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Understanding Electronic Music: A Phenomenological Approach

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UNDERSTANDING ELECTRONIC MUSIC: A PHENOMENOLOGICAL APPROACH

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ABSTRACT

Today composers have a variety of sounds at their disposal and with the advancements of technology it is no wonder that composers would turn to electronic means for producing music. However, this leaves the listener with unmapped terrains of sound, rich in complexity, and calls for new listening strategies in order to begin to understand how electronic pieces "work." This dissertation presents a phenomenological approach to analyzing electronic music by incorporating the experiential perspective of the listener, and also incorporates psychological perceptual aspects based on Gestalt principles. Drawing on a phenomenological approach is viable for the analysis of electronic music because in most cases a score is not available for the listener, as is the case with traditionally notated works. This approach aims to decipher how sonic events are defined and heard within an individual composition, since the sound palette available to a composer within this genre has grown to enormous portions. Once sonic events are identified within a composition, the listener can then investigate the formal structure, providing a deeper understanding of the work.

The first chapter provides an overview of electronic music including a brief history of the genre, analytical consideration of electronic works, and analyses that incorporate a phenomenological approach. The second chapter describes the concept of phenomenology and explains how the listener can incorporate this type of analytical approach, which includes investigating factors that cause the listener to segment musical events. The third chapter discusses the identification of sonic events, and divides them into two main categories – events that incorporate the aspect of *musique concrète*, including the voice, traditional instruments, and found objects as sound sources, and events that are derived purely by electronic means. This chapter provides brief analyses of selected works that illustrate various ways composers employ sonic events that fall into the two main categories mentioned. The fourth chapter provides complete analyses of six works mentioned in the previous chapter, illustrating how the listener can identify sonic events, categorize them, and create a listening score, which in turn aids in investigating the formal structure of the work. The final chapter offers general conclusions regarding electronic works based on the analyses presented.

INTRODUCTION

In the twentieth century, composers embraced an enormous variety of compositional procedures and soundscapes, and some rejected the principles of tonal structure and design. As a result, the scope of “art music” can hardly be invoked or conceived in singular terms. Although we are fortunate to live in an all-encompassing musical era, the evolutionary path music has taken presents the listener with a challenge–how to comprehend this complex web of music, and specifically how to understand the listener’s experience of individual pieces within such a vast body of literature. With the advancements of technology, it was foreseeable that composers would utilize computers and machines to create electronic music. The composers’ use of electronics allows a new variety of sounds to be created and used, including sounds that could be deemed “noise,” and these sonic events in turn become fundamental musical elements within a composition. Yet, how can the listener discuss these elements in a musical context? How can scholars examine music with limitless sonic possibilities and whose “score” might only exist as electronically stored data or a “session”? The purpose of the present project is to explore electronic music from an experiential perspective in order to discover a work’s structure and form. Although technology offers us a vast number of benefits, understanding the technical language of electronic compositions can be difficult and not always relevant to the musical experience. Therefore, the focus here is on the finished product, what one hears and perhaps ways the listener *could* or *should* hear a piece of electronic music in order to make sense of how it “works.”

Electronic music is a genre that breaks down musical barriers and calls for a new musical discourse. In order to develop a cohesive methodology applicable to electronic music, the music must be explored in all its complexity, assessing not only its content but also its musical impact. An analytical approach to electronic music should also involve an investigation of the composer’s and the piece’s historical background in order to aid in understanding the composition’s content. The listener will need to understand what was and was not technologically available to the composer since over the past sixty years or so, electronic music has developed considerably due to the advancements of technology.

Earlier electronic music composers spent days, even weeks in the studio, perhaps cutting and splicing tape or waiting for the computer to compute given information, in order to produce one snippet of a composition, while today's composers have a variety of computer programs and compositional devices at their fingertips ready to produce a sound in a matter of seconds with the click of a mouse. The sound palette available to the composer has grown to vast proportions, and as a result, listeners need to employ a different approach than they would in listening to music for more conventional forces.

In addition, electronic music does not suggest a particular analytical method for describing its content and structure. In an article focusing on Edgard Varèse's *Poème Électronique,* Lawrence Ferrara notes, "Many if not most theoretical systems of musical analysis break down when an attempt is made to apply them to atonal and electronic music."[1] There is no universal methodology as there is for the analysis of tonal harmony, for instance. The analyst would use twelve-tone analysis to analyze the music of Schoenberg, after 1924, but not that of Bela Bartók. A listener to an electronic composition could invoke all the analytical procedures they know or have learned, but such approaches may not be applicable. In an article focusing on the analysis of electronic music, Bruno Bossis states:

> A systematic methodology for the analysis of electroacoustic music has yet to be devised. Such a methodology would lead to a more precise vision of this corpus and would encourage the formulation of general historical and aesthetic propositions, but a certain number of specificities have hindered this research.[2]

The hindrances that Bossis lists are "the absence of a perceived instrumental typology" (i.e. an immense sound palette in which the source of a sound may be unknown) and "the problem of representation" (i.e. notation).[3] Furthermore, given the variety of sonic and syntactic options available to the composers in the twentieth century, it may not be obvious whether or not to apply inherited analytical methodologies to electronic music.

Some analyses of standard repertoire focus on the parameter of pitch nearly to the exclusion of all other musical parameters. As one might suspect, concentration on pitch

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[1] Lawrence Ferrara, "Phenomenology as a Tool for Musical Analysis," *The Musical Quarterly* 70/3 (Summer, 1984): 358. In this article Ferrara specifically addresses a phenomenological perception of Varèse's *Poème Électronique.*
[2] Bruno Bossis, "The Analysis of Electroacoustic Music: from Sources to Invariants," *Organised Sound: An International Journal of Music Technology* 11/2 (2006): 103.
[3] *ibid.*, 103.

alone in a piece of electronic music is problematic simply because pitch may not always be discernable, as in the case of tone clusters, inharmonicity, and/or noise elements found within the work. As Trevor Wishart notes:

> In this sonic space, traditional categories and hierarchies of musical parameters break down. In particular, 'timbre'—essentially an umbrella term for all those features of sounds not captured in traditional notation, including stationary spectra, spectral changes, formant structures, formant changes, vibrato/tremolo and their evolution, graininess, jitter, etc.—provides a multidimensional arena in which pitchness is but one dimension.[4]

As a result, the genre of electronic music allows timbre and the use of *sonic events* to now take priority over pitch. A sonic event is "any sound or sound-configuration which is perceived as a primary musical unit—a singular aural gestalt."[5] Deciphering and identifying the sonic events within a composition allows the listener to catalog and determine the structural relationship of the musical material in the music.

With any new genre of music comes the inherited issue of understanding a new musical language. One useful precedent is provided by the writings of James Tenney. His *Meta + Hodos* specifically aims to challenge our way of thinking about and listening to twentieth-century music in general. Tenney states:

> The increased aural complexity of much of the music of the twentieth-century is such an evident characteristic that it should need no demonstration. Nevertheless, an examination of the many factors which produce this complexity, and some of its effects in our perception of the music, will be necessary before we can hope to describe the musical materials in a really meaningful way. The complexity is not merely of structure, but also of *substance*. That is, it is not simply the result of a new arrangement of traditional materials or elements. The elements themselves *have changed*, and the changes affect not only the musical structure, but our way of listening to the music as well.[6]

It is clear that Tenney is particularly concerned with how listeners are to attend to a music that contains a certain amount of complexity. This complexity is reflected not only in the organization of musical elements but also in our understanding of what compromises a musical element in the first place because they have changed. For instance, each pitch

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[4] Trevor Wishart, "Sonic Composition in *Tongues of Fire," Computer Music Journal* 24/2 (Summer, 2000): 23.
[5] James Tenney, *Meta + Hodos: A Phenomenology of Twentieth-Century Musical Materials and an Approach to the Study of Form; and META Meta + Hodos* (Hanover, NH: Frog Peak Music, 1992): 23.
[6] *ibid.*, 4. (emphasis mine)

contained within a tone cluster may not be aurally distinguishable, therefore the cluster is perceived as a structured whole.[7] Furthermore, sounds are no longer restricted to those of traditional vocal/instrumental forces, but they can also be created electronically changing the makeup of compositions drastically. Tenney further notes:

> The elemental building-materials of [twentieth-century] music are no longer limited to *musical tone*, but may include other, more complex sounds… The substance and material of this music is sound–this definition is inescapable–and it is of secondary importance whether this material is in the form of a tone with clearly defined pitch, or of the highly complex and indefinitely-pitched sound of a cymbal. Any sound might occur at some point in a piece of music, with a function there that is virtually independent of the constitution or structure of the sound itself, being determined instead by the larger musical content in which it occurs.[8]

Instead of focusing on a melodic line, a motive, or a harmonic progression, our attention can center on individual sonic events of structural importance within a composition. Approaching music in this manner is particularly beneficial for investigating electronic music, since the sound palette available to the composer is virtually limitless and each individual piece will contain its own unique progression of musical elements. Furthermore, the criteria by which we perceive a sonic event in one piece of music, might not be the same in another piece, even music by the same composer.

Music in which sonic events, rather than the traditional aspects of pitch and/or rhythm, act as musical parameters requires segmenting and organizing these events perceptually in order to establish discrete events within the musical texture. Consequently the listener now asks the questions, "What is a sonic event? How can I segment these events? And what makes an event different from another?" Once the listener has a firm grasp of the sonic events that comprise the make-up of a composition then the listener can start to draw connections as to how those sonic events function within the larger structure of the work. Nonetheless, it depends on what musical parameters, or as David S. Lefkowitz and Kristin Taavola call "Domains," comprise a composition.

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[7] According to Tenney, "The clearest examples of such complex sound-elements are tone-clusters and other highly dense and dissonant chords… sound-structures which seem relatively "opaque" to the ear. Such chords cannot usually be analyzed by the ear into constituent tones, and I think they are not intended to be so analyzed. They are seldom subject to harmonic orientation, because one's perception of pitch in these dense sound-complexes is limited, at best, to the pitch of their highest or lowest tones, or to a mean pitch-level, when no more than the approximate range and register of the chords can be recognized." Tenney, 6.
[8] Tenney, 7-8.

> We consider the theory a tool for thinking in music – listening, performing, analyzing, and composing; it breaks music up into analyzable chunks, it helps evaluate the way Domains interact with each other, and it provides new ways of thinking about music in general.[9]

The internal context and scope of an individual electronic composition reveals what kinds of musical elements are involved in understanding the piece from a structural perspective. Therefore, the listener will need to focus on comprehending the content of an individual composition in order to answer the foregoing questions. Additionally, when listening to any type of music, with perhaps the exception of monophonic music, there are multiple layers of sound that one can perceive depending on how the listener's attention is divided. In these cases, discussing textural layers can clarify the relative prominence of various sonic events and how they function in juxtaposition within an electronic composition.

Understanding how this genre of music works relies on the framework of the music itself to guide in an investigation of sonic events, since each composition will have its own unique organization of sonic events. In this light, the listener utilizes his or her own perception of the composition itself, incorporating a *phenomenological* approach to the music. A phenomenological approach views music as a phenomenon, which incorporates the listener's aural comprehension of the music in question. According to Judith Lochhead:

> A 'phenomenon' is the focus of someone's experience. The statement, 'I see the chair' means 'I perceive the chair' or 'I am experiencing the chair' or 'I am experiencing the phenomenon of the chair.' Thus, someone's experience of a chair depends not on the cognitive capabilities of the subject who has the experience nor on the attributes of the chair, but rather on the thing of experience and the way that thing is experienced by someone.[10]

Therefore, this approach relies on an experiential perspective of a piece of music and utilizing what is perceived by the listener to interpret structural aspects of the work.

Music of any kind implies different meanings, significations, and intertextual findings for every type of listener, whether you are an analyst, performer, composer,

[9] David S. Lefkowitz and Kristin Taavola, "Segmentation in Music: Generalizing a Piece-Sensitive Approach," *Journal of Music Theory* 44/1 (Spring, 2000): 172.
[10] Judith Lochhead, "Some Musical Applications of Phenomenology," *Indiana Theory Review* 3/3 (1979): 19.

musician, or non-musician. The influence of a listener's own social, cultural, historical, biographical, and/or educational background also shapes his/her interpretation of the music. Furthermore, the composer of the work itself may also bring his/her own intentions of musical meanings for the listener, although that does not necessarily mean the intention will be realized. Consciously or subconsciously, and whether or not a composer admits to an underlying musical meaning or borrowing, a current experience can be influenced by a past or the expectation of a future experience, which in turn could affect the compositional process. Michael L. Klein's recent book titled *Intertextuality in Western Art Music* provides various ways that meaning and intertext can be investigated.[11]

> Various types of intertextuality suggest themselves. We may concern ourselves with just those texts that an author brought to her writing and study a *poietic* intertextuality. We may concern ourselves with the texts that a society brings to its reading and study a *historical* intertextuality, or we may open the text to all time and study a *transhistorical* intertextuality. The intertexts we make may be within a *style* or within a *canon*. We may make efforts to deafen ourselves to the multiple references of text to others across styles and histories, or we may remain attentive to an *aleatoric* intertextuality that roams freely across time. From the perspective of an author to that of a reader, from the boundaries of the historical to the boundlessness of the transhistorical, from the competencies of understanding a style to those of understanding a canon, the ways that we define and confine intertextuality hold court over our perspectives on the text and how we make sense of it. Since as readers we bring texts to our understanding of the single text, some notion of intertextuality, however defined, must underpin explicitly or implicitly our struggle to make meaning of a text.[12]

Nonetheless as Nicholas Cook notes, different musical meanings and interpretations do not imply arbitrary readings of works.

> Like a literary or musical text, a pot or a picture does not simply have meaning built into it, just waiting to be discovered. … Any pot or picture has an indefinite, though not indefinite, number of physical attributes, and each society makes its own selection from and interpretation of those attributes. … The meaning that the object acquires within a particular culture is thus supported by—and at the same time helps to stabilize—the specific selection off attributes which that culture has

[11] Several authors have written extensively on the subject of musical meaning and intertextuality, borrowing from literary critics (in particular Harold Bloom), and incorporating the disciplines of semiotics, hermeneutics, aesthetics, and narrativity. One can find extensive work on the subject by Robert Hatten, Kofi Agawu, Joseph N. Straus, and as noted, Michael L. Klein, among others.
[12] Michael L. Klein, *Intertextuality in Western Art Music* (Bloomington: Indiana University Press, 2005): 12.

> made; it helps to make the object what it *is* for that culture. In this way, while meaning is socially constructed, it is both enabled and constrained by the available attributes of the object.[13]

While different interpretations can be made about a piece of music and instill different expectations and understandings for other listeners, it is these different interpretations that allow us to open a dialogue about the music. The results benefit all listeners if each interpretation, even if in opposition, comes together to form a larger, well-rounded experience for the listener. Cook continues to note, "The material traces of music support a range of possible meanings, and they can be thought of as bundles comprised of an indefinite number of attributes from which different selections will be made within different cultural traditions, or on different occasions of interpretations."[14] In addition, Elizabeth Hellmuth Margulis states:

> Listening to music is a complex and multidimensional experience. Many different modes of engagement are possible; a person can listen casually, attentively, pragmatically, emotionally. Accordingly, the types of prediction that can be made in response to music are complex and multidimensional. … Different modes of engagement elicit different kinds of predictions.[15]

Because different modes of listening and different experiences/interpretations of music are possible, it is important to address the question of what the purpose of listening is taken to be within the context of this project. We will seek to understand the final product—what the listener will *hear*—of electronic works from a variety of composers, ranging from early works to most recent, and we will also propose an initial approach to identifying sonic events and structural aspects of the works from the listener's perspective. The purpose of the upcoming analyses is not to impose a particular interpretation upon listeners of electronic music, although it will be present, but instead to welcome different readings of these works, and offer my own as a personal hearing. The goal is to achieve a deeper understanding of this genre of music, which is perhaps still young enough for individual hearings to be possible, even when particular sounds or configurations of sounds might seem very familiar to the listener, or even very strange.

[13] Nicholas Cook, "Theorizing Musical Meaning," *Music Theory Spectrum* 23/2 (Autumn, 2001): 178-179.
[14] *ibid.*, 179.
[15] Elizabeth Hellmuth Margulis, "Surprise and Listening Ahead: Analytical Engagements with Musical Tendencies," *Music Theory Spectrum* 29/2 (Fall, 2007): 197.

Furthermore, many electronic pieces do not have an existing score, which creates an inherent difficulty when approaching the genre. In some cases there may be a score, but it typically only represents a cartographic view of the piece. This type of view illustrates only a two-dimensional aspect of the piece, usually frequency or amplitude versus time, excluding particular layering of sound and/or the diversity of sounds possible within a given piece. According to Simon Emmerson, "Scores for electroacoustic music exist, of course, but have a variety of functions: for performance with instruments or over complex loudspeaker systems, or simply for reading and background information, but rarely for the recreation of the work itself."[16] Without a score information such as the instruments/sounds, tempo(s), articulations, pitches, rhythm, and dynamics that are employed throughout a piece are not apparent. A transcription could provide an approximate graphic guide to the musical content, but it would not account for the complex sounds. Now the listener adds to the previous list of questions, "What are the sounds being employed? How can I identify them? What types of manipulations of these sounds are taking place? And ultimately, how are the sounds organized within the musical context?" The lack of a score means that a visual notation that corresponds to the aural is not available; therefore the aural aspect of the music becomes the main provider of any musical information the listener perceives.

In a 2007 article, Brian Alegant tests his students' ability to analyze sonata form movements solely by listening to the piece without the use of a score. In turn, his "primary aims are to stimulate thought about the topic of analysis without score, and to suggest that it is both possible and rewarding to teach this particular skill."[17] Alegant begins by noting Gary S. Karpinski's ideas about developing the listeners' skill.

> Karpinski makes three assertions about developing listening skills: first, that students should focus on the recurrence of motivic and thematic materials, textural changes, harmonic instability, and key areas; second, that students need to listen *repeatedly;* and third, that the skills gained through acquiring "intimacy with even only a handful of works" can be transferred to unfamiliar repertoire.[18]

[16] From the introduction of *The Language of Electroacoustic Music* Simon Emmerson, ed. (The Macmillan Press, Ltd.: London, 1986): 2.
[17] Brian Alegant, "Listen Up! Thoughts on iPods, Sonata Form, and Analysis without Score," *Journal of Music Theory Pedagogy* 21 (2007): 141.
[18] *ibid.*, 141.

While Alegant and Karpinski are focusing on tonal music and specifically addressing students' listening skills, the same skills could also apply to electronic music. More importantly, Karpinski notes the importance of multiple listenings to fully grasp the content and as well as being able to transfer gained knowledge to studying other compositions. In addition, Alegant demonstrates that analysis of music does not always call for the visual aid of a score.

The analytical approach applied in this project relies on an experiential perspective by investigating the segmentational process of sonic events, and the various perceptual layers of these events when applicable, within a composition in order to reveal how they function or do not function together. *Concentrated listening*, intended to illustrate the structure and form of a piece via perception, allows the listener to address all of the previous questions presented and enables the experience of the music itself to become a vital tool in discovering a piece's structure. As Thomas Clifton states, "Musical significance is not in the facts themselves, but is experienced through them."[19] The aim here is to develop and illustrate a systematic approach of discussing electronic music through segmentation and aural psychological perception in order to understand how to listen to a composition from the genre of electronic music.

[19] Thomas Clifton, "Music and the A Priori," *Journal of Music Theory* 17/1 (Spring, 1973): 71-72.

CHAPTER 1

OVERVIEW OF ELECTRONIC MUSIC

Brief History of the Genre

The advancements of technology have shaped the evolution of electronic music. Composers are able to explore and create new sounds, going beyond the limitations of traditional instruments and the capability of performers. Earlier compositions, too, were limited as composers had to invent or collaborate in the production of the tools necessary for their desired musical results. As a result, before attempting to analyze electronic music, the listener must first understand the genre's origins and development. From the late 1940's, electronic music can be traced back to two main locales – Cologne, Germany, which focused on the aesthetic of purely electronic based compositions known as *elektronische Musik*, and Paris, France, which was known for the aesthetic of incorporating samples of found sounds called *musique concrète*. Certain forms of electronic music and instruments existed beforehand, but these two cities were where the eminent pioneers in the electronic music community began working.

