The Pennsylvania State University

The Graduate School

School of Music

MUSICAL TIME AND ITS PERCEPTION IN THE MUSIC OF MESSIAEN, STOCKHAUSEN, AND GRISEY

A Thesis in

Music

by

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Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Master of Arts

December 2018

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Abstract

The perception of musical time suggests that listening to music is a varied endeavor, affecting the perception of chronometric time, or even evoking a sense of timelessness in one's temporal awareness. This thesis explores musical time and how it can be manipulated by considering the writings and compositions of Olivier Messiaen (1908–92), Karlheinz Stockhausen (1928–2007), and Gerard Grisey (1946–98). It shows a consistent train of thought on the part of these composers, as Messiaen was a teacher of both Stockhausen and Grisey at the Paris Conservatoire, with Grisey also being a student of Stockhausen at the Darmstädter Ferienkurse in 1972.

Beginning with a philosophical investigation of the concept of musical time, this thesis then turns to cognitive mechanics in relation to the listener's subjective listening experience, memory, and musical content that can effect temporal manipulation. Next, an examination of the writings and compositional techniques of Messiaen, Stockhausen, and Grisey supplies insight into their preferred methods of temporal manipulation. Using the ideas gleaned from their writings, this thesis examines Messiaen's *Chronochromie* (1959–60), Stockhausen's *Kontakte* (1958–60), and Grisey's *Partiels* (1975) and *Tempus Ex Machina* (1979) from temporal perspectives. These analyses suggest how a listener may perceive the passage of time while listening to each piece. Finally, building on the work of these composers, this thesis concludes with insights as to how composers might manipulate musical time to manipulate or cause cessation in a listener's perceived passage of time.

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Acknowledgements

I would like to thank my thesis advisor Dr. Vincent P. Benitez for his invaluable guidance in the writing and completion of this thesis. Words are insufficient to describe my gratitude for his time and patience. Furthermore, I would like to acknowledge him not only as my mentor in music theory but also as a mentor in music composition. Dr. Benitez's insight into the workings of music, across numerous genres and time periods, has been most informative and inspirational. Most importantly, his introduction to music of the last century has truly influenced my compositional approach. For this, I am truly grateful.

Continuing, there are three other professors I would like to recognize. First, I am indebted to Dr. Eric J. McKee for his perspective, not only throughout this thesis project but also for his courses I attended while at Penn State. Second, I would like to acknowledge Dr. Maureen A. Carr. Over the course of my studies at Penn State, it has been my privilege to be her student and her assistant. Third, I would like to thank Dr. Mark Ballora for his mentorship and friendship over the years.

Lastly, I would like to acknowledge my wife, Dr. Patricia (Tish) Jennings. Without her love and support over the years, I would not be typing these words. Thank you!

Chapter 1: Introduction

I have noticed over the years that while listening to music, my experience of musical time does not seem to correspond to its actual length as measured by a clock. Such an experience can feel faster, slower, or about the same, even though the exact timespan may or may not have elapsed.[1] In addition, the act of listening to music has led me on occasion to an experiential state that seems to lie outside of time. As a composer, the experiential nature of the fluidity and/or cessation of chronometric time is of interest to me and is the motivation for this study.

The concept of musical time (and how music is experienced in general) seems to be less studied than other more quantifiable aspects of music, such as harmony and voice leading, counterpoint, and form. Most of the training I received that dealt directly with time and duration in music was the study of rhythm. Although rhythm directly supports melodic and harmonic structures, I did not learn about its other aspects, such as the "how and why" music is propelled forward and experienced in time. I am not the only one to single out this obvious omission: as Mark Delaere states, it is "hard to find a course on tempo, metre and rhythm," not to mention the concept of musical time.[2]

Granted, the focus of my studies was generally on the music of the common-practice period and the breakdown of tonality in the late nineteenth and early twentieth centuries. Luckily for me, there were a couple of seminar classes while attending

1. Jonathan D. Kramer, *The Time of Music: New Meanings, New Temporalities, New Listening Strategies* (New York and London: Schirmer Books, 1988), 1.

2. Mark Delaere, "Tempo, Metre, Rhythm: Time in Twentieth-Century Music," in *Unfolding Time: Studies in Temporality in Twentieth-Century Music*, ed. Darla Crispin, 13–44, Collected Writings of the Orpheus Institute (Leuven, Belgium: Leuven University Press, 2009), 13.

graduate school that introduced me to the concept of time being fluid, and that composers were attempting to manipulate the perception of time in their compositions in the Western tradition.

In the twentieth century, many composers abandoned functional tonality in favor of new ways of constructing music, resulting in a plurality of musical styles that has been characterized as neo-tonal, atonal, serial, minimalistic, aleatoric, or stochastic. These styles featured new means of pitch organization that are quantifiable and able to be dissected, so to speak. Composers also created rhythmic designs that either advance a sense of forward motion or result in a series of discontinuous musical blocks, which evoke stasis. In a sense, these styles also leave the listener in a quandary: the expectation of what might or should occur in a composition was replaced by the expectation that anything might occur.

For me, musical composition is about the creation of expectations, as well as the manipulation of tension and release, or any lack thereof, for the listener. As human beings, we have evolved to look for patterns from our past to help predict what will happen in the future. If one listens to a piece in sonata form, there is an expectation that the composition will express a certain formal structure, comprising an introduction, an exposition, a development, a recapitulation, and a coda. In addition, one might infer that there will be two contrasting subject groups that are developed and repeated. In addition, the subject groups will have certain key relationships in both the exposition and recapitulation.

There are also expected key relationships connecting the other movements in a classical-period symphony. Yet, listening to music is not just about hearing it in a linear

fashion, but in various mental time spaces that involve the listener's memory, particularly the retention of past musical events occurring while listening to a composition. This knowledge of the composition's preceding material in the present moment creates an expectation of its future events. That being said, listening to music might be viewed as an activity that is essentially both linear and nonlinear in orientation.[3]

If the concept and my experience of the nonlinearity of musical time as presented above is an actual phenomenon, then this argument lends support to the opening of this paper and affirms my own experience of the fluidity of musical time. As a composer, this begs a question in my mind: "how do composers manipulate the experience of musical time?" This question is ultimately the central focus of this paper.

In *The Time of Music*, Jonathan Kramer explores various aspects of musical time that I find intriguing. On a philosophical level, he discusses the unique malleability of musical time versus a stricter chronometric time. Obviously, music happens in what he calls "absolute time," which is seen as a series of successive events that are outside the listener's perception of time. These events can be measured by "clock duration," which is separate from the listener. However, he argues that time is not independent of one's subjective experience, and that the passage of time while listening to music is not a one-dimensional temporal experience but, in essence, a nonlinear experience.[4] Of course, music does happen while a clock ticks away somewhere, but my own perception of musical time is in line with Kramer's view that music has the ability to "create, alter,

3. Kramer, *The Time of Music*, 2.

4. Ibid., 2–3.

distort, or even destroy time" while experiencing music.[5] Kramer also labels a number of different types of musical time, such as gestural time that manipulates temporal expectations, moment time that is discontinuous, and vertical time that invokes stasis.[6]

Studying the works of Olivier Messiaen (1908–92) focused my attention on how musical time could be manipulated. What struck me was that through various compositional techniques, Messiaen strove to manipulate his listeners' sense of the past, present, and future in order for them to experience a sense of timelessness, suggesting a glimpse at eternity that seemed to explain my own experiences.[7] Upon further study of musical time, I found that two of Messiaen's students at the Paris Conservatoire, Karlheinz Stockhausen (1928–2007) and Gerard Grisey (1946–98), wrote numerous articles on the subject and were often cited in relation to the study of musical time and its perception. On further evaluation, it appears their ideas continue a thread of thinking that appears to stem from Messiaen.

In this thesis, I will explore this line of thinking about musical time, tracing its theoretical lineage from Messiaen to Stockhausen to Grisey, as all three wrote about time and its perception in various treatises and articles. I feel that this examination of each composer's views on musical time is important, as they were at the forefront of temporal approaches still present in the works of composers today. I surmise that Messiaen's initial goals to cease chronometric time helped to create the compositional attitude of the

5. Kramer, 5.

6. Ibid., 6–7.

7. Vincent P. Benitez, "Reconsidering Messiaen as Serialist," *Music Analysis* 28, nos. 2–3 (July–October 2009): 282.

experiential nature of sound itself, especially through the use of birdsong.[8] In addition, he used a variety of rhythmic devices, as well as serial and permutational techniques, to create new listening experiences. Messiaen used these techniques to create pieces that reflect moment time in that sections of a composition are self-contained units and may not be related to each other and hence follow no logical structure.

Stockhausen continued to explore the nature of sound itself, and how music could be experienced "most strongly." He used math, audiotape, filters, and oscillators to create pieces that were far removed sonically from traditional acoustic music, in addition to compositions that were mixtures of both acoustic and electronic music. All of these activities were taking place while expanding not only Messiaen's compositional techniques but also the perception of musical time.[9] Stockhausen attempted to unify both pitch and duration that I surmise had a foundation in integral serialism. In addition, he wrote about how time and music were perceived, which closely emulates Messiaen's line of thinking. Stockhausen also wrote pieces that reflected moment time.

Lastly, I feel that the French spectral composer Grisey continued to augment Messiaen's and Stockhausen's views on the perception of musical time, in addition to their ideas about the nature of sound itself. Grisey's abstraction of how listeners perceive musical time is clearly in line with such thinking. For example, in his writings, Grisey discusses how music is structured quantitatively from the standpoint of musical events,

8. In speaking of his techniques, I will not discuss in length his religious symbolism nor his synesthesia, as they are particular to Messiaen.

9. Karlheinz Stockhausen, "Structure and Experiential Time," *Die Reihe* 2 (1958): 65

rhythm, and density, which is linked with how music unfolds over time.[10] Furthermore, he refines both Messiaen's and Stockhausen's ideas of how music is perceived qualitatively through his discussions about the important role memory plays in the perception of musical events.[11] These ideas are, in my opinion, a mandatory read for music students, and essential for composition students.

When discussing Messiaen, I will examine his "three laws of experienced duration" and how these relate to understanding musical time.[12] Following that, I will investigate how he uses the modes of limited transposition, nonretrogradable rhythms, and symmetrical permutations—all part of his aesthetic, "the charm of impossibilities"—as a means to manipulate time. Finally, I will look at Messiaen's permutational techniques and use of birdsong as they relate to stasis and moment time, using *Chronochromie* (1959–60) as a case study.

After considering Messiaen, I will look at how Stockhausen manipulates time and its perception. In addition to intergral serialism, Stockhausen builds upon Messiaen's three laws of experienced duration to structure his temporal approach. He describes in detail a system of "experiential time" that appears to be event-based (or a lack thereof) that distorts the listener's perception. Moreover, Stockhausen uses moment form in various pieces in a fashion similar to Messiaen's *Chronochromie* that results in moment

10. Gérard Grisey, "*Tempus Ex Machina*: A Composer's Reflections on Musical Time," *Contemporary Music Review* 2, no. 1 (1987): 257.

11. Ibid., 273.

12. Olivier Messiaen, *Traité de rythme, de couleur, et d'ornithologie (1949–1992),* 7 vols. (Paris: Alphonse Leduc, 1994–2002), 1:10.

time.[13] Many of his ideas about time and the nature of sound itself can be found in articles such as "Structure and Experiential Time" (1958), "How Time Passes By" (1959), and "The Concept of Unity in Electronic Music" (1962). Accordingly, they shall serve as an interpretive backdrop to my analysis of the temporal aspects of *Kontakte* (1958–60).[14]

I will then turn my attention to Grisey and his thoughts on a listener's memory and consequent perception of time. Expanding on both Messiaen's and Stockhausen's ideas, Grisey outlines a temporal model of perception based on musical events that he calls a "scale of complexity," which moves from order to disorder, the predictable to the unpredictable.[15] Events are a driving force in a composition, and like Messiaen's and Stockhausen's temporal approaches, Grisey suggests how a listener's perception of time can be affected by various musical considerations. Using "*Tempus Ex Machina*: A Composer's Reflections on Musical Time" (1987) as the starting point for a discussion of temporal perception in Grisey's music, I will then show how *Partiels* (1975) and *Tempus Ex Machina* (1979) shed light on various aspects of his compositional aesthetics, as these

13. Ed Chang, "KONTAKTE - Planning & Design," Stockhausen – Sounds in Space Blog, November, 2015, accessed October 4, 2017, http://stockhausenspace.blogspot.com/2015/11/kontakte-planning-design.html.

14. Karlheinz Stockhausen, "Structure and Experiential Time, *Die Reihe* 2 (1958): 10–40; idem, "How Time Passes By," *Die Reihe* 3 (1959): 64–74; idem, "Die Einheit der Musikalischen Zeit" (The Unity of Musical Time), trans. E. Barkin as "The Concept of Unity in Electronic Music," *Perspectives of New Music* 1, no.1 (1962): 39–48.

15. Ching-Yi Wang, "Spectral Music and Gérard Grisey's *Vortex Temporum I and II*" (PhD diss., Universty of California, Davis, 2012).

two pieces exemplify both the timbral aspects of spectralism (*Partiels*) and scale of complexity (*Tempus*).

As alluded to earlier, the ideas presented and realized by Messiaen and his students are gaining credence, as composers search for new ways to "play" with the listener's expectations and, ultimately, the perception of music. This is shown by scientific studies and compositions that have used various concepts from Messiaen, Stockhausen, and Grisey as compositional templates for measuring the temporal discontinuity in a listener's perception of a piece's length.[16] Using the knowledge gleaned from my examination of the work of these three composers, I will speculate as to how composers of today might be able to manipulate musical time.

16. Michele Biasutti and Eugenio Pattaro, "Counting the Duration of a Musical Piece: An Experimental Research," in *The Proceedings of the 9th International Conference on Music Perception and Cognition* (University of Bologna, Italy, 2006): 1469–76.

Chapter 2: Olivier Messiaen and Musical Time

I engaged in a detailed study of Olivier Messiaen's music as a graduate student, and to my surprise, Messiaen attempted to bring about a suspension of time in his music. I was intrigued, and I learned that there were various techniques used by composers to manipulate the perception of time in contemporary music. While researching this paper, I concluded that Messiaen's influence on the study and implementation of methods to manipulate musical time was significant, and that his ideas continue to resonate with composers and theorists today. I believe that much of the research conducted on the subject of musical time may stem from Messiaen's thoughts and techniques, along with his students' writings.

In this chapter, I will examine Messiaen's views about time and how his use of musical events can alter its perceived length. I will then consider his compositional aesthetic known as the "charm of impossibilities" and how he sought to use it as a means to manipulate time. In particular, I will examine the integral serial techniques related to this aesthetic and how they create moments of stasis. Finally, I will interpret *Chronochromie* as exemplifying moment time. Using Messiaen's three laws of duration, I will uncover various temporal designs in the work that suggest how time is being manipulated.

Messiaen's Musical Time

Much of Messiaen's music is religious in nature, with some of his compositional techniques designed to lead listeners to a state of timelessness, or in Messiaen's view, to the divine. As Ian Darbyshire opines, the composer's goal is to cease intellectual

functions in the listener.[1] For this to occur, the listener's references of the past and thoughts of the future essentially stop. At this point of cessation, I surmise that music can be apprehended directly in the present moment. In essence, music is heard as it is and not filtered in our usual dualistic thinking, that is, music as the object with a subject listening to it. To understand this concept better, let us examine Messiaen's views on time and its perception.[2]

When considering Messiaen's views on time and eternity, we must look to the philosophical thought of Saint Thomas Aquinas (1225–74) and Henri Bergson (1859–1941). To start, Messiaen regards time and eternity as dualistic in nature, and that both time and eternity are needed to understand how duration is quantified. Time is linear in nature, with a before and an after on either side of a present moment. Eternity, however, is outside of time and, in Messiaen's and Aquinas' opinions, an attribute of God. In other words, eternity is a concept that the mind can understand on an intellectual level as evidence that God exists.[3]

Bergson likewise interprets time as dualistic, but he adds the dimension of space. Through the interpretive filter of Armand Cuvillier, Messiaen regards Bergsonian time in terms of "true duration" and "structured time" (see Table 1).

1. Ian Darbyshire, "Messiaen and the Representation of the Theological Illusion of Time," in *Messiaen's Language of Mystical Love*, ed. Siglind Bruhn (New York: Garland, 1998), 36.

2. In speaking of these techniques, I will not delve into Messiaen's religious symbolism nor his synesthesia.

3. Benitez, 270.

Table 2.1. Comparison of "true duration" and "structured time" based on the work of Henri Bergson and Armand Cuvillier.[4]

True duration	Structured time
Duration is concrete – evaluated by its relation to us *Duration is heterogeneous* – always changing *Duration is qualitative* – immeasurable *Duration is subjective* – within us	*Time is abstract* – an empty, static container *Time is homogeneous* – all parts are identical *Time is quantitative* – measurable *Time is objective* – outside of us

Messiaen's structured time appears as chronometrically oriented because it is an abstract concept with equally measurable parts that are independent of perception. One can view structured time and measure it with external tools such as a clock, but one will nevertheless experience chronometric time through one's subjectivity.[5] Although structured time is measured, it is still dualistic in nature, as it is a measured concept that is contained in a spatial container, separate from an object that is being perceived.

True duration appears to arise from an egocentric view of time. It is measured in relation to the mind's perceived length of chronometric duration. Specifically, time point A to time point B in one's awareness is always in a state of flux and dependent on a listener's memory of the past and anticipation of the future. Thus, true duration cannot be quantified because it is experienced in variable real-time. Thus, true duration cannot be measured absolutely because the resulting durational construct stems from a listener's subjective memories, moods, and other distractions.

4. This synoptic table is derived from Benitez, 270.

5. Ibid.

At this juncture, I want to stress the significance of subjectivity: if the passage of time is not subjective and oriented in a listener's perception, then time is experienced with no fluidity or, perhaps, there would be no concept of time at all. However, it appears that this is not the case, because if time is a static chronometric experience from the listener's viewpoint, then there would be no sayings like "time flies" or "that took forever." There would be no sense of "flow" or of being in "the zone," as they say in sports. Because this subjectivity and temporal fluidity appears to exist, our perception of time can be manipulated and, possibly, our dualistic sense of time can cease as well. In essence, we can experience the phenomenon of musical time.

That said, in the *Traité de rythme*, Messiaen explains further how musical time is experienced by a listener in his "three laws of experienced duration" (trois lois sur la durée vécue).[6]

1. *Sense of Present Duration. Law:* The more time is filled (with events), the shorter it seems to us – the more it is empty (of events), the longer it seems.
2. *Retrospective Appreciation of Past Time. Inverse laws:* The more time was full (of events), the longer it seems to us now – the more it was empty (of events), the shorter it seems to us now.
3. *Law of the Attack-Duration Rapport:* At equal duration, a brief sound followed by a silence seems longer than a prolonged sound.

6. *Traité de rythme*, 1: 23. English translation taken from Melody Baggech, "An English Translation of Olivier Messiaen's *Traité de rythme, de couleur, et d'ornithologie,* Volume 1" (DMA doc., University of Oklahoma, 1998), 32.

