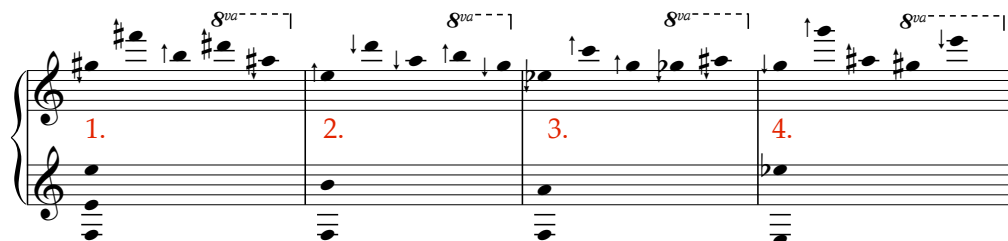
Figure 1.9b: Transcription of Figure 1.9a

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[108] Ibid.

Figure 1.10: *Lonely Child*, **mm. 37–38 (strings and voice only)**

Published analyses of Vivier's combination tone chords usually deduce algorithms based on spectra from either *Lonely Child* (1980) or *Bouchara* (1981), primarily because *Lonely Child* is the first (and perhaps best-known) work to explore this form of harmony and *Bouchara* has the clearest representation of spectra. Both works contain between seven and twelve frequencies per chord. In these analyses, the algorithms present the frequencies in ascending order (e.g., $f1...fn$) and express the combination tones using like terms of the two generative frequencies, as shown in the penultimate column of Figure 1.8. Often the two lower frequencies (of which the combination tone is the sum) are given as well (e.g., $f2 + f3$), as shown in the last column of Figure 1.8.

Figure 1.11 compares the algorithms Mijnheer, Levesque, and Christian give for the first
spectrum in *Bouchara* 6, and Figure 1.12 compares the algorithms Tannenbaum and
Gilmore give for the first spectrum of *Lonely Child,* m.25.[109] Although the analysts assign
different variables to the generative frequencies (e.g., a + b, b + m, X + Y), in Figures
1.11 and 1.12 all the algorithms represent the lowest generative frequency with b (*basse*)
and the upper generative frequency is represented by m (*mélodie*). Like terms facilitate
comparisons.

First Spectrum in *Bouchara,* 6												
Freq. Rank	Score Note	Score Freq.	Sketch Freq.	Mijnheer			Levesque			Christian		
				Freq.	fa+fb	b+m	Freq.	fa+fb	b+m	Freq.	b+m	
f1	C3	131	130	130	f1	b	131	f1	b	131		
f2	D#3	156	154	154	f2	m	155.5	f2	m	156		
f3	D4↓	285	284	284	f1 + f2	b + m	286.5	f1 + f2	b + m	287	b + m	
f4	G#↓	403	414	414	f1 + f3	2b + m	417.5	f1 + f3	2b + m	418	2b + m	
f5	A4	440	438	438	f2 + f3	b + 2m	442	f2 + f3	b + 2m	443	b + 2m	
f6	F5	698	698	698	f3 + f4	3b + 2m	704	f3 + f4	3b + 2m	705	3b + 2m	
f7	A5↓	855	852	852	f4 + f5	3b + 3m	859.5	f4 + f5	3b + 3m	861	3b + 3m	
f8	C#5	1109	1112	1112	f4 + f6	5b + 3m	1121.5	f4 + f6	5b + 3m	1098	5b + 3m	
f9	E6↓	1281	1290	1290	f5 + f7	4b + 5m	1251.5	f5 + f7	4b + 5m	1279	4b + 5m	
f10	G6	1568	1550	1550	f6 + f7	6b + 5m	1565.5	f7 + f8*	8b + 6m*	1566	6b + 5m	

Freq. = Frequency
Score Freq. = Equal temperament frequency of note in score
↓ = Note is lowered a quarter tone
b = Lower generative frequency (*basse*)
m = Higher generative frequency (*mélodie*)
b + m = Combination tone expressed as the sum of multiples of the generative frequencies, b and m
fa + fb = Combination tone expressed as the sum of two lower-ranking frequencies
* Error: Given the frequency listed, Levesque likely intended the last combination tone to be
$\qquad$ f6 + f7 and 6b + 5m.

**Figure 1.11: Comparison of algorithms for the first spectrum in *Bouchara* by Mijnheer,
Levesque, and Christian**

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[109] Mijnheer, cited in Braes, "An Investigation," 208–9; Levesque, "Les voix de Vivier," 41; Christian,
"Combination-Tone Classes," (2015), 236; Gilmore, "On Claude Vivier's 'Lonely Child,'" 8;
Tannenbaum, cited in Braes, "An Investigation," 211. Braes's algorithm for *Bouchara* is the same as
Mijnheer's, only Braes defines the lowest generative frequency, b, as 65 Hz and Mijnheer defines it as 130
Hz. As a result, all the coefficients for the b are doubled in Braes. As Christian notes: "Although this
doubling ensures that the frequency of the contrabass low C is brought into the correct octave, it clouds the
relationships between the various equations because the melody term's coefficient is not also multiplied by
two, and thus is not factored out."(225). For a comparison of analytical approaches to Vivier's spectra in
the secondary literature, see Christian, 220–226.

First Spectrum in *Lonely Child, m.*25							
Freq. Rank	Score Note	Score Freq.	Sketch Freq.	Sketch Freq.	Tannenbaum		Gilmore	
					Freq.	b+m	Freq.	b+m
1	G3	196	G3	196	196	b	196	b
2	A4	440	A4	440	440	m	440	m
3	E5↓	640	E↓	636	636	b + m	636	b + m
4	G#5	831	G#5	832	832	2b + m	832	2b + m
5	C6	1047	C6↑	1076	1076	b + 2m	1028	3b + m
6	F6	1397	F#6	1468	1468	3b + 2m	1420*	4b + m*
7	B6	1976	B6↓	1908	1908	3b + 3m	2008*	5b + m*

Freq. = Frequency

Score Freq. = Equal tempered frequency of note in score

Sketch Freq. = Equal tempered frequency of note in sketch

↑ = Note is raised a quarter tone

↓ = Note is lowered a quarter tone

b = Lower generative frequency (*basse*)

m = Higher generative frequency (*mélodie*)

b + m = Combination tone expressed as the sum of multiples of the generative frequencies, b and m

* = After the third combination tone, Gilmore simply indicates that the pattern continues

Figure 1.12: Comparison of algorithms for the first spectrum in *Lonely Child*, m.25, by Tannenbaum and Gilmore

Although the algorithms in Figures 1.11 are the same, the frequencies differ slightly: Mijnheer's frequencies reflect those found in the sketches, whereas Levesque's and Christian's frequencies reflect ideal equal tempered quarter tones, what Bryan Christian calls "target" frequencies.[110] Note that in Levesque's algorithm A4 = 442 Hz, whereas in Christian's A4 = 440 Hz. In Figure 1.12, the algorithms differ considerably: Tannenbaum follows the procedure Vivier establishes in the sketches, even though there is discrepancy between the notes in the sketch versus those in the score (due to Vivier's sometimes inconsistent rounding of frequencies), whereas Gilmore's algorithm reflects the score. Slight differences in frequencies can have an impact on the algorithm, particularly in the higher frequencies.

As Christian and Gilmore have pointed out, Vivier's spectra resemble a subset of the sidebands that would be produced in the technique of ring modulation when complex

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[110] Christian, "Combination-Tone Classes" (2015), 230.

tones are used as both the carrier and modulator signals. Judging by the terms in the algorithms for Vivier's spectra, the complex tones in his metaphoric ring modulation appear to contain between 8–15 harmonics.

While the algorithms in Figures 1.11 and 1.12 offer insight into the generative process, they are not fully representative of the elaborations and modifications in his later works. *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire* feature much larger collections (between twenty and thirty-one combination tones) and *Trois airs* also transposes segments of the combination tone chords by a variable interval.

Combination-Tone Class Matrices

Bryan Christian proposes a method for analysing combination tone chords in Vivier's music, as well as a standardized vocabulary to facilitate their discussion. His approach, which is inspired by Carl Stumpf and Angela Lohri, differs considerably from Braes, Levesque, Mijnheer, Tannenbaum, and Gilmore.[111] It uses an addition matrix, which he calls a combination-tone class matrix (CTC matrix), based on the first eleven harmonics of the generative frequencies.[112] Each cell in the matrix represents a combination-tone class (CTC) that is the sum of a multiple of one generative frequency (b) with a multiple of the other generative frequency (m). The matrix, therefore, reveals all the possible CTCs between two frequencies and their multiples. (If likened to ring modulation, the matrix gives all the sidebands generated by addition.) Figure 1.13 is a CTC matrix for the first combination tone chord of rehearsal number 6 in *Bouchara*. The vertical axis gives multiples (i.e., harmonics) of the lowest generative frequency (b = 131), while the horizontal axis gives the multiples of the higher generative frequency (m = 156); the matrix proper includes only coefficients ≥ 1. Once the matrix is complete, the frequencies of the quarter tones in the score (or manuscript) are matched to the closest CTCs in the matrix and highlighted to reveal a pattern (Figure 1.14).

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[111] Christian draws on Carl Stumpf's definition of a combination tone ($\pm\alpha h \pm\beta t$) and Angela Lohri's use of matrices to uncover relationships between combination tones (226–28).

[112] Christian adds that the size of the matrix can be adjusted to incorporate more or fewer harmonics. While an 11 x 11 matrix is sufficient in *Bouchara*, the spectra in *Trois airs pour un opéra imaginaire* and *Wo bist du Licht!,* which contain three times more frequencies, require matrices up to 17 x17.

		1	2	3	4	5	6	7	8	9	10	11	12
		156	312	468	624	780	936	1092	1248	1404	1560	1716	1872
1	131	287	443	599	755	911	1067	1223	1379	1535	1691	1847	2003
2	262	418	574	730	886	1042	1198	1354	1510	1666	1822	1978	2134
3	393	549	705	861	1017	1173	1329	1485	1641	1797	1953	2109	2265
4	524	680	836	992	1148	1304	1460	1616	1772	1928	2084	2240	2396
5	655	811	967	1123	1279	1435	1591	1747	1903	2059	2215	2371	2527
6	786	942	1098	1254	1410	1566	1722	1878	2034	2190	2346	2502	2658
7	917	1073	1229	1385	1541	1697	1853	2009	2165	2321	2477	2633	2789
8	1048	1204	1360	1516	1672	1828	1984	2140	2296	2452	2608	2764	2920
9	1179	1335	1491	1647	1803	1959	2115	2271	2427	2583	2739	2895	3051
10	1310	1466	1622	1778	1934	2090	2246	2402	2558	2714	2870	3026	3182
11	1441	1597	1753	1909	2065	2221	2377	2533	2689	2845	3001	3157	3313
12	1572	1728	1884	2040	2196	2352	2508	2664	2820	2976	3132	3288	3444

Figure 1.13: CTC matrix ⟨131, 156⟩ for first spectrum in *Bouchara,* 6

		1	2	3	4	5	6	7	8	9	10	11	12
		156	312	468	624	780	936	1092	1248	1404	1560	1716	1872
1	131	287	443	599	755	911	1067	1223	1379	1535	1691	1847	2003
2	262	418	574	730	886	1042	1198	1354	1510	1666	1822	1978	2134
3	393	549	705	861	1017	1173	1329	1485	1641	1797	1953	2109	2265
4	524	680	836	992	1148	1304	1460	1616	1772	1928	2084	2240	2396
5	655	811	967	1123	1279	1435	1591	1747	1903	2059	2215	2371	2527
6	786	942	1098	1254	1410	1566	1722	1878	2034	2190	2346	2502	2658
7	917	1073	1229	1385	1541	1697	1853	2009	2165	2321	2477	2633	2789
8	1048	1204	1360	1516	1672	1828	1984	2140	2296	2452	2608	2764	2920
9	1179	1335	1491	1647	1803	1959	2115	2271	2427	2583	2739	2895	3051
10	1310	1466	1622	1778	1934	2090	2246	2402	2558	2714	2870	3026	3182
11	1441	1597	1753	1909	2065	2221	2377	2533	2689	2845	3001	3157	3313
12	1572	1728	1884	2040	2196	2352	2508	2664	2820	2976	3132	3288	3444

Figure 1.14: CTC matrix ⟨131, 156⟩ that highlights the cells closest to the pitches in the score

Christian cautions that sometimes a CTC other than the one representing the closest frequency in the score might be selected (e.g., the second or third closest frequency). Such allowances are occasionally necessary to accommodate Vivier's inconsistent rounding or to reflect a larger CTC matrix pattern within a section. Each distinct pattern of cells represents a different algorithm. Christian uses the matrices and the patterns they reveal as a means to describe relationships and transformations between combination tone chords.

Matching the CTCs to the equal temperament quartertones in the score can produce slightly different spectra than those based on the sketches alone. The discrepancy occurs because a matrix can have multiple CTCs for the same quartertone, especially in the higher registers. For example, CTC <5,6> in Figure 1.14 (1591 Hz) also returns a G6 when rounded to the closest quartertone, whereas CTCs <1,9>, <7,4>, and <11,1> in the same matrix fall within 1–2 quartertones of G6.[113] As such, the resulting pattern of a CTC matrix does not reflect the frequencies or algorithm Vivier followed when creating the chords, but rather an equal-tempered idealization of the score. Figure 1.15 is a CTC matrix based on the first spectrum in *Lonely Child*. The generative frequencies, CTCs <1,0> and <0,1>, are highlighted in green and blue respectively. The CTCs that best reflect the frequencies in the sketches, i.e., <1,2>, <3,2>, <3,3>, are highlighted in orange, while the CTCs that best reflect the score, i.e., <3,1>, <5,1>, <1,4>, are highlighted in purple. The frequencies of the lowest two combination tones, i.e., CTCs <1,1> and <2,1>, are common to both the sketch and score and appear in red. Although the differences are slight, they nonetheless reflect different chords and, by extension, different information. Because score-based CTCs are not necessarily the sum of two lower-frequency CTCs in the same pattern, they do not imply hierarchical relationships in the way that the sketch-based frequencies do. For example, CTC <5,1> cannot be the sum of two lower CTCs in the same matrix

		1	2	3	4	5	6
		440	880	1320	1760	2200	2640
1	196	636	1076	1516	1956	2396	2836
2	392	832	1272	1712	2152	2592	3032
3	588	1028	1468	1908	2348	2788	3228
4	784	1224	1664	2104	2544	2984	3424
5	980	1420	1860	2300	2740	3180	3620
6	1176	1616	2056	2496	2936	3376	3816

CTCs Common to Sketch and Score
CTCs Based on Score
CTCs Based on Sketch

Figure 1.15: Comparison of sketch and score-based CTCs for first spectrum of *Lonely Child*, m. 24

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[113] CTC <5,6> is read "5b + 6m."

The frequencies in the sketches (and the hierarchy they imply) are very important when it comes to identifying how combination tone chords are modified. *Prologue pour un Marco Polo*, *Samarkand*, and *Trois airs pour un opéra imaginaire* contain combination tone chords that include difference tones or have been modified with a variable interval of transposition; therefore, the frequencies in the score cannot be expressed with a CTC matrix.

Without the sketches, identifying the structural relationships between the chords (and their transformations) would be extremely difficult. Because my interest lies in the relationship between the abstract structure and the more phenomenological, embodied perception of the spectra, the sketch-based frequencies provide more insight. My use of the CTC matrices is therefore limited to deciphering or confirming the frequencies of the initial combination tone chords to trace their subsequent modification and structural implications. (These modifications are discussed in more detail in Chapters 4 and 5.)

Appendix A contains a list of idiomatic terms Vivier uses in his sketches, scores, performance notes, and program notes to denote specific analytic processes and techniques. Chapters 4 and 5 refer frequently to them, and as much as possible, I have tried to preserve the original French term; however, sometimes repetition renders the original term cumbersome (especially if it is long), in which case the shorter English version is preferable.

1.7 Overview of the Present Study

This chapter has provided a preliminary context for the analysis of Vivier's late works by reviewing the secondary biographical and analytical literature and outlining the relevant influences of his style and the basic mechanics of his *couleurs*.

Chapter 2 gives an overview of cross-domain mapping and the key conceptual metaphors that Lakoff and Johnson identify as being instrumental to our understanding of time. It then looks at Arnie Cox's application of these metaphors in his phenomenology of anticipation, presence, and memory, which explains the logic behind musical time and

motion. The chapter closes with a brief discussion of the suitability of the musical motion metaphor for non-tonal or non-metric music.

Chapter 3 looks at Steve Larson's theory of musical forces, which qualifies musical motion by appealing to our embodied experience of physical forces (i.e., gravity, inertia, and magnetism). The second section of the chapter presents a plan to render the musical forces more malleable to the post-tonal, often nonmetric environment of Vivier's music. This plan involves abandoning musical magnetism and incorporating concepts borrowed from Robert Hatten and Matthew BaileyShea. From Hatten, I borrow musical friction, musical momentum (as distinct from musical inertia), and the notion of an embodied, sentient musical agent. From BaileyShea, I borrow the concept of unpredictable environmental forces.

Chapter 4 analyzes the force and energy metaphors that the texture, timbre, dynamics, and rhythm of the *couleurs* suggest in the 1 to 4 and 11 to 36 of *Wo bist du Licht!*[114] Vivier uses these parameters to create processes of intensification and attenuation that unify and animate predetermined durational schemes and structures. These force and energy metaphors, which are considered independently from the melody, are relayed through a musical observer who, depending on the perspective adopted, experiences them by imagining what if feels like to be submerged into the virtual environmental context of the forces, or indirectly by adopting a neutral, outside perspective of the musical motion.

Chapter 5 explores the relationship between the melody—embodied through a musical agent—and the texture of the *couleurs* in the first two *airs* of *Trois airs pour un opéra imaginaire.* In the first *air*, the surface activity of the spectra suggests unpredictable environmental forces that act upon the musical agent's intentions and movements. The musical agent compensates for the forces by either increasing or decreasing his or her energy output. In the second *air*, which places greater emphasis on timbre and qualitative metaphors, the *couleurs* represent a projection of the musical agent's mental states. As

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[114] In this study, I will use boxed numbers to refer to rehearsal numbers in the score.

the agent's mental states change, the *couleurs* thin in texture and rise in register, suggesting a narrative of spiritual purification.

Finally, Chapter 6 offers concluding remarks about the present study and its implications for further research into the music of Claude Vivier.

Chapter 2: Temporal and Musical Motion

Music is a curious, ephemeral art that many believe we understand almost entirely through metaphor. It is taught, performed, notated, recorded, and discussed by appealing to the senses. The rich language and system of signs we have developed to facilitate our understanding of music centres on concepts of space, time, and motion that we propagate through metaphor.[1]

Whenever we speak of structure, form, motion, or contour, we tend to conceptualize musical events in terms of locations and moving objects in space. These types of metaphors differ from the traditional concept of musical representation (i.e., more descriptive, literary applications of metaphor) in that they are an automatic part of our cognitive reasoning, a result of our embodied experience in the world. The role of conceptual metaphor in musical analysis cannot be overstated.

This chapter examines the application of conceptual metaphor to musical thought. The first section focuses on the mechanics of conceptual metaphor, i.e., the process of cross-domain mapping, as presented by linguist George Lakoff and philosopher Mark Johnson in *Philosophy in the Flesh*.[2] It addresses the spatialization of time, conceived from static and dynamic perspectives, within the context of embodied realism. The second section examines the key metaphors that Arnie Cox, influenced by Lakoff and Johnson, identifies

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[1] Although conceptual metaphor surfaces in all musical discourse, its role in analysis is perhaps more explicit in writings on: musical motion (see Chapter 1); cognition (Michael Spitzer, *Metaphor and Musical Thought* [Chicago: Chicago University Press, 2004]; Lawrence Zbikowski, *Conceptualizing Music: Cognitive Structure, Theory, and Analysis* [New York: Oxford University Press, 2002]); analytical language (Marion Guck, "Analytical Fictions," *Music Theory Spectrum* 16/2 [1994]: 217–230; "A Woman's [Theoretical] Work," *Perspectives of New Music* 32/1 [1994]: 28–43); gender (Susan McClary, *Feminine Endings: Music, Gender, and Sexuality* [Minneapolis: Minneapolis University Press, 1991]; Fred Everett Maus, "Masculine Discourse in Music Theory," *Perspectives of New Music* 31/2 [1993]: 264–293); narratology (Fred Everett Maus, "Music as Drama," *Music Theory Spectrum* 10 [1988]: 56–73); and ethnomusicology (Steven Feld, "Flow Like a Waterfall: The Metaphors of the Kaluli Musical Theory," *Yearbook for Traditional Music* 13 [1981]: 22–47; Lawrence Zbikowski, "Music, Language, and What Falls in Between," *Ethnomusicology* 56/1 [2012]: 125–131). For an overview of metaphor's range in music scholarship, see Lawrence Zbikowski, "Metaphor and Music," in *The Cambridge Handbook of Metaphor and Thought*, ed. by Richard Gibbs, Jr. (Cambridge: Cambridge University Press, 2008), 502–24.

[2] Lakoff and Johnson, *Philosophy in the Flesh: The Embodied Mind and Its Challenges to Western Thought* (New York: Basic Books, 1999). See also *Metaphors We Live By* (1980).

as being integral to our concept of musical motion. It also discusses the logic underlying this popular conception of metaphor and the criticism with which it is sometimes met. Despite the association with prediction it sometimes generates, musical motion remains a valuable metaphor for musical analysis.

2.1 Conceptual Metaphor and Cross-Domain Mapping

According to Lakoff and Johnson, conceptual metaphors are essential for grasping abstract concepts since they allow us to explore the unknown in terms of more primary, familiar domains of experience. Our most immediate and intuitive form of knowledge comes from our embodied interactions with our environment, i.e., sensorimotor experiences.[3] Primary metaphors, i.e., metaphors based on sensorimotor experience, are an automatic and unconscious part of neural and cognitive development.[4] They are formed early in life by coactivating the areas of the brain responsible for sensorimotor experience and subjective experience. This coactivation (which manifests itself as a conflation between a feeling/judgment and a sensorimotor experience) creates neural pathways between the two areas that strengthen and increase through repetition.[5] More elementary still, image schemas are preconceptual, generalized reoccurring structures that we use to formulate concepts.[6] Along with primary metaphors, they are a necessary and unconscious part of reasoning and make up the building blocks of abstract thought. When combined, they form the complex metaphors that characterise abstract concepts such as time, love, causation, morality, etc.

From a cognitive perspective, conceptual metaphor maps features from one conceptual domain (the source) to another (the target).[7] These inferred features take the form attributes (e.g., is warm) or structural relations (e.g., y follows x) and occur because both the target and source domains share a common experiential correlation. The pertinence of

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[3] Lakoff and Johnson, *Philosophy in the Flesh,* 45.
[4] Ibid., 56.
[5] Ibid., 57.
[6] Lawrence Zbikowski, *Conceptualizing Music: Cognitive Structure, Theory, and Analysis* (New York: Oxford University Press, 2002), 69.
[7] Ibid., 58.

conceptual metaphor depends on which structures or attributes are mapped and which ones are not.[8] Teasing these out can be difficult because metaphorical thinking is not a lucid, nor linear thought process. Instead, it is a largely unconscious process involving several image schemas with parallel mappings.[9] Because a complex metaphor can include multiple primary metaphors, image schema, and commonplace knowledge, attempting to identify and isolate the individual mappings and images is challenging.[10]

To illustrate the construction of a complex metaphor, Lakoff and Johnson use the metaphor A PURPOSEFUL LIFE IS A JOURNEY.[11] This metaphor arises from the widespread cultural belief that we should have goals in life and strive to meet those goals. It combines the primary metaphors PURPOSES ARE DESTINATIONS and ACTIONS ARE MOTIONS with the definition of a journey as an extended trip consisting of numerous intermediary destinations. The end result is a complex metaphor involving four submetaphors, centred on the abstract concept of a path, i.e., PATH image schema, which connects locations:

> A PURPOSEFUL LIFE IS A JOURNEY
> A PERSON LIVING LIFE IS A TRAVELER
> LIFE GOALS ARE DESTINATIONS
> A LIFE PLAN IS AN ITINERARY

Yet, since these submetaphors describe a process (temporal motion), they also imply the metaphors TIME'S ORIENTATION and MOVING OBSERVER which, as will be seen shortly, involve additional location-event-structure submetaphors. Only after the main metaphors are recognized can the validity of the inferences be evaluated. As Lakoff and Johnson caution, "one must learn where metaphor is useful to thought, where it is crucial to thought, and where it is misleading. Conceptual metaphor can be all three."[12]

From a philosophical perspective, conceptual metaphor proposes an empirical epistemology based on embodied realism. Embodied realism claims that our

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[8] Mark Johnson, *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason* (Chicago: Chicago University Press, 1987), 109–110, 116–117.

[9] Lakoff and Johnson, *Philosophy in the Flesh*, 62.

[10] Ibid., 60. An abstract philosophical concept such as time can incorporate up to two dozen metaphors, 71.

[11] Ibid., 61–62. Lakoff and Johnson use small capitals to identify metaphors and image schemas, a practice that I will follow in this study.

[12] Ibid., 73.

understanding of truth cannot be separated from the joint-function of our minds and bodies. Viewed from this perspective, as thinking and feeling beings, we are inevitably linked with our environment, and whatever truth we discover is a product of our bodies:

> At the heart of embodied realism is our physical engagement with an environment in an ongoing series of interactions. There is a level of physical interaction in the world at which we have evolved to function very successfully, and an important part of our conceptual system is attuned to such functioning. The existence of such "basic-level concepts" characterized in terms of gestalt perception, mental imagery, and motor interaction is one of the central discoveries of embodied cognitive science.[13]

Truths, therefore, are not absolutes that exist independent from our understanding, but rather the result of a stable scientific understanding based on vast and deep converging evidence. In contrast, disembodied realism claims "concepts and forms of reason are characterized not by our bodies and brains, but by the external world in itself."[14] As a result, the truth of disembodied realism, since it is independent of our understanding, is thought to be immutable and absolute.

Although not absolute, scientific truths (or "results") exact a high degree of predictability and verifiability, rendering them widely accepted. The principal results underpinning Lakoff and Johnson's theory of conceptual metaphor are the existence of the embodied mind, cognitive unconscious, and metaphorical thought.[15] By looking at how we perceive and conceptualize time, the following will help demonstrate how conceptual metaphor manifests itself in thought and language, influencing the way we reason.

The TIME ORIENTATION metaphor

According to Lakoff and Johnson, our conception of time is grounded in metonymy and metaphor, and stems from a relational and literal understanding of motion, space, and

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[13] Ibid., 90.

[14] Ibid.

[15] Ibid. The studies in cognitive science, cognitive linguistics, and neural science that support these results appear in sections A and B of Lakoff and Johnson's reference list (585–97).

events.[16] We define and measure time by comparing events: iterative events, e.g., the movement of the earth around the sun, serve as units of measure against which other events are gauged.[17] These periodic events are based on observations of change in our environment. We then extend our understanding of events to our understanding of time, resulting in what Lakoff and Johnson identify to be four "literal and inherent" properties:

> 1. Time is directional and irreversible because events are directional and irreversible; events cannot "unhappen."
> 2. Time is continuous because we experience events as continuous.
> 3. Time is segmentable because periodic events have beginnings and ends.
> 4. Time can be measured because iterations of events can be counted.

Figure 2.1: Literal and inherent properties of time[18]

Because our understanding of space, motion, and time-defining events is literal (i.e., not metaphorical), it lends "a certain amount of non-metaphoric structure to our concept of time;"[19] however, the motion of time and any spatial orientation we attribute to it is metaphorical, and emerges from our experience of movement in space.

It may seem counterintuitive to think of motion as being more elementary than time (we think of motion as change in spatial relations *in* time), but, as Lakoff and Johnson point out, there is a significant distinction between a cognitive perspective of time and motion and a physics perspective of the same concepts:

> It should be said at the outset that motion in our conceptual system is not understood in the same way as in physics. In physics, time is a more primitive concept than motion and motion is defined as the change of location over time. But cognitively the situation is reversed. Motion appears to be primary and time is metaphorically conceptualized in terms of motion. There is an area in the visual system of our brains dedicated to the detection of motion. There is no such area

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[16] Ibid., 137.

[17] Ibid., 138.

[18] Ibid.

[19] Ibid., 167.

for the detection of global time. That means that motion is directly perceived and is available for use as a source domain by our metaphor systems.[20]

In this sense, we seem biologically predisposed to impose our understanding of motion in space on other more abstract domains of experience.

The TIME ORIENTATION metaphor localizes the past, present, and future relative to an observer. In Western culture (and many others), the spatial area in front of the observer represents the future, the area occupied by the observer is the present, and the area behind the observer the past.[21] The origin of this pairing has to do with our tendency to face objects that approach us and to look in the direction of where we are going. As a result, we have developed a sense of front and back to our bodies, based primarily on our sense of sight, and partition the space around us in terms of front (ahead) and back (behind).[22] We also extend this concept of front and back to other entities, including time, and whether we approach temporal events or temporal events approach us, we meet it "head on" or "face to face."[23] We therefore preserve the structure of our embodied experience in the spatial domain by orienting the temporal domain so that there is a correspondence between ahead/future, here/present, and behind/past.

In essence, TIME ORIENTATION situates the past, present, and future relative to the observer's concept of front and back; however, it orientates temporal determinations only spatially. To evoke the motion of time, TIME ORIENTATION must be coupled with either the MOVING TIME or MOVING OBSERVER metaphor.[24]

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[20] Ibid.,139–140.

[21] Ibid., 140.

[22] Ibid., 34–35.

[23] Not all cultures face the future. Some link sight (front of body) with what is known and familiar. Since the past is already determined, they face and "see" the past and have their backs to the future, the unknown (ibid., 141).

[24] Ibid., 141.

The MOVING TIME and MOVING OBSERVER Metaphors

The MOVING TIME and MOVING OBSERVER metaphors are complementary "figure-ground reversals of one another."[25] Both describe the same relationship between a stationary element (the ground) and a moving element (the figure or figures), but one reflects the stationary element's perspective and the other reflects the moving element's perspective. Metaphors that express the same content from opposing perspectives of the figure-ground relationship are called *duals* and represent event-structure duality.[26] In MOVING TIME, time (which represents the figure) moves and the observer (which represents the ground) remains stationary. The future approaches the observer and becomes the present when it reaches him/her.

With MOVING OBSERVER, the situation is reversed; time is stationary (time represents the ground) and the observer moves (the observer represents the figure). Time(s) are conceived as occupying locations within a bounded space or at a specific point. Specific, instantaneous events (e.g., *dinner is at 7:00 pm*) occur at points while durations or extended activities (e.g., *she completed her work in three hours*) take place within a bounded region on the landscape. Here, the bounded region is a container that holds a specific quantity of time.[27] The observer approaches future events, but brings the present wherever he/she goes.

In both metaphors, the present occurs wherever the observer is, with the observer facing the future.[28] Although both metaphors are equally valid and common in our language, they reflect inconsistent perspectives in that the same element cannot be both figure and

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[25] Ibid., 149.

[26] Ibid., 194.

[27] The CONTAINER schema can represent almost anything, from states of being (e.g., *she is in shock*; *he is in danger*), to locations (*the library is on campus; France is in Europe*), to times (*there are 7 days in a week*). The essence of the CONTAINER, according to Lakoff and Johnon, is its clearly defined dimensions in that an object cannot simultaneously be both "in" and "out" of the same CONTAINER (31–32). For applications of the container schema in music theory, see Candace Brower, "Pathways, Blockage, and Containment in Density 21.5," *Theory and Practice* 22/23(1997): 35–54; "A Cognitive Theory of Musical Meaning," *Journal of Music Theory* 44/2 (2000): 323–79; Janna Saslaw, "Life Forces: Conceptual Structures in Schenker's *Free Composition* and Schoenberg's *The Musical Idea*," *Theory and Practice* 22/23 (1997): 17–33.

[28] Lakoff and Johnson, *Philosophy in the Flesh*, 140, 148.

ground at the same time.[29] Figures 2.2 and 2.3 summarize Lakoff and Johnson's mappings for each metaphor.[30]

Mapping of MOVING OBSERVER and TIME'S ORIENTATION metaphors

The Location of the Observer	→	The Present
The Space in front of the Observer	→	The Future
The Space behind the Observer	→	The Past
Locations on the Observer's Path of Motion	→	Times
The Motion of the Observer	→	The "Passage" of Time
The Distance Moved by the Observer	→	The Amount of Time

Examples of locational expressions with temporal correlates:

"We're *approaching* the year's end."   "We've *reached* June."
"He'll have his degree *within* two years."   "She left *at* 10 o'clock."
"We're *halfway through* September."   "We *passed* the deadline."

Figure 2.2: Lakoff and Johnson's composite mapping of the metaphors MOVING OBSERVER and TIME'S ORIENTATION

Mapping of the MOVING TIME and TIME'S ORIENTATION metaphors

Objects	→	Times or Temporal Events
The Motion of Objects Past the Stationary Observer	→	The "Passage" of Time or Events
Location of the Observer	→	The Present
Space in front of the Observer	→	The Future
Space behind the Observer	→	The Past

Linguistic examples:

"The time for action *has arrived*."   "The deadline is *approaching*."
"Thanksgiving is *coming up* on us."   "Time is *flying by*."
"The time *will come* when you'll be sorry."   "Payday is *here*."

Figure 2.3: Lakoff and Johnson's composite mapping for the metaphors MOVING TIME and TIME'S ORIENTATION

There are variations within each perspective. For example, with MOVING TIME, time can take the form of a single substance (as in *the flow of time*) or multiple moving objects (*the days passed quickly*). This variation maps our concept of quantities onto our concept of

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[29] Ibid.,149.
[30] Ibid., 142–43, 146.

durations.[31] When conceived as a river, it mirrors our day-to-day experience of time's directional and irreversible properties. For this reason it is often associated with a Newtonian sense of time.[32]

An important variation within the MOVING OBSERVER metaphor is representation of space and time as a single domain (space-time) rather than two separate domains. When conceived in terms of a motion-situation, distances and durations become interchangeable. Lakoff and Johnson define a motion-situation as "a single complex conceptual schema in which the two domains of time (that is, time defining events) and motion are present together as part of [a] single whole. Where two things are correlated in such a schema, one can stand metonymically for the other."[33] As Lakoff and Johnson point out, this metonymy between space and time is reflected in statements such as "San Francisco is half an hour away from Berkeley," where half an hour stands for distance.[34]

Another form of metonymy common to both metaphors is the event-for-time substitution, i.e., where an event replaces or "stands in" for its duration or its temporal location.[35] For example, in the MOVING TIME metaphor, when we say "Christmas is coming," the event of Christmas (a future event) stands for December 25th (a future time). With the MOVING OBSERVER, if we say "we're heading towards the cadence," the cadence represents a location (future time). In both cases the event itself substitutes for its temporal position. More complex and nuanced expressions of time and its meaning can be gained by combining MOVING OBSERVER and MOVING TIME with other metaphors, e.g., TIME AS A RESOURCE, TIME AS MONEY, and STEALING TIME (this last one has interesting applications in music).

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[31] Lakoff and Johnson, *Philosophy in the Flesh*, 144– 45.

[32] TIME IS A RIVER is a variation on MOVING TIME. In music, the juxtaposition of Newtonian and Einsteinian perceptions of time has been raised by David Epstein, *Shaping Time: Music, the Brain, and Performance* (London: Prentice Hall, 1995), Arnie Cox, "The Metaphoric Logic of Musical Motion and Space," (Ph.D. dissertation, University of Oregon, 1999), and Robert Adlington, "Moving Beyond Motion: Metaphors for Changing Sound," *Journal of the Royal Musical Association* 128/2 (2003): 297–318.

[33] Lakoff and Johnson, *Philosophy in the Flesh*, 152.

[34] Ibid.

[35] Ibid., 154.

Recognizing the Logical Constraints of Temporal Metaphors

The MOVING TIME and MOVING OBSERVER metaphors for temporal motion are reminiscent of the contrasting dynamic and static temporal perspectives, or A-series and B-series, presented in early twentieth-century philosopher J. M. E. McTaggart's seminal article, "The Unreality of Time."[36] The article rejects the reality of time by demonstrating how both dynamic and static perspectives lead to a contradiction. The A-series, which represents the dynamic perspective, involves temporal determinations (past, present, future) to situate different events at different times. Proponents of this series believe our use of tense reflects observations of change rooted in our experience of expectations, experience, and memory.[37] Alternately, the B-series draws on notions like *before/after*, *earlier/later* to establish permanent order relations between terms or events.

According to McTaggart, the A-series leads to either a contradiction or an endless regress. As Judy Lochhead explains:

> ...for McTaggart, it is contradictory to say that an event that is present now, will have been in the future, and will be in the past. The contradiction is not resolved by the assertion that the event has these temporal determinations "successively". This assertion requires the introduction of a second-order time series. The moments of this second-order series would also have, simultaneously, the three temporal determinations, requiring again the assertion of a third-order series, and so the argument goes in an infinite regress.[38]

The B-series, in turn, is shown to depend on the A-series to account for the perception of change; for without the concept of tense or succession, the B-series cannot distinguish between the terms of a relation.

The A-series inadvertently spatializes time by conceiving temporal events as locations, then concludes that it is a contradiction for an event to occupy more than one location simultaneously (an object cannot be in two different places at once). Also, by thinking of

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[36] J.M.E. McTaggart, "The Unreality of Time," *Mind* 17 (1908), 457–74.

[37] Judy Lochhead, "The Metaphor of Musical Motion: Is There An Alternative," *Theory and Practice*, 14/15 (1989–90): 86.

[38] Ibid., 86–87.

temporal events as locations (either points or bounded regions), it assumes the existence of an area or "landscape" that contains them. In the argument, this landscape corresponds to positing a "second-order time series."

McTaggart's argument demonstrates the pervasiveness of both a priori assumptions and metaphorical thinking. It approaches the concept of time (and statements made about time) from the literal point of view of disembodied realism. At the outset, it assumes time exists independently of body and mind, and functions like a container in which things or events occur because of the way it is reflected in thought and language. To posit this function, i.e., assume events happen *in* time or *at* a time, is to take the MOVING OBSERVER metaphor literally. It necessarily evokes disembodied realism because its metaphysical framework requires that all true statements exist independently of our understanding.[39] Failing to see the application of a conceptual metaphor can, as caution Lakoff and Johnson, lead to contradictions, puzzles, and even silliness.[40] Zeno's arrow paradox is an example of taking a temporal metaphor literally. If, as Zeno proposes, time is a series of consecutive points, then an arrow in flight will, at any given moment, occupy a fixed point in time. If that is the case, how can the arrow be in motion? By confusing literal motion with metaphorically conceived motion, the paradox shows "that the most common concepts that we use every day and in terms of which we state our truths cannot be taken as literally fitting an objective reality."[41]

If "conceptual metaphor is what makes most abstract thought possible," then almost all theories will involve conceptual metaphors.[42] Those that involve time, e.g., theories in philosophy, physics, or music theory, usually favour one temporal perspective over the other, resulting in a literal interpretation of one or more underlying conceptual metaphors, which may then be passed off as "truths." When evaluating such theories or concepts, being aware and critical of any a priori assumptions (or methodological commitments) helps determine the appropriateness of the derived results.

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[39] Lakoff and Johnson, *Philosophy in the Flesh*, 156.

[40] Ibid., 157–159.

[41] Ibid., 158.

[42] Ibid., 129.

2.2 Musical Motion

Most will agree that music is an art form that involves listening and being attuned to aural changes. In large part, we express these changes in terms of motion because of how we experience changing states of relations in our environment, hence the primary metaphor CHANGE IS MOTION. Music literature abounds with allusions to motion, proving just how pervasive the metaphor remains. It is a complex metaphor involving (at the very least) the duals MOVING TIME and MOVING OBSERVER and STATES ARE LOCATIONS and STATES ARE POSSESSIONS. Causal explanations of musical motion (e.g., appeals to forces and energy) implicate additional metaphors such as CAUSES ARE FORCES and DIFFICULTIES ARE IMPEDIMENTS TO MOTION.[43]

Arnie Cox examines the logic and cognitive impetus for thinking of music in terms of space and movement.[44] Applying Lakoff and Johnson's theory of conceptual metaphor to music, he states that we conceptualize and experience musical motion in much the same way we conceive of temporal motion. That is to say, the same logic and metaphors that constitute our understanding of time inform our understanding of music. As a result, we extend the metaphors MOVING OBSERVER, MOVING TIME, and TIME ORIENTATION—with the same logical entailments—to music, only substituting musical events for temporal ones (mapping is shown in Figure 2.4[45]). Thus, in MOVING OBSERVER, musical events constitute locations and an observer moves from one location to another; in MOVING TIME, the listener remains stationary while musical events approach and move past him or her. In both metaphors, past musical events are behind the observer, present musical events share the same location as the observer, and future musical events are ahead (face to face) of the observer. Many of the same variations and metonymies apply as well. A case in point is the frequent conflation of "where" or "when" when discussing musical

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[43] Ibid., 179.

[44] Arnie Cox, "The Metaphoric Logic of Musical Motion and Space," (Ph.D. diss., University of Oregon, 1999).

[45] To designate the passage of musical time, Cox uses the metaphor AS TIME GOES BY instead of MOVING TIME and TIME'S LANDSCAPE instead of MOVING OBSERVER. This dissertation will use MOVING TIME, and both MOVING OBSERVER and TIME'S LANDSCAPE.

events. As Cox point out, the questions "where is the second theme?" and "when is the second theme?" request the same information, suggesting a space-time source domain.[46]

Mapping of the MOVING OBSERVER and TIME'S ORIENTATIONS metaphors to musical events

Locations on the Observer's Path of Motion	→	Times (Temporal Events)	→	Musical Events
The Motion of the Observer	→	The "Passage" of Time	→	The Passage of Musical Events
The Distance Moved by the Observer	→	The Amount of Time	→	The Amount of Musical Events
The Location of the Observer	→	The Present	→	Present Musical Events
The Space in front of the Observer	→	The Future	→	Future Musical Events
The Space behind the Observer	→	The Past	→	Past Musical Events

Mapping of the MOVING TIME (AS TIME GOES BY) and TIME'S ORIENTATIONS metaphors to musical events

Objects	→	Times (Temporal Events)	→	Musical Events
The Motion of Objects Past the Stationary Observer	→	The "Passage" of Time	→	The Passage of Musical Events
Location of the Observer	→	The Present	→	Present Musical Events
Space in front of the Observer	→	The Future	→	Future Musical Events

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Figure 2.4: Reproduction of Cox's mapping of temporal motion and musical motion

Interior and Exterior Perspectives of Motion

Cox also distinguishes between an *interior* and *exterior* perspective of both metaphors, resulting in four perspectives of motion overall.[47] These four perspectives are rooted in our experience of motion, our interactions with moving objects, and our observations of motion. If the perspective reflects the gaze of the observer, then it constitutes an interior perspective. In MOVING TIME, this pertains to the grounded observer's experience of having musical events approach and move past him or her. In TIME'S LANDSCAPE, this pertains to the moving observer's experience of approaching and departing from musical events. If the perspective originates from outside both the observer and the musical

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[46] Ibid., 199.