One of the earliest electronic instruments was Thaddeus Cahill's *Telharmonium,* which was finished in 1901 and was also known as the *Dynamophone*. It transmitted music through loudspeakers using electricity to produce sound waves via telephone lines. In a text written about the history of electronic music Joel Chadabe notes:

> [Cahill's] idea was to build an electronic music synthesizer. … [Its] sounds were produced by combining sine waves generated by dynamos whose outputs were linked through a complex switching system. The sounds were heard through horns attached to telephone receivers fitted with especially thin diaphragms for better bass response.[1]

[1] Joel Chadabe, *Electric Sound: The Past and Promise of Electronic Music.* (Prentice Hall: New Jersey, 1997): 4.

Another instrument, which has versions that are still in existence today, is Leon Theremin's self-titled *Theremin,* first demonstrated in 1920.[2] It used two vacuum tube oscillators to produce sound. In his book, Chadabe describes the instrument, how it was played and how it sounds.

> The theremin was a cabinet about one foot deep, eighteen inches wide, and about two feet high, placed on a table or stand. Emerging from the top right of the cabinet was a thin vertical rod, which was the pitch antenna. A loop, the volume antenna, was mounted horizontally on the left side of the cabinet. Theremin played it by moving his hands in the air. When his right hand moved closer to the volume antenna, it caused the pitch to go higher. When his left hand moved closer to the volume antenna, it caused the sound to get softer. The sound was somewhere between a viola and a clarinet, smooth and lyrical, sometimes reminding listeners of the human voice. Theremin later said, "I conceived of an instrument that would create sound without using any mechanical energy, like the conductor of an orchestra."[3]

Today the listener can find various demonstrations of Theremin playing on the Internet, including the famous Theremin player, Clara Rockmore.[4] In 1928, Maurice Martenot's *Ondes Martenot* was first demonstrated at the Paris Opera and also used oscillators to generate sound. Again, Chadabe notes:

> [Martenot] performed [on the instrument] by inserting a finger in a ring and pulling a ribbon left or right, causing pitches to change correspondingly lower or higher. While his right hand was occupied playing the ribbon, his left hand was employed at a small panel to the left of the keyboard, varying loudness and activating different timbres by manipulating various controls. A few years later, although the ribbon was and remained a distinguished feature of the Ondes Martenot, Martenot added a keyboard that could be used independently or in conjunction with the ribbon. He also placed a lever under the keyboard, to be pushed upward by the right knee to control continuous timbral changes.[5]

Although similar in sound to the Theremin, the Ondes Martenot allowed the performer to control timbral changes. Most notably is Olivier Messiaen's use of the instrument, which

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[2] The Beach Boys used a Theremin in their song "Good Vibrations" from the 1967 album *Smiley Smile* and Nine Inch Nails has developed their own version of a Theremin.
[3] Chadabe, 8.
[4] For more information on the Theremin refer to http://en.wikipedia.org/wiki/Theremin (accessed 02/01/09). For videos of Clara Rockmore refer to http://www.youtube.com/watch?v=pSzTPGlNa5U, which is a performance of Saint-Saëns's "The Swan" or Tchaikovsky's Valse Sentimentale found at http://www.youtube.com/watch?v=jEl4zCQBv2c&feature=related (accessed 02/01/09). In 1977 Delos International also released a recording of Clara Rockmore accompanied by Nadia Reisenberg on piano titled *The Art of the Theremin: Clara Rockmore* (CD 1014).
[5] Chadabe, 12.

includes such compositions as *Oraison* written in 1937 and Turangalîla-Symphonie composed in 1946-48.[6] As with the Theremin, there are also various demonstrations of playing the Ondes Martenot that can be found on the Internet.[7]

The first commercially successful electronic instrument was Laurens Hammond's 1935 Hammond electronic organ. It was widely used in rock, jazz, blues, and gospel music. In Peter Manning's book on electronic music, he notes:

> The Hammond Organ, although a more conventional instrument from the performer's point of view, gained a reputation for its distinctive if not entirely authentic sound quality. This was largely due to the method of tone generation employed, involving the rotation of suitably contoured discs in a magnetic field in a manner reminiscent of the Dynamophone.[8]

The Hammond organ recreates a pipe organ-type sound by using additive synthesis of waveforms from the harmonic series. While the instrument is still in use today, composers can also imitate the Hammond sound digitally.

Earlier in 1913 a painter named Luigi Russolo, who was part of the Italian Futurist movement, invented instruments called *intonarumori*, or noise intoners. The series of instruments divide into "six timbral types: booms, whistles, whispers, screams, percussive sounds and vocal sounds (human and animal)."[9] Chadabe notes that the instruments were "boxes of various sizes, each with a crank in the back, a sound-generating mechanism inside, and an amplification horn in front. A lever mounted on top of each box, was used to adjust pitch."[10] Nonetheless, Russolo's ideology is of more importance than the actual instruments themselves, which unfortunately are not in existence anymore. As Robert Morgan notes:

> Futurism stands in the history of twentieth-century music as the first clear manifestation of a major and enduring concern: the relationship between new music and modern technology. Although the Futurists apparently had no direct influence on subsequent compositional developments, their wish 'to conquer the

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6 Available recordings of the compositions mentioned in this chapter can be found in the Appendix.

7 For more information refer to http://en.wikipedia.org/wiki/Ondes_Martenot or http://120years.net/machines/martenot/, which includes a more detailed history, pictures, and sound files (accessed 02/01/09). For a video performance of the first movement of Turangalîla-Symphonie featuring Pierre Laurent Aimard, Cynthia Millar, Andrew Davis, and the National Youth Orchestra of Great Britain refer to http://www.youtube.com/watch?v=170VZGFoTKg&NR=1 (accessed 02/01/09).

8 Peter Manning, *Electronic and Computer Music*. 2nd ed. (Oxford University Press: Oxford, 1993): 3.

9 Robert A. Morgan, *Twentieth-Century Music: A History of Musical Style in Modern Europe and America.* (W. W. Norton and Company: New York, 1991): 116.

10 Chadabe, 3.

> infinite variety of noise-sound' has remained a recurring interest throughout the century.[11]

Electronic composers have a wide variety of technology at their hands to use for musical creativity. As a result, the sound palette available to the composer is limitless and ever expanding. But not only have electronic composers broaden the sound palette; composers of traditional instruments also stretched the capability of the instruments employing extended techniques and challenging performers. *Corale*, which was composed by Luigi and Antonio Russolo in 1921, is an example of a piece that incorporates the intonarumori. The piece includes the use of a traditional orchestra but illustrates an important compositional device found in electronic compositions – sound manipulation. In this piece the listener hears "noise" juxtaposed with the orchestra, which warps or manipulates the sound. Another example of an earlier electronic composition is John Cage's *Imaginary Landscape No. 1* written in 1939, which uses an "electrical buzzer, oscillator, generator whine, and contact microphone."[12]

Today the term electronic music may apply to any means of electronically produced music, whether it is generated from the computer by use of software programs, a synthesizer, audio editors, or drum kits, for example. However, earlier practitioners of the genre were divided not only by geography, Cologne and Paris, but also by compositional aesthetic. In 1948, the Frenchman Pierre Schaeffer began working at the Radiodiffusion-Television Française (RTF), experimenting with recorded sounds and composing music that became known as *musique concrète*.[13] *Musique concrète* utilizes prerecorded sounds taken from the environment, which are then electronically manipulated. The sonic elements stem solely from found sound and can range from the human voice to the use of traditional instruments to rustling leaves to car horns—any recordable sound imaginable. As Schaeffer states:

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[11] Morgan, 117.
[12] *ibid.*, 360.
[13] Although Schaeffer is known for coining the term *musique concrète*, pieces of this nature existed beforehand. Walter Ruttmann's *Wochenende,* composed in 1930, is an experimental film with only audio. The Egyptian born composer, Halim el-Dabh composed *Wire Recorder Piece* in 1944, which was broadcast on the radio in Egypt. Ruttmann's piece is available on *An Anthology of Noise and Electronic Music/ First A-chronology 1921-2001* released on Sub Rosa SR 190 (2002) and el-Dabh's piece is available on *An Anthology of Noise and Electronic Music/ Fourth A-chronology 1937-2005* released on Sub Rosa SR 250 (2006).

> This determination to compose with materials taken from an existing collection of experimental sounds, I name *musique concrète* to mark well the place in which we find ourselves, no longer dependent upon preconceived sound abstractions, but now using fragments of sound existing concretely and considered as sound objects defined and whole.[14]

Schaeffer's first composition associated with the term *musique concrète* was an experiment of sound titled *Etude aux Chemins der Fer* (Railroad Study) composed in 1948. This piece uses recorded materials from locomotives and the listener can clearly distinguish the sounds of trains along with the manipulations that Schaeffer employs, including looping and rendering sounds backwards.

In October of 1948, Schaeffer presented the *Concert de Bruits* (Concert of Noises) which consisted of five *musique concrète* studies broadcast over French radio. The concert was a success, which enabled Schaeffer to enlist musical assistance from Pierre Henry and Jacques Poullin. The first major *musique concrète* composition was *Symphonie pour un Homme Seul*, a collaboration by Schaeffer and Henry in 1950. In 1951 the studio was reestablished as the Groupe de Recherche de Musique Concrète. While Henry remained at the studio, Schaeffer spent his time between Paris and doing various projects in North Africa. However, in 1957 Schaeffer returned to Paris and Henry left the studio financing Studio Apsome with his own money. In 1958, Schaeffer along with Luc Ferrari, François-Bernard Mâche, Michel Philippot, and Iannis Xenakis established a new studio from scratch known as Groupe de Recherches Musicalis (GRM).

Whereas *musique concrète* incorporates the idea of using found sounds and turning these everyday sounds into music by composing "'by ear,' experimenting and critically listening to sounds and their combinations," *elektronische Musik* grew out of serialism.[15] After studying in Paris, in 1952 Karlheinz Stockhausen began working in Cologne at Westdeutscher Rundfunk (WDR, later renamed Nordwestdeutscher Rundfunk in 1955), which was founded by Herbert Eimert. The ideology that applies to German based electronic music of that period was that of "creating precise, sonic realizations of complex scores, formally elaborated in advance, in the spirit of the serial methods of composition. [Composers] insisted on using only electronically produced sounds, whose

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[14] Chadabe, 26-27.
[15] Jean-Claude Risset, "Foreword" in *Electroacoustic Music: Analytical Perspectives.* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): xiv.

physical parameters could be precisely controlled."[16] *Elektronische Musik* consisted of only using purely derived electronic sounds, and in particular additive synthesis, which involves combining waveforms to add various partials of the overtone series together. The first two pieces that Stockhausen composed at the studio, created from only sine waves, were *Studie I* and *Studie II* written in 1953 and 1954 respectively.

However in 1955, the distinction between these two aesthetics of electronic music began to break down with Stockhausen's composition *Gesang der Jünglinge,* which employs the element of *musique concrète* by using a sample of a young male's voice in combination with purely electronic generated sounds. As noted by Konrad Boehmer,

> In 1958, ten years after the funding of the Paris studio, Schaeffer drew radically different theoretical conclusions from the methods developed up to that time, laying the foundations of what later became known as *acousmatic* modes of production. After this turning point, *musique concrète* grew closer to the aesthetic presuppositions of the Cologne school. Moreover, in 1985 Pierre Schaeffer proposed to abolish the term *musique concrète*, unfortunately without success.[17]

Also in 1955, Luciano Berio and Bruno Maderna established an electronic music studio in Milan, the Studio di Fonologia at the Radio Audizioni Italiane (RAI). After hearing a concert of electronic tape pieces by Otto Luening and Vladimir Ussachevsky in the United States in 1952, Berio developed an interest in their music and started a friendship with the composers. In 1953, Berio met Maderna, who worked in Germany, and they began developing Studio di Fonologia. This studio fused the two aesthetics of electronic music. As Thomas Licata notes, "[In this studio] the distinctions between the compositional aesthetics of *musique concrète* and 'electronic music' were further eroded, if not thoroughly discarded."[18] Moreover, one finds in the history of electronic music that although various camps of compositional styles were established, these distinct camps did not remain secluded because composers moved from one studio to another to collaborate, creating a mix and mingling of ideas. For instance, Stockhausen not only worked in Cologne, but he also worked in Paris with Schaeffer. As well, Berio, Pierre Boulez, and Edgard Varèse worked in the Paris studio. John Cage worked in the Milan studio, and

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16 Risset, xiv.

17 Konrad Boehmer. "Koenig – Sound Composition – *Essay*" in *Electroacoustic Music: Analytical Perspectives.* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 59-60.

18 Thomas Licata, "Luigi Nono's *Omaggio a Emilio Vedova*" in *Electroacoustic Music: Analytical Perspectives.* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 74.

although Berio helped establish the Milan studio, he also worked at the Columbia-Princeton Electronic Music Center and IRCAM (discussed later). In addition, Japanese composers, who were also developing studios in Tokyo such as Jikken Kobo (Experimental Workshop) created in 1951 by Joji Yuasa, Toru Takemitsu, Hiroyoshi Suzuki, and Kazuo Fukushima and the Nippon Houso Kyokai (NHK – Japanese Broadcasting Corporation) founded by radio producers, engineers, and composers in 1953, visited the studios in Paris and Cologne to not only collaborate with other composers, but also to model their studios after the European ones.

The equipment for electronic music studios was very expensive, however a handful of people were able to build their own studios, such as Tristram Cary. Working in London, Cary bought his first tape recorder in 1952, and developed his own studio from there. Louis and Bebe Barron developed a studio in New York around 1948 to establish the Project for Music for Magnetic Tape. It was in the Barron studio that Cage composed *Williams Mix* in 1951. (A brief excerpt of this piece is discussed in Chapter Three.) In Europe the government largely funded electronic music studios within radio stations, whereas in the United States composers turned to academia and grants for their funding, mainly establishing studios within an academia setting. The first prominent studio in the U.S. began as a collaboration between Princeton and Columbia Universities.

In 1959 Otto Luening and Vladimir Ussachevsky from Columbia joined with Milton Babbitt and Roger Sessions from Princeton to form the Columbia-Princeton Electronic Music Center. Initially Luening and Ussachevsky developed a studio at Columbia and sought to obtain a synthesizer from RCA. Babbitt knew of this and was also interested in the instrument, which led to the joining of the two studios and acquiring an RCA Mark II synthesizer though a grant from the Rockefeller Foundation. Developed in 1957 by Harry Olson and Herbert Belar, the synthesizer generated sound through vacuum tubes using oscillators and noise generators. The actual production of sound consisted of giving the synthesizer commands with a punched paper roll. The paper rolls would then "tell" the synthesizer how the pitch, volume, duration, and timbre were to be controlled. Milton Babbitt worked with the machine extensively and notes:

> The machine was totally neutral. There were no set-ups or samplers. We had to start from scratch and do everything from the beginning. … We didn't want to reduce the dimensions of music, we just wanted to enhance them. And we did but

> the problem was that it was a monster of a machine. It was the size of a whole room, a huge affair.[19]

The RCA Mark II synthesizer was used in Babbitt's *Vision and Prayer* composed in 1961 for soprano and synthesized tape. (An excerpt of this piece is also discussed later in Chapter Three.) Unfortunately in the '60s, according to Babbitt, "Our studio was invaded. They didn't steal much of the synthesizer because they wouldn't know what to do with it. They took amplifiers and tape machines. To rewire all of that, the synthesizer would never have got back into shape."[20] Nonetheless, classical analog tape techniques were being surpassed by digital technologies in the '70s. In the mid '80s Princeton ceased its affiliation with the studio and became associated with Bell Labs under the direction of Godfrey Winham and Paul Lansky. Today the Columbia-Princeton Electronic Music Center is still active, but was reorganized in 1995 as the Columbia University Computer Music Center (CMC) directed by Bradford Garton.

On the other side of the continent in the 1960s, composers in San Francisco began experimenting with tape music. Tape music consists of using materials recorded on tape, which were cut and spliced together, ran backwards, looped, employed various recording speeds, and/or dubbed over multiple times to create various manipulations of sound. In 1961 at the San Francisco Conservatory, composers Ramon Sender and Pauline Oliveros began a series of tape music concerts called *Sonics*, which eventually lead to them forming a group of the same name. Other composers associated with the group were Morton Subotnick, Phil Winsor, Laurel Johnson, and Tony Martin. However, their experimentation with tape music was not favored at the conservatory because of unfortunate bad press. This prompted Subotnick and Sender to relocate their studio in a house, forming the San Francisco Tape Music Center (SFTMC).[21] Oliveros joined a year

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[19] Interview with Jason Gross, "Milton Babbitt talks about *Philomel*" (April 2000). From http://www.furious.com/perfect/ohm/babbitt.html (accessed 09/26/08).
[20] *ibid*.
[21] David W. Bernstein recently edited a book titled *The San Francisco Tape Music Center: 1960s Counterculture and Avant-Garde*, which provides an overview of the studio's inception with interviews and essays written by Sender, Oliveros, and Subotnick among others. The book also includes a DVD of a recent festival in 2004 called "Wow and Flutter," which "not only celebrated the artistic achievements of Pauline Oliveros, Ramon Sender, Tony Martin, Morton Subotnick, and Bill Maginnis, but also demonstrated the continuing vitality of their creative work." David W. Bernstein, ed. *The San Francisco Tape Music Center: 1960s Counterculture and Avant-Garde* (University of California Press: Berkeley, 2008): 289.

later in 1962. This center was also a bridge between the aesthetics of *musique concrète* and *elektronische Musik*. As noted by Subotnick, "At that point, there was a big battle between the Stockhausen elektronische Musik and the Schaeffer musique concrète, and we wanted to bridge these differences by calling it 'tape music,' which could be anything that was on tape."[22] In 1967 the SFTMC received a grant to join the Mills Center for Contemporary Music, with Oliveros as director. The center then became known as the Mills Tape Music Center (MTMC) and was later renamed the Center for Contemporary Music (CCM). However, when Robert Ashley took over direction of the center in 1969 all the original members of the SFTMC had left and the equipment had been taken apart.[23] A prime example of a tape piece is Steve Reich's *It's Gonna Rain,* which was commissioned by the SFTMC in 1965.

Nonetheless, the processes of creating music electronically during this earlier period, from the late '40s until the '70s, was extremely time consuming. As previously noted, tape music consisted of cutting and splicing sounds together, a very tedious job especially in comparison to today's music editing programs (Peak, Protools, Audiomedia, Session 8, etc.). Also, with electronically generated music, the composer would have to wait days or even weeks before actually hearing the sound(s) they had composed using patches and punch cards. If the sound was not satisfactory the whole process of cutting and splicing tape, creating new punched paper rolls, or constructing new patches to "plug in" would have to be redone. As Boehmer notes, "During the 'classical' period of the Cologne studio I have observed [Gottfried Michael] Koenig, Stockhausen, and other composers repeating simple actions and working long hours until the result, in an optimal way, corresponded to their musical imagination."[24] This issue was solved in the late 1970s with the development of digital technology and programs that work in real-time processes.

In 1970 another important studio began in Paris, known as IRCAM (Institute for Research and Coordination of Acoustics and Music). IRCAM was founded and developed by Pierre Boulez through the enlistment of the President of France, Georges

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22 Chadabe, 87-88.

23 Recently a group of Bay Area composers have revised the aesthetic and ideology of the group, calling themselves the New San Francisco Tape Music Center (NSFTMC) officially taking the name in 2000 with the approval of Sender, Subotnick, and Oliveros.

24 Boehmer, 62.

Pompidou. Boulez's most significant composition produced at IRCAM was *Répons*, initially composed in 1981 with revisions made until 1984. At IRCAM, Boulez was able to work with live processing, to him much more rewarding than the amount of hours that are spent working with tape, cutting and splicing. For the live processing of sounds Boulez used the software 4X, developed by Giuseppe DiGiugno, the first digital signal processor. *Répons* features a large chamber ensemble of twenty-four players with six soloists and live electronics, "in which sounds played by the six soloists (piano, synthesizer, harp, cimbalom, vibraphone, and xylophone) were independently transformed and routed through different loudspeakers placed around the hall."[25] Not only does the piece include the aspect of electronically manipulating the sounds of traditional instrumentation in real-time, it also features the aspect of spatialization by incorporating different locations for the speakers throughout the performance location. Some of the other composers associated with the center are Jean-Claude Risset, Gerald Bennett, Max Mathews, and John Chowning. As Chadabe notes:

> IRCAM was at first organized as five departments. In addition to the computer department, there was a department of instrumental performance headed by Vinko Globokar, an electronic music department headed by Luciano Berio, a department of pedagogy headed by Michel Decoust, and a department of the *diagonal* headed by Gerald Bennett (whose job it was to keep the other departments in a cooperative relationship).[26]

Not only was IRCAM dedicated to composing electronic music, but also research including acoustics and software programs. The official opening of IRCAM was in 1977 and it is still active today under the direction of Frank Madlener.