These laws are important because they map out a basis for understanding the perception of musical time. These laws were not only significant to Messiaen but also to composers that followed him.[7] Vincent P. Benitez sums up Messiaen's laws:

> In the first law, which deals with the present, the more events a time span contains, the shorter it will seem; conversely, the fewer events a time span contains, the longer it will seem. In the second law, which deals with the past, the inverse happens: the more events a time span contains, the longer it will appear, and the fewer events a time span contains, the shorter it will appear. According to Messiaen, memory plays a vital role in the appreciation of the second law through its reversal of the sense of speed associated with the first. A time span with few or no events lacks interest and therefore produces only a vague memory; it lacks interest for us. Accordingly, even if that time span is long chronometrically, it will be perceived as shorter than a chronometrically equivalent time span with many more events because it contracts in proportion to its relatively few memories. In contrast, the other time span expands in proportion to its more numerous memories.[8]

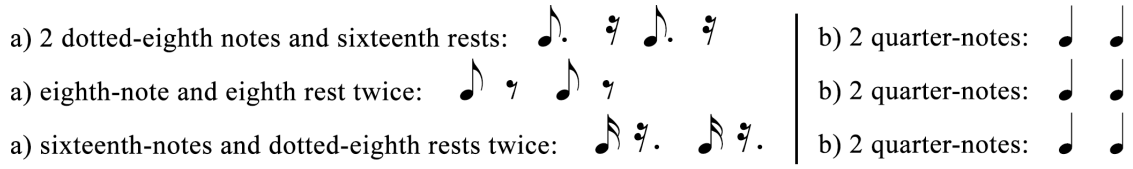
As Benitez notes, law one states that musical events in the present moment can make the listener experience time in a fluid manner. Law two shows how memory plays a role in the perception of time upon reflection. If one looks at the third law of Attack-Duration and the relationship of rests to notes, although the durations are chronometrically equal between the *a* and *b* sections, the examples in the *a* section will be perceived as being longer, because the silences are generally thought of as part of the preceding sonic event (see Example 2.1). This is due to the addition of rests within the same durations instead of two long notes. These silences become events that are heard and subsequently create two more musical events in the same period of time.[9] These added events could change a

7. Delaere, 31.

8. Benitez, 271.

9. Benitez, 272.

Example 2.1. Law of attack-duration relationships (loi des rapports attaque-durée).[10]



listener's perception of time in the present moment to feel shorter, and in one's memory, to feel longer than the actual passed chronometric time. If this is indeed how one perceives the examples above, and if the three laws work together to influence the perception of time passing, then, along with the first two laws, I surmise that a composer could manipulate a listener's experience of time.

In sum, the subjectivity and memory of the listener is important in perceiving the fluid nature of musical time. Messiaen's three laws of duration are significant because we have a model for the perception of time, and both Stockhausen and Grisey expand upon these ideas. This begs yet another question: What compositional techniques did Messiaen use to influence a listener's temporal perception? To answer this question, I turn to his "charm of impossibilities" and integral serial techniques in order to examine how he sought to influence the listener's sense of time and, perhaps, lead a listener to glimpse the eternal present.

"The Charm of Impossibilities"

To me, the "charm of impossibilities" is a creative aesthetic comprised of compositional tools that help get "notes on the page," especially in the realm of algorithmic composition typified by integral serialism. If we look at them, this

10. Baggech, 32.

compositional aesthetic consists of three parts: the modes of limited transposition, nonretrogradable rhythms, and symmetrical permutations. Each aspect inherently limits the possible outcomes of a musical aspect of Messiaen's compositions and, as Jean Marie Wu explains, when combined in a musical structure, they lead one to the "truth of eternity."[11]

To begin, because the modes of limited transposition are all examples of transpositionally symmetrical collectons, they have a restricted number of transpositions. If one thinks of mode 1, the whole-tone scale, this characteristic of restriction is rather obvious, since it has only one transposition before it repeats itself. Although this aspect of restriction typifies the modes of limited transposition, this is not to say that they are not full of scalar and harmonic colors. On the contrary, these scales just limit the possibilities of the notes and chords available. Because of these musical restrictions, Roberto Fabbi considers Messiaen's modes as evoking "the subtraction of a directional temporal dimension from harmonic phenomena."[12] When I think of this statement, it seemingly describes how Messiaen might create a feeling of stasis, because the limitations on content keep the perception of pitch and harmonic material to a minimum. These limitations would also have an effect on memory, as there are less musical events that get tracked mentally as a composition moves forward in time.

11. Jean Marie Wu, "Mystical Symbols of Faith: Olivier Messiaen's Charm of Impossibilities," in *Messiaen's Language of Mystical Love,* ed. Siglind Bruhn (New York: Garland, 1998), 112.

12. Roberto Fabbi, "Theological Implications of Restrictions in Messiaen's Compositional Processes," in *Messiaen's Language of Mystical Love*, ed. Siglind Bruhn (New York: Garland 1998), 59.

I feel that this same subtraction of directional dimensionality is further expanded in Messiaen's use of nonretrogradable rhythms. I would now like to consider two interpretations of his use.

According to Darbyshire, nonretrogradable rhythms are a representation of time itself, and these rhythmic palindromes influence the listener's normal sense of time. These rhythms present the listener with a sensation that time is fluid—moving forward and backward simultaneously.[13] Fabbi also states that the palindromic aspect of Messiaen's music is metaphysically necessary because he needs to overcome the forward motion of time.[14] My interpretation of these ideas is that, in addition to halting the forward direction of time, the palindromic aspect of the "charm of impossibilities" could inhibit the listener's ability to reflect on past musical events and hinder the anticipation of future ones due to lessening the mind's ability to grasp a pattern. What is more, statements from the above scholars seem to validate Kramer's assertion that musical time can be multiply-directed and nonlinear.[15] In my opinion, Messiaen sought to use the "charm of impossibilities" to bring the listener to the present moment.

Let us now examine Messiaen's symmetrical permutations, another important aspect of the "charm of impossibilities." This compositional device is used to develop serialized pitch and rhythmic materials for use in a composition. Messiaen employed this technique as a way to rearrange a serial group of ordered objects (e.g. chromatic series of

13. Darbyshire, 37.

14. Fabbi, 60.

15. Kramer, 46.

durations in *Chronochromie*). This reordering would obfuscate the underlying structure of the music and keep the listener from anticipating future events.

One must keep in mind that if one is rearranging more and more objects, then the number of permutational possibilities exponentially arises. For example, if one has four objects, there are 24 possible permutations. If one has 12 objects, one has 479,001,600 permutations before returning to the original series. If one were to create a composition that went through all of the permutations, it could be a very long time before the original series was restored.[16]

Because Messiaen wanted to limit the possibilities, he used symmetry in his permutations to reduce the number needed to return to the original series. Let us look at an example of a serial group that consists of four durations. Each has a base value of a sixteenth note, with a sixteenth note added to each later duration (see Example 2.2).[17]

Example 2.2. Extreme example of limited permutations.

Object Number Original Series	1 2 3 4
Object Number First Permutation	1 4 3 2
Object Number Original Series	1 2 3 4

16. Fabbi, 60.

17. Example 2.2 is derived from Fabbi, 60.

Looking at the durational rows in Example 2.2, notice that the first and third values are always the same, with the sixteenth and dotted-eighth notes in the same slot, whereas the second and fourth change places. Because there was no change in the first and third object slots, this symmetry reduced the number of possible permutations from twenty-four to just two. If this is done with larger groups of objects, the number of permutations can be drastically reduced with a return to the original series within a specified number of permutations that are determined by the composer.

The restriction of possible permutational outcomes of serial groups is comparable to the modes of limited transposition and nonretrogradable rhythms, and is practically imperceptible on the surface without analysis. To me, this imperceptibility should obscure a pattern in the composition, as Messiaen's "charm of impossibilities" work against the listener's memory.

As stated earlier, Messiaen is trying to reveal to the listener a glimpse of eternity or a timeless state by inhibiting the mind's ability to grasp or reflect upon the music through this compositional aesthetic."[18] The "charm of impossibilities" seem to act as an agent to circumvent time's forward motion, to work against linearity, and ultimately against memory. In my experience, the moment when music is apprehended without reflection is the moment when the experience of timelessness happens.

The "charm of impossibilities" was not the only trick up Messiaen's compositional sleeve. Serialism would be expanded beyond being an agent of pitch

18. Darbyshire, 36.

organization, used for other parameters such as rhythm, attack, durations, and dynamics as well.

Integral Serialism

When looking at Messiaen's serial practice, it is obvious that his techniques do not follow the classical dodecaphonic ones of Schoenberg and Webern. For me, integral serialism is an elegant way to realize a composition through algorithmic means, and Messiaen was one of the pioneers of this type of compositional process. His work with permutations and other devices provided a path for both Stockhausen and Grisey to pursue as they developed their own musical languages.

One temporal result of Messiaen's use of serialism, the modes of limited transposition, and nonretrogradable rhythms in his music is the presence of moment time. In *The Time of Music*, Kramer discusses nonlinearity, moments of stasis, and sections of music that are not related, seemingly not following a "logical" structure. These moments are self-contained units and can be placed anywhere in a compostition.[19] In essence, these charachteristics describe the musical effects of Messiaen's use of integral serialism in his compositions.

In *Mode de valeurs et d'intensités* (1949), Messiaen created an integral serial piece by serializing pitches, durations, and dynamic intensities as separate elements in three groups, as seen in Example 2.3.[20]

19. Kramer, 50.

20. Benitez, 268.

Example 2.3. Messiaen's modes and its three divisions from *Mode de valeurs et d'intensités.* [21]

There are three twelve-note groups, with each pitch having a different duration, dynamic marking, and, at times, articulation. Messiaen did not use serial techniques such as retrograde, inversion, or retrograde inversion for pitch materials, combined with intuitive compositional decisions, to propel the piece forward both rhythmically and structurally. Instead, Messiaen used a fan technique he developed in the 1940s that is related to his symmetrical permutations to reorder the notes in each group or mode.[22] In table 2.2 below, Robert Sherlaw Johnson shows how Messiaen reorders the first group at m. 24, from the first and last note moving towards the center of the row. Similarly, in m. 29, he reorders the second group with the specified note order (see Table 2.2).

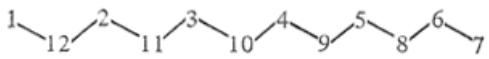
21. Olivier Messiaen, *Quatre Études de rythme: avec analyse du Compositeur*–with analysis by the composer (Paris: Durand, 2008), 10.

22. Benitez, 282–86.

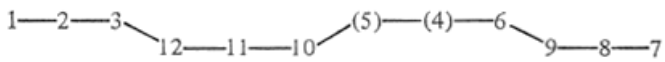
Table 2.2. Robert Sherlaw Johnson's graphic illustration of the note order in *Mode de valeurs.*[23]

Note Order in *Mode de valeurs*

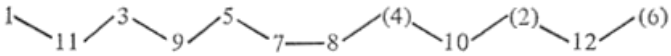
1. Bars 24-28 (Group I)



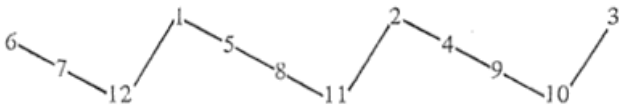
2. Bars 29-39 (Group II)



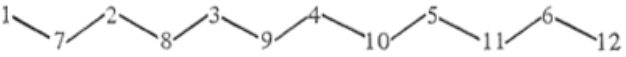
3. Bars 39-49 (Group II)



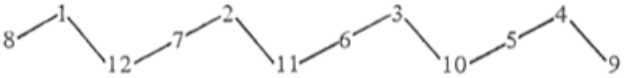
4. Bars 53-57 (Group I)



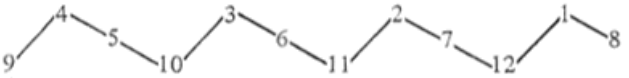
5. Bars 61-80 (Group III)



6. Bars 81-86 (Group I)



7. Bars 86-96 (Group II)



8. Bars 103-107 (Group I)

Darbyshire notes that the fan techniques listed above are used to limit the number of permutations possible in each note group. He also asserts that this reordering of notes

23. Robert Sherlaw Johnson, *Messiaen* (Berkeley and Los Angeles, CA: University of California Press, 1975), 108. Used with permission.

is "symbolic of the mind's eternal dominion over created time" and that "the complicated movements revealed are indicative of a transcendence beyond the limitations of matter, of time or space."[24] Although that statement seems a "little over the top" to me, one can see that fan techniques make for quicker work when creating a new note sequence to the original mode. Also evident in Johnson's table is Messiaen's permutational logic for the distribution of individual notes.

As a note of interest, *Mode de valeurs* appears to be a precursor to other pieces that emerge a few years later that are pointillistic in nature. For me, John Cage's *Music of Changes* (1951), Stockhausen's *Klavierstück I* (1952), Pierre Boulez's *Structures I* (1952), and *Mode de valeurs* are all melodically disjunct and do not feel goal-oriented. While these pieces move forward chronometrically, they lack a feeling of a metrical pulse, adding to the sense of discontinuity. Pieces like *Mode de valeurs* are a single static moment, with material that inherently plays against the listener's memory due to the random quality of the music.

If a listener experiences *Mode de valeurs* through the lens of Messiaen's three laws, then his or her perception of chronometric time should feel faster than the actual elapsed time, and slower upon reflection, due to the number of note events and the random nature of them unfolding over time. This alone would be interesting, but the random feeling of the events combined with the single timbre of the solo piano creates a fairly static, self-contained musical moment. I might conclude that this feeling of stasis through temporal manipulation is Messiaen's goal in *Mode de valeurs*, as this lack of

24. Darbyshire, 47.

direction and linearity is designed to evoke a sense of the eternal now or eternity, which is a common goal of Messiaen's music.[25]

Personally, I find moment time and stasis appealing in that they keep my attention fixed on the music in the present moment rather than thinking about how it will unfold, as linearity appears on the surface to be nonexistent. However, I do notice while listening for some time to compositions with static moments, such as *Mode de valeurs*, they tend to be less interesting to me, becoming more or less background noise, especially after multiple hearings. Essentially, I feel that static moments become a single piece of musical information.

As might be surmised, musical moments are not limited to just random sounding events but can be very dynamic. Although moments are successive chronometrically, they may or may not follow a linear logic in a composition, and are generally found in music of the last 100 years. Moreover, moments may or may not be related, are not goal-oriented, and follow each other without transitions. Furthermore, the aural positioning of moments while listening usually feels arbitrary. This discontinuity tends to feel static, as the music on the surface is not "going anywhere." However, this quality does not mean that there are no underlying structural designs governing a composition.[26]

Kramer notes that there are paradoxes in moment time because a listener cannot entirely separate linearity and nonlinearity, as moment time thwarts memory, and moments separate duration from content.[27] I find these paradoxes important, as Kramer's

25. Kramer, 55.

26. Ibid., 50.

27. Ibid., 219.

statement affirms Messiaen's views as to how memory can alter one's sense of time (as perceived in his law of retrospective appreciation of past time).

Let us turn our attention now to Messiaen's *Chronochromie* and explore how moment time functions in the piece. By considering his compositional techniques and three laws of experienced duration in relation to the work, I will show how various temporal designs embedded in the piece evoke the static nature of moment time.

Chronochromie and Moment Time

Kramer cites Messiaen's *Chronochromie* as an example of a work that is in moment time.[28] As stated earlier, moment time is nonlinear, full of discontinuity, and can be multiply-directed from temporal perspectives. Messiaen's use of moment time in his music shows a clear line of development in his music, from *L'Ascension* (1933) to *Chronochromie* (1959–60). Kramer points out that *L'Ascension* contains contrasting sections that are somewhat goal-oriented but exhibit aspects of moment time. However, a decade later, *Visions de L'Amen* (1943) contains sections that seem to be in moment time—especially in the fourth movement, when returning material feels less like a recapitulation and more like static moments. Continuing this trend, the *Turangalîla-Symphonie* (1946–48) is a work mostly in moment time, and, by 1960, *Chronochromie* is a work that is fully representative of it. [29]

Scored for full orchestra and numerous percussion instruments, *Chronochromie* has moments that range from a few seconds in the first movement, to longer moments

28. Kramer, 213–14.

29. There are works after *Chronochromie* in Messiaen's oeuvre that continue to display aspects of moment time, but not to the extent of this piece.

over a minute in length, and moments that encapsulate an entire movement. There are no traditional structural entities such as cadences, downbeats, or returns of sections, and the piece also makes use of a wide variety of textures and timbres.[30]

The work consists of seven movements: an "Introduction," "Strophes I and II," where each "Strophe" is followed by an "Antistrophe," an "Épôde," and a "Coda." The piece uses a number of Messiaen's compositional techniques throughout the piece. For instance, "Strophe I" is a single moment that uses a permutational scheme, birdsongs, and synesthetic color chords in cycles. Similar processes are also used to realize other movements as well.[31] It is also important to note that throughout the work, birdsong is a prominent voice, so to speak, that augments the temporal dimension of the work. Birdsong is thoroughly integrated with techniques derived from the "charm of impossibilities" to suspend time and bring a glimpse of eternity to the listener.[32]

Let us now turn to movements 1 and 6 from *Chronochromie* and consider how they work from temporal vantage points.[33] The "Introduction" (first movement) has numerous short moments: mm. 1–16, 17–19, 20–25, and so on. These moments have different moods and textures that follow one another with little or no time between them, thus hindering the mind's reaction to fully comprehend the preceding moment before

30. Kramer, 216.

31. Amy Bauer, (2016). "The Impossible Charm of Messiaen's *Chronochromie*," (University of California, Irvine: oa_harvester:1565002, 2016), 5. Accessed October 15, 2017, http://escholarship.org/uc/item/5xw0x3gc

32. Wu, 112.

33. Although *Chronochromie* uses permutations and other aspects of the charm of impossibilities, I am more interested in what happens temporally while listening to the piece versus Messiaen's underlying compositional techniques. Therefore, I will speculate on his temporal goals.

drawing the listener's attention to the next moment. If we use Messiaen's sense of present duration law, we can surmise that he was, in effect, slowing down the listener's perception of time, as the moment is nearly full of musical content. As Messiaen did not leave much time between moments, or even the other movements, there is no time to reflect upon what was heard, thus the retrospective inverse law does not come into effect. This structural trend continues with the next four movements that I consider to be designed to keep the listener from reflecting on the music. In my estimation, Messiaen's use of moment time and lack of space between movements in *Chronochromie* was designed to lead the listener to what I think is the goal of the piece, the "Épôde."

In the "Épôde," Messiaen changes the texture by using only upper strings and cello with each section divided (6 vn1, 6 vn2, 4 vla, 2 vcl) instead of the full orchestra. Whereas the other movements contained birdsong, this movement plays a cacophonous outburst of continuous birdcalls. In addition, Messiaen forgoes any other compositional techniques, opting to use only birdsong that separates this movement from the rest of the piece. This moment is four and a half minutes with a very small change of density in the middle that lasts a few seconds when the cacophony returns. Described by Amy Bauer as polymetric and free rhythmically, this movement uses birdcalls from 21 different species and discards permutations and color chords in order to drive the music (see Example 2.4).[34]

34. Bauer, 4–5.

Example 2.4. Messiaen, *Chronochromie*, "Épôde," mm. 32–33.[35]

35. ÉPÔDE (from CHRONOCHROMIE) by Olivier Messiaen. Copyright © 1963 (Renewed) by Éditions Musicales Alphonse Leduc, Paris. International Copyright Secured. All Rights Reserved. Used by Permission.

Example 2.4 (continued). Messiaen, *Chronochromie*, "Épôde," mm. 34–35.

The "Épôde" is not goal-oriented and sounds very static. The use of a strings-only texture and the discarding of permutational techniques and chord structures found in the other movements of *Chronochromie* focuses attention on these timbral and harmonic differences. The amount of aural information is overwhelming at times, and it is in this "moment" that Messiaen was trying to suspend time and give the listener a glimpse of eternity. The overload of sound should speed up the listener's perception of chronometric time and, perhaps, even destroy the feeling of time moving altogether.

I feel that this movement is the high point of *Chronochromie* for two reasons. First, the compositional techniques and timbre set this movement apart from the others. Second, the position of this movement is situated second to last and may hold a clue as to why it was placed there. Kramer notes that proportions within a work are a place to look for structural information when considering atonal and moment-time works.[36] The placement of the "Épôde" second from the end seems justified as the "Strophes" and "Antistrophes" would seem to belong together. In addition, the beginning might not be a good place to begin with a climax of sorts in a work such as this. My proposition is that Messiaen used the first five movements to manipulate the listener's sense of time before destroying it with a glimpse of the eternal. I also feel that Messiaen would not want to leave the listener in a state outside of time, so he essentially transports the listener back to the world with the last movement.