[47] Ibid., 201.

events (and looks in on both), it constitutes the exterior, "third person" perspective of motion that belongs to neither element in the figure-ground relationship.[48] In MOVING TIME, the exterior perspective depicts musical events approaching a stationary observer; in MOVING OBSERVER, it depicts an observer moving to and from musical events.

Exterior perspectives involve gauging distances between elements (i.e., the amount of separation between two elements), a process that requires a minimum of two fixed points. As such, they are an exclusive feature of the TIME'S LANDSCAPE metaphor. Since the MOVING TIME metaphor only has one fixed point of reference (the observer), the metaphor's structure precludes any grasp of distance. This limitation is one of the logical entailments of the metaphor.[49] While MOVING TIME does not recognize distance, it does recognize succession (i.e., the order of events). By contrast, since TIME'S LANDSCAPE can contain multiple fixed points of reference (e.g., the "landmarks," the location of the observer), grasp of distance follows as one of its logical entailments. Cox clarifies that the exterior perspective of MOVING TIME is really a "fiction" whose "logic depends on a blending of perspectives;" it requires that we first conceptualize a musical space through which music can move.[50] The exterior perspective of moving time is really then a bounded region on TIME'S LANDSCAPE through which time flows.

In practice, Cox acknowledges the difficulty of recognizing which perspective is being represented. Frequently, we switch back and forth between perspectives, and may not even be aware of it.[51] Musical analysis tends to favour TIME'S LANDSCAPE because it presents all musical events simultaneously, thereby facilitating the comparison of events through the metaphor KNOWING IS SEEING or SEEING IS KNOWING.[52]

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[48] Ibid., 203.
[49] Ibid., 201.
[50] Cox, "The Metaphoric Logic," 144.
[51] Ibid., 233–34, 237.
[52] Ibid., 237.

STATES ARE LOCATIONS and STATES ARE POSSESSIONS

According to Cox, almost all descriptions of musical motion stem from combining the aforementioned temporal metaphors with the duals STATES ARE LOCATIONS and STATES ARE POSSESSIONS. In mechanics, motion involves displacing an object from one position or location to another. When we physically shift positions or locations, we change the distance between our bodies relative to other objects in the environment. The new visual perspective affects our frame of mind, thereby playing a role in the phenomenology of motion. The metaphor STATES ARE LOCATIONS

> gives spatial meaning to states of mind and states of being in accordance with the following entailed metaphors: CHANGE OF STATE IS CHANGE OF LOCATION, CHANGE OF STATE IS MOTION BETWEEN LOCATIONS. ... the mapping of locations onto states thus gives us a metaphoric state-space, which corresponds to the metaphoric time-space that emerges in TIME'S LANDSCAPE.[53]

Since all attributes or states of being can be conceived in terms of bounded regions (locations) on time's landscape, we can qualify any type of musical change as motion, hence the metaphor CHANGE IS MOTION.

The equivalent of STATES ARE LOCATIONS from the MOVING TIME perspective is the metaphor STATES ARE POSSESSIONS.[54] Instead of locations, the latter objectifies states or attributes as tenable objects. The stationary observer experiences changes of state (or change in attributes) as the objects come in and out of their possession. In the context of music, this metaphor "establishes music as a stationary entity that changes state through the acquisition of characteristics, so that the motion in this case is that of the attributes toward the present state of the music."[55] Any musical description that employs verbs such as gain, get, become, increase, decrease—usually in reference to a process (e.g., getting louder, density increases, losing momentum, etc.)—draws on this metaphor. In post-tonal repertoire, where the absence of established conventions and structures causes greater

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[53] Cox, "The Metaphoric Logic," 225.

[54] In Lakoff and Johnson, this metaphor goes by the name of ATTRIBUTES ARE POSSESSIONS, *Philosophy in the Flesh*, 195–96, 198.

[55] Cox, "The Metaphoric Logic," 225.

reliance on qualitative description, the STATES ARE POSSESSIONS metaphor tends to figure more prominently.

In music analysis, we frequently shift back and forth between ground and figure perspectives. It may be that the distinction between MOVING TIME and TIME'S LANDSCAPE (or STATES ARE POSSESSIONS and STATES ARE LOCATIONS) reveals different stages of the analytical process. For example, MOVING TIME may reflect initial experiences and impressions and TIME'S LANDSCAPE may reflect a retrospective synthesis of the overall experience.

So far we have seen that the main metaphors underlying our concept of temporal and musical motion are the duals MOVING OBSERVER and MOVING TIME, and STATES ARE LOCATIONS and STATES ARE POSSESSIONS. The metaphors STATES ARE LOCATIONS and STATES ARE POSSESSIONS often combine with the metaphor CAUSES ARE FORCES to form more complex expressions of causation, forced movement, and agency. Figure 2.5 presents these duals side by side, along with other location event-structure metaphors that will have an important role in the following chapters.[56]

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[56] Submappings from Lakoff and Johnson, *Philosophy in the Flesh*, 179, 198.

Temporal Metaphor: MOVING OBSERVER	Temporal Metaphor: MOVING TIME
Location Event-Structure Metaphors:	Object Event-Structure metaphors:
STATES ARE LOCATIONS	STATES ARE POSSESSIONS
CHANGES ARE MOVEMENTS (between locations)	CHANGES ARE MOVEMENTS OF POSSESSIONS (acquisitions or losses)
PURPOSES (GOALS) ARE DESTINATIONS	PURPOSES (GOALS) ARE DESIRED OBJECTS
CAUSES ARE FORCES	CAUSES ARE FORCES
CAUSATION IS FORCED MOVEMENT (between locations)	CAUSATION IS TRANSFER OF POSSESSIONS
ACTIONS ARE SELF-PROPELLED MOVEMENTS	n/a
DIFFICULTIES ARE IMPEDIMENTS TO MOTION (e.g., blockages, features of the terrain, burdens, counterforces, and lack of energy)	n/a
FREEDOM OF ACTION IS THE LACK OF IMPEDIMENTS TO MOTION	n/a
EXTERNAL EVENTS ARE LARGE, MOVING OBJECTS THAT EXERT FORCE	n/a

Figure 2.5: Basic location event-structure metaphors and object event-structure metaphors

Note that not all location event-structure metaphors have a complementary object event-structure equivalent (they are not all duals). For example, the metaphor ACTIONS ARE SELF-PROPELLED MOVEMENTS, which describes actions committed by an agent as a result of that agent's own energy and impetus, does not make sense in the object-event-structure where the agent is stationary (assuming the agent and the observer are the same). The greater range of basic location event-structure metaphors—especially where force, energy, and agency are concerned—renders them more common in musical analysis attempting to establish causal relationships, or analysis based on embodied experience, which will be the focus of the next chapter. They are included here to illustrate how metaphors combine to create more composite meanings.

In a similar vein, Figure 2.6 includes a list of some of the image schemas that surface in musical analysis. The logical constraints imbued by the fundamental structural features shapes how we formulate concepts and relations (e.g., an object cannot be both inside and outside a container at the same time). Like metaphor, image schemas are understood to be an automatic and integral part of our thought process.

Path	Source-Path-Goal
Container	Cycle
Verticality/Scales	Link
Process	Collection
Superimpose	Attraction
Balance	Part-Whole
Front-Back	Near-Far
Inner-Outer	Center-Periphery
Splitting	Merging
Restraint	Counterforce
Blockage	Removal

Figure 2.6: Image schemas common in music analysis

All these metaphors and image schemas rely on concepts of spatial relations. Either directly or indirectly, all musical change can be inferred from motion in space.

Cox's Anticipation-Presence-Memory Continuum

While the metaphor CHANGE IS MOTION and the duals STATES ARE LOCATIONS/STATES ARE POSSESSIONS metaphors explain how we think of musical motion, Cox remarks that they do not tell us why. We have seen that complex metaphors are built from primary metaphors, which in turn are rooted in sensorimotor experience. Our application of motion to any abstract domain is therefore inferred from our bodily experience of motion. Because we a) see and gauge spatial relations between ourselves and our environment, and b) exercise a certain degree of control over these spatial relations by moving and interacting with our surroundings, our movements are often prompted by intentions and feelings. As we approach our desired location, or an object approaches us, we anticipate the arrival. Through these projected arrivals, we begin automatically to correlate *anticipation* (future events) with *ahead* and *approach*:

> Anticipation in the domain of physical motion becomes the source domain for anticipation in more abstract domains such as music because physical motion is the more fundamental and pervasive feature of our existence. ... The identity of 'anticipation' in both the concrete and abstract domains is what allows and motivates the mapping of spatial relations onto the relations of musical and other events, and it is what makes the metaphoric spatialization of anticipated events eminently logical: because 'anticipation' means 'ahead' and 'approached' or

'approaching,' we are motivated to understand any and all anticipated events in terms of 'ahead' and 'approach.'[57]

For Cox, the anticipation we sense with respect to future events—whether these are abstract arrivals (times or musical events) or literal arrivals (locations)—is a subjective experience common to the spatial, temporal, and musical domains. These domains share a phenomenology of anticipation, presence, and memory, which he calls the anticipation-presence-memory continuum, that is inferred from our experience of continuous motion in space.[58]

This phenomenology of anticipation, presence, and memory is based on Mark Johnson's explanation of the constraints that the PATH/GOAL image schema has on metaphors such as STATES ARE LOCATIONS, PURPOSES ARE GOALS, and MOTION ALONG A PATH.[59] Our experience of motion, Johnson explains, is motivated by intentions that we aim to satisfy. We conceptualize the relation between intention and satisfaction as a path, with intention marking the starting point (the source) and satisfaction marking the end point (the goal). The source and goal may be connected by a sequence of points that represent interim goals, resulting in a correspondence with the metaphors MOTION ALONG A PATH and PURPOSES ARE GOALS (as is the case for the metaphor A PURPOSEFUL LIFE IS A JOURNEY).[60] Although the goal gives direction to the path, direction itself is not part of the PATH image schema. The PATH schema connects two locations only.[61]

Cox's anticipation-presence-memory continuum introduces a timeline to Johnson's experience of motion. Anticipation and presence, representing the future and the present, correspond to the intention and satisfaction that Johnson claims underlies the PATH/GOAL schema.[62] The main difference is that Cox's model includes memory, thereby establishing a link with the past. Johnson considers the addition of a timeline a variation

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[57] Ibid., 205–6.

[58] Ibid., 210.

[59] Ibid., 205, 265.

[60] Johnson, *The Body in the Mind*, 113–17.

[61] This point distinguishes the PATH schema from the PATH/GOAL (or SOURCE/PATH/GOAL) schema.

[62] Cox, "The Metaphoric Logic," 262.

to the PATH/GOAL schema. The past is likely excluded from Johnson's model because it has no bearing on intention and satisfaction. Intention and satisfaction are only experienced in the present; if motion continues past a goal point, it is because a new path/intention has been initiated. The goal, therefore, becomes the source of the new path. In this manner, sources and goals can link multiple paths, creating an intricate network of paths, but only one path is relevant at a time. By overlaying a timeline onto Johnson's experience of movement (i.e., by incorporating the TIME ORIENTATION and MOVING OBSERVER metaphors), Cox connects past experience with present experience, thereby providing grounds for comparison, and more importantly, a phenomenology of temporal and musical continuity from our experience of continuous motion.[63]

Since we experience anticipation, presence, and memory of events in the spatial, temporal, and musical domains, then the three domains have a common correlational experience, making any cross-domain mappings between them apt. By virtue of their common phenomenology of continuity, Cox proposes what he calls "a general event domain," i.e., a "spatial/experiential/phenomenological continuum."[64] This continuum is an abstract relational structure that represents the mapping of our experience of continuous motion in the spatial domain onto the temporal and musical domains. It is a conceptual tool that reflects the literal properties of our understanding of time (see Figure 2.1) along with the metaphorical ones.

Two important points regarding Cox's phenomenology of anticipation, presence, and memory need to be stressed. First, the experiences are usually unconscious.[65] Because conceptual metaphor is an automatic cognitive process, one is not always aware of the correlations being made between domains. We normally become aware of anticipations only if they are not met, i.e., retrospectively. Second, anticipation does not necessarily mean predictability or expectation. By anticipation, Cox is referring to a set of projected

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[63] Ibid., 210.
[64] Ibid.
[65] Ibid., 205.

possibilities or prospective events; therefore, it is possible to experience anticipation without making predictions or having specific expectations.

Objections to Metaphors of Musical Motion

There tend to be two general reasons for why the musical motion metaphor is met with criticism:[66] the first stems from a narrow (overly specific) conception of musical motion as prediction; the second contests the relevance of defining musical change as motion. When musical motion is characterized (or defined) in terms of prediction, its applicability to repertoire is limited. Any music that does not meet the requirements of motion tends to be automatically, and often pejoratively, labelled "static." This is frequently the case with non-tonal or non-metric music. In *Sweet Anticipation*, David Huron lists several reasons for why absence of motion (predictable motion) may be considered negatively. From an evolutionary point of view, failing accurately to anticipate motion in our environment could have disastrous consequences for survival. Cognitively, the anticipation and satisfaction of goals generates a sense of pleasure.[67] Further, lack of motion is frequently associated with negative connotations, hence the common causal metaphor DIFFICULTIES ARE IMPEDIMENTS TO MOTION.

In music, absence of motion usually stems from associating motion with the prediction of pulses or structural goals. When associated with pulse, musical motion refers to a capacity to elicit literal motion from the listener. Whether listeners actually move their bodies in consequence is unimportant, as long as they feel they can or could synchronize their bodies to the music, e.g., dancing, clapping hands, stomping feet, etc. This phenomenon, known as entrainment, "involves a coordinated set of attentional periodicities on different time scales" which at minimum, requires "a tactus coordinated with one other level of organization."[68] Music that fails to evoke this sensation, according to Justin London, cannot be said to have motion. For London, absence of motion is not an

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[66] Most criticism centres on the STATES ARE LOCATIONS and PURPOSES ARE DESIRED LOCATIONS metaphors.

[67] David Huron, *Sweet Anticipation: Music and the Psychology of Expectation* (Cambridge, Massachusetts: MIT Press, 2007), 3, 131–132.

[68] Justin London, *Hearing In Time* (New York: Oxford UP, 2004), 25.

aesthetic criticism of the music; it is an observation that the music lacks the necessary structural features that our cognition requires to entrain.[69]

Prediction in the form of anticipated goals (e.g., harmonic progressions, symmetrical phrasing, tonal syntax, etc.), which are ubiquitous in discourse about tonal music, manifests itself as musical motion through the PATH/GOAL image schema and the MOTION ALONG A PATH/GOALS ARE LOCATIONS metaphors mentioned earlier. Because these metaphors are so intimately linked with tonal music, they have come to reflect a specific way of hearing and set of aesthetic values. When tonal listening habits (and their corresponding expectations) are applied to non-tonal repertoire, they can lead to an unfair criticism of the music since they often do not capture what is relevant or interesting. Because non-tonal music does not exhibit the gestures, meter, and other structures that the tonal listener expects, the listener may experience the music as discontinuous. Failure to anticipate and recognize tonal and metric patterns (i.e., goals along the PATH/GOAL schema) may cause some listeners to lose focus, and by losing focus, the music appears disjointed or static. For others, the absence of musical causality liberates the present.[70]

While no one denies that music involves change, some contest whether musical change needs to be expressed as motion. For musicologist Robert Adlington, musical motion metaphors place unnecessary emphasis on the temporal domain and its directional qualities. Change, he claims, can be communicated just as effectively without undue spatial emphasis on succession and continuity:

> the conceptualization of change as motion is purely metaphorical—as Lakoff and Johnson themselves strongly assert. It is an effective metaphor, frequently used in response to the need to find a physical correlate to the relatively abstract notion of 'change'. But if an alternative physical correlate suggests itself for a particular type of changing experience—increasing pressure, for instance—the requirements of cognitive metaphor are already fully satisfied: an abstract notion is grasped

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[69] Justin London, "Temporal Complexity in Modern and Post-Modern Music: A Critique from Cognitive Aesthetics" in *Unfolding Time*: *Studies in Temporality in Twentieth-Century Music*, ed. Darla Crispin (Ghent, Belgium: Leuven University Press, 2009), 52–53.

[70] See, for example, Christopher Hasty's overview of ideas on continuous and discontinuous change in "On the Problem of Succession and Continuity in Twentieth-Century Music," *Music Theory Spectrum* 8 (1986), 58–60.

using an appropriate metaphor. To insist that this experience of increasing heat is additionally accompanied by a sense of motion is to impose a second-level metaphor where one is not needed. We all have a ready knowledge of the feeling of increasing pressure; it is an immediate, physical experience that requires no additional metaphorical overlay. One may choose to identify the successive moments of increasing heat with spatial movement, but it is hardly a requirement to do so in order to grasp the nature of the experience. And of course, as the arguments of metaphor theory clearly imply, there is no "truth" about temporal experience that requires to be identified as motion, for motion is merely a convenient metaphor for the experience of change.[71]

This quotation contains several points I want to address: the statements that "our conceptualization of change as motion is purely metaphorical" and "there is no 'truth' to temporal experience that requires to be identified as motion, for motion is merely a convenient metaphor for the experience of change;" and the spatialization of non-motional processes like *increasing* pressure.

In the domain of space and motion, displacement of location or shift of position represents literal change. In this respect, our concept of change as motion is not entirely metaphorical; it has a very real, sensorimotor basis. We use this literal knowledge as a source domain to understand non-motional changes, e.g., mental states, via the metaphors CHANGE IS MOTION and the duals STATES ARE LOCATIONS and STATES ARE POSSESSIONS. So, while not all changes constitute motion, some changes do, and therefore, there is an in-part literal basis to our understanding and conceptualization of change.

Likewise, our concept of time (or temporal events) is not entirely metaphorical either; it is defined in part by metonymy.[72] We have a literal understanding of events as directional, irreversible, continuous, segmentable and measureable, which we cannot help but impose on the domain of time through the correlation of time-defining events.[73] If temporal experience stems from both the correlation of events (literal motion in the spatial domain) and automatic metaphoric thinking, then to say "there is no truth about temporal experience that requires to be identified with motion," from an embodied realist

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[71] Robert Adlington, "Moving Beyond Motion: Metaphors for Changing Sound," *Journal of the Royal Musical Association*, 128/2 (2003), 309.

[72] Lakoff and Johnson, Philosophy in the Flesh, 137, 167.

[73] Ibid., 167–68.

perspective, is not entirely accurate. Nor is motion "merely a convenient metaphor for the experience of change." Motion and metonymy provide an in-part literal basis to our experience of change and time. There is no denying that the CHANGE IS MOTION metaphor is convenient. Our familiarity with motion makes it an automatic and tremendously effective source domain.

Terms like increasing or decreasing, which refer to changes of state, have continuity and directionality embedded within them. The concept *increasing* implies quantity, comparison and duration. It is a judgment that there is *more* of whatever entity or characteristic it describes. To be aware of more, in turn, signals an act of comparison that involves our memory in some capacity. This act of comparison is not instantaneous, but rather a process within which the concept of duration and time are implicit. Adlington makes this point by using two arrows to show the "redundancy" of spatializing process and continuity:

> the fact that music continues to change is captured by the progressive nature of this vertical descent: no further 'movement' is necessary to conceptualize the music's changing character. The additional lateral or horizontal element in Figure 1(a) [Figure 2.7 below] is, I would argue, the product of a second-level metaphorical conceptualization (in terms of 'onward' movement as well as descent)—an additional conceptualizing move that goes beyond what is strictly needed in order to grasp the music.[74]
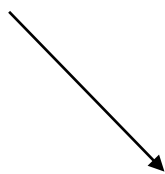
Figure 1a) Diagonal arrow   Figure 1b) Vertical arrow

Figure 2.7: Reproduction of Adlington's illustration of the redundancy of spatializing continuity

I agree that both arrows in Figure 2.7 (i.e., Figures 1a and 1b in the Adlington quote) imply duration. The arrows symbolize displacement; the direction of the displacement makes no difference since process and continuity (i.e., the "onwards" factor) are

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[74] Ibid., 310.

contained within the logic of the arrows.[75] Emphasizing continuity with additional horizontal motion (as opposed to simply vertical motion) is unnecessary unless there are other graphic, schematic, or conceptual reasons for which time needs to be (or is preferably) depicted on a separate axis.

Duration aside, both quotations by Adlington raise questions regarding metaphor analysis, such as determining necessary and sufficient conditions and working out hierarchies of mappings.[76] If the sufficient condition for a cognitive metaphor is that "an abstract notion is grasped using an appropriate metaphor," and where "appropriate" refers to a physical correlate, then any embodied, sensorimotor experience can serve as the source domain as long as there is an experiential correlation with the target domain. This describes Lakoff and Johnson's definition of primary metaphor. The sensorimotor correlate is a necessary condition of primary metaphor, but not of complex metaphor. Primary metaphors combine to create complex metaphors, and complex metaphors can combine to create even more complex metaphors.[77]

It seems complexity increases not only with the number of mappings, but also the number of mappings separating a target domain from a sensorimotor source domain (when presented sequentially). While we have a condition to differentiate complex metaphor from primary metaphor, are there criteria for privileging one primary metaphor over another, or one complex metaphor over another metaphor? How should hierarchies be approached (and are they even relevant)? While these questions may seem overly simplistic, I think the answer lies in familiarity. Abstract concepts and descriptions will

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[75] Arrows can represent both PATH and SCALE (i.e., verticality) image schemas. The PATH schema implies a location event-structure metaphor (e.g., STATES ARE LOCATIONS) whereas the SCALE schema can imply either a location event-structure metaphor or an object event-structure metaphor. According to Mark Johnson, the SCALE schema differs from the PATH schema in three ways: 1) the directionality is more or less fixed (up is more, down is less); 2) it is cumulative, e.g., "If you are collecting money and have accumulated $15, then you also have $10. But this does not usually hold for progress along a path; if you pass through point A and arrive at point B, then you are no longer at point A (point A is not carried along into the present position);" and 3) it tends to be normative (Mark Johnson, *The Body in the Mind* [Chicago: Chicago University Press, 1987] Kindle edition, Location 2895-2906 of 5298).

[76] By hierarchies of mappings, I mean the logical, sequential presentation of mappings. Neurologically, mappings occur in parallel.

[77] Lakoff and Johnson, *Philosophy in the Flesh*, 63.

likely be effective if based on more ubiquitous sensorimotor experiences, like motion (but not restricted to motion).

Musical motion privileges our sensorimotor experience of moving through space because our concept of temporal events is itself spatialized, and not in an entirely metaphoric capacity either. Because the MOVING OBSERVER and MOVING TIME metaphors are so entrenched (partly because of the literal aspects afforded by space-time metonymy), it is difficult to imagine an alternative. Until we devise new ways to conceptualize time and experience events (spatial, temporal, or musical), event-structure metaphors like CHANGE IS MOTION, STATES ARE LOCATIONS or STATES ARE POSSESSIONS make sense, but more importantly are effective. This is not to say that novel metaphors and more obscure sensory source domains should be avoided. To the contrary, they confer rich meaning that primary spatial metaphors alone might not. As Cox points out, any experience (literal or not) is relevant if a common experiential correlation exists between the target and the source. For certain forms of analysis, motion metaphors may be preferred simply because of their familiarity. I believe this to be the case for Claude Vivier's *Wo bist du Licht*! and *Trois airs pour un opéra imaginaire*.

Chapter 3: Analytical Approaches to Vivier's Music

While the previous chapter showed how the motion we attribute to time and music is inferred metaphorically from our physical experience of motion, it did not define or address the mechanics of motion. Motion describes the change in position of a body relative to a frame of reference resulting from forces acting upon it. Whether we are aware of it or not, our body's movements incorporate an intuitive understanding of gravity, weight, mass, inertia, friction, tension, energy, etc., that we obtain through visual cues and muscular-nervous sensations. We learn to calibrate these external and internal forces in order to move our bodies as desired.[1] If musical motion is indeed analogous to our experience of physical motion, then musical motion should evoke analogous physical forces. This is the logic underlying Steven Larson's theory of musical forces, which extends the musical motion metaphor by invoking many of the same mechanical concepts that inform our experience of physical motion. In particular, it proposes that musical equivalents of gravity, magnetism, and inertia influence how we perceive, attend, and extract meaning from tonal music. Larson's theory draws on Lakoff and Johnson's conceptual metaphor, Gestalt psychology, studies in music cognition, and Schenkerian tonal models of prolongation.

This chapter explores how Larson's theory of musical forces can be expanded to accommodate Vivier's music. Although Vivier's music is not tonal, it has a strong triadic element due to the harmonicity of the combination tone chords (spectra) and the central role of the melody. Most music that is heavily dependent on melody evinces a quality of continuity that is difficult to divorce from an embodied experience of continuous motion. In this respect, Vivier's music lends itself well to motile, or forces-based, analysis. The first section of this chapter provides a general overview of Larson's theory of musical

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[1] Steve Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music* (Bloomington, IN: Indiana University Press, 2012), 66–67; George Lakoff and Mark Johnson, *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought* (New York: Basic Books, 1999): 36; See also Shaun Gallagher, "Body Schema and Intentionality," in *The Body and the Self,* ed. José Luis Bermúdez, Anthony Marcel, and Naomi Eilan (Cambridge, Mass.: MIT Press, 1995), 225–44.

forces (gravity, magnetism, and inertia). The second section expands and modifies the musical forces to suit the post-tonal context of Vivier's music. To this end, I propose abandoning musical magnetism and expressing intention through a musical observer (as suggested by Cox in Chapter 2) or a musical agent, as proposed by Robert Hatten. With concepts borrowed from Robert Hatten, Matthew BaileyShea, and Robert Adlington, I expand the repertoire of forces to include musical analogues to gravity, inertia, momentum, friction, energy, waves, and wind. After defining these forces and their application in Vivier's music, an overview of the general analytical approach undertaken in Chapters 4 and 5 is given.

3.1 Steve Larson's Theory of Musical Forces

Central to Steve Larson's theory of musical forces is the idea that we forge meaning by parsing and grouping information into "patterned relations," which, according to Gestalt psychology, tend to be based on "simple, complete shapes."[2] Although the definition of pattern can be broad, it usually constitutes either a) "a design or shape ... that could serve as a model;" b) a unifying structure bearing "some kind of internal symmetry or logic," or c) repetition.[3] Meaning emerges as a result of forming associations by hearing an event as being (or being similar to) something else, i.e., via analogy and metaphor, and for Larson, this process is a "creative act."[4]

Fundamental to Larson's musical forces is the metaphor MUSICAL SUCCESSION IS PHYSICAL MOTION, which appeals to our experience of movement.[5] It utilizes the automatic, intuitive knowledge that ensues from seeing and hearing objects move, moving objects, moving our bodies, and sensing our bodies move.[6] As such, it does not

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[2] Steve Larson, *Musical Forces*, 35.

[3] Ibid., 32–33.

[4] Ibid., 35. Larson uses the term analogy to refer to any "mapping that calls attention to similarities between two different things—regardless of whether those things belong to the same or to different domains" (37). Metaphor, by contrast, requires a cross-domain mapping.

[5] Ibid., 21.

[6] Ibid., 67.

call upon a theoretical understanding of physics.[7] This emphasis on embodied, human mechanics has the advantage of being familiar to all, thus affording a common vocabulary and means of articulating the experience of musical motion. Larson's theory focuses on three forces—gravity, magnetism, and inertia—which will be reviewed below. Although designed with melodic expectation in mind, Larson explores ways of extending the forces to other parameters such as rhythm and motion. Before proceeding to a synopsis of musical gravity, magnetism, and inertia, I wish to quote at length Larson's disclaimer regarding the confines of his musical forces:

> I do not claim that the account given here completely explains the roles of musical forces in our experience of music. I do not claim that musical forces completely explain musical experience. I do not claim that every melodic motion results from giving in to musical forces. I do not claim that musical forces have the same universality or "natural" status that physical forces do. I do not claim that such forces are an important part of every culture's music. I do not claim that gravity, magnetism, and inertia are the only forces that shape melodic expectations. I do not claim that musical forces and musical motion are the only metaphors that inform music discourse and musical experience. And I do not claim that the ideas of pattern, analogy, and metaphor offered in this book give a complete account of human meaning-making.[8]

In short, the theory of musical forces does not apply to all musical contexts, nor will it resonate with all listeners; it simply offers a way of enhancing our understanding when hearing music (or musical motion).

Melodic Gravity

"Melodic gravity is the tendency of a note (heard as 'above a stable position') to descend."[9] According to Larson, experienced listeners of tonal and popular music (any music that has a tonal centre) infer melodic expectations in part from their embodied experience of gravity. People come to a rudimentary understanding of gravity by sensing and observing objects of mass (including their own bodies) move and interact in space. Early on, they realize that objects always fall to the ground unless they are otherwise

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[7] Ibid., 22.
[8] Ibid., 3.
[9] Ibid., 83.

secured, and that effort is required to counter the effects of this downward pull (e.g., jumping, hanging off monkey bars, walking uphill). Intuitively, many appreciate a connection between an object's mass and the attractive force of the ground (i.e., the concept of weight). Gravity, therefore, is an integral part of our experience of motion.

If our experience of motion includes sensitivity to the effects of gravity, then our experience of these effects can serve as a source domain for musical motion, especially melodic contour. Larson suggests that listeners transfer the adage "what goes up, must come down" to their expectations of melodic contour.[10] We experience gravity as an inevitable, downward force that culminates in a state of rest. Rest, or cessation of motion, occurs when the acting forces are in a state of equilibrium. Usually this opposing or balancing force comes in the form of a stable platform, like the ground's surface. Just as gravity attracts objects to the ground's surface, melodic gravity in a tonal context compels descending motion to the tonic. The tonic establishes a fixed platform that grounds melodic contour. We thus transfer our expectations of physical motion (and physical trajectories of motion) to melodic motion.

Larson leaves the expressive meaning of musical gravity open to interpretation since it depends on context and listener's subjective experience. If a melody succumbs to melodic gravity, it no longer expends energy or effort resisting it. The decreased effort or energy can have different emotive connotations depending on how that decreased effort, energy, or activity is interpreted in the source domain, and how or if it combines with other metaphors to create more complex meanings.

To demonstrate this potential for flexible meaning, Larson contrasts the downward motion in the last part of the popular melody *Twinkle, Twinkle Little Star* with the bass line in *Dido's Lament*, shown in Figures 3.1 and 3.2. In the former (Figure 3.1), the descending motion comes across as "dissipated" energy, an "effortless return to its starting point" after the easy, "athletic" leap to the dominant.[11] In *Dido's Lament*, the

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[10] Ibid., 87.

[11] Ibid., 83–84.

tempo, repetitive bass line, and morose text reflect being "pulled slowly and inevitably downward" by the "weight of sadness." The effect is felt in the bass line's slow, chromatic descent to the dominant, G3—F♯3—F3—E3—E♭3—D3, where "the primary motion of each gesture is a drooping or sighing one that gives in to gravity." The ascending tonic leap from G2 to G3 that restarts the descent is not part of the gesture, but rather a consequence of repetition (Figure 3.2).[12]

Figure 3.1: Twinkle, Twinkle Little Star

Figure 3.2: Dido's Lament, from Henry Purcell's *Dido and Aeneas*, Act III

Of the three musical forces, Larson claims musical gravity is the weakest. It tends to be less influential than magnetism or inertia, especially at the local level, because "we are less aware of gravity when we are in low, stable positions."[13] By contrast, melodic gravity seems more influential at global levels—as is the case in tonal contexts with the

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[12] Ibid., 84.
[13] Ibid., 88.

Urlinie or *Ursatz*—because it reflects the overall, general trajectory of motion, hence capturing the eventual inevitability of gravity's effects.[14]

Larson also extends his application of musical gravity to rhythm, claiming that the hand and foot gestures associated with upbeats and downbeats (rooted in physical motions such as dance and conducting) impart a vertical quality or connotation to beats. This vertical motion is reminiscent of resisting and submitting to the force of gravity.

Melodic Magnetism

Melodic magnetism refers to the "tendency of an unstable note to move to the closest stable pitch, a tendency that grows stronger as we get closer to that goal."[15] An unstable pitch compels the listener to "auralize" a different, more stable tone in its place, e.g., hearing the leading tone as leaning towards the tonic. Larson grants that "we experience magnets later in life than we do gravity, inertia," which renders physical magnetism a less familiar source domain; however, because we experience intentions and desires that motivate our movements, we can use these intentions as a source domain for musical magnetism.[16] As Larson stipulates, "[t]he desire for any goal that grows stronger as that goal approaches may provide a source that can be mapped onto the target domain of musical attractions."[17]

Melodic magnetism describes the motion between chord members (i.e., root, third, and fifth) as a form of attraction that increases with proximity. For example, where a melody is supported by tonic harmony, scale degrees 1, 3, and 5 function as points of attraction. In a major-mode context, motion from scale degree 4 would therefore feel a pull in the direction of scale degrees 3 and 5; however, since scale degree 4 is a semitone closer to

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[14] Although Larson's analogy of gravity to melodic motion is conditioned by his basis in orthodox Schenkerian theory (and a restriction to tonal music), arguments in support of an ascending *Urlinie* have been made by David Neumeyer, "The Ascending 'Urlinie,'"*Journal of Music Theory* 31/2 (1987): 275–303; William Rothstein, "On implied Tones," *Music Analysis* 10/3 (1991): 289–328; Henry Martin, "More Than Guide Tones: Steve Larson's Analyzing Jazz—A Schenkerian Approach," *Journal of Jazz Studies* 7/1 (2011): 121–44.

[15] Larson, *Musical Forces*, 88.

[16] Ibid., 95.

[17] Ibid., 94–95.

scale degree 3 than it is to scale degree 5, the magnetic pull exerted by scale degree 3 will be stronger. The force of attraction intensifies with proximity, which Larson quantifies as being inversely proportional to the square of the semitone distance (where one semitone = 1). A note's net pull towards its closest attractor is expressed as the inverse of the square semitone distance to the closest stable pitch (i.e., $1/d_{to}^2$) minus the inverse of the square semitone distance to the closest stable pitch in the opposite direction ($1/d_{from}^2$). Since the magnetic pull on scale degree 4 is stronger in the direction of scale degree 3 (d_{to}) than it is scale degree 5, the net pull on scale degree 4 towards 3 is 0.75:[18]

$$M = 1/d_{to}^2 - 1/d_{from}^2$$
$$M = 1/(1)^2 - 1/(2)^2$$
$$M = 1 - 0.25$$
$$M = 0.75$$

Larson defines melodic stability, in turn, in accordance with Schenkerian prolongational structures.[19] Tones that persist on multiple levels of structure (from foreground to background) have greater stability than those limited to foreground levels (i.e., tones considered to be surface elaborations). Since melodic magnetism depends on stability, and stability depends on learned synchronic structures, Larson recognizes that melodic magnetism reflects learned behaviour from tonal conditioning more so than melodic gravity and melodic inertia.[20] In this sense, melodic magnetism is more contrived (i.e., socially cultivated) and less instinctive than the other musical forces.

While stability increases in a Schenkerian context with each hierarchical level, tones on higher levels of structure (i.e., closer to the background) do not exert greater magnetic force. Since melodic magnetism increases proportionally with proximity, its effects are felt more strongly at the local level than the global level. Distance, thus, weakens magnetic force. As Larson puts it, "the pull of a magnet not only grows stronger as it gets closer and closer, it does so in an accelerating way that can be quantified. As a result, we are more likely to observe its influence on the local, rather than the global, trajectories of

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[18] Ibid., 105–6. The subscripts "to" and "from," which indicate the direction of the attraction, are borrowed from Larson.

[19] Ibid.

[20] Ibid., 5.

objects."[21] Consider, for example, the difference, in a major-mode context, between a leading tone resolving to the tonic at the end of a phrase and the motion from scale degree 7 in an *Urlinie* (even if 8-lines are rare). In the former, the scalar proximity is coupled with temporal proximity (as is typical of local structural levels). In a conventional *Urlinie*, scale degree 7 descends to scale degree 6, despite the "shorter" Cartesian distance between scale degrees 7 and 8. Because the *Urlinie* represents an abstraction of a generalized trajectory, its pitches are not usually temporally adjacent at the foreground level (although they could be). The larger temporal distance weakens the magnetic force of attraction. Context and other factors (e.g., timbre, dynamics, gravity, inertia, correlates pertaining to weight and size, etc.) can enhance or hinder musical magnetism as well.

When applied to rhythm, magnetism describes the tendency to auralize a stronger, more stable metrical position in the place of a weaker one.[22] For example, an event occurring on the last sixteenth of the fourth beat in 4/4 time, of an *allegro vivace*, might be auralized on the following downbeat. Although the offbeat and downbeat are equidistant, the magnetic pull towards the downbeat would be stronger because the downbeat represents a stronger metrical position than the fourth offbeat.

Melodic Inertia

Melodic inertia is the tendency for a "pattern of motion to continue in the same fashion, where the meaning of same depends on how that pattern is represented in musical memory."[23] Similar to Newton's first law of motion, it refers to both resting and moving objects. Unless forces compel it to change its state, an object at rest will either remain at rest or continue on its given path with the same speed and direction. The amount of force required to exert changes in an object's momentum depends on both the mass and velocity of the object. The effects of musical inertia are sometimes described as direction,

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[21] Ibid., 95.

[22] Ibid., 148.

[23] Ibid., 96.

or what Leonard B. Meyer calls good continuation.[24] Although Larson's discussion of melodic inertia refers primarily to pitch contour, it nonetheless takes rhythm into account since rhythm strongly influences pattern perception. For Larson, rhythm is more than durational values; it encompasses the totality of musical events that articulate it. He defines rhythm as motion, and while it is possible to have rhythm without melody, the inverse is not. For this reason, rhythm is an integral part of melody. Rhythmic inertia refers to the tendency for a metric or rhythmic pattern to continue (with or without pitch).

It should be mentioned that inertia (or its moving component, momentum) is not a force, but rather a property of a body that describes its capacity to resist change. A force, in contrast, is what causes an object to change its state of rest or motion. The degree of change depends on the force's magnitude and direction. Aware of this technical inconsistency, Larson nonetheless preserves the vernacular term "inertial force" because it encapsulates how we intuitively perceive or feel inertia (e.g., the forward jerk experienced when a car slams on its brakes).[25] Again, Larson stresses that musical forces imply musical motion primarily from our physical sensations of motion, not a technical understanding of physics. From this perspective, it makes sense to group musical inertia with musical gravity and musical magnetism; therefore, when discussing Larson's theory of musical forces, I will abide by his terminology and refer to musical inertia as a musical force.

Musical inertia is deemed to be more influential than magnetism and gravity: it is more pervasive than magnetism, more impactful than gravity, and unlike the other two musical forces, maintains its level of influence (strength) across structural levels.[26] It is also the most intuitive (i.e., least socially conditioned) musical force since it involves making basic observations as to how events are either similar or different. This type of comparison applies readily to a variety of musical contexts and parameters. If unimpeded, inertia can "carr[y] motion beyond the points of stability to which other forces draw

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[24] Ibid., 98. See "Principles of Pattern Perception: The Law of Good Continuation," in Leonard B. Meyer, *Emotion and Meaning in Music* (Chicago: Chicago University Press, 1956), 83–127.
[25] Ibid., 22.
[26] Ibid., 100.

objects."[27] This innate property to bypass stable pitch platforms makes inertia's influence greater than gravity and magnetism; however, inertia often works in tandem with the other forces to bring about "smooth motions that tend toward a state of equilibrium."[28] From an embodied perspective, physical inertia is a rich, familiar source domain.

Larson's hierarchy of motion has its foundation in physical gesture.[29] It builds on the observation that all gestures terminate in a state of rest, thus exhibiting a cycle of stasis-motion-stasis. Force is required to overcome an object's inertial resistance, but once that object is set in motion, its momentum maintains a fixed trajectory until friction slows its movement or brings it to a halt. A musical gesture, like a physical gesture, exhibits a cycle of motion defined by a beginning, middle, and end, separated by two states of rest. This diachronic structure, or pattern of ordered relations, serves as the basis for musical form.

Combining Musical Forces

Like physical forces, Larson suggests that musical forces behave in a consistent and quantifiable manner in tonal music. As such, computer programs can be (and have been) devised to evaluate musical tension. These inform listeners' expectations towards stability, continuation, and closing (supported by studies in music cognition). Larson's algorithm for melodic expectation measures the net force between two successive notes in a tonal context and takes only pitch into account. The net force refers to the combined work of musical gravity, magnetism and inertia ($F = W_G + W_M + W_I$), which he weighs as follows:[30]

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[27] Ibid.

[28] Ibid.

[29] According to Larson, "... our experience of musical motion seems to borrow not just selective features of physical motion but any aspect of physical motion that can be mapped onto musical succession... one of those constraints is that physical motions tend to have beginnings, middles, and ends that move from stability through instability then back again to stability. Like many musicians, I often refer to such a motion (one with a beginning, middle, and end) as a 'gesture'" (145).

[30] Ibid., 105–6.

Gravity	Giving in to gravity	+ 1
	Not giving in to gravity	0
Inertia	Giving in to inertia	+ 1
	Going against inertia	− 1
	No inertial implication	0
Magnetism	$1/distance_{to}^2 - 1/distance_{from}^2$	

Figure 3.3: Assignment of weights in Larson's algorithm for melodic expectation

While the labels and names for the various forms of tension may differ (e.g., Larson uses the analogy of physical forces), they all involve the concepts of attraction and continuity, but some consider musical gravity to be redundant since it can be subsumed under attraction and inertia.[31] Larson concedes that the similarity between existing computer programs, which weigh and measure the parameters comparably, demonstrates how influential and pervasive the idea of musical forces is in our perception and interpretation of tonal music.[32] Because post-tonal music does not share the same pitch hierarchy and consistent (predictive) behaviour of tonal music, this type of generalized algorithm (which depends on the consistent application of forces within a common structure) has little applicability. In post-tonal music, in which pitch relations are much more contextualized, the application (analogy) of musical forces becomes more descriptive than prescriptive. The strength of the musical forces lies in the communicative power of embodied metaphors, not the structural unification (structural modeling).