Although Chowning worked at IRCAM, he also received funds from the music department at Stanford University to form CCRMA (Center for Computer Research in Music and Acoustics). Co-founded with Leland Smith in 1975, the research center is still active today. More importantly, Chowning developed a synthesis technique known as FM (frequency modulation) synthesis in 1971-73, and sold the license to Yamaha. Chadabe notes:

> In *frequency modulation*, the instantaneous frequency of one waveform, called the *carrier,* is varied by another waveform, called the *modulator.* The extent to which

[25] Chadabe, 181.
[26] *ibid.*, 119.

> the carrier frequency varies, called *peak deviation,* is determined by the amplitude of the modulator. The rate at which the carrier frequency varies is determined by the frequency of the modulator.[27]

From the Yamaha royalties and other grants the center was able to grow considerably during the 1980s. Furthermore, other universities also began to create studios such as MIT, University of California San Diego, Michigan State University, and the University of Toronto. More studios were also developed in Europe as well, in Sweden, Denmark, and England. In fact, it is not uncommon today to find electronic music studios associated with universities and their composition departments all over the world. Other university based studios in the U.S. include the Harvard University Studio for Electroacoustic Composition, Indiana University Center for Electronic and Computer Music, and Peabody Computer Music Department, to name a few.

Now returning to the synthesizer, as previously mentioned an instrument used for creating electronic music, a name that is highly regarded with the development of synthesizers, which cannot go without mention, is Robert Moog. In the '50s, Moog began building and selling theremins and was then later approached by Herbert Deutsch in 1963, basically to build a machine that could produce "sounds that went wooo woo wooo."[28] As he thought about it, Moog decided that he could have one oscillator controlled by another. These oscillators would be voltage-controlled and had knobs on them that controlled frequency and amplitude modulation. It was from this conception that Moog than began building and selling his synthesizers. Other early synthesizers include Paul Ketoff's 1965 *Synket* (Synthesizer Ketoff), which had a touch-sensitive keyboard. Also in the early '60s, Donald Buchla started composing at the SFTMC, but saw how time consuming cutting and splicing tape was, and set out to develop "new equipment, including the idea for an optically controlled 'synthesizer'."[29] Buchla and Subotnick than began working together to create *Series 100* also known as the "Buchla Box." However, earlier synthesizers had problems specifically with tuning and the use of patchcords, which could become a tangled mess and often did not work or connections would easily break. Moog's *minimoogs* solved the problem with patchcords by

[27] Chadabe*,* 251.
[28] *ibid.*, 141.
[29] *ibid.*, 146.

incorporating buttons or a switch for module connections. Even so, Dave Smith's 1978 *Prophet-5* "was more than a real synthesizer. It was fully programmable and polyphonic [and] features microprocessor-based auto-tuning."[30] Since *Prophet-5* was programmable composers no longer had to recreate their sounds whenever the machine was turned on; they now could be saved.

In addition, several Japanese companies began developing keyboard synthesizers in the 1960s, including Roland, Yamaha, and Korg. As previously noted, Yamaha was instrumental in licensing and patenting Chowning's FM synthesis. Ikutaro Kakehashi, founder and president of Roland, recalls:

> In Japan there was no history of the organ. And at that time, no organs. So someone I knew imported a very simple electronic organ from the USA. It was made with tubes. It broke and he asked me to fix it. I was operating a TV store, so I fixed the organ and I liked the sound very much. Then I changed direction, from TV to music.[31]

These companies continue to develop synthesizers and were instrumental in producing commercially successful instruments. More importantly was the development of MIDI (Musical Instrument Digital Interface) in the early '80s, which was developed because of the need to have a standard musical interface. Kakehashi first saw this need when he noted, "It's wasted energy if people can't communicate, so in the digital era, the question was how to share data, and not to have a standard was not possible."[32] Chadabe further notes:

> The primary benefit, as intended, was that any number of devices, regardless of their manufacturers, could be linked in a single system to be controlled and synchronized by a single performer, and this flexibility in system design allowed composers to build up systems incrementally, gradually adding or exchanging components according to their pocketbooks and musical needs. Further, the availability of universally compatible components led to a larger and more diverse international market into which any component of the instrument, whether hardware or software, whether made by a large or small company, whether conventional or radical, could be sold.[33]

Previously the equipment and devices that composers used to produce their compositions were not compatible with each other, for instance if a composer created a piece using a

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[30] Chadabe, 157.
[31] *ibid.*, 194.
[32] *ibid.*, 194.
[33] *ibid.*, 196.

particular synthesizer it could only be reproduced on that machine. With the creation of MIDI, the composer could "hook anything into anything," and compositional data could be shared among devices.[34]

Along with the development of electronic studios and instruments, computer software and programs were also developed to create electronic music.[35] Most notable is Max Mathews, who conducted research for Bell Labs in Murray Hill, New Jersey, in order to improve the voice signal over phone lines. Starting in the late 1950s, Mathews began developing music programs that could generate sound from the computer digitally—with binary code. This began work on a series of programs known as the Music N series dating from 1957 through 1968. Jean-Claude Risset's *Mutations* written in 1969 is an example of a composition that uses the Music V program incorporating additive synthesis and frequency modulation. Other composers of electronic music would also experiment with these programs and then find ways to improve them. As noted by Agostino Di Scipio, "Mathews's work with Music V became a reference for many sound synthesis software developers."[36] Such studios as those at Stanford, IRCAM, MIT, and University of California, San Diego (UCSD) installed Music-N programs and worked with them extensively. Noteworthy was Hubert Howe and Godfrey Winham from Princeton who, in the '60s, adapted Music IV into Music IV-BF, which employed FORTRAN language. The use of FORTRAN language was a landmark in computer software programming because the programs could run on any computer, not just the type of computer that was used to design the program in the first place, which was the case previously.

The last Music-N installation came from CARL (Computer Audio Research Laboratory) at UCSD, which was formed by F. Richard Moore in 1979. "CARL research included software synthesis, programming, and the design and development of realtime

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[34] Chadabe, 195.
[35] For further reference, the *Computer Music Journal,* published quarterly, pertains various articles that are mostly dedicated to discussing various programs and software that are available for creating electronic music. An occasional article will focus on a particular composition, but typically for the benefit of other composers, however they do provide insight into the composer's viewpoint. In addition, there are various periodicals dedicated to the subject and feature the latest technologies.
[36] Agostino Di Scipio. "A Story of Emergence and Dissolution: Analytical Sketches of Jean-Claude Risset's *Contours*" in *Electroacoustic Music: Analytical Perspectives.* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 152.

performance systems. … The software, written largely by Moore, was called *cmusic*."[37] Earlier in 1968, Barry Vercoe had the idea "to develop a language that would enable composers to represent their audio processing ideas as near to the hardware as [they] could get them."[38] From this notion Vercoe developed Music 360 from 1968-1971, which "ran about five times faster than Music IV-BF and, ultimately it could do things that IV-BF wasn't able to do."[39] Vercoe later developed Music 11 in 1973, which was an equivalent of Music 360, but music could be played from a keyboard using real-time.

There are also programs, such as Max/MSP, in which the composer composes music for a traditional instrument. Then the music of the live performance is sent to the computer for real-time manipulation. The input of sounds in a piece that uses this program are then processed by algorithms created by the composer in Max/MSP. As the player performs live, in real-time, the sound is manipulated according to specifications written by the composer with the program. As a result, the finished product is the combination of electronically produced music and traditional instrumentation. Today there are an abundance of software programs and with personal computers the composer has a plethora of software and programming options to choose from. Creating an electronic music studio is not as challenging as it was previously for composers. Studios can now be found in the home and have become portable with the use of laptops. As Chadabe notes:

> As we better understand the human process of making music and as we become more aware of the nature of the relationships between people and the musical instruments they play, our understandings will lead us toward using technology more wisely in designing instruments that will be optimally beneficial to human creativity. As that happens, the electronic musical instrument, in its myriad manifestations, is likely to become the most ergonomic, sensitive, expressive, powerful, sophisticated, flexible, creative, socially beneficial, altogether rewarding instrument ever developed. And as we learn how to make it, we'll learn how to play it - and the other way around.[40]

Nonetheless, the concern is still for sound—the creation and manipulation of sounds—being able to produce an infinite variety of sounds beyond the scope of traditional

[37] Chadabe, 123.
[38] *ibid.*, 121.
[39] *ibid.*, 121.
[40] *ibid.*, 338.

instruments and the execution of complex sounds that are not possible on traditional instruments.

Although the three main camps of early electronic music consisted of purely electronic music, *musique concrète*, and tape music, the analyst can place the genre into the two main categories, from which the genre originated—purely electronic compositions and compositions that employ sampling. This sampling could be any found source that exists in the real world, which is used within the composition however the composer sees fit. The latter category of electronic music that employs sound samples can be broken down even further. The sound samples could be from a traditional instrument or the human voice, and may therefore include live performers, or taken from nature, in other words the sounds of life in general (birds, water, wind, cars, etc.). However, a piece of electronic music may not be immediately recognizable as a piece that is purely electronic, uses tape, or has sampling in it. Therefore it is pertinent to know the history of the genre, and the background of the composer and the work itself.

Analytical Consideration of Electronic Music

Scholars have drawn mainly on three different methods to support their analytical approaches to electronic music. Some analyses use highly technical computer jargon, which may be from the composer him/herself, but are usually of limited analytical use. The second category includes analyses that use spectrographs, sonograms, and similar renderings that show frequency and amplitude as a collective unit along a time axis (cartographic views). The last approach involves creating a "listening score," a symbolic representation, chart, or map of the piece. Although any of these three methods may provide insight into a composition, each also has its own shortcomings.

A recent collection of essays entitled *Electroacoustic Music: Analytical Perspectives* contains analyses incorporating either the composer's sketches or spectrographs.[41] The use of technical language unfortunately does not always provide a relevant understanding of a work that is at all congruent to our musical perception of it. Instead it typically aids in understanding the compositional process employed by the composer. Jean-Claude Risset notes that, in light of the essays that utilize composer's archives, “To take full advantage of these somewhat cryptic traces, those who undertake the analyses must be enlightened specialists, often composers themselves.”[42] For example, Pascal Decroupet and Elena Ungeheuer’s essay from *Electroacoustic Music: Analytical Perspectives*, “Through the Sensory Looking-Glass: The Aesthetic and Serial Foundations of *Gesang der Jünglinge,”* uses Stockhausen’s sketches which include charts of serial computations and ratios to illustrate the formal aspects of the piece.[43] However, at some points the reader may feel as if only Stockhausen himself could fully grasp the content. *Gesang* is a *musique concrète* work, incorporating electronic sounds with the sampling of a human voice. While the content of the essay may seem daunting, the appendix at the end is beneficial to one’s listening experience of the piece. First, the text is presented in its basic form for the listener to read. Then there is a legend for a list of vocal categories, such as *vp*, which indicates “vocal polyphony, variable in density,” or *sm*, which means “temporal harmonic spectrum of mixed timbres, numbered.”[44] These categories represent the type of manipulation occurring on the voice samples. Lastly, the appendix traces the text as it is presented in the piece, indicating time by minutes and formal sections, and also which vocal categories are present with the text. These vocal categories allow the listener to comprehend what types of manipulation of sounds they will hear and have a deeper understanding of the listening experience.

In his essay, “A Story of Emergence and Dissolution: Analytical Sketches of Jean-Claude Risset’s *Contours,*” Agostino Di Scipio focuses on the composer’s sketches of specific programming sequences that are used in the work.[45] Di Scipio discusses how

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[41] Thomas Licata, ed., *Electroacoustic Music: Analytical Perspectives* (Greenwood Press: Connecticut, 2002).
[42] Risset, xvi.
[43] Pascal Decroupet and Elena Ungeheuer, “Through the Sensory Looking-Glass: The Aesthetic and Serial Foundations of *Gesang der Jünglinge”* in *Electroacoustic Music: Analytical Perspectives,* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 1-39.
[44] *ibid.*, 32.
[45] Agostino Di Scipio, “A Story of Emergence and Dissolution: Analytical Sketches of Jean-Claude Risset’s *Contours*” in *Electroacoustic Music: Analytical Perspectives,* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 151-186.

the sequences are created and "examines the synthesis techniques adopted, including classic methods such as waveshaping, frequency modulation, and various additive synthesis methods."[46] Fortunately, Di Scipio states from the beginning of the essay that he purposefully did not use complex computer jargon in order for the essay to be user-friendly and susceptible to a larger audience of readers. As Marco Stroppa simply notes, "The truth is that nobody is really interested in doing exactly what the composer has done for a second time."[47] Of course the listener is interested in what the composer has created musically, but few have the ability to recreate the work themselves. The analyst is mainly concerned with the product of the composer and the computer, the music itself. Analyses that are derived from sketches and/or those that incorporate computer jargon may present the reader with incomprehensible technical material. Such analyses are beneficial to those who can grasp them, but to the layman information about the piece is lost in some regard.

Spectrographs, sonographs, and similar renderings of music allow the analyst to investigate frequency and amplitude over time producing a graph of the density of sound within the piece. Various shades of grey indicate when sounds are heard; lighter shades designate soft sounds and dark areas represent loud sounds. Robert Cogan's chapter on "Electronic and Tape Music" in *New Images of Musical Sound* examines Babbitt's *Ensembles for Synthesizer,* Risset's *Little Boy,* and his own work *No Attack of Organic Metals* using spectrum photos.[48] Cogan's purpose for using spectrum photos is to reveal how musical and sonic elements are "organized into structural formations."[49] He notes, "We can, using spectrum photos, discern the constituent musical and sonic elements and the ways in which they are organized into structural formations."[50] Cogan analyzes the contents of the spectrographs focusing primarily on register—high, middle, and low frequencies—to illustrate how each of the three pieces can be partitioned into sections. As mentioned previously, essays in *Electroacoustic Music: Analytical Perspectives* employ spectrum photos as well,[51] including "*Diamorphoses* by Iannis Xenakis" written

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[46] Di Scipio, 154.
[47] Marco Stroppa, "The Analysis of Electronic Music," *Contemporary Music Review* 1 (1984): 177.
[48] Robert Cogan, *New Images of Musical Sound* (Harvard University Press: Massachusetts, 1984).
[49] *ibid.*, 103.
[50] *ibid.*, 103.
[51] Other essays in this book that do not employ spectrum photos or composer's sketches in their analysis, but keep with the main theme of the text by investigating formal structures, include Konrad Boehmer's essay, "Koenig – Sound Composition – *Essay.*" The piece is dissected into eight parts with Boehmer

by Thomas DeLio.[52] DeLio's analysis aims at identifying the structure of the work by focusing on the range of frequency and how the piece can be divided into three sections that overlap and merge with each other. As DeLio notes,

> The form of the piece can be described as a three-stage progression. In the first stage, Xenakis introduces two contrasting frequency regions and two contrasting sound types. In the second stage, these two regions and sound types are completely separated. In the third and final stage, they are pitted against one another through a pair of sonic inversions.[53]

DeLio uses sonogram photos to study the contrast of light and dark shadings, which represent sound, in given frequency ranges—low, middle, and high. Another essay is Thomas Licata's "Luigi Nono's *Omaggio a Emilio Vedova,"* which shows the formal structure through amplitude, the use of sustained and short sounds, and diffused or compact spectrum.[54] To investigate these aspects of the formal structure, Licata studied the contrast of shadings found in the photos, similar to DeLio's analysis. Lastly, Kristian Twombly's essay "Oppositional Dialects in Joji Yuasa's *The Sea Darkens*" keeps with the theme found throughout the text and discusses the formal structure of the piece.[55] Twombly divides the work into two sections by examining differences among register, gesture, and tone color, which are represented by various shadings found in the photos. Twombly notes, "The interaction of these contrasting materials provides the basis for the formal structure of much of the work as well as the dramatic tension of the piece, and the synthesis of these materials near the end of the piece constitutes the work's

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focusing on the first part, "Part A," which uses serial techniques and various electronic manipulations including "ring modulation, transposition, filtering, reverberation, intensity curves, and other transformations." Konrad Boehmer, "Koenig – Sound Composition – *Essay*" in *Electroacoustic Music: Analytical Perspectives,* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 68. In Jerome Kohl's essay "Serial Composition, Serial Form, and Process in Karlheinz Stockhausen's *Telemusik,*" he notes that *Telemusik* is made up of "thirty-two moments of various duration, each beginning with the stroke of a Japanese temple instrument. The durations in seconds of these moments are derived from the six members of the Fibonacci series from 13 to 144." Jerome Kohl, "Serial Composition, Serial Form, and Process in Karlheinz Stockhausen's *Telemusik*" in *Electroacoustic Music: Analytical Perspectives,* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 100.

[52] Thomas DeLio, "*Diamorphoses* by Iannis Xenakis" in *Electroacoustic Music: Analytical Perspectives,* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 41-57.

[53] *ibid.,* 50.

[54] Thomas Licata, "Luigi Nono's *Omaggio a Emilio Vedova"* in *Electroacoustic Music: Analytical Perspectives,* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 73-89.

[55] Kristian Twombly, "Oppositional Dialects in Joji Yuasa's *The Sea Darkens*" in *Electroacoustic Music: Analytical Perspectives,* Thomas Licata, ed. (Greenwood Press: Connecticut, 2002): 217-235.

dénouement."[56] Other oppositions found in the piece are the use of English and Japanese, and a female and male voice.

Another book of essays titled *Analytical Methods of Electroacoustic Music* contains analyses that employ the use of spectrographs.[57] Whereas the previous collection of essays edited by Licata focused on the overall form of the compositions, this text features articles that address other musical aspects. In one article, Mary Simoni investigates Paul Lansky's *As If,* written for synthesized tape and a string trio.[58] Simoni's analysis incorporates set theory analysis to explore the pitch content of the piece, and focuses mainly on the score of the string trio. Simoni notes, "One of the principal compositional elements unifying *As If* is the composer's selection of pitches and how collections of these pitches, or sets, are presented both melodically and harmonically."[59] While Simoni mentions a number of sets in this essay, her analysis focuses primarily on the diatonic sets. The other sets that are mentioned seem arbitrary to the reader because they lack a connecting thread to the diatonic sets within the discussion of a particular musical segment. Spectrographs are employed to show various harmonic spectrums produced by the string trio and/or synthesized tape.

The focal point of Benjamin Broening's essay "Alvin Lucier's *I am sitting in a room"* pertains to the minimalist ideology of music as a process.[60] Broening employs spectrographs to investigate the pitch and time of the piece, searching for the moment where Lucier's speech *really* becomes unintelligible. Nonetheless, Broening notes the actual moment of unintelligible speech is not a clear-cut sonic event, and depends on the listener's perception of the piece. Another essay by Andrew May, "Philippe Manoury's *Jupiter*," focuses on a work that includes electronics with a flute. A signal is sent from a live flute player to the computer in which a software program takes the data from the sounds of the flute to generate transformations of the live playing. May's analysis "attempts to correlate notation, software, performance, and sound in order to address

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[56] Twombly, 218.
[57] Mary Simoni, ed., *Analytical Methods of Electroacoustic Music* (Routledge: New York, 2006).
[58] Mary Simoni, "Paul Lansky's *As If"* in *Analytical Methods of Electroacoustic Music.* Mary Simoni ed., (Routledge: New York, 2006): 55-88.
[59] *ibid.*, 56.
[60] Benjamin Broening, "Alvin Lucier's *I am sitting in a room"* in *Analytical Methods of Electroacoustic Music,* Mary Simoni, ed. (Routledge: New York, 2006): 89-110.

timbre, interaction, and form."[61] *Jupiter* is in a classical concerto form, with exposition, development, and recapitulation. May uses peak-graphs, which are like sonograms measuring frequency over time, to illustrate how sonic links are created between the flute and the electronically produced music.

Although these articles tend to be quite comprehensible to the reader and can cover a wide range of topics, one drawback of spectrum photos is that sonic elements are fused together when representing them in real-time. Spectrograms are "two-dimensional graphic representations of frequency and amplitude as a function of time," and as a result, distinct sounds are no longer represented as distinct.[62] The sounds become blended, in turn losing the essence of each individual sonic event. In other words, this type of visual representation loses such elements as what types of sounds there are and how they simply "sound." Only on a rare occasion in these types of articles does the analyst point out intricacies of the sonic events under question.