Were the moments in *Chronochromie* successful in manipulating and/or stopping time? When I initially listened to *Chronochromie* without the score, the "Épôde" stood

36. Kramer, 52.

out as completely different, and my sense of the music changed. I am not sure if my perception of time was stopped, but my sense of the flow of time was altered as I listened to the piece. As I now have engaged in multiple listenings of this work, my experience of the music has changed, and the discontinuity has become more linear as I have become more familiar with the piece. Such is the loss of the initial impact of a piece, but as we well know, after many hearings of a work of music, one can always find something new.

If I take my own experience and evaluate it with Kramer's ideas, the compositional use of moment time seems to be an effective way to manipulate time, in combination with material on a local level that changes one's perception of it. The pointillistic moments of *Mode de valeurs* and the aural cacophony of *Chronochromie* both had an effect on my perception of time, but we need to be reminded that each listener will have his or her own subjective view of time when listening to music.

As stated in the introduction, Messiaen's compositional practice appears to be a foundation upon which his students Stockhausen and Grisey built, growing as composers and advancing ideas about musical time. Messiaen developed strategies to manipulate time from his philosophical stance about experienced duration. He used the "charm of impossibilities," serialism, and moment time as springboards to compositional techniques in varying degrees in his music to lead listeners to a glimpse of eternity. These ideas and techniques set the stage for the exploration of our next composer, Karlheinz Stockhausen.

Chapter 3: Karlheinz Stockhausen,

Experiential Time, and Compositional Unity

Karlheinz Stockhausen was an influential composer of the mid-twentieth century, known especially for being a member of the Darmstadt School. As a student of Messiaen at the Paris Conservatoire in 1952, Stockhausen absorbed the composer's ideas about musical time and integral serialism.[1] While in France, he spent time with Pierre Boulez and Pierre Schaeffer, among others, studying musique concrète, which would lead to compositions and writings that would influence spectral composers such as Gérard Grisey.[2]

Stockhausen dedicated much effort to the contemplation and realization of his ideas related to musical time, as evidenced by the articles he wrote in the mid-1950s and early 1960s. In the article "Structure and Experiential Time" from 1955, he laid out his concept of "experiential time" that I feel is a direct elaboration of Messiaen's laws of experienced duration.[3] In the article "How Time Passes" from 1957, Stockhausen attempts to create a self-contained system where note durations and pitches are related and unified.[4] This system seems to be yet another way to get notes on the page, and I view this as a continued development of serialism. In "The Concept of Unity in Electronic Music" from 1962, Stockhausen looks at the "correlation of timbre, pitch,

1. Jonathan Harvey, *The Music of Stockhausen: An Introduction* (Berkeley, CA: University of California Press, 1975), 16.

2. Karl Heinrich Wörner, *Stockhausen; Life and Work*. ed. and trans. Bill Hopkins (University of California Press, 1973), 253.

3. Stockhausen, "Structure and Experiential Time," 64–65.

4. Stockhausen, "How Time Passes," 11.

intensity, and duration."[5] Moreover, he leads off with ideas that he viewed as important in electronic music versus instrumental composition. However, I suggest that Stockhausen was indeed thinking about such ideas in acoustic instrumental composition years earlier when he discusses unifying ideas related to his preparatory work for *Kontakte* (1958–60). To me, these ideas are important as they show not only continued movement away from traditional compositional techniques but also how these ideas expanded thinking of sound as a means to itself. Moreover, Stockhausen views these ideas as related to perception and temporality, in addition to electronic pieces (see Table 3.1).

Table 3.1. Stockhausen's ideas for composing electronic music as distinguished from instrumental music.[6]

1. The correlation of the coloristic, harmonic-melodic, and metric-rhythmic aspects of composition
2. The composition and de-composition of timbres
3. The characteristic differentiation among degrees of intensity
4. The ordered relationships between sound and noise[7]

Stockhausen's ideas would also resonate with spectral composers in the following decades. However, I deem that these ideas should be presented now, because having them in mind can give us a better understanding of his approach to musical time and the

5. Stockhausen, "Concepts of Unity," 39.

6. Ibid., 39–40.

7. Ibid., 39.

development of his compositional techniques. Accordingly, let us examine Stockhausen's views on "experiential time" and his quest to create a unified musical structure in "How Time Passes."

Experiential Time

The article "Structure and Experiential Time" sets the stage for how Stockhausen regards the experience of listening to music and the concept of the fluidity of musical time. The following quote sums up his view on the experience of listening to music:

> If we realise, at the end of a piece of music—quite irrespective of how long it lasted, whether it was played fast or slowly and whether there were very many or very few notes—that we have 'lost all sense of time', then we have in fact been experiencing time most strongly.[8]

Again, a familiar theme plays out in the quote—losing one's sense of time or experiencing timelessness while listening to music. I equate Stockhausen's idea of experiencing music "most strongly" as analogous to Messiaen's view of his listeners experiencing a glimpse of eternity. In both cases, chronometric time has been manipulated and perhaps destroyed for the listener. For me as a composer, the idea of such an ideal listening experience is fascinating. Both Messiaen and Stockhausen believed there is such an experiential state, and through music, both sought to create a means to lead the listener to such an experience.

Stockhausen breaks down the experience of listening to music as "experiential time," and believed that musical events, or "processes of alteration" that follow each other at varying speeds and density, dictate how such alterations are grasped by the mind.

8. Stockhausen, "Structure and Experiential Time," 65.

Such processes can happen whether events (alterations) do or do not change, or whether that change occurs quickly or slowly, no matter the density of said events. As Stockhausen explains his ideas, I am fascinated, but not surprised, as to how his view of experiential time resembles Messiaen's durational laws, and how memory governs temporal manipulation. Below is how Stockhausen describes experiential time:

> By experiential time we mean the following: when we hear a piece of music, processes of alteration follow each other at varying speeds; we have now more time to grasp alterations, now less. Accordingly, anything that is immediately repeated, or that we can recollect, is grasped more rapidly than what alters. We experience the passage of time in the intervals between alterations: when nothing alters at all, we lose our orientation in time.[9]

Stockhausen's statement clearly shows that his view of the perception and the subjective nature of time builds upon Messiaen's ideas. His view also suggests the presence of a conceptual container that consists of a number of elements in which music is apprehended as experiential time. Furthermore, Stockhausen feels that a listener's sense of time can be lost, in addition to the mind experiencing the passage of time. In my opinion, these ideas are also similar to the concepts of "true duration" and "structured time" of Bergson and Cuvillier explored in chapter 2, because of the subjective dual nature of Stockhausen's view of experiential time, in that, time exists both within the listener and separate from the listener.

Let us now turn to the various elements that comprise Stockhausen's notion of experiential time, beginning with "processes of alteration." This term describes musical events that happen successively. A process can be just about anything, as even a single

9. Stockhausen, "Structure and Experiential Time," 64.

note has a beginning and an ending. It is thus a process of sound, with the change being silence. Furthermore, silence is also an alteration and should be viewed as such. These alterations naturally have "durations," and a duration is the chronometric length of a process that is comprised of sound objects and/or silence. When two alterations occur successively, the time between each alteration is called the "interval of entry."[10]

The descriptive properties of the processes of alterations are quantifiable, since they can be measured outside of the listening experience and are not subjective. Events that either happen or do not happen can be measured. Furthermore, the sounds, or lack thereof, can be analyzed and explained in terms of their acoustical properties and chronometric duration. However, the next set of terms that Stockhausen uses moves from the quantitative to the qualitative. As sounds are inherently empty events without a listener, it takes a listener to react to, or to place a mental value or construct to these processes.[11]

Stockhausen discusses the experience of alterations. For example, the "degree of alteration" is the listener's perception in the amount of change between different processes. Processes that repeat have low degrees of alteration, and a surprise has the highest degree of one. Similarly, time structures are linked to the degree of alteration. They are variable alterations that have a structure and are experienced qualitatively via mental concepts, such as repetition and surprises.

10. Stockhausen, "Structure and Experiential Time," 64.

11. Ibid.

In what appears to be an analogue to Messiaen's laws of experienced duration, Stockhausen explained that experiential time is dependent on the "density of alteration." If the music is full of events that grab the listener's attention via surprises, time passes more quickly, whereas repetitive music is perceived more slowly. Stockhausen continues to suggest that the listener has to be surprised in order for the trick of alteration to grab the listener's attention. However, if contrasting alterations come at a pace where the listener begins to expect contrasts, surprises, or disjunct sections of music, then the experience of the above-mentioned types of alterations simply become a batch of musical information, much like repetition, and the mind will ultimately lose interest.[12]

Next, Stockhausen explains what constitutes a "degree of information":

> The degree of information is thus greatest when at every moment of a musical flow the momentum of surprise (in the sense we have described) is greatest: the music constantly has 'something to say.' But this means that the experiential time is in a state of flux, constantly and unexpectedly altering.[13]

This quote is important to me because it directly points to a relationship between the music and the listener. It appears that various degrees of information can keep the listener's perception of time in flux and, perhaps, more connected to the music. Not surprisingly, Stockhausen then explains how memory and the amount of time a listener has to grasp and reflect upon past events between alterations makes the passage of time feel slower or longer, in similar language to Messiaen's laws of experienced duration. It is apparent that Stockhausen learned much from his teacher, while expanding upon Messiaen's ideas.

12. Stockhausen, "Structure and Experiential Time," 64.

13. Ibid., 64.

I believe the concepts of "density of alteration" and "degree of information" are powerful tools that a composer can use to manipulate the listener's temporal experience. If the listener's experience of time is constantly in flux as Stockhausen describes, it should be possible for a composer to alter the experience of time to a point where music becomes timeless. This is the point of perception I believe Stockhausen was describing when he stated that music was felt most strongly. It is also the point where I believe the music is apprehended directly without reflection, and thus the listener is, in effect, in a timeless state.

As I mentioned earlier, Stockhausen's ideas of experiential time appear to break down into two areas of thought: (1) descriptions of alteration types that can be heard and quantifiably be viewed in the score, and (2) types whose alterations and processes affect the listener's perception of musical time. Just about anything in a composition that is heard (or even plain silence) can manipulate the listener's temporal perception. Stockhausen also addressed the mind's ability to remember and reflect upon what was heard opposite new material while listening to a piece. The more nonpredictable surprises (alterations) that occur give the listener less time for reflection, thus time feels faster. On the other hand, if there are fewer events or if the alterations become predictable, the slower time goes.[14] To prove these points, Stockhausen used the second movement of Anton Webern's String Quartet, op. 28 (1937–38) as a model of how chronometric time is manipulated.

14. Stockhausen, "Structure and Experiential Time," 65.

As the second movement contains only quarter notes, Stockhausen observed that the alterations come in the form of pitch, articulation, density, and tempo. In two examples from this analysis, Stockhausen explained that the alterations which change at a constant rate of speed affected (that is, slowed down) the perception of chronometric time. Next, he stated that when the tempo of these alterations increased, perceived time remained constant.[15] One can conclude that Messiaen's durational laws are evident in Stockhausen's analysis. Stockhausen notes, moreover, that temporal perception can remain constant in addition to being experienced as flexible. I find this important, because here is yet another temporal experience for the listener and creative tool for the composer.

We can see how "Structure and Experiential Time" elaborates Messiaen's temporal views. Musical time can be fluid and difficult to perceive, due to the structure and content of music that constantly plays with the mind's expectations and memory. At the conclusion of this article, Stockhausen sums up these concepts in that, each and every aspect of music "forms a whole, a unity. The multiplicity is welded together: it becomes time experienced through sound: it becomes music."[16] This includes not only what is heard but also the listener appearing to be a part of the whole, a necessary part of the experience that is music. Continuing the trend of unification in "How Time Passes," Stockhausen contemplates a musical unity of pitch and rhythm.

15. Stockhausen, "Structure and Experiential Time," 68.

16. Ibid., 75.

"How Time Passes" and Serialism

An often-cited article by Stockhausen is "How Time Passes." Curtis Roads states that Stockhausen is trying to build "a unified view of the relationship between the various timescales of musical structure."[17] Stockhausen felt compelled to unify the inherent timescales of pitch and timbre with rhythm into a single system, due to the limitations of traditional serial techniques that were fairly rigid in their implementation, and also because integral serialist compositions were pointillistic and static—a moment unto itself.[18] A result of Stockhausen's work was the creation of a chromatic scale of durations that was used in works such as *Gruppen*, *Zeitmasse*, and *Klavierstuck XI*.[19]

"How Time Passes" begins with this statement: "Music consists of order relationships in time; this presupposes that one has a conception of such time."[20] I find this statement somewhat amusing in that, yes, I would hope that most listeners understand that music unfolds in a linear fashion. However, this set-up seems justified because Stockhausen defines alterations of different lengths as *phases* and states how these phases are then compared by the mind. The listener perceives whether they are periodic or not, how long they are, as well as the proportions of the perceived alterations. Stockhausen takes this measurement further and says that these "acoustically-perceptible

17. Curtis Roads, *Microsound* (Cambridge, MA: The MIT Press, 2001), 73.

18. Christopher K. Koenigsberg, "Karlheinz Stockhausen's New Morphology of Musical Time," Paper, (Oakland, CA: Mills College, 1991), 24, accessed October 11, 2018, https://edoc.site/karlheinz-stockhausen39s-new-morphology-of-musical-time-pdf-free.html.

19. Stockhausen, How Time Passes," 40.

20. Ibid., 10.

phases" fall into two categories, durations and pitches. Low frequency oscillations below the human-hearing threshold become durations, and the frequencies above the point of discernment of oscillations by the human ear become pitch.[21]

The above ideas form the basis of Stockhausen's chromatic scales of duration. After what seems to be much discussion about unifying pitch and rhythm, he eventually uses the 12th root of two (as used in equal temperament tuning) to derive note lengths for each pitch based on a fundamental note duration and metronome marking. An example of this is shown below with a whole note equaling sixty beats per minute (see Table 3.2).

Table 3.2. A chromatic scale of durations.[22]

Chromatic number	Chromatic duration (x 12th root of 2)	Metronome markings
13 (A octave)	0.500 sec.	MM = 120
12 (G sharp)	0.530 sec.	MM = 113.3
11 (G)	0.561 sec.	MM =106.9
10 (F sharp)	0.597 sec.	MM= 100.9
9 (F)	0.630 sec.	MM = 95.2
8 (E)	0.667 sec.	MM = 89.9
7 (D sharp)	0.707 sec.	MM = 84.9
6 (D)	0.749 sec.	MM =80.1
5 (C sharp)	0.794 sec.	MM =75.6
4 (C)	0.841 sec.	MM = 71.4
3 (B)	0.891 sec.	MM = 67.3
2 (A sharp)	0.944 sec.	MM = 63.6
1 (A)	1 sec. sec.	MM = 60

21. Stockhausen, "How Time Passes," 10–11.

22 This table is taken from Koenigsberg, 39.

Stockhausen is thorough in his explanation of how he came to create this chromatic scale of durations. However, there are critiques of his line of thinking, as Roads points out: "A main lesson of Stockhausen's 1957 essay 'How Time Passes' is precisely how awkward it can be to apply a proportional series developed for one time scale (e.g., pitch periods) to another time scale (e.g., note durations). (Specifically, it does not make much sense to transpose the intervallic relations of the chromatic scale into the domain of note durations)."[23]

I think that Roads conveys a good critique of Stockhausen's work in order to create a unified pitch and rhythmic structure. Although the above table gives the composer the notes and durations to use in a composition, Stockhausen would apply other pre-compositional techniques in order to realize a composition in works such as *Gruppen* (using the chromatic scale of durations).[24] However, when I heard the realization of one in *Kontakte* (1958–60), it made for an interesting surprise, and I could feel my own sense of time being manipulated by the effect.

At this juncture, one might ask about the relationship to musical time with Stockhausen's work in attempting to unify pitch and rhythm. Clearly, he seemed preoccupied with time and the relationship between pitch and duration, and was determined to find a way to move beyond integral serialism. To me, these compositional tools combined with other serial strategies were vehicles of expression for the composer and were a means to give the listener a new set of aural surprises. Further, I feel that these

23. Roads, 331.

24. Sarah Ann Overholt, "Karlheinz Stockhausen's Spatial Theories: Analyses of *Gruppen für drei Orchester* and *Oktophonie, Electronische Musik vom Dienstag aus Licht*" (PhD diss., University of California, Santa Barbara, 2006), 36–50.

surprises, or lack thereof, were used to manipulate a listener's temporal experience. Stockhausen would continue to unify controlling parameters of a composition and manipulate time using electronics. Moreover, he would combine them with acoustic instruments to give the listener a new set of aural experiences. In the end, Stockhausen, like Messiaen, would use moment time, with the techniques described above, to create his work, *Kontakte*.

Moment Time and *Kontakte*

In the 1960s Stockhausen used moment form in a number of his works. As Kramer has pointed out in *The Time of Music*, Stockhausen derived his approach to moment form from a number of composers, but was influenced most by Stravinsky and Messiaen.[25] As described above, moment form is made up of individual moments and is not goal-directed. Every moment is a self-contained unit that can stand on its own in a composition, where preceding and following moments are unrelated. This seems very evident in *Kontakte*.

This aesthetic is of prime importance, since I consider it to be a way to unlock timelessness in the present moment. From my perspective, I tend to experience timelessness when I let a composition unfold, versus actively analyzing it. Individual moments and moment-form structures affect my personal listening experience because, generally, analyzing such a piece and grasping the complexity of the underlying structure on the first few hearings can be difficult—at least for me. This difficulty is personally liberating, because I let go of my preconceived notions and just experience the piece.

25. Kramer, 201.

Furthermore, when listening to a new composition, I am more apt to listen with attention. If the composition grabs my attention, and if the work has something new to say to me as a listener, said piece will usually get a few hearings if it reaches me on either an intellectual and/or emotional level. One such composition is Stockhausen's *Kontakte*. It intrigues me from an aural standpoint, as it uses both an electronically-realized tape and acoustic instruments to perform it. In addition, the tape realization is quadrophonic, adding a spatial element to the music as well.[26] These components were enough for me to find the piece interesting, but after doing research for this thesis, I found that *Kontakte* also fell in line with the subject of musical time.

Stockhausen's work in unifying parameters of music did not stop with his chromatic scales of duration. In his article "The Concept of Unity in Electronic Music," Stockhausen continued to reveal his quest to unify music under a single-controlling aesthetic, similar to that of his durational scales, as explained by the following statement: "In the preparatory work for my composition *Kontakte*, I found, for the first time, ways to bring all properties under a single control. I deduced that all differences of acoustic perception can be traced to differences in the temporal structure of sound waves."[27]

It appears that Stockhausen was exploring the realm of electroacoustic music and subtractive synthesis in this article, as he discussed how he generated the electronic sounds heard in *Kontakte* with oscillators, filters, and tape machines.[28] This mode of

26. In researching this paper, I used a stereo version of this piece. It does approximate the ideal performance but a binaurally encoded or multichannel versions of *Kontakte* will be released in the future, so that one can experience the performance as it was intended.

27. Stockhausen, "The Concept of Unity," 40.

28. Ibid., 42–47.

composition recalls his use of similar techniques in earlier works such as *Klangstudie I* (1952).[29] This is significant because he seems to use "sound" (however compiled) for its own sake as a stand-alone musical entity in a composition. Moreover, he held to the thought that composition is no more than a "temporal ordering of pulses."[30] Stockhausen further concluded that "any drastic separation between acoustics and music is no longer meaningful where composition includes the synthesis of the sound waves themselves."[31] This thought appears to be the driving force behind *Kontakte*, in addition to temporal manipulation. For me, Stockhausen created an ideal vehicle in the early days of electronic music, which could influence the listener so that he or she could experience music most strongly through the sheer uniqueness of sound and moment form.