3.2 Application of Force (and Embodied) Metaphors to Non-Tonal Contexts

Larson's musical forces are conceptualized with a Schenkerian model of tonal music in mind. Schenkerian analysis approaches common-practice tonal music with the assumption that all pieces share the same underlying, fundamental structure, the *Ursatz*. The *Ursatz*, which involves a fundamental melodic descent (from scale degree 3, 5, or 8) over a I–V–I large-scale harmonic progression, represents a diachronic event structure, i.e., a set of temporally ordered relationships, that evokes the MOTION ALONG A PATH

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[31] Larson notes that even though Fred Lerdahl and Elizabeth Margulis do not overtly refer to musical gravity, it is nonetheless implied in their models since these recognize "tendencies for downward motion as a by-product of the stability values and other factors in their models"(103).

[32] Ibid., 109.

metaphor. All pieces follow the same basic path, or trajectory of motion, which therefore defines the trajectory to be taken. When moving from the foreground to background, the motion, or the sequence of events, becomes increasingly predictable with each structural level. In such a context, forces like gravity, magnetism, and inertia, conceptualized in a deterministic fashion, simply reinforce or reaffirm the model in a tautological manner.

In post-tonal music, pitches do not abide by the same hierarchical relationships as tonal music. Motion (and the structures it represents) does not evince the same consistency and predictability, and as a result, deterministic forces have more limited applicability. With fewer common conventions and overarching models, motion becomes more localized, context dependent, and difficult to anticipate. Of the three forces proposed by Larson, gravity and inertia transfer more readily to the indeterminacy of post-tonal music (they can apply to most linear contours; gravity represents a platform and inertia, continuity). Their broader applicability might be due, in part, to our greater familiarity with their embodiment. Magnetism, because it depends the most on the properties of the tonal system, implies a determinism that is less compatible with post-tonal music. Before addressing magnetism's deterministic implication, our more removed engagement with it needs to be explored first.

Because we have sufficient mass and density, gravity and inertia represent a very real, visceral part of our experience of physical motion; we feel them in every gesture. We do not have a similar sensorimotor experience of magnetism. Since our bodies are not magnetic, magnetic forces simply do not affect our movements the way that gravity and inertia do.[33] Our understanding of magnetism stems from visual observations and theoretical predictions that polarized metals behave in a certain manner (e.g., fridge magnets, nails strung together). From this theoretical understanding, we infer magnetic attraction from a broader understanding of attraction as desire or intention.[34] In short, the

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[33] All sensory phenomena—whether it appeals to the sense of touch, taste, smell, sight, or hearing—can be reduced to the transmission of electrical signals to the brain; however, because we are unconscious of this physiological mechanism, magnetism (or electromagnetism) does not offer an intuitive, familiar source domain for conceptual metaphor.

[34] Desire and intention, as discussed in Chapter 2, are conceptualized (and therefore spatialized) using the PATH image schema and MOTION ALONG A PATH metaphor.

source domain for magnetic attraction is desire and intention. Magnetic attraction therefore represents a second level of cognitive mapping that is absent with the other force metaphors.

While many argue that we embody the tension and release quality of tonal music in terms of physical-psychological attraction (e.g., sexual attraction, hunger, thirst), and indeed this seems to be the approach taken by Larson and Hatten (i.e., that musical magnetism is an analogue for magnetic force, which in turn is an analogue for psychological/physical attraction), psycho-physical attraction does not have the same structural entailments as magnetic attraction. These different entailments are what make magnetic attraction a poor or less suitable metaphor for post-tonal music.

Unlike magnetic attraction, which leads to either attraction or repulsion, an intention or desire can lead to multiple possible outcomes. Because nothing guarantees the fulfillment or satisfaction of an intention or desire, nor the consistency of intention over time, intentions do not imply the same deterministic motion that magnetism does. If an intention is abandoned, a new path leading to a new goal automatically surfaces. (Recall from Chapter 2 that only intentionality gives direction to the PATH schema.) For the most part, intentions and goals are unconscious for many listeners and observers, thus making the metaphoric path (and trajectory of motion) they follow equally unconscious. As suggested by Leonard Meyer, and developed further by Arnie Cox and Christopher Hasty, expectations tend to surface to consciousness only as they are being thwarted:

> Thus while our conscious minds do not actively expect a consequent unless the pattern reaction is disturbed, our habits and tendencies are expectant in the sense that each seeks out or 'expects' the consequents relevant and appropriate to itself. Though he may never become aware of his expectations as he reaches in his pocket for a pack of cigarettes, the behaviour of the habitual smoker shows that he does expect or, perhaps more accurately, his habits expect for him.[35]

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[35] Meyer, *Emotion and Meaning,* 25. See also Hasty, *Meter as Rhythm*; "Phrase Formation," 188; Cox, "The Metaphoric Logic," 206, 215, 218.

Expectations can also be "non-specific, in that we are not sure precisely how they will be fulfilled."[36] Retaining this flexibility for multiple outcomes is crucial in a post-tonal context. For this reason, I propose replacing musical magnetism with intentionality and therefore making the underlying mapping explicit. This concept of intention (I am using intention synonymously with desire, expectation, or goal) both motivates and initiates the observer's motion on TIME'S LANDSCAPE.[37] Robert Hatten's musical agent, whom is "not only embodied but able-bodied, and capable of generating what might be called initiatory energy," also fulfills this role.[38] The agent explains how paths are first set into motion, as well as how they can conflict with the "environmental constraints" that musical forces represent. While Hatten introduces the agent in addition to musical magnetism, in post-tonal contexts, intentionality expressed through an agent suffices.

In addition to eschewing the force of musical magnetism and positing an observer or musical agent, my analyses of Vivier's music expand the repertoire of forces to include Hatten's musical analogues to friction and momentum, BaileyShea's concept of unpredictable environmental forces, and various energy metaphors (e.g., conversions between kinetic and potential energy, pressure, heat), as advocated by Robert Adlington and Yonatan Malin.[39] Friction represents a natural addition because of its experiential nature in our understanding of changes in inertia and momentum. Energy metaphors, which go beyond the "initiatory energy" of the agent, offer a means of describing embodied non-motional changes or states of being (e.g., pressure). These, too, constitute an important part of our embodied experience and therefore serve as a rich source domain. Although gravity, inertia, momentum, friction, and energy make up the majority of the metaphors in the following analyses, any sensations and activities that engage these

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[36] Meyer, *Emotion and Meaning*, 26.

[37] Temporal metaphors, such as TIME'S LANDSCAPE, are discussed in Chapter 2.

[38] Robert Hatten, "Musical Forces and Agential Energies: An Expansion of Steve Larson's Model," *Music Theory Online* 18/3 (2012), [5].

[39] Robert Hatten, "Musical Forces;" Matthew BaileyShea, "Musical Forces and Interpretation: Some Thoughts on a Measure in Mahler," *Music Theory Online* 18/3 (2012); Robert Adlington, "Moving Beyond Motion: Metaphors for Changing Sound," *Journal of the Royal Musical Association* 128/2 (2003): 297–318; Yonatan Malin, "Metric Analysis and the Metaphor of Energy: A Way into Selected Songs by Wolf and Schoenberg," *Music Theory Spectrum* 30/1 (2008): 61–87.

forces may be appropriate in better informing our experience. An embodied source domain provides immediate, intuitive, and *common* knowledge, and as such, has increased communicative power. Increasing the toolbox to incorporate all embodied metaphors (i.e., metaphors based on sensory input) provides the analyst with more choice, which is key when the purpose of the metaphors is to relate the observer's relationship with the musical environment.

As mentioned in Chapter 2, the observer's experience changes depending on the perspective he or she adopts. With the interior MOVING TIME perspective, the observer remains stationary and impassively allows the forces of the environment (or qualities of the music) to move past him or her. With interior MOVING OBSERVER perspective, the observer moves about the environment and experiences the forces directly as they interact with his or her motions. At times the forces can enhance the observer (or agent's) movements, other times they can be an impediment (e.g., paddling against a current). The exterior MOVING OBSERVER perspective tends to be reserved for impartial, detached observations of motion, where the observer represents neither element of the figure-ground relationship. Although these perspectives are mutually exclusive, the observer or analyst can switch back and forth between perspectives. Metaphors, therefore, need to reflect these different perspectives. The following two chapters demonstrate through analysis how gravity, inertia, momentum, friction, and energy metaphors apply to *Wo bist du Licht!* and the first two *airs* of *Trois airs pour un opéra imaginaire*. Below I describe my application of these musical forces in the analyses that appear in Chapters 4 and 5.

Musical Gravity

In tonal music, musical gravity represents a moveable platform that attracts downward motion. It is a context-dependent point of reference, usually marking the lowest pitch reference, the tonic. In Chapters 4 and 5, musical gravity takes both a structural and qualitative form. As a structural element, it appears as a pedal tone; as a qualitative element, it evokes sensations pertaining to weight (e.g., interaction of mass and gravity). Because Vivier's spectra tend to involve pedal tones, the lowest frequency in the spectra has time to assert itself as a localized platform. For the duration of a spectrum, the lowest

frequency anchors motion. Just as our experience of gravity does not change with the altitude of a platform (i.e., our bodyweight feels the same on the ground as it does on the top floor of a skyscraper), nor does the experience of musical gravity change from one spectrum to the next. In both cases, the platform attracts objects and provides the necessary resisting force, or pushback. When successive spectra have the same lowest generative frequency, a pedal tone is created that, by virtue of its sustained presence, begins to sound like a fundamental and project the harmonic spectrum to which it belongs. While this fundamental adds an air of consonance (or dissonance depending on the combination tones), it mostly imparts heaviness. This weight can influence the perception of motion or energy output of the melody and combination tones above it. We will encounter examples of this in the following chapters.

Musical Inertia and Musical Momentum

Although closely related, momentum and inertia are not interchangeable. Inertia, which refers to the capacity to resist change, depends on mass. Momentum, the product of mass and velocity, is the amount of force needed to change a state of inertia, either moving or resting. For example, a resting train engine (i.e., a large, heavy, object) has a high inertia due to its mass and it takes significant force to get it to move (i.e., overcome inertial stasis). As it starts moving down the track, it picks up speed (i.e., increases velocity) and gains momentum. Should it need to stop suddenly, it would take more force to overcome the higher momentum when it is moving quickly than when it is moving slowly. The momentum changes because the velocity changes; the velocity changes because force(s) act(s) upon it. If the train engine maintains the same direction and speed, that uniform motion represents a moving state of inertia.

Larson's musical inertia refers to the continuity of a pattern, where the term pattern can encompass a wide range of musical contexts as long as it has an "internal logic," e.g., the direction of a contour, a sequence, a rhythm, an incremental process (acceleration, crescendo, decrescendo, transformation), etc. Defined so broadly, musical inertia refers to both inertia and momentum, and can implicate other forces such as friction. Like Hatten, I also make a distinction between inertia and momentum: I use inertia to describe a

musical state of "sameness" and momentum to refer to the "amount" of motion or force that an object displays, which I tend to reserve for processes of intensification or attenuation, i.e., changes in momentum over time. My definition of musical momentum differs from Hatten's in that it depends on a combination of both perceived velocity and perceived mass. As a result, changes in momentum can result from perceived changes in the product of velocity and mass.

Musical Friction

Friction seems a natural inclusion for a theory of musical forces, particularly one rooted in motion metaphors. Like gravity and inertia, it constitutes an integral part of the mechanics of motion, and as such, everyone has ample embodied experience of it. We experience friction primarily as a form of resistance, e.g., air resistance (walking with a headwind versus a tailwind) or abrasion (e.g., chaffing). It represents an important part of Hatten's expansion of Larson's forces. (In Larson's theory of musical forces, friction is superfluous: musical magnetism and gravity define stability and attract motion, while inertia can describe a pattern of winding down or slowing down.)

Because friction represents a primary impediment to motion, it is often used as a source domain for obstacles in general; hence the metaphor DIFFICULTIES ARE IMPEDIMENTS TO MOTION. In a musical context, most forms of attenuation (i.e., any perception of something lessening), especially if it leads to a state of rest, may be construed as musical friction. Any process that promotes a sense of slowing down or diminishing momentum, e.g., decrescendos, *ritardandos*, *ritenutos*, lengthening durations, "flattening" of the musical contour, etc., are especially adept at evoking musical friction. In the two years before his death, Vivier became increasingly interested in time and the threshold between rhythm and duration.[40] The passages of *spectre rythmique* in *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire*, which explore this threshold, are good examples of musical friction.

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[40] See Vivier's "Pour Gödel," "Cinéma et musique," "Que propose la musique?" in *Circuit* 2/1–2 (1991): 125–130.

Musical Energy

Although not as common as motion metaphors, energy metaphors in music-analytical discourse have gained prominence. They go hand in hand with force metaphors and complement the latter by offering a means to convey a force's intensity or the level of effort required for an agent or observer to move. A moving observer or agent has kinetic energy whereas a stationary observer or agent has a capacity for energy, i.e., potential energy. The transfer and conversion of musical energy can impart direction or intention to gestures. This last attribute is exploited most in the analyses.

Also, musical energy offers a way to express forces and states that do not involve visible signs of motion. Heat, or thermal energy, is the kinetic energy of molecules. Pressure is the measure of force per area, but with a fluid or gas, it refers to the measure of energy per volume. While musical thermal energy does not figure in the analyses, musical pressure does. It usually coincides with passages where the focus is on the changing state of one parameter (not including pitch), with little to no activity in the other parameters. For instance, just before the *spectre rythmique* in *Wo bist du Licht!*, the strings pulse a spectrum in triplets while performing a crescendo. The stasis of the spectra (harmonic inertia) and pulses (rhythmic inertia), combined with the increasing volume seem to reflect an increase in pressure.[41]

Note that a single musical phenomenon or parameter can give rise to different metaphors (e.g., a crescendo could convey increased pressure, heat, or proximity, intensity (energy), etc.), so multiple interpretations are possible that do not necessarily reflect inconsistencies, just different perspectives. The musical-mechanic and -thermodynamic metaphors described above, along with related concepts such as weight, density, mass, velocity, and volume (space), do not constitute an exhaustive list, but enumerate the main source domains that inform the analyses in the following chapters.

In addition to emphasizing the binaries push vs. pull and active vs. passive, BaileyShea makes a distinction between three categories of musical forces: motion produced by non-

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[41] Claude Vivier, *Wo bist du Licht!*, 30.

sentient (passive), predictable environmental forces (e.g., Larson's musical forces); agential forces, i.e., the willed motion or willed effort of a musical agent (10); and non-sentient, variable, *unpredictable* forces like wind and water.[42] The forces in this last category "behave like dramatis personae—whether antagonistic, sympathetic, or benign––but they aren't interpreted as having any willful intentions." In *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire*, the *technique sinusoïdale* suggests wave and wind metaphors since they vary in intensity and can arise unpredictably.

Analytical Approach and Analytical Tools

My analysis of the two works of Vivier that appear in the following chapters approaches musical form from the perspective of embodied metaphor. I use the term "form" to describe any structure that conforms to what Larson calls a diachronic hierarchy, i.e., "an ordering of elements with respect to the time of a piece within which they occur."[43] All descriptions involving the temporal order of sections, subsections, phrases, etc., fall within the realm of form. Within this category, I will, like Larson, use the term "musical gesture" to describe smaller events that have a beginning, middle, and end, thus exhibiting a unified cycle of stability-instability-stability.[44] While Larson's use of musical gesture centres on motion, I use it also to describe non-motional changes that involve process, i.e., a succession of states as in increasing pressure. As in tonal music, smaller musical gestures combine to form larger gestures and structures. I use the term "structure" to describe what Larson calls a synchronic hierarchy, i.e., "an ordering of events with respect to some inherent quality rather than with respect to the time of a piece within which they occur."[45] These inherent qualities are "presumed independent of the pieces in which they might occur."[46] In Vivier's late music, the algorithms of the spectra and durational schemes constitute structures. The formal analyses in Chapters 4 and 5

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[42] BaileyShea, "Musical Forces and Interpretation, [1, 9–10]"

[43] Larson, *Musical Forces*, 55.

[44] Ibid., 145.

[45] Ibid., 54.

[46] Ibid., 55.

incorporate sketch study (structure) with embodied metaphoric experience to gain an understanding of how Vivier realizes his pre-compositional structures.

Recordings, Scores, and Sketches

Unlike purely phenomenological analyses that depend entirely on listening without the use of a score,[47] the approach in this study combines recordings with score study and sketches to construct an idealised interpretation. At times inconsistencies between the score, manuscript, recordings, and sketches, require interpretive decisions. In such cases, precedence is given to the manuscript, unless the inconsistency results from an arithmetic mistake, as was the case in Figure 1.7. Because Vivier was known to work quickly and take short cuts, mistakes occur (especially arithmetic); however, before assuming such a mistake, practical explanations, e.g., instrumental limitations, are considered.[48]

Vivier's compositional sketches inform the structure and organization of the music by revealing patterns that would otherwise go unnoticed with the score and recordings alone. Most of the works' formal, durational, and melodic and harmonic content derives from the spectra or durational schemes calculated during the pre-compositional stage. For the most part, Vivier notates the spectra as scales (rounded to the closest quarter tone) overlaid with or without corresponding equal temperament frequencies. Those without frequencies indicate a transposition of a previously calculated spectrum.[49] Figure 3.4 shows two spectra from *Trois airs pour un opéra imaginaire* as they appear in the sketches, along with a transcription directly below. The spectrum on the lower staff is a transposition (T7) of the spectrum on the upper staff. As can be seen from Figure 3.4, the legibility of the notes and frequencies in the sketches is not always clear.[50] To help

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[47] See, for example, Naomi Cumming, "The Horrors of Identification: Reich's 'Different Trains,'" *Perspectives of New Music* 35/1(1997): 129–52; Judy Lochhead "How does it Work? Challenges to Analytical Explanation," *Music Theory Spectrum* 28/2 (2006): 233–54.

[48] Bob Gilmore, Braes, and Levesque have all commented on the expedience with which Vivier sometimes worked and its impact on legibility of sketches and manuscripts.

[49] Bryan Christian makes the same observation.

[50] Division de la gestion de documents et des archives, Université de Montréal, Fonds Claude Vivier (P235), P235/D4, 0064.

decipher or deduce these, I rely on combination-tone class matrices to deduce frequencies.[51]

Figure 3.4: Example of Vivier's sketches for spectra *Trois airs pour un opéra imaginaire*

Visual Representation

This study relies heavily on visual depictions of the musical forces and qualities. It uses timelines and schemas to translate aural phenomena into a condensed, static, visual medium. The schemas and timelines offer a distinct advantage over score excerpts because they facilitate depictions of long durations (i.e., sections spanning several minutes or more) and the representation (and spatialization) of less pitch-centred parameters such as texture, timbre, and form. As much as possible, events in the schemas are spaced so that the visual distance is proportionate to the duration (temporal distance).

The graphs follow standard Western musical conventions such as being read from left to right (thus reflecting the flow of time on the horizontal axis) and expressing pitch (and

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[51] Combination-tone class matrices are discussed in Chapter 1.

register), in ascending order, from bottom to top on the vertical axis. Structural and hierarchical relationships are also expressed vertically in order of importance from top to bottom. They also make use of colour blocking to differentiate layers, spectra (chord changes), texture, dynamics, or text to communicate additional information, all of which is made explicit in the legend.

Analyses

Chapters 4 and 5 offer analyses of *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire* and follow similar formats: they begin with background information regarding the composition, followed by an examination of the overall structure and form, which in large part consists of sketch analysis pertaining to the generation of spectra and the ensuing formal implications. Once the underlying architecture is laid bare, the music is analyzed from the perspective of conceptual metaphor, with particular attention to temporal, force, and energy metaphors.

Chapter 4: *Wo bist du Licht!*

Wo bist du Licht! (for mezzo-soprano, percussion, strings, and tape) was commissioned by the Société Radio-Canada (Canadian Broadcasting Corporation) and dedicated to Vivier's friend, Rober Racine.[1] The manuscript, which is signed 11 March 1981, was completed around the same time as *Prologue pour un Marco Polo* (dated 1 March 1981), indicating that Vivier likely worked on both pieces simultaneously. This is the first of his works to feature his *technique sinusoïdale*.[2]

The concept for *Wo bist du Licht!,* which predates August 1980, most likely began in the spring upon completion of *Lonely Child*. Among the sketches for *Wo bist* is a proposal for a radiophonic project featuring political speeches, thirteen strings (prerecorded on tape), and two percussionists.[3] Vivier's aim, as expressed in the proposal, had been to compose a montage of important socio-political texts from 1945–1972 (i.e., the period spanning the release of the atomic bomb at the end of World War II to the end of the Vietnam war) that he would then manipulate to create an alternate history.[4] The texts would be chosen as much for their emotive and musical content as their historical significance. In the end, the project seems to have resulted in two separate works: *Zipangu* (composed for thirteen strings) and *Wo bist du Licht!* (for mezzo-soprano, twenty strings, two percussionists, and tape).

While *Zipangu* reflects the initial instrumentation Vivier had planned, *Wo bist* is closer to the proposal's original political and historiographical intentions. The tape layer, for instance, contains broadcast recordings of an excerpt from Martin Luther King's iconic address at the Lincoln Memorial on 28 August 1963; an *in situ* broadcast of Robert Kennedy's assassination; a narration of Friedrich Hölderlin's "Der blinde Sänger,"

[1] Rober Racine is a Montreal-born multidisciplinary artist.

[2] The sinusoidal technique, or *technique sinusoïdale,* is described briefly in the glossary of Vivier's analytical terms found in Appendix A, but will be taken up again in Section 4.2.

[3] Division de la gestion de documents et des archives, Université de Montréal. Fonds Claude Vivier (P235) P235/D4, 065.

[4] Ibid. An English translation of the proposal is included in the Appendix B1 (my translation).

quatrains 4–9; and descriptions of torture taken from a Radio-Canada documentary on the Vietnam War.[5] The mezzo-soprano's text includes five of the poem's thirteen quatrains, along with two brief instances of *Sprechstimme* (presumably written by Vivier), and a long passage of his idiosyncratic *langue inventée*. The latter, Vivier insists, "bears no signification."[6] My translation of the program notes is given in Appendix B3.

According to Vivier's program notes, the work represents a "lamentation on human suffering," the key to which can be found in Hölderlin's poem.[7] The title *Wo bist du Licht!* is taken directly from the second line of the poem's first quatrain. Although the significance that Vivier attached to this poem and its author is not clear, it could be that Vivier saw himself as the blind singer. Vivier's own loneliness, sorrow, and fear parallel the blind man's suffering and isolation; however, where the blind man's grief is tied to the past (the "marvellous visual images" etched in memory), Vivier's suffereing comes from the unrealised potential of what the future could hold, or rather the disillusionment of its impossibility. Both appear to be seeking solace (light) in death. As Bob Gilmore has speculated, Vivier's quest for freedom and the blind man's search for light "can be seen as implicitly acknowledging that all hopes of paradise in this world are in vain."[8]

As the first work to include Vivier's *technique sinusoïdale*, *Wo bist* is an experiment in texture and temporality. The *couleurs* are treated more independently from the melody than in previous works, and as a result, they foster a stronger sense of musical motion. This chapter explores the force and energy metaphors that gradual changes in duration, dynamic, and texture of the spectra evoke. The strings, percussion, and tape create what Robert Hatten calls a virtual environment, i.e., a space constrained by "virtual environmental forces," which here imply the effect of musical gravity, inertia,

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[5] The original address from the "March on Washington," August 28 1963, 20th Century Fox TFS 3201. Face 1, from 14:52 minutes from beginning; live broadcast of Robert Kennedy's Assassination is from "USA 30 ans d'histoires," Archives sonores de Radio-Canada no. 760814-3.

[6] Claude Vivier's Program Notes. Division de la gestion de documents et des archives, Université de Montréal. Fonds Claude Vivier (P235) P235/D4, 065.

[7] Ibid. See Appendix B2 for a parallel German/English translation of the poem.

[8] Bob Gilmore, *Claude Vivier: A Composer's Life* (Rochester N.Y.: Rochester UP, 2014), 183–84.

momentum, friction, and energy.[9] In particular, this piece relies on changes in inertia and momentum to create smooth processes that lend coherence to formal sections. While inertia refers to an object's ability to resist a change of state (either moving or stationary), momentum is the quantity of motion that an object displays, and is defined in physics as the product of mass and velocity. Its analogue in this project combines the perceived sense of tempo (acceleration, deceleration) with the perceived sense of mass or size that a musical object displays (mass can be evoked multiple ways, e.g., register, density, timbre, etc.). Any change in momentum therefore arises as a result of changes in the product of tempo and mass. Since momentum and inertia feature most prominently in the first and third sections of the piece (Sections A and C), they are the focus of this chapter and are discussed in Sections 4.3 and 4.4. Sections 4.1.and 4.2 provide an overview of the piece's general form and spectral organization.

4.1 General Form

Wo bist's symmetrical four-part form is identified as Sections A, B, C, and B' in the formal diagram of the piece given in Figure 4.1. As with most of Vivier's pieces, formal sections are predetermined and tend to align with rehearsal numbers. The diagram contains key textural characteristics. Because Vivier's program notes offer a succinct overview of the formal, melodic, and textural aspects of *Wo bist du Licht!,* they are translated in Appendix B3 (the translation is my own). An overview of each section is given below; however, because Sections A and C are taken up in detail in sections 4.3 and 4.4, their treatment here is brief.

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[9] Robert Hatten, *Interpreting Musical Gestures, Topics, and Tropes* (Bloomington: Indiana University Press, 2004), 115. See Chapter 3 for an explanation of how these forces constrain the virtual environment in Vivier's late works.

Wo bist du Licht!
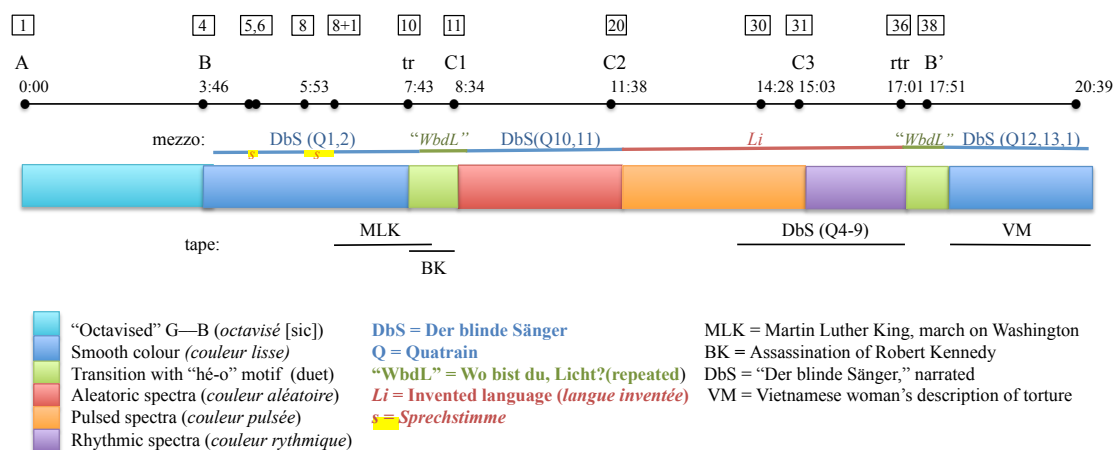
Figure 4.1: Formal diagram of *Wo bist du Licht!*

Section A

The absence of melody in Section A stands out among Vivier's other openings and
prologues (e.g., *Orion*, *Lonely Child*, *Bouchara*). Rather than present a melodic theme
whose phrase structure determines the piece's large-scale form, the opening of *Wo bist*
focuses on two processes of transformation: the dissolution of a noise-like soundmass
into a harmonic major third, and a long decrescendo and crescendo accompanied by a
deceleration and acceleration. The shift from stasis to motion in the former suggests the
breaking point between static friction and dynamic friction, while the palindromic quality
of the latter depicts musically the transformation of kinetic energy into potential energy,
then back to kinetic energy again.

Sections B and B'

Vivier calls the chordal, homorhythmic texture of the spectra and melody in Sections B
and B' *couleur lisse*.[10] In addition to the similar melodic, timbral, and harmonic texture,
the vocal text in Sections B and B'comprises primarily of the first and last two quartrains
of Hölderlin's poem (i.e., quatrains 1–2, 12–13). The political recordings are also more or
less restricted to the B sections (and transition), where the messages exhibit a pessimistic

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[10] See the glossary of terms in Appendix A.

progression as hope ("I have a dream," Martin Luther King) devolves into disillusionment (Robert Kennedy's assassination), and disillusionment devolves into apathy (documentary on torture).[11] As the last quatrain of the poem suggests, release comes in death only. Both the poem and recordings create a linguistic and semantic coherence in Sections B and B' that imparts a formal symmetry to the piece (although not balanced).

Transition and Retransition

Bookending Section C is a transition (and retransition) in which an antiphonal exchange of the phrase "Wo bist du, Licht" takes place between the voice and strings. Vivier describes this exchange as a "phased duet" since the time between the call and answer becomes progressively shorter until both parts align once again.[12] In the first iteration of this duet (illustrated in Figure 4.2), only the second contrabass and mezzo-soprano participate in this exchange, but in the retransition, the strings are divided equally between the mezzo and contrabass. The series of durations are the same for the transition and retransition.
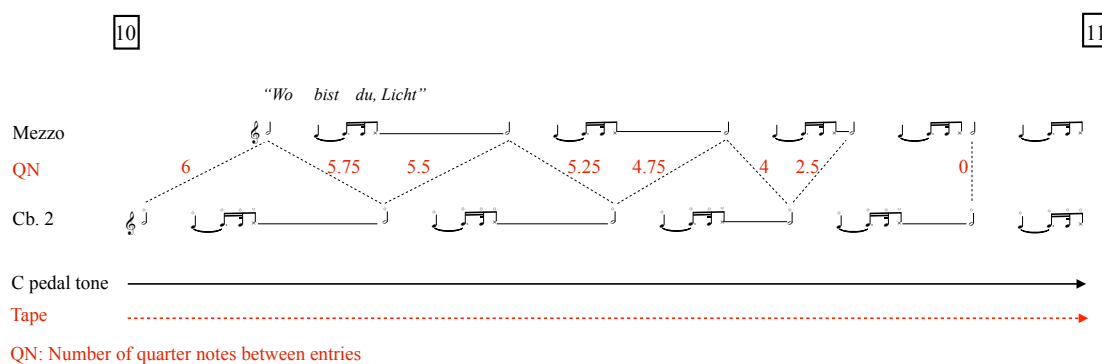
Figure 4.2: Transition featuring phased duet of hé-o motive between mezzo-soprano and contrabass, *Wo bist du Licht!*, 10

Most of Vivier's transitions or retransitions have a thinner texture relative to the sections they link and often include either a harmonic series, shortening or lengthening durations (creating a sense of acceleration or deceleration), or a variation on the *hé-o* motive (an oscillating minor third). Examples of these are provided in Figures 4.3 to 4.6. Figure 4.3, the transition in *Lonely Child*, gradually unveils thirteen of the first twenty-two harmonics of E♭2 (harmonics 1–3, 5, 7–12, 15, 20). In Figure 4.4, the retransition from *Lonely Child*, the temporal interval between bass drum attacks decreases by a quarter note, thus creating a feeling of acceleration. All other voices rest during this retransition. The *hé-o* motive, which was dubbed by Ross Braes, receives its name from the syllables shouted into the tam-tam in m. 132 of *Orion* (1979), shown in Figure 4.5.[13] Note that it also appears in the contrabass as harmonics. Often harmonics (artificial or natural) and a pedal tone accompany the *hé-o* motive, as is the case in Figures 4.2 and 4.5. Figure 4.6, the retransition from *Bouchara*, combines the *hé-o* motive, harmonics, and a perceived acceleration in the form of shorter durations.

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[13] Ross Braes, "An Investigation into the Jeux de Timbres in Claude Vivier's Orion and His Other Instrumental Works of 1979–1980" (Ph.D. diss, University of British Columbia, 2003), 161.

Lonely Child by Claude Vivier
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Figure 4.3: Transition featuring E♭2 harmonic series (strings only), *Lonely Child* **(1980), mm. 67–77**

Lonely Child by Claude Vivier
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Figure 4.4: Retransition featuring perceived acceleration in bass drum, *Lonely Child* **(1980), mm. 141–149**

Figure 4.5: Retransition featuring *hé-o* motive in contrabass and percussion III, *Orion* (1979), 20

Figure 4.6: Retransition featuring *hé-o* motive and perceived acceleration (strings and voice only), *Bouchara* (1981), 22 – 1

Section C (Development)

Section C, which functions as a development, contains three subsections, each of which focuses on a different texture: C1 (*couleur aléatoire)*, C2 (*couleur pulsée*), and C3 (*couleur rythmique*).[14] Subsection C1 exemplifies a process of magnification through a series of expanding ascending and descending scalar segments, a means of easing into the *technique sinusoïdale.* In Subsection C.1.1, the homophonic texture of the *couleur lisse* gradually transforms into a dense micropolyphony, the effect of which is an increase in momentum. In Subsection C.1.2, the micropolyphony reverts to a homophonic, synchronized texture and decreases the momentum.

In Subsection C2, the *technique sinusoïdale*—now pulsed in triplets (*couleur pulsée*)— move in and out of phase. Initially, the inertia exhibited by the regular meter and wave periods resists the disruptions caused by the phase shifts; however, halfway through, the intensity of the latter proves too great and an energetic turbulence (i.e., unpredictable wave motion) ensues until friction abates the energy and momentum. Where the turbulence is most pronounced, the contour and dynamics of the irregular wave motion convey a sense of changing gravity, inertia, and momentum similar to riding a roller coaster. After a short transition, Subsection C3 restores the homorhythmic block spectra, but pulses them at irregular intervals and independently of the melody (*couleur rythmique*). The increasing temporal intervals between attacks foster a sense of diminishing momentum, which seems to be provoked by the tape layer, the recorded narration of "Das blinde Sänger" introduced towards the end of Subsection C2.

4.2 Spectral Content

The spectra in this piece have a pronounced diatonic quality, primarily because the generative pitches form consonant intervals. For example, the ratios of the generative intervals in sections B and B' (P5, P4, M3, m6, m7, P4, m3, M6) can all be generated from integers one to ten. More dissonant intervals (e.g., A4 or d5), which are limited to

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[14] Division de la gestion de documents et des archives, Université de Montréal. Fonds Claude Vivier (P235) P235/D4, 066. All sketches for *Wo bist du Licht!* in this chapter come from file P235/D4, 066.

Section C, require integers as high as sixty-four to form their ratios.[15] Although the relative consonance of the generative intervals has an impact on the perceived level of harmonicity, dynamic balance and playing techniques (particularly those that produce noise transients) play a role as well.

The spectra in *Wo bist* contain either twenty (with generative pitches doubled) or thirty-three frequencies. Sections featuring homophonic textures like *couleur lisse* or *spectre rythmique*, i.e., where each instrument sustains one tone (Sections B, C3, B'), contain twenty frequencies. Sections featuring the *technique sinusoïdale*, i.e., where each instrument plays a range of frequencies from the same spectrum (Sections C1, C2), contain on average thirty-three frequencies. Figures 4.7a and 4.8a show an example of each, along with a transcription of the spectrum.[16] In the case of the smaller spectra (e.g., Figure 4.7b), each instrument sustains one tone: the contrabasses play the generative frequencies and the remaining strings play the combination tones. In the case of the *technique sinusoïdale*, Vivier divides the spectrum (including the generative frequencies) into nineteen overlapping bands of frequencies (Figure 4.8b). Each band is then assigned to one instrument, which arpeggiates the combination tones in ascending and descending order to create a wave contour (Figure 4.8c).
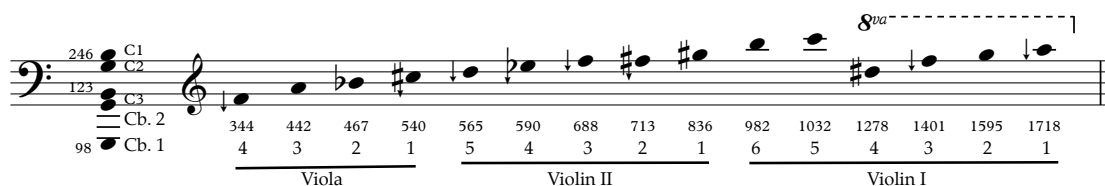
Figure 4.7a: Transcription of spectrum 1, *Wo bist du Licht!*

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[15] For example, in five-limit tuning, an augmented fourth has a ratio of 45:32 and a diminished fifth a ratio of 64:45.

[16] The arrows preceding noteheads (or built into accidentals) refer to quarter tone alterations. For example, the ↓ in front of F4 indicates F4 should be lowered a quarter tone.

Figure 4.7b: Spectrum 1 (*couleur lisse*), *Wo bist du Licht!*, 4

Figure 4.8a: Transcription of spectrum 21, *Wo bist du Licht!*

		Cb		Vc			Vla				Vln II					Vln I					
Rank	Note	2	1	3	2	1	4	3	2	1	5	4	3	2	1	6	5	4	3	2	1
1	D♭2																				
2	F2																				
3	E♭3																				
4	B♭3↓																				
5	B3↓																				
6	D4																				
7	E♭4																				
8	E4																				
9	F♯4↓																				
10	G4↓																				
11	G♯4																				
12	A4↑																				
13	B♭4																				
14	C5↓																				
15	C♯5↓																				
16	C♯5																				
17	E♭5↓																				
18	E♭5																				
19	F5↓																				
20	F5																				
21	F♯5↓																				
22	A♭5↓																				
23	A♭5																				
24	A5↓																				
25	B5↓																				
26	C6																				
27	C♯6↓																				
28	E♭6																				
29	F6↓																				
30	G6																				
31	G♯6																				
32	C7																				
33	D7↓																				

Figure 4.8b: Division of spectrum 21 into overlapping bands of combination tones

Figure 4.8c: Spectrum 21, *Wo bist du Licht!*, 17

As Figure 4.8b shows, the contrabasses, cellos, violas, and violin II.5 play all the combination tones within their respective bands, whereas violins II.4 to I.1 only play odd or even numbered ones depending on the chair the performer holds: odd chaired violins, e.g., I.1, I.3, play the odd-ranked combinations tones, even chaired violins play the even-ranked combination tones.[17] The arpeggiation of frequencies allows Vivier to accommodate larger, more complex spectra, and by restricting the bands in the violins to odd or even combination tones, Vivier can broaden the overall range without increasing the number of tones each instrument must play. This procedure helps compensate for the narrower intervals between upper adjacent combination tones. The result is a more uniform band range (approximately two octaves) across the registers.

Algorithms and Structure

The algorithms used to generate the spectra follow the same principles outlined in Chapter 1. As in *Lonely Child* and *Bouchara,* none of the spectra are modified. Of the seventy spectra in this piece (labeled 1–70 in chronological order), only twenty-four constitute true combination tone chords, i.e., chords generated by adding the frequencies of two generative pitches in various combinations. The majority (forty-six) are transpositions of the twenty-four combination tone chords. Within formal sections, the number of distinct intervals between the generative tones limits the number of combination tone chords. If an interval is repeated with different pitches, Vivier simply transposes the original spectrum. For example, Figure 4.9 contains two spectra based on a generative interval of a M3 between 4 and 5. Spectrum 1 (upper staff) represents the original combination tone chord while Spectrum 3 (lower staff, which first appears at 5 – 1) transposes Spectrum 1 up a whole tone. Transposed spectra will henceforth be identified with the ID of the original spectrum in parentheses, e.g., Spectrum 3(1). As can be seen in Figure 4.9, the spacing between all chord tones of Spectrum 1 and Spectrum 3(1) is identical.

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[17] When referring to the *divisi* violins in the score, e.g., violin II.4, the Roman numeral indicates the section (second violins) and the Ararbic numeral indicates the chair held by the performer (fourth chair).

Figure 4.9: Transcription of spectrum 1 and spectrum 3(1), *Wo bist du Licht!*

In Sections B and C, each distinct interval represents a new algorithm, but in Section B', all intervals follow the same algorithm, with one exception.[18] Because the algorithms are section-specific, the same generative interval will have different algorithms from one formal section to the next. Figure 4.10 shows the different algorithms for a P5 generative interval in Sections B, C, and B'. The first column gives the frequency rank; the second column gives the frequency in Hertz; the third column gives the combination-tone class (CTC); and the fourth column gives the two lower frequencies of which it is the sum.

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[18] Spectrum 47, the first chord in Section B', contains the extra combination tone CTC <10,7>. All other spectra in Section B' end with CTC <9,6>.