Listening scores created from numerous and concentrated listenings allow the analyst to draw conclusions about the structure of a composition. These types of scores are intuitive descriptions of musical articulations and form, which can be a symbolic representation, chart, or a map of the music in time. These scores can include verbal, pictorial, and/or staff-based notation, depending on the composition and the analysis. These types of scores can also work in conjunction with a narrative of the piece making them readily comprehensible. While Stroppa notes that listening scores can be "crude and approximate, particularly in comparison with the complexity and perfection of traditional notation," they present sonic events in a chronological order and aid in illustrating how these events relate or do not relate to each other.[63] Bruno Bossis also points out the shortcomings of such representations of music, but also recognizes their validity.

> Although acoustic authenticity is preferred, graphic transcription is still difficult to decipher due to the lack of recognized norms and an often-excessive simplification of schemata. Yet these listening schemata often do provide

[61] Andrew May, "Philippe Manoury's *Jupiter*" in *Analytical Methods of Electroacoustic Music,* Mary Simoni, ed. (Routledge: New York, 2006): 145-146.
[62] Broening, 95.
[63] Stroppa, 177.

> meaningful symbolization. Sounds are no longer noted individually. Instead, the form or shape of a complex acoustic phenomenon is suggested.[64]

By creating a listening score the listener can categorize and organize the sounds that are heard in a composition. Although listening scores are only representative of one specific piece, through investigating a number of electronic music compositions we can devise some general questions to ask in order to codify an analytical approach for this genre of music. Brian Fennelly's 1967 article "A Descriptive Language for the Analysis of Electronic Music" is an early attempt concerned with how to go about describing this genre of music.[65] Nonetheless, as one would suspect, the issue with Fennelly's descriptive language is that technology has advanced considerably with more ways of creating and manipulating sounds. At the time Fennelly's focus was primarily with pitch versus noise, but more importantly, he notes the importance of simply listening to the sounds themselves.

In his article, "Phenomenology as a Tool for Musical Analysis," Lawrence Ferrara employs a listening score to focus on the formal structure of Varèse's *Poème Électronique*.[66] Ferrara's objective is to provide a narrative that is founded on various dimensions of meaning, such as syntax, semantics, and ontology. Ferrara illustrates this process through a series of his "reflections" of the piece, identifying each class of sounds heard by giving them an associative name, which eventually leads Ferrara to partition the piece into ten sections. Ferrara's final conclusion is that Varèse's piece has a free formal structure in which an unfolding of sonic events occurs, but "not in a traditional setting."[67] Along with Ferrara's descriptive reflections, he also provides the listener with a listening score that lists which sounds occur within the sections of the work. Ferrara's reflections and score do not keep track of the time when sonic events or new sections occur, so in this case, the listener will need to become familiar with the work by listening to it multiple times in conjunction with Ferrara's analysis for a deeper understanding of the composition.

[64] Bruno Bossis, "The Analysis of Electroacoustic Music: From Sources to Invariants," *Organised Sound: an International Journal of Music Technology* 11/2 (2006): 104.
[65] Brian Fennelly, "A Descriptive Language for the Analysis of Electronic Music," *Perspectives of New Music* 6/1 (Autumn-Winter, 1967): 79-95.
[66] Lawrence Ferrara, "Phenomenology as a Tool for Musical Analysis," *The Musical Quarterly* 70/3 (Summer, 1984): 355-373.
[67] *ibid.*, 371.

In a more recent article, Judith Lochhead looks at Charles Dodge's *Any Resemblance is Purely Coincidental* in order to figure out how the piece "works."[68] Dodge's piece is for piano and tape, including a sample of Enrico Caruso singing "Vesti la giubba" from Leoncavallo's *Pagliacci*. Lochhead's analytical approach involves her own experience of the piece in which she creates "maps" of the work. These "maps" are essentially listening scores for the work, in which Lochhead's "descriptive map" presents the categories of the sounds found within the work in conjunction with a timeline. The sounds are categorized by Lochhead as "old recording," "old music" (the piano and Caruso), "old music transformed," "new music," and "electronic sounds." By incorporating the maps in the analysis, listeners can follow them as they listen to the piece and trace the sounds that they will hear. In addition, Lochhead addresses aspects of opposition found within the work, such as old music (Leoncavallo sample) versus new music (electronics), and acoustic (piano) versus electronic sounds. In her analysis, she also provides the listener with "explanatory maps" that trace these oppositions in correlation to the descriptive map. Lochhead's maps of Dodge's *Any Resemblance* are derived from her own listening experience illustrating how this aspect of investigation can be incorporated in the analysis. Accordingly, Lochhead notes, "How it works must lead to hearing as a category of musical understanding."[69] In other words, we can come to know a piece and gain a deeper insight of it simply by listening.

Listening scores serve as an accessible tool for understanding a composition and are user-friendly. An important factor for creating a listening score is the clear and accurate representation of the piece in order to function as an aid to comprehension. The creator of a listening score should embrace the concept of music as a phenomenon. Since music is a sonic event, and we hear and listen to music, it can be understood phenomenologically as an aural experience. Although all three methods of analysis discussed are applicable to electronic music providing the analyst with viable information about a piece, creating a listening score allows the composition to be ready-at-hand and provides the most comprehensible investigation of a piece. This method will be employed for the analyses in this essay.

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[68] Judith Lochhead, "'How Does It Work?': Challenges to Analytical Explanation," *Music Theory Spectrum* 28/2 (Fall 2006): 233-254.
[69] *ibid.*, 252.

Phenomenological Application Incorporated into Music Analysis

Only a small number of scholars have adopted an overtly phenomenological approach to analyzing music. Others have employed similar approaches but do not use the term phenomenology in their analysis. The following will provide an outline of work that has been done incorporating phenomenology in musical analysis and will also highlight some articles that use this approach, but do not attach this specific term.

In his 1969 article entitled "Musical Analysis as Phenomenology," Philip Batstone forthrightly states that phenomenology is a viable tool for musical analysis because it allows the listener to "describe musical compositions as aural phenomena," which they ultimately are.[70] Batstone also notes that since phenomenology pertains to the "now" moment of time, we should then begin to turn our attention to hierarchical levels of musical elements, how the music progresses, and how changes in musical elements occur. These are all key elements in attentive listening and all part in answering the question: How am I hearing this music? Batstone specifically addresses Webern's *Three Little Pieces for Cello and Piano*, Op. 11 because its structure is complex and focuses on such musical elements as "extreme position, contrast, and closure."[71]

More recent analyses utilizing phenomenology include a number of essays written by Judith Lochhead. Her dissertation, written in 1982, focuses on "musical structure through our experience."[72] Specifically, Lochhead investigates temporal aspects of twentieth-century music, and employs a phenomenological method since "recent pieces share no common system, [and] analysis must clarify the context which each piece uniquely establishes and within which it works."[73] Lochhead first begins by looking at pieces by earlier composers, such as Lassus, Bach, and Schumann, then turns to twentieth-century composers such as Webern, Carter, Dallapiccola, Babbitt, and Reich. Lochhead uses various time periods of music simply to show that temporal processes are

[70] Philip Batstone, "Musical Analysis as Phenomenology," *Perspectives of New Music* 7/2 (Spring-Summer, 1969): 94.
[71] *ibid.*, 97.
[72] Judith Lochhead, "The Temporal Structure of Recent Music: A Phenomenological Investigation" (Ph.D. diss., State University of New York at Stony Brook, 1982): 153.
[73] *ibid.,* 1-2.

evident in any era. Throughout her dissertation Lochhead focuses on what she calls "temporal objects," or musical units, and how they can be experienced in time. Temporal objects may have a distinct boundary, they may overlap, or they may be continuous. In addition, drawing on Heidegger's observations, temporality is viewed as an experience of past, present, and future. In other words, temporal objects are events that unfold as part as a temporal whole. As the listener experiences the temporal whole, these events are waiting to be heard in the future, will be heard in a moment of now, and become a past event. The succession of events then in turn creates the temporal whole.

By incorporating a phenomenological approach, many of Lochhead's articles focus on the subject of temporality in twentieth-century music. Her article, "The Metaphor of Musical Motion: Is There an Alternative?" deals specifically with rhythm and its complexity in twentieth-century music.[74] After discussing musical motion, the second part of this article looks at three specific authors–Allen Forte, Christopher Hasty, and David Lewin–and critiques their notions of temporal structures. Her purpose is to outline their respective findings and "to clarify the assumptions underlying theories about the temporal structure of music."[75] Therefore, this article does not deal with specific pieces per se, but issues in temporal structure in twentieth-century music as viewed by other leading theorists. Another article titled "Joan Tower's *Wings* and *Breakfast Rhythms I and II*: Some Thoughts on Form and Repetition" again deals with temporal structures.[76] Lochhead looks at the use of repetition in two specific pieces by Joan Tower, a twentieth-century composer. Her aim is to show how repetition can define musical form by the process of "building up" of a whole from an accumulation of parts. Lochhead sets out to show that "repetition may have a variety of functions that extend beyond the stabilizing role often ascribed to it."[77] As we have seen from her previous articles, Lochhead is again concerned with temporal structure, this time with the application of repetition.

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[74] Judith Lochhead, "The Metaphor of Musical Motion: Is There an Alternative?," *Theory and Practice* 14-15 (1989/90): 83-103.
[75] *ibid.,* 103.
[76] Judith Lochhead, "Joan Tower's *Wings* and *Breakfast Rhythms I and II*: Some thoughts on Form and Repetition," *Perspectives of New Music* 30/1 (Winter, 1992): 132-156.
[77] *ibid.,* 132.

Thomas Clifton's book *Music As Heard: A Study in Applied Phenomenology* also focuses on the aspect of temporality.[78] In particular, Clifton discusses the background of experience, specifically focusing on musical time. The inherent problem is how do we "feel" time. "It is not possible to formulate a general rule about the fullness of time and experienced duration because of the complexity of the relation between feeling, cognition, and volition, and the form of time."[79] Clifton then notes that it is musical events themselves that will ultimately define time, presenting music as an object. In this light, time can also be noted through experiences of past, present, and future, which Clifton discusses in his chapter three. In chapter four, Clifton discusses his concept of "time in motion" which explores the beginnings and endings of musical events. With endings, a distinction is made between stopping and ending in which the former does not have fulfillment and the latter does. Other topics discussed here are continuity, contrast, various types of interruption, and levels (or strata) of time.

Following the discussion of "time in motion," Clifton next considers "space in motion" starting with the simplest form of motion, a single melodic line. It is simple because in terms of space it occupies a narrow space, however this space can have a certain amount of complexity incorporating such aspects as contour, width, distance, timbre, and rhythmic levels. Clifton continues by discussing surfaces and various types of structure, from the complex ("high relief") to the not so complex ("low relief"). Then the following chapter addresses the "play element," which pertains to the listener's experience. As Clifton states:

> A consideration of essential backgrounds of experience entails not only a description of the logical requirements demanded by the materiality of the musical composition, but also the contributions made by the participating listener. To my mind, nowhere does this required fusion between experiencing self and experienced music show itself more clearly than in the notion of play as a musical essence.[80]

This chapter basically outlines how the essences of music–time in motion, space in motion, and the play element–are to interact with each other. Nonetheless, the last chapter, "the stratum of feeling," really gets to the heart of what Clifton is trying to

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[78] Thomas Clifton, *Music as Heard: A Study in Applied Phenomenology* (Yale University Press: New Haven, 1983).
[79] *ibid.,* 53.
[80] *ibid.,* 71.

express to the reader. This chapter discusses how a piece has meaning to us because we experience it, phenomenologically, and we "possess" the experience. The listener can possess his/her own experience of a piece music because each experience is individual to the listener, therefore it is his/her own. As Clifton notes:

> In other words, before we place a piece of music in its historical and cultural setting and regard it as a cultural or aesthetic object about which we can make learned sounds, it is first 'our' music, something through which we live, something which, in a certain sense, we become. The piece, therefore, has value because I possess it, and it possesses me. But I do not possess it simply because it has value. If this were not the case, value would have to be interpreted as a property instead of a judgment.[81]

In conjunction with our possession of the music, is a belief in that music, and from this belief we can then intellectualize it, which is the fundamental aim of applying phenomenology to music. In his book, Clifton largely focuses on tonal music, including Bach, Beethoven, Brahms, Chopin, and Mozart. He also includes a brief discussion of some Gregorian chants and selected examples from Webern and Ives.

Phenomenological approaches to music not only investigate temporal aspects, but also formal structures as well. For example, Lawrence Ferrara's article, also mentioned in the previous section, titled "Phenomenology as a Tool for Musical Analysis," specifically discusses Varèse's *Poème Électronique* an electronic composition written in 1958. Ferrara's procedure in applying a phenomenological approach is to attend "to formal structures (syntax)…, report semantic meanings…, uncovering of ontological meanings…, [and lastly] the final 'open' listenings."[82] Ferrara introduces the reader to the term "open listenings," which involves listening to a piece number of times and tracing your impression of the work. By listening openly to *Poème Électronique,* Ferrara's aim is to describe the sonic events that he hears and to place them within a formal structure. As noted in the previous section, from a series of his own "reflections" of the piece, Ferrara concludes that *Poème Électronique* has a free formal design in which there are ten sections that comprise the whole of the work. Ferrara notes, "While there is no strict form or teleological impulse, concomitantly there is a definite sense that all the sections are

[81] Clifton (1983), 273.
[82] Ferrara, 360.

organic and vital to the work."[83] By using his own experiential reflections, Ferrara is able to decipher and categorize the sonic events found within the piece, which enables him to come to a deeper understanding of the structural aspect of the piece.

Another book that incorporates a phenomenological approach that focuses on formal structures is James Tenney's *Meta + Hodos: A Phenomenology of Twentieth-Century Musical Materials and an Approach to the Study of Form.*[84] Tenney is mainly concerned with the issues that arise when investigating twentieth-century music, specifically the complexity of musical materials, such as tone clusters or inharmonicity, which may occur and function as important elements within the composition. Tenney's aim is to show that by realizing complex structures as musical units, or "clangs," we can then begin to comprehend the structure of a work. Tenney states:

> In place of "sound," "sound-configuration" or " musical idea" I propose the word *clang*—to be understood to refer to any sound or sound-configuration which is perceived as a primary musical unit—a singular aural gestalt. For subordinate parts of a clang, use the word *element*—whether these are articulated in the vertical dimension as "linear" or *concurrent* parts, or in the time-dimension as *successive* parts—i.e. tones, chords, or sounds of any kind. Finally, some term is needed to designate a succession of clangs which is set apart from other successions in some way, so that it has some degree of unity and singularity, thus constituting a musical gestalt on a larger perceptual level or temporal scale—though it will not be as "strong" a gestalt as is the clang. For this larger unit I shall use the word *sequence.*[85]

However, Tenney's book is just a beginning approach in that he does not investigate a piece in its entirety, focusing instead on the smaller musical units. Some of the composers whose works are discussed in this book include Schoenberg, Webern, Bartók, and Ives, to name a few, in which the clangs, elements, and sequences are investigated. In his approach Tenney invokes particular psychological properties for grouping, such as similarity and proximity, which are also two of the five Gestalt principles of perception. This book is vital because it addresses many inherent issues in listening and analyzing twentieth-century music, and more importantly, seeks to provide a new method to

[83] Ferrara, 371.
[84] James Tenney, *Meta + Hodos: A Phenomenology of Twentieth-Century Musical Materials and an Approach to the Study of Form; and META Meta + Hodos* (Hanover, NH: Frog Peak Music, 1992).
[85] *ibid.*, 25.

listening to complex musical materials found within the compositions in order to make them more readily understandable.

David Lewin's 1986 article titled "Music Theory, Phenomenology, and Modes of Perception" provides the reader with a model of the perception of a sonic event within a piece of music.[86] Lewin's model allows the listener to understand a sonic event within the context of the composition, which is the basis for the listener's perception of the musical event. From this perception of an event the listener can then discuss the event within a given musical language. Of course a number of statements can be made about a sonic event, but ultimately the listening experience influences the listener's musical decisions. Nevertheless, Lewin's own application of his model in the article suggests that the sonic event is not necessarily a "logical necessity for a perceptual discourse about music [because] at the very least it has a lexical function."[87] Of course we could easily skip the "sonic event" aspect in discussing tonal music, which is Lewin's particular focus in this article, because the language of tonal music is already well established in our discourse. However, the recognition of the sonic event is pertinent to the analysis of electronic music because of its lexical function. In other words, electronic music cannot be arranged for alternate media, as tonal music can. Electronic compositions may incorporate an infinite number of sounds, sounds not produced by traditional instruments, and the function of a sonic event enables us "to mark, collect, and compare a certain ensemble of formal perceptions, that is perceptions about [the sonic event]."[88] Furthermore, once a sonic event is realized and subjected to a deciphering relational process, the event can then be understood within musical language, either spoken or written.

Scholars who have applied a phenomenological approach to music seem to agree that this type of approach is applicable to any era of music, whether it is Bach or Varèse, and the formal structure of a composition is often investigated. Moreover, there are also articles that employ a phenomenological approach, but are not explicit in saying that their approach is from a phenomenological viewpoint. Christopher Hasty has written several such articles. His article "Segmentation and Process in Post-Tonal Music" is based on an

[86] David Lewin, "Music Theory, Phenomenology, and Modes pf Perception," *Music Perception* 3/4 (Summer, 1986): 327-392. Lewin represents his model as p=(EV,CXT,P-R-LIST,ST-LIST), which means perception = the event, the context, the perception and relational list, and the statement list.
[87] *ibid.*, 336.
[88] *ibid.*, 336.

analytical method which favors listening to the music in order to efficiently partition the piece into segments.[89] Hasty provides an evaluative system of perceptual prominence by noting which musical parameters, or "domains," create unity in a segment. The segmentation of a particular event that shows the most unity, or "continuity," should be the most readily perceivable. Therefore, when determining which musical segments are the most significant "emphasis will be given to the theoretical component which predicates implicit musical perceptions."[90] Another article by Hasty is "Phrase Formation in Post-Tonal Music."[91] This article addresses how pieces can be divided up into parts and hierarchical levels. Therefore, when discussing this type of musical coherence it is realized as a "temporal *phenomenon* [in which] we begin by asking what constituent parts are and how they are united to form a whole."[92] Lastly, a third article by Hasty titled "On the Problem of Succession and Continuity in Twentieth-Century Music," specifically addresses temporality (like we have seen in Lochhead's work) and the notion of continuous versus discontinuous change.[93] This article, out of the three I have mentioned, is more open to its phenomenological application. Hasty even mentions Edmund Husserl (the originator of phenomenology) in this article, discussing the notion of protension and retention in relation to time.

Another article that has phenomenological underpinnings is Jonathan Kramer's "New Temporalities in Music."[94] In this article Kramer discusses the aspect of time in which his main focus is on "moment time." Here music is sectioned off into segments of time and how understanding the *moment* can generate form.

> The *self-containment of moments* allows the listener to process them as individual entities. This requires a statistical mode of listening, a mode which is quite possible in the absence of temporal linearity. *As we go through the piece*, we accumulate more and more data concerning form; the more data we apprehend, the more we understand the balance (or lack of it) that is generating the form.[95]

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[89] Christopher Hasty, "Segmentation and Process in Post-Tonal Music," *Music Theory Spectrum* 3 (Spring, 1981): 54-73.
[90] *ibid.,* 55.
[91] Christopher Hasty, "Phrase Formation in Post-Tonal Music," *Journal of Music Theory* 28/2 (Autumn, 1984): 167-190.
[92] *ibid.,* 168. (emphasis mine)
[93] Christopher Hasty, "On the Problem of Succession and Continuity in Twentieth-Century Music," Music *Theory Spectrum* 8 (Spring 1986): 58-74.
[94] Jonathan D. Kramer, "New Temporalities in Music," *Critical Inquiry* 7/3 (Spring, 1981): 539-556.
[95] *ibid.*, 549. (emphasis mine)

Kramer depends on the experience of the musical moment in order to understand how that moment functions structurally within the composition.