Before I delve into the underlying structure of *Kontakte* and its temporal implications, I would like to make a few general observations about the piece. First, the sheer amount of work and time it took to create the electronically-realized sounds in the late 1950s is mind-boggling. Stockhausen created the voices in *Kontakte* in such a way that they foreshadow the multitimbral synthesis that would appear later. Currently, computers and software now make it convenient to create complex sounds that can evolve over time, instead of being created with analog tape, oscillators, and filters that were then layered to tape. In addition, setting up and realizing a chromatic scale of

29. Tae Hong Park, *Introduction to Digital Signal Processing: Computer Musically Speaking* (World Scientific, Singapore, 2010), 331.

30. Stockhausen, "The Concept of Unity," 40–41.

31. Ibid., 47.

durations that can be controlled in real-time is also an easy matter. It is no wonder that it took two years with an assistant for Stockhausen to complete *Kontakte*.[32]

Another aspect I find interesting is how I perceive the roles that silence and stasis play in the composition. In the moments that are fairly static, both seem to be a background upon which the separate voices interact or do not interact. These states of sound help focus attention on the alterations currently heard versus the reflection of past events. In a sense, I find them reminiscent of a vessel in which one can anticipate the next event filling the space. Silence and stasis also give the mind time for Messiaen's retrospective appreciation of past time to come into effect.

Kontakte and Its Structure

The title *Kontakte* refers to "contacts" between the sound families of wood, metal, and skin percussion, along with the piano. In addition, it also refers to contact between the spatial elements in the tape realization, and contact with moments. The effect is striking in numerous instances, as the separate voices seem to swirl about in space, make "contact" with each other, and continue on their way in that space.[33]

As stated earlier, *Kontakte* is in moment form. A breakdown of moment types in *Kontakte* by Ed Chang using terminology from Stockhausen's article "Moment Form" (1963) is of interest because of the insight into the structure of moments (and submoments) found in *Kontakte* (see Table 3.3).[34] As we can see, moments are divided

32. Roads, 73.

33. Chang.

34. Ibid.

Table 3.3. Ed Chang's moment types in *Kontakte*.[35]

Static or Dynamic	***Gestalt or Structure***	***Example of Moment type***
Static State (holding steady pitch ranges, tempo and/or dynamic)	Gestalt (individual, indivisible)	6 note chord/arpeggio (even rhythm) with all sounds, similar timbre, and dynamic. Static sound density
	Structure (divisible)	Repetition of different textures (pitch set, cluster, etc...). Static intensity and lengths of the individual parts
	Combination	One layer of repeating clusters with 1 layer made from a sustained pitch. Static intensity.
Dynamic Process (changing from one extreme to another, glissando, crescendi, etc..., usually more than 1 property)	Gestalt	Rising glissando Dynamically moving through space
	Structure	Repetitions of points and clusters. Dynamically decreasing intensity of each cluster group
	Combination	Repeating sequence of 2 kinds of percussive accents using a narrow bandwidth of sound in even rhythm Dynamically slowing down and fading away

into states that are either static or dynamic, and each state is then reduced to give an example of how moments are constructed from a timbral and structural point of view, in addition to being a combination of various realizations.[36] With this understanding, I find it easier to consider the individual moments and how they work on a temporal level based on the degree of information of the alterations that make up the moments of *Kontakte.*

35. This table is taken from Chang.

36. Chang.

Conceptually, *Kontakte* was designed to have 18 structures divided into 6 parts each, but due to time constraints, or due to perhaps Stockhausen not finding the opening to his satisfaction, there are only 16 found in the score, which are clearly labeled with Roman numerals at the top.[37] In the overall design, moments can be broken down into three structural types, from larger to smaller: moment-groups, moments, and partial moments. The moment-groups can consist of and contain more than one of the 16 structures that are similar with common elements. Moments are usually contained in a structure that is perceived as an individual entity or voice. Partial-moments exist as variations of an individual moment due to a parameter change involving timbre or pitch; however, they are still perceived as part of a larger moment. In effect, there appears to be both macro- and micro-moments throughout this piece.[38] But how does Stockhausen come to realize these moments or groups of moments? Serialism, of course!

Stockhausen uses a 6 x 6 matrix to control various parameters in moments that determine what changes, the degree of change, and the parameter that changes. These matrices control parameters, such as the spatiality of the electronic track, instrumentation, tempo, dynamics, form, and register. There is also a separate matrix used for the change of notes in the pitched instruments. Clearly, Stockhausen continues to use serial techniques as a way to realize this composition, but he seems to control more of the qualitative aspects of the music than in previous pieces.[39] To use an analogy, the 6 x 6

37. John Rea, "On Stockhausen's *Kontakte* (1959–60) for Tape, Piano and Percussion: A Lecture/Analysis by John Rea given at the University of Toronto, March 1968," *Circuit* 192 (2009): 77–86.

38. Chang.

39. Ibid.

matrices seem to function like presets on a digital synthesizer because they function like knobs that control filtering, low frequency oscillators, ADSR envelopes, etc. Unlike synthesizers, Stockhausen had to realize the sounds/moments onto tape to hear them, instead of having instant feedback from a modern synthesizer as one changes various parameters.

Stockhausen took two years to complete this work. It was well planned, and his sketches clearly show his line of thinking. They contain matrices that show the serial aspects already in mind, in addition to the overall parameters of the form in structures and moments. Moreover, the finished score labels the divisions between the structures (moment-groups) and subgroups. Luckily, this labeling also corresponds with their entrance timings and makes *Kontakte* ideal for a temporal analysis. Accordingly, let us now turn to how Stockhausen manipulates temporal perception using his view of experiential time in conjunction with Messiaen's three laws of duration as models for analysis.

Kontakte and Temporal Manipulation

As I have argued, the subjectivity of the listener is a significant determining factor in how musical time is experienced. Anecdotally, this subjectivity was apparent from comments by the audience at the premiere of *Kontakte* regarding how it was perceived, such as (and I paraphrase for brevity): "the length was too long," "it should have been shorter," "I felt saturated by too much sound," and "I'd rather listen to something I hate than to electronic music."[40] Again, the listener is the sole judge of his or her temporal

40. Rea, 79–80.

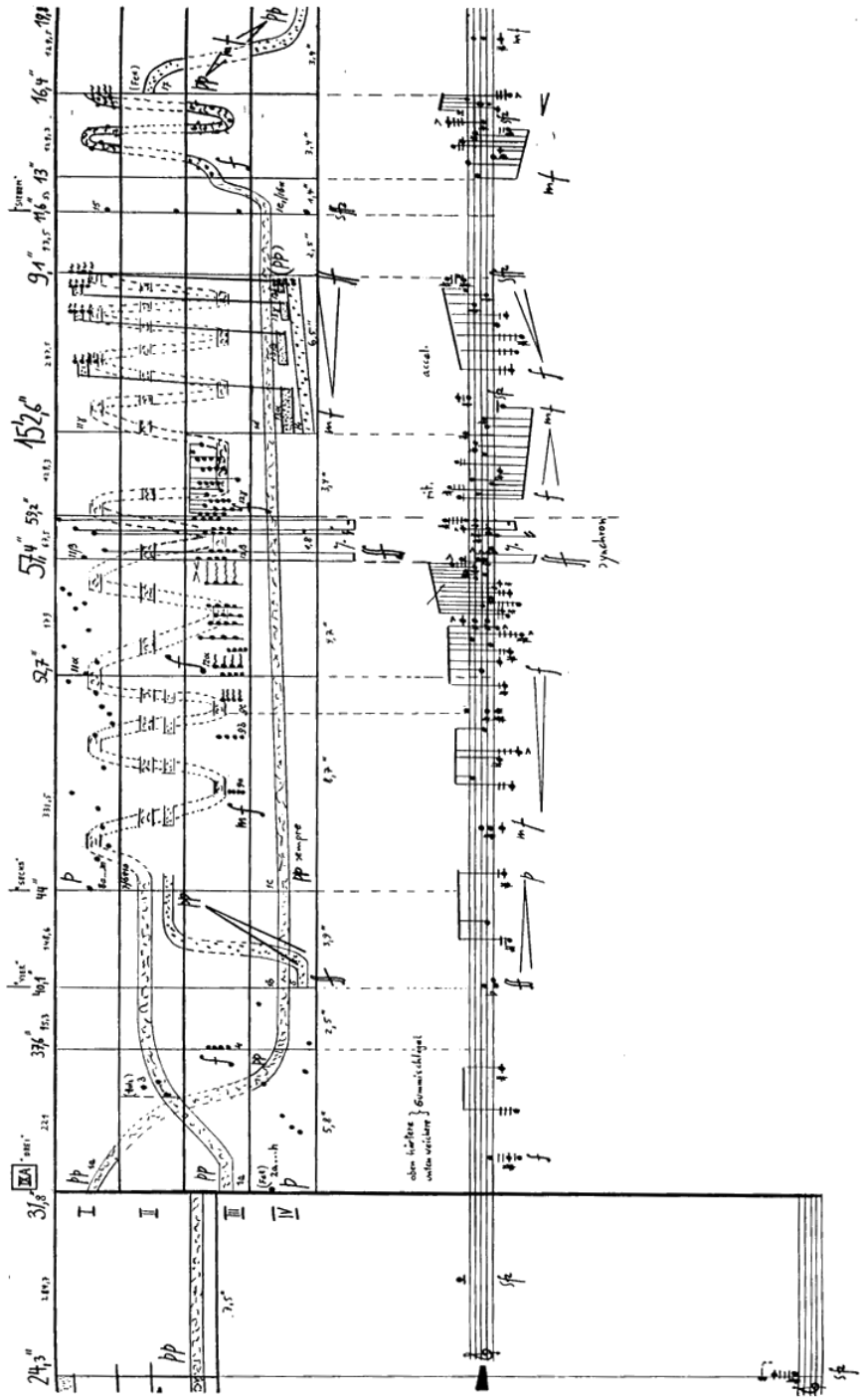
experience, and I will not pretend to say how an individual should experience music. However, using both Messiaen's and Stockhausen's viewpoints, I believe that one can surmise how a generic listener might perceive the length of *Kontakte*. As there are 16 structures within a total duration of almost 35 minutes, a complete temporal analysis of the piece would, in my opinion, become redundant and time consuming. Therefore, I will examine Structures IX and X, as they follow each other chronometrically, and because I feel that they are representative of the work and of Stockhausen's ideas of experiential time.

The score is in a graphical nonstandard notation for the electronics at the top of the page (see Example 3.1).[41] The percussion and the piano are unmetered, and are found below the graphic realization of the electronics. A chronometric timeline is at the top of the page that is not to scale; it is free and seems to denote important events. The structures are labeled with Roman numerals and substructures, with Latin alphabet designations (A–F in this structure) above the notation in the timeline. One should notice the Roman numerals below the start of this structure, as they designate the speaker from which the electronic sounds will emanate. In addition, the speaker placement numerals will be found in various locations throughout the piece, but will be labeled in Roman numerals and commented upon in and above the score.

If we look at the graphic notation in the electronic realization, there are clear differences in the way Stockhausen depicts events. Individual dots are staccato notes, and

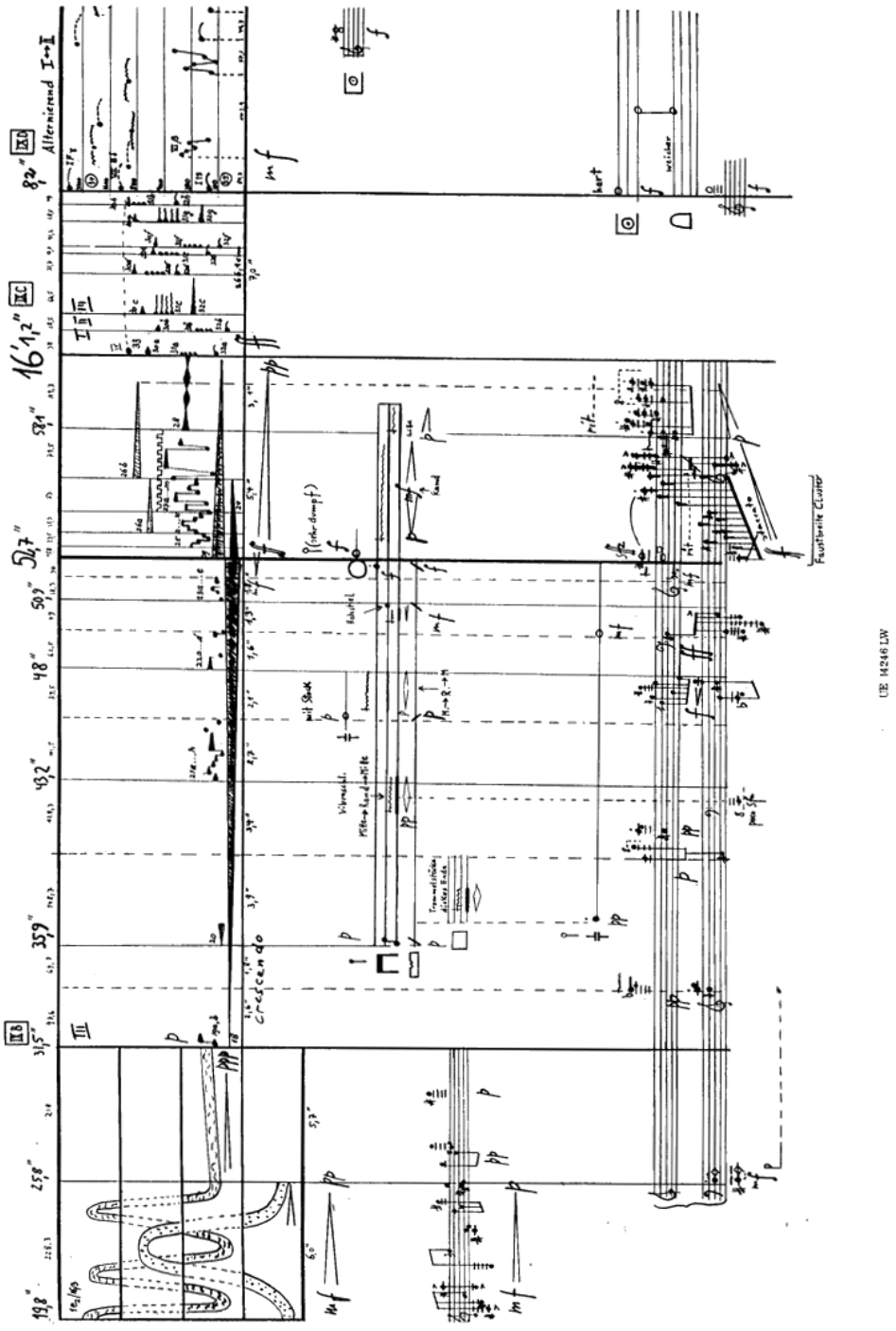
41. Karlheinz Stockhausen, *Kontakte Nr. 12 für elektronische Klänge, Klavier und Schlagzeug* (Vienna: Universal Edition, 1968), 10.

Example 3.1. Stockhausen, *Kontakte*, "Structure IX A."[42]



42. Used with permission by the Stockhausen-Stiftung für Musik.

Example 3.1 continued. Stockhausen, *Kontakte*, “Structure IX B-D.”



the longer nontapering lines are typically nebulous sounds that are evolving timbrally, and their trajectory in space can easily be traced in the graphics. In substructure IX-B, emanating from speaker III, the filled-in tapered lines that look like crescendo dynamic markings are usually moments that are static but increase or decrease in amplitude depending upon the thickness of the taper. At 15:56 in the score, there are a number of other notations with dots and connecting lines. These are changes in pitch. This score interpretation could go on for another two pages, but this should be sufficient information to make sense of the forthcoming discussion.

Structure IX lasts two minutes and thirty seconds and follows a fairly static section with sparse alterations that occur in Structure VIII. I surmise that the feeling of chronometric time was being perceived as longer in duration and perhaps slowing at the end of that structure. When the first substructure begins in Structure IX, the dynamic of the music is quiet, and there is a group of four moments. The interval of entry between the percussion and staccato voice slowly increases over a background of wandering atmospheric voices. This increase of density, in addition to the increase in the spatial aspect, continues up until 15:09 when the density lessens. If we use Messiaen's present duration law, chronometric time should appear to speed up as the density increases. This pattern appears to return to finish Substructure A. As there are no great surprises (as there have been similar patterns in the previous structures), one could experience time the same way as clock time, or quicker due to the density of alterations.

Substructure IX-B follows a path of stasis to one of a dense interval of entries. This density also consists of a change in timbre in the individual moments (voices) that become less dense over time, suggesting an arch. Substructures C and D are quite short.

There is also a change in the density of voices in these moments that feel static and pointillistic. As they are short with less density, I surmise that the perceived time that passed was slower than clock time.

Substructure IX E is also short (11 seconds), but starts out with a bang. There appears to be 10 separate voices in the notation that begin loud and become soft at the end. This cacophony sounds like a truck hitting a dumpster, with all of its contents crashing down until it settled. I think that "kontakt" was made here. In any event, contrasting Substructure IX-E is IX-F. Starting pianissimo, it contains sustained voices similar to earlier moments that are moved about spatially, crescendoing to fortissimo. This should make time feel slower at first, with an increasing speed to the end, which leads to Structure X.

In Structure IX, Stockhausen uses a wide range of temporally contrasting devices that feel fluid. There are many changes in the degree and density of the alterations, in addition to timbral and spatial changes in various moments and partial moments. This gives the listener much to hear and at times not much time to reflect in the individual moments. Overall, I believe that Structure IX would make the listener's perception of time shorter than it was chronometrically.

Although moments theoretically can lead into any other moment in a piece such as this, Substructure IX-F leads to Structure X in a natural way. This, I am sure, is not an accident or a random scheme. Perhaps a number of parameters in Stockhausen's matrices were used as a starting point for the next section. Moreover, it appears that the voice that crescendos and carries into the next structure is too dramatic, as it becomes a "temporal

transformation," as described in his article, "The Concept of Unity in Electronic Music" (Example X).[43]

Structure X is self-contained because it is not divided into substructures (it is four minutes and thirty seconds long). As noted, a voice in the previous structure is carried over seamlessly into this one, subsequently transformed by an oscillating fall in pitch. During this fall, it is apparent that this "voice" is made up of individual pulses that become farther apart as the pitch is lowered and eventually becomes a pulse itself. This temporal transformation is related to Stockhausen's work unifying pitch and rhythm, as discussed earlier (see Example 3.2).