Spectrum 1, 4				Spectrum 11, 11 +3				Spectrum 47, 38 +4			
M3 in Section B				M3 in Section C				M3 in Section B'			
Rank	Freq	CTC	sum of	Rank	Freq	CTC	sum of	Rank	Freq	CTC	sum of
1	98	<1,0>		1	65	<1,0>		1	82	<1,0>	
2	123	<0,1>		2	82	<0,1>		2	104	<0,1>	
3	246	<0,2>	2+2	3	147	<1,1>	1+2	3	186	<1,1>	1+2
4	344	<1,2>	1+3	4	212	<2,1>	1+3	4	268	<2,1>	1+3
5	442	<2,2>	1+4	5	229	<1,2>	2+3	5	290	<1,2>	2+3
6	467	<1,3>	2+4	6	277	<3,1>	1+4	6	350	<3,1>	1+4
7	590	<1,4>	3+4	7	294	<2,2>	2+4	7	372	<2,2>	2+4
8	540	<3,2>	1+5	8	359	<3,2>	3+4	8	454	<3,2>	3+4
9	565	<2,3>	1+6	9	311	<1,3>	2+5	9	476	<2,3>	3+5
10	688	<2,4>	3+5	10	376	<2,3>	3+5	10	558	<3,3>	4+5
11	713	<1,5>	3+6	11	441	<3,3>	4+5	11	640	<4,3>	5+6
12	836	<1,6>	3+7	12	342	<4,1>	1+6	12	722	<5,3>	6+7
13	982	<5,4>	5+8	13	424	<4,2>	3+6	13	826	<5,4>	7+8
14	1032	<3,6>	5+7	14	489	<5,2>	4+6	14	930	<5,5>	8+9
15	1278	<3,8>	9+11	15	506	<4,3>	5+6	15	1034	<5,6>	9+10
16	1401	<3,9>	10+11	16	523	<3,4>	5+7	16	1198	<7,6>	10+11
17	1695*	<6,9>	11+13	17	571	<5,3>	6+7	17	1362	<9,6>	11+12
18	1818*	<10,6>	12+13	18	588	<4,4>	5+8	18	1548	<10,7>	12+13
				19	636	<6,3>	6+8				
				20	653	<5,4>	7+8				
				21	670	<4,5>	8+9				
				22	817	<5,6>	10+11				
				23	783	<7,4>	11+12				
				24	766	<8,3>	12+13				
				25	913	<9,4>	13+14				
				26	995	<9,5>	14+15				
				27	1029	<7,7>	15+16				
				28	1159	<9,7>	17+18				
				29	1289	<11,7>	19+20				
				30	1487	<9,11>	21+22				
				31	1544	<15,7>	23+24				
				32	1908	<18,9>	25+26				
				33	2188	<16,14>	27+28				

*Instead of 1695 and 1818, Vivier's sketch has 1595 and 1718. Vivier likely misread *f*13 as 882:

Figure 4.10: Comparison of algorithms for M3 in Sections B, C, and B'

Note that the frequency *rank* does not always reflect the ascending order of frequencies, but rather the order in which Vivier added the combination tones in the sketches. Although the order of creation often coincides with ascending order, in *Wo bist* each algorithm has at least one frequency that disrupts the ascending order. For example, in Spectrum 1, F7 is higher than F8 and F9, and in Spectrum 11, F22 higher than F23. Since the overwhelming majority of Vivier's combination tones represent the sum of two lower frequencies in the spectrum (usually adjacent-ranked frequencies for combination tones F8 and up), preserving the order of creation facilitates the identification of the two sum terms, which in turn helps reveal Vivier's algorithm. As explained in Chapter 1, this

knowledge, in conjunction with the combination-tone class matrices, eliminates some of the guesswork when it comes to illegible frequencies in the sketches. The fourth columns of Spectrum 11 and Spectrum 47 in Figure 4.10 show that Vivier favors an alternating pattern of adjacent- and next-to-adjacent-ranked frequencies in the mid register (e.g., F5 + F6, F5 + F7, F6 + F7) and a pattern of adjacent frequencies, often enchained (e.g., F10 + F11, F11 + F12...), for the higher combinations. The first combination tone chord, Spectrum 1, is the most irregular. (The sketch for Spectrum 1 shows erasure marks and alterations, suggesting Vivier was not satisfied with the initial combination tone chords.)

In total, there are eighteen algorithms: three in Section B (based on the P5, M3, m7[19]), thirteen in Sections C1–3 (P5, P12, P4, M3, M10, m3, m10, M6 (two algorithms for this interval), A4, M7, m7, m9), and two in Section B' (M3, x[20]). Figure 4.11 is a tree diagram (in table form) based on the combination-tone classes (CTCs) for the eighteen algorithms in *Wo bist du Licht!* Instead of including all the information given in Figure 4.10, the table includes only the CTCs and their rank since including the sum terms would render the width unwieldy. The table presents the CTCs in the order in which they are generated; it is *not* configured to optimize the number of common CTCs by presenting them as common columns (i.e., common "branches"). Many algorithms share common CTCs, but rank them differently. The letter at the bottom of each column identifies the algorithm and its chronological order in the piece. Only four CTCs appear in all eighteen algorithms, which appear in bold in Figure 4.11: <1,2>; <2,2>; <2,3>; <3,2>. Spectra 1, 11, and 47 (from Figure 4.10) are generated from algorithms A, D, and Q respectively.

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[19] Section B has a generative interval based on a m6, but it follows the same algorithm as the M3.

[20] x = variable harmonic interval

Combination Tone Class "Tree" for Spectra in *Wo bist du Licht!*

Rank	H	L	P	I	E	F	G	J	K	M	N	O	D	R	Q	A	B	C
1.	1,0																	
2.	0,1																	
3.	1,1														0,2			
4.	2,1														1,2			
5.	3,1			1,2											2,2			
6.	1,2			3,1											1,3			
7.	2,2			2,2											1,4			
8.	3,2			3,2											3,2			
9.	1,3			1,3										2,3	2,3			
10.	2,3			2,3										3,3	2,4			
11.	5,2			3,3										4,3	1,5			
12.	3,3	4,3		4,2							4,1			5,3	1,6			
13.	4,3	3,4	5,3	5,2							4,3	4,2		5,4	5,4			
14.	3,4	5,3	3,4	4,3							3,4	5,2		5,5	3,6			
15.	6,3	4,4	4,4	5,3	3,4						5,4	4,3		5,6	3,8			
16.	5,4	5,4	5,4	3,4	5,3						4,5	3,4		7,6	3,9			
17.	3,5	4,5	4,5	4,4	4,4			6,3		5,4	5,5	5,3		9,6	6,9	2,11		
18.	4,5	3,6	3,6	3,5	2,6	5,4		5,4		4,5	6,5	6,3	5,4	10,7	10,6	6,10	6,10	
19.	5,5	5,6	5,6	4,5	4,5	3,5	4,5	4,5		3,5	3,6	5,6	5,4					
20.	3,6	7,6	6,6	3,6	3,6	4,5	3,6	3,6	5,6	4,5	6,5	7,6	4,5	M3	M3	P5, m6	m7	
21.	4,6	7,7	9,6	5,6	5,6	3,6	5,6	6,5	7,5	3,6	7,5	7,7	5,6					
22.	5,6	8,7	8,7	7,5	4,7	4,6	7,5	9,4	9,4	5,6	8,5	8,8	7,4	R	Q	A	B	C
23.	9,5	9,7	7,8	9,4	9,4	5,6	9,4	9,5	9,5	9,4	4,6	9,9	8,3					
24.	7,6	9,8	9,8	9,5	6,7	7,5	7,7	7,7	7,7	9,5	7,7	9,10	9,4	Section B'	Section B			
25.	8,6	9,9	9,9	9,6	7,7	9,5	9,7	8,7	8,7	7,7	8,7	11,10	7,7					
26.	9,7	7,11	7,11	8,7	8,7	7,7	11,7	11,6	11,6	8,7	10,7	11,11	9,7					
27.	11,7	8,12	8,12	7,8	7,9	9,7	7,11	11,7	11,7	11,6	9,9	12,12	11,7					
28.	8,9	12,12	11,12	7,10	6,11	11,7	12,11	9,9	9,11	11,7	7,11	14,13	9,11					
29.	7,10	14,13	15,12	8,12	8,12	7,10	16,11	7,11	12,11	8,9	15,10	15,15	15,7					
30.	9,10	15,14	17,13	16,9	13,11	7,12	16,14	8,12	18,9	7,10	11,13	17,17	18,9					
31.	7,12	17,14	15,15	18,9	13,14	7,14	20,14	14,10	15,14	7,11	18,14	18,19	16,14					
32.	12,12	18,15	16,16	15,15	15,16	16,12	18,18	18,9	22,13	8,12	16,20	20,20						
33.	17,11	18,17	18,17	14,18				16,12		14,10	22,21	22,21						
	m10	M7	P12	M10	P5	M6	A4	m7	m3	M6	P4	m9	M3					
	H	L	P	I	E	F	G	J	K	M	N	O	D					

Section C (spans the main columns H–D)

Figure 4.11: Algorithm tree based on combination-tone classes

4.3 Section A, [1] to [4]

The 3:46-minute introduction to *Wo bist du Licht!,* Section A, contains just four musical gestures which are boxed in a different colour in Figure 4.12.[21] Of the four, three constitute a distinct timbre: a bass drum stroke (red), a Balinese gong stroke (blue), and an accented eighth note in the strings (green). The fourth gesture, a sustained M3 in the strings (purple), changes timbre as a function of the bowing, and therefore is the most

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[21] Timing reflects Claude Vivier, *Wo bist du Licht!,* Société de Musique Contemporaine du Québec, directed by Walter Boudreau, with mezzo soprano Marie-Annick Béliveau, ATMA Classique/ASIN: B01G47FDP4, 2001, compact disc.

adaptive of the group. These gestures repeat in sequence throughout the section, much of which takes place without the backdrop of a pulse. The absence of melody, along with the economy of material, helps focus attention on duration, dynamic contour, contrast between timbre and harmony, and the different force and energy metaphors that they entail. Indeed, the piece's most extreme contrasts of dynamics, timbre, and tempo occur in Section A, which creates an anguished and dramatic opening for a song on human suffering.

Figure 4.12: Cycle of musical gestures in Section A, *Wo bist du Licht!*, 2 + 9

Figure 4.13 shows the timbral contrast, dynamic contour, and sense of acceleration and deceleration that the cycle of gestures implies in Section A. Subsections are delineated by dynamic and timbral processes. From 1 to 4, the strings unify Section A by transitioning from an inharmonic timbre to a harmonic major third. This transition, which involves different bowing techniques, is depicted in Figure 4.13 with the different hues of gray. The dynamic contour divides Section A into two parts at 2. The first half, Subsection A1, maintains a *fff*, which intensifies the effect of the overbowing. In Subsection A2, the dynamics carve out an inverted arch that the cycle of gestures enhances by pairing the dynamic scale with a perceived tempo scale. As the dynamics soften, the temporal interval between attacks lengthens, thus giving a sense of slowing down. As the dynamics increase, the temporal intervals shorten and a feeling of acceleration ensues. Figure 4.13

depicts this perceived change in tempo with the black diamonds at the bottom of the graph. These spatialize the temporal intervals between bass drum strokes, which here should be understood as representing the cycle of gestures as a whole (Figure 4.12 shows the cycle). The trough of the inverted arch, 3 + 2 (two measures after rehearsal number three), marks the moment of equilibrium, or stasis, that separates the deceleration from the acceleration (e.g., like the recoil action of a spring). As we will see, the time signatures within each subsection reflect patterns that contribute to the inner coherence of the subsections. The following discussions for Subsections A1 and A2 will each begin with an overview of the musical structure before addressing the particular motion and energy metaphors of that subsection.
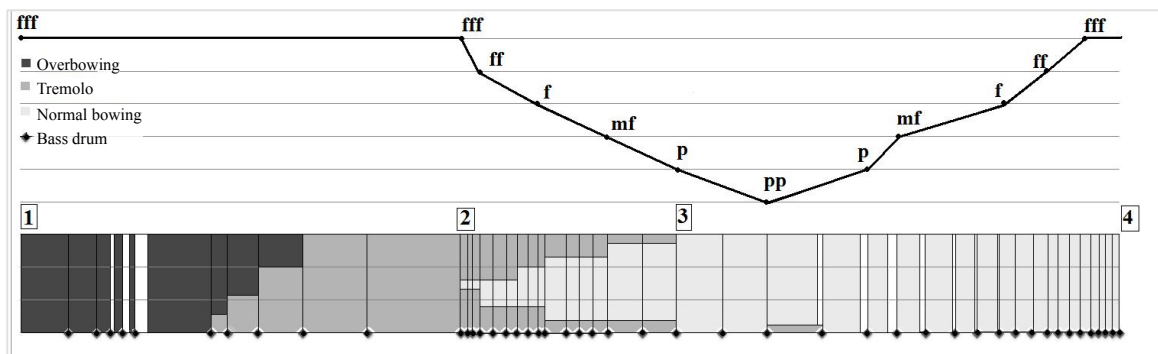
Figure 4.13: Formal diagram of Section A

4.3.1 Subsection A1, from 1 to 2

This opening juxtaposes the noise-like timbre of the strings with periods of rest that follow the bass drum. The time signatures, shown in Figure 4.14, change with each measure and determine the durations of the juxtaposed sounds. In the first 10 measures, we see that an inverse relationship exists between the durations of the noise-like timbre (black) and the durations of the rest (red). Both sets of durations follow the number sequence 1, 2, 4, 7, 11 (an additive series where the difference between adjacent terms increases by 1), although with different denominators (quarter note and sixteenth note).[22]

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[22] Vivier's chorale "Jesu erbarme dich" (1973) begins with a similar arrangement of time signatures, only with numerators based on the first five numbers of the Fibonacci sequence. See Martine Rhéaume,"Stylistic Transitions in Vivier's Emergent Musical Style," *British Postgraduate Musicology*, 10(2009), 4.

The contrast of long and short durations makes it difficult to perceive a pulse. The 16/4 measure (circled in blue) terminates the reciprocal relationship by combining aspects of both time signature patterns: the denominator (4) continues the denominator pattern initiated by the strings, and the numerator (16) continues the number series initiated by the numerators associated with the rests.

Time signatures associated with strings
Time signatures associated with bass drum and rests
♦ Bass drum attack
▮ Overbowing
▮ Overbowing with tremolo
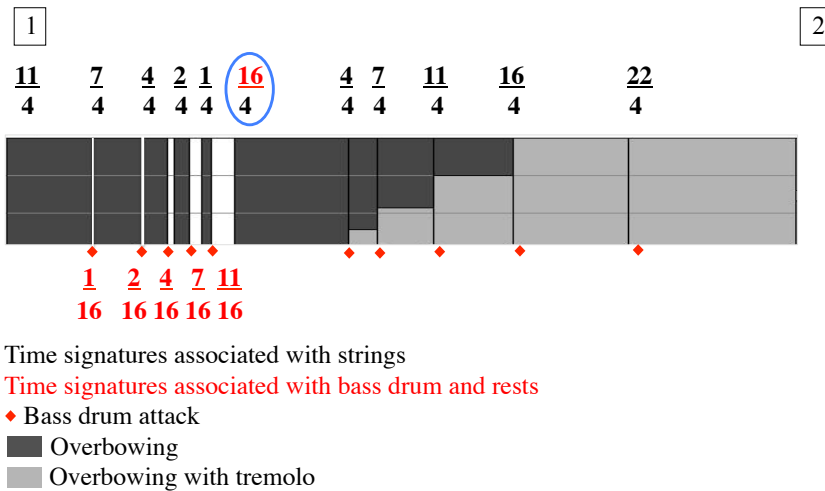
Figure 4.14: Time signatures in Subsection A1

The remainder of Subsection A1 repeats the additive series from 4 to 22. Both the strings and bass drum align on the downbeat of the 4/4 measure, the beginning of the series' restatement. Thereafter, the bass drum delays its entries by an incremental number of sixteenth notes (1, 2, 3, 4). Likewise, the number of strings that adopt overpressure tremolo bowing also increases incrementally by one with each measure. These durational and timbral processes are summarized in Figure 4.15, a modification of Vivier's sketch for the organizational scheme for Subsection A1.

Row A	11		7		4		2		1		16	4	7	11	16	22
Row B		1		2		4		7		11						
Row C												+2	+3	+4	+5	+6
Row D													1	2	3	4

Row A	Duration of strings (overbowing) in quarter notes
Row B	Duration of bass drum and rest in sixteenth notes
Row C	Number of strings adopting tremolo
Row D	Number of sixteenth notes delaying bass drum from downbeat

Figure 4.15: Adaptation of Vivier's sketch for the durational scheme in Subsection A1

The additive series for Subsection A1 (i.e., 1, 2, 4, 7, 11 ...) appears in Row A of Vivier's more generalized durational sketch for Section A, reproduced in Figure 4.16 (the row identifications and legend are not part of the original sketch). The Row B contains the difference between successive terms in the first row (note the arithmetic error 29 + 8 = 36, highlighted in red), and Row C contains the first six numbers of the Fibonacci sequence. As will be seen, Vivier derives all the formal and durational proportions from the series in this scheme.

Row A	1	2	4	7	11	16	22	29	36	45	55
Row B		1	2	3	4	5	6	7	8	9	10
Row C	1	2	3	5	8	13					

Row A	Additive series where difference between successive terms increases by one
Row B	Difference between successive terms in Row A
Row C	First six numbers of the Fibonacci sequence

Figure 4.16: Adaptation of Vivier's sketch of additive series in Section A

Although duration plays a crucial role in this section, the dominant parameter in Subsection A1 is the timbre of the strings where tremolo bowing gradually replaces the sustained overpressure bowing (see Figure 4.13). In normal bowing, the hair of the bow acts as a hook that grips and pulls the string before releasing it. This mechanism allows the string to vibrate freely, thus amplifying the harmonics. By contrast, overbowing requires heavy pressure that crushes the string and impedes the normal pull-and-release motion of the string. As a result, the string cannot vibrate freely. The acoustic effect of the added friction is a series of unpredictable overtones that can obscure the fundamental; however, because Vivier notates specific pitches, he likely intends for the fundamentals to remain slightly audible throughout Subsection A1. As the tremolo permeates throughout the strings (from the low register to the high register), the initial block of noise-like timbre becomes granular with the micro-movement of the tremolo. The tremolo conveys the strain and fatigue of applying and sustaining intensive opposing forces. This combination of force and counterforce results in a high-pressure stasis.

Motion in Subsection A1

Several parameters contribute to this sense of static friction in the opening. Perhaps most overt is the pressure of the overbowing, which crushes the string and restricts its range of

motion. This dampening effect, which adds roughness to the timbre, is both a literal and metaphorical impediment to motion. On the one hand, the roughness in the timbre represents intense friction, i.e., the grating of two surfaces under pressure. On the other hand, the pitch invariance, or lack of contour, suggests stasis or inertia. This combination of grinding motion on one level and stasis on another evokes the inertia and static friction of a large, heavy object and the energy that is required to move it. The size and weight of the object are inferred from the *fff* and the density of the B/G octave doublings and unpredictable overtones. The juxtaposition of noise and silence represent alternating periods of effort (agent or observer exerting force upon an object) and rest (recovery of energy lost while applying active force). Here the moving observer serves as an intiatory agent to overcome the inertia of the noise-timbre, which is embodied as a large, heavy object.

The tremolos, which introduce a persisting vibrating motion suggestive of muscle fatigue, create anticipation for the breaking point. This release of static friction to dynamic friction occurs at 2 , where both normal bowing and the cyclic motion between the four gestures begins. The harmonicity of the normal bowing (shown as light grey in Figure 4.13, beginning mid-register) imparts smoothness compared to the abrasive overbowing, but the sense of motion really stems from the newly introduced cycle of gestures. After twenty-two seconds (22/4, $\downarrow$ = 60) of static tremolo, the cycle provides welcome relief. Both these elements, i.e., the reduction in friction (brought on by normal bowing) and the smooth repetitive cycling, characterise the ease of motion of dynamic friction.

4.3.2 Subsection A2, 2 to 4

In Subsection A2, the focus changes from timbre to duration. During the inverted arch contour of the dynamics, the cycle involving the four musical gestures (bass drum, Balinese gong, accented eighth note, and the sustained dyad) forms a repetitive loop whose durational proportions alter slightly. The number of attacks in each cycle varies according to the synchronicity of the gestures. The bass drum and sustained dyad form one rhythmic layer. The timing of the accented eighth note and Balinese gong are more variable, but align for the first and last five cycles (i.e., from 2 to 2 + 5 and 4 – 5 to 4) in

the subsection. Therefore, the cycles bookending Subsection A2 contain only two attacks. As the dynamic level decreases, the time interval between the gong and bass drum increases, which creates an impression of slowing down, or temporal expansion.

Figure 4.17 spatializes the synchronicity between the bass drum (BD), sustained major third (S3), Balinese gong (G), and accented eighth note (A8) in the form of a timeline. Each dot represents an attack, and each set of dots constitutes a cycle. The temporal intervals within a cycle are expressed below the dots as a ratio of sixteenth notes. For example, the first cycle, which has a total duration of eight sixteenth notes, contains two attacks of which the durations are in a ratio of 6:2, i.e., the bass drum and stings attack on the first sixteenth note of the cycle and the Balinese gong and accented eighth note attack on the seventh. In the second cycle, which is a sixteenth note shorter, the durations are 5:2. While the ratios between $\boxed{2}$ and $\boxed{3} - 1$ are more erratic, they remain consistent between $\boxed{3} - 1$ and $\boxed{4}$ within each time signature. As Figure 4.17 shows, the two sixteenth notes between the accented eighth note and Balinese gong represent the most constant temporal interval (two sixteenth notes) in Subsection A2.

$\boxed{2}$ $\boxed{3}$

| $\frac{8}{16}$ | $\frac{13}{16}$ | $\frac{21}{16}$ | $\frac{34}{16}$ | $\frac{45}{16}$ |

BG
A8
S3
BD

6:2 5:2 3:2 5:2 10:3   10:2:1 8:2:1   6   17:2:1   9:2:2   16   29:2:3   38:2:5

| $\frac{55}{16}$ | $\frac{45}{16}$ | $\frac{36}{16}$ | $\frac{29}{16}$ | $\frac{22}{16}$ | $\frac{16}{16}$ | $\frac{11}{16}$ | $\frac{7}{16}$ |

BG
A8
S3
BD

45:2:8   27:2:16   23:2:11   20:2:7   16:2:4   12:2:2   8:2:1   5:2

BG: Balinese gong   BD/S3: A8: BG
A8: Accented eighth note
S3: Sustained major third
BD: Bass drum
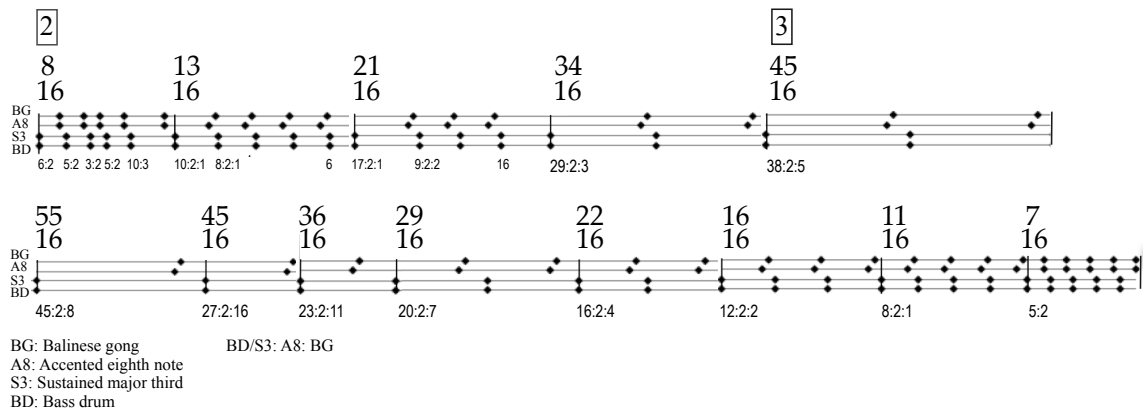
Figure 4.17: Timeline of cycles in Subsection A2

Vivier's sketch for the durational scheme of Subsection A2 is more elaborate than his sketch for Subsection A1. A modified transcription of this sketch is given in Figure 4.18. The time signatures, given in Row B, reflect the two number series introduced in Figure 4.16, including the arithmetic error. Row A represents the number of cycles (or measures) per time signature. Row B gives the time signature numerators (the denominator for all is

16). For example, the first time signature in $\boxed{2}$ is 8/16 (or 4/8) and contains five cycles and measures. Row C refers to the eighth note of the Balinese gong. Row D represents the sum of Rows B and C. Row G, the product of Rows A and B, represents the number of sixteenth notes per time signature. Row E likely divides Row G by four to obtain the duration in quarter notes, even though the highlighted cells represent mistakes in arithmetic.[23] Finally, Row F represents the temporal interval between the Balinese gong and following bass drum (i.e., the third number in the ratios of Figure 4.17).

Row A	5	4	3	2	2	1	1	1	2	2	3	4	5
Row B 1 2 3 4 5	8	13	21	34	45	55	45	36	29	22	16	11	7
Row C	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Row D	6	11	19	32	43	53	43	34	27	20	14	9	5
Row E	2	3.25	6.25	7.5	11.25	13.75	11.25	8	7.25	6.5	4	2.75	1.75
Row F		1	2	3	5	8	16	11	7	4	2	1	
Row G	40	52	63	68	90	55	45	36	58	44	48	44	35

	Fibonacci number series
	Series where the difference between terms increases by 1
	Number is common to both series
Row A	Number of cycles (measures) per time signature
Row B	Numerator of time signatures
Row C	Subtraction of accented eighth note
Row D	Average duration (in sixteenth note) of sustained M3 (sum of Rows B and C)
Row E	Duration in quarter notes of section defined by time signatures (Row G divided by 4)
Row F	Duration of rest (in sixteenth notes) between accented eighth note and sustained M3
Row G	Number of sixteenth notes per section defined by time signatures (product of Rows A and B)

Figure 4.18: Adaptation of Vivier's sketch for the durational scheme in Subsection A2

Motion in Section A2

The overall dynamic and durational symmetry of Subsection A2, which suggests a palindrome, implies a motion metaphor capable of conveying the changes in velocity that accompany an action (or process) and the reversal of that same action. In this respect, the kinetic and potential energy of a bungee cord offers a better metaphor for Subsection A2

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[23]In the sketch, the end of Row E has ♩= 85.5 written next to it, suggesting the values refer to quarter notes. The arithmetic mistakes may simply be a consequence of Vivier working quickly.

than pursuing the static-dynamic friction metaphor from Subsection A1.[24] When breaking from static to dynamic friction, the sudden change from stasis to motion can feel like acceleration. When a load-bearing bungee cord is stretched (as is the case in a bungee jump), the least amount of tension and greatest speed occurs when the kinetic energy is highest, i.e., in the initial stages of the drop after the slack has been taken up. As the force exerted on the cord stretches the cord, the kinetic energy is converted into potential energy and the motion slows down until the cord reaches its maximum tension and stops. At this point, the cord's potential energy is at its maximum while its kinetic energy is at a minimum. As the cord retracts to its original position, the potential energy is converted into kinetic energy. Analogously, in Subsection A2 the dynamic contour and lengthening and shortening durations of the cycles simulate the conversions between kinetic and potential energy of a bungee, along with its ensuing changes in speed.

Figure 4.19, an annotated version of the formal diagram for Section A (Figure 4.13), summarizes the force and energy metaphors that the changes in timbre, dynamics, and tempo (implied by the durational ratios of the cycle) evoke in Section A. In Subsection A1, the tension and pressure from the overbowing, coupled with the uniform dynamic level and invariant pitch content, conveys a sense of inertia or static friction (or rather, the increased effort required to overcome static friction). In Subsection A2, the symmetry of the decrescendo and crescendo, which is overlaid with a perceived deceleration and acceleration, suggests an exchange of potential and kinetic energy similar to the elongation and retraction of a bungee cord.

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[24] Other metaphors, e.g., the trajectory of a ball thrown straight up into the air, would also be relevant; however, I prefer the image of a bungee jump since I think it better represents changes in speed.
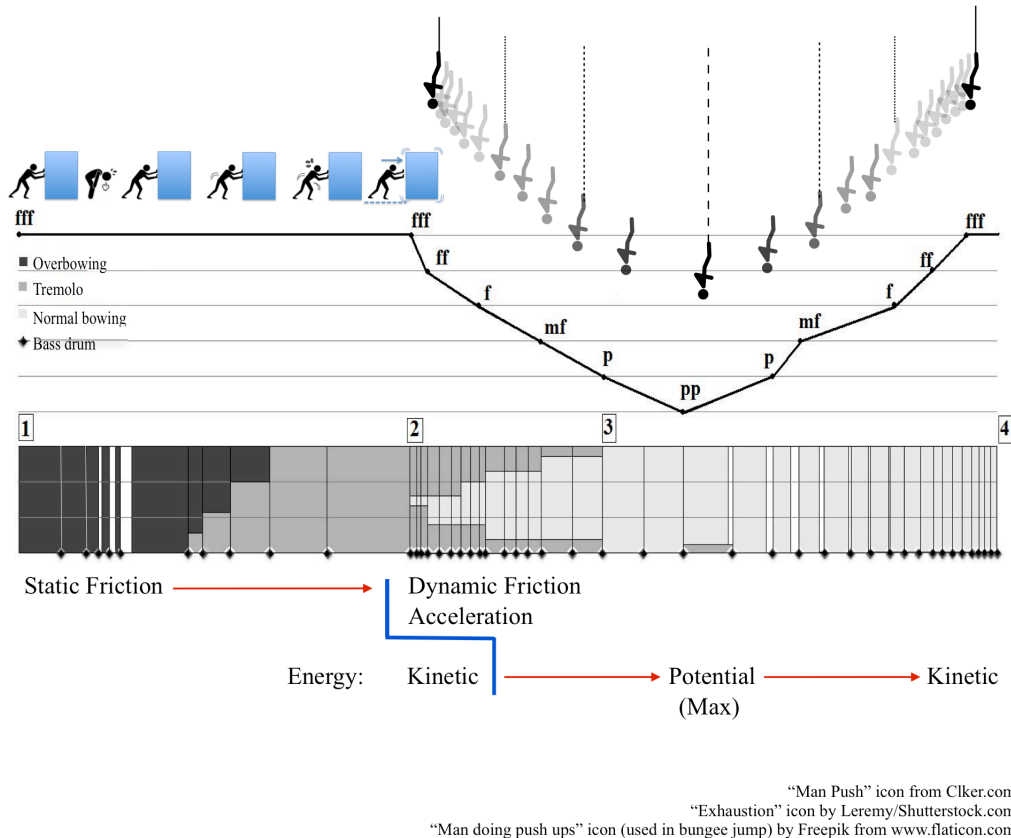
Figure 4.19: Force and energy metaphors in Section A

In Figure 4.19, the crossover from the friction metaphor to the potential-kinetic energy bungee metaphor is expressed as a modulation. What links the two metaphors is the sense of acceleration in the first three cycles of 2 (suggested by the proportions 6:2, 5:2, 3:2 in Figure 4.17). In Subsection A1, acceleration occurs just after the breaking point of static friction to dynamic friction. In Subsection A2, the tempo is quickest where the kinetic energy is maximized and potential energy minimized. Conceptually, this perceived acceleration functions a bit like a pivot between force and energy metaphors. Like Subsection A1, Subsection A2 evokes the MOVING OBSERVER (i.e., TIME'S LANDSCAPE) temporal metaphor, only from the exterior perspective and not the interior perspective.

By excluding melody and limiting the number of gestures in this introduction, Vivier concentrates the focus on the differing temporal proportions, as well as the changes in timbre. This introduction serves as a good example of Vivier's broader understanding of

form and counterpoint as moments of temporal alignment, i.e., "points of coming together," between all parts and parameters.[25]

4.4 Section C

Section C has a three-part structure that is subdivided into five subsections:

> C1: *Couleur aléatoire*
> > C1.1 from 11 to 17
> > C1.2 from 17 to 20
> C2: *Couleur pulsée*
> > C2.1 from 20 to 30
> > C2.2 (transition) from 30 to 31
> C3: *Couleur rythmique*, from 31 to 36

In Sections C1 and C2 Vivier uses the contour of a sinusoidal wave to create changes in texture and the perception of momentum. Modeling the contour after the sine wave may be a further elaboration of instrumental synthesis, which is itself a metaphorical manifestation of Fourier analysis. The sine wave's balanced and easily recognizable contour lends well to durational transformations such as phasing, augmentation, or diminution and suggests changes in velocity. The amplitude of the wave (i.e., the pitch interval between the crest and trough) and the number of notes needed to complete a wave cycle likewise contribute to a sense of size or mass (inertia). When considered together, these analogues to velocity and mass foster a sense of musical momentum. As mentioned earlier, each subsection relies on a different treatment of *couleur*. In Section C1 the *couleur aléatoire* increases then decreases the momentum. In Subsection C2, the *couleur pulsée* conveys inertia, followed by turbulence, diminishing momentum, and an accumulation of pressure. In Subsection C3, the *couleur rythmique* evinces a loss of velocity that seems to result from the overlay of musical media (live music versus acoustic). This friction brings Section C's momentum to a halt.

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[25] Susan Frykberg, "Claude Vivier in Conversation," *Musicworks: The Journal of Sound Exploration* 18 (1982): 8–9.

4.4.1 Section C1: *couleur aléatoire*, 11 to 20

One of the aims of Vivier's radiophonic proposal was to "examine the sound of history under a magnifying lens."[26] This objective is metaphorically represented in the music by expanding the bands of adjacent frequencies in the spectra to form increasingly longer ascending and descending scales. The length of each scale therefore represents a different power of magnification. The effect is a transformation of the block homophony from Section B (*couleur lisse*) into a dense polyphony that has a disorienting effect. Indeed, Bob Gilmore referred to the spectra in this section as "repeating mobiles," responsible for the "vertiginous swirl under the voice and the banging and chiming of the percussion."[27] The process of magnification in Subsection C1.1 coincides with increasing dynamic levels and shortened durations, which combined with the lengthening scales suggests a virtual environment that is picking up mass, velocity, and energy. In Subsection C1.2, the longer wave cycles and softer dynamics convey a drop in velocity that exceeds any perceived increase in mass, thus resulting in an overall lessening of momentum.

Subsection C1.1, 11 to 17 – 1

The same number series that guided the time signatures in Subsection A1 dictates the scale sizes in Subsection C1.1, which increase from 1, 2, 4, 7, and 11 notes respectively. The scales, abstractly depicted in Figure 4.20, change pitch content with each new spectrum. Note that the dynamics mirror the melodic contour. Throughout the *technique sinusoïdale* in Section C1.1, the dynamics of the upper register (i.e., violins I.1 to II.4) follow the pitch contour, which begins with descending motion. In the lower register (i.e., violins II.5 and contrabass 2), the dynamics do the inverse of the pitch contour, which begins with ascending motion. (Figure 4.8c illustrates a similar relationship between the melodic and dynamic contours of the two registers in Section B.) Aurally, the constant

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[26]My translation of "Examiner à la loupe (transformation vers la gamme) le son de l'histoire." See my translation of Vivier's radiophonic project proposal in Appendix B1.

[27] Bob Gilmore, *Claude Vivier: Life of a Composer* (Rochester, NY: Rochester University Press, 2014), 184.

repetition of the ascending and descending segments more or less obscures the dynamic-melodic contrast between the upper and lower registers.
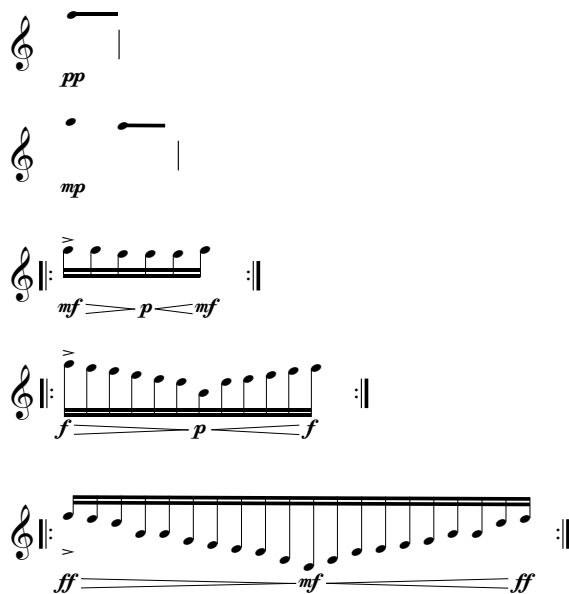
Figure 4.20: Lengths of scales in Subsection C1.1

The different scale lengths are distributed throughout the orchestral range in six stages. Figure 4.21 shows this distribution process by depicting each scale length as a different colour and numbering the stages. The rows represent the strings in descending order of register, with violin I.1 occupying the first row and the contrabass 2 occupying the last. The numbers below indicate the quarter note duration of the stages (spatialized by the column widths).[28] The black squares, representative of the Balinese gong attacks, also emphasize these durations. The bass drum and chimes have a similar formal function in that they mark the changes in spectra. By $\boxed{17}$ – 1, all parts (except contrabasses) play the 11-note scales and a new process begins, Subsection C1.2. Although not included in Figure 4.21, the dynamic range increases with the ambitus of the scales.

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[28] Three of the stages have a different duration in the score than in Vivier's sketch, reproduced in Figure 4.22.
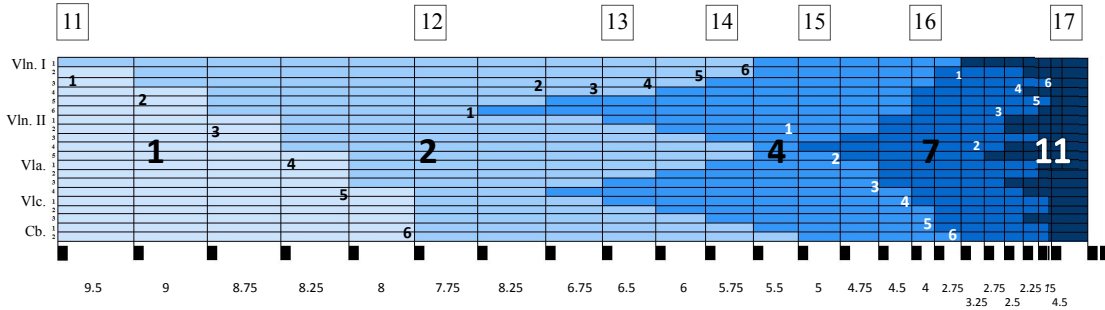
Figure 4.21: Distribution of scale lengths in six stages in Subsection C1.1

As shown in Figure 4.21, the durations of the twenty-four stages become progressively shorter. Vivier derives these durations from a number scheme based on 126 quarter notes (or 504 sixteenth notes), the total duration of the section. Figure 4.22 is an adaptation of Vivier's sketch depicting these stages.[29] In the scheme, Vivier divides the total duration of the Subsection C1.1 (504 sixteenths) by the total number of stages (twenty-four) to obtain an average duration of twenty-one sixteenth notes (shown as Row A in Figure 4.22). Vivier redistributes the number of sixteenth notes within the twenty-four stages by subtracting one to twelve sixteenth notes from half the stages and adding the same amount to the other half (Rows A–C). Again, the durations undergo a similar modification by subtracting the seemingly arbitrary sequence 5, 4, 4, 3, 3, 3, 2, 1, 1 from the first nine stages and adding them to the last nine (Rows C–E). In their final form, the durations of the stages are converted into quarter notes (Row F) and assigned a different dynamic marking to correspond with the scale size (Row G–H). By 17 - 1 the conversion process is complete.

<hr>

[29]The original sketch does not contain Rows G-I, nor does it label rows. Also, the sketch presents the durations of the stages as increasing (when read from left to right), whereas in Figure 4.22 they are presented as decreasing to reflect their chronological order in the music.

Row A	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
Row B	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12
Row C	33	32	31	30	29	28	27	26	25	24	23	22	20	19	18	17	16	15	14	13	12	11	10	9
Row D	+5	+4	+4	+3	+3	+3	+2	+1	+1							-1	-1	-2	-3	-3	-3	-4	-4	-5
Row E	38	36	35	33	32	31	29	27	26							16	15	13	11	10	9	7	6	4
Row F	9.5	9	8.75	8.25	8	7.75	7.25	6.75	6.5	6	5.75	5.5	5	4.75	4.5	4	3.75	3.25	2.75	2.5	2.25	1.75	1.5	1
Row G	*mp*						*mf*						*f*						*ff*					
Row H	1						2						3						4					
Row I	2						4						7						11					

Row A	Average durational interval in sixteenth notes
Row B	First modification: adding and subtracting 1-12 sixteenth notes from Row C
Row C	Sum of Rows A and B
Row D	Second modification: adding and subtracting sequence 1,1,2,3,3,3,4,4,5 from Row C
Row E	Duration of stages in sixteenth notes (sum of Rows C and D)
Row F	Duration of stages in quarter notes (Row E divided by 4)
Row G	Dynamic associated with stages (and scale size)
Row H	Number of tones added to create next scale size
Row I	Scale size

Figure 4.22: Adaptation of Vivier's sketch for the durational scheme in Subsection C1.1

Motion in Subsection C1.1

If the listener adopts the interior observer perspective, the lengthening scales imply changing spatial relations. Although magnification itself does not change an object's proportions, size, or location (it simply changes the observer's perspective), when conceptualized via the STATES ARE LOCATIONS or STATES ARE POSSESSIONS metaphors, the increased definition afforded by the higher power of magnification (which manifests as a larger size) suggests visual proximity. TIME'S LANDSCAPE and MOVING TIME spatialize these different sizes as degrees of proximity, where change in proximity implies motion between the observer and the spectra: either the observer approaches the spectra (MOVING OBSERVER) or the object approaches the observer (MOVING TIME). In the former, each power of magnification (1x, 2x, 4x, 7x, 11x) becomes a separate bounded region on TIME'S LANDSCAPE and the moving observer experiences the changing states of the music by walking though the different containers (Figure 4.23, left). In the latter, the observer remains stationary as the changing states of the spectra move past him or her (Figure 4.23, right).
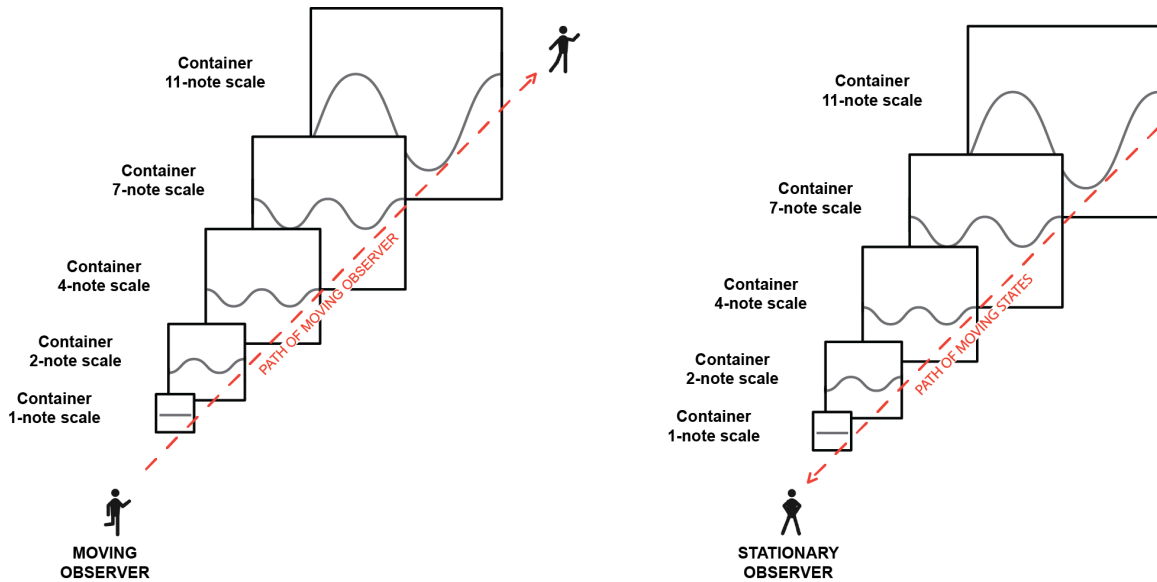
Figure 4.23: Powers of magnification in Subsection C1.1 from the MOVING OBSERVER (left) and STATIONARY OBSERVER (right) perspectives

As the bands of the spectra appear larger, it has a destabilizing effect on the observer. Higher powers of magnification can obscure the identity of an object by removing it from its familiar visual context. In a similar vein, the lengthening of the scales, particularly in the contrabasses, alters the usual environment of the spectra and creates a sense of disorientation. As mentioned in Chapter 3, the generative frequencies, which often take the form of pedal tones, ground the spectra and function as a stabilizing platform for musical gravity. Although the platform is redefined with each new spectrum, its presence and weight remain relatively constant (i.e., the rhythm may change, but the generative frequencies are always the lowest frequencies in the spectrum and remain audible for the duration of the spectrum). When the generative frequencies are not sustained, but played as fragments of scales in contrary motion, the perception of this platform (and hence the perception of musical gravity) is weakened, which in turn changes the virtual environment. As the dynamics increase along with the lengths of scale, the destabilizing and disorienting effect intensifies.