One further article that seems to rely upon a hidden phenomenological approach is John Roeder's "A Calculus of Accent."[96] Roeder's focus is on twentieth-century music such as Berio's *Sequenza I,* Bartók's *Music for Strings, Percussion, and Celeste,* Carter's "Insomnia" from *A Mirror on which to Dwell,* and Xenakis's *Diamorphoses*, to name a few. According to Roeder, "Analytical techniques for identifying and classifying pitch and durational patterns may prove fruitless for this music, either because they reveal no underlying organizational principles, or because any consistencies they uncover seem weakly, if at all, related to *listeners' perception.*"[97] As a result, Roeder's aim is to show how organization of a composition can be found by tracing on the foreground level of perception, the time of the piece realized by accentuation.

Whether or not authors explicitly state that phenomenology is their basis for analysis, the fact is that the view has been and can be used to create meaningful discussion of and insight into musical analysis. A phenomenological approach to electronic music, or any genre of music, is useful because it makes available a representation of the music as heard. Further, since electronic music may not always have a score to represent the music, listeners must therefore rely on their experience in order to come to a deeper understanding of the music.

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[96] John Roeder, "A Calculus of Accent," *Journal of Music Theory* 39/1 (Spring, 1995): 1-46.
[97] *ibid.*, 1. (emphasis mine)

CHAPTER 2

PHENOMENOLOGY AND AN ANALYTICAL APPROACH

The Concept of Phenomenology

When listening to a piece of music for the first time, particular musical elements may capture the listener's attention. These elements could be, but are not limited to, a melody, harmonic progression, rhythm, or a particular sonic event, and our experience of them may be conscious or subconscious. Upon initial listenings, listeners may begin to build up expectations for the progression of the musical elements within a composition. These expectations are either satisfied or unsatisfied, but the listener still recognizes that these musical events function as part of the piece. In addition, the expectations of one listener may differ from another listener's expectations of musical events. As a listener hears a work repeatedly, the experience of the music suggests relationships between all the musical aspects, including whether they are similar or contrasting. This type of attentive listening involves focusing on one's perception of the music in order to determine musical structures, incorporating what the listener knows and/or what the listener thinks they know about the music. The experience of the music also allows the listener to decipher which musical elements are the most salient. These salient musical elements can be examined objectively in order to explore how they function within the piece and how the piece "works."[1] In return, this act of *concentrated listening* portrays music as a phenomenon and realizing music as phenomena allows the listener to be embedded in the experience of actively listening to the music. Judith Lochhead notes:

> Edmund Husserl, the originator of phenomenology, characterized this philosophical movement with the slogan 'to the things themselves'. A philosophical concern for the things or phenomena of experience–for the 'things-

[1] In experimental work by Irène Deliège, et al., the authors note: "In general, the listening processes of musicians and of nonmusicians are dependent on similar sensitivities to characteristics of the musical surface." Irène Deliège, Marc Mélen, Diana Stammers, and Ian Cross, "Musical Schemata in Real-Time Listening to a Piece of Music," *Music Perception* 14/2 (Winter, 1996): 128.

> as-they-appear-to-us'–as opposed to the traditional concern for noumena–for the 'thing-in-itself.'[2]

Husserl is concerned with the experience of a given subject in relationship to *how* we will experience it. As a result, a phenomenological approach to music prompts several questions: What am I hearing at this moment? How does one moment relate to another (if there is any relationship to be found)? And as a whole are there larger connections to be made? Yet before answering these questions in a musical context, we must first understand how to go about seeking the answers.

A phenomenological approach encourages a cooperative relationship between experiencing the music and attending to that experience. This type of listening entails understanding how to approach hearing electronic music, to understand what type of compositional devices may be used, and what sounds the listener will hear. For instance, the sounds that a listener may hear in an electronic composition could include live musicians and traditional instruments, samples of familiar sounds, and/or be unfamiliar or abstract sounds. With the lack of a traditional score, listening to the music itself could be the only clue to realizing the structure of a composition, and as a result, our experience and perception of the music serves as a vital role in the analytical approach. As Philip Batstone notes, phenomenology is a viable approach to electronic music because "it attempts to describe perceived things and such attempts are basic to phenomenology and because it is not merely concerned with sensuous responses but with perceived relationships."[3] Therefore, a phenomenological approach calls for one's perception of a piece of music to be the most effective analytical device, respective of the listener since he/she *hears* the music. Listeners that seek to understand the organization of a composition will create relationships between musical elements, whether it pertains to phrase structure, harmonic progressions, rhythmic aspects, or the grouping of sounds. As F. Joseph Smith notes, "Listening is not merely passive reaction; it is its own kind of

[2] Judith Lochhead, "The Temporal Structure of Recent Music: A Phenomenological Investigation" (Ph.D. diss., State University of New York at Stony Brook, 1982): 100.
[3] Philip Batstone, "Musical Analysis as Phenomenology," *Perspectives of New Music* 7/2 (Spring-Summer, 1969): 94.

activity."[4] Smith's stance on a phenomenological approach is one of a free listening environment, absent of any preconceived notions. He states:

> For phenomenology is not merely a standpoint or a perspective but a radical attempt to let reality speak (or sound) for itself. When we speak of standpoints and perspectives we speak ordinarily of some individual's view. In phenomenology it is not just a question of someone's viewpoint. It is a question of letting 'reality' speak in and to us. Reality of this kind is not just 'opinion,' especially since it takes in much more than the thinker's perspective. The ontological dimension, as phenomenological, rather than as metaphysical, is not an abstract absolute but the concrete, flesh-and-blood dimension of being fully and openly human. We let things—including other humans—speak for themselves instead of dictating to them from prefabricated cultural and metaphysical categories. … In other words, one does not precategorize anyone's work but lets it be what it *is*. This letting-*be* is the core of the truly phenomenological attitude. The philosophical attitude is thus basically a musical one. Phenomenological philosophy is an attempt at openness and true listening.[5]

Furthermore Thomas Clifton notes,

> The most telling contribution of a phenomenological attitude is the means it offers for uncovering and describing phenomena which are immanent in the composition and presented *by* it. This is different from the more traditional purpose of analysis which describes how certain events or compositional procedures are constitutive *of* the composition.[6]

From a phenomenological perspective the listener may come to an understanding of *how* to listen to a genre of music that incorporates complex structures by allowing the music to be what it is as we actively listen to it. In essence, listeners are dealing with an aural phenomenon in which the music can be representative of itself. In this light Clifton states, "We listen to a musical work and experience its sense."[7] In other words, music can tell us what it wants to tell, if we are open to letting it speak for itself. Clifton also notes, "We not only have to distinguish between music and notation, but have to realize that music is a 'person' which addresses us, and with which we engage in dialogue."[8] From this "conversation" listeners can come to know a piece more intimately for what it is to us as a structural piece of art.

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[4] F. Joseph Smith. *The Experience of Musical Sound: Prelude to a Phenomenology of Music.* (Gordon and Breach Science Publishers, Inc.: New York, 1979): 111.
[5] *ibid.*, 17.
[6] Thomas Clifton, *Music as Heard: A Study in Applied Phenomenology* (Yale University Press: New Haven, 1983): ix.
[7] Thomas Clifton, "Music and the A Priori," *Journal of Music Theory* 17/1 (Spring, 1973): 68.
[8] *ibid.,* 74.

James Tenney notes with respect to the complexity of twentieth-century music, "an important question is raised: how or where is one to find that thread of continuity which we assume to inhere in every integral work of art?"[9] Before we answer Tenney's question, we first have to ask what constitutes continuity and how do we find this continuity that listeners so desire. Ultimately the continuity of a composition will depend on the piece itself and how sonic events are employed. However, the listener should not just haphazardly listen to a piece of music. According to Lochhead, a phenomenological approach is an "investigation based on the notion that we can know musical structure through our experience."[10] Furthermore Batstone has noted, "Phenomenology should teach us to understand musical artworks as aural phenomena, that is, it should help us to hear them more meaningfully."[11] Attentively listening to a piece of music does not mean that listeners naively describe their experience, but instincts and intuition play a vital role in how we ultimately wish to describe the music in some meaningful way. Clifton notes:

> The phenomenological attitude was chosen as a way of uttering meaningful statements which are objective in the sense that they attempt to describe the musical object adequately, and subjective in the sense that they issue from a subject to whom an object has some meaning.[12]

Consequently when one listens to music in general, incorporating his/her perception creates a shift from a solely objective viewpoint to include the subjective–for it is a matter of how *one* ultimately perceives the music. Even though Tenney notes that "grouping or subdivision into clang-like units [or sonic events] is almost entirely arbitrary or subjective," subjectivity does not create a naïve or baseless understanding of music because there are psychological factors at hand when one listens to music.[13] Coinciding with the psychological properties of perception, which will be discussed shortly, as educated musicians we also develop an intuitive process of listening to music. As Clifton states:

> Intuitive description is the result of having taken careful notes while mucking around in that swamp, looking precisely for nothing less than firm ground. This

[9] James Tenney, *Meta + Hodos: A Phenomenology of Twentieth-Century Musical Materials and an Approach to the Study of Form; and META Meta + Hodos* (Hanover, NH: Frog Peak Music, 1992): 16.
[10] Lochhead (1982), 153.
[11] Batstone, 110.
[12] Clifton (1983), viii-ix.
[13] Tenney, 79.

> would be an audacious undertaking except for the realization that both the swamp and the building erected over it are both located *within us*. And it follows that if there is firm ground, that too will be located *within us*.[14]

The "mucking around" correlates to the simple act of listening, coinciding with what Lawrence Ferrara refers to as "open listenings." Open listenings refer to the concept of listening to a piece of music on a number of occasions to specifically note your perception of the piece, thus arriving at a "reflective description of that listening."[15] Ferrara goes on to note, "The purpose of these 'open' listenings is to orient the analyst to the work."[16] On the other hand, the "firm ground" is that cohesiveness the listener desires to find in music, or any art form for that matter, and the methodology of which the firm ground is derived from. Consequently, open listenings inevitably involve the subjectivity inherent in our perception, whereas the objective psychological basis of our perception provides a firm ground. Therefore what comes from *within us* is not only intuitive (Clifton's "mucking around") but also scientific (the firm ground), which Clifton says are "consequences of human acts."[17] As a result, a phenomenological approach will allow objective and subjective reasoning to provide answers to structural/analytical questions about a composition.

Nonetheless, since the listener cannot haphazardly listen to a piece of music when attempting to engage in an analytical discourse, it is essential to investigate how Smith's notion of "letting the music be" will actually work.[18] Clifton points out that the analytical questions involved with the notion of "letting the music be" in relation to formalistic theoretical should coexist, especially now with the diversity of twentieth-century music that the analysts are faced with. He states:

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[14] Thomas Clifton, "Some Comparisons between Intuitive and Scientific Descriptions of Music," *Journal of Music Theory* 19/1 (Spring, 1975): 68. (emphasis mine)

[15] Lawrence Ferrara, "Phenomenology as a Tool for Musical Analysis," *The Musical Quarterly* 70/3 (Summer, 1984): 359. Coinciding with Ferrara's notion of open listenings, Deliège, et al. state, "The *segmentation* procedure requires subjects to listen to a piece as they would listen to a story," in other words the narrative unfolds as we openly listen to a composition. Deliège, et al., 127.

[16] Ferrara, 359.

[17] Clifton (1975), 68. Clifton continues: "In listening to a particular complex of sounds, I perform a certain act by means of which these sounds assume musical significance. Or I can attend to this same sound-complex and, once again acting on a decision, study its physical properties (wave forms, spectra, 'real' durations, envelope, etc.). I can continue shifting my point of view toward the sound-complex to make an analysis of its indivisible units (e.g., specifiable pitches, if any), and I can analyze these units with specific intentions in mind." Clifton (1975), 68-69.

[18] Smith, 17.

> What slight-of-hand is required to juggle the formal with the material, the general with the particular, and the universal with the personal? … These questions relate to a rather well-worn but still misunderstood problem: the problem of the reciprocity between music, as a process existing independently of a person, and a person, whose attentive presence is needed to make a musical process meaningful.[19]

The sole purpose in an analytical investigation is to find cohesiveness within the music in order to intelligently provide a meaningful musical discourse. Batstone notes, "From these simple assumptions regarding perception can arise descriptive analyses of the most wonderfully complex music, analyses whose viability is shown by the extent to which they assist aural understanding."[20] As a result, our listening must be directed and yet remain open. How is this possible?

Listeners must be receptive of what they are hearing because the initial prominent musical elements will either become more definitive or change when listening to a piece of music depending on how we eventually hear the composition unfold in its entire musical context. With every listening, new and perhaps important musical elements may be revealed that the listener did not account for beforehand. As David Lewin states, it is also important to note that "we can certainly modify our perceptions, too, during the time in which we come to now a piece more richly."[21] Consequently, as musicians our own knowledge influences how we hear the music, which can create a dialogue of different, yet insightful, interpretations. Deliège, et al., agree, "The 'real-time' processes involved in listening are influenced by, on the one hand, a listener's prior musical experience and competence and, on the other hand, by the specific idiosyncrasies and the cultural and historical provenance of the musical material used."[22] This influence, which may be subconscious or conscious, ensures an element of subjectivity in how we perceive and conceive of music.

In the case of electronic music, the sonic events of a piece must be deciphered and identified before a listener can begin to perceive how the piece is organized. One purpose of music analysis is to discuss the structure of a piece of music in some logical sense.

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[19] Clifton (1973), 67-68.
[20] Batstone, 97.
[21] David Lewin, "Music Theory, Phenomenology, and Modes of Perception," *Music Perception* 3/4 (Summer: 1986): 361.
[22] Deliège, et al., 120.

However, electronic music presents particular challenges since the listener may not know how to go about systematically discussing the music. Listeners will need to recognize various sonic events and the segmentation of these events in order to provide an understanding of the cohesiveness within the work. According to Christopher Hasty, "Segmentation is generally understood as the division of a musical work into structural components."[23] On the relevance of segmentation in analyses Dora A. Hanninen notes:

> What might analysts gain by taking a more active interest in segmentation? One answer: when analysts articulate the rationales for particular segmentations, they open up the possibility for precise and reasoned intersubjective discourse about how their analytic interpretations differ, and about ambiguity, richness, and multiplicity of hearings. Another: analysts who look closely at details of musical segmentation can often connect formal, and in some cases even quantifiable, aspects of music analysis with qualitative judgments and intuitions, interpreting the latter and perhaps enhancing cogency and clarity in music criticism.[24]

Hanninen further notes,

> In electroacoustic music, for example, the question of what constitutes a segment, or whether an analyst is interested in segmentation, is complicated considerably by the electronic medium and compositional methods. Additive synthesis foregrounds the intimate relation between pitch and timbre. A composer's complete control over the evolution of a sound envelope in multiple dimensions (including frequency, intensity, and spatial location) problematizes the term 'note' and suggests its replacement by terms such as 'sound-event' and 'texture' that carry relatively more analytical weight and stand in more complex relation to segments and segmentations.[25]

Within any musical composition, the listener can rely on the segmentation of various events, a phrase, section, sonic event, and so on, in order to hear the piece structurally. According to David S. Lefkowitz and Kristin Taavola:

> Segmentation–the process of parsing a composition into meaningful parts–lies at the heart of many music-theoretic activities. Given the fact that the very word "analysis" means the division of the whole into its constituent parts, segmentation is intrinsic–implicitly or explicitly–to many analytic endeavors.[26]

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[23] Christopher Hasty, "Segmentation and Process in Post-Tonal Music," *Music Theory Spectrum* 3 (Spring, 1981): 54. Hasty continues to note, "Segmentation [is] the formation of boundaries of continuity and discontinuity which result from the structures of various domains, [i.e. musical parameters]." Hasty, 59.
[24] Dora A. Hanninen, "Orientations, Criteria, Segments: a General Theory of Segmentation for Music Analysis," *Journal of Music Theory* 45/2 (Fall 2001): 346.
[25] *ibid.*, 417.
[26] David S. Lefkowitz and Kristin Taavola, "Segmentation in Music: Generalizing a Piece-Sensitive Approach," *Journal of Music Theory* 44/1 (Spring, 2000): 171.

By comprehending how sounds are realized as events, how they are segmented from other events, and then in turn how all these events fit together, listeners can then begin to discuss how a piece works as a whole. But how would the listener explain the "rationale" for his/her use of segmentation?

Psychological Aspects

According to Gestalt principles, listeners tend to organize or segment musical elements by proximity (how close events are), similarity (for example, the repetition of a motive), good continuation (events that follow in a certain order), common fate (events that change in the same way), and familiar configurations (for example, the grouping of a triad).[27] Carolyn Drake notes:

> Many studies have shown that listeners segment a sequence according to its surface characteristics (event duration, pitch, intensity, timbre, etc.) following the principles laid down by the Gestalt psychologists: a change in any sound parameter leads to the perception of a break in the sequence and thus to the creation of groups separated by the changes.[28]

Irène Deliège, et al., note, "On the first hearing of a piece, perceptual segmentation relies on the perception of qualitative changes in musical flow."[29] These qualitative changes can be represented by the Gestalt principles. These principles can act alone or in conjunction with each other and aid in explaining why the listener might hear a musical element a particular way. Diana Deutsch has noted that it is these "mechanisms that enable us to form linkages between some elements and that inhibit us from forming linkages between

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[27] Diana Deutsch, "Grouping Mechanisms in Music" in *Psychology of Music*, Diana Deutsch, ed. 2nd ed. (Academic Press: California, 1999): 300. Guy J. Brown and Martin Cooke have also noted, "The sequential grouping of auditory events is influenced by a number of factors, many of which concern the continuity and similarity of consecutive sounds. These factors include pitch proximity, temporal proximity, intensity and perceived spatial location. Additionally, sequential grouping is influenced by the *timbre* of successive auditory events." Guy J. Brown and Martin Cooke, "Perceptual Grouping of Musical Sounds: A Computational Model," *Journal of New Music Research* 23 (1994): 114.
[28] Carolyn Drake, "Psychological Process Involved in the Temporal Organization of Complex Auditory Sequences: Universal and Acquired Processes," *Music Perception* 16/1 (Fall, 1998): 13.
[29] Deliège, et al., 123.

others."[30] These links and groups are musical moments, or segments, that generate an ordering of musical elements within a composition. According to Jonathan Kramer,

> The self-containment of moments allows the listener to process them as individual entities. As we go through the piece, we accumulate more and more data concerning the form; the more data we apprehend, the more we understand the balance (or lack there of it) that is generating the form.[31]

However, the organization of a composition depends on its own unique relationship of sonic events, how one group can or cannot fit with another group of musical elements within the particular piece.

The segmental process of musical events is shaped by how the musical parameters change perceptually working in conjunction with the psychology of Gestalt principles. As Tenney notes, "The scale of organizations in any single piece of music may change considerably from one to the next, and this requires a *greater flexibility of the listener's scale of perception*."[32] This flexibility entails not only understanding complex structures themselves, but also the process of actively listening to a piece of music. Here we can look to Lewin's model of perception in order to systematically represent such a process. Lewin's model states that our perception of a moment in music comes from the sonic event, its musical context, and finally a statement about the perception in musical language.[33] In fact, Lewin's model "enables us to bypass certain false dichotomies in analytical discourse, dichotomies that arise when we implicitly but erroneously suppose that we are discussing *one* phenomenon at one location in phenomenological space-time, when in fact we are discussing *many* phenomenon at many distinct such locations."[34] A number of statements can be made about a sonic event, but it is ultimately with the guidance of our listening experience that we finalize our musical decisions.[35] As Ferrara notes, "One can close or open many potential meanings of a works given particular mode of orientation."[36] As we listen more to a piece of music, we become more familiar with

[30] Deutsch, 299.
[31] Jonathan D. Kramer, "New Temporalities in Music," *Critical Inquiry* 7/3 (Spring, 1981): 549.
[32] Tenney, 20. (emphasis mine)
[33] Lewin, 335. Lewin represents his model as p=(EV,CXT,P-R-LIST,ST-LIST), which means perception = the event, the context, the perception and relational list, and the statement list.
[34] *ibid.*, 357.
[35] As Lewin notes, "The thing EV will have at the very least a lexical function, enabling us to mark, collect, and compare a certain ensemble of formal perceptions, that is perceptions-about-EV." Lewin, 336.
[36] Ferrara, 356.

its particularities and the repercussions sonic events have on one another. Understandably when listening to music, it occurs in real time thus causing sound events to appear in a constant relationship to others. According to Drake, "An essential function of our perceptual system is to situate each event in time and in relation to other events occurring within a particular time span."[37] Based on the psychological principles of music perception and our own musical intuitions, we can formulate segmentations of musical events, as we are aware of the music in passing time.