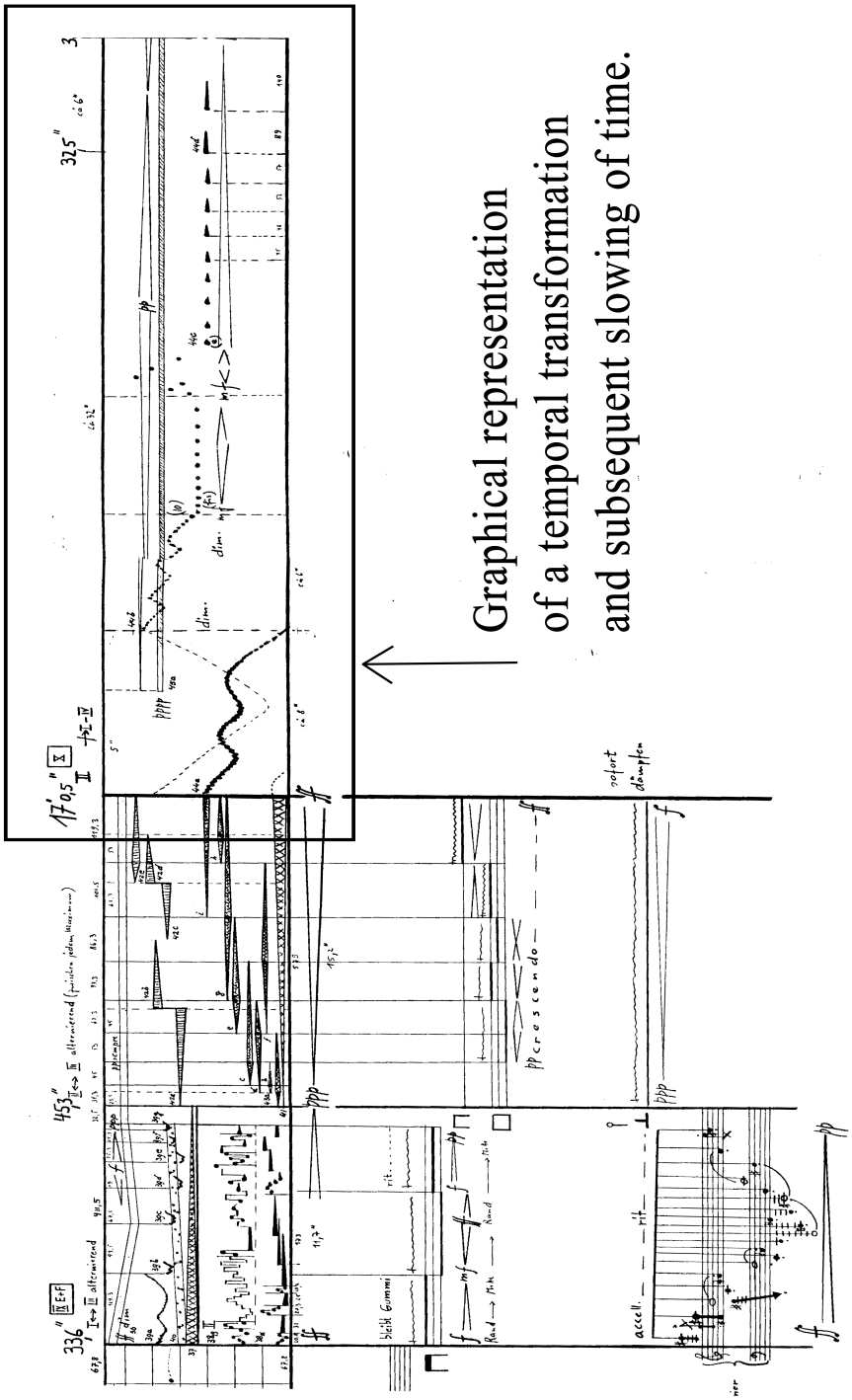
This transformation becomes noticeable when we hear the properties of a sound as a single entity versus separate events, such as pitch, timbre, duration, and intensity.[44] This effect is striking because as the pitch lowers, the individual pulses become rhythmic elements and slow down into a steady state. This steady state is then interrupted, and the pitch of the pulse lowers, gets farther apart, and fades out until there is a feeling that time stops. This alteration is very well placed, because it sets up the stasis that follows.

Following this initial opening, the moment is reduced to various spatialized drones that fade in and out and are mostly static for the rest of the section. But there are random sounding alterations in the piano, percussion, and droning electronic voices that evolve over time. For me, this stasis makes time feel longer chronometrically, as there are less events. However, the interspersed alterations make it difficult to reflect

43. Stockhausen, "The Concept of Unity," 47.

44. Rea, 84.

Example 3.2. Stockhausen, *Kontakte*, Structure X A: An example of a temporal transformation.[45]



45. Stockhausen, *Kontakte Nr. 12,* 19–20. Used with permission by the Stockhausen-Stiftung für Musik.

upon the preceding events. Toward the end of the section, more alterations appear at an increasing rate, thus compressing time. This change in the frequency of the alterations subsides, and there is less density in the texture, which I interpret as a slowing of perceived time that leads into Structure XI.

Overall, I see Structure X as static, and perceived time should feel slower, especially after the opening temporal transformation. When I reflect upon these two sections together, I conclude that Stockhausen was indeed using his compositional techniques for temporal manipulation. I do not believe it is a coincidence that he placed the two observed sections next to one another. As evidenced by his detailed sketch and score, it would seem that nothing was left to chance. His use of various timbres, alteration densities, and temporal manipulation throughout the work keep the listener from reflection, thus keeping the attention of the listener on the music, so to speak.

If we use the temporal views of both Messiaen and Stockhausen, the density and the degrees of alterations in Section IX should compress the perceived length of chronometric duration for the listener. The temporal transformation is also precisely placed because, timbrally, it appears to be derived from the previous section and sets up Section X, especially, to feel timeless until the density of alteration increases. I deduce that this attention-grabbing is designed to make the listener not reflect upon the music.

If we recall Stockhausen's degree of information (musical events that keep a listener surprised and interested in the music, versus too many or too few events that cause the listener to lose interest), it would appear that he kept the music in a state of temporal flux, just enough to keep the listener engaged in order to help him or her to experience the music more strongly. Accordingly, I would like to bring Messiaen back

into this consideration of Stockhausen's *Kontakte*. As stated earlier, I equate Stockhausen's experiential time with Messiaen's laws of experienced duration. In addition, I equate Stockhausen's view of a listener experiencing music with that of Messiaen's view of a listener being led to a glimpse of eternity. Both, in their own way, sought to alter time through temporal manipulation. Both used serial techniques and moment time as a means to do so. But did they succeed? In a sense, yes. Messiaen's "Épode" and Stockhausen's *Kontakte* did have something new to say: for me, I did experience a sense of temporal manipulation and a sense of time being stopped.

Does moment time have the same effect upon other listeners? While describing the effect upon musical time while listening to *Kontakte* versus a piece by Beethoven, John Rea stated: "This quality of being enraptured—almost hypnotized—does not occur in Beethoven… In this respect, I believe moments do succeed; they virtually destroy progressive or developing time, as it is known in classical music."[46] I concur! We will now see if Gerard Grisey has anything "new to say" regarding musical time.

46. Rea, 85.

Chapter 4: Grisey, Process, and the Listener

Gérard Grisey (1946–98) was not only a student of Messiaen but of Stockhausen as well. He was associated with the French spectralist school, which emerged in the 1970s.[1] Just as Messiaen and Stockhausen believed that serialism was too restrictive, the spectralists would also move from integral serialism to embrace sound for its own sake. Because of this departure, they would develop new strategies using the inherent physical qualities of sound as building blocks for compositions.

Reminiscent of Messiaen's and Stockhausen's development of moment time and integral serialism, the spectralists would create new ways to put notes on the page. However, they would not only embrace but also would continue to expand upon Messiaen's and Stockhausen's ideas of temporality, music perception, and the nature of sound itself. The combination of these views with the development of spectral techniques is of great interest to me because Grisey not only describes how he gets his notes on the page but also discusses the effects of his techniques on a listener's temporal perception. In essence, this is the focus of this chapter. To lay the groundwork for this focus, I will consider basics concepts of spectralism in what follows.

Spectral Development

The development of spectral music can be traced back to the writings of a number of earlier composers, who discussed the nature of sound itself, such as, Henry Cowell, in his *New Musical Resources* (1930); Paul Hindemith, in *The Craft of Musical*

1. Julian Anderson, "A Provisional History of Spectral Music," *Contemporary Music Review* 19, pt. 2 (2000): 15.

Composition (1942); and Messiaen, in the *Technique de mon language musical* (1944).[2] These composers examined harmonic spectra (overtone series) and used them as part of their approach to pitch organization.[3] Notably, Messiaen influenced French spectralist composers, as many of them were his students at the Paris Conservatoire. One such influence is illustrated in the *Technique*, where Messiaen discusses chords derived from natural resonance, which originates in the harmonic series.[4] Pieces like *Couleurs de la Cité Céleste* (1963) would use the timbral structure of a trombone pedal tone as harmonic material for the piece.[5] Messiaen would further influence the French spectralists when Grisey and others formed a new music ensemble called *l'Itinéraire* in 1973. With Messiaen's encouragement, these composers set out to create their own musical language through the use of all aspects inherent in the nature of sound.[6]

Another group of composers that influenced the spectralists were from the Darmstadt School, of which Stockhausen was a member (in 1972, Grisey studied with Stockhausen.)[7] Like Messiaen's music, a number of Stockhausen's works have spectral elements in them, such as *Stimmung* (1967), which uses a harmonic spectrum, and

2. Henry Cowell, *New Musical Resources* (New York and London: Alfred A. Knopf, 1930); Paul Hindemith, *The Craft of Musical Composition* (Mainz: Schott, 1984); and Olivier Messiaen, *The Technique of My Musical Language*, trans. John Satterfield, 2 vols. (Paris: Alphonse Leduc, 1944/1956).

3. Anderson, 8–10.

4. Messiaen, *Technique*, 50.

5 Ching-Yi Wang, "Spectral Music and Gérard Grisey's *Vortex Temporum I and II.*" (PhD diss., University of California, Davis, 2012), 67.

6. Pierre Albert Castanet, "Gérard Grisey and the Foliation of Time," trans. Joshua Fineberg, *Contemporary Music Review* 19, pt. 3 (2000):15

7. Castanet, 47.

Mantra (1970), which uses ring modulation as one of its features.[8] In addition, it is easy to see the influence of Stockhausen's electronic pieces, as many techniques developed by electroacoustic composers would find their way into the spectralist's oeuvre.

Although Messiaen and Stockhausen influenced the spectral composers early on, technology was another force that helped spur the development of this type of music. One important technological achievement was the development in 1965 of the Fast Fourier Transform (FFT) algorithm that analyzes digitally sampled sounds in real time.[9] Two years later, commercial spectral analysis units were being produced that enabled one to easily view a representation of a sound's frequencies (see Figure 4.1).[10]

As composers could now "see" the physical properties of sound, they would use this detailed information as material for use in compositions. In essence, sound itself, with all of its inherent components, such as noise, attack, formants, frequency (vs. notes) could be analyzed and used as an element in their compositions. If we look deeper into the spectralist's compositional toolkit, it is evident that not only were spectra used but also numerous concepts from electronic sound synthesis and effect technology became part of this aesthetic.[11]

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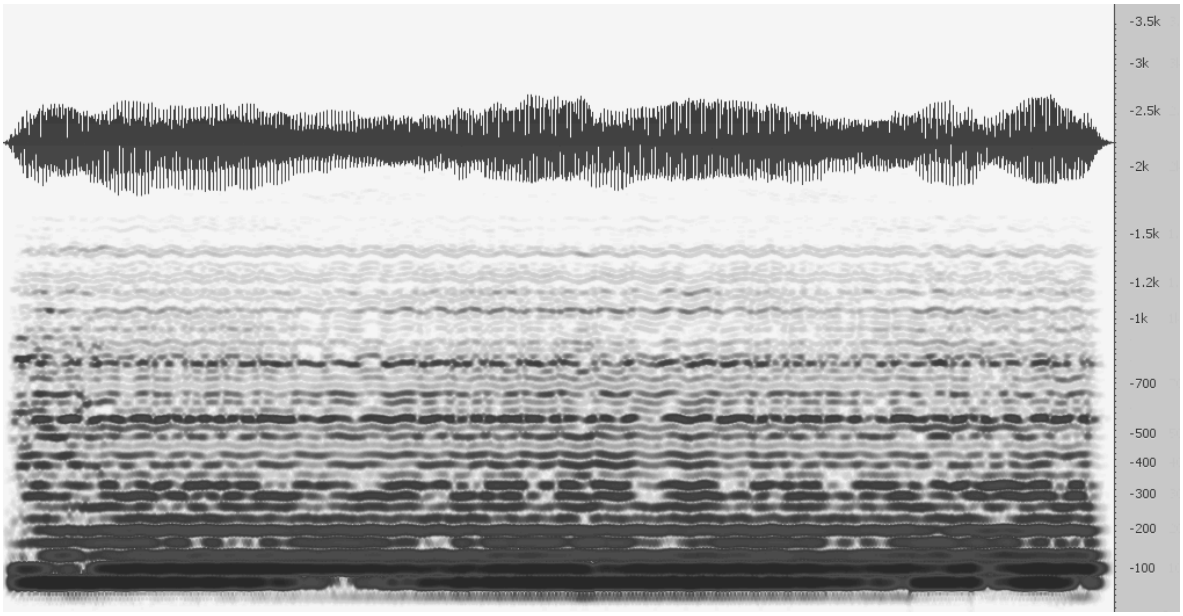
8. Anderson, 13.

9. The Fast Fourier Transform (FFT) algorithm digitally samples an audio signal and divides it into its frequency components, which are single sinusoidal oscillations at distinct frequencies that have their own amplitude.

10. Joe Deery, "The 'Real' History of Real-Time Spectrum Analyzers: A 50-Year Trip Down Memory Lane," *Sound and Vibration* (January, 2007), 55, accessed May 28, 2018. http://www.sandv.com/downloads/0701deer.pdf.

11. Grisey, "*Tempus Ex Machina*," 259.

Figure 4.1. A fast Fourier transform (FFT) of the note C1 from a double bass.[12]



These tools, like Messiaen's and Stockhausen's devices to get notes on the page, are just that—tools. As Julian Anderson points out, in defining a "spectral composer," the composers themselves found the term misleading, as spectra and other electroacoustic devices are only superficial features in their works.[13] Furthermore, they sought to remove the distinctions of pitch, dynamics, intensity, and duration (e.g. *Mode de valeurs*). In doing so, they blurred the line between harmony and timbre.

12. This is a spectral view of the note C1 (32.703 Hz) played with a bow on a double bass with a C extension. The top of the picture shows the waveform, while the lower portion shows the harmonic spectra of the note. The darker the color, the louder the amplitude for a given overtone frequency, which is shown on the right side of the figure. As you can see, the fundamental is not that visible, whereas the second partial at 65.406 Hz is stronger in amplitude. The amplitudes of various partials that are filtered through an instrument's body are known as formants and give an instrument its unique timbre. This example was created by recording my double bass with the computer program Izotope RX for spectral analysis.

13. Anderson, 7–8.

One more important point of note. Comparable to Messiaen and Stockhausen, the spectralists were concerned with the predictability of their music, and the subsequent temporal and psychological effects on the listener.[14] The concern of how a listener perceives and reacts to the temporality of music appears to be just as important as sound in the development of the spectral compositional process.

Let us now examine a number of spectral compositional techniques, as this will supply background to the discussion of Grisey's writings and compositional processes. This is important because the techniques are not separate from the structure and form of a composition. In addition, I consider that his writings on temporal matters are better understood with these concepts in mind.

Spectral Concepts

When I was first introduced to spectral music, I was excited because the sounds were very new to my ears. After gaining an understanding of the fundamentals of spectral composition, some of the mystery of this style was dispelled, and I was able to discriminate between a number of the techniques as they occurred in real time. Although these sounds were a departure from tonal composition, and from traditional and integral serial techniques, spectral music is deeply rooted in sound itself. To me, these newer technical innovations are similar in importance to the abandonment of tonality and form of the previous generation of composers. However, just as important as their innovations were, the spectralists' view of sound itself was just as important as the techniques they developed.

14. Anderson, 8.

While being interviewed about the term spectralism, Grisey replies that he found the term spectralism limiting in its definition, because (as will become evident) spectralism is more than the sound component that the name implies. He also notes that spectralism is more of an approach to composition and "not a system like serial music or even tonal music." Furthermore, Grisey considers sounds "not as dead objects that you can easily and arbitrarily permutate in all directions, but as being like living objects with a birth, lifetime and death."[15]

It is striking that Grisey seems to point to both Messiaen's and Stockhausen's approaches to serialism and implies that they lacked vitality. Grisey's view of music being alive, versus artificial (or dead), is an important theme, because he views sound as an organic living thing with a life cycle. In my opinion, a cycle implies the passage of time and could be construed as somewhat linear. As Grisey said, dead objects can be permutated in all directions, but the process of life has an organic trajectory. This attitude resonates with me, in that, sound, as well as music, can interact with each other not as objects, but as living entities. But how do the spectralists breathe life into their music? Sound itself is a building block upon which some compositions are founded.

If we recall the *son-pedale* played by the trombone in Messiaen's *Couleurs de la Cité Céleste*, it is an object upon which the timbre of various passages is transformed, through frequencies that are either inside or outside of the trombone note's harmonic spectra.[16] The spectralists would further refine this technique and combine it with

15. David Bündler, "Gérard Grisey," self-published interview, March, 1996, last modified December 16, 2001, accessed May 29, 2018. http://www.angelfire.com/music2/davidbundler/grisey.html.

16. Wang, 67.

Stockhausen's approaches to electronic synthesis techniques in order to bring their compositions to life. But as Grisey states, spectralism as a genre is more than just an extension of the overtone series as the name might imply. In consequence, let us examine their compositional processes to see what other elements are present in the spectralist oeuvre.[17]

One such element is the concept of frequencies (Hz) versus notes or pitches. As is known, sounds made in nature are not tempered like the twelve-note chromatic scale of Western music. The spectralists use the overtone series (partials) as harmonic and timbral structures in their compositions. Partials are derived from a fundamental frequency that is multiplied by whole numbers, with the first partial being the fundamental frequency (f_1). That said, if a sound object consists of frequencies that are natural whole number partials, it is said to be in "harmonicity." If an object contains frequencies outside of harmonicity, then it is in a state of "inharmonicity."[18]

Because the frequencies of the partials are dependent upon the register in which they occur and are not tempered, the spectralists developed a microtonal system of 24 notes (quarter tones) for use in their compositions. In order to notate frequencies for instrumental players, they used a modified standard notational system to approximate the actual frequency the composer wanted, which has continued to evolve since its inception. However, computers and synthesizers can play at predefined frequencies with more

17. The information presented below is found in a number of sources. However, the journal *Contemporary Music Review* published a volume that is an excellent introduction to spectral music. See *Contemporary Music Review* 19, pt.2 (2000).

18. François Rose, "Introduction to the Pitch Organization of French Spectral Music," *Perspectives of New Music* 34, no. 2 (Summer 1996): 8–9.

accuracy.[19] With the understanding of how spectra are derived, how do these composers use spectra in their compositions?

To answer this question, one technique the spectralists used is called instrumental synthesis, which is derived from additive synthesis. In essence, a composer can build a sound object using the partials from a given spectrum, in addition to inherent nonharmonic sounds, like noise and transients from a naturally occurring source. For example, if we recall the analysis of the double bass note C1 from the FFT shown above, a representation of that note can be created using other instruments to play the partial's frequencies at the correct amplitude. What is more, it may even sound like the original instrument.[20]

Instrumental synthesis is not used to replicate sounds only; rather, spectra can be used to distort the replication of a sound and even create new sounds through instrumental synthesis (or electronic synthesis). For instance, composers can rearrange the amplitude of various partials to create different formants. They can invert, compress, or expand a harmonic spectrum's frequencies using various schemes. Furthermore, there are also techniques that are derived from artificial sound synthesis. Various filtering methods, such as amplitude, frequency, and ring modulation that inhibit, enhance, or change frequencies, are used as a means to manipulate timbre.[21]

19. Joshua Fineberg, "Guide to the Basic Concepts and Techniques of Spectral Music," *Contemporary Music Review* 19, pt. 2 (2000): 82–84.

20. Fineberg, 85–92.

21. Rose, 16–19.

In spectralism, the notion of the distinctness of harmony and timbre is blurred. In a sense, timbre becomes harmony, and the two are not separable objects. These timbral objects can be used to create harmonic and melodic content. In addition, timbres can be used as reservoirs of sound that give a composition a timbral/harmonic structure. They can be grasped by the listener and aid in the coherence of a piece. Once established, these reservoirs of sound can be manipulated, distorted, and juxtaposed in a multitude of ways.[22]

Again, I have touched upon the basics in discussing the ways in which sound can be manipulated. But as has been the case in the previous two chapters, these are just new ways that spectral composers get the notes onto the page. As with the compositional schemes of Messiaen and Stockhausen, the spectralists were creating new sounds for the listener, and these sounds should have a similar effect on a listener's sense of time, as they should be aural surprises. However, frequency and timbre are not the only aspects of spectralism—their music also moves through time as well.