From an exterior observer's perspective, the increased dynamics, shortened durations of the stages, and wider amplitude of the scales evince an overall process of intensification that suggests a rise in momentum. Each time an instrument expands the ambitus of the

scale, the added tone(s) can be interpreted as increasing the scale's mass. Likewise, the acceleration stemming from the progressively shorter stages can be interpreted as an increase in velocity. As the product of mass and velocity increases, the resultant momentum and energy level manifests itself in the rising dynamics. At 17 – 1.b.1, all strings but the contrabasses play independent eleven-note scales with a complementary (or inverse-complementary) dynamic contour of *ff* > *mf* < *ff*. The result is a dense micropolyphony of the instrumental texture. This moment of homogeneity—which lasts just one quarter note—marks the formal boundary between the two processes of increasing momentum within Section C1.

Subsection C1.2, 17 – 1 to 20

In Subsection C1.2, slower, aleatoric values (expressed in the score as unstemmed black noteheads) replace the eleven-note scales. These longer scales, which will hereafter be called aleatoric waves, are distributed between the upper and lower registers so that each register plays a half-cycle while the other register rests. This process has its clearest representation in the last two measures of this Subsection C1.2. Figure 4.24 illustrates how the two complementary half-cycles create a single, sinusoidal motion.

- - - - Aleatoric wave, upper register (Group A)
——— Uneven repetition of pitch (Group A)
- - - - Aleatoric wave, lower register (Group B)
——— Uneven repetition of pitch (Group B)
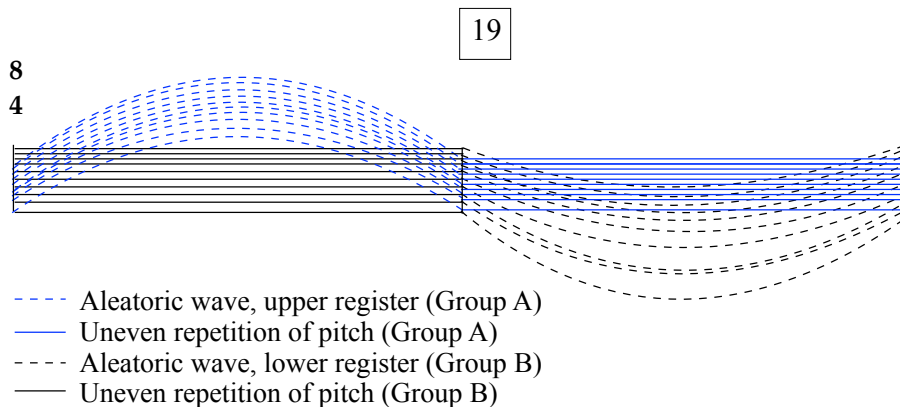
Figure 4.24: Illustration of aleatoric wave in Subsection C1.2, 19 – 1

Unlike Subsection C1.1, the longer periods of the aleatoric wave expand from seven to sixteen quarter notes in six stages. The overall dynamic contour also decreases with each temporal expansion. Figure 4.25 summarizes the conversion of undecuplet scales (shown

in purple) to the aleatoric wave (robin's egg blue). Each blue cell represents a single period of the aleatoric wave. The duration of the period, in quarter notes, is given in the last row. While the blue cells represent homophonic motion, the purple cells represent micropolyphonic motion since each row depicts an independent layer of the undecuplet scales. As before, the bass drum and tubular bells mark the changes in spectra; however, here the bass drum also marks the beginning of each aleatoric wave (the Balinese gong remains silent until Section C2). A grace note is used to initially set the wave-related bass drum attacks apart from the spectra-related ones. The deeper, heavier timbre of the bass drum is well suited to depict the larger metamorphoses of the aleatoric wave. Unlike the undecuplet scales, the dynamic level of the aleatoric waves remains constant within the cycle.

Mass Increasing

Velocity Decreasing due to Friction

Reh.	17 -1 b.2	17 + 1	18 - 1	18 + 1b.4	18 + 4	18 + 5	19
Vln I.1	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p > pp < p*	*pp*	
Vln I.2	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p > pp < p*	*pp*	
Vln I.3	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p*	*pp*	
Vln I.4	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p*	*pp*	
Vln I.5	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p*	*pp*	
Vln I.6	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp*	*p*	*pp*	
Vln II.1	*ff >mf < ff*	*f > p < f*	*mf*	*mp*	*p*	*pp*	
Vln II.2	*ff >mf < ff*	*f > p < f*	*mf*	*mp*	*p*	*pp*	
Vln II.3	*ff >mf < ff*	*f*	*mf*	*mp*	*p*	*pp*	
Vln II.4	*ff*	*f*	*mf*	*mp*	*p*	*pp*	
Vln II.5	*ff >mf < ff*	*f*	*mf*	*mp*	*p*	*pp*	
Vla 1	*ff >mf < ff*	*f > p < f*	*mf*	*mp*	*p*	*pp*	
Vla 2	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp*	*p*	*pp*	
Vla 3	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp*	*p*	*pp*	
Vla 4	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp*	*p*	*pp*	
Vc 1	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p*	*pp*	
Vc 2	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p*	*pp*	
Vc 3	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p > pp < p*	*pp*	
Cb 1	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p > pp < p*	*pp*	
Cb 2	*ff >mf < ff*	*f > p < f*	*mf > p < mf*	*mp > p < mp*	*p > pp < p*	*pp*	
Period ♩	7	8	9	14	15	16	

Polyphonoic undecuplet scales

Homophonic aleatoric wave

Figure 4.25: Distribution of aleatoric waves and dynamic levels in Subsection C1.2

The sketch for the durational scheme for this subsection is reproduced and modified as Figure 4.26. In Row A Vivier divides sixty quarter notes (the intended length for the section) into six groups of ten quarter notes. He subtracts one to three quarter notes from the first three durations, and adds them to the last three (Rows A–C). He then increases

the last three durations by three quarter notes each (Row D) so that the total duration of the subsection amounts to sixty-nine quarter notes. The resulting six durations (Row E) are divided by two [not shown] and assigned one of six dynamic levels (sixth row).

Row A	10	10	10	10	10	10
Row B	-3	-2	-1	+1	+2	+3
Row C	7	8	9	11	12	13
Row D	n/a	n/a	n/a	+3	+3	+3
Row E	7	8	9	14*	15	16
Row F	*ff*	*f*	*mf*	*mp*	*p*	*pp*

Row A	Average duration of aleatoric periods in quarter notes
Row B	First modification: adding and subtracting 1–3 quarter notes from Row A
Row C	Sum of Rows A and B
Row D	Second modification: adding three quarter notes to last three periods
Row E	Sum of Rows C and D
Row F	Dynamic level associated with period of aleatoric wave

* The aleatoric wave in the score at 18 + 3 deviates from the sketch in that it constitutes a hybrid of two different half-cycles (7 and 10 quarter notes respectively). The total duration of Subsection C1.2 is 72 quarter notes.

Figure 4.26: Adaptation of Vivier's sketch for the durational scheme in Subsection C1.2

Motion in Subsection C1.2

The decreasing dynamics and longer durations in Subsection C1.2 represent two of the strategies that Hatten identifies as typical of friction (or diminishing momentum) since both attenuate tension.[30] Also, the stasis of the sustained pitches has a drag-like effect that further impedes motion and attenuates tension. So even though the aleatorical wave sweeps up more strings with each period and transforms the micropolyphonic texture into a homophonic, sinusoidal motion, the gain in inertia (i.e., perceived as an increase in mass) is insufficient to offset the decrease in velocity; therefore, the overall perception is of decreasing momentum throughout section C1.2.

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[30] Robert Hatten, "Musical Forces and Agential Energies: An Expansion of Steve Larson's Model," *Music Theory Online,* 18/3(2012), [19].

In viewing the separate components of momentum, had all strings participated in the aleatoric wave with no sustained pitches, the effect would be very different. If the mass increases at a faster rate than the velocity decreases, momentum would still increase despite the longer periods, softer dynamics, and calming effect of the homophony. In such a case, a discrepancy could arise between an external observer's perception of increasing momentum and energy and an interior observer's perception of subsiding tension.

Paradoxically, the diminishing momentum in Subsection C1.2 establishes a foundation for the build in momentum and tension that lead to the climax of the piece in Subsection C2.

Subsection C2.1, 20 to 30

Between 20 and 30, a "pulsed" wave (articulated in triplets) emerges in counterpoint to the aleatoric wave and creates an interesting timbre reminiscent of low-level amplitude modulation. (Vivier uses the same technique at 17 in *Bouchara*). As shown in Figure 4.27, the pulsed wave, like the aleatoric wave, is divided between the upper and lower registers: the upper register (violins II.4 to I.1) initiates the first half of the cycle (i.e., ascending and descending or 0°–180°) and rests while the lower register (violin II.5 to cello 3) continues with the second half of the cycle (i.e., descending and ascending, or 180°–360°). Once the lower register completes the cycle, the upper register resumes the motion. The pulsed wave, which is half the period of the aleatoric wave, undergoes six phase shifts before realigning once again to form one continuous wave motion.[31] With each phase difference, more strings defect to the pulsed wave until the aleatoric wave completely disappears at 24. The contrabasses, whose pulses are twice the duration of the triplets, create a hemiola effect. Figure 4.28 shows the distribution of both types of waves

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[31] In a periodic wave, phasing refers to the distance between two successive crests, which represents a distance of 360° (explained in Subsection 1.5). As shown in Figure 4.29, the pulsed wave in Section C2 has a cycle of 36 triplets, thus each triplet represents a distance of 10.° As the lower register shortens its cycle, it creates a phase difference with the upper register. For example, if the lower register shortens its cycle by two triplets, thereby beginning the second half of the cycle two triplets before the upper register has finished the first half the cycle, it creates a phase difference of 20°.

throughout the strings in Section C2. The robin's egg blue cells represent the aleatoric waves, the light green cells represent the aleatoric waves played *tremolo sul ponticello*, and the periwinkle blue cells represent the pulsed waves. The last row gives the degree of phasing between Groups A and B of the pulsed waves.
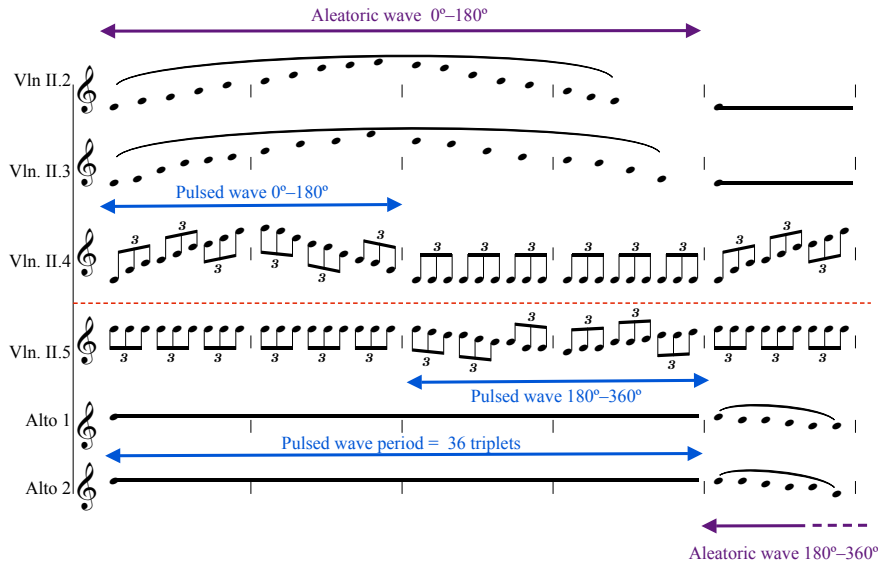
Figure 4.27: Cycle of pulsed and aleatoric waves in Subsection C2.1

Reh.	20	21	22	23	24	25	26	27	28	29	29+2	29+4	30
Vln I.1	pp				p < mf > p	p				p < mf > p	p	p < mf > p	pp
Vln I.2	pp				p < mf > p	p < mf > p	p < f > p	p < ff > p	p				pp
Vln I.3	pp				p < mf > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vln I.4				p	p < mf > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vln I.5	pp			p	p < mf > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vln I.6	pp			p	p < mf > p	p < mf > p	p < f > p	p				p < mf > p	pp
Vln II.1	pp		p	p	p < mf > p	p < mf > p	p < f > p	p < ff > p	p				pp
Vln II.2	pp		p	p	p < mf > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vln II.3	pp	p	p	p	p < mf > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vln II.4	p	p	p	p	p < mf > p	p < mf > p	p				p	p < mf > p	pp
Vln II.5	p	p	p	p	p < mp > p	p < mf > p	p				p	p < mf > p	pp
Vla 1	pp	p	p	p	p < mp > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vla 2	pp	p	p	p	p < mp > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vla 3	pp		p	p	p < mp > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vla 4	pp		p	p	p < mp > p	p < mf > p	p < f > p	p					pp
Vc 1	pp			p	p < mp > p	p < mf > p	p < f > p	p < ff > p				p < mf > p	pp
Vc 2	pp			p	p < mp > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Vc 3	pp				p < mp > p	p < mf > p	p < f > p	p < ff > p	p < f > p	p < mf > p	p	p < mf > p	pp
Cb 1	pp				p < mp > p	p < mf > p	p < f > p	p < ff > p	p				pp
Cb 2	pp				p < mp > p	p < mf > p	p < f > p	p					pp
Degrees of Phasing	0	0	20, 30	60	100	150, 180	180, 0	0, 180	180?	180?	180	180	n/a
Tape													

Aleatoric wave
Aleatoric wave *tremolo sul ponicello*
Pulsed wave (triplets)
Pulsed wave (2/3 quarter note)
Pulsed static spectrum (no wave contour)
Narration of strophes 4–9 "Der blinde Sänger"

Figure 4.28: Distribution of aleatoric and pulsed waves in Subsection C2.1

Between ☐20☐ and ☐24☐, the periodicities are synchronized on multiple levels of structure: the eighth note (pulse), measure (emphasized by changes in contour occurring on the downbeat), and hypermeasure (emphasized by the percussion and periods of the waves). Once again, the percussion plays a formal role by outlining the periods of the waves: the Chinese gong marks each new cycle of the aleatoric wave while the Balinese gong does the same for the pulsed wave in Group A. Both aleatoric and pulsed waves in Group A provide the frame of reference for the phasing undergone by Group B, which starts at ☐22☐. There, Group B shortens its cycle by two, then three triplets, creating a phase difference of 20° and 30° with Group A. As shown by Figure 4.29, the phasing increases to 60°, 90°, and 150° until it reaches 180° at ☐25☐ + 1. Following ☐26☐, the phase difference alternates between 0° (360°) and 180°.

The synchronicity of elements degrades further after ☐26☐ + 3 due to the changes in time signature, period, and contour. Even though the Chinese gong remains coordinated with the aleatoric waves, the period of the latter fluctuates between twenty-six and eight quarter notes.[32] Meanwhile, the pulsed wave, in addition to being phased with itself (i.e., Group B is phased relative to Group A), is also phased with the Balinese gong from ☐26☐ to ☐27☐.

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[32] Specifically, the periods change in the order of 26, 24, 25, 6.5, 8, and 10 quarter notes.

Figure 4.29: Phasing in Section C2.1 between 20 and 26

Motion in Subsection C2.1

The virtual environment created by the forces in Subsection C2.1 is more complex than in Section C1. Initially, the triple meter and regular periods of the aleatoric and pulsed waves (in Group A) create a state of inertia, i.e., the continuation of a pattern without change in intensity or direction. Although the synchronicity of meter, hypermeter, and wave contour remains relatively constant between 20 and 24, the sense of entrainment

(i.e., the impulse to attune to periodicities in the environment[33]) develops as the triplet pulse becomes more prominent, i.e., closer to 24. There the entrainment is sufficiently pronounced to withstand the phasing in Group B so that the latter has little, if any, disruptive effect.

After 24, the momentary loss of the aleatoric wave, more pronounced phase shifts in the pulsed waves, and hemiola effect in the contrabss take their toll and the momentum starts to become more erratic. On the one hand, the slower rhythm in the contrabass has a drag-like, friction effect, as does the irregular (and slower) *sul ponticello* aleatoric wave, played *p* (light green in Figure 4.28). On the other hand, the erratic phasing and growing dynamic contrasts within the pulsed waves, which peak at 27 with *pp < ff > pp*, evince increasing energy and momentum. The result is a chaotic, turbulent sonic environment, which begins to dissipate at 28 where both the dynamics and wave amplitudes (interval between crest and trough) are on the decline and the irregular aleatoric wave occupies half the instrumental voices. At 29, the addition of the recorded narration of the "Der blinde Sänger" (see dashed red arrow in Figure 4.28) introduces another layer of friction that helps bring the overall momentum and energy down. With the exception of the tape layer, these dampening devices seem to be the result of environmental friction, i.e., a natural resistance that attenuates motion when no compensating force is used. Hatten distinguishes environmental friction from what he calls agential friction—a willful, agential impediment to motion.[34] The tape layer, as a foreign medium, represents the latter and will be discussed further in Section C3.

From an interior, embodied perspective, the triplets create a lulling effect that enhances the observer's responsiveness to the wave contours midway though Subsection C2. Although the entrainment is strongest at 24, the observer's sensitivity to the fluctuations in gravity, inertia, and velocity that specific points (phases) in the wave cycle evoke is

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[33] Justin London defines entrainment as the impulse (and capacity) to synchronize our bodies' movements with periodicities in the environment. Justin London, "Temporal Complexity in Modern and Post-Modern Music: A Critique from Cognitive Aesthetics" in *Unfolding Time: Studies in Temporality in Twentieth-Century Music*, ed. Darla Crispin (Ghent, Belgium: Leuven University Press, 2009), 52–53.

[34] Hatten, "Musical Forces and Agential Energies," [12].

more acute between ⟦24⟧ and ⟦27⟧ where the dynamic range and wave amplitudes are broadest.[35] As the melodic wave motion ascends (first and last quarters in the wave cycle), inertia and gravity work together to create a feeling of increased weight in the observer. By analogy, on a rollercoaster, the rider experiences this effect as increased pressure on the back from the chair pressing into him or her as the cart climbs (some listeners, such as myself, naturally tilt their head back slightly at this point in the melodic contour.) At the apex of the crest (90°) when a change in direction is initiated, a brief moment of weightlessness takes place ("air time" in rollercoaster parlance). The weightlessness occurs because the forces of gravity and inertia are balanced, thus not acting upon the body in one way or another. If the change in direction is especially fast, a sense of continued upward motion occurs as inertia causes the rider to maintain the trajectory of motion from the ascent. As the body descends rapidly, the feeling of weightlessness, which is often described as a sinking feeling in the stomach, persists until the next change in direction.

In the music, the crests of the waves have more impact on the listener than the troughs primarily because the ear is more sensitive to higher frequencies than it is to lower ones. Even where there are no crescendos or decrescendos, i.e., from ⟦20⟧ to ⟦24⟧, the contour fosters an impression of increased volume. The addition of crescendos and decrescendos after ⟦24⟧ only further amplifies this effect. Note, however, that the dynamic contour in the lower register works against this natural inclination. The lower register has crescendos where the melodic contour descends and the inverse where the melodic contour ascends (Figure 4.8c illustrates this relationship between register, melodic contour, and dynamics), but more often than not, the end result of this combination of dynamic and melodic contour is a flattening of the overall dynamic level

Unlike a roller coaster where the change of direction at the trough is felt as intensely as the crest, the descending motion of the musical waves between 180° and 270°, particularly in Group B, do not have the same impact. Instead, the troughs are inferred

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[35] Different recordings emphasize these fluctuations more strongly at different moments in the score, hence the range given above.

from the hypermeter and a familiarity with the sine-like contour. (If changes in direction occur every 180°, and the duration of the full cycle is twelve quarter notes, then a change can be expected every six quarter notes.) So even if the contour recedes from audibility, its return can be predicted and anticipated as long as the meter and periods remain regular. As the phasing and periods become more erratic, as is the case after 24, the listener stops anticipating the crests (or troughs), but simply responds to the crests when they arise, e.g., at 27, thus succumbing to the forces of the turbulent virtual environment.

Subsection C2.2, 30 to 31

At 30, all wave motion ceases. In its place, a static spectrum, still pulsed in triplets, gradually adopts uneven "Morse code" tremolo as a crescendo builds tension to 31. This passage, which is depicted in Figure 4.30, functions as a transition from Sections C2 to C3. This transition sounds especially static, even constrained, after the sinusoidal contours of Sections C1 and C2. When coupled with the crescendo, the absence of melodic contour and pulsed triplets suggest a steady buildup of pressure. While the dynamics convey the overall increase in energy, the tremolo functions as a metaphor for the increased kinetic motion of the molecules that define pressure. The pressure continues to build until its release on the downbeat of 31, the climax of the piece and the beginning of Section C3. Although this passage shares some similarities with Subsection A1 (they both feature static blocks of sound that are slowly activated by tremolo), the interior perspective of the observer is different. In Section C3 the observer is the recipient of the force whereas in Subsection A1 he or she is the agent exerting the force.

Increasing Pressure → Release

Reh.	30	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	31
Vln I.1	*pp*		*cresc...*						*cresc...........*				*ff*
Vln I.2	*pp*		*cresc...*						*cresc............*				*ff*
Vln I.3	*pp*		*cresc...*					*cresc.........*					*ff*
Vln I.4	*pp*		*cresc...*					*cresc.........*					*ff*
Vln I.5	*pp*		*cresc...*					*cresc.........*					*ff*
Vln I.6	*pp*		*cresc...*					*cresc.........*					*ff*
Vln II.1	*pp*		*cresc...*					*cresc.........*					*ff*
Vln II.2	*pp*		*cresc...*					*cresc.........*					*ff*
Vln II.3	*pp*		*cresc...*					*cresc.........*					*ff*
Vln II.4	*pp*		*cresc...*					*cresc.........*					*ff*
Vln II.5	*pp*		*cresc...*					*cresc.........*					*ff*
Vla 1	*pp*		*cresc...*					*cresc.........*					*ff*
Vla 2	*pp*		*cresc...*					*cresc.........*					*ff*
Vla 3	*pp*		*cresc...*					*cresc.........*					*ff*
Vla 4	*pp*		*cresc...*					*cresc.........*					*ff*
Vc 1	*pp*		*cresc...*					*cresc.........*					*ff*
Vc 2	*pp*		*cresc...*					*cresc.........*					*ff*
Vc 3	*pp*		*cresc...*					*cresc.........*					*ff*
Cb 1	*pp*		*cresc...*					*cresc............*					*ff*
Cb 2	*pp*		*cresc...*					*cresc............*					*ff*

■ Pulsed spectrum (triplets)
■ Uneven tremolo (Morse code)
■ Section C3, *couleur rythmique*

Figure 4.30: Distribution of pulsing and uneven tremolo in Subsection C2.2

4.4.2 Section C3: *couleur rythmique*, 31 to 36

In Section C3, *couleur rythmique* (block articulation of spectra in uneven pulses or rhythms that are distinct from the melodic rhythm) replaces the *couleur pulsée*. The rhythms tend to involve simple patterns that are applied to the individual durations or to the rhythmic groupings. Figure 4.31, which is based on Vivier's only sketch for this material, transcribes the six rhythms and shows their overall patterning.[36]

The Roman numerals reflect the chronological order in the music. As can be seen from Figure 4.31, each rhythm has a different duration and dynamic level and favors number sequences and palindromes. In Rhythm I, which begins at 31, the groupings (identified by yellow brackets) increase by one quarter note and the last fifteen quarter notes form a palindrome (shown by the blue horizontal bracket). Rhythms II and V (beginning at 32 and 34 - 1 respectively) also form palindromes, but here the symmetry applies to the duration of the groupings, not the individual durations as in Rhythm I. In Rhythm III, adjacent values increase by an eighth note, and in Rhythm IV, adjacent values decrease

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[36] Division de la gestion de documents et des archives, Université de Montréal. Fonds Claude Vivier (P235) P235/D4, 066.

by a sixteenth note, save the first beat (beginning at 33 and 33 + 3 respectively). Finally, in Rhythm VI, at 35, the groupings increase by a quarter note, but subtract or add sixteenth note increments from each grouping.

Figure 4.31: Transcription of Vivier's sketch for *couleur rythmique* in Section C3[37]

Motion in Section C3

The longer durations in both the melody and spectra throughout Section C3, along with the softening dynamics, suggest diminishing momentum and intensity. The recorded text acts as a form of agential friction that steers attention away from the music (thus

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[37] Coloured brackets are not part of the original sketch.

distracting the observer), and in this capacity, impedes the musical motion. As a foreign medium, it does not integrate acoustically with the spectra and melody: the rhythm and intonation of the spoken German, the timbre of the male voice, and the volume of the track place it in conflict with the music, even if the content of the poem is, as Vivier states, "the key to the work."[38]

The use of extra-musical recorded material in Section C differs considerably from the use in Section B. In Section B, the recorded tracks fade in and out during moments of rest in the melody, "like memories."[39] The tracks do not compete with the sung text, and therefore there is little sense of conflict or impediment to the musical motion. To the contrary, Vivier appears to tailor the melodic contour and rhythm of the spectra to complement Martin Luther King's pitch and speech rhythm. For example, in the first two lines of Martin Luther King's speech beginning at $\boxed{8}$ + 2, the words *fathers died*, *Pilgrim's pride*, and *mountain side* evince the same accented syllables and inflection (a drop of approximately a minor third between the first two syllables):

```
                  ....  sweet land of liberty, of thee I sing.
                   /  -  -                 /  -     -
        Land where my fathers died, land of the Pilgrim's pride,
               /     -   -                           / = Accented Syllable
        From every mountainside, let freedom ring!    - = Unaccented Syllable
```

Vivier reflects this change in intonation by pairing it with synchronized descending motion in the spectra.

Although not a force or energy metaphor, a puzzle analogy expresses the contrast in the treatment of recorded material in Sections B and C3 (Figure 4.32). Whereas the texts in Section B are woven into the fabric of the music (i.e, the two media "fit"), the text in Sections C2–C3 does not have the same complementary role (i.e., the two media do not quite fit).

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[38] See translation of Vivier's program notes in Appendix B3.

[39] Vivier's performance notes at $\boxed{8}$ +1, which are difficult to read in Figure 4.32, state: "dans cette pièce la bande est toujours très douce, comme un souvenir!" [In this piece, the tape is always soft, like a memory!].
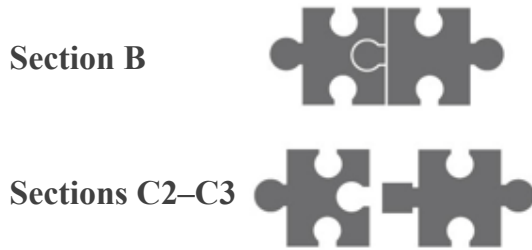
Figure 4.32: Puzzle analogy of tape layer in Section B vs. Sections C2–C3

Instead, the juxtaposition of a live musical medium and the recorded extra-musical medium creates conflict. As a foreign medium, the recorded track introduces agential friction to the virtual environment, and as a result, impacts the spectra by decreasing the momentum in preparation for the retransition (the phased duet) at 36 so that Section C ends with a similar level of energy with which it began.[40]

4.5 Final Thought

The intention of the radiophonic project was to create an alternate history by juxtaposing and manipulating recorded socio-political texts with music to create an intersection of musical, social, and political spaces. And while the details in the original radiophonic proposal are somewhat vague, some found their way into *Wo bist du Licht!* For example, the sinusoidal technique, as a metaphor for magnification, preserves the idea of scrutiny or examination, and the overlay of recorded socio-political texts with acoustic music alters the temporal space by weaving historical time, chronometric time, and musical time. Also, the content of the recorded texts, which begins with Martin Luther King Jr.'s iconic address on Washington and finishes with descriptions of torture in the Radio-Canada documentary, regresses from a state of optimism to apathy. When combined with Hölderlin's poem, "Der blinde Sänger," these texts convey the cruel side of hope, an appropriate message for a song about human suffering.

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[40] In Robert Hatten's expansion of Larson's Musical Forces, agency can be assigned to forces as well as melody, as is the case with agential friction. This agency separates the force from the "neutral environment of the physical forces." If its will works against another agent (e.g., melody) or against the forces of the environment, it becomes an "*opposing agential force.*" In such a case, Hatten claims "agential conflict" becomes a "more appropriate analogy" than friction. Robert Hatten, "Musical Forces and Agential Energies," [12].

Although much could be said about the texts, this chapter focused exclusively on the motion and force metaphors that changes in accompaniment's texture, timbre, and rhythm evoke in Sections A and C. Vivier uses the *couleurs* to create smooth processes of intensification and attenuation that unify the formal sections of the work. These processes suggest a musical environment in which analogues to inertia, momentum, friction, pressure, and gravity constrain the musical motion. The listener, or observer, experiences these environmental changes both directly or indirectly by either moving through the virtual space or surveying it from afar (or alternating between the two). I will review the motion metaphors in these sections.

Section A delineates a two-part structure governed by two processes. In the first, juxtapositions of silence with a *fff* noise-timbre gradually yield to the harmonicity of a major third as the strings change from overbowing, tremolo, to normal bowing. The combination of heavy pressure and stasis convey the high energy needed for an agent to overcome the inertial stasis of a large object. The breaking point between static and dynamic friction marks the beginning of the second process. Here, the symmetry of the decrescendo and deceleration, followed by a crescendo and acceleration, suggests a conversion of kinetic energy into potential energy, then back into kinetic energy, much like a slow motion bungee drop.

In Section C1.1, the lengthening scales of the spectra, along with the intensifying dynamics and shorter durations, suggest an increase in momentum achieved by increasing both the velocity and mass. This process creates a dense polyphony that Section C1.2 transforms by slowly dispersing a homophonic aleatoric wave throughout half the orchestral register while the other half remains static. The stasis of the latter creates drag, which decreases the momentum, as shown by the softening dynamics and diminishing velocity.

In Section C2.1, the regular meter and triplet pulse (rhythmic inertia) of the *couleur pulsée* has a hypnotic effect on the MOVING OBSERVER that improves his or her responsiveness to the wave contours. The observer metaphorically experiences these contours as shifting sensations in weight and inertia, similar to riding a rollercoaster. As

the phasing, periods, and hemiola become more unpredictable and intense, the environment turns turbulent until agential and environmental friction decrease the momentum. In Subsections C2.2, a feeling of increasing pressure arises from the pulsed block spectra, whose lack of melodic contour (i.e., motion) suggests an energy metaphor rather than a mechanical metaphor. The crescendo, tremolo bowing, and pulses mimic a steady increase in pressure by depicting the increased kinetic energy of molecules until that pressure is released on the downbeat of Section C3, the culmination point.

In Section C3, the rhythmic spectra beat six different rhythms that feature either a palindrome or linear incremental changes in duration. Throughout the six rhythms, both the spectra and melody evince longer durations and diminishing dynamics that are consistent with diminishing momentum. Like the braking effect of the flattening spectra in Section C2, the flattening of the rhythm in Section C3 fosters a sense of declining velocity. This loss of momentum seems to be exacerbated by the overlay of the recorded narration of "Der blinde Sänger," which acts as a form of agential friction.

All of these force and energy metaphors highlight the formal sections, which are predetermined by durational schemes. For the most part, these depend on steady incremental changes or the simple additive series introduced in Section A. Although the number six does not feature in either of these number series, it has a prominent role throughout this piece: the number of texts ("Der blinde Sänger" [mezzo], invented language [mezzo], Martin Luther King Jr.'s Address on Washington, *in situ* broadcast of Robert Kennedy's assassination, narration of "Der blinde Sänger," and the Radio-Canada documentary on torture during Vietnam the war); the number of stages with which each scale length is deployed in Subsection C1.1; the number of periods of the aleatoric wave in Subsection C1.2; the number of phase shifts in Section C2.1; and the number of rhythms in Section C3. Given Vivier's Catholic-inspired mysticism, one wonders whether or not the significance of the number six in this piece is at all related to its biblical symbolism of human weakness.

Certainly the most ambitious in terms of length, phasing, and sociopolitical content, *Wo bist du Licht!* is also a testing ground for new ideas. Some of these will be further

explored in Chapter 5, particularly the threshold between rhythm and duration, and the texture of spectra.

Chapter 5: *Trois airs pour un opéra imaginaire*

In the spring of 1982, Vivier moved to Paris on a grant from the Canada Council for the Arts to compose an opera on the life of Tchaikovsky. According to Bob Gilmore's biography, *Claude Vivier*, the inspiration for the opera came after a friend, musicologist Véronique Robert, relayed to Vivier a recent theory regarding the cause of Tchaikovsky's death: rather than dying from cholera, Tchaikovsky was supposedly coerced into committing suicide.[1] Although allegations of suicide have always surrounded the composer's death, it was Alexandra Orlova's article "Tchaikovsky: The Last Chapter" in *Music and Letters* 62 (1981) that brought the theory wide attention in the West.[2] Her article, which was published shortly after Orlova emigrated from Russia to the United States, claims Tchaikovsky poisoned himself after a threat was made to expose a homosexual affair he had with a young member of the nobility. To avoid bringing shame to the Imperial School of Jurisprudence (his alma mater), Tchaikovsky was ordered to terminate his life by a "court of honor" comprised of his former classmates.[3] It is easy to see how the dramatic potential of this tragic speculation, coupled with a deep respect and admiration for Tchaikovsky's music, appealed to Vivier.

Before beginning any serious work on the opera, Vivier tested new ideas in a piece he began writing that summer, *Cinq airs pour un opéra imaginaire.* According to Vivier, "this piece I'm doing is an important bridge to cross before beginning the opera, technical work, obviously, a rediscovery (A) of counterpoint (B) of more dramatic musical time, closer to speech, with *atomic* elements of different kinds."[4] Sketches and an early manuscript indicate that Vivier originally planned to include five *airs*, but the final version, completed in November 1982, contains just three. Dedicated to French

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[1] Bob Gilmore, *Claude Vivier: A Composer's Life* (Rochester, NY: Rochester University Press, 2014), 210.

[2] The original Russian version of the article was published as two parts in the New York-based weekly, *Novyi amerikanets*: "Taina zhizni Chaikovskogo*," Novyi amerikanets* 5–11 (1980), 20–21 and "Taina smerti Chaivovskogo," *Novyi amerikanets* 12–18 (1980), 22–23.

[3] For a critique of Alexandra Orlova's theory, see Alexander Poznansky and Ralph C. Burr, "Tchaikovsky's Suicide: Myth and Reality," *19th-Century Music* 11/3 (1988), 199–220.

[4] Claude Vivier, in a letter to Thérèse Desjardins, quoted in Gilmore, *Claude Vivier*, 206.

contemporary ensemble L'Itinéraire (for whom the work was commissioned), L'Itinéraire, with soprano Brenda Hubbard and director Yves Prin, premiered *Trois airs pour un opéra imaginaire* on 24 March 1983 at the Centre Pompidou, just weeks after Vivier's death.

Whether Vivier intended to incorporate these *airs* into the Tchaikovsky opera is uncertain, nor is it clear whether he intended to even proceed with the project.[5] In letters to his closest friend Thérèse Desjardins (dated early January), Vivier expressed feeling homesick and lonely (triggered by the holidays), but was hard at work on a commission for the Groupe vocal de France.[6] This new project, *Glaubst du an die Unsterblichkeit der Seele* [Do you believe in the immortality of the soul], appears to have been the main focus of Vivier's professional attention between January and March 1983. (When conducting the initial murder investigation into Vivier's death, this was the manuscript the police found open on Vivier's desk.[7]) Given Vivier's preoccupation with *Glaubst du*, it is not surprising that the opera project would have temporarily been set aside.[8]

Regardless of the possible connection to the Tchaikovsky opera, *Trois airs* evinces a new purity of thought in its organization, lyricism, and sound quality. The form, harmony, and melody are all byproducts of the spectra (to be discussed below), which are in turn combination tones of two frequencies. That all material can be traced to such a modest source shows an elegant economy of means. Although Vivier uses similar techniques as in *Wo bist du Licht!*, i.e., the *technique sinusoïdale*, *spectre pulsé*, *spectre aléatoire*, and *spectre rythmique*, the application here differs and results in a richer contrapuntal texture (particularly where pulsed and aleatoric spectra are concerned). In previous works,

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[5] Ibid.

[6] Ibid., 213–214.

[7] A lot of the pagination we find on the sketches was penned by the police as part of the investigation, not by Vivier.

[8] *Glaubst du an die Unsterblichkeit der Seele* is written for twelve voices, three synthesizers, percussion, and electronics. The text, written in French and Vivier's invented language, is a narrative of stark realism very unlike his prior semantic and sometimes sentimental texts. One passage in particular, in which the tenor—whose voice is altered by a vocoder—describes being stabbed by a handsome young man on the metro seems to foreshadow Vivier's own imminent and tragic death. Even more foreboding is the tenor's account of feeling cold, alone, and frightened, the same fears Vivier relayed to Thérèse Desjardins in his letters that winter.

polyphony (when present) often stems from phasing—a form of imitation that simply displaces and superimposes an object in time. The texture of those earlier works is predominantly homophonic, with the voice and orchestra moving in homorhythmic blocks. In *Trois airs*, the writing and counterpoint are more deliberate and crafted, especially the transposition of the spectra and durations. This return to counterpoint is perhaps, in part, what Vivier meant when he said that *Trois airs* had a more "traditional orchestration."[9] As Bob Gilmore remarks, "perhaps he felt he had gone as far as he could, at least temporarily, in that direction [the dyadic homophonic texture], and that textural principles he had consciously bypassed in the process would now refresh his compositional imagination. Such is abundantly the case in the *Trois airs*."[10] In this work, the spectra now serve as a *means* to an end, i.e., the raw material for composition, rather than an *end* in itself.[11]

The vocal style in *Trois airs* has a more operatic quality that Vivier likened to *bel canto.* Like *Bouchara*, the text consists exclusively of *langue inventée,* and therefore avoids some of the awkward sentimentality of some of the prior texts he penned himself. Fortunately, the *langue inventée*, which has no semantic content to detract from the music, eliminates this literary awkwardness, but retains expressive meaning through the sound symbolism of voice timbre and phonemes.[12]

Overview of the Work

This section includes a brief overview of all three *airs*, even though the focus of this chapter is the relationship between the spectra and melody in the first two *airs*. These two *airs* are taken up individually and in greater detail under headings 5.1 and 5.2. The

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[9] Quoted in Gilmore, *Claude Vivier*, 206.

[10] Ibid., 207.

[11] Vivier's approach to spectra is discussed in Chapter 1, Section 1.6.

[12] In *Speech, Music, Sound* (London: Palgrave Macmillan Press, 1999), Theo van Leeuwen argues that the actions involved in the articulation of phonemes (e.g., placement of the tongue and lips, air flow, aperture, etc.) convey expressive meaning through the metaphors they evoke. R. Murray Schafer's more playful *When Words Sing* (Scarborough, ON Canada: Berandol Music Limited, 1970) also explores the expressive characteristics of speech sounds.

program notes for the premiere, which Vivier wrote himself, outline the basic formal aspects of the piece and are reproduced here (translated by Bob Gilmore):

> This work is literally what the title suggests. The main elements of my piece are: a spectrum with regular pulsation moving towards an irregular and individual pulsing; from this pulsing arises a series of short, brilliant lines rocketing towards the highest register. The rhythm thus produced flattens out more and more to become pure duration. Everything becomes homophonic only to break up once again, becoming contrapuntal and stabilising in an orchestration that becomes ever thinner and moves more and more towards the high register. Finally there is an abrupt return to homophony, moving towards a sound/noise from the whole ensemble, which shatters brutally on a pure interval in order to allow a return to spectral writing. (3 January 1983)[13]

The durations of the first and second *airs* are roughly the same (4:04 minutes), while the third *air* is slightly over half that duration (2:28 minutes).[14] Each *air* has a unique style and texture that evokes different motion and virtual environmental forces. By texture I mean the combination of rhythm, contour, density, and dynamics articulated in the instrumentation, mostly through the surface activity of the spectra; by style I mean the interaction of the totality of musical parameters, including texture, melody, vocal qualities, timbre, and sound symbolism. Like *Wo bist du Licht!*, the first *air* incorporates *couleur pulsée*, *couleur aléatoire*, and *couleur rythmique*, but focuses more on motivic development within the spectral texture rather than phasing of the sinusoidal contour.

The second *air* begins with a homophonic texture, but slowly dislodges into a contrapuntal texture featuring layers of planing, followed by a polyphony of aleatoric values. As the texture thins, the music moves towards the high register where it culminates in a sublime two-part counterpoint between the voice and lower woodwinds (as *Klangfarbenmelodie*), with subtle accompaniment from the piccolo, flute, and upper strings.[15] The lyricism of this interaction perfectly exemplifies Vivier's new discovery of

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[13] Gilmore, *Claude Vivier*, 207.

[14] Timing refers to Claude Vivier, *Trois airs pour un opéra imaginaire*, Société de Musique Contemporaine du Québec (SMCQ), directed by Walter Boudreau, ATMA Classica, 2001, compact disc.