There is also a retrospective aspect of time, as our hearing involves the past, present, and future expectations of sonic events. Referring to the philosophy of Husserl's retentional consciousness, Lochhead states, "As each now-moment of the sounding tone [or sonic event] is pushed into the past, it is held in retentional consciousness: its 'mode of appearance' changes from 'now' to 'just-having-been'. As each particular moment is pushed farther and farther back, its mode of appearance is in constant flux."[38] The constant flux occurs because as we process the sounds that we hear or have heard, relational judgments are continuously being produced. According to Drake, "We do not examine the final state of the mental representation for a piece of music, but rather the ongoing processes that lead to the creation of this representation."[39] The relationship of sonic events depends not only on a momentary context of the piece but the *entire* musical context of the piece. Deliège, et al., have noted:

> In this way, longer structures (motives, phrases, etc.), [or segments,] may be labeled and encoded in memory by means of cues that alone are stored in immediate memory and enable access to the entire structure. The cues can then be used as signposts; they embody invariant characteristics of the musical material and take on the function of referential entities enabling constant evaluation of new material. Thus the cue provides the basis for grouping and for the chaining together (concatenation) of groups at different hierarchical levels of listening; concatenation of groups will continue for as long as a particular cue continues to be recognized. When a new and contrasting cue is perceived, it establishes the boundaries of the higher level grouping–periods or sections of the piece–and can initiate a new grouping.[40]

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[37] Drake, 11.
[38] Judith Lochhead, "Some Musical Applications of Phenomenology," *Indiana Theory Review* 3/3 (1979): 21.
[39] Drake, 23.
[40] Deliège, et al., 120.

The authors here are specifically discussing tonal music, but the process of utilizing musical cues can also relate to sonic events. They also note how musical cues can function on different perceptional layers, which works in conjunction with the segmentation of sonic events. Nevertheless, the act of listening is circular, always connecting back to what was previously heard and at the same time perceived. It is from these general applications of perception and the intimacy of knowing a particular piece that its shape and structure becomes apparent to the listener.

Not only does the listener have to discern sonic events within a composition, but one may also ask, "How would a listener handle hearing multiple sonic events at once?" The most common example of our ability to divide attention aurally is the "cocktail party effect." In a room full of people that are talking, for instance a cocktail party, your ear can specifically hone in on one voice that is speaking to you, in turn tuning out the others. Likewise, when listening to a composition we have to process more than one sound at a time. Tenney discusses hierarchical layers within complex music in *Meta+Hodos*, but does not seek to classify these layers.[41] According to Batstone, the perception of a composition takes "place in only one 'now' of perceptual time, and to begin attempts to show that this is a supportable notion, it is necessary to attempt to find hierarchization of elements and evidence of progression and the process of change."[42] In other words, our perception of music can be divided into musical layers in which some layers may be perceptually more prominent than others, which aids the listener when investigating the music's structure. When at least two layers can be distinguished within a musical texture, a listener may hear one as a figure against a ground. Leonard B. Meyer's discussion of texture provides several different ways in which the perception of a listener may be categorically divided pertaining to the concept of figure-ground.

> The musical field can be perceived as containing: 1) a single figure without any ground at all, as, for instance, in a piece for solo flute; 2) several figures without any ground, as in a polyphonic composition in which the several parts are clearly segregated and are equally, or almost equally, well shaped; 3) one or sometimes

[41] In relation to the layering of sonic events Tenney notes: "If one's attention is directed towards one or more of the *less* essential parts in a complex structure, the *more* important structural features of the larger configurations may be missed. This assumes, of course, a situation in which there *is* a hierarchy of more and less essential elements–which may not always be so–but the situation does occur often enough to make this a factor worth considering." Tenney, 17.

[42] Batstone, 105.

> more than one figure accompanied by a ground, as in a typical homophonic texture of the 18th or 19th centuries; 4) a ground alone, as in the introduction to a musical work–a song, for instance–where the melody or figure is obviously still to come; or 5) a superimposition of small motives which are similar but not exactly alike and which have little real independence of motion, as in so-called heterophonic textures.[43]

Furthermore, with the option of a limitless sound palette, a composer of electronic music presents the possibility of the listener encountering musical elements within an extremely rich and vast polyphonic texture. Alan Belkin notes, "The more contrast listeners have to deal with, the more information they must assimilate. … The listener cannot attend equally intensely to many rich events at the same time, [so] it is often useful in a dense texture to assign each layer [of sound] a different level of perceptual prominence."[44] Belkin specifically discusses two layers of perceptual prominence–the *foreground* and *background* layers of musical perception. Sonic events can perceptually shift from layer to layer and more than one event can coexist on a given layer. More specifically, the foreground layer is going to apply to the most prominent sound event or sound events in combination, and the background layer is subordinate to the foreground in terms of prominence. Belkin continues to state:

> The breakdown of sounds into such streams or layers can be achieved in many ways. … Foreground and background [layers] often contrast in register, spectral composition, or gestural shape. … Frequently a composer will add several receding background layers, to give a feeling of depth or resonance. … Background levels give a sense that there is more to the music than meets the ear at first, thus creating a kind of intrigue or mystery.[45]

[43] Leonard B. Meyer, *Emotion and Meaning in Music* (The University of Chicago Press: Chicago, 1956): 186. Deliège, et al. also note, "The cue-abstraction mechanism may, in this sense, be compared with the well-known figure/ground phenomenon. Information is reduced by focusing attention on small features that can be distinguished from a more diffuse or global environment. The cues play the figural role and become abstractions used to lighten the load on memory storage." Deliège, et al., 122. The concept of selective hearing or attention dividing can be further explored in John Pierce's "Hearing in Time and Space" in *Music, Cognition, and Computerized Sound: An Introduction to Psychoacoustics.* Perry R. Cook, ed. (MIT Press: Massachusetts, 1999): 89-104. Bigand, Forêt, and McAdams further note that "if music presented the same difficulty for divided attention as has been observed in other domains (spoken language, video games, and so on), polyphonic music would probably not have become as developed as it has." As a result of their experimentation, the authors concluded, "the present finding provided several kinds of evidence that participants developed perceptual strategies to remedy the difficulty of diving attention." Bigand, E., S. Forêt, and S. McAdams, "Divided Attention in Music," *International Journal of Psychology* 35/6 (2000): 271, 277.

[44] Alan Belkin, "Orchestration, Perception, and Musical Time: A Composer's View," *Computer Music Journal* 12/2 (1988): 51.

[45] *ibid.*, 51.

Both Meyer and Belkin bring to our attention that a composition could not only present music on a foreground and background level of perception, but that a multitude of musical layers could also be present. The number of layers that are evident will be determined by the context of a piece, if any. With the complexity of electronic music and the sonic events available to the composer of the music, layering of sounds is a pertinent characteristic and dividing our attention is inevitable in polyphonic textures. The questions to ask now are why is this sonic event more prominent than others, does our attention shift, and if so, how does it shift throughout the piece? To answer these questions there are various musical parameters to consider such as pitch, rhythm, texture, dynamics, and any other parameters applicable to the particular piece.[46] Even when listening to a piece of music, we can say if the pitch is high or low, if the music is loud or soft, or if it is fast or slow, and this can be accomplished by *actively* listening to the composition. Musical events pertaining to any musical parameter that are viable to a particular piece can capture our attention and participate in the hierarchy of our selective hearing. As Tenney states, "In each case the attention will tend to be directed toward–and more sharply focused upon–the element which exhibits the highest values on some parametric scale."[47] According to the prominence of sonic events, when more than one sonic event is apparent at the same time, we can assign each unit to a different perceptual layer. Nevertheless, these layers work in conjunction with each other and would not be considered whole without each other since they will guide our overall sense of the musical flow and organization. The foreground layer of a work is not the sole unifier of a piece, but both layers are equally important aiding in defining expectations and perceiving musical shape and structure. Hasty notes, "It is important to remember that higher levels of structure in a sense subsume the detail of lower levels, but cannot exist independently from that detail."[48] Conversely, the foreground layer will most likely lead the discourse of a piece since it is the most prominently perceptual layer that we attend to. The result of incorporating various perceptual layers within a piece will allow the

[46] Michael Clarke specifically mentions five basic parameters of music—pitch, timbre, rhythm, dynamics, and space. We will expand these five basic parameters to include others as we investigate the music itself. Michael Clarke, "Extending Contacts: The Concept of Unity in Computer Music," *Perspectives of New Music* 36/1 (Winter, 1998): 233.
[47] Tenney, 38.
[48] Hasty (1981), 72.

listener to efficiently catalog the sonic events in a composition. Once the events of a piece are apparent then the listener can begin to assess how they function and coexist in juxtaposition, and ultimately how the piece "works."

A phenomenological application aids in revealing the structure of electronic music from an experiential perspective. The various musical parameters applicable to an individual work will constitute the sonic events and the use of Gestalt principles explains how these sonic events may be segmented further into groups of events. *Concentrated listening* involves an awareness of our ability to divide attention among musical elements. The layering of events reveals how our attention can be further divided, and the significance of an event at a particular moment within the piece. This type of approach opens the door for further investigation of a composition and how the sonic events form its musical structure. According to Batstone, "[A phenomenological approach] can allow us to examine musical compositions in all their particularity as aural phenomena without a priori worrying about what we think we can or do hear."[49] Teetering on the edge of subjectivity, basing an approach on the listener's experience and intuition, is not that daunting when we allow our discussions of music to be open, in correlation to the "open listenings" one must embark upon in a phenomenological viewpoint of music. As Clifton states:

> All that can be asked is that the person making the intuitive description do so under conditions of rigor which also preserve the integrity of the musical object. The question is not whether the description is subjective, objective, unbiased, or idiosyncratic, but very simply is whether or not the description says something significant about the intuited experience, so that the experience itself becomes something from which we can learn, and in doing so, learn about the object of that experience as well.[50]

[49] Batstone, 110.
[50] Clifton (1975), 70.

CHAPTER 3

ANALYSIS OF ELECTRONIC MUSIC: IDENTIFYING AND SEGMENTING SONIC EVENTS

When a listener hears an electronic composition for the first time, or any music for that matter, a number of questions can be asked. For example, "What am I hearing? Can I tell what the instrumentation is? What progression will the music take? Is there a cohesive structural formation to the piece?" In other words, can we come to understand a piece of music by simply listening to it? In James Tenney's *Meta+Hodos*, discussed previously, the main focus is how a listener in the twentieth century can adapt to hearing music that incorporates a wide range of complex sounds. Technology and the use of computers have allowed composers to create a musical palette of infinite sounds. However, encountering an ever-changing sound palette may leave the listener in unfamiliar surroundings. In order to begin a meaningful discussion of an electronic composition, the sonic events must first be identified and distinguished within the piece. Even though the listening experience of a given piece will concern the individual content of the composition, there are some universal aspects that can be noted about electronic music in general.

Identifying sonic events requires the listener to become familiar with a composition through multiple listenings and to begin to segment the various sonic events from each other. The progression of these sonic events reveals the structure of the composition and there are a number of factors that influence the listener's segmentation of sonic events. Diana Deutsch notes:

> When presented with a complex pattern, the auditory system groups elements together according to some rule based on frequency, amplitude, temporal position, spatial location, or some multidimensional attribute such as timbre. Any of these attributes can be used as a basis for grouping, but the conditions determining which attribute is used are complex ones.[1]

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[1] Diana Deutsch, "Grouping Mechanisms in Music" in *Psychology of Music*, Diana Deutsch, ed. 2nd ed. (Academic Press: California, 1999): 299-300.

Sonic events can be segmented by the onsets and endings of the events, simply when the event(s) start and stop. Moreover, changes in pitch, register, contour, volume, duration, repetition, use of motives, and especially the use of timbre can determine how the listener segments the sonic events. Deutsch states:

> Tones can also be grouped together on the basis of sound quality, or timbre. This is an instantiation of the principles of similarity: we group together tones that are similar in timbre and separate out those that are dissimilar. As a result, when different instruments play in parallel, we may form groupings based on their timbres even when their pitch ranges overlap heavily.[2]

Although Deutsch is addressing musical tones or distinct pitches in this instance, the listener of electronic music can make a correlation here between tones and a more general class of sonic events. If the listener hears two sonic events that are different timbres they can be segmented because of their lack of similarity. The concept of similarity is one of the Gestalt principles of perception, previously discussed, and any of the five principles can be utilized as an aid in comprehending the psychological aspects that govern the segmentation of sonic events.[3] As John A. Sloboda notes:

> Of course, many functions of music may be grasped by composers and listeners only intuitively and implicitly. It is not expected that a full formal description will always be forthcoming. A listener may gain intense value from a musical experience without necessarily being able to articulate and explain the basis of this value. In other cases, the listener may be clear enough about the outcome (e.g. "it renewed my sense of hope") but be unable to articulate the mechanism by which this outcome was achieved. Psychology in general (and cognitive psychology in particular) has much experience in formalizing and uncovering those processes which seem to be hard to consciously report.[4]

Determining how to segment events can be a complex process, especially if the events are unfamiliar or new, and what is influencing the segmentation may be a result of a number of reasons. Philip Batstone lists three basic assumptions used in a segmental approach to complex music, which can be applied to music in general.

> 1) Perceptual importance of extreme position–position in time, register, etc. (all other things being equal)
> 2) The perceptual importance of contrast, and

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[2] Deutsch, 318.

[3] For an explanation of Gestalt principles refer to page 47.

[4] John A. Sloboda, "Music Psychology and the Composer" in *Structure and Perception of Electroacoustic Sound and Music,* Sören Nielzén and Olle Olsson, eds. (Excerpta Medica: Amsterdam, 1989): 9.

> 3) The perceptual importance of closure (being defined here as repetition of any element in any parameter after a contrast).[5]

Batstone's approach to segmentation coincides with some of the psychological aspects of the Gestalt principles of perception. Music segmented by "extreme position" could incorporate aspects of proximity, familiarity, and similarity, and familiarity and similarity also correspond to musical elements of contrast. Segmentation by closure would correspond with the aspect of good continuation. Batstone further notes how these aspects of perception can aid the analyst.

> From these simple assumptions [noted above] regarding perception can arise descriptive analyses of the most wonderfully complex music, analyses whose viability is shown by the extent to which they assist aural understanding.[6]

However, employing the listener's perception of a piece of music does not mean that "assumptions" will be made regarding the segmentation of sonic events. When the listener seeks to identify and distinguish the sonic events of a composition, there are psychological factors present that aid the listener in coming to a deeper understanding of the work.

Sonic events, once identified, may appear to occur on varying perceptual levels. In other words, sounds may appear to be on a foreground layer while others are placed on a background layer, in terms of their perceived salience. Naturally, the listener will be drawn to sounds that are perceived on a foreground level, but any and all layers, if applicable, are important to the structural make-up of a composition. As with the segmentation of sonic events, the layering of sonic events can also be determined by the onsets and endings of events. When a new event occurs within a composition the listener's attention will immediately be drawn to it, placing it on a foreground level of perception. However, sounds can shift between various perceptual layers depending on how the piece unfolds, similar to how one's gaze shifts between components of a figure-ground illusion. Pitch, contour, volume, duration, and timbre can also determine how a listener perceives layering in a composition, just as they shape the segmentation of events.

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[5] Philip Batstone, "Musical Analysis as Phenomenology," *Perspectives of New Music* 7/2 (Spring-Summer, 1969): 97.
[6] *ibid.*, 97.

An article by Alan Belkin lists some general attributes of foreground and background layers of sound, which are presented in the following table and can be used by the listener.[7]

Table 3.1 Layers of sound

Foreground levels	Background levels
Striking, in high relief, strong contrasts Dense information content Louder	Less strongly defined Poor information content Softer

The use of spatialization techniques, such as panning, can also cause listeners to shift their attention to or away from an event. With the advent of stereo, the use of multi-channel recording, later 5.1 surround sound, and even more recently 7.1 surround sound, space can be controlled more precisely within the compositional process.[8] Composers can create the sense that sounds are far away or up close, and sounds can move from speaker to speaker to produce an all encompassing soundscape. Deutsch notes, "When tones emanate from different spatial locations, temporal relationships between them are important determinants of how they are perceptually grouped together."[9] Again Deutsch is addressing musical tones, but this notion can certainly be applied to the use of panning and various loudspeaker configurations incorporated in electronic music. If a particular sonic event moves around in space through the use of panning, the listener's ear will follow the sound as it moves. Likewise, if multiple sonic events move around in the same manner, the group of events functions together on a larger structural level.

The texture of an electronic composition can range from thin to dense textures, as in traditional music, ranging from one little sound to a multitude of sonic events depending on the composition. Another variable for creating a dense texture could be the product of the manipulation of a single sound. Denser textures may cause the listener to

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[7] Alan Belkin, "Orchestration, Perception, and Musical Time: A Composer's View," *Computer Music Journal* 12/2 (1988): 51.

[8] 7.1 uses the same configuration of speakers as 5.1—one in the front center, two to the front left and right, and two to the back right and left—however, there are two more speakers added, placed to the side right and left.

[9] Deutsch, 328.

perceive multiple layers of sonic events, relegating some to the background. In addition, sonic events can also grow, transform, evolve, and/or fuse together. Composer Trevor Wishart comments on his own notions of sonic metamorphosis, stating:

> Perhaps in this way we might create a set of perceptually acceptable transformational steps for the listener, linking starting sound to noise. Moreover, when presenting this material in a piece, we don't need to sequence the increasingly noisy sounds in that temporal order. As long as it is possible for the listener to make the connection at some stage of a repeated listening, we have a perceptible transformational structure, an audible connection between two quite distinct sounds: our starting sound and noise.[10]

The aspect of evolving or growing from one sonic event to another creates a continuous stream of sonic events, and could also produce a state of static sound. On the other hand, discontinuous motion may involve staccato or percussive attacks, a sense of chaos, and/or abrupt changes. As a result, the listener may or may not perceive meter or rhythmic attributes in an electronic composition.

Nonetheless, the rhythmic flow, whether it is continuous or discontinuous, is a way for listeners to organize music. According to Rudolf E. Radocy and J. David Boyle, "Rhythm is an essential component of all music, whether [that of] primitive societies, non-Western societies, traditional Western art music, or contemporary popular styles."[11] The authors further note, "Rhythm's primary function is to give order. Music is a temporal art that must be organized comprehensibly, and most definitions of rhythm allude in some way to rhythm as music's organizational and dynamic force."[12] An electronic composition may be ametrical or the meter could be easily detected employing symmetrical or asymmetrical rhythms, and of course the meter can also change within a composition. Silence can also function structurally in music. Deutsch states, "When a sequence of sound elements is presented with pauses interspersed between them, we readily group the elements into sequences that are defined by the pauses."[13] The listener will segment groups of sonic events by silence, and also segment events of similar timbre

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[10] Trevor Wishart, "Sonic Composition in *Tongues of Fire," Computer Music Journal* 24/2 (Summer, 2000): 24.
[11] Rudolf E. Radocy and J. David Boyle, *Psychological Foundations of Musical Behavior.* 4th ed. (Charles C. Thomas Publisher, LTD.: Springfield, Illinois, 2003): 144.
[12] *ibid.*, 145.
[13] Deutsch, 319.

with pauses placed between on some lower structural level depending on the content of the piece.

In an article by Russ Ethington and Bill Punch, the authors describe experiments in which they were able to categorize some basic attributes of sounds that could possibly appear as responses by subjects. These are given in the following table.[14]

Table 3.2 Subjects responses to sound

Attack	***Presence***	***Cutoff***
Blown	Bright	Percussive
Bowed	Resonant	Staccato
Hammered	Clear	Damped
Keyed	Warm	Legato
Plucked	Surging	Sustained
Struck	Ringing	---

This is not a complete list, but the list is general enough for listeners to begin to describe what they hear in a more comprehensible manner. A number of electronic compositions also feature glissandi, “woo” sounds, and “ohh” sounds. The use of reverberation and echo, along with pulsating sounds, are also found quite frequently in electronic compositions, which are easily identifiable by the listener. It must also be noted that certain electronic sounds from earlier electronic compositions may sound timbrally “old” or antiquated to the listener.