Movement Concepts

So far, I have discussed spectral harmonic/timbral techniques as static entities that exist as concepts—not yet put onto the page or into a computer sequencer. In this section, I will discuss the ways in which the spectralists make their music come alive temporally, and various concepts of how their music can evolve over time.

If we look back to Messiaen's work, he used what is called additive rhythm. Instead of using a meter that defines its subdivisions, he used a constant value as a basis

22. Fineberg, 98–99.

for an event's length.[23] This way of notating music results in the quantification of musical time. In contrast, spectralists employed symbolic notation for their music, which is a flexible system, in which the overall temporal structure can seem consistent even if tempo changes occur, which helps minimize the renotation of musical passages.[24]

The spectralists likewise use accelerations and decelerations in processes that are based on a logarithmic curve, due to the idea that the feeling of an exponentially altering tempo change is more convincing and pleasing to the listener than a linear one. But notating tempo changes from a curve is somewhat difficult and even harder to change if a composer wants a different rate of change. As one can imagine, these logarithmic curves can be useful to add interest to a process. (Spectralists love processes!) In addition to being structural, process is a force to create movement. As mentioned earlier, moving from harmonicity to inharmonicity is one process. In addition, the transformation of one spectrum of sound into another is likewise a process. All told, these are evolutionary types of processes that are perceptible on the surface over long periods of time.

On both short and long time scales, the smooth movement from one musical state to a goal state is a process. There can also be many states of transformation between the starting point and the goal. This type of process is called interpolation, which is "data-driven" and can consist of all musical factors, such as tempo, frequencies, and rhythm. The movement can be linear, use curves, or add or remove data to achieve a desired result. One artifact from interpolation are the transformations that occur between the goal

23. Fineberg, 104.

24. Ibid., 105.

points, which, according to Fineberg, is where the surprises and discoveries of new sounds can originate, giving the listener something to mentally grasp.[25] However, too much of one thing, as we know, can become predictable.

The spectralists wanted to limit the predictability of their music. If the listener hears processes moving from one state to another that is similar, then that ends the surprise of that sound, and, as we have learned, surprise keeps the listener engaged. Furthermore, spectralists present sound objects in different perspectives that distort these objects while cohering with the overall spectral material. Through such techniques, spectralists not only smooth or disrupt processes but also use processes within processes, have processes complete other processes, or have multiple layers of processes governing movement between states. It seems endless, but again, this movement from one state to another is where surprises are revealed.[26]

What do these process strategies do? In a word, they limit the directionality of processes. Unlike moment time and form, spectralism tends to be more goal-oriented. The breaking up of the straight line of linearity obfuscates the goal and keeps the listener engaged, and engagement is one of Grisey's concerns. In his reflections on musical time, Grisey draws attention to some of the inner mechanics of temporal manipulation via rhythm, duration, process, and perception.

25. Fineberg, 108.

26. Ibid., 109.

Grisey's Reflections on Musical Time

"*Tempus ex Machina*: A Composer's Reflections on Musical Time" is an important explanation of Grisey's temporal thoughts.[27] In his article, Grisey discusses the role of the listener's perception, memory, and internal sense of time, as well as relationships between the composer, performer, and listener. Just as important though, he creates a model that describes processes and the possible effects on the listener. Notably, Grisey states that the most salient aspect of the article is the "absolute relativity of temporal perception, which has become a function of the quality of the sound objects and the difference between successive objects."[28] This statement, and the information contained in the article, shows the continued expansion of Messiaen's and Stockhausen's views on musical time and its perception.

The article discusses three representations of time: (1) a quantitative aspect called the "skeleton of time," (2) a qualitative aspect called the "flesh of time," and (3) a perceptual aspect called the "skin of time."[29] The first two aspects are composer-driven (e.g., compositional process and form), whereas the skin of time examines how the listener perceives and remembers events in a composition. This third aspect is important to me because he discusses with a fair amount of detail how a listener perceives music. Furthermore, he delivers what I feel is valuable insight into how a composer might

27. Grisey, "*Tempus Ex Machina*," 239–75.

28. Ibid., 239.

29. Ibid., 257–72.

counteract the erosion of the listener's memory over time.[30] Let us examine these three aspects, starting with the foundation—the "skeleton of time."

Quantitative Reasonings

In discussing the skeleton of time, Grisey states that the temporal unit of measurement a composer uses for sound organization is divided into rhythm and duration. Rhythm is perceived by its relationship to meter and pulse. Duration, on the other hand, is perceived as being related to events that just occurred. These thoughts appear to be similar to Messiaen's use of duration in his approach to integral serialism, where isolated sonic events are grasped in relation to previous ones. As is evident, Grisey is thinking about the perceptual acuity of the listener.[31]

Continuing with this thought, Grisey critiques Messiaen, Stockhausen, and others on the listener's perception of their use of underlying temporal structures, which often obfuscates patterns and pulse. He believes that composers may be overestimating the perceptual skill of listeners to perceive such structures after a composition has concluded. In addition, he notes that those who are able to discern these structures are specialists "who read the score."[32] In any case, this point and others lead up to what I find as most important—Grisey's "scale of complexity." He describes it in the following manner:

> In place of the arbitrary and generally dualistic categories which have been used in an attempt to classify durations: short/long, ternary/binary, rational/irrational values, symmetry/asymmetry, I substitute a scale of complexity – no doubt

30. Wang, 53.

31. Grisey, "*Tempus Ex Machina*," 239–40.

32. Ibid., 242.

equally arbitrary – but which has the advantage of reverting to the phenomena of musical time as they are perceived and allowing a continuity to be grasped.[33]

The scale of complexity explains the perception of durational events. It moves from ordered to disordered events, from predictable events to unpredictable ones. Grisey notes that this information is not to be an all-encompassing linear map, but dependent upon the musical space in which the events reside (see Table 4.1).

Table 4.1. Grisey's scale of complexity based on his table.[34]

Periodic	Maximum Predictability	Order
Continuous-dynamic a. continuous acceleration b. continuous deceleration	average predictability	to
Discontinuous-dynamic a. acceleration or deceleration by stages or by elision b. statistical acceleration or deceleration	light predictability	
Statistical complete redivision, unpredictability of durations, maximum discontinuity	zero predictability	Disorder
Smooth rhythmic silence		Outlier

Grisey offers composers a map that clearly echoes Messiaen's and Stockhausen's ideas. As is evident from a cursory glance, the predictability column falls under the realm of perception. And as argued in earlier chapters, perception and predictability are important in how time is manipulated and perceived. Therefore, let us examine the

33. Grisey, "*Tempus Ex Machina*," 243.

34. Ibid., 244.

complexity scale to glean perceptual and temporal information, in addition to how it relates to and expands upon Messiaen's and Stockhausen's views.

Periodic events are understood to be not simple processes, nor structures in a hierarchal system such as meter, but events that lead to expectation. Grisey makes light of how composers in the digital domain (sequencers) fight against repetitiveness to breathe life into their compositions by some form of fluctuation, because something too perfectly periodic becomes stale. Likewise, he contrasts the removal of periodicity in serial music (harmonic or rhythmic) with the periodicity of minimalism. In essence, he believes that serial music is "haunting," and that minimalism is the reemergence of a "repressed object." Grisey feels that the periodicity in minimalism and in African music can lead to a state of trance and even destroy time. In short, this seems to be a statement that contradicts some of Messiaen's designs to achieve the same goal through obfuscation of patterns. But then again, as seen in the above quote, Grisey notes that there is a duality in the categories of duration as events, either periodic or aperiodic. He likewise finds that the power of redundancy helps the listener's memory and can create a place of stasis within a musical structure.[35]

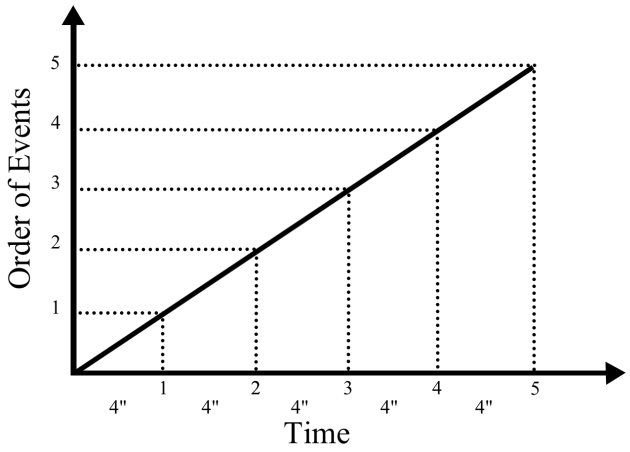
I find that periodic events are structural resting points where forward motion ceases. However, too much time in stasis can let the listener's mind wander, echoing Stockhausen's belief that a listener can get bored. One example that comes to mind is a vamp in a song. If it goes on too long, it seems like something is wrong. On the other hand, if it is too short, is sounds like a mistake. But if it is just the right length, and in a

35. Grisey, "*Tempus Ex Machina*," 247–49.

good context, a vamp can be a solid resting place in a composition's structure before "moving on."

Periodicity is only a tool, and one that can lead to expectation. In "*Tempus Ex Machina*," Grisey depicts periodicity and linear processes using a graph as a visual representation that shows a 1:1 relationship of events to time (see Figure 4.2). In the next section, Grisey describes how to move away from periodicity to keep the listener engaged.

Figure 4.2. A visual representation of periodic events and linear processes based on Grisey's figure.[36]



Grisey spends much time on the continuous-dynamic area of his scale of complexity. It contains two aspects, continuous acceleration and deceleration, which are expressed as logarithmic curves. He expresses the reasoning behind these curves using a modified Webener/Fechner law that describes the perception of durations in the quote below:

36. Figures 4.2 through 4.5 have been reformatted from Grisey's original handwritten figures as depicted in Grisey, "*Tempus Ex Machina*," 248.

$S = k \log E$

> Where S is the sensation (or the psychological dimension), E is the excitation (or the physical dimension) and k is a constant value which conditions the relationship between an augmentation of S and a given augmentation of E.
>
> Sensation therefore varies roughly as the logarithm of excitation.
>
> As every musician has been able to see for himself, to maintain an equivalent sensation of difference whatever the duration, one must have a longer difference between long durations than between short durations. In addition, the spontaneous acceleration of a musician is always of the logarithmic type.[37]

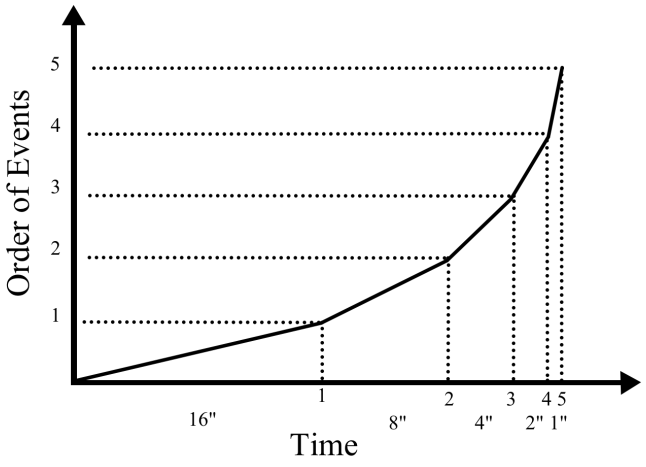
Upon examination, it seems to be a valid argument that a logarithmic speeding up and slowing down feels more natural than a linear and more predictable ordering of events while moving away from periodicity (see Figure 4.3). Grisey further explains that logarithmic curves are a way to control the speed and psychological tension of processes as the events become less periodic.[38] But what is the effect of this tension and its dual state-periodicity?

Grisey explains how acceleration and deceleration of durations distorts the listener's temporal experience. He notes that the first and longest sounds heard in a piece are remembered with the most clarity. As acceleration happens, the events the mind has grasped onto blur in one's memory, and the ability to recall such information fades. As acceleration increases, the listener is engaged with the material and is "propelled forward" in the process to a goal that is not apparent yet. Grisey states that "the arrow of

37. Grisey, "*Tempus Ex Machina*," 247.

38. Ibid.

Figure 4.3. A visual representation of a geometric logarithmic acceleration.[39]



his [the listener] own biological time and that of musical time, added together, cause a complete loss of memory."[40]

Deceleration has the opposite effect. Shorter events are remembered earliest and also act as a "rebalancing of forgetfulness" as musical time is "turned in the opposite direction." Importantly, this "biological time" (versus musical time moving in two directions, forward and backward) seems to represent an internal temporal experience that can be disrupted. Grisey's understanding of this experience shows that this rebalancing can create an oscillation between the perception of time moving faster or slower. In other words, this is an elaboration of Messiaen's laws of experienced duration. In Grisey's case, events that increase in speed require less time to process and remember. Events that slow down over time give the listener more time to reflect on past events, as well as anticipate future ones. However, what I find most intriguing is that he believes

39. Note the decrease of time by 1/2 per event of events to time. This curve is reformatted from the Grisey original. Grisey, "*Tempus Ex Machina*," 248.

40. Grisey, "*Tempus Ex Machina*," 249.

that this oscillation can leave "the listener in a sort of state of *temporal suspension*."[41] This seems to be another way to suspend time for the listener that is outside of stasis and complete cacophony.

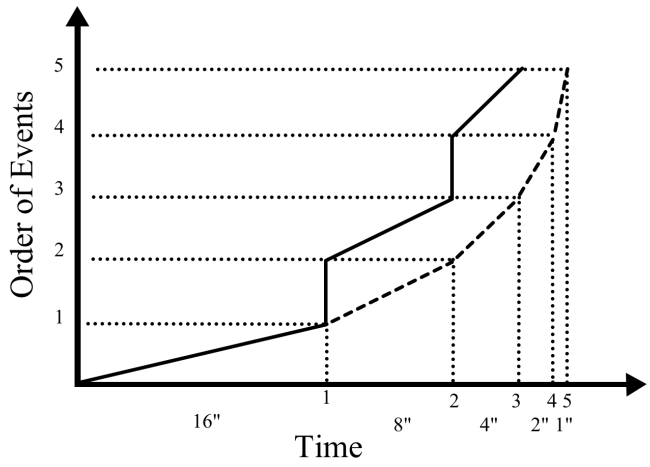
Grisey continues to contemplate whether the oscillations between faster and slower durations, and biological time, keep the listener in a suspended temporal state. However, he does affirm that acceleration causes vertigo. If we remember the concept of duality, then there must be a slowing at some point as a reference for acceleration. In any case, Grisey believes that acceleration makes the listener lose sense of the length of chronometric duration, and in essence, destroys absolute time as understood by Messiaen.[42] This oscillation between acceleration and deceleration can become a predictable object or process that becomes periodic. It can also, as Grisey has alluded to, cause an uneasiness in the listener due to a disruption in one's biological time. To avoid this pitfall, Grisey further explains how to obfuscate the directionality of a process.

The discontinuous-dynamic aspect of the scale seeks to make periodicity and logarithmic acceleration/deceleration less predictable and noticeable. Since processes, as well as form, have durations, how does a composer create interest in a process that seems to be moving from points 1 to 5? Grisey describes two ways to break up a logarithmic curve. First, he describes creating discontinuity by omitting a section of a curve and jumping to a state that was to happen later in a given temporal span. For example, in Figure 4.4, there is a process that moves from states 1 to 5. But when point 1 is supposed

41. Grisey, "*Tempus Ex Machina*," 248.

42. Ibid., 249–52.

Figure 4.4. A visual representation of acceleration by elision.[43]



to occur, the process jumps to point 2, and the process continues to point 3. The same thing happens when point 3 is reached and state 4 is bypassed as well. In essence, there is a discontinuity that creates a temporal and aural compression of the process.[44]

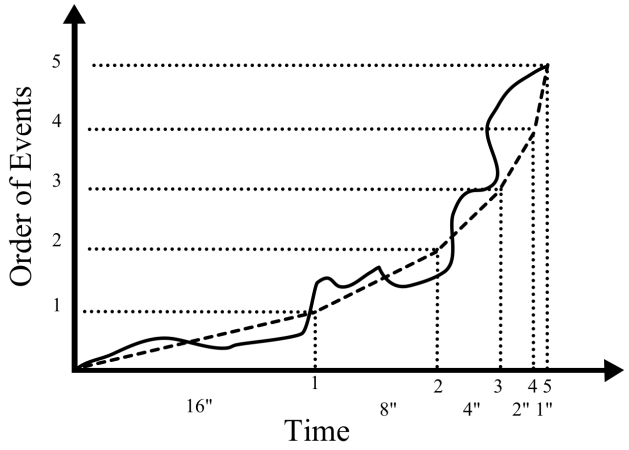
The second way to break up the progression of a logarithmic curve is to superimpose curves within logarithmic processes (see Figure 4.5). Grisey's understanding is that the mind cannot grasp the underlying structure of the processes creating discontinuity and notes that the mind will pay attention to the process of events. Here, discontinuity is referred to as a "surprise in the moment," and that overloading the listener with discontinuity and new information causes one to "focus our attention on the present moment, prevent us from taking any kind of retrospective view, and put a mute in our memory!"[45]

43. The dashed line represents the original acceleration curve from Figure 4.2. The solid curve shows the omission of the events and the resulting compression of time from the process. This curve is a reformatting of Grisey's acceleration by elision curve. See Grisey, "*Tempus Ex Machina*," 252.

44. Grisey, "*Tempus Ex Machina*," 252–53.

45. Ibid., 253.

Figure 4.5. A visual representation of statistical acceleration.[46]



These thoughts are reminiscent of both Messiaen's and Stockhausen's views of how events play a role in memory, and seem to be another analogue to time being suspended as the listener is kept in the present moment. As Grisey closes out this section, he leaves us with a thought that I perceive to be a warning to composers about discontinuity and perception:

> [All] types of superimposition of different curves come into the category that we have just defined. However, it is no longer so much a matter of imagining different curves as in the preceding category, than of composing with continuity and discontinuity, with dynamism and stasis, an unstable and perpetually renewal play. Here we encounter the principle of uncertainty in perception: what we gain in dynamism we lose in unpredictability, and vice versa.[47]

The above quote shows the duality implicit in music as related to events and durations. As listeners, we hear them as separate objects. This reminds me of Stockhausen's views on experiential time, in that composers must traverse the line

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46. The dotted line is our original curve and the solid line represents other processes governing the shape of the process. This statistical acceleration curve is reformatted and based entirely on Grisey's handwritten curve. See Grisey, "*Tempus Ex Machina*," 253.

47. Grisey, "*Tempus Ex Machina*," 253.

between the duality of too much and too little of each aspect governing a composition in order to keep the listener engaged, versus being bored or over saturated and confused. Perception is key and, to paraphrase Stockhausen, when one loses all sense of time, one is strongly experiencing time.[48] This duality is also present in Messiaen's views because I believe that the fine line of the present moment lies between this duality—the place of his glimpse of eternity.

The final two temporal categories in the scale of complexity are statistical and smooth. Statistical time involves a total unpredictability of events and durations, and, like random serial pieces, this randomness can hold the listener's attention (although in a limited fashion). Smooth time (where there is no duration or temporal events) seems similar to me because there is little for the listener to grasp onto, but it still can be perceived.[49] I feel that both of these states suggest a "backdrop," if you will, for events to stand out and pique the listener's attention. Recalling the bird calls from the "Épôde" of Messiaen's *Chronochromie*, and the stasis following the temporal transformation in Stockhausen's *Kontakte*, these instances appear to be good examples of the statistical and smooth aspects of Grisey's scale of complexity.

Thus far we have examined the quantitative aspect of Grisey's thoughts on musical time. Whether durations are structural pillars, processes, or moment-to-moment objects, they can still be analyzed. In the scale of complexity, it is clear that he gave much thought to how time is manipulated and experienced by the listener. In what

48. Stockhausen, "Structure and Experiential Time," 65.

49. Grisey, "*Tempus Ex Machina*," 256.

follows, Grisey continues his discourse by describing a qualitative aspect of musical time: the "flesh of time."