[15] I am using the term *Klangfarbenmelodie* to describe the re-orchestration of melodic units. See Richard Taruskin's discussion of Webern's orchestration of Bach's *Musical Offering* in "Chapter 6 Inner Occurrences (Transcendentalism, III)," in *Music in the Early Twentieth Century*, vol. 4 of *The Oxford History of Western Music* (New York: Oxford University Press, 2005; reprint 2010), 161–163.

counterpoint. Unlike the first and third *airs*, in which the musical motion evokes metaphors of physical force, motion in the second *air* emerges as a result of localizing different mental states and moving between them.

The third *air* marks a return to strict homophony, where the spectra and melody form a single homorhythmic layer once again. Emphasis is on instrumental timbre and the impassioned vocal style. The timbre becomes increasingly inharmonic due to overbowing, flutter-tonguing, and tremolos, while the shorter, more repetitive, phrases and louder dynamics provide a stark contrast with the intimacy and softness of the second *air*.[16] In terms of rhythm and meter, the third *air* exhibits the most complex transitions between time signatures with different subdivisions occurring almost instantaneously.

Whereas the analysis in Chapter 4 focused on the virtual environmental forces suggested by the spectra independent from the melody, the analysis in this chapter considers the relationship between the two. The first and second *airs* demonstrate two types of active interaction between a virtual agent, embodied through the melody, and the virtual environment.[17] In the first *air*, the spectra represent independent, unpredictable environmental forces that act on the agent. This category of motion, which Matthew BaileyShea proposes, combines non-sentient physical forces (like Larson's Musical Forces) with agency and unpredictability. It involves "imagining an agent operating among virtual environmental forces" that are "variable and unpredictable."[18] Such forces would involve "elements like wind and water," which are exactly what the *technique sinusoïdale* suggests in the first *air*. In addition to the wind and water motion, musical gravity represents an important presence in the virtual environment. At times these forces benefit the agent's motions or efforts (e.g., moving with the wind), but at other times they hinder them (e.g., moving against the wind).

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[16] Harmonicity and inharmonicity are discussed in Chapter 1.

[17] Robert Hatten's notion of an embodied musical agent and a virtual environment is discussed in Chapter 3, Section 3.2.

[18] Matthew L. BaileyShea, "Musical Forces and Interpretation: Some Thoughts on a Measure in Mahler," *Music Theory Online* 18/3 (2012), [11].

In the second *air*, the spectra function as an outward manifestation of the agent's changing states of mind. That is to say, the spectral environment is a mental projection of the embodied melody. As such, the environment does not influence the agency of the melody. Any struggle or conflict that the melody displays is internally driven as opposed to externally imposed. Given this reversal of the causal relationship between the agent and spectra, analysis of the second *air* relies more on sound symbolism, timbre, and tropes to convey emotion.

5.1 The First *air*, ⬚1⬚ to ⬚17⬚

The first *air* features a classic homophonic texture consisting of melody, bass, and accompaniment.[19] Like *Wo bist du Licht!*, it includes portions of pulsed spectra, aleatoric spectra, and rhythmic spectra, but with a looser adherence to the sinusoidal contour. In this *air*, Vivier develops a set of motives whose ascending contour mimics the upswept motion of the wind. Each section of the three-part form, identified as Sections A, B, and C, produces a unique virtual environment that has a different effect on the melody. In Section A, the pedal tones function as a manifestation of musical gravity (or friction in the form of drag) that pulls on the melody while the aperiodic wave motion of the spectra provides the melody with forward thrust. This energy from the waves mitigates some of the pedal tones' pull or drag, which in turn helps the melodic agent conserve energy. In Section B, swift, ascending gestures, like gusts of wind, replace the wave motion of the spectra. As the metaphoric wind builds in intensity and becomes turbulent, it impedes the movements of the melodic agent by adding resistance. The melodic agent must then struggle against both the pull of the pedal tones and the push of the wind motives to ascend to the culmination point of the piece in ⬚13⬚. In Section C, both the decline in the wind's intensity and weaker pedal tones create a calm environment that is reflected in the melody's minimal tension. This reduction in tension conveys a sense of diminished agential effort, or willingness to acquiesce to the environmental forces.

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[19] Claude Vivier, *Trois airs pour un opera imaginiaire* (New York: Hendon Music Inc., first printed 2009; second printing 19 October 2010). Available: http://www.boosey.com/cr/perusals/score.asp?id=1309 [accessed 18 November 2016]

5.1.1 Spectra in First *air*

The piece opens with two strokes from the crotales and chimes, which are left to resonate and decay fully. Thereafter a wash of sound, created by the wave texture of the *technique sinusoïdale*, sets the music in motion. Figure 5.1 shows the orchestration of the first spectrum (identified as 1o, where o stands for original) at $\boxed{1}$ + 3. Unlike the pulsed waves in *Wo bist du Licht!*, the contour of the pulsed waves in *Trois airs* is roughened by rests and minute changes in contour that emphasize pairs of tones. As before, the waves represent overlapping bands of frequencies from the spectrum, which are articulated as ascending and descending scales. Figure 5.2, a transcription of Spectrum 1o, shows how Vivier divides the spectrum into bands of seven ascending frequencies. Excluding the generative frequencies 65 Hz (C2) and 98 Hz (G2), all frequencies in Figure 5.2 are the sum of two lower frequencies in the spectrum and can be expressed as the sum of a multiple of 65 Hz and 98 Hz. Note that Vivier omits the quartertone alterations of the original spectrum (shown in Figure 5.2) from the sextuplets in Figure 5.1. Out of practicality, Vivier often omits more cumbersome alterations during rapid passages.

Figure 5.1: Orchestration of spectrum 1o, first *air*, *Trois airs*, ⃞1 + 3
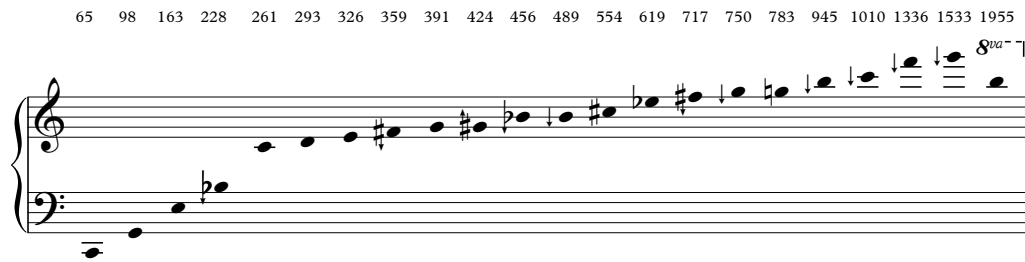
Figure 5.2: Transcription of spectrum 1o with frequencies

The order in which the combination tones are generated reflects a series of steps, or algorithm, that defines each spectrum. Figure 5.3 gives the algorithm used to produce spectrum 1o. The first column gives the rank of the frequency (from lowest to highest), identified as F1–F22; the second column gives the frequency (in Hertz); the third column gives the corresponding note in the score; the fourth column gives the combination tone class; and the fifth and final column shows the lower ranking frequencies of which it is the sum.[20]

The first *air* contains thirty spectra that are grouped into fifteen pairs and contain either twenty-one or twenty-two frequencies. Each pair consists of an original spectrum (o), generated via combination tones, and a permuted version (p) that involves transposition (discussed below). The pairs, which are numbered 1–15 in chronological order of appearance, occur together, usually with the permuted spectrum immediately following the original spectrum (the order is reversed for pairs 9 and 15).

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[20] Combination-tone classes (CTC) are explained in Chapter 1, Section 1.6.

Spectrum 1o, 1 + 3				
Rank	Frequency	Pitch	CTC	Sum of
F1	65	C2	<1,0>	
F2	98	G2	<0,1>	
F3	163	E3	<1,1>	F1 + F2
F4	228	B♭3↓	<2,1>	F1 + F3
F5	261	C4	<1,2>	F2 + F3
F6	293	D4	<3,1>	F1 + F4
F7	326	E4	<2,2>	F2 + F4
F8	359	F♯4↓	<1,3>	F2 + F5
F9	391	G4	<3,2>	F3 + F4
F10	424	G♯4↑	<2,3>	F3 + F5
F11	456	B♭4↓	<4,2>	F3 + F6
F12	489	B4↓	<3,3>	F4 + F5
F13	554	C#5	<4,3>	F5 + F6
F14	619	E♭5	<5,3>	F6 + F7
F15	717	F♯5↓	<5,4>	F7 + F9
F16	750	G5↓	<4,5>	F8 + F9
F17	783	G5	<3,6>	F8 + F10
F18	945	B5↓	<7,5>	F11 + F12
F19	1010	C6↓	<8,5>	F11 + F13
F20	1336	F6↓	<10,7>	F14 + F15
F21	1533	G6↓	<7,11>	F16 + F17
F22	1955	B6	<15,10>	F18 + F19

Figure 5.3: Algorithm for spectrum 1o in first *air* [21]

Algorithms

Although there are fifteen pairs of spectra, only nine of these exhibit distinct algorithms along the lines of spectrum 1o. Five pairs are transpositions of other spectra and one pair repeats an algorithm with different generative pitches (thus producing a different spectrum). The table in Figure 5.4 (a modified tree diagram) depicts the relationship between the nine algorithms by showing the hierarchy of the frequencies (i.e., the order in which each combination tone is created) as well as the similarities between the algorithms' combination-tone classes: the more columns ("branches") that algorithms have in common, the more similar they are to one another. With the exception of the generative frequencies F1 and F2 (first two rows), each cell in Figure 5.4 represents a combination tone class. The letter at the bottom of each column identifies the algorithm (labeled A–H), followed by the generative interval, the identification number of the

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[21] Arrows (↑↓) indicate quarter tone alterations.

original spectra generated by the algorithm and its location in the score. Identification numbers followed by an original spectrum in parentheses, e.g. 12(6o), indicate a transposition of the spectrum given in parentheses. Transposed spectra are not generated by following a new algorithm; their relationship to the algorithm (via transposition) is mechanical. As can be seen by the common column of the first seven rows (i.e., the "trunk" of the tree), the first seven steps are the same. Thereafter, the CTCs vary, but the procedure remains very similar since each combination tone represents the sum of two frequencies ranked within 3 partials of each other (e.g., F3–F6). Most, however, consist of adjacently-ranked, ascending frequencies. Again, the patterns that reoccur most frequently are chains of ascending frequencies (e.g., F2 + F3, F3 + F4, F4 + F5, etc.) and chains that alternate adjacent-ranked ascending frequencies with next-to-adjacent ranked ascending frequencies (e.g., F4 + F5, F4 + F6, F5 + F6, etc.).

Rank	Combination-Tone Class "Tree" for First *air*								
F1.	<1,0>								
F2.	<0,1>								
F3.	<1,1>								
F4.	<2,1>								
F5.	<1,2>								
F6.	<3,1>								
F7.	<2,2>								
F8.	<1,3>		<3,2>						
F9.	<2,3>	<3,2>	<1,3>						
F10.	<3,3>	<2,3>	<2,3>						<4,2>
F11.	<4,2>	<4,2>	<3,3>						<5,2>
F12.	<4,3>	<3,3>	<4,3>	<4,3>	<5,2>				<4,3>
F13.	<5,3>	<4,3>	<3,4>	<5,3>	<4,3>				<3,4>
F14.	<3,5>	<5,3>	<5,3>	<5,4>	<5,3>			<3,4>	<5,3>
F15.	<3,6>	<4,5>	<4,4>	<4,5>	<5,4>			<5,4>	<5,4>
F16.	<5,6>	<3,6>	<5,4>	<3,6>	<4,5>			<4,5>	<7,4>
F17.	<8,5>	<6,6>	<4,5>	<5,6>	<5,5>	<3,6>		<3,6>	<9,4>
F18.	<9,6>	<7,6>	<3,6>	<7,6>	<8,5>	<8,5>	<5,6>	<5,6>	<9,5>
F19.	<8,8>	<9,8>	<5,6>	<9,6>	<9,5>	<9,6>	<8,5>	<7,6>	<7,7>
F20.	<6,11>	<10,11>	<7,6>	<10,7>	<9,6>	<10,7>	<9,5>	<7,7>	<8,7>
F21.	<8,12>	<13,12>	<7,7>	<9,9>	<10,7>	<9,9>	<9,6>	<8,8>	<10,7>
F22.	<13,11>		<8,7>	<7,11>	<9,9>	<7,11>	<10,7>		<12,8>

Algorithm:	F	A	H	D	B	E	C	I	G
Generative Interval:	M7	P5	P12	M7	M3	m7	M6, M10	A4	m10
Spectra ID:	6o:	1o:	9o:	4o:	2o:	5o:	3o:	14o:	7o:
Location:	[8]	[1]	[13]	[6]+3	[4]	[7]	[5]+2	[15]+4	[9]
Spectra ID:	12(6o):	11(1o):				8(5o):	10o:		13(7o):
Location:	[15]	[14]+3				[10]+2	[13]+2		[15]+2
Spectra ID:							15(10o):		
Location:							[16]+4		

Figure 5.4: Algorithm tree based on combination-tone classes in first *air*

Permutation of the Spectra

The orchestration of the first permuted spectrum (1p) in [3], shown in Figure 5.5, follows the same principles as the original spectrum, i.e., it overlays bands of frequencies. The range will change slightly due to the permutation process, which transposes segments of 1o by a variable interval that involves quarter tones.

Figure 5.5: Orchestration of spectum 1p, first *air*, *Trois airs,* 3

The transposition process is made explicit in Figure 5.6, Vivier's sketch for the permutation. The fractions above the notes, which refer to whole tones, represent the intervals of transposition. Note that the frequencies are not all in ascending order: for example, 391 (G4) appears before 359 (F♯4↓), which suggests Vivier was calculating and

notating frequencies simultaneously, then rearranging them in ascending order, as shown on the upper staff of the sketch in Figure 5.7a. On the lower staff of Figure 5.7a, Vivier transcribes the permuted spectrum according to the intervals shown in Figure 5.6:

> F4–F6 are transposed down ¼ tone
> F7–F10 are transposed down ½ tone
> F11–F15 are transposed down ¾ tone
> F16–F21 are transposed down 1 tone
> F22 is transposed down 1¼ tones

Figure 5.6: Vivier's sketch for spectrum 1o showing intervals of transposition for spectrum 1p[22]

Because the tones in 1p result from transposition, they are not accompanied by frequencies in the sketches. Excluding F1–F3, as the segments rise in register, the interval of transposition expands slightly. Figure 5.7b, a transcription of Figure 5.7a, circles the tones Vivier selects for the melody over that particular spectrum. Only tones without quartertone alterations that fall within the soprano's range are chosen for the melody. The vertical lines in Figure 5.7a and 5.7b refer to the orchestration and indicate the band of frequencies assigned to each instrument. For example, the piccolo (shown in Figure 5.5) will arpeggiate the range between A6↓ and F5↓, and violin I will arpeggiate the range between E♭6↓ and D5↓, etc. Each band involves an average of seven adjacent frequencies.[23]

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[22] Division de la gestion de documents et des archives, Université de Montréal. Fonds Claude Vivier (P235) P235/D4, 063. All sketches included in this chapter come from file P235/D4, 063.

[23] The bands for violin II and clarinet 1 have eight frequencies. Combination tones a quarter tone apart are omitted from the sextuplets figures, e.g., instead of F5 and F5↓, only F5 appears in the sextuplets for spectrum 1p.
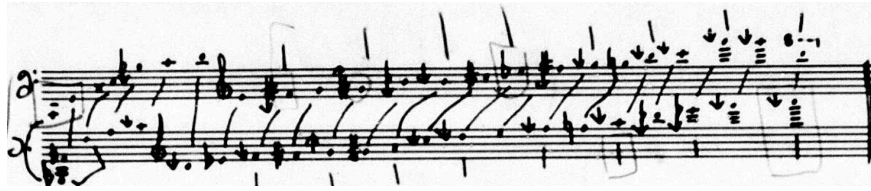
Figure 5.7a: Vivier's sketch for spectrum 1o (upper staff) and spectrum 1p (lower staff)
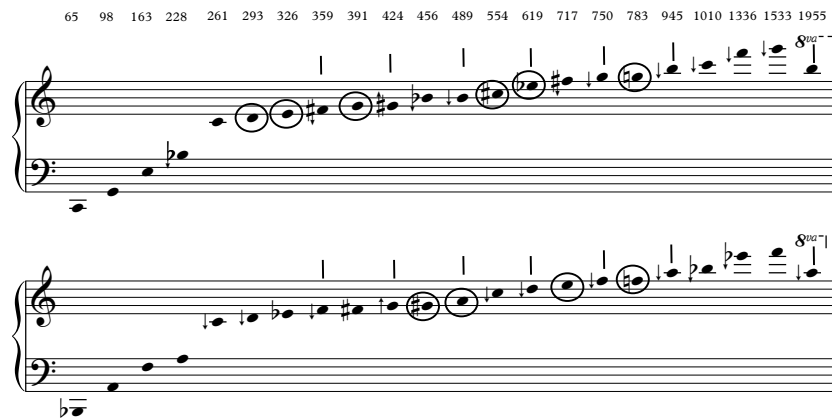
Figure 5.7b: Transcription of Figure 5.7a outlining melodic tones (circled) and frequency bands (vertitical lines)

Although spectrum 1p lowers F1 by a tone and raises F2 and F3 by a semitone, the remaining permuted spectra raise F1–F3 by a half tone so that the overall range of the original spectra contracts by 1¾ tones. Although the majority of the permuted spectra follow this pattern, there are slight variations between the spectra in the sketches and those in the score, as well as between the number of frequencies in each spectrum. Despite these variations, the procedure remains to transpose segments of the original spectrum by an interval that ranges between 1–1¾ tones.

5.1.2 Structure and Form

Once the spectra and melody tones are selected, the general structural and formal outlines begin to take shape. Figure 5.8, inspired by one of Vivier's sketches, shows the melodic, harmonic, and textural organization of the first *air*. In each system, the bass clef contains the generative pitches of the spectrum (these are manifested as pedal tones in the contrabass and bass clarinet) and the treble clef contains an outline of the melody (sung by soprano). Each measure in Figure 5.8 contains one spectrum and the melodic pitches

derived from it. Solid phrases reflect the phrasing in the score, while dashed phrases depict phrase groups. The horizontal lines beneath the systems indicate the texture of the spectra and the force metaphors they suggest: gravity, water, and wind. These metaphors will be discussed in greater detail in what follows. Also included are the tempo markings and formal sections. The three layers of this musical fabric (melody, bass, and accompaniment) are in keeping with traditional homophonic textures.

Figure 5.8: Form of first *air, Trois airs*, 1 to 17

As Figure 5.8 shows, the phrasing does not necessarily align with the harmonic rhythm and spectral pairings. Often phrases span two or more pairs without necessarily beginning with an original spectrum, e.g., the second dashed phrase begins on spectrum 1p and ends midway through spectrum 2o. Vivier eases into the different spectral textures (or motivic treatment of textures) by overlapping them with one another. The only clean juxtaposition occurs at 13, where motive Wind B (light blue) follows Wind A (pink) sequentially. These smooth textural transitions (via overlapping) and the weaker alignment between the spectra and phrase structure help ensure a fluidity of motion in the first *air*.

The form is shaped foremost by the dynamics, which represent general levels of intensity or energy, followed by the texture, then the melody, and to a lesser extent, the spectral pairs. Figure 5.9 compares the boundaries suggested by these parameters. The dynamics show a process of intensification between 1 and 7 – 1 (*mp–ff*), another between 10 and 13, and moderate swell between 7 and 10 (*pp–f–mp*).[24] After 13, they release tension with a systemic decrescendo from *fff* to *pp al niente*. The break in the melody at the end of 9 represents an interruption, not a sectional boundary, primarily because the Wind A motive remains active throughout.
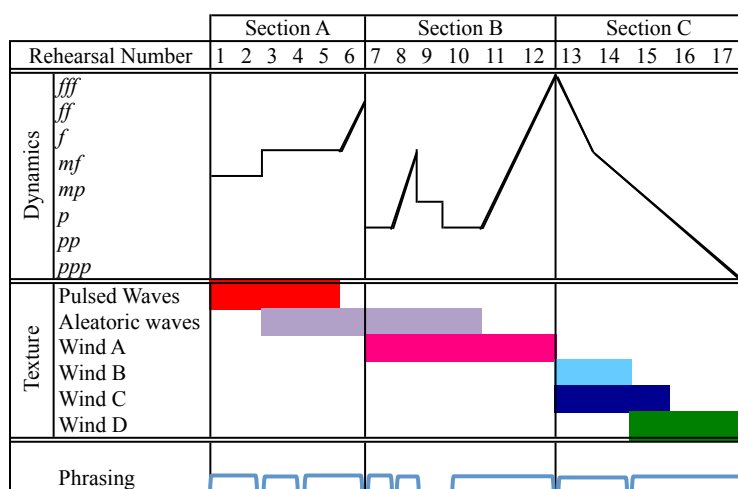
Figure 5.9: Schematic comparison of dynamics, texture, and phrasing in first *air*

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[24] Refers to the measure preceding 7. The addition or subtraction sign (+, −) refers to the number of measures either before (−) or after (+) the rehearsal number.

The strongest boundaries occur at 7 and 13 where the changes in dynamics, texture, phrasing, and spectra occur simultaneously, except for the phrasing in 13. Whereas the spectra, dynamics, and texture suggest an elided boundary on the downbeat of 13 (i.e., the downbeat marks both the end of a process and the beginning of a new process), the melodic phrasing indicates a break between Sections B and C since a new phrase begins on B5 at 13 + 1. Yet, although the melody's B♭5 on the downbeat of 13 sounds like a point of arrival, so does the B5 in the next measure. Because the B5 continues the melodic ascent begun at 12 and is sustained longer, reinforced by the tam-tam and Balinese gong, and precipitated by a brief accelerando, it challenges the boundary suggested by the spectra, texture, and dynamics. In the end, the sense of arrival offered by the dynamic contour, spectra, and texture on the downbeat of 13 overrides the melody, percussion, and tempo. Dynamic contour and texture, therefore, play a bigger hand in determining form than melody.

5.1.3 Section A, 1 to 7

The accompaniment to the vocal line in Section A is made up of three layers: the pedal tones in the contrabass, bass clarinet, and horn (which sustain the three lowest frequencies of the spectra, i.e., F1–F3); the *technique sinusoïdale* in the remaining woodwinds and strings, articulated as both *couleur pulsée* (sextuplets) and *couleur aléatoire*; and finally the percussion, which includes the crotales and chimes. The interaction between the three layers and the forces they convey create a virtual environment that both supports and constrains the motion of the melodic agent. The impact on the melody will be taken up after an independent assessment of the virtual environmental forces, which are visually depicted in Figure 5.10.
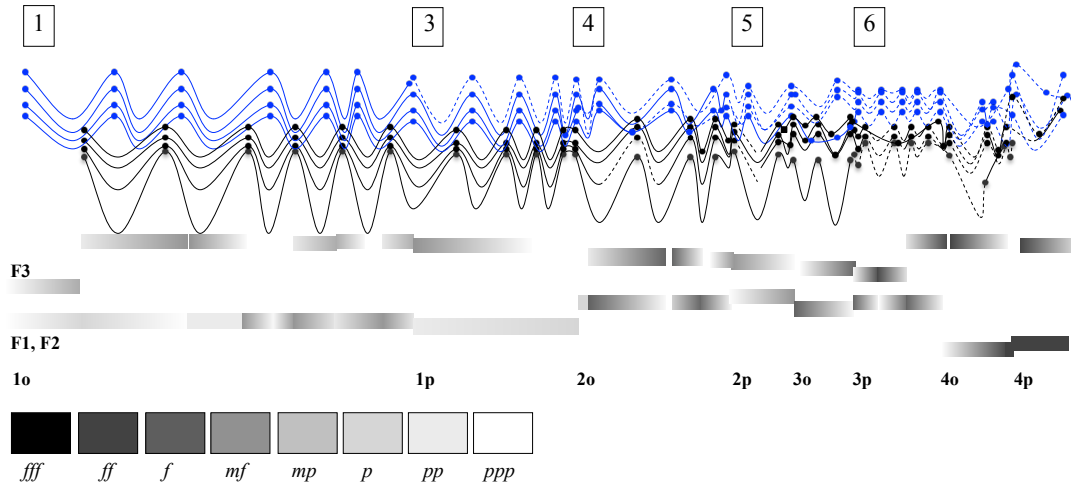
Figure 5.10: Environmental forces in Section A, first *air*

The solid curves represent the two layers of *couleur pulsée*. As was the case in *Wo bist du Licht!* Vivier divides the ensemble into an upper register (piccolo, violin I, flute, violin II, shown in blue) and a lower register (clarinet 1, viola, clarinet 2, cello) shown in black. These groups remain in effect until the aleatoric waves (*couleur alétoire*—dashed curves) completely overtake the pulsed waves halfway through 6. The dots on the crests indicate rhythmic accents (>), as well as the peaks of crescendos. The dynamics for the waves follow the pitch contour so that both increase and decrease simultaneously. With the exception of the flute and piccolo, the sextuplet rests, when present, immediately precede the rhythmic accents and therefore emphasize the syncopation. This syncopated effect is more pronounced in the piccolo and flute, where the rests appear intermittently throughout the wave contour. The excerpts in Figures 5.1 and 5.5 show the use of accents, dynamics, and rests in the pulsed waves.

As the crests in Figure 5.10 show, the wave cycles occur at irregular intervals, but tend to lengthen following changes in spectra and shorten in anticipation of them. The expansion and contraction of the cycles create a subtle sense of acceleration and deceleration that conveys both a changing intensity and a forward motion. The change in intensity stems from the fluctuations in density implied by the longer and shorter temporal intervals between crests. The undulating melodic contour evokes the gentle motion of the ocean. Together, both the intensity and forward motion suggest the lateral "push" of a variable

force, such as waves.[25] This emphasis on lateral motion contrasts with the wave motion in *Wo bist du Licht!*—particularly between 24 and 27—where the observer identifies with the wave's contour (as though riding the contour) and embodies the changes in weight and momentum associated with vertical motion (i.e., the waves' amplitude). Although the two layers of pulsed waves have differing periods, their contractions and expansions still have an amplifying effect that comes from perceiving the two layers as a single, larger layer, like a group wave.

The pedal tones, shown as horizontal gray lines in Figure 5.10, offer stable, low, platforms that exert a certain amount of pull. Where pedal tones express musical gravity in Larson's musical forces, for Hatten they impart a form of drag, or friction, which can drain the energy of the melodic agent.[26] In Section A (and for most of the first *air*), the contrabass, bass clarinet, and horn sustain the first three frequencies of the spectra (F1–F3). The contrabass (sustaining F1) and bass clarinet (sustaining F2) form one rhythmic and dynamic layer, while the horn (sustaining F3) forms a separate dynamic layer with a slightly different rhythm. With the exception of 5, the contrabass plays the downbeats of each new spectrum, whereas the horn avoids the downbeats after the second measure. Because of the stasis of the pedal tones, the dynamics play a critical role in conveying intensity. Figure 5.11, which transcribes the dynamics of the contrabass and horn, shows the contrasting intensity between the F1/F2 and F3 pedal tone layers.

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[25] Of course, the motion of ocean waves is much more complex and depends on many factors, such as the wind, the depth of the water, the currents, proximity to shoreline, etc.

[26] Robert Hatten, "Musical Forces and Agential Energies: An Expansion of Steve Larson's Model," *Music Theory Online* 13/3 (2012): [18], Example 9.

1 ♩ = 60

Cor — pp ⟨ mp   pp ——————————   mf ⟩ a niente

Cb. — pp ⟨⟩ p ——————— a niente pp   mf ⟩ pp

2   **3**

Cor — pp ⟨ mp ⟩   pp ———— mf ———— a niente

Cb. ⟨ mf ⟩ pp ——⟨ mf ⟩ pp ——————————

4   **5**

Cor — pp ———— f ⟩ a mente ppp ⟨ mf ⟩ a niente ppp ⟨

Cb. — p subito   f ⟩ a niente   p ⟨ f ⟩ pp   ppp ⟨ mf f ⟩

6 poco a poco rit. . . . .

Cor — f   ppp subito ⟨ ff ⟩ pp   pp ——————————

Cb. — a niente   f ⟩ a niente pp ———— f ———— a niente

. . . . ♩ = 45

Cor — ff ———— a niente   ff ———— p

Cb. ———————————— ff

Figure 5.11: Transcription of dynamics in contrabass and horn in Section A, first *air*

The F1 pedal tones also have a harmonic function in that they start to project their own harmonic series the longer they are sustained. Generative intervals of an octave, perfect fifth, or major third (or compounds of these intervals) reinforce this harmonic series and, as a result, can influence the perception of tone stability in the melody, impacting what we hear as a goal tone. I define a goal tone as a "locally asserted" tone (either through repetition or duration) or a tone that conveys a feeling of rest with "gestures that recall appoggiaturas or suspension formations."[27] While this tendency starts to approach Larson's conception of musical magnetism (and the structural principles of tonal music), it differs in that the gravitational platform has only the potential to influence the perception of melodic goal tones. Unlike Larson's musical magnetism, where chord tones and non-chord tones are predefined by tonal music's hierarchical structure, harmonicity

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[27] Hatten, "Musical Forces and Agential Energies," [22].

and consonance are not built into Vivier's post-tonal harmonic environment. Instead, melodic goals depend on a wide range of parameters including, but not limited to, harmonicity; however, in Section A, melodic goals do reinforce the harmonies projected by the generative intervals prior to ⑥.

Impact of Environmental Forces on Melody in Section A

The melody in the opening to the first *air* displays greater range of motion and alacrity than is typical for Vivier's melodies. More often, Vivier gradually expands the ambitus of the melody by broadening the melodic intervals incrementally; however, the leap from E4 to G5 in ② swiftly follows the oscillation between D4 and E4.[28] Both the E4 and G5, melodic goal tones, strongly reinforce the C series projected by the pedal tones. Figure 5.12 transcribes the melody, percussion, horn, and contrabass between ② to ④. Melodic goals receive emphasis from the percussion and pedal tones in the form of delayed accented attacks that range between one and five sextuplets (shown as red fractions above the systems in Figure 5.12), often increasing or decreasing by increments of one sextuplet.

As the delay of the attacks in the percussion and pedal tones increase between ① and ④, and again in ⑥, it creates a subtle deceleration that further undermines the weakening pulse, but also suggests two overlapping tempos. With the exception of ⑤, the melody, contrabass, and bass clarinet have synchronized attacks on the downbeats of chord changes and goal tones, suggesting they form a cohesive layer at the phrase level. The attacks of the horn and percussion trail behind the goal tones by an increasing temporal interval and appear to slow down relative to the melody. The contrabass and bass clarinet, which play both the downbeats of chord changes and the delayed attacks with the horns and percussion, function as a hinge between the suggestive tempos of the melody (downbeat stream) and horn (afterbeat stream) layers. The result is a temporal heterophony or temporal friction abstractly depicted in Figure 5.13

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[28] Score available: http://www.boosey.com/cr/perusals/score.asp?id=1309 [accessed 18 November 2016]

Figure 5.12: Transcription of melody, horn, contrabass, and percussion, *Trois airs*, 2 to 4

Figure 5.13: Temporal friction implied by rhythm of melody, pedal tones, and percussion

The majority of melodic goals fall on the downbeat of chord changes, involve durational accents, and are approached by ascending motion. The ascending motion and longer note values demand more agential energy to compensate for the pull of the pedal tones. To overcome this pull, the melodic agent builds potential energy with the use of preparatory gestures. In 1 and 6, they take the form of oscillations (D4/E4 and B♭4/D5) that, like the mini squats that precede a large jump, help propel the melodic leaps. The lower neighbour motion in 2 + 1 and 5 + 1 (the E♭5—D5—E♭5 and E5—D5—E5) has a similar function. In 3 and 6, this preparatory motion manifests as shortening durations (i.e., acceleration), implying an increase in velocity and gain in agential momentum. The large downward leap followed by an even larger ascending leap in 6 + 5 uses musical gravity to the agent's advantage, like the motion of a springboard. Figure 5.14 illustrates these gestures relative to an abstract depiction of the melodic contour.

Icons by Andrei Kim/Shutterstock.com

Figure 5.14: Melodic agent in Section A, first *air*

Whereas gravity and friction in the environment work against the agent, the propulsion of the pulsed and aleatoric waves works in tandem with the agent's movements.

5.1.4 Section B, ⬚7⬚ to ⬚13⬚

The *subito piano* on the downbeat of ⬚7⬚ marks the beginning of Section B. The same layers that dominated Section A remain active in Section B, but the spectra, articulated as ascending segments instead of waves, become the dominant environmental force and will work against the melodic agent [agent's efforts]. This change in the spectra's contour and rhythm introduces a new force metaphor, wind. As an unpredictable, and potentially very powerful environmental force, wind offers a flexible musical force metaphor. In the first *air*, wind takes the form of a quick ascending seven-note gesture—henceforth called the Wind motive—that first appears as grace notes in the cello at ⬚7⬚ – 2, beat 3. Although the duration of the Wind motives' seventh note varies, the duration of the first six attacks takes one of three forms, shown in Figure 5.15: triplet eighth note (Wind A), a duple eighth note (Wind B), or grace notes (Wind C). Like the sinusoidal technique, the pitches of the Wind motive represent frequency bands of the spectra ~~and therefore~~ that change with each chord.

Figure 5.15: Wind motives in Section B, first *air*

Figure 5.16 gives an overview of the virtual environmental forces in Section B. The upswept arrows depict the Wind motives, with the nocks (i.e., opposite end of the arrowhead) positioned to reflect the pitch and timing of the first attacks. Black arrows represent Wind A; blue arrows represent Wind B; green arrows Wind C. The larger, block arrowheads, which appear after ⬚10⬚, indicate a trill on the last note (see Figure 5.17 for an example of these trills). The dashed blue curves represent aleatoric waves and the horizontal grey lines depict the pedal tones. Again, the dynamics of the pedal tones are

reflected by the hue of grey: lighter shades of grey correspond to softer dynamic markings and darker shades correspond to louder dynamics.
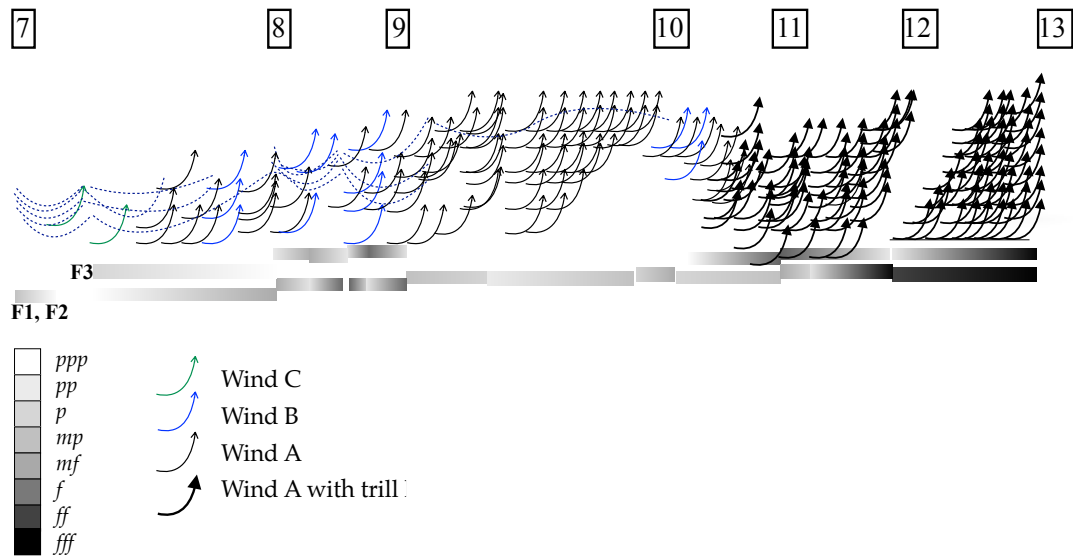
Figure 5.16:Density of wind motives in Section B, first *air*

As before, the F1 and F2 pedal tones continue to form a single rhythmic and dynamic layer, while the F3 pedal tone, when present, has a contrasting dynamic contour and synchronized attacks with the chimes and crotales. Unlike Section A, the F2 and F3 pedal tones are shared between the cello, horn, and bass clarinet. Only the F1 pedal tone remains exclusive to the contrabass. The pedals and percussion continue to punctuate melodic goals with delayed accents that vary between 1 and 5 sextuplets, but now the chimes also briefly double the melody in 8 and 12. Vivier also uses the Balinese and Chinese gongs to mark important points of arrival (downbeats to 7, 9, 13) and coordinate the timing of certain Wind motives. Both the dynamics of the pedal tones and spectra intensify after 10.

Wind A, the most defining feature of Section B, overtakes the aleatoric waves between 7 and 10, but only fully dominates the texture between 10 and 13. As the aleatoric waves are phased out, Vivier alters their timbre with tremolo in the strings and flutter-tonguing in the flute. Both playing techniques add a roughness to the timbre that helps the transition from wave metaphor (water) to wind metaphor (air). The tremolo uses rhythm

to disrupt the flow of the melodic contour, while the raspier sound of the flutter-tonguing draws attention to the breath, and by extension, air.

In contrast to the constant ebb and flow of the waves' energy, the Wind motives simply dissipate. The dampening effect of their decrescendos conveys a decrease in proximity, or motion away from the observer, while the ascending contour gives direction to that motion and a feeling of weightlessness.[29] Finally, the brevity of the first six attacks imparts a sense of speed. In this way, the contour, dynamics, and rhythm of the Wind motives (especially Wind A) work together to create a weightless, fleeting motion that nonetheless builds in intensity throughout Section B.

As can be seen from Figure 5.16, the density and dynamic level of Wind A increases throughout Section B. Although the degree of contrast between the start and end of the decrescendos remains constant (a range of approximately two dynamic levels), the dynamic levels increase with each rehearsal number. Also affecting the overall amplitude is Wind A's density in musical space: homorhythmic occurrences that span a wider range of the ensemble's register, as in 12, display more dynamic intensity than areas where the motivic saturation is low, e.g., as in 7 or 9. These homorhythmic Wind A motives function as a systemic crescendo. They are also timed and orchestrated to free up (or fill in) registral space in an ascending, sweeping motion that mimics the melodic contour of the wind motives. Figure 5.17, an excerpt of the strings from 12 - 1, shows how Wind A carves out the registral space.

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[29]Although we experience wind primarily as a lateral force (crosswind, tailwind, headwind) as opposed to a vertical force (updraft, downdraft), wind can lift objects off the ground and carry them off, e.g., dust, leaves, kites, snow; however, rather than interpret the ascending contour as an updraft, it could simply convey the force's lower density relative to the inertia of the pedal tones and melody (embodied agent).

Figure 5.17: Wind A shaping register space (strings only), *Trois airs,* 12 - 1

Both the dynamics and density of Wind A influence the perceived intensity of the force, which builds considerably between 10 and 13. As before, the dynamic level tends to reflect the overall amount of energy displayed by a force. The increase in register density reflects a growth in mass, which in turn gives the perception of increasing momentum. In Section B, both the register density (perceived as increased mass) and the temporal density (perceived as increased velocity) of Wind A show the wind's rising intensity. Figure 5.16 reflects this density by the number of arrows vertically aligned (representing mass) and the shorter horizontal distance between the arrows (showing velocity).

Impact of Environmental Forces on Melody in Section B

Just as strong wind can enhance or impede physical motion (consider, for example, rowing with a tailwind versus a headwind), the wind in the virtual environment of Section B becomes an obstacle for the melodic agent after 11. Between 7 and 9, the melody's descending goal tones (C5—B4—A4—G♯5) suggest the pedal tones exert more "pull" on the melody than does the wind "push." By placing the phrase's goal tone an octave higher (G♯5 as opposed to G♯4), the melody goes against the environmental forces, suggesting agential will. This agent compensates for the pedal tones with shorter durations at the beginning of the ascent at 8 + 2. Like a running start, these shorter

durations build momentum that is also manifested in the soprano's *forte*, an outward expression of the agent's increased effort.

After the break at the end of ⑨, the wind supplants gravity as the dominant hindrance to melodic motion, particularly between ⑪ and ⑬. There, the agent lacks the necessary energy to withstand the wind and maintain a steady, ascending course from F♯5 in ⑪ to B♭5 in ⑬. Instead, the linear motion of the melody is disrupted several times, which suggests the agent has to take a few steps back—shown by the drops to B4 (twice), A4, and F♯5—to bolster his or her efforts before continuing again to the destination. The wind interferes with the agent's ease of motion by restricting his or her initial efforts. As a result, the agent cannot use speed at the onset of the climb to help propel him or her by either creating a running start (as in ⑧) or releasing potential energy (like the springboard at the end of Section A). Instead, the agent struggles to counter both the pull of gravity and the even more forceful push of the wind.

Figure 5.18 illustrates the interaction of the melodic agent with the virtual environmental forces in Section B. Between ⑦ and ⑨, the dissipating aleatoric waves do not provide the melodic agent with same forward motion as do the pulsed waves did in Section A; however, the newly introduced wind motives are not sufficiently dense to impede the agent's motion either. Only the pedal tones continue to pull on the melody as it ascends, which the melodic agent easily overcomes by increasing his or her energy output (displayed as *forte*) with a running start when needed (Figure 5.18, left). The soprano's break in ⑨ creates a shift in perspective from the MOVING OBSERVER (who identifies with the melodic agent) to STATIONARY OBSERVER (MOVING TIME). The absence of melody removes the sense of agency, thus leaving the observer to passively experience the wind motives move past him or her (Figure 5.18, middle). Between ⑩ and ⑬, the return of the melody (and melodic agent) restores the interior MOVING OBSERVER perspective. As the dynamics, density, and rhythm of Wind A increase, the unpredictable force evolves from a breeze to a blustering wind that taxes the melodic agent's intended movements (5.18, right).