When categorizing sonic events, the subdivisions of *musique concrète* and *elektronische Musik* are extremely useful to the listener. However, these two categories do not stand alone, as evident by the fact that Schaeffer unsuccessfully tried to abandon the term *musique concrète* altogether. Composers may choose to use a variety of sound materials in a composition, whether it is purely electronic, or electronic with traditional instruments including voice and/or electronics incorporating found sounds. A composer can mix and mingle any aesthetic depending on the desired compositional outcome. When an electronic composition utilizes found sounds, such as the voice, instruments, or sounds of nature, the listener will immediately recognize these musical events and

[14] Russ Ethington and Bill Punch, “Seawave: A System for Musical Timbre Description,” *Computer Music Journal* 18/1 (1994): 32.

categorize these sounds as events due to the psychological properties of familiarity and similarity. In addition, the initial onset of these sounds will tend to bring the sonic events to the foreground layer of perception because of their familiarity to the listener. As W. Luke Windsor notes:

> Electroacoustic music drives its materials from many sources, sources that are often identifiable, whether in terms of real or virtual origination. Moreover, the identifiable sources are laden with familiarity, with potential meaning, with *affordance structures*, due to our everyday contact with a sounding environment.[15]

Sounds can also deceive the listener of their true source of origin. A listener today, for instance, may question whether or not the composer has used a sample of a real violin or a real bird, or if they created the sound electronically. In this sense the reproduction of familiar sounds can be hard to distinguish, but the listener will recognize the sounds and be able to associate them with a descriptive term to catalog the sound within the composition.

The following analyses of musical excerpts will illustrate how the listener can begin to identify and segment the sonic events found in electronic compositions. While each composition will present its own unique framework of sonic events, they can be partitioned into two main groups, compositions that incorporate samples and those that are derived from purely electronic sounds. In the case of unfamiliar or new sounds it will be useful to assign each sound a descriptive name as part of the listening and analytical process in order to categorize the sound and follow its progression throughout a composition. In the case of some sonic events I will just use the word timbre and others I will use associative terms that describe what the timbres may resemble. It must be noted that a sound I perceive as an "animal howl," for instance, may be described as something else by another listener, but the object is to categorize an event in a descriptive fashion for further investigation. Nevertheless, let us first start with compositions that would fall into the category of *musique concrète*, featuring recognizable recorded sound sources, since the listener can easily recognize these sonic events through familiarity. There are three types of sources for sampling that fall into the category of *musique concrète*. The

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[15] W. Luke Windsor, "Using Auditory Information for Events in Electroacoustic Music," *Contemporary Music Review* 10/2 (1994): 91.

first section of analyses will feature works that incorporate the sampling of the human voice as a sonic event. This category is given its own section because the voice is a primary source of communication and we are conditioned to attend to the sound of the voice. The second section will feature works that utilize traditional instruments and the third section will discuss works that include found sounds, including sounds from nature. Lastly, a fourth section will focus on works that are composed purely by electronic means. Since composers have a variety of sounds at their disposal, some of the following analyses that fall into the *musique concrète* category will also incorporate a discussion of electronic sounds that are heard in the excerpts. Further, some pieces could fall into one or more of the three categories of *musique concrète* depending on the source materials used in the compositional process.

The Voice as a Sonic Event

The use of the human voice is most striking because it is our chief form of communication and we are deeply conditioned to attend to such sounds. When the voice is used in a composition the listener's attention will be immediately drawn to that source. Perry R. Cook notes:

> The most fundamental sound-making devices (and musical instruments) available to humans are simple percussion instruments and the voice. For some time now the human race has possessed speech: the ability to convey abstract and complex meanings with sounds produced by the voice. Much of the brain is dedicated to producing and perceiving speech, and much of our experience is so inescapably tied into speech that we naturally filter much of our sensory input through linguistically related thought processes.[16]

The voice can be used as an intelligible or unintelligible resource; the samples can be spoken or sung, male or female, and from a child or an adult.

[16] Perry R. Cook, "Voice Physics and Neurology," in *Music, Cognition, and Computerized Sound: An Introduction to Psychoacoustics,* Perry R. Cook, ed. (MIT Press: Massachusetts, 1999): 105.

One prime example of the use of voice is Paul Lansky's composition *Six Fantasies on a Poem by Thomas Campion,* composed in 1978-79. A majority of Lansky's works involves the use of the human voice manipulated electronically in the compositional process. This multi-movement work illustrates the use of a female voice sample, provided by Hannah MacKay, rendered intelligibly and unintelligibly at different times throughout the work. Lansky notes:

> Each of the fantasies attempts to musically transform a single reading by Hannah MacKay of a well-known poem by Thomas Campion, and to musically highlight some aspect of her speech: contour, vowels, resonance, articulation, consonants, etc., explicating the implicit music within. … The piece was written in 1978-1979 using IBM 360/91 and 3033 mainframe computers. It uses a technique known as Linear Predictive Coding, in addition to a variety of filtering and processing techniques.[17]

Audio Example 1 is an excerpt of the first movement of the piece entitled "Her Voice."[18] From the beginning of the piece the listener will hear a soft, hollow pulsating "woo" sound, electronic in nature, and six seconds later a louder, higher pitched woo sound enters, layered with the preexisting woo. Although the sounds are related to each other by similarity the listener will segment these two sonic events as separate entities because of the different onset timings, which also places the second woo temporarily on a higher level of perception. In addition, these two sonic events are segmented because of their difference in pitch and volume. At eleven seconds the two sonic events fade out and an intelligible, but manipulated voice enters, lasting for a second, stating "Lawra." Due to the familiarity of the voice to the listener, the voice is easily recognizable as a distinct sonic event. During a few seconds of silence, the listener anticipates what is to come next and segments these events from the next because of the pause. From anticipation comes expectations, which can be subjective and conceived differently by listeners, but the element of expectation exhibits itself in any listening, by any listener, if seeking it.

At sixteen seconds the first woo sound that was heard at the opening comes back, and according to the perceptual principle of good continuation the listener might expect

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[17] Paul Lansky, liner notes taken from http://silvertone.princeton.edu/~paul/liner_notes/fantasies.html (accessed 09/26/2008).

[18] This project has an accompanying CD of the audio examples. If it is unavailable, recordings for all of the musical examples mentioned can be found in the appendix. In some cases the listener can find excerpts on composers' personal websites or other various-related Internet sites.

to hear the second louder, higher pitched woo sound layered on top of the preexisting woo sound followed by the voice again, which indeed does happen. At twenty seconds the second woo appears and at twenty-one seconds the voice enters saying "Rose-cheekt Lawra." The voice sample is multiplied and has a legato resonating quality. There are again a few seconds of silence that follow, once more breaking the audible events into subsections, and the sequence of events then starts over. Figure 3.1 presents a listening score for the excerpt to illustrate how these sonic events function together and relate to each other in time. (Listening scores will only be provided in this chapter when a considerable number of events occur to aid the listener and the reader.) The right column of the score provides the "instruments," a timeline, and the formal structure. Vertical dashes in the left column indicate when an event occurs and horizontal dashes indicate a continuous sound; a vertical dash at the end of horizontal dashes indicates that the sound has ended. When an event is panned it is in italics and when an event seems to evolve or transform from another event it is preceded by an asterisk.

Voice	"Lawra" | "Rose-cheekt Lawra" |
"Electronic" sounds	woo (fade out) |---▶---|---▶---| woo ; woo (fade out) |--▶--|--▶-----| woo
Time in seconds	0 5 10 15 20 25 ▶
Structure	Segment 1-----------| (silence) Segment 2----------| (silence)

Figure 3.1: Listening score for *Six Fantasies on a Poem by Thomas Campion* excerpt – opening of "Her Voice"

This movement continues in this manner juxtaposing various "woo" sounds of pitch and volume, and the voice becomes more intelligible as the segments of sonic events present more text from Campion's poem. From this example the listener can place the various woo sounds on different perceptual layers from their onsets and endings, while the intelligible voice is the prominent feature on a foreground layer. The listener recognizes the voice as something they are familiar with and will try to assimilate this sonic event with the other unintelligible events that occur, which also happens to originate from the voice sample.

Lansky's composition *Notjustmoreidlechatter,* written in 1988, uses the voice in a different manner. This piece is a companion piece to *Idle Chatter* and *just_more_idle_chatter* written in 1985 and 1987 respectively. As Lansky notes, "[These] are three sister pieces which explore the same territory from different points of view. They are not intended as a suite, but as three distinct and different pieces which happen to have a lot in common."[19] *Notjustmoreidlechatter* also uses voice samples from Hannah MacKay, but rendered unintelligible and they are layered on top of each other, as presented in Audio Example 2, which provides the opening of the work. Lansky notes of the piece:

> In mid-piece, the chattering becomes almost intelligible and speech-like, further tempting the listener to attempt comprehension, but then retreats to its customary babble. The background singers have by now learned how to sing counterpoint, however, and assume an even more commanding role in the ensemble. … [The piece] was made on a DEC MicroVaxII in 1988 [and] uses a technique known as Linear Predictive Coding, granular synthesis and a variety of stochastic mixing techniques.[20]

Although the concept of the work strives to reach the intelligible, the ambiguity of the unintelligible voice overrides any attempt. Heard in the example, the top layer of sound consists of snippets of the voice, almost percussive with a layer of sustained, resonating voice "harmony"–chorus-like "ohhs." Here the listener can segment these two sonic events as separate, the percussive snippets and the voice harmony, simply because of their rhythmic and timbral differences. The piece also features the use of panning, which places the listener in a sea of audible movement in turn creating a fast-paced rhythmic evolution. Although the snippets create a sense of chaos, the opposing "harmony" produces a sense of peace, overwhelmingly beautiful at times, because of its tonal nature.

Anna Rubin's *Crying the Laughing and Golden,* completed in 1983, is another piece that explores the use of a sampled voice, this time a sample of a woman's laughter. Composers not only use speech, but any form of verbal utterance that can be sampled,

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[19] Paul Lansky, liner notes taken from http://silvertone.princeton.edu/~paul/liner_notes/morethanidlechatter.html (accessed 09/26/2008).
[20] *ibid*.

including laughter, crying, sighing, or coughing. The sample goes through a number of manipulations such as playing it backwards, reverberation, and time stretching, which creates an evolving tapestry of timbres. An excerpt of this work can be heard in Audio Example 3; it will also be discussed in its entirety in Chapter Four. At 1:07 a barely audible whispering voice fades into the sound palette already in motion comprised of harsh, rhythmically chaotic "insect" sounds and more rounded, hollow pulsating "spaceship" sounds. The whispering is unintelligible, manipulated electronically, and the listener is immediately drawn to the voice as a sonic event to decipher the speech, placing it now on the foreground level of perception. As the whispering fades in, the other sounds fade into the background then briefly return to the foreground, only to fade out again at 1:22, leaving the manipulated voice as the prominent feature. While the insect sounds stop completely, the spaceship sound remains, almost inaudible on a background level. Here, the voice sample has a percussive ending, sounding as if it is being played backwards, giving it an eerie quality, and pans to the right speaker. At 1:43 the spaceship sound ends and a soft, continuous, hollow "wind" sound enters almost inaudibly in the background. The voice sample transforms becoming similar to the insects sounds previously heard, and pans from the left and right speakers. Almost inaudible on a background layer, the sounds of "wooden chimes" seem to evolve from out of the voice sample at 2:08. The voice now begins to quiet down, transforming into an electronic sound that starts off high-pitched and glissandos down. This new sound is then immediately transformed into a woman's laughter at 2:28, which is reverberated and echoed. Still layered with the sounds of laughter are the wooden chimes, but the wind ceases and the remaining two sonic events can be equally divided among the listener's attention. The introduction of the laughter creates a segment from the previous material, which included the whispering, because of the contrast of the voice sample. Figure 3.2 provides the listener with a listening score for this excerpt to illustrate how the evolution of sounds provides an ongoing progression of connected events.

Voice	*whisper* (*backwards*) *insect |---------------------------|-----------→------------------------|--------------------→ --
"Electronic" sounds	insect (ends) ----------→--------------|--------------------------------| spaceship (almost inaudible) wind |--------------------------------------→
Time in minutes	1:05 1:10 1:15 1:20 1:25 1:30 1:35 1:40 1:45 1:50 1:55 2:00 2:05 →
Structure	Segment --→

Voice	*whisper/insects* * laughter -----→------------------------|-----|--------------→ glissando
"Electronic" sounds	wind --------→--------------------------| wooden chimes |---→
Time in minutes	2:05 2:10 2:15 2:20 2:25 2:30 2:35 →
Structure	Segment cont. -----------------|Segment-----→

Figure 3.2: Listening score for *Crying the Laughing and Golden* excerpt

There are several sonic events heard in this excerpt in conjunction with the voice. However, the sonic events that appear to be purely electronic blend with and evolve from the voice samples creating an evolution of sound. Rubin holds the sounds together in this excerpt by overlapping new events with preexisting sounds, blending the transition from event to event.

Otto Luening and Vladimir Ussachevsky's tape piece *Incantation,* written in 1953, illustrates another use of layering with various samples. Along with the voice, this piece also features samples of the flute, piano, recorder, bells, and a plate, which can be heard in Audio Example 4. In addition, here is an example of a composition that falls into all three categories of *musique concrète.* As each new sonic event occurs, the previous events are displaced to a lower level of perception. The piece opens with a low, bass grumble heard on a background level. Then reverberated "spaceship" glissandi can be heard that rise and fall in pitch. At twenty seconds the listener then hears a piano sample fade in, which is manipulated to sound resonatingly hollow, and at twenty-four seconds the voice enters, an "ohh" with glissando. Then the voice becomes unintelligible and manipulated by being rendered backwards. In this excerpt the listener will hear four sonic events–the low grumble, the spaceship, the piano, and the voice–which are all differentiated by timbre and the onset of these events. The low grumble is placed on the background level of perception, and at first the spaceship is the prominent event. Then with the onset of the piano, it is momentarily placed on the foreground level until the voice enters. The piece not only uses a sample of the voice, but also incorporates other samples that intertwine on various levels of perception.

Milton Babbitt's *Vision and Prayer,* composed in 1961, is a piece that features the voice along with a synthesized accompaniment incorporating a traditional figure-ground texture as heard in Audio Example 5. The piece uses the text from Dylan Thomas's poem of the same name. The listener will hear various sporadic electronic sounds, which are serialized. The voice features intelligible spoken and sung text along with the use of *Sprechstimme*. Another composition by Babbitt, *Philomel,* composed in 1962, uses the live voice involving a performer and recorded samples of the voice. As with *Vision and Prayer*, this piece was created with the RCA Mark II synthesizer at the Columbia-Princeton Electronic Music Center. Of the piece, Babbitt notes:

> John Hollander, the poet at Yale, knew a great deal about music and had written a lot about it. He wrote a piece for me where I would know exactly what the conditions would be—it would be for solo soprano, there would be at least four sets of speakers around the hall and that it would be a work in which I would record her voice and fabricated and modulated through the synthesizer. … [Hollander] also understood that the synthesizer could do anything. It was no longer a question of whether it could be played or whether it could be heard. So he kept very close to me, to what the surrounding singer would do and how I laid it out. So it was very much a collaboration between the two of us. It took me about a year and I could have used more time. It was very, very difficult because first of all, I had to create the sounds from the synthesizer. Then I had to tape her

> voice for sections. A great deal of the time, she's singing straight but also a great deal of the time, she's answering herself as she is recorded.[21]

With *Philomel* not only does Babbitt include a live performer and electronics, but he also incorporates samples of the voice in which the performer interacts with herself, as heard in Audio Example 6.

The excerpt presents the opening of the piece in which the listener hears the voice with not only electronic accompaniment, but also the recorded samples of the voice manipulated by adding various layers to the voice—echoed, reverberated, muffled, and panned. In some cases the sampled voice features a soft dynamic creating the sense of being far off in the distance, which places the sound on a background layer of perception. Babbitt notes of the voice part:

> The vocal part is fairly straight-forward. It had to be since she was producing that in the confines of the human voice. I wrote things for her that I would not have wrote [sic] otherwise because so much of it depending [sic] on what was going on electronically. Sometimes the matching of timbres or the rhythm of the ensemble and her own rhythmic part was all taken together. This was something that you would never dare try with live performers.[22]

By incorporating electronic manipulation, Babbitt was able to create sounds from the human voice that were not otherwise possible because of performer constraints. These two Babbitt compositions illustrate other ways of incorporating the voice in electronic pieces. *Vision and Prayer* uses the voice in more of a traditional setting with electronic accompaniment. *Philomel* incorporates a live performer along with manipulated voice samples as part of the accompaniment at times creating a sea of voices.

Trevor Wishart is a freelance composer whose compositions deal mainly with the manipulation of the voice. *American Triptych,* composed in 1999, uses samples of American historical figures representing the American Dream—Martin Luther King Jr., Neil Armstrong, and Elvis Presley. Although the use of voice samples are evident, the origins of the samples may instill an even deeper sense of familiarity to the listener because of the sources of the samples, not to mention the listener's intertextual interpretation of each of the subjects. Audio Example 7 provides an excerpt of a denser

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[21] Jason Gross, "Milton Babbitt talks about *Philomel*" (April 2000). Taken from http://www.furious.com/perfect/ohm/babbitt.html (accessed 09/26/08).
[22] Gross.

section midway through the work. (The piece will be discussed in its entirety later in Chapter Four.) This example illustrates how even though the excerpt has a sense of chaos and the three samples at times fuse together, they can still be segmented as individual sonic events because each sample is a different speaker, with whom the listener is familiar. This familiarity will cause the listener's attentions to shift creating a constant motion of sound. At 7:30 the listener hears a variety of events, juxtaposed and in succession. First, King's sample "Let freedom" is heard with the "free" part of the text held out followed by a short staccato "bomp" from Elvis, and then a snippet of Armstrong's radio transmission.

Although these events take place in a matter of seconds, all three are decipherable as events because of the different subjects used for sampling and the various timbres they create. "Let" is then heard three times juxtaposed with a loop of Elvis's "bomp," the third states "Let Free" with the "Free" text held out. Again in a matter of seconds, the sounds fuse together chaotically incorporating Armstrong's transmission as an undertone to the chaotic juxtaposition of Elvis and King. At 7:45 new text is heard from King's sample, "From every mountainside," juxtaposed with the chaos. This sample is different from the previous voice sample of King because here the sample sounds non-manipulated, whereas "Let freedom" is spliced and extended at times. The insertion of this event and the change in text places it on a foreground level while it is present. After the new text is heard, "Let free" with the "free" part held out occurs again juxtaposed with Armstrong's transmission, and an interjection from Elvis with a "bomp." Here, "Free" changes in timbre slightly with a resonating high-pitched ringing. Figure 3.3 presents a listening score that breaks down the chaos found in *American Triptych,* illustrating how all the events fit together to form a unified whole.

Martin Luther King Jr.	“Let free” “Let”“Let”“Let free” “Let free” |-----------------|-----|----|-------------------|------|---------------------→ “From…”
Elvis Presley	“bomp” “bomp” (*loop*) “bomp” | |--|-----------------→
Neil Armstrong	transmission transmission ----→-----|------| |---------------------→
Mixture of Samples	*fusion |---------------------------|
Time in minutes	7:30 7:35 7:40 7:45 7:50 →
Structure	Segment ---→

Figure 3.3: Listening score for *American Triptych* excerpt

Although a sense of chaos ensues from the juxtaposition of events that are heard, the listener’s attention will divide according to the onsets and endings of each manipulated sample as it enters the sound palette, creating a shifting perceptual level of events. As a result, the listener hears an ongoing progression of events.

Wishart’s composition *Tongues of Fire,* composed in 1995, uses a sampled voice that is transformed to realize other sounds. This renders the source unintelligible and if listeners did not know the sound source they would likely conclude that the sounds came from other sources, or were purely electronic. In an article written by Wishart specifically addressing this piece, he notes that the composition is built from one sound and discusses his use of transforming sounds.