Qualitative Reasonings

The "flesh of time" touches on the psychological and phenomenological aspects of musical time, as Grisey's reflections turn to perception and predictability. The argument appears to stem from how sound material is perceived in relation to other sound objects, and, in turn, relates that material to how composers evoke musical time (perceptible time).[50] These concerns will be echoed in Grisey's later article, "Did You Say Spectral?," where he discusses the temporal consequences of spectralism due to the possibility of music creating a dialectic between different types of times, chronometric, biological, and musical.[51]

Not surprisingly, Grisey invokes both Messiaen and Stockhausen, in that, one must have two objects, whether sound or silence, to have music. Once there is more than one event, the mind begins to compare it to the preceding sound and anticipates how future events might materialize. Grisey uses the term "preaudibility" to discuss the phenomenon. If we remember Stockhausen's degree of change and degree of information, this touches on the core of Grisey's argument. For example, if there are two similar sounds that occur next to each other, there is a great amount of predictability, and musical time is perceived as expanded. However, a contrasting sound makes the listener

50. Grisey, "*Tempus Ex Machina*," 257–58.

51. Gérard Grisey, "Did You Say Spectral?," *Contemporary Music Review* 19, pt. 3 (2000): 2–3.

perceive time as contracted.[52] Following this reasoning, it would appear that using predictability can create oscillation between expanding and contracting time that may lead to a state of temporal suspension that is similar to Grisey's notion of how events can cause an oscillation in a listener's sense of biological time.

This reasoning is similar to Messiaen's laws of duration and to Stockhausen's views on surprises, and that is no surprise (pardon the pun) to me. In fact, it seems that preaudibility is a valuable tool to focus the listener's attention on the inherent qualities of sound, and Grisey formulates this into a law of perception: "the acuity of auditory perception is inversely proportional to that of temporal perception."[53] At the heart of this law is contraction and expansion. If a sound is contracted, one has less time to take in the musical structure happening in the moment. However, if there is an expansion of time, then the listener can be drawn into a sound's quality. Therefore, to become immersed into a sound's microphonic structure, long durations are required to give the listener ample time to hear what is occurring.[54] This is further explained by Grisey in that spectralism, from its inception, is interested in slowness and has no regard for formalism, because the past showed little to no interest in "time and entropy as the actual foundation of all musical dimensions."[55]

52. Grisey, "*Tempus Ex Machina*," 258.

53. Ibid., 259.

54. Ibid.

55. Grisey, "Did You Say Spectral?," 2–3.

This reasoning can be viewed as another direct elaboration of Messiaen's sense of the law of present duration: "the more time is filled (with events), the shorter it seems to us—the more it is empty (of events), the longer it seems."[56] If we replace more and less with expansion and contraction, it becomes apparent to me where Grisey derives his law of perception.

Although the spectralists use sound for its own sake, they utilize durations, whether long or short, to zoom in or out of a sound structure. Zooming in by expansion of durations brings the listener inside of a sound structure, which takes the listener's attention away from the parameters of melody or harmony, in addition to the unfolding structure of a piece. Likewise, through contraction, zooming out lessens the attention to the details of individual sounds until the relationships between events are eventually destroyed and the entire process of a piece becomes a single duration (in other words, an object). This is an important point, as Grisey feels that objects and processes are one and the same.[57]

Time, however, is a factor in how these processes and objects are perceived. In examining the extremes of contraction or expansion, I feel that time can stop at both ends of the spectrum, as both can invoke either stasis when expanded, or the entirety of time in an instant when contracted. Between the extremes, musical time is constantly fluctuating, as processes are transformed by other processes. As mentioned earlier, both ends of the scale of complexity can also create stasis. For example, is periodicity or randomness a

56. Messiaen, trans. Baggech, "*Traité de rythme*," 32.

57. Grisey, "*Tempus Ex Machina*," 259–68.

process or an object? They are both, in that they draw attention to the mind, are unfolding, and will eventually end. But if we consider Grisey's ideas of oscillation between the contraction and expansion of time against a listener's own sense of time, it appears that a suspension of perceived time can occur at the extremes of Grisey's scale of complexity. In other words, a listener's temporal state can be suspended within the boundaries of the entire scale of complexity.

As we have seen, the "skeleton of time" and the "flesh of time" are both conceptual in nature, since Grisey is discussing the mechanics of manipulating musical time. From the scale of complexity to addressing the expansion and contraction of time, there is little discussion of how listeners perceive musical time. In the final section of "*Tempus*," Grisey gives thought as to how the listener interacts with time, and what influences that interaction.

The Listener

Although the "skeleton of time," along with the "flesh of time," are both composer-driven, the "skin of time" is where the listener's temporal perceptions of time interact with the musical time of a composition. This interaction is, of course, subjective. Although Grisey's views on the matter have been discussed earlier in this chapter, I believe that he articulates his views more clearly because he, and other spectralists, pay equal attention to how time is perceived by the listener, as opposed to that of actual temporal processes. In the "skin of time," Grisey discusses memory, the erosion of memory, and how a composer might overcome memory degradation. For me, Grisey's ideas sound familiar and appear to expand upon Messiaen's three laws of experienced

duration in addition to Stockhausen's ideas on experiential time, both of which discuss the nature of memory and its effect upon the listener's temporal experience.

Grisey notes that the immediate past is what we can recall most easily. For example, I cannot recall a whole structure of a long and complicated piece of music and make sense of its entire structure in my mind after one hearing—or even a few. Grisey understands this and points out that there are those who can perceive such a structure, and those (like me) who cannot, whose memory erodes over time. In addition, he points out that all experience is subjective to one's experience. However, his point is salient: How can a composer work against the degradation of the listener's memory over time?

Grisey describes a few ways to accomplish this.[58] First there is repetition. Sometimes the simplest answer is the most obvious, and perhaps overlooked. But there it is, repetition. Next is the "degree of salience of a sound or sequence" and how something that is particularly contrasting can leave an impression in the listener's memory. For instance, a big crashing sound can startle a listener, and this surprise will probably be remembered later. Moreover, Grisey contrasts this startling effect with processes that do not have much difference between events. In the case of a surprise, there could be more of a chance of preaudibility later in a piece because the listener might expect another surprise. However, with processes that do not change much, there will be less information to remember as the memory has less to hold onto, and such events erode from working memory. Grisey likens this erosion to that of hypnosis and feels that "time past is no

58. Grisey, "*Tempus Ex Machina*," 273.

longer measurable" due to the mind not remembering past events because of a lack of contrast.[59]

This last point is of interest to me just by the wording: "time past is no longer measurable." If time is not measurable, then is the listener outside of time? Grisey may be referring to periodicity or to stasis caused from smooth time. As there seems to be no value judgment attached to this remark, it seems that composing a section of music to make memory degrade can be as structural as a contrasting event and complex processes. The final point Grisey makes is that composers can have some influence over entropy at the beginning and ending of a piece, as these structural points are something that the mind tends to remember naturally and are more easily recalled. [60]

Grisey concludes his essay on the "skin of time" with a section called "Insight."[61] He brings the listener into the spotlight and leaves the composer in the shadows because it is an actual listener who perceives the composition in the moment, rather than an ideal listener. As discussed earlier, experience, culture, and language shape the musical perception of a listener. In essence, a composer cannot be sure how his or her music is perceived, or if the designs implemented will manipulate time one way or the other for any particular listener. Grisey's final words are a telling summary of the information presented: "Real musical time is only a place of exchange and coincidence between an

59. Grisey, "*Tempus Ex Machina*," 273.

60. Ibid.

61. Ibid.

infinite number of *different times*."[62] For me, this interaction between coincidence and an infinite number of times is a thing of beauty.

Spectrum and the Time Machine

So far, the discussion of Grisey's ideas about time has been more theoretical than practical. At this juncture, I will briefly examine the opening processes linked with *Partiels* (1975) and *Tempus Ex Machina* (1979), two of Grisey's compositions that contain examples of the contraction and expansion of time, as well as his scale of complexity. I will demonstrate that *Partiels* typifies his use of spectra, instrumental synthesis, and the contraction and expansion of sound. I will also infer how these techniques can affect a listener's memory and temporal perception. I will likewise show how *Tempus Ex Machina* exemplifies Grisey's scale of complexity. This examination will look at the implementation of acceleration curves and oscillation within the instrumental parts. I will then surmise how the piece might affect a listener's perception of time.

Partiels (1975)

Grisey composed *Partiels* in 1975; it is part of a suite called *Les Espaces Acoustiques. Partiels* uses the spectral analysis of a trombone pedal on the note E1 as generative material. The piece begins with a process that features 14 subprocesses, which ends at rehearsal 13. The first subprocess starts with the note E1in the double bass, sounding a number of times at varying temporal lengths. Following this beginning are

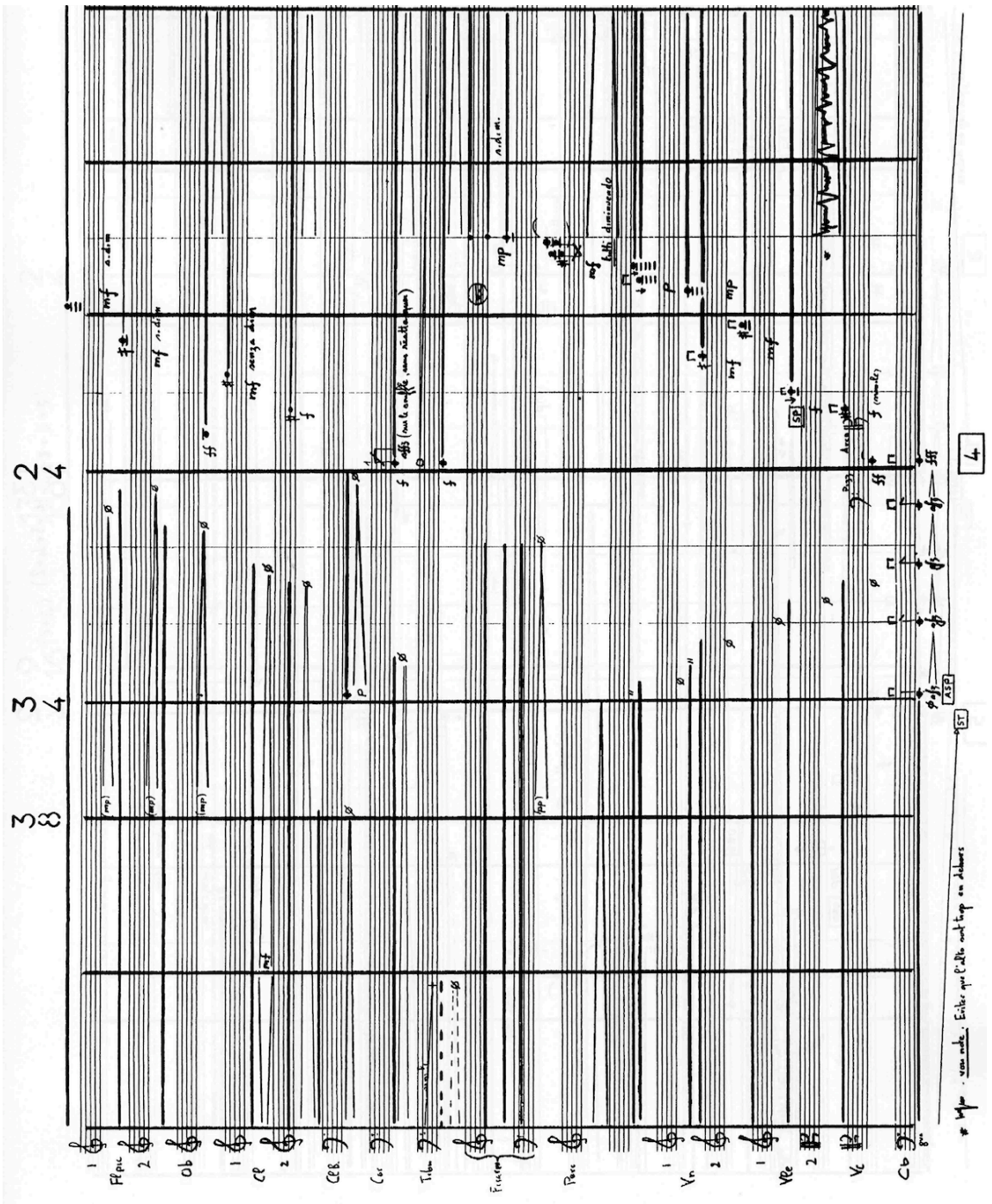
62. Grisey, "*Tempus Ex Machina*," 274.

other instruments entering and sounding partials generally from low to high frequencies that are either in harmonicity or not. These partials then fade out. This first subprocess is a clear example of instrumental synthesis and appears to be a fundamental idea of the first process, since this pattern (or process within a process) is repeated numerous times. But this subprocess, and its following iterations, are not exact copies, as various parameters change with each iteration.

It is clear that Grisey is bringing the listener "into the sound" by sounding the partials' entrances one after another, and by the long decay of notes. My experience of this opening is that it held my interest, while keeping me engaged and wondering what events would come next. It is likewise clear that Grisey is using repetition to work against the degradation of memory. However, in each subprocess, he creates changes over the course of the entire process to keep the listener's mind focused on the music. With the listener engaged and filled with expectation, how does Grisey manipulate the listener's experience of time?

If we look at the fourth iteration of the repeated pattern on page 4 of the score (see Example 4.1), the entrances between the instruments sounding the upper partials are shortened, thus creating a curve of acceleration followed by a period of decay as the sounds decrescendo. I feel that this subprocess can be viewed as a quick contraction followed by an expansion of time. The contraction is due to the increased rate at which the partials are sounded, which, in turn, draws one into the sound by revealing its component parts. This is yet another example of how more events create the perception of chronometric time speeding up.

Example 4.1. *Partiels*. Music by Gérard Grisey. Copyright © 1976 by Casa Ricordi S.r.l., Milano – Italy. All rights reserved. Reproduced by kind permission of Hal Leonard MGB S.r.l. – Italy.



Countering this feeling of contraction is the decay of the sustained notes. As there are fewer events, time slows and attention is kept "inside the sound," so to speak. The entrances could have been linear and periodic, or sound all at once, but I think that Grisey is trying to push and pull the listener's sense of passing time, thus inhibiting the reflection of past events by this expansion of a sound. When this contraction and expansion is taken together, this is a prime example of creating an oscillation between perceived time against a listener's biological time.

In this aforementioned subprocess, it was shown that both contraction and expansion occur, followed by a smooth state that slows time, which could induce temporal stasis. However, in the cello part, there appears some statistical noise that I perceive as an object for the listener's mind to latch onto. This noise breaks up the repetition from the preceding similar processes to keep it from wandering; however, it is not too disruptive in that it does not take the listener out of the musical experience. This subprocess repeats itself in various states of harmonicity until Grisey deems that the listener needs a change of pace, so to speak. As explained earlier, repetition can only go so far until the listener gets bored and tunes out.

I find the music of Example 4.1 telling because the level of detail contained in it shows the effort and thought put into the precompositional process. In addition, I am surprised as to how it exemplifies the spectralist oeuvre, and how these techniques appear to govern every aspect of this composition. Furthermore, the attention paid to the listener's perception of time is well thought out and implemented.

Tempus Ex Machina (1979)

Composed in 1979 and scored for six percussionists, *Tempus Ex Machina* illustrates Grisey's scale of complexity. To demonstrate this temporal facet, I will focus on the first structural process (from the opening until rehearsal number 23). This examination will uncover some of the underlying processes that govern the opening of the piece and how they are associated with the scale of complexity. Following that, I will consider how this opening process might affect the listener's sense of time due to acceleration curves and oscillation. Let us begin with an overview of this process.

The first structural process moves from periodicity to statistical unpredictability. It then returns to periodicity and consequently becomes smooth. Structurally, the return to periodicity occurs at about two-thirds of the way through the process and is important to highlight. In "*Tempus*," Grisey notes that listeners can "tolerate a long acceleration followed by a short deceleration rather than its opposite (a short acceleration followed by a long deceleration)."[63] This is an interesting observation because Grisey's implementation follows his writings, as the acceleration is longer than the deceleration. Furthermore, the process's trajectory feels natural and not contrived upon repeated hearings (to me at least). I feel that this is further evidence that Grisey kept the listener's experience in mind while composing the piece.

In each instrumental part, there is a periodic aspect performed at a low dynamic level. Throughout the process, the periodic aspect speeds up but also contains oscillations to break up the periodicity. Likewise occurring in each part is a surprise object that is

63. Grisey, "*Tempus Ex Machina*," 249.

played at infrequent and random times at a loud dynamic level. As the process progresses, the intervallic entries between these surprise objects become more regular until periodicity is reached in all parts in rhythmic unison at a loud dynamic level. This periodic section then begins to slow down and decrease in amplitude until a smooth silence results.

As is evident, Grisey's design is well constructed. There are a number of logarithmic curves at play—soft to loud, slow to fast, and periodicity to statistical. Moreover, the section returns to silence, with curves that reverse durational length and dynamic level. In sum, this is a birth, a life, and a death of a process as Grisey described in "*Tempus*." Consequently, it is now time to turn to the inner workings of this process by looking briefly at the score to see how he uses curves within the larger structural curve to move from periodicity, to statistical noise, and then back to periodicity.

The opening process begins with one performer playing quarter-notes at a tempo of 45 beats per minute (bpm) with no discernible meter or groupings of events. Moreover, this quarter-note pattern is broken by silence followed by the pattern returning. To me, this opening slows my perception of the passage of time and even evokes a feeling of stasis until the next player enters.

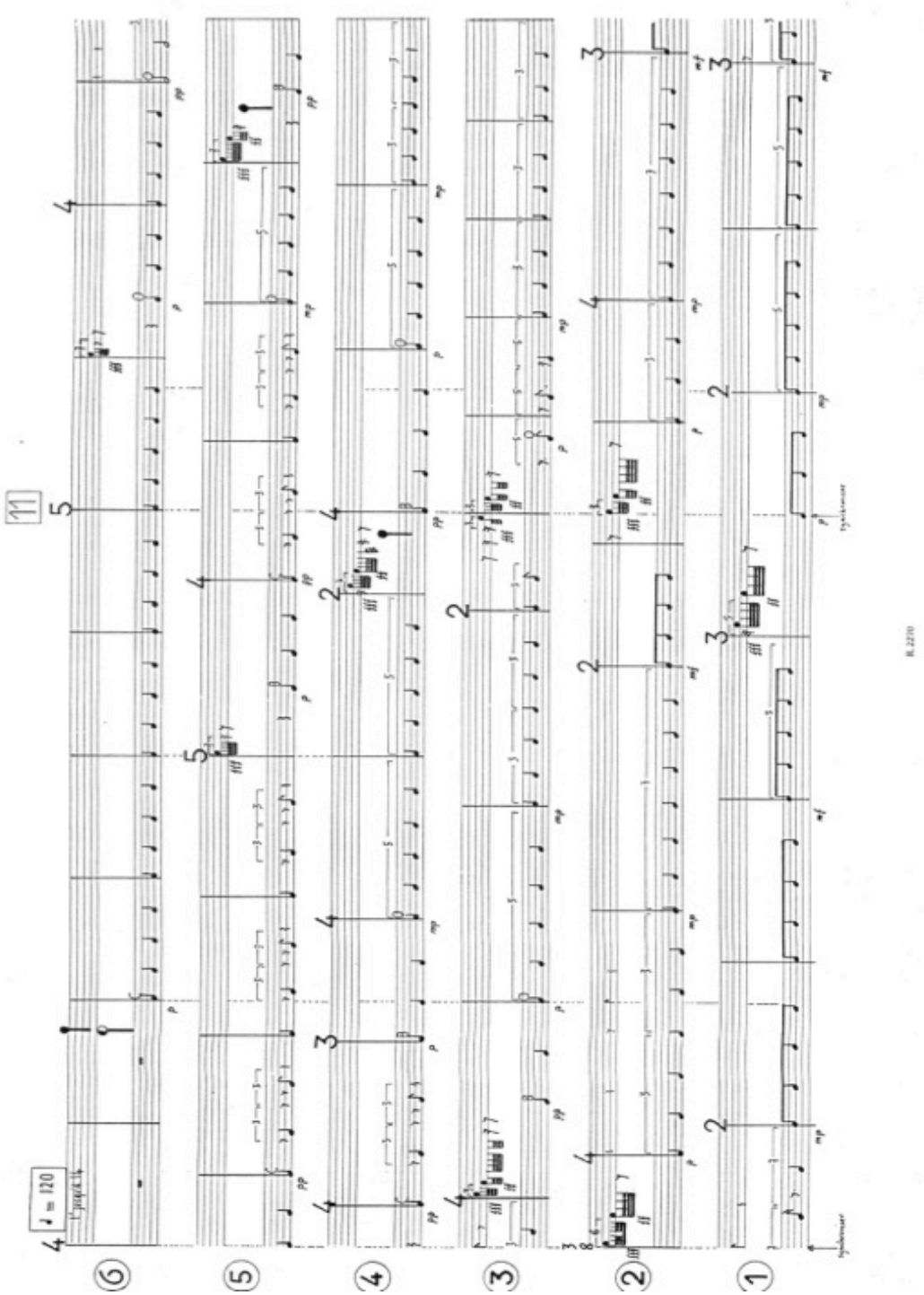
The six percussionists enter one after another at different times, and with different durational values at each entrance. Yet, each previous player does not change the absolute tempo at which they perform, and the six performers play at different tempi until rehearsal number 14, when the parts line up and the all performers play at the same tempo and reach periodicity with each other.