MOVING OBSERVER
Agent minimally
affected by wind

STATIONARY OBSERVER
(No agent)

MOVING OBSERVER
Agent struggling
against wind

Icons by Leremy/Shutterstock.com
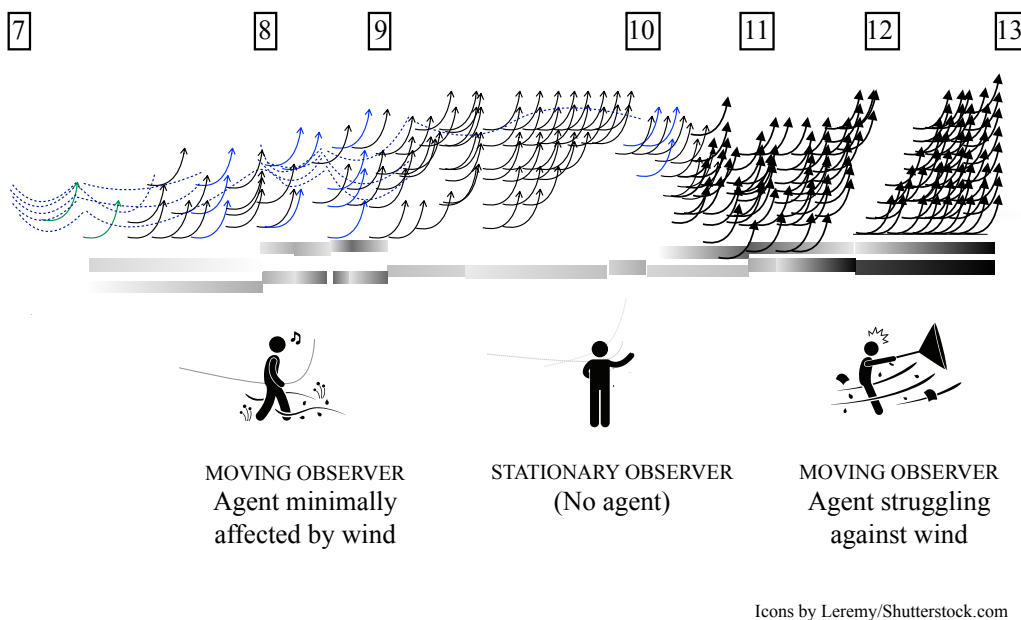
Figure 5.18: Agent (and observer) interacting with wind in Section B, first *air*

5.1.5 Section C, 13 to 17

In Section C, Vivier replaces Wind A with motives Wind B, C, and D (a new motive that will be discussed shortly), which form three separate, overlapping layers that are shown in Figure 5.19. The motives disseminate throughout the orchestral register by progressively liberating or occupying the musical space from one registral extreme to the other in a two-part process: As Wind B recedes from the musical space in descending order, Wind C takes its place; When Wind B (blue) is completely phased out at 14 + 3, Wind D (green) enters and overtakes the musical space from Wind C (mauve) in ascending order. This occupation of the register space resembles the changes in momentum undergone in *Wo bist du Licht!*

Rehearsal Numbers	13	2	3	4	14	1	2	3	4	15	1	2	3	4	16	1	2	3	4
Piccolo	B	C												D					
Violin 1	B	C												D					
Flute	B			C															
Violin 2	B			C										D					
Clarinet 1	B						C			D									
Viola	B					C				m				D					
Clarinet 2	B						C			D									
Cello	B						C	D											
Bass Clarinet	B(I)						D(I)												
Double Bass	F1																	D(I)	

Figure 5.19: Orchestral distribution of Wind B, C, and D in Section C, first *air*

Wind remains the predominant virtual environmental force, but diminishes significantly throughout Section C and therefore does not impact the melody as it did at the end of Section B, nor do the pedal tones exert as much pull due to their weakened presence. Figure 5.20 depicts the virtual environment between ⏹13⏹ and ⏹17⏹. As before, the horizontal lines represent pedal tones F1 and F3 (F2 is absent) and the royal and dark blue arrows represent Wind B and Wind C respectively (first shown in Figure 5.15). Again, the placement of the arrows represents the pitch and chronometric timing of the first attacks. We can see by the spacing of Wind B and C that the temporal density of Wind B increases while that of Wind C decreases between ⏹13⏹ and ⏹14⏹ + 3. Wind D, a form of *couleur rythmique*, is a rhythmically variable motive represented by the green arrows. Note that the bass clarinet plays an inverted form of Wind D, as do the horn and contrabass in ⏹16⏹ + 4, which is why they appear as descending arrows in Figure 5.20. Although Vivier withdraws the pedal tones, he maintains the effect of their pull by inverting Wind D in these instruments.
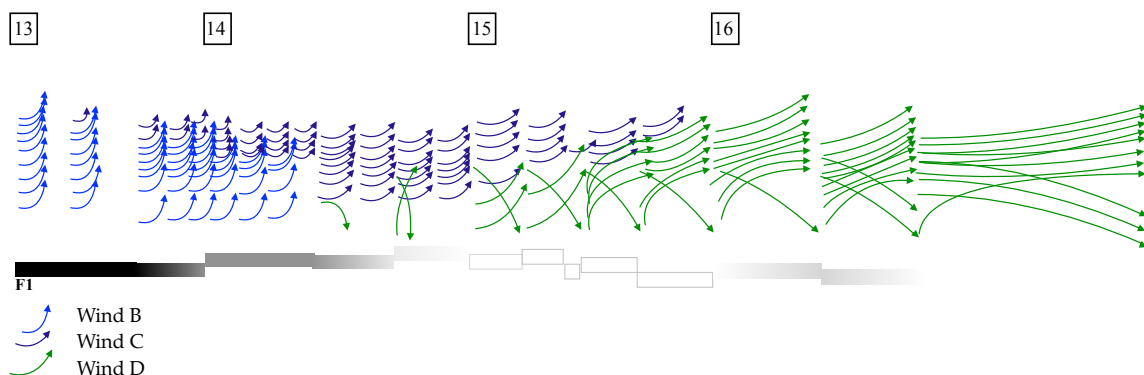
Figure 5.20: Density of Wind B, C, and D in Section C, first *air*

Since Wind D originates in the bass clarinet, only the bass clarinet plays all eight iterations of the motive. These are transcribed in Figure 5.21 to show the evolution of the *couleur rythmique* in Section C. We can see that the durations of the first six attacks become more individualized as Wind D progresses. An additive pattern begins to emerge at ⏹15⏹ + 1, but has its most clear representation at ⏹16⏹ where the first six values increase by a sixteenth note. Even though the total duration of Wind D motives decreases and increases between ⏹14⏹ + 3 and ⏹17⏹, Wind D nonetheless creates an impression of

deceleration and winding down because of the widening temporal interval between the first and seventh attacks.

Figure 5.21: Development of Wind D (*couleur rythmique*) in Section C, first *air,* 14 + 3 to 17

The temporal interval between the first to seventh attacks has a greater influence on the perception of speed than the temporal interval between successive motives (i.e., between the first attacks of successive motives) because we hear the seventh attack as a point of arrival. Once the goal tone is attained, it loses motional significance. In the case of the inverted Wind D motives, the descending motion to the seventh attack also represents a point of impact with a virtual gravitational platform ("ground"). As Robert Hatten has proposed, descending motion to a platform can create different types of impact, which, depending on the rhythm and embellishment of the goal tone, imply "various degrees of

rigidity among platforms."[30] As examples, he demonstrates that a swift decent to an accented goal tone can result in a high impact *splat* (rigid platform), whereas a goal tone embellished with an upper neighbor may evoke a sense of rebound (flexible platform) while one embellished with a lower neighbor may evince a form of shock absorption (permeable platform).[31]

Since the Wind D motives in the bass clarinet terminate on the F1 pedal tone, the virtual environment's gravitational platform, they do connote a sense of impact and finality. This impact, however, is mitigated by the durational expansions of the *couleur rythmique* and the decrescendos, two forms of "agential 'braking' of momentum" identified by Hatten.[32] Although Hatten attributes general changes in momentum to the will of a musical agent, the wind motives introduced above represent a non-agential environmental force. In Section C, the deceleration of Wind D, which takes the form of a written-out *ritardando* through the durational expansion of the *couleur rythmique*, and the softening dynamics (*fff* to *ppp al niente*) create a loss of velocity that suggests diminishing momentum or dying wind intensity.

Impact of Environmental Forces on Melody in Section C

Like the wind in the virtual environment, the melody also shows signs of decreased intensity. The melodic contour favours descending motion, comprised of shortened durations that lengthen as the melodic contour ascends. These slight durational contractions and expansions create subtle accelerations and decelerations that indicate the melodic agent is conforming to the environmental forces rather than working against them, particularly gravity; however, with each descent, the durations become more uniform. While this slower impact could be the result of agential braking or a weaker pull from the pedal tones, it could also be a gentle glide path, i.e., the agent's willingness to be moved by a calmer wind. Although gliding implies a finite action, i.e., a steady process of decline (a winding down motion) that eventually succumbs to gravity, it can be sustained

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[30] Hatten, "Musical Forces," [18].
[31] Ibid., Example 9.
[32] Ibid., [18].

with favourable winds and gain altitude with updrafts. As a motion metaphor, gliding implies a certain passivity or reduced effort since the glider (or musical agent in this case) uses the wind's energy to create smooth, fluid motions rather than deplete his or her own energy stores.

This more passive approach is consistent with the softer dynamics and the fluid contour of the melody. Even the ascents are paired with decreasing dynamics, and while the large leaps resemble those in Section A, the longer preparatory motion in Section C does not convey the same alacrity or release of potential energy. (Compare, for example, the springboard gesture in $\boxed{7}$ – 2 with the A5—A4—F♯4—A5 in $\boxed{16}$.) Although the final ascent (beginning at $\boxed{16}$ -1) features increasing durations, it bears none of the tension that we normally associate with ascending contours. Instead, the melody—like the wind motives—simply drifts away with a decrescendo *al niente*, as though gently carried off by the wind. Because the melody ends with slow ascending motion to B5 and not a smooth 'landing' like the inverted Wind D motives, it suggests a decrease in proximity indicative of motion away from the observer. The stasis created by melody's prolongation of B5 during the last 21 seconds brings about a shift in perspective from the interior MOVING OBSERVER (who, again, identifies with the melodic agent) to the exterior MOVING OBSERVER (who is aware of growing distance), as shown in Figure 5.22.

Interior Moving Observer
(Melodic Agent)

Exterior Moving Observer
(Aware of Distance from Agent)
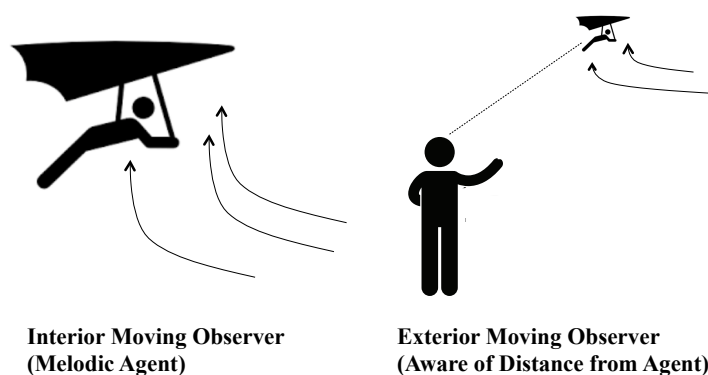
"Hang glider" icon from Clker.com
"Man standing" icon by Leremy/Shutterstock.com

Figure 5.22: Changing perspective of melodic agent and MOVING OBSERVER in Section C, first *air*

Section C does more than abate the tension accumulated prior to ⎕13⎕, it diminishes the momentum to a halt by flattening the rhythm in the spectra. The loss of intensity manifests itself as a decline in both volume and temporal density of Wind C and D, and in the melody, it manifests as a passive willingness to be led by the wind, thus taking the path of greatest ease.

Summary of First *air*

In the first *air*, the treatment of the spectra tells a story. In Section A, the lengthening and shortening wave cycles ebb and flow with the phrase structure and harmonic rhythm. The pulsed and aleatoric waves supply a stream of energy that the melodic agent can use in addition to his or her own efforts and compensatory measures to counter the pull of the pedal tones.

In Section B, the aleatoric waves disperse as wind motives, primarily Wind A, gain both temporal and registral density. The louder dynamics, trills on the seventh note, and more importantly, the melodic agent's labored ascending motion after ⎕11⎕ reflect the increased intensity of the wind. The melody's struggle indicates a conflict between the agent's intended path of motion, i.e., the ascent to B♭5, and the resistance imposed by the environment.

In Section C, the blustering wind begins to calm with the durational expansion of the wind motives. Wind C and D decrease momentum by either allowing more time to flow between evenly spaced attacks (Wind C) or by progressively widening the temporal intervals between the first seventh attacks, thus delaying the point of arrival. These processes create a feeling of deceleration and decreased energy that restores some of the equilibrium lost at the end of Section B. For the melodic agent, the wind's decreased intensity promotes a sense of calm, smooth movements that suggest a more passive willingness to be led by the environmental forces, as is the case with gliding, as opposed to working against them.

5.2 The Second *air*

In the first *air*, the musical agent traverses the virtual environment that the texture of the spectra suggests. The predictable and unpredictable, non-sentient forces that shape the environment influence the agent's motion by imposing different energy demands on the agent.[33] Often, the observer identifies with the melodic agent by adopting an interior MOVING OBSERVER perspective. By positing a musical agent, we are anthropomorphizing the melody since we are imagining what it would feel like to be the melody.[34] In the second *air*, the embodied agent does not move through a virtual, natural forces-driven environment. The spectra, instead of representing external forces, become a projection of the agent's psychological state. In large part, the emphasis on states of mind over physical forces emerges as a result of the subtle motion of the spectra. With fewer overt changes in texture, attention is more easily squared on the melody and the changing voice qualities. Since the two-part form is dictated by the portrayal of mental states, analysis of the second *air* centres on the melody and the sound symbolism implicit in the voice, timbre, and text. As we will see, some of these states reflect a particular age or stage of psychosocial development that, when considered with the thinning texture and emerging ethereal timbre, suggest a larger narrative of sonic purification and the cycle of life. This narrative will be discussed last, under the heading 5.2.4. As before, an overview of the spectra (5.2.1) and form (5.2.2) precedes the analysis of formal sections (5.2.3).

5.2.1 Spectra in the Second *air*

The spectra in the second *air* contain fewer pitches and are less active than in the first *air*, and although they appear simpler, their manipulation is more complex. None appear in their original forms; all are permuted through two stages of transposition. Figure 5.23 shows the orchestration of the first two spectra of the second *air* (16p, 17p), while Figure 5.24 explains the permutation process.

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[33] See Chapter 3, Section 3.2.

[34] This is the basis of Arnie Cox's *mimetic hypothesis.* Arnie Cox, "Embodying Music: Principles of the Mimetic Hypothesis," *Music Theory Online*, 17/2 (2011): [8].

Figure 5.23: First two measures of second *air*, *Trois airs pour un opéra imaginaire*, [17]

According to the sketches, Vivier begins this permutation process by generating combination tone chords from simple algorithms, similar to the first *air* (Stage 1). He then transposes the combination tones of the original spectrum (i.e., F3–F11 only) down a P12th (Stage 2); divides the latter into three subsets (Stage 2); transposes the lowest subset down a whole tone, the middle subset down a semitone, and the highest down a quarter tone (Stage 3); and finally selects pitches from each stage (circled), to create a final spectrum containing eleven frequencies (Stage 4). Note that the selected pitches from Stage 3 are transposed down two octaves in Stage 4. The final result is the permuted spectrum.
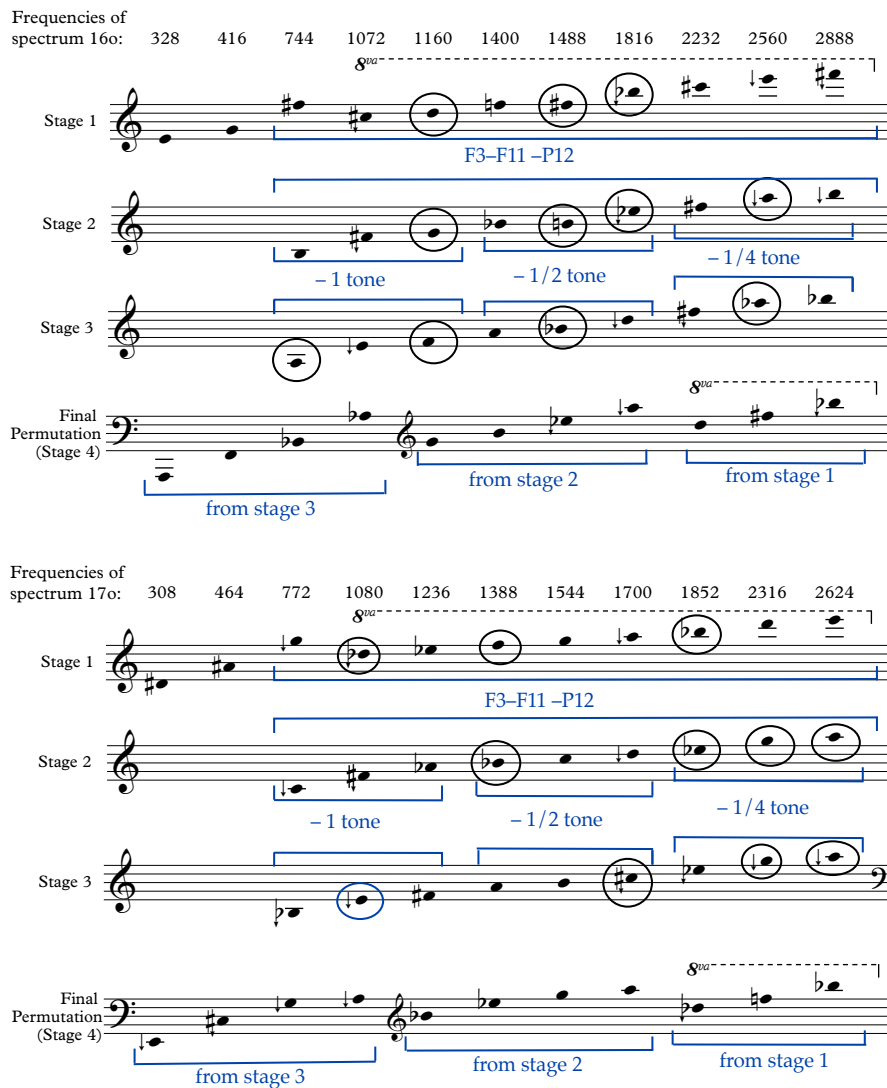
Figure 5.24: Permutation process of spectrum 16o and spectrum 17o

Algorithms

The fourteen spectra in the second *air,* identified as 16p–29p, derive from eight distinct algorithms. These algorithms, identified as J–Q, appear below the columns of the table in Figure 5.25. Once again, common columns indicate similarities between algorithms. As can be seen by the first five rows, the algorithms follow the same first initial steps. Although the original spectra do not appear in the music, they realize the algorithms and therefore are identified in the tree as 16–29o, with their location in the score, below the relevant algorithm. Transposed spectra are identified with their source in parentheses, e.g., 25(16o) is a transposition of 16o.

Rank	Combination-Tone Class "Tree" for Algorithms in Second *Air*							
F1	<1,0>							
F2	<0,1>							
F3	<1,1>							
F4	<2,1>							
F5	<1,2>							
F6	<2,2>	<3,1>						
F7	<3,2>	<2,2>						
F8	<2,3>	<3,2>						<1,3>
F9	<3,3>	<4,2>	<3,3>	<2,3>			<1,3>	<3,2>
F10	<4,3>	<3,3>	<4,3>	<3,3>		<5,2>	<2,3>	<3,3>
F11	<3,4> or <5,3>	<4,3>	<5,3>	<4,3>	<5,2>	<4,3>	<3,3>	<4,3>

Algorithm	N	M	J	L	Q	O	P	K
Spectra ID	21o	20o	16o	18o	27o	22o	24o	17o
Location	[24]	[22]	[17]	[19]	[34]	[26]	[29]	[17]+ 1
Spectra ID			25(16o)	19o			29(24o)	26(17o)
Location			[32]	[20]			[35]– 1	[33]
Spectra ID				28(19o)				
Location				[34] + 3				
Spectra ID				23o				
Location				[28]				

Figure 5.25: Algorithm tree of combination-tone classes in second *air*

Texture of the Spectra

The spectra undergo three processes of transformation between [17] and [35]. First, the initial homophony separates the texture into two, then three layers of planing. Second, the planed layers dissolve into individual wave-like contours featuring aleatoric values. Third, even repetitions of ascending segments (similar to Wind C in Section C of the first *air*) replace the aleatoric values. During the course of the last two processes, the texture

becomes increasingly thinner while the register range rises. The formal diagram of the second *air*, Figure 5.26, shows these changes in the spectra, along with the mental states conveyed in each section (these states will be discussed under Sections 5.2.3, 5.2.4, and 5.3). The colour-blocking shows the harmonic rhythm, with each spectrum and its algorithm identified below the last row; the horizontal lines within the colour-blocked sections indicate independent rhythmic layers (i.e., layers of planing); the letter A represents aleatoric waves; the letter E represents the ascending even repetitions of segments; blank spaces indicate silence; asterisks represent harmonics; and the letter G indicates glissandi. Once again, the instrumentation shown on the left side is arranged according to range, not instrumental choir.

Section	A										B		
Subsection	A1				A2		A3	A4		B1		B2	B3
Mental State	Hesitation				Anxiety		Playfulness	Contentment		Nostalgia and Longing		Intro-spection	Serenity
	17	18	19	20	22		24	26	28	29	31	32	33	34
Vib.										E*	*	*	*	*	*	*
Vln I	*	*	* * * *	1*	1*	1*	1*	1*	1 *	A*	E*	*	*	*	*
Vln II	*	*	* * * *	*	*	*	*	*	*	A*	*	E*	*	*	*	*
Picc										A		E		
Flute				2	2		2	A			E		E	
Cla 1						A							
Cla 2						A	*Klangfarbenmelodie*			
Viola		2	2			A	*		E*	G	G	
Horn		3	A			*Klangfarbenmelodie*			
Cello		3	3	A	*			G	G	
B. Cla						*Klangfarbenmelodie*		
Cb.							
Spectra	16p 17p		18p	19p	20p	21p	22o	23p 24p	25p	26p	27p 28p

Key		
1, 2, 3	Layers of planing
1, 2, 3	Layers of planing
A	Aleatoric durations
E	Even repetitions
G	Glissado
*	Harmonics

Figure 5.26: Form of second *air, Trois airs,* 17 to 35

As was shown in Figure 5.23, the spectra begin as block homophonic chords. At 18, Vivier splits the texture into two layers of planing and again into three layers at 20 + 2, illustrated in Figures 5.27 and 5.28 respectively. Each layer features a different pitch and dynamic contour. Red dots underneath attacks (shown as "x") belong to the permuted spectrum; all other tones result from planing, as shown by the interval of transposition (in semitones). Sometimes the planing occurs in anticipation of the permuted spectrum (as is the case with the black layer with spectrum 17p (Figure 5.27), but more often it follows

the permuted spectrum. As the texture becomes more polyphonic, the tones of the
permuted spectrum often do not sound simultaneously, rendering the spectra as an
increasingly abstract structure, both aurally and visually.
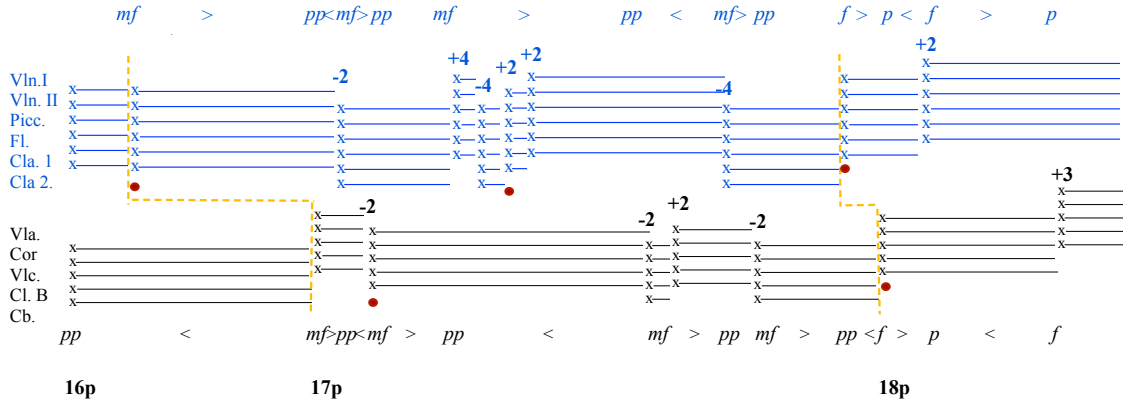
Figure 5.27: Planing of two layers, spectrum 17p, second *air,* 18
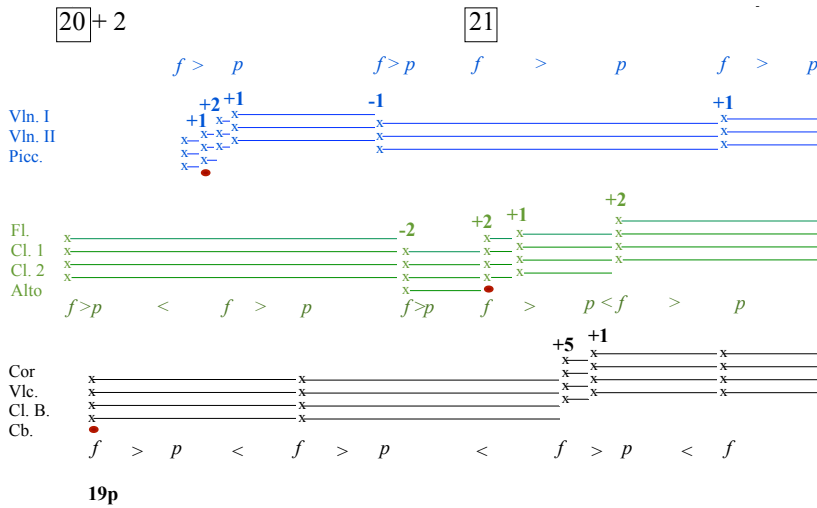
Figure 5.28: Planing of three layers, spectrum 19p, second *air,* 21 – 4

To accommodate the increased number of pitches that the aleatoric wave contour requires
(which begins at 22), Vivier includes more pitches from the first three stages of the
permutation process. For example, in Figure 5.29, which shows the aleatoric waves
underway at 25, the viola, horn, and cello arpeggiate pitches from Stage 3 of the
permutation process, shown in Figure 5.30, while the clarinets arpeggiate pitches from
Stage 2.

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Figure 5.29: Orchestration of spectrum 21p, second *air, Trois airs*, 25 – 1 to 25
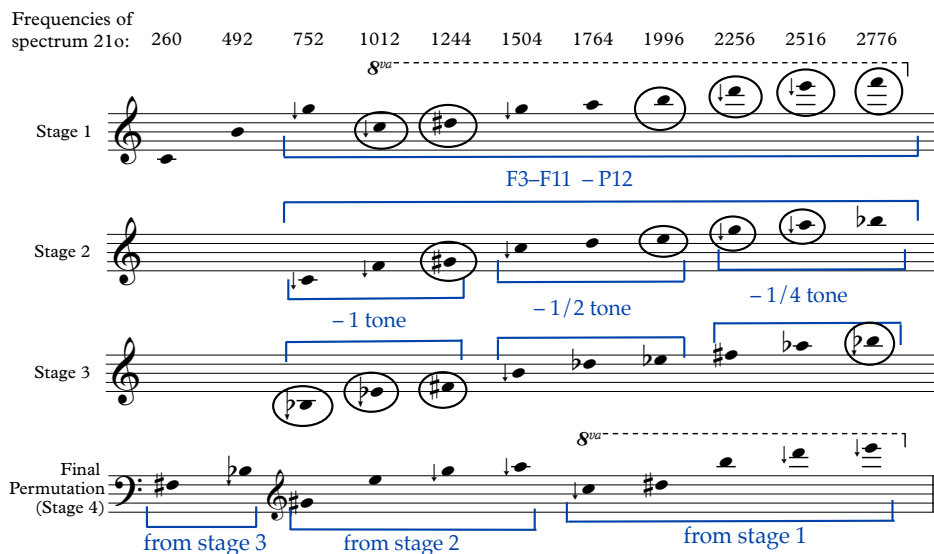
Figure 5.30: Permutation process of spectrum 21o, second *air*

At 28, the sizes of the spectra decrease as the even, ascending segments replace the aleatoric values and instruments begin dropping out of the texture (as shown in Figure 5.26). For example, 31 represents the midpoint of this process: the contrabass, bass clarinet, cello, and second clarinet have dropped out of the texture while the violins and vibraphone play the even repetitions of ascending segments reminiscent of Wind C from Section C of the first *air*, albeit slower and with fewer tones. The result is a thin, higher-pitched texture with a hollow timbre that conveys a sense of lightness, or minimal mass.

5.2.2 Structure and Form

The two-part form of the second *air*, which depends predominantly on the melody, contains seven subsections, each of which depicts a different mental state. Figure 5.26 identifies these sections and mental states in the first three rows. Section A, 17 to 28, contains four subsections (labeled A1–4), while Section B, 28 to 35, contains three

(labeled B1–3). The timing above the rehearsal numbers pertains to the SMCQ recording.[35]

Each subsection coincides with a change in spectra, lending harmonic support to the different mental states. The melody evokes these states through different combinations of range (ambitus), tone centres, dynamic contours, phrase organization, phonemes, timbre, and texture. Just as mental states can incur physical responses (e.g., trembling brought on by fear or anxiety), physical gestures—and in this case melodic gestures—can be used to reveal the mental states of a musical agent.[36] While the following analysis may draw on force metaphors now and again, e.g., the inertial stasis of a melody, it is important to remember that they are used to describe the psychology of a musical agent, not the motion of non-sentient environmental forces.

5.2.3 Section A

Section A involves four states organized into two pairs: hesitation (A1) and anxiety (A2), and playfulness (A3) and contentment (A4). Vivier unifies the subsections of the first pair through elision of the boundaries between the two states, and he unifies the subsections of the second pair with a common vocal timbre. He also makes greater use of extended voice techniques such as *ululement* (hooting), *voix tremblée de la gorge* (throat vibrato), and lip vibrato. These techniques add to the playfulness of Subsections A3 and A4. As shown in Figure 5.26, the texture of the spectra transitions from homophonic to polyphonic with spectra changes that support the phrase structure. Since the structure of the spectra was discussed under heading 5.2.1, its treatment here will be limited to its relation to the melody. Each subsection is taken up individually and accompanied by a transcription of the melody.

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[35] Claude Vivier, *Trois airs pour un opéra imaginaire*, Société de Musique Contemporaine du Québec (SMCQ), Walter Boudreau, ATMA Classica 2001.

[36] Opera and film music make it their business to convey such emotions.

Subsection A1: Hesitation, 17 to 22

After the musical motion of the first *air*, the opening to the second *air* sounds especially static with the slower tempo (MM =51.5), longer durations, and oscillating motion between G♯4–A♯4 between 17 and 19 – 1. The rhythm quickens just prior to 18, but slows down again with detached G♯s, which sound especially sporadic in the absence of a pulse. Because the spectra alternate with the melody, there are no pedal tones to project a particular harmony, nor do the dynamics and rhythm favour one tone over the other. This oscillating motion and structural ambiguity between the tones, or musical inertia, seem to reflect a mental inertia typical of indecision and hesitation on the part of the agent.

The *forte* E♭5 at 19 finally breaks the paralysis and expands the melody's ambitus and dynamic range. Thereafter, the reoccurring E♭5, C5, and A4 function as goal tones from which the melody momentarily departs and returns. Each excursion away from the goal tones increases the melodic range, suggesting the agent is growing bolder; however, the need to return frequently suggests lingering hesitation or doubt. The goal tones, which receive durational emphasis, are also embellished with lip vibrato, hooting, or irregular repetitions. The irregular repetitions of *ta* and *pè* in 21, which sound a bit like stammering or stuttering, reveal momentary stress or anxiety from the agent.

As the range expands, the dynamics and rhythm of the spectral layers begin to emphasize each melody note with a different region of the register. The alternation between the high and low registers imparts a sense of verticality to the voice. Figure 5.31 illustrates this effect between 18 and 19 . Notice how the planing in 18 is less coordinated with the melody than it is in 19. As the coordination becomes more precise, the impression of a more confident state of mind (reflected by the agent's more emboldened motion) becomes clearer.

Figure 5.31: Register and dynamic pairing of melody and spectra in second *air, Trois airs*, 18 to 19

Subsection A2: Anxiety, 22 + 1 to 24

The crescendo at the end of 21, which culminates with the *ff* at 22, leads to a dramatic shift in style in the next measure. The intensity of the higher melodic range (C♯5–G5), louder dynamics (*mf–ff),* and quicker rhythm accounts for much of the drama, as does the melodic doubling in the brake drum. The latter's metallic inharmonic timbre infuses the melody with a bit of frenzy, while the tremolo in the strings (excluding the contrabass) and the horn's instruction to play slightly brassy create trepidation, which both suggest a mental state of heightened anxiety.

Both the opening phrase F♯5—G5—D♯5 (repeated twice) and the closing phrase E5—(C♯5)—D♯5 evince a lyrical, motivic quality (more evocative of *bel canto*) that contrasts with the inertia of Subsection A1. The pairing of an opening and closing phrase displays a more classical organization similar to what William Caplin identifies as a sentence structure: i.e., a presentation phrase that repeats a basic idea twice, followed by a continuation phrase that fragments the basic idea and leads to a cadence.[37] Although Caplin's formal functions are strongly tied to the expression of tonal harmony (the approach is intended for common practice tonal music), the most elementary structures of the phrases (e.g., basic idea, contrasting idea), which really refer to very basic gestures,

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[37] William E. Caplin, *Classical Form: A Theory of Formal Functions for the Instrumental Music of Haydn, Mozart, and Beethoven* (New York: Oxford University Press, 1998).

can be applied to post-tonal music. By conforming to melodic expectations, the more familiar phrase structure in Subsection A2 fosters a sense of continuity and lyricism because it enables the observer or agent to anticipate moments of arrival and closure.

Other than the tremolos, the only change to the spectral texture is the horn's transition to aleatoric values and a wave-like contour. Instructed to play slightly brassy, the horn's additional contrapuntal layer adds complexity, which reinforces the projection of an anxious state of mind.

Subsection A3: Playfulness, 24 to 26

In Section A3, Vivier instructs the voice to sing straight and a bit childlike (*voix très droite, un peu enfantin*). The juxtaposition of long and short values in the first phrase (i.e., 24 to 25), doubled again by the brake drums, has a swinging quality that, like skipping, evokes youth and play. This shift to a childlike state of mind abates the anxiety and tension from Subsection A2, as do the softer dynamic level and lower melodic range (G♯4– E♭5). The text and beating of the lips also display playfulness, but with an emphasis on novelty and sensation. The phonemes in this passage seem chosen for their pleasing articulations (i.e., they are fun to make). The repeated "t," a non-voiced dental plosive, places the tongue against the upper teeth to block part of the mouth and build pressure, which is then released in a quick burst of air. It lends especially well to quick rhythms that require precision and softer dynamic levels, which is the case in 24. Here the "t" is repeated 20 times with five different vowels, but not in any consistent syllabic pattern, despite the rhythmic and melodic repetition. As a result, it sounds somewhat like a tongue twister.

In the second phrase, which is also repeated twice, Vivier follows the "m" with the rolled "r." Both consonants produce strong vibrations that "tickle" the lips or tongue. The nasal "m," which is articulated with the mouth closed, allows the air to pass through the nose, which then causes the lips to vibrate. The rolled "r," which involves a trill of the tongue, is articulated with the mouth open, with the air flowing down the centre of the tongue. Note the motion of the mouth for these two phonemes (closed to open) creates an

automatic crescendo, which Vivier exaggerates by paring the "m" with *p* and the rolled r with *f*.

Between 24 and 26, the cello, viola and clarinets adopt aleatoric values in addition to the horn. Although the texture is its most polyphonic in Subsection A3 (eight layers), it does not sound dense, but rather very light due to the softer dynamic range (*pp–mp*), particularly in contrast to the dynamic range of Subsection A2 (*mp–ff*). The light-hearted, playful mental state is thus reflected in the lightness (lower mass) of the spectra.

Subsection A4: Contentment, 26 to 29

Subsection A4 begins with a melody reminiscent of a nursery rhyme or children's song. Again, the voice is sung straight (*voix droite!*), but instead of being doubled with the brake drums, Vivier doubles it with the crotales. Like the glockenspiel, the crotales, when used to highlight melody (as opposed to punctuating accents as in the first *air*), evoke a nostalgia and innocence reminiscent of childhood.[38] Its piercing timbre resists fusion with the spectral timbre. Like Subsection A2, the more familiar, classical phrasing, which also approximates a sentence structure, conveys motion by meeting general melodic expectations. Although the unresolved ending to C♯5 at 29 is a bit unexpected, it creates a smooth transition to Section B. Because it appeals to convention, this more classical phrase structure imparts a social quality to the melody, and by extension, the agent. In a similar vein, because nursery rhymes and children's songs belong to the folk traditions of a culture, they, too, convey socialization, with the gaiety of the melody suggesting the notion of contentment.

During this upbeat children's melody, the spectra complete their transition to aleatoric values while also thinning the texture and altering the timbre with flutter-tongue and harmonics. The harmonics and rests in the horn, bass clarinet, contrabass, and cello

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[38] Most mechanized, acoustic forms of music rely on either pitched percussion or columns of air. Because toys, music boxes, ice cream trucks, merry-go-rounds, etc., use mechanical music to attract or appeal to children, we come to associate these timbres with childhood.

(depicted in Figure 5.26), raise the register and lighten the texture. The fricative, "airy" timbre of the flutter-tonguing also lightens the texture.

To summarize, Section A cycles through four metal states: hesitation (conveyed primarily via musical inertial stasis); anxiety (conveyed through phrase structure and a mapping of intensity onto verticality); playfulness (evoked by the phonemes); and finally a state of contentment (established by appealing to a culture's folklore). As the agent progresses from one state to the next, the melody acquires a greater range of pitch, text, and expressive content. Likewise, the texture of spectra shows greater mobility with planing and aleatoric layers as it breaks away from heavier, block homophony to the lighter, aleatoric polyphony.

5.2.4 Section B, 28 to 35

The mental states and texture in Section B are more consistent in expressive content than those in Section A and therefore flow easily from one to the next. Because the boundaries between the subsections are so fluid, and because Subsections B2 and B3 are significantly shorter than B1, it makes more sense to discuss them sequentially under a single heading.

Section B: Nostalgia and Longing, Introspection, and Serenity

The states of mind presented in Section B—nostalgia and longing, introspection, and serenity—suggest a more mature, advanced age. The longing or nostalgia can be heard in 30 to 34, where the emphases on melodic seconds, which include a durational accent on the first note, partially allude to the sighing motive.[39] Unlike the Baroque *pianto* (a descending minor second associated with anguish and weeping), these subtler, melancholic sighs seem linked with memory. The second clarinet initiates this visit to the past with its ascending D4—E4—F4 in 29 + 1. This melody in the clarinet is the first

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[39]My understanding of the sighing motive is that it involves a descending minor second, with the second note placed in a metrically weaker position than the first.

instance in *Trois airs* where an instrument (other than the voice) rises to the foreground as melody.

The heterophonic exchange that ensues, where the clarinet echoes the voice, suggests a second melodic agent that takes on the persona of memory. As memory, it stirs a sense of longing and nostalgia in the primary melodic agent (embodied through the voice) that, in turn, imparts two temporal perspectives to the heterophony: the past (embodied by the clarinet) and the present (embodied by the voice). The exchange becomes contrapuntal when the stopped horn takes over for the line at 32, followed by the bass clarinet at 33, which results in a *Klangfarbenmelodie* (see Figure 5.26, the formal diagram for the second *air*). The change in timbre is likely motivated by the bass clarinet's greater range and dynamic control in the low register. Although the *Klangfarbenmelodie* technique offers a contrasting timbre and contour, it shares the same rhythm as the melody, and therefore does not display as much independence or agency after 32.

Between 29 and 32, Vivier phases out the aleatoric lines in favour of the even, ascending segments, played as harmonics in the strings and vibraphone (bowed), and as straight tones in the flute and piccolo. The harmonics raise the melodic range of the accompaniment to approximately C5–G#6. With the exception of the lower counterpoint, Section B contains only two notes in the low register: a C2 at 32 -1 and an E1 in the last measure. As the soprano sustains a G5, the cello and horn play a C2 that enters and fades with a discrete, but immensely effective, crescendo and decrescendo *pppp–pp*. This isolated perfect fifth, which projects the C harmonic series, seems to emanate from the voice, or rather from the depth of the musical agent's emotional state, which at that moment seems to ache with longing. Shortly after the sublime and crushing C2/G5, a sense of sadness follows that is evoked by the harmonic minor thirds and tritone between the horn and soprano (B2/D5, D3/F5, B3/F5).

The humming in at the end of 33 (Subsection B2) adds an introspective quality to the longing and nostalgia. Because the "m" prevents the sound from projecting, it requires a certain level of proximity to be heard, and although proximity often connotes intimacy, here the closed aperture also establishes a metaphoric distance between the agent and the

external observer. As Theo van Leeuwen observes, "*Mmmm* can be the most non-committal of reactions, neither yes nor no, the act of explicitly keeping your thoughts inside."[40] Rather than voice his or her thoughts, the agent keeps them private. As the observer becomes aware of this introverted act, it changes the perspective from interior to exterior.

It is interesting that the humming should take place just before the serenity of the last phrase, Subsection B3. Occurring between the nostalgia and the serenity, the humming marks a pivotal psychological turning point (or realisation) that enables a positive shift in mental state. The uninterrupted ascent from C5 to G♯5, which concludes on an E harmonic series, evinces a certain resolve or acceptance that bears none of the struggle or tension that ascending melodic contours often do. Instead, it sounds effortless and calm, similar to the ascent at the end of the first *air*. The serenity stems primarily from the *ppp* dynamic marking, longer durations, and thin, light texture of the spectra. The viola and cello's harmonic glissandi at 33 + 1, 34 + 2, and 35 − 1, which highlight the last of note of phrases like an ending, impart an ethereal quality to the timbre.