Examining the first two-thirds of the section, we can easily detect two acceleration curves that are connected with each entrance. First, the tempo for the quarter-note durations increases by 15 bpm (45–120) for each player. In addition, the time it takes for each percussionist's entrance is decreased as the number of measures also decreases with each entrance. This tempo increase is continuous, seems predictable, and, in my opinion, illustrates the continuous-dynamic aspect of the scale of complexity.

Looking at rehearsal number 11, we see player 6 performing in periodic quarter-notes, with the other players performing in various states of rhythmic subdivisions (see Example 4.2). These subdivisions add to the ametrical quality of the process, because, as the periodic aspect of the instrumentation increases in speed, the subdivisions within each measure become smaller and oscillate between faster and slower. This is a good example of the discontinuous-dynamic curve, with the overall effect becoming a statistical curve or graph. This oscillation between slower and faster events in an individual player's part should have an effect on the listener's sense of elapsed time, as this oscillation plays against his or her biological time. But as in Messiaen's "Épôde" from *Chronochromie*, I feel that the overall cacophony of all six parts has the general effect of time speeding up for the listener.

Further adding to the feeling of acceleration are the surprise hits (seemingly random events that occur on different instruments than are used for the periodic quarter-notes). They appear in the upper stave in each performer's part. Over the course of the process, these hits become more frequent and predictable. If we invoke Messiaen's or

Example 4.2. *Tempus Ex Machina*, Rehearsal 11: Polytempo. Music by Gérard Grisey. Copyright © 1980 by Casa Ricordi S.r.l., Milano – Italy. All rights reserved. Reproduced by kind permission of Hal Leonard MGB S.r.l. - Italy



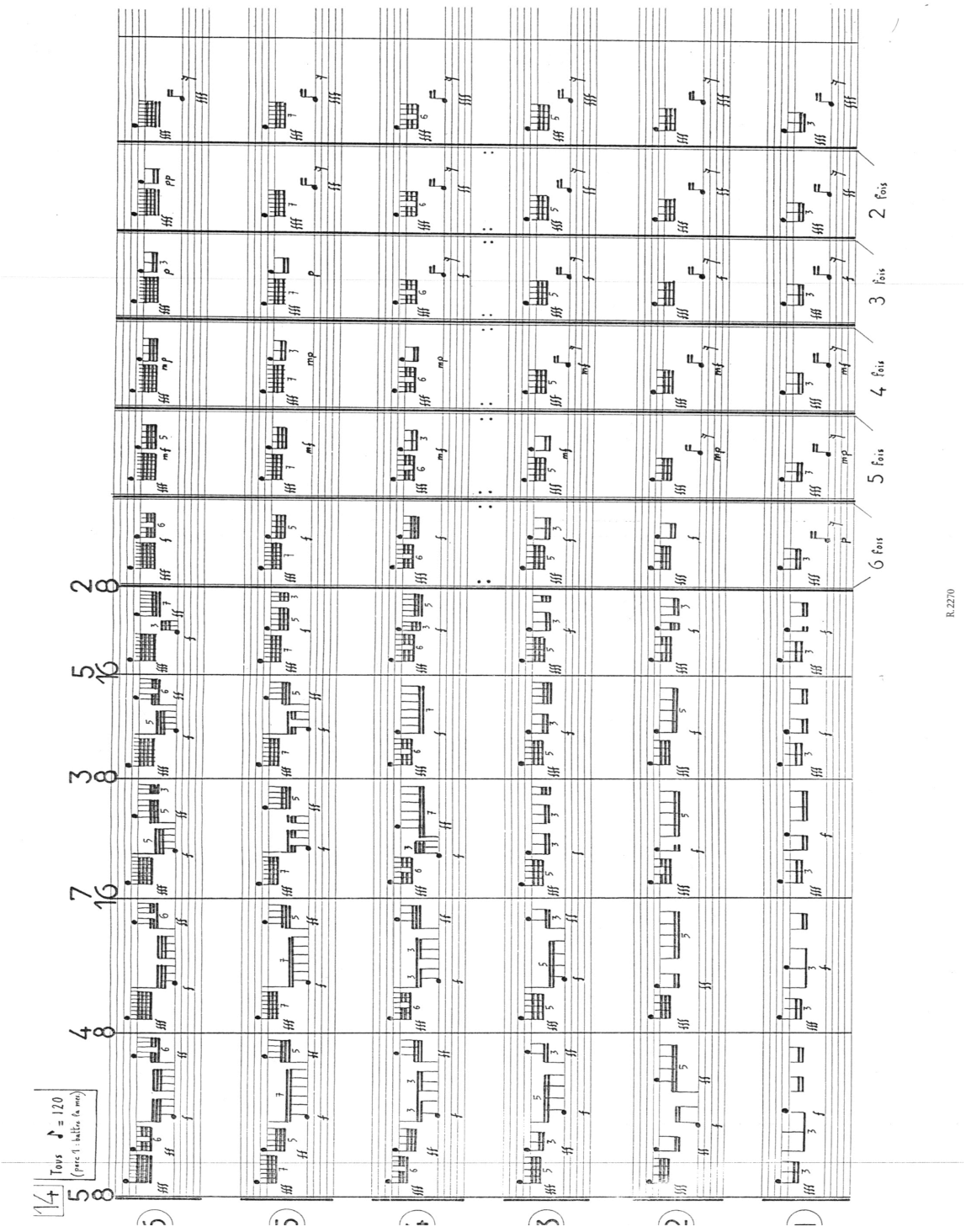
Stockhausen's views of how events are perceived, the increase in information will make the listener feel as if time is moving faster. Furthermore, if we use Grisey's scale of complexity to explain this speeding up of perceived time, this increase in cacophony is compressing time and will feel shorter for the listener. These processes continue to compress time into rehearsal 13. At that moment, these surprise hits become more frequent until periodicity is achieved (goal point) at rehearsal 14 (see Example 4.3). At this juncture, there is an inverse curve, and over the next two minutes, the time machine slows, decreases in amplitude, and comes to a grinding halt, thus ending the opening process in a static state.

Final Thoughts about *Partiels* and *Tempus Ex Machina*

The opening process of *Tempus Ex Machina* is esentially a microcosm of Grisey's scale of complexity. These ideas show that rhythm and durations, which make use of basic acceleration curves from the complexity scale, can create an engaging piece of music. Similarly, the same can be said of *Partiels*, as it and *Tempus Ex Machina* exemplify basic tenets of spectral compositional techniques as espoused by Grisey. In other words, they are goal-oriented and use the manipulation of perceived time as a compositional structure. In addition, *Partiels* uses sound as generative compositional material that is manipulated through instrumental synthesis, in addition to structures designed for temporal manipulation.

Another interesting observation is how the techniques discussed earlier appear to govern most aspects in both compositions. Both pieces are rhythmically and structurally

Example 4.3. *Tempus Ex Machina*, Rehearsal 14: Periodicity. Music by Gérard Grisey. Copyright © 1980 by Casa Ricordi S.r.l., Milano – Italy. All rights reserved. Reproduced by kind permission of Hal Leonard MGB S.r.l. – Italy



complex due to the implementation of various curves that govern not only the music at a local level but also in the overall structure of the processes examined. As they are goal-oriented, the structures of these pieces are a departure from the moment-time compositions of Messiaen and Stockhausen, in addition to being far removed from traditional compositional techniques and form. An important aspect of form and structure arises from Grisey's consideration of the temporal perception of the listener that, undoubtedly, played a large part in the development of the structures of both *Partiels* and *Tempus Ex Machina*. For me as a composer, this understanding is a valuable tool in creating pieces that may manipulate a listener's temporal state.

Conclusion

As stated in chapter 1, the goal of this thesis was to discover the ways in which the listener's perception of time can be manipulated. In my estimation, and somewhat surprisingly, Grisey's approach to musical time feels more direct and to the point than that of either Messiaen or Stockhausen. I draw this conclusion because I believe Grisey sees the listener as being at the center of his or her own "biological" time. My observation of Messiaen's views is that he uses musical time to bring the listener outside of one's self (and their biological time) to experience timelessness as something greater than one's self. That being said, Messiaen's goal is my goal as well. My opinion of Stockhausen's view of "experiencing music most strongly" lies between those of Messiaen and Grisey.

In each case, Messiaen, Stockhausen, and Grisey sought to manipulate the listener's sense of time through music. And as also noted, Stockhausen and Grisey built

upon Messiaen's ideas, thereby expanding the understanding of musical time. This in turn led to the continued refinement of compositional techniques intended to manipulate a listener's temporal perception. As I contemplate these ideas, what knowledge can I glean from my study, and how do I integrate and, perhaps, expand upon this knowledge? This is the subject of my next chapter.

Chapter 5: Conclusion

When I reflect on my motivation for writing this thesis, my hope was to find effective compositional tools for the manipulation of a listener's sense of time in order to evoke a sense of timelessness in his or her perceptions. Accordingly, there are ways to manipulate a listener's perception of time, namely, by disrupting one's internal sense of time with nonlinear musical time. This phenomenon of timelessness was examined briefly in chapter 2, with Messiaen's glimpses of eternity; in chapter 3, with Stockhausen's experiencing time most strongly; and in chapter 4, with Grisey's state of trance, or temporal suspension. In each case, these composers used various creative means to bring the listener to this timeless state. Messiaen's and Stockhausen's methods seem similar in that they used different designs to work against the listener's memory while keeping the mind focused on present events and processes. In contrast, Grisey acknowledges the use of memory retention and periodicity, in addition to working against memory, as ways to influence temporal perception. Interestingly, it appears that the differences in their preferred methods can have similar temporal outcomes. Let us review how these various temporal schemes influence a listener's perception.

Surprise, the unexpected jolt of an event, the variable number of events over time, the obfuscation of pattern, and the acceleration and deceleration of motion can all be used to disrupt the listener's temporal perceptions. The result of each of these composers' preferred methods, in most cases, is the feeling of speeding up or slowing down time. However, while listening to the compositions discussed in this thesis, there were times when I felt that the passage of time became static, or that my perception of time ceased. This phenomenon generally occurred when the rate of events or alterations slowed,

leading to smooth time, in alignment with Grisey's thought. Using Stockhausen's temporal transformation and the immediately following stasis from *Kontakte* as an example, the slowing of pulses and lowering of pitch lured me into the following static event. During this stasis, I noticed that my thoughts lessened, and I experienced the sound without reflection. In essence, the process kept my attention until a new event occurred. However, in that moment between the previous and following alterations, my experience of the passage of time ceased.

Inversely, Messiaen's "Épôde" from *Chronochromie* revealed to me that statistical events full of information can evoke a timeless state as well. I was surprised as to how numerous statistical events, or random moments, can cause a similar sensation of timelessness as static events. This overloading of musical information causes my mind to become overwhelmed, and it "lets go" of trying to comprehend the information. I perceive timelessness, but in a different way. The musical information becomes nondiscernible, and my perception of time passing ceases until my mind feels the need to grasp onto something. Reflection begins again, and my perception of the passage of time is restarted.

The above two examples lie at the extremes of Grisey's scale of complexity. However, Grisey showed that there was another technique that exists within the scale of complexity that creates a temporal suspension for the listener. He explained that an oscillation between expanding and contracting time disrupts the listener's internal temporal sense. Furthermore, this disruption also inhibits the listener's ability to predict the temporal flow of future events. I view this technique as similar to Messiaen's and Stockhausen's moment time in that it works against memory. Moreover, I also feel that

Grisey's oscillation is another way to obfuscate patterns, in addition to disrupting the listener's sense of time.

Further confirming how oscillation affects my perception of temporal flow is when I first heard Stockhausen's temporal transformation from *Kontakte*. In this instance, my internal sense of time sped up and slowed down over the course of the event. My understanding of this phenomenon was solidified once I understood that the oscillation between the pitch rising and falling, combined with the speeding up and slowing down of the individual pulses linked to frequencies, was the cause of my temporal disruption. But this oscillation was leading me into a sense of stasis, which made the experience more powerful.

The above techniques involve surface-level events that are easily perceived by the listener. Under the surface, many of the techniques of Messiaen, Stockhausen, and Grisey demonstrate how their music was very well planned. From the examination of the compositions in this thesis, I surmise that they intentionally used form as a guide to lead the listener to temporal stasis, because individual moments or processes lead to specific points in the works that evoke timelessness. The preceding moments in Messiaen's *Chronochromie* lead to the statistical randomness of the "Épôde." The temporal transformation in Structure 9F in Stockhausen's *Kontakte* leads the listener to stasis or smooth time in Structure X. Similarly, the chaos gradually built upon in the first process of Grisey's *Partiels* leads to a periodicity that suggests a trance-like state. Therefore, a composer can use form (in addition to surface musical elements) to create material that manipulates the listener's memory and disrupts his or her sense of internal time, which, in turn, leads a listener to a point of temporal stasis.

Messiaen, Stockhausen, and Grisey have explained in their writings and shown in their compositions that precompositional preparation is a fundamental technique for evoking a state of timelessness in a listener. All used form and surface-level events to lead the listener to such a sense of stasis. Just as important, they understood that the listener is at the center of his or her temporal experience, and many of their compositional techniques were created and fine-tuned to manipulate a listener's temporal interaction with their music. Given this understanding of their compositional processes and ideas, how will this knowledge affect my compositions, and what temporal outcomes might present themselves to the listener?

As a composer, I have generally employed intuitive methods, letting the form of a composition arise from the process of creation. I improvise first, and then rework material. Over time, the composition takes shape until it "feels right." Needless to say, this has caused me some distress when I have examined my composition's forms—or lack thereof.

In this thesis, I sought to discover ways to create timelessness in music. Although I sought to understand how time could be manipulated, I was surprised at how form, in addition to the manipulation of time, was central to the precompositional processes of Messiaen, Stockhausen, and Grisey. Messiaen used techniques linked with the "charm of impossibilities" and integral serialism as significant constituents of his pieces. Stockhausen also used serial techniques in his music, in addition to processes used to create moment time in *Kontakte*. Similarly, Grisey used numerous ideas from his scale of complexity and other spectral techniques as part of *Partiels* and *Tempus Ex Machina*. As I contemplate their compositional structures coupled with their views of temporal

manipulation, it is evident that my approach to form will be altered as I integrate these ideas into my work.

One of the first ideas that came to my mind was to create a high-level temporal map to derive the underlying structure of a composition. Although this map is inspired by all three composers, it was Grisey's writings that solidified this idea, as I considered such a map as akin to building a skeleton, and subsequently "fleshing it out," as a means to realize various temporal goals. But how could this map manifest itself as a precompositional temporal structure for a composition?

For instance, such a design could include high-level structural areas superimposed over a chronometric timeline, such as: (1) a beginning, (2) various temporal goals, (3) location of a climax, and (4) an ending. Within these, I could frame various temporal structures like periodicity and stasis to achieve goal points. Using the compositions examined in this thesis as models, a climax appears to occur at roughly two-thirds of the way through a process or entire piece. This could be a clue of sorts, but it seems natural that a composer would not want to have the climax before the midpoint. It also could be that the composers were using structural guides, such as the golden mean or the Fibonacci series as a means to generate structures. In any case, beginning with a structure and layering various temporal strategies upon it to achieve a goal, such as timelessness, appears to be a good way to begin the compositional process in order to evoke timelessness in a listener.

Another insight that I derived from this study demonstrates how content is derived; it is of less importance than its realization in a composition in order to manipulate a listener's temporal experience. Messiaen's "charm of impossibilities,"

Stockhausen's experiments to unite pitch and rhythm and use of electronics, and Grisey's spectral techniques are very different approaches in the creation of material to be heard by the listener. Although the examined pieces sound very different, each composer was successful in creating a timeless state. Again, this leads me to see that form on a large scale, and how material is presented at local levels, appears to be of great importance in altering a listener's temporal perception. For me, this means that the methods from which I derive my initial material for compositions can remain unchanged. In essence, I can use my current musical language and combine it with these findings from this study to create musical time, and influence a listener's perception of time.

As I continue to derive inspiration from this exploration, the above insights lead me to contemplate how the use of multiple techniques of temporal manipulation is perceived when executed simultaneously. What effect does a logarithmic curve have when occurring with smooth time, or with statistical curves? Can stasis be a backdrop or a container for musical information upon which events are presented like paint on a canvas? These questions, and many others, inspire me to think of effective ways to create musical time and effectively manipulate a listener's temporal perceptions.

During the course of this study, I feel that I have garnered a basic understanding of compositional techniques to bring a listener to a timeless state. Nevertheless, I also feel that I have inadequate data as to how listeners interact with it. However, Grisey suggests a path to seek an answer to this question, in addition to how memory and culture play a role in the listener's experience.

> How does the listener organize and structure the complexity of a sound? How does his memory choose what he perceives? What roles do his culture and musical education play in this choice? In what time does this listener live and breathe? So many questions which I will not try to answer here, since they seem to me to belong more to the sociologist's or psychologist's area of research than to the empirical reflections of a composer.[1]

In addition to pointing out where to look for this information in the work of specialists, Grisey appears to confess that his thoughts are a self-report of his own experience. Therein lies a problem. The data concerning how a listener experiences musical time is subjective and is therefore qualitative. Grisey and I both experience musical time differently, as does every other listener. But as Grisey points out, we composers can look to specialists that study music cognition in order to derive information for our own compositional processes. That being said, one of my near-term goals is to study research on music cognition. With the latest research coupled with the information derived from this thesis, I hope to create compositions that have temporal effects on general audiences.

This hope echoes my motivation for this study and leads me to reflect on the reasons why I want to create a sense of timelessness in my compositions. The answer seems simple, and I believe it can be explained with Stockhausen's idea of experiencing music most strongly.[2] When I consider how the compositions examined in this study affected my own sense of time, it becomes apparent that, on numerous occasions, I was directly experiencing the music (most strongly). While in this state, there is no distinction between myself and the music, and the perceived passage of time ceases. In essence,

1. Grisey, "*Tempus Ex Machina*," 272.

2. Stockhausen, "Structure and Experiential Time," 65.

when I experience timelessness while listening to music, I am altogether in the present moment experiencing Messiaen's glimpse of eternity—and, to me, this is where the true beauty of music exists.

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