5.3 Narrative of Sonic Purification and Life Cycle in the Second *air*

Up to this point, the discussion of metaphor and sound symbolism for the second *air* has centred on the melody, text, and timbre of the individual instruments rather than the collective timbre of the ensemble. Yet, as the second *air* progresses, the spectral timbre becomes increasingly sinusoidal-like. Section B, for example, consists almost entirely of the piccolo, flute, and harmonics in violins and vibraphone. These timbres have a similar thin, whistle-like sound, the essence of which Rebecca Leydon claims "is really the absence of any quality per se—a sort of Platonic ideal of pure pitch." While the flute and piccolo still bear traces of their materiality or bodily origin (i.e., the sound of the breath), it is more difficult to pinpoint the instrument (material source) playing the harmonics

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[40]Theo van Leeuwen, *Speech, Music, Sound* (London: Palgrave Macmillan, 1999), 149.

because the attack transients do not come through. As Leydon states it, "in casting off physical encumbrances, isolated harmonics reach us as evidence of non-corporeality."[41]

This potential for expressing various levels of corporeality invites a host of other connotations, most of which pertain to spirituality (e.g., purity, the sublime, the ethereal etc.)[42] The valuation attributed to these qualities relies on primary spatial metaphors since we spatialize degrees of embodiment (and their spiritual connotations) in terms of verticality, with disembodiment positioned high and embodiment (materiality, turbulence, etc.) positioned low. The mapping of verticality-embodiment-spirituality appears to be particular to timbre (as opposed to pitch) since ascending melodic lines typically convey *more* physicality (i.e., force) due to the increased tension, pressure, emotion, breath, volume, etc., they tend to demand.[43] This association of embodiment with timbre is often accompanied by what Rebecca Leydon calls a narrative of sonic purification, i.e., a large-scale gesture where "sinusoidal purity is the goal of a musical process"[44] Although the sonic purification narratives Leydon describes "trace a path from complexly textured sounds to isolated single frequencies," the general trajectory that the timbre, texture, and register in the second *air* undergoes is the same, albeit less pronounced.

This timbral process of purification, which also represents a transition from corporeality to non-corporeality (a spiritual narrative), works synergistically with the voice and melody to construct a larger narrative. This larger narrative chronicles the passage of time by alluding to certain stages of life. Many of the mental states depicted in the voice and melody seem to echo key moments in what German psychoanalyst Erik Erikson (1902–

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[41] Rebecca Leydon, "Clean as a Whistle: Timbral Trajectories and the Modern Musical Sublime," *Music Theory Online* 18/2 (2012): [4.3].

[42] Ibid., [5.3].

[43] Arnie Cox, "The Metaphoric Logic of Musical Motion and Space," (Ph.D. diss., University of Oregon, 1999), 37. Interestingly, a "disembodied" low sine tone does not evoke the same spiritual entanglements. Instead, it tends to convey a non-human, and non-spiritual, artificiality.

[44] Leydon, "Clean as a Whistle," [5.1].

1994) identified as the eight stages in psychosocial development.[45] Very briefly, these stages are:

1. Trust vs. Mistrust (Infancy): Stage of building trust where consistent and reliable care enables the infant to develop a sense of trust that will help them feel secure.

2. Autonomy vs. Shame and Doubt (18 months–3 years): Stage where children become mobile, explore their surroundings and begin to make decisions that will lead to confidence and a will to survive in the world.

3. Initiative vs. Guilt (ages 3–5): Stage of curiosity, development of interpersonal skills that is centred on play where children develop a sense of initiative and purpose.

4. Industry (competence) vs. Inferiority (ages 5–12): Stage where children gain competencies (reading, writing, arithmetic), seek approval and reinforcement from peers and authority figures to develop a sense of pride in their accomplishments.

5. Identity vs. Role Confusion (ages 12–18): Stage where teenagers must define their identity and the roles they will occupy as adults in order to develop a sense of commitment and acceptance of others and oneself.

6. Intimacy vs. Isolation (ages 18–40): Stage where closer, more intimate, long-terms bonds with others are formed that develop a sense of security and caretaking.

7. Generativity vs. Stagnation (ages 40–65): Stage where careers, families, and roles within community are established that lead to a sense of being a piece of a much larger humanitarian whole.

8. Ego Integrity vs. Despair (ages 65+): Final stage where general productivity in all faucets of life (i.e., workplace, family, community, etc.) declines thus prompting a contemplation and examination of one's life and accomplishments. If the life is deemed successful, a sense of integrity and wisdom ensues that provides closure and confidence in the face of death.

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[45] See Erik Erikson, *Identity and the Life Cycle: Selected papers* (1959; reprint, New York: W.W. Norton and Company, 1980).

The qualities raised in Section A, which exhibit a younger frame of mind than Section B, bear many similarities with Erikson's first five stages. Section B, by contrast, draws a parallel with Stage 8. Figure 5.32 is a timeline of the second *air* that localizes the mental states conveyed through the melody and voice (discussed above) with Erikson's stages of development, as well as the process of sonic purification, which in turn can be construed as a form of spiritual development.
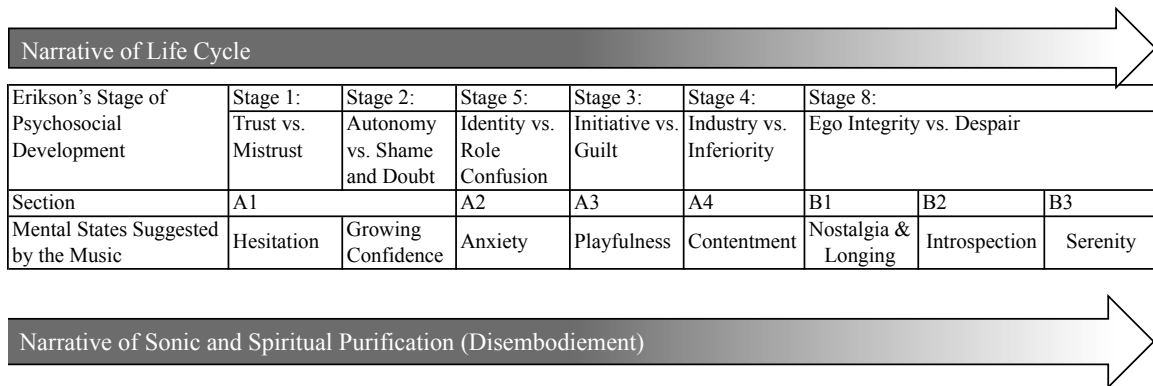
Narrative of Life Cycle

Erikson's Stage of Psychosocial Development	Stage 1: Trust vs. Mistrust	Stage 2: Autonomy vs. Shame and Doubt	Stage 5: Identity vs. Role Confusion	Stage 3: Initiative vs. Guilt	Stage 4: Industry vs. Inferiority	Stage 8: Ego Integrity vs. Despair		
Section	A1		A2	A3	A4	B1	B2	B3
Mental States Suggested by the Music	Hesitation	Growing Confidence	Anxiety	Playfulness	Contentment	Nostalgia & Longing	Introspection	Serenity

Narrative of Sonic and Spiritual Purification (Disembodiement)

Figure 5.32: Timeline of mental states in second *air*

In particular, hesitation at the onset of Subsection A1 seems representative of Stage 1, while the expansion of the melodic ambitus and phonemes in the later part of A1 shows the growing confidence characteristic of Stage 2. The goal tones, from which the melody frequently departs and returns, mimic the process of exploring a newfound autonomy from the safe distance of parental guidance. Although both Subsections A3 and A4 feature straight tones in voice, which carry connotations of naivety (and hence childhood), Subsection A3 comes across as being developmentally younger than section A4. The phonemes in Subsection A3, which consists of sounds that are pleasing to make, suggests a more independent, individualized act of play that is more characteristic of Stage 3. By contrast, the melodic structure of the nursery rhyme in Subsection A4 suggests an awareness of social convention (songs are often shared within a culture) that could represent Stage 7, or the interactive play more typical of Stage 4. Only the anxiety in A2, which seems representative of the conflict of Stage 5 or the isolation that could ensue from a failure to form bonds in Stage 6, goes against the chronological order of Erikson's stages in the Section A.

Section B's progression from nostalgia, introspection, and serenity, coupled with the more pronounced changes in texture and timbre, call to mind the integrity, wisdom, and closure of Stage 8. Although the interaction with the past manifests initially as attachment (through the longing and nostalgia of the melodic sighs), its severance during the contemplative humming, like the release of weight or corporality, allows the melody to finally rise and face death with grace and serenity.

5.4 Final Thought

Given Vivier's fervent spirituality (recall he was a former postulate) and preoccupation with the themes of death, childhood, innocence, and love, which surface in *Lettura di Dante*, *Kopernicus*, *Lonely Child*, *Wo bist du Licht!*, *Bouchara*, *Prologue pour un Marco Polo*, etc., it is certainly possible that certain vocal and instrumental timbres, particularly those that reoccur in various works, bore special significance or expressive meaning for Vivier. In context of these themes, a narrative that combines sonic and spiritual purification with a cycle of life does not seem implausible.

Whenever we posit a musical agent (sentient or non-sentient) or imagine musical forces, we inevitably begin to construct narratives. In the first *air*, the melodic agent braved non-sentient, unpredictable environmental forces like water and wind while also contending with more predictable forces like gravity. These forces constrained the movements of the musical agent, who was embodied through the melody. In the second *air*, the melody, text, and timbre suggest the changing mental states of a musical agent. The changing qualities of the music become an outward projection of the agent's state of mind; thus, instead of being constrained by external physical forces, the agent experiences his or her own internal "psychological forces."

Chapter 6: Conclusion

At the Society for Music Theory conference in Indianapolis (2013), the subject of Vivier's music came up while I was having lunch with a small group of theorists and graduate students. While those familiar with his music expressed interest in and admiration for it, the consensus was that it did not lend itself well to analysis. As one young faculty member put it, "you can't do anything with it." At the time, I was struggling to make standard analytical approaches fit Vivier's music, so the comment gave me pause. Despite numerous modifications, none of the approaches I had tried revealed anything about what makes Vivier's music so appealing, i.e., its personal, somatic, and sensual qualities. Too often, these more evocative, interpretive and subjective aspects of music are relegated to the periphery for want of knowing just what to do with them; they require a phenomenological approach to analysis.

I discovered that an embodied, metaphorical approach works well in this respect. By positing an observer, musical agent, or both, and treating the musical space as a virtual landscape dominated by environmental forces, the analyst experiences musical change as a form of embodied metaphorical motion. The analyst anthropomorphizes the music by asking himself or herself what it would feel like to be the music, move as the music moves, or be moved by the music.[1] This approach relies on our intuitive, everyday understanding of moving through space and interacting with moving objects, as well as the conflated subjective sensations we come to associate with such movements. Our everyday experience of motion provides a framework and vocabulary for discussing what we perceive to be musical motion and musical tension. Terms like motion, tension, direction, momentum, and stasis surface often in descriptions of music, and perhaps because they seem so intuitive to many, rarely are they defined.

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[1] Cox, "Embodying Music," [8]; BaileyShea, "Musical Forces and Interpretation," [7].

At the core of the metaphorical approach to music analysis in this dissertation is Lakoff and Johnson's theory of conceptual metaphor.[2] It claims that we understand abstract concepts by first mapping them onto more familiar domains of experience and then inferring structural relationships from those mappings. This form of embodied realism stipulates that all knowledge is mediated, at some level, through the body.

In his extension of Lakoff and Johnson's theory to musical motion, Arnie Cox reveals that our experience of anticipation, presence, and memory does not differ in the spatial, temporal, and musical domains.[3] This shared experiential correlation renders cross-domain mapping between the three domains intuitive and commonplace. Although metaphor can arise from any two domains sharing an experiential correlation, Cox shows that most descriptions of music rely on the complementary pairs of metaphors MOVING TIME and MOVING OBSERVER, and STATES ARE LOCATIONS and STATES ARE POSSESSIONS. In MOVING OBSERVER, temporal (or musical) events represent fixed locations on a landscape, and the observer experiences different events by moving from one location to another. In MOVING TIME, the observer remains stationary while temporal or musical events move past him or her. Cox expands these complementary outlooks by distinguishing between an interior, first-person perspective and an exterior, third-person (impartial) perspective. The metaphors STATES ARE LOCATIONS and STATES ARE POSSESSIONS metaphors follow the same logic, but here qualitative states take the form of locations (to or from which the observer moves) or possessions (which the observer momentarily holds).

Building on Lakoff and Johnson's theory of conceptual metaphor, Steve Larson proposes a trio of musical forces to describe melodic expectation in tonal music conceived from a Schenkerian perspective.[4] For Larson, many experience musical motion as a metaphorical extension of bodily motion, subject to similar mechanical constraints like gravity and inertia. Melodies are compelled to move and rest according to patterns of motion

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[2] Lakoff and Johnson, *Metaphors We Live By*; *Philosophy in the Flesh.*
[3] Cox, "The Metaphorical Logic."
[4] Larson, *Musical Forces.*

determined by musical analogues to gravity, magnetism, and inertia. In Larson's musical forces, musical gravity describes the impetus to follow ascending motion with descending motion and return, or rest, on a stable, low platform (i.e., the tonic); musical magnetism explains the attraction stable tones exert over unstable tones; and musical inertia refers to the tendency for a musical pattern to continue, where the term pattern can refer to a broad range of situations.

Because Vivier's music falls outside common-practice tonality, Larson's musical forces require some expansion and modification. To this end, I abandoned musical magnetism and incorporated instead concepts from Robert Hatten and Matthew BaileyShea.[5] From Hatten I borrowed the notion of musical friction, musical momentum (as distinct from musical inertia), and a musical agent. Because momentum and friction can account for a variety of processes of intensification and attenuation (irrespective of genre) they represent flexible motion metaphors for post-tonal music. My definition of musical momentum differs slightly from Hatten's in that I qualify it as a change in the perceived combination of tempo and mass. Like its physical counterpart, momentum increases if the product of velocity and mass increases. The opposite holds true for diminishing momentum, which we tend to attribute to friction. By isolating the components of momentum, we draw attention to the different forms momentum might take in the music.

Sections C1 and C2 of *Wo bist du Licht!* show different expressions of changing momentum. In Subsection C1.1, momentum increases as a result of both increased mass (manifested as longer scale lengths) and increased velocity (manifested by the shortening duration of the stages). In Subsection C1.2, the *pp* marking and longer wave cycles suggest diminishing energy and velocity, despite the aleatoric wave's dispersal throughout the register. Even though the aleatoric wave amasses instruments, it is insufficient to compensate for the friction of the static tones, resulting in diminishing momentum. The opposite occurs in Subsection C2: initially the velocity remains constant (evinced by the regular periods of the pulsed waves), but the rising dynamic level and larger wave amplitudes convey an increase in momentum due to a perceived increase in

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[5] BaileyShea, "Musical Forces and Interpretation;" Hatten, "Musical Forces and Agential Energies."

mass. After 27, both the velocity and mass diminish, and therefore so does the momentum. Musical mass is a flexible concept that can manifest in a variety of ways, including registral density, timbre, and texture—anything that carries a connotation of size or weight.

Hatten's embodied, sentient, musical agent enables the analyst to ascribe intention, conflict, and emotion to musical gestures, which in turn, opens the door to numerous narrative interpretations or possibilities. The agent can also replace the intentionality implied by musical magnetism. In tonal music, musical magnetism describes the impulse and desire to rest or resolve on stable pitches, which are, in turn, predetermined through tonality's hierarchical pitch structure. Because we do not consciously experience magnetism directly with our bodies the way we do gravity or inertia (our bodies are not magnetic), magnetism does not have the same value as an embodied motion metaphor. Rather, its value stems from its ability to express attraction and intention. Since post-tonal music does not evince the same pitch hierarchies, magnetism (as a motion metaphor) has limited applicability in this context. Thus, by positing an agent as an expression of intention or desire, the notion of magnetism becomes redundant. And unlike the attraction implicit in musical magnetism, the sentient agent can change his or her goals for any context, which again proves helpful in a post-tonal environment.

The terms virtual environment and virtual environmental forces, which appear throughout the analyses in Chapters 4 and 5, are also borrowed from Hatten. They describe the space in which the musical agent operates.[6]

Finally, BaileyShea's concept of a non-sentient, unpredictable environmental force, like water or wind, is particularly apt for the *technique sinusoïdale* in *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire*. According to BaileyShea's basic push vs. pull binary, the *technique sinusoïdale* in these pieces can be both a "push" or "pull" force that increases or decreases not by the volition of an agent, but as a consequence of

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[6] Hatten, "Musical Forces and Agential Energies," [4]; *Interpreting Musical Gesture*, 115.

circumstance, much like weather.[7] In post-tonal contexts where musical motion is less predictable, recourse to an unpredictable, environmental force serves as an asset.

The analytical studies in Chapters 4 and 5 show three different forms of interaction between the harmonic spectra, the observer, and the agent. In the first, virtual environmental forces are considered primarily from the perspective of an observer, not a musical agent. The analysis of *Wo bist du Licht!* in Chapter 4 reflects this scenario by deliberately excluding the melody from the analysis to focus on the motion of the spectra and the various force and energy metaphors they evoke (i.e., friction, inertia, gravity, kinetic/potential energy, momentum, and pressure). Here the spectra create a virtual environment that evinces non-sentient forces or states that are both predictable (e.g., gravity, inertia) and unpredictable (e.g., changes in momentum that are self-initiated, like waves). The sense of musical motion is relayed via an observer—not an agent—who experiences the forces by either standing in or walking through the spectral environment.

In the second scenario, the virtual environmental forces act upon the musical agent, as in the first *air* of *Trois airs*, discussed in Chapter 5. The agent, embodied through the melody, interacts with the virtual environment created by the spectra, which again includes predictable forces (gravity) and unpredictable forces (wind, water). The forces impact the mobility and energy of the agent by countering the agent's efforts and creating conflict (as in Section B) or supplementing the agent's efforts (as in Section A) and not creating conflict. Another possibility occurs when the agent allows himself or herself to be led by the forces (as in Section C), which, again, does not evoke tension or struggle.

In the last scenario, the virtual environmental forces do not affect the melodic agent. If a conflict arises, it arises from the agent, not from a struggle between the agent and his or her environment. In the second *air*, the spectra represent a projection of the agent's mental states, not neutral, independent, environmental forces. As an extension of the musical agent, the spectra do not impact the agent's intentions or motions.

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[7] BaileyShea, "Musical Forces and Interpretation," [8].

While the first scenario relays motion via an observer, the second two scenarios relay motion primarily through the perspective of an embodied, thinking, and feeling agent. The focus on an observer over an agent, or *vice versa*, raises the question of how the observer (moving or stationary) differs from the agent. My use of both terms throughout Chapters 4 and 5 has been consistent, but reveals subtle differences in their application. Like musical agents, my observers are sentient, but they differ in that they do not express emotions or intentions (or rather their sense-impressions and intentions are limited to gauging force or spatial relations[8]). Their role in the analyses, especially in Chapter 4, is to relay the imagined motion of the music and any sensations related to that motion. This motion can be either experienced directly, as in the interior perspectives, or indirectly, as in the exterior perspectives, and from either the position of figure or ground. The musical environment therefore never projects the observer's state of mind, nor does the observer have the power or ability to change the environment. In short, the observer answers the questions: What is it like to be a bystander "in" the virtual environment created by the spectra? What does the motion of the predictable and unpredictable forces feel like?[9]

The agent, by contrast, is sentient, wilful, and capable of conveying emotion and conflict. The agent interacts with the virtual environment either actively (working against or with the forces) or passively (giving into the forces). For the virtual environment to offer resistance (e.g., Section B of the first *air*), there must be conflict between the agent's path of motion (or intended path of motion) and the direction, or magnitude, of the forces. If the environmental forces support the agent's efforts, or if the agent gives in to the environmental forces, then there is no conflict between the agent and his or her environment. If the environment has no bearing on the agent, then conflict or tension, if present, stems from another source. In the second *air*, this source consists of the agent's own mental states, which the agent projects in the form of spectra.

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[8]An observer without intentions would contradict the MOVING ALONG A PATH metaphor and SOURCE/PATH/GOAL schema so crucial to Cox's phenomenology of anticipation, presence, and memory. The logic of musical motion depends on it.

[9] Cox, "Embodying Music," [8].

In *Wo bist du Licht!* and *Trois airs,* musical agency is implicit with the melody and the human voice. The timbre of the human voice, whether singing or speaking, cannot easily be divorced from its embodied, living source, and therefore seems to automatically convey agency. The narrated recording of Hölderlin's "Der blinde Sänger" in Sections C2 and C3 of *Wo bist*, by virtue of its timbre, introduces agential friction (a willed impediment to motion) to the virtual environment of the spectra. Melody, whether sung or instrumental, elicits anthropomorphization most likely because of its similarity to speech and its association with singing, which again, suggests a human body. Musical agency arises as a result of an impulse to anthropomorphize melody. In the first and second *airs* of *Trois airs*, the melody, sung by the soprano and briefly undertaken by the second clarinet at 29, evokes agency.

My distinction between the observer's emotionally detached involvement versus the agent's intentional and emotional engagement may be partly motivated by the way that mental states, qualities, etc., are objectified in the metaphors STATES ARE LOCATIONS or STATES ARE POSSESSIONS. In both cases, mental states are presented as separate and external to the observer. Awareness of the cross-domain mapping between mental states and spatial relations, in turn, implies a degree of analytical detachment (i.e., an external perspective). Although the same conceptual metaphors that structure our thoughts structure the agent's, any awareness of the mappings represents a shift in perspective from the agent's first-person outlook to the exterior moving observer perspective. The agent's outlook may overlap with the interior perspectives of the moving or stationary observer, but there can be no overlap between the agent and the exterior moving observer perspective. In short, the agent depends on the music, exists so long as the music unfolds, and does not continue to have agency outside the music; the observer, an extension of the analyst, is self-reflective, has hindsight, and can step outside the music and feign objectivity.

In Vivier's music, structure is largely worked out during the pre-compositional stage, which includes generation of spectra, durational schemes, various additive number series, and instrumental groupings. Since melody is the dominant parameter in Vivier's works, we might expect the form to unfold from the melody. This is the case for pieces like

Siddhartha, *Orion*, *Lonely Child*, and *Bouchara*, which are partly inspired by Stockhausen's *Mantra*. Each formal section corresponds to a phrase in the melody that is stated at the outset of the work. By contrast, form in *Wo bist du Licht!* and *Trois airs pour un opéra imaginaire* emerges foremost from the texture and dynamics of the spectra, not the melody. It is for this reason that analysis of the spectra serves as the point of departure for the phenomenological, metaphorical approach developed here. I have tried to mitigate the difficulty of integrating quantitative and qualitative analysis by grounding the musical metaphors in structural elements of the music, which I then relate to familiar embodied concepts. Alhtough subjective, these musical metaphors, reflective of embodied listenin, are not arbitrary.

The variety and breadth of texture afforded by the *technique sinusoïdale* enables Vivier to create processes of intensification or attenuation that incorporate changes in contour, rhythm, dynamics, tempo, and timbre. These processes, which are evocative of changes in momentum, define the formal sections of the work and contextualize the melody. They sustain the melody and give it direction. This approach to form differs from Vivier's prior spectral works where the block homophony, often homorhythmic with the melody, dominates the texture and varies little in pulse or tempo. The more sophisticated treatment of texture, rhythm, and tempo in *Wo bist* and *Trois airs* reflects Vivier's increased preoccupation with time.

The analysis of the virtual environmental forces in Chapters 4 and 5 focuses on the textural transformations of the spectra, but could be expanded to include the inherent harmonic tension of the spectra by applying virtual pitch theory. That is, the harmonicity of the spectra could be gauged by finding the fundamental or virtual fundamental whose series best represents the spacing of the combination tone chord.[10] If the intervallic content of the combination-tone chord matches or partly matches more than one set of harmonics, then multiple prospective fundamentals (virtual and real) are possible. In such

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[10] Many algorithms have been devised for this purpose. See, for example, Robert Hasegawa, "Gérard Grisey and the 'Nature' of Harmony," *Music Analysis* 28/2–3 (2009): 349–371; Llorenç Balsach, "Application of Virtual Pitch Theory in Music Analysis," *Journal of New Music Research* 26/3 (1997): 244–265.

cases, selection will likely depend on the musical context. For example, Robert Hasegawa's analysis of Gérard Grisey's *Vortex Temporum II* demonstrates how the prominence of certain repeated or sustained notes alter how they are heard and ranked as overtones, thus privileging some fundamentals over others.[11] The resulting fundamentals could then be used to establish progressions based on harmonicity and inharmonicity or fundamental (i.e., "root") motions.[12] Thereafter, one could potentially develop a form of musical magnetism reflective of Vivier's harmonic and melodic language.

Of course, some analysts question the relevance of applying virtual pitch theory to complex chords.[13] Because the resulting sound of an orchestrated spectrum is so far removed from its spectral model, the virtual pitch becomes a theoretical construct to measure tension rather than a psychoacoustic phenomenon.[14] Furthermore, the plurality of options imparts an arbitrariness whose only limitation is the analyst's sonic imagination.[15] Depending on the cut-off point in the harmonic rank (i.e., the harmonics upon which the ratios are based, e.g., the first 18 harmonics, first 33 harmonics, 100 harmonics, etc.), either no virtual pitch is possible or any virtual pitch is possible.

Another area that could be expanded in future research into environmental forces in Vivier's music is the role of tempo. As does velocity, it plays a critical role in the perception of musical momentum. In Chapters 4 and 5, I used velocity to refer to perceived accelerations and decelerations, which took the form of durational expansions or contractions, motivic density, and tempo indications. It also impacts the perception of texture via the synchronicity of layers. This last point is of particular interest since it affects the perception of motion, time, and form, which can then extend to a variety of forces. A more in-depth approach to the phenomenology of musical time, which

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[11] Hasegawa, "Gérard Grisey," 364. Hasegawa also establishes several preference rules for selecting fundamentals.

[12] Balsach, William Thomson, and particularly Robert Hasegawa have all drawn parallels between virtual pitch theory and Hugo Riemann's concept of tone representation (*Tonvorstellung*). William Thomson, "The Harmonic Root: A Fragile Marriage of Concept and Percept," *Music Perception* 10/4 (1993): 385–416.

[13] Roger Reynolds, "Seeking Centers," *Perspectives of New Music* 32/2 (1993): 272–91; Thomson, "The Harmonic Root."

[14] Reynolds, "Seeking Centers," 282.

[15] Thomson, "The Harmonic Root," 390.

specifically addresses acceleration, deceleration, and tempo but is not dependent on a regular pulse, may reveal more subtle temporal and rhythmic processes. These, in turn, could illuminate Vivier's conception of counterpoint as a "more refined way of looking at homophony, or heterophony" which involves phase-shifting with different *tempi*.[16] In this respect, Christopher Hasty's *Meter as Rhythm*, inspired by philosopher Alfred Whitehead's *Process and Reality*, may offer insight.[17]

Because melodic analysis was limited to *Trois airs pour un opéra imaginaire*, written exclusively in Vivier's *langue inventée*, this study did not explore motion metaphors and sound symbolism framed within the context of a semantic text. While a semantic text imposes certain limitations with respect to narrative, the additional context it provides might help focus the sound symbolism by suggesting specific motional and qualitative metaphors, especially where timbre and speech sounds are concerned. The timbre and text of Vivier's last work, *Glaubst du an die Unsterblichkeit der Seele* (incomplete, January 1983, written for three synthesizers, percussion, and twelve voices), which in Vivier's own words explores the "polarity of motion and stasis," as well as life and death, offers rich potential for sound symbolism. Regrettably, this unfinished work and its signification are now and will forever be inextricably tied to the tragic circumstances of Vivier's death.

We can only speculate what directions Vivier's compositional style might have taken had events unfolded differently the night of 7 March 1983. After taking the simplicity of his style to an extreme in *et je reverrai cette ville étrange* (October 1981), Vivier returned to the more complex textures he experimented with in *Prologue pour un Marco Polo* and *Wo bist du Licht!*. In an interview with Bob Gilmore, Montreal composer José Evangelista shared a statement Vivier made approximately a month before he died in which he expressed feeling that "his music had been too simple and that he wanted from now on to write more complex music."[18] If *Trois airs pour un opéra imaginaire* were to

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[16] Claude Vivier, interview with Frykberg, "Claude Vivier in Conversation," 8.

[17] Hasty, *Meter as Rhythm*.

[18] Gilmore, *Claude Vivier,* 228.

be a foretaste of what was to come, what the Tchaikowsky opera might have been, we have indeed been robbed of something remarkable.

The tendency to aggrandize and romanticize the potential of a great talent cut short creates biases that need to be acknowledged and kept in check. Vivier's international presence and importance to Canadian contemporary music and culture are a source of pride for Canada. That Vivier achieved so much just shy of turning thirty-five years of age, and did so by forging an identity that was neither European nor American, but uniquely his own, inspires a new generation of young composers across the globe. His very personal way of writing, as Julian Anderson wrote, "emanates an extraordinarily distinct atmosphere quite unlike any other composer."[19] Frank and direct in its accessibility, the late music of Claude Vivier offers to listeners and scholars of music a kind of humanistic paradox of visceral and spiritual dimensions that resonates literally and figuratively on many levels.

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[19] Anderson, "A Provisional," 17–18.

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Appendix A: Glossary of Vivier's Terms

The following is a list of idiomatic terms Vivier uses in his sketches, scores, performance notes, and program notes to denote specific analytic processes and techniques.

Couleur **(colour)**: Vivier's term for spectra, which in his case refers to combination tone chords.

Couleur lisse **(smooth colour)**: Describes spectra that are sustained or homorhythmic with the melody. It is perhaps better to define it in terms of what it is not, i.e., it refers to *couleur* that is neither *pulsée*, *rythmique*, nor *aléatoire*.

Couleur rythmique **(rhythmic colour):** Describes spectra articulated in a non-repetitive, non-retrogradable rhythm, independent of the melody. Often includes varied subdivisions and portrays a deceleration through the use of increasingly longer values.

Couleur alétoire **(aleatoric colour):** Describes spectra that feature durational values with some degree of indeterminacy, notated with unstemmed noteheads.

Couleur pulsée **(pulsed colour):** Describes spectra articulated in even durations, i.e., even pulses.

Technique sinusoïdale **(sinusoidal technique) or** *onde sinusoïdale* **(sinusoidal wave):** Vivier uses both terms interchangeably. It describes spectra whose frequencies are divided into bands (i.e., groups of ascending combination tones) that are played as ascending and descending scales. The resulting contour mimics the wave motion of a sine curve. Often Vivier pairs this technique with either *couleur pulsée* or *couleur aléatoire* to create a pulsed wave or aleatoric wave.

Mélodie intervalisée **or** *accord octavisé* **(intervalised melody or octavised chord):** Describes chord made up of two pitch classes played homorhythmically with the melody. Frequently appears at the ends of pieces, during the "chorale" passages, *Orion*, *Bouchara*, *Lonely Child*. In *Wo bist du Licht!* it is used in the introduction, the G/B in ☐1 to ☐4.

Durée aléatoire **(indeterminate time)**: Describes a sense of time that exceeds the durational threshold of rhythm, i.e., durations that do not evince a sense of pulse or meter.

Durée pulsée: Pulsed time (but not necessarily evocative of a meter)

Durée battue: Metered time

Langue inventée **(invented language)**: Invented language that has no semantic significance beyond the sonance of the speech sounds.

Phasing: Describes the temporal displacement of a musical segment, spectrum, or motive. It differs from canon in that it implies loss of synchronicity.

Contrepoint: Differs from the traditional conception of counterpoint as the weaving of simultaneous melodies, or polyphonic lines. Instead, it refers to the general ebb and flow of the temporal synchronicity (or alignment) of musical parameters; Vivier describes it as "points of coming together and drifting apart."[20]

Tremolo Morse Code: uneven tremolo intended to sound like Morse code

Voix droite **(straight voice):** indication to singer to abstain from vibrato

Tremolo irrégulier: unmeasured or irregular tremolo

*Hululement***:** tremolo with the hand on the mouth

Battement des lèvres / vibrato des lèvres **(beating of the lips/lip tremolo)**

Voix tremblée de la gorge/tremolo de la gorge **(throat vibrato)**

Changer la couleur des consonnes (**change the colour of the consonants**)

Changer la couleur des voyelles **(change the colour of the vowels)**

Changer la couleur des voyelles et des consonnes **(change both the vowels and consonants)**

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[20] Susan Frykbert, "Vivier in Conversation," 8–9.

Appendix B1: Translation of Vivier's Radiophonic Proposal[21]

Political Speech

Proposal: Radiophonic Project

Material: A new broadcast (and political speeches) with tape of 13 strings (4 3 3 2 1) and 2 percussions

_____

History of the 20th century between 1945 (atomic bomb) and man's first steps on the moon (the end of the Vietnam war!)

An era—this broadcast should be a document on one of the most significant schisms in our history. [See disaffection of the "people" in socialist societies, end of the American capitalist dream][22]

The aim is, in fact, to gather the historical signification of radiophonic texts by a common denominator: musical flow.

Discover the history of power and its most subtle filiations in contemporary history.

The 13 strings and 2 percussions should assist impassibly in this great human drama, somewhat like how great monuments (see cathedrals or the stones on Easter Island) witness history and stories unfold. This music should be continuous—a slow transformation.

_____

Method:

First: collect aural archival footage from as many domains as possible.

Next, listen to the texts, not with a historical ear, but an emotive and musical one.

Make a montage that would recreate history, and maybe draw from it the conclusions it perhaps never wanted to expose in broad daylight.

_____

[21] Division de la gestion de documents et des archives, Université de Montréal. Fonds Claude Vivier (P235) P235/D4, 065. Translation Mine.
[22] The square brackets appear in Vivier's proposal

Technique:

Continuous foreground: the orchestra: time stretches in an uchronic universe—think soundmasses that evolve slowly and somewhat represent an eternal vision of temporal space.

This soundmass, extracted from an eternal music, reveals history to us—not by counterpoint, but by overlaying its historical vinage. Imagine a couple of moments where these two temporalities become one – intimate moments in history, or the opposite, public moments!

Imagine a radiophonic text modulated by an alternate, but similar, history.

Imagine the fermatas in history, stop history, examine the *sound* of history under a lens (transposition towards the low register).

Discuss the music of history and make a new music—loving, tender, but still critical, questioning.

Imagine the intimate sound of a public event and the public sound of an intimate event.

The Voices:

A work in counterpoint that transforms the defining voices of the contemporary era into homophony. Transform them, give them substance, make them points in history, make them timbre, make them into a continuous support for another text (through repetition or expansion of their temporal spectrum).

Conclusion

Draw from the sound of history its own set of acoustical laws—the life of the sound of history.

Appendix B2: Translation of Friedrich Hölderlin's "Der blinde Sänger"

The Blind Singer[23]

"Ελυσεν αινόν αχοζ απ όμματων Αρηζ" — Sophocles
Where are you, young one, who would always
   Wake me in the morning, where are you light?
     My heart is awake, but the night always
      Holds and binds me in its holy magic.

Once near dawn I listened, glad to wait
   For you on the hill, and never for nothing.
     Not once did your messengers, the sweet breezes,
      Deceive me, for always you came,

All-inspiring in your loveliness,
   Down the usual path; where are you, light?
     Once again, my heart is awake, but always
      The endless night binds and constrains me.

Once the leaves greened for me; the flowers
   Would shine like my own eyes;
     Not far away, my own faces
      Shone for me, and, when I

Was a child, I saw the wings of heaven
   Traveling above and around the woods;
     Now I sit silent and alone, from one
      Hour to the next, making shapes

Of love and pain from brighter days,
   Taking comfort only in my thoughts,
     And strain far to hear if perhaps
      A kindly rescuer comes to me.

Then I often hear the voice of the Thunderer
   At midday, when the honored one comes near,
     When he shakes the house, and under him
      The foundation quakes, and the mountain resounds.

Then I hear my rescuer in the night, I hear
   Him kill, this liberator, to give new life;
     From sunrise to sunset I hear the Thunderer
      Hurry on, and you call in his direction,

My strings! My song lives with him,
   And as the source follows the stream,
     Wherever he has a thought, I must also go,
      Following the sure one on his erratic path.

Der blinde Sänger[24]

Ελυσεν αινον αχος απ' ομματων Αρης Sophokles
Wo bist du, Jugendliches! das immer mich
   Zur Stunde weckt des Morgens, wo bist du, Licht!
     Das Herz ist wach, doch bannt und hält in
      Heiligem Zauber die Nacht mich immer.

Sonst lauscht' ich um die Dämmerung gern, sonst harrt'
   Ich gerne dein am Hügel, und nie umsonst!
     Nie täuschten mich, du Holdes, deine
      Boten, die Lüfte, denn immer kamst du,

Kamst allbeseligend den gewohnten Pfad
   Herein in deiner Schöne, wo bist du, Licht!
     Das Herz ist wieder wach, doch bannt und
      Hemmt die unendliche Nacht mich immer.

Mir grüßten sonst die Lauben; es leuchteten
   Die Blumen, wie die eigenen Augen, mir;
     Nicht ferne war das Angesicht der
      Meinen und leuchtete mir, und droben

Und um die Wälder sah ich die Fittiche
   Des Himmels wandern, da ich ein Jüngling war;
     Nun sitz ich still allein, von einer
      Stunde zur anderen und Gestalten

Aus Lieb und Leid der helleren Tage schafft
   Zur eignen Freude nun mein Gedanke sich,
     Und ferne lausch ich hin, ob nicht ein
      Freundlicher Retter vielleicht mir komme.

Dann hör ich oft die Stimme des Donnerers
   Am Mittag, wenn der eherne nahe kommt,
     Wenn ihm das Haus bebt und der Boden
      Unter ihm dröhnt und der Berg es nachhallt.

Den Retter hör ich dann in der Nacht, ich hör
   Ihn tötend, den Befreier, belebend ihn,
     Den Donnerer vom Untergang zum
      Orient eilen, und ihm nach tönt ihr,

Ihm nach, ihr meine Saiten! es lebt mit ihm
   Mein Lied, und wie die Quelle dem Strome folgt,
     Wohin er denkt, so muß ich fort und
      Folge dem Sicheren auf der Irrbahn.

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[23] Friedrich Hölderlin, "Der blinde Sänger," *Nine Poems*, Translated by Maxine Chernoff and Paul Hoover, accessed 19 May 2015, http://www.conjunctions.com/webcon/holderlin.htm.
[24] Friedrich Hölderlin, "Der blinde Sänger," accessed 19 May 2015, http://gutenberg.spiegel.de/buch/friedrich-h-262/72.

Where to? Where to? I hear you here and there,
Your majesty! And all around the earth it sounds.
Where do you end? And what, what is there,
Beyond the clouds, and what will become of me?

Day! Day! Above the tumbling clouds, I will
Welcome you back! My eyes will flower for you,
O light of youth, O joy, returning once again,
Yet now more spiritually the golden source

Flows from its holy chalice, and you,
Green earth, in your peaceful cradle, and you,
House of my father! And you, loved ones
I met once in the past, draw near,

O come, that the joy will be yours,
That you will receive the blessing of sight!
O take this life from me, that I may
Endure it, take the godly from my heart.

Wohin? wohin? ich höre dich da und dort
Du Herrlicher! und rings um die Erde tönts.
Wo endest du? und was, was ist es
Über den Wolken und o wie wird mir?

Tag! Tag! Du über stürzenden Wolken! sei
Willkommen mir! es blühet mein Auge dir.
O Jugendlicht! o Glück! das alte
Wieder! doch geistiger rinnst du nieder,

Du goldner Quell aus heiligem Kelch! und du,
Du grüner Boden, friedliche Wieg! und du,
Haus meiner Väter! und ihr Lieben,
Die mir begegneten einst, o nahet,

O kommt, daß euer, euer die Freude sei,
Ihr alle, daß euch segne der Sehende!
O nehmt, daß ichs ertrage, mir das
Leben, das Göttliche mir vom Herzen.

Appendix B3: Translation of Vivier's Program Notes for *Wo bist du Licht!*[25]

[A] Meditation on human suffering, this work is a long continuous melody. The music is perceived from different aspects:

A) Formal aspect

I develop here a very important aspect of the music: the sinusoidal wave. An introduction of sound/noise (in fact, a octavised [sic] G–B[26]) leads directly to a melody surrounded by complex harmonic spectra. We hear the slow development of a spectral music connected to another spectral music espousing the contours of a sinusoidal wave. [From] the notion of aleatoric duration, the music strives towards a regular meter or even subdivisions [sic].[27] From this moment, the amplitude of the spectrum progressively closes and the pulse disappears and reappears. At this point in the development, when [the contour of] my spectrum should have flattened towards the centre, it reappears towards the extremes in even pulses that progressively disintegrate. Then, suddenly the music becomes rhythmitized [sic] only to become, it too, increasingly smoother. The end of the music evinces exactly the same contours as the end of the melody.

B) Melodic aspect

As one might expect, the melody is in fact a long, more or less ornate, melody. At the beginning and end of this long chant, I use the spectrum's fundamental notes in the voice, but in the centre, I built my melody on modes derived directly from my harmonic spectra. Marking the beginning and end of my spectral development, we find highlighted a "Wo bist du Licht" duet entering slowly in phase.

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[25] Translation mine. Division de la gestion de documents et des archives, Université de Montréal. Fonds Claude Vivier (P235) P235/D4, 065. They are included among the selection of Vivier's texts published by *Circuit: Revue nord-américaine de musique du XXe siècle* 2/1–2 (1990–91): 119–20.

[26] "en fait, un sol si octavisé [sic]"

[27] "La notion de la durée aléatoire, la musique se dirige vers une durée battue ou divisée également [sic]."

C) Textural aspect

The text by Hölderlin, *Der blinde Sanger*, is superimposed with three types of text:

1 - Emotive text having a great significance for America: Martin Luther King's last speech and an *in situ* recording of Robert Kennedy's assassination. Both these texts are presented as distant memories that resurface in the music's consciousness.

2 - Abstract text, bearing no signification.[28] This text is sung while just a bit further (and as a kind of call from the singer) someone (pre-recorded) reads the text from Hölderlin.

3 - Finally, a text on descriptions of torture. This text has enormous emotive power due to the almost indifferent tone of the two radio announcers.

> The text by Hölderlin, *The Blind Singer*, contains the secret to my work. An old blind man remembers his past, marvelous visual images; greenery, the wings of clouds, etc. The present is evoked by auditory images: thunder, earthquake. He seeks the light, freedom, perhaps even death …
>
> a love song
> a children's song
> behind the shadows
> a war – the Vietnam war
> Some political speeches
> repeating and overlaying with one another [sic]
> and slowly the simple love song
> defeats the war.
> A couple of reflections [texts] on war
> the fascination of power
> children's laughter, a concert of women's voices—
> and the star child returns with an ambiguous message:
>   Martin Luther King's hope is simultaneously a description of torture.
> In a divine aural country
> still sounds a broken man's voice
> that repeats incessantly to God his despair
> without which he would not have known for certain God existed.

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[28] This is a reference to Vivier's invented language.

Curriculum Vitae

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