> My composition *Tongues of Fire* is a musical work created for the recorded medium using the computer. It relies on the computer’s signal processing power to metamorphose one kind of sound material into another, thereby making audible connections between different kinds of sounds and enabling a musical structure to be developed in the sonic domain. … I begin with a starting sound, and apply any number of different small metamorphoses. A metamorphosis must lead to a perceptually similar sound. I then transform many of these sounds a little, and so on. In this way, I build a tree of interconnected sounds with its *nodes* and *branches.* As this process of sound generation proceeds, I select particular sounds to further metamorphose, or to use finally in the piece, on the basis of their intrinsic aesthetic qualities and their audible relationships to one another. However, some sounds may be used purely because they form a perceptual bridge

> between two other more notable sounds, like passing tones in a pitch-based musical organization.[23]

The article traces various events within the piece, but Wishart notes that the article is really "for the benefit of composers rather than potential listeners."[24] While Wishart discusses the piece in some detail, I will only focus on segmenting an excerpt of sonic events as the ordinary listener would hear them. In the excerpt provided in Audio Example 8, the listener will hear an ongoing evolution of sound. At eight minutes the listener will hear a dense, chaotic texture featuring glissandi getting higher in pitch. At 8:20 another sonic event fades in, separating it from the chaotic events, which sounds like prerecorded "music." Although the listener recognizes this as a new sonic event, the two events, which are now layered together, remain on the same perceptual layer because of the dynamic of the new event; it is soft, which does not make it a prominent feature. The two events fuse together, colliding with a bang. Then at 8:27 a sample of an unintelligible voice enters, sounding like gibberish. Here, the gibberish voice is layered on top of the chaotic rumbling texture (from which the gibberish seems to come) in percussive, staccato sparks. Since the timbre more or less remains the same, these two juxtaposed sounds continue as two sonic events layered together. Then the gibberish metamorphoses into more sustained sounds slowing down rhythmically to ticking sound at 9:40. The ticking sounds almost like laughing and continues until ten minutes when a brief moment of silence occurs. This moment of silence creates a break in the sections of the piece and at 10:04 the listener hears the spurts of percussive, staccato gibberish again, which then proceed to transform timbrally into resonating percussive bangs of gibberish. The listener becomes enthralled in the moment, and is left to wonder, "Where is this going?" Wishart notes:

> The material [for this piece] are arranged in temporal sequence, or overlaid contrapuntally (strictly speaking, as counterstreams) to emphasize, mask, or complicate their perceptual connection, forming an evolving structure in time. It is primarily this temporal unfolding of materials that I hope the listener will perceive and appreciate.[25]

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[23] Wishart, 22.
[24] *ibid.,* 22.
[25] *ibid.*, 23.

By using one sound source for the production of all the sounds in the composition, Wishart is able to produce an ongoing chain of events where sounds metamorphose into new sounds. As a result, the listener hears an unfolding of sonic events linked to one another. While both of Wishart's compositions feature the aspects of an ongoing evolution of sound and chaotic textures, each piece uses voice samples in contrasting ways with different compositional outcomes.

The previous analyses illustrated how the human voice can be used as a source for sampling in electronic works. The voice can be heard as intelligible or unintelligible and can be comprised of speech, laughter, coughing, or any verbal utterance. A composition may also incorporate the use of a live performer and include various aspects of textures, whether as a prominent feature or accompaniment. In fact, a large number of compositions use sampling of the voice; perhaps because it is a primary source of communication. For instance, for their twentieth anniversary in 2004, the Society of Electro-Acoustic Music in the United States (SEAMUS) released a compact disc based strictly on pieces that use voice samples.[26] In particular, the composers for this compilation were asked to use interviews recorded from the 2002 SEAMUS conference in Iowa. The composers were allowed to use any material from the recordings as they wished. Although all of the pieces incorporate the voice, the compilation illustrates how composers can use voice samples in a variety of unique ways, creating a plethora of sounds from intelligible to unintelligible material.

Traditional Instruments as a Sonic Event

Composers of electronic music also incorporate acoustic instruments in their compositional processes. The composer may include a live performer and/or record the performer to use the material as a sample. In some cases, composers may transform the

[26] *SEAMUS 20th Anniversary (1984-2004)* Music from SEAMUS (Society of Electro-Acoustic Music in the United States). CD EAM-2006-2.

sounds produced by a live performer through electronic manipulation. These types of compositions may be pre-programmed for a specific compositional outcome or involve an aspect of indeterminacy. Consequently, the composer has created a new connection, between the performer, his/her instrument, and now the electronics. The sample of a traditional instrument can be rendered intelligible or be manipulated to produce a different, new sound. The listener can recognize specific musical aspects from the use of an instrument, such as tonality or lack thereof, register, rhythmic stability, and/or conjunct or disjunct motion. In some cases the electronic part serves as accompaniment, similar to Babbitt's *Vision and Prayer*, which uses the voice with electronic accompaniment. In other cases the instrument is sampled and manipulated so as to render it undetectable as a traditional instrument, but creating new sounds.

One notable composer who created a series of works that include incorporating traditional instruments with electronics is Mario Davidovsky, a student of Milton Babbitt and associated with the Columbia-Princeton Electronic Music Center. His twelve works all titled *Synchronisms,* the first composed in 1962 and the last in 2006, feature solo instruments such as the flute, cello, violin, and clarinet, small chamber groups, and *Synchronisms No. 7* (1974) even includes an orchestra. Several of these works also incorporate the use of the voice. Davidovsky's most famous work from this series is *Synchronisms No. 6* (1970) for piano and electronics, which won a Pulitzer Prize in 1971.

Otto Luening's composition *Fantasy in Space* was written in 1952 at Henry Cowell's house in upstate New York and presented in the same year by Leopold Stokowski at a concert at the Museum of Modern Art in New York City. *Fantasy in Space* is a tape piece that uses a recording of the flute. (This piece will also be discussed in its entirety later in Chapter Four.) Here, Luening recorded himself playing the flute and then rerecorded over each to create a flute "quartet." As noted by Joel Chadabe, "the flute was made to sound like a strange new instrument."[27] In the piece the listener can hear definite pitches and could easily transcribe them. The pitch content is primarily tonal with some dissonance as heard in Audio Example 9. In the audio excerpt the listener can also hear how the different flute "voices" are manipulated by reverberation and are layered on

[27] Joel Chadabe, *Electric Sound: The Past and Promise of Electronic Music* (Prentice Hall: New Jersey, 1997): 44.

top of each other. The reverberated sounds were created using a device built by Peter Mauzey, conveniently called a Reverberation Box. Halfway through the brief composition Luening inserts an original melody, folk-like in nature, played on the flute without electronic manipulation. *Fantasy in Space* is an example of an electronic piece that takes advantage of overdubbing to create a texture of multiple sounds from one instrument. Luening also utilizes the combination of juxtaposing the sample with and without electronic manipulation.

Whereas Luening's *Fantasy in Space* is an example of a tape piece, which would have required hours of recording, and splicing and cutting of tape, Mobberley's composition illustrates the advancements of technology and the ability to edit snippets of music within software programs. Mobberley notes:

> *Spontaneous Combustion…* is the ninth in a series of works that combine a soloist with a computer-generated accompaniment that is comprised solely of sounds from the solo instrument. The effect is rather like a concerto for a performer and him/herself. The saxophone sounds were recorded and edited on a 386 machine, and manipulated/mixed using CSOUND. The title describes the unpredictable, virtuosic nature of much of the piece, which draws in subtle ways from various jazz styles—from blues to be-bop.[28]

Audio Example 10 provides an excerpt from James Mobberley's *Spontaneous Combustion* written in 1991 for saxophone and computer-generated accompaniment. *Spontaneous Combustion* is an example of a piece that employs the traditional instrument as a soloist with electronic accompaniment, where the accompaniment is also derived from the instrument. The piece opens with a swelling, grumbling trill from the saxophone that fades in and then out. The grumble repeats, this time transforming through manipulation into a glissando with a crash that sounds like a cymbal. Then the saxophone plays three sustained tones, in which the listener will hear three soft prerecorded trills by the saxophone on a background layer that glissando, the first descending in pitch the other two ascending. As the third trill is heard, the saxophone softens and the sustained pitch evolves into "knocking" sounds at thirty seconds. The knocking then metamorphoses into a loud trill that glissandos up in pitch. At the end of the glissando the last pitch is sustained and manipulated into a high-pitched ringing that is then panned

[28] James Mobberley, liner notes taken from *Music for SEAMUS* (Society of Electro-Acoustic Music in the United States) *Volume 1*. CD EAM-9301.

back and forth between the speakers. The abrupt transformation of sound, the sustained sax into knocking, creates a segment of events from the discontinuity of not only timbral qualities, but also rhythm and volume. While the ringing continues to pan back and forth from left to right, the saxophone descends in pitch with five-note scalar patterns. At forty-eight seconds the ringing turns into knocking and an ascending scalar saxophone passage doubled with a lower octave is heard. At fifty-two seconds the saxophone reaches a sustained tone in its high register, stopping the knocking. The saxophone then glissandos down in pitch and becomes multiplied and reverberated. In the piece, the non-manipulated saxophone sounds are coupled with electronic accompaniment that is derived from samples of the saxophone, creating a game of interaction between the two sources.

Figure 3.4 provides a listening score for the opening of *Spontaneous Combustion,* illustrating how material taken from the saxophone can become its own accompaniment.

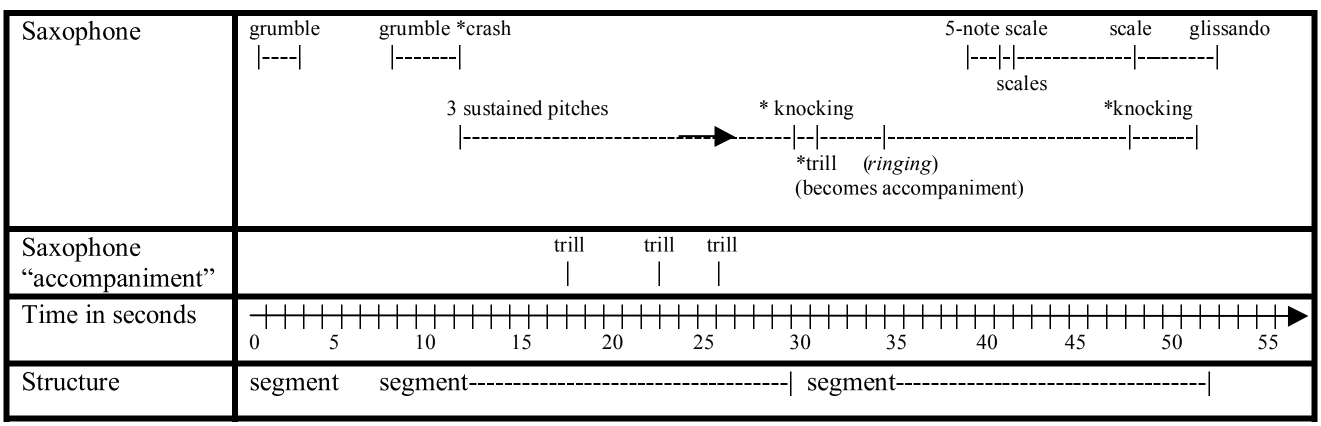

Figure 3.4: Listening score for *Spontaneous Combustion* excerpt

This excerpt illustrates how Mobberley uses the saxophone not only as a solo instrument but also as an accompaniment to itself. As the performer plays sustained tones and scalar passages, the computer-generated sounds come in and out of the listener's perception, adding to the texture of the work. As a result, the saxophone becomes the driving force of the compositional outcome.

Benjamin Broening's *Nocturne/Doubles,* written in 2001, features the use of a piano and computer and juxtaposes tonality with abstract electronic sounds. Broening notes:

> *Nocturne/Doubles* is the second in a series of works based on the seventeenth and early eighteenth century French musical concept of *doubles*, a technique of ornamentation. The *Doubles* series takes this idea as its starting point and applies the variation technique to the timbre of the soloist, as well as the pitched material. The computer also responds, [through the use of software,] to the piano's music; sometimes confirming and summarizing, sometimes extending, altering or recontextualizing the piano's melodic and harmonic material.[29]

In this piece the piano part is tonal and uses motivic material that is perceived by the listener as being enhanced by the electronics.

Audio Example 11 presents an excerpt of the opening of this piece, which begins with a single, staccato note played on the piano that is manipulated electronically being echoed, reverberated, and panned primarily to the left. This then evolves into a shimmering "ohh" that comes from the background. Here, there are two layers of sound– the piano and its echoed manipulation with the shimmering "ohh." The piano attacks repeat two more times, conforming to the aspect of similarity and familiarity, while during the third occurrence the "ohh" fades out. The pauses between the attacks on the piano, which are softer each time, create a segmental subdivision on the lowest level of structure. At thirty-one seconds the piano part is lengthened to a five-note conjunct motive repeated two times and transposed, with each repetition slowing down in speed, while the "ohh" sonic event fades back in. At thirty-nine seconds the listener hears the five-note motive again layered with "ohh." As heard before, the five-note motive repeats twice, transposed and slowing down, recalling notions of familiarity and similarity, and again segmenting the two on the lowest level of structure. Then at forty-nine seconds a descending run is heard by the piano followed by a loud attack with the electronic shimmer, which leads into a new segment of music.

The aspects of familiarity and similarity heard in the brief excerpt allow the listener to segment sonic events on more than one structural level. As mentioned earlier, on the lowest structural level the listener can segment the opening piano events by the occurrence of each piano attack, creating three segments. However, the listener can also

[29] Benjamin Broening, liner notes taken from *Music from SEAMUS Volume 13*. CD EAM-2004.

hear these events as one segment because the attacks become familiar with each repetition. When the five-note motive is introduced at thirty-one seconds, this becomes a new segment because of its contrast from the opening piano attacks. The repetition of the five-note motive again at thirty-nine seconds creates another lower-level structural segment within the larger segment. Nonetheless, the listener hears a connecting thread between these segments, the layered "ohh" event. In the excerpt, the listener will hear three main segments created by the contrast of the piano's musical material—single note attacks on the piano, a five-note motive, and a descending run. Figure 3.5 represents a listening score that presents the sonic events and the various levels of structure that occur within the excerpt.

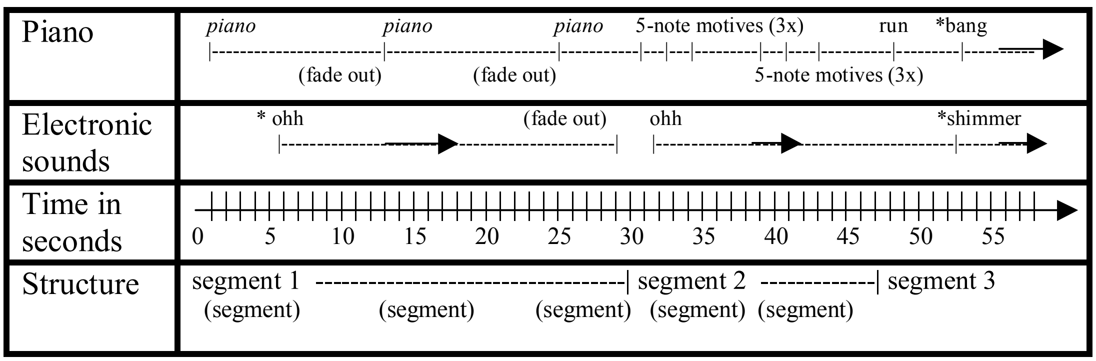

Figure 3.5: Listening score for *Nocturne/Doubles* excerpt

Nocturne/Doubles illustrates the juxtaposition of a traditional instrument and electronics in that the piano presents tonal material that is used motivically in conjunction with the electronics, coexisting and evolving together. In contrast, Mobberley's use of the saxophone also coexists with the electronics, but with the added element of the saxophone "accompanying" itself.

Russell Pinkston's *Gerrymander,* written in 2002, features the Bb clarinet and electronics. This piece uses Max/MSP program (discussed in Chapter One), which takes input from the live clarinet playing and manipulates that input to generate the electronic part in real-time. Audio Example 12 provides an excerpt of the piece beginning at forty-five seconds. The listener will hear the clarinet playing a tonal melodic line with conjunct and disjunct motion. This event is coupled with electronic shimmer. The listener can also hear the effects of Pinkston's use of Max/MSP as the clarinet is echoed and reverberated. Then at 1:13 a dampened "bang" is heard. The bang closes the previous section, segmenting the opening from the musical content that follows. In addition, now the clarinet material changes and is manipulated with electronic "flutter tonguing" creating a contrast between the more melodic content in the preceding segment. The underlying shimmering is now gone just leaving "short breath" clarinet manipulations on the background layer. The use of such interactive programs like Max/MSP creates a musical conversation between performer and electronics. While the performer creates sound with a traditional instrument, the computer manipulates the sound taking the listener on an evolving musical journey.

Paul Oehlers's *Archetypal Infusion: MemEry2k*, written in 2000, features the harp with electronics. While the previous analyses illustrated such aspects as self-accompaniment, evolving tapestries, and real-time manipulation, Oehlers's work sets out to explore the opposition of traditional instrumentation—the harp—versus electronics. However, Oehlers's intention is to negate the opposition and create a blended timbral palette. As Oehlers notes:

> [This piece] explores the concept of juxtaposition of dissimilar musical elements while maintaining a complimentary timbral environment. The resulting texture enables the harp to maintain its identity while still creating an ambiguity between the harp and electronics through several sections of the piece.[30]

Audio Example 13 provides an excerpt of the piece that illustrates the ambiguity of the harp and electronics. At 2:48 the listener hears percussive drum-like sounds followed by a high-pitched shimmering chime sound that leads into a clear distinctive plucking of the harp. Each different sound evolves into the next creating a blending of timbres. This effect continues at 2:55 when the pluck of the harp blends into "rattling metal." The harp plucks continue layered on top of the rattling metal. *Archetypal Infusion: MemEry2k* specifically fuses the timbre a traditional instrument with electronics keeping the integrity of the timbral component, which allows the two sources to coexist and blend together as one single instrument.

[30] Paul Oehlers, linear notes taken from *Music from SEAMUS Volume 11*. CD EAM-2002.

Although the examples given thus far have included a solo traditional instrument with electronics, composers also employ multiple traditional instruments within a composition. One example is Eric Chasalow's *Suspicious Motives* composed in 1999 for flute, clarinet, violin, cello, and electronics. This piece, as it is an homage to Mario Davidovsky, also includes a one-word sample taken from an interview with Davidovsky. *Suspicious Motives* is very much a contemporary piece with rhythmic chaos, dissonance, and sporadic motion as heard from the excerpt in Audio Example 14. From this excerpt the listener can distinguish the traditional instruments from the electronics, but the two are juxtaposed so as to create a quintet. In other words, all the instruments within the composition form a cohesive ensemble, each instrument weaving in and out of the musical tapestry and achieving a contrapuntal juxtaposition of sound.

Vladimir Ussachevsky's 1965 composition *Of Wood and Brass* is a tape piece that incorporates multiple instruments. The original recorded material consists of a trombone, trumpet, xylophone, and Korean gong. The piece was produced at the Columbia-Princeton Electronic Music Center. However, the manipulation of sounds employed renders the original instrumentation unintelligible, as heard in Audio Example 15. This excerpt is from the opening of the work in which the listener will hear sporadic electronic sounds. It is hard to distinguish which instruments are producing what sounds. The first few sounds are harsh but are reverberated, producing a resonating quality. The harsh electronic sound, perhaps a trombone sample, continues without reverberation, and at twelve seconds the timbre changes to sound of "metal tin" being banged on. The metal timbre then changes to sound a little more hollow, and at seventeen seconds the transforming timbres collide into a "scream," which segments into a section of new sounds and timbres.

The previous brief analyses demonstrate how composers incorporate traditional instruments in the compositional process. A composition can use a solo instrument or any ensemble combination, incorporating live performers if desired. In some solo instances, the electronic parts could act as accompaniment and/or the sounds of the solo instrument could be manipulated to form its own accompaniment creating multiple layers of sound. Like a voice sample, samples of traditional instruments can be rendered intelligible or unintelligible. Composers may choose to exploit the instruments' natural timbre or manipulate the sound to create new, imaginative sounds. In some instance the instrument(s) and electronics are meant to mesh in terms of timbre; other compositions juxtapose the differences of sound quality. When left as an intelligible sound source, traditional instrumentation in the use of electronic works by any means, will be recognized as a sonic event because the listener perceives it as such by familiarity.

Found Objects as a Sonic Event

Everyday sounds can also be used as source material in an electronic composition. These sounds can of course consist of anything found in nature or anything man-made. They can include, but are not limited to, nature, animals, means of transportation, closing doors, pots and pans, construction sounds, whatever the imagination can think of, and whatever the composer desires to use as source material for sounds. Michel Chion notes:

> Obviously crucial questions of sound as material are asked regarding recorded sound and music, in which the composer has the ability to use any source of sound. This is in fact a kind of music where the acoustic materialization of the work is entirely in the hands of the composer. Both level of material and organization are involved in common actions resting entirely under his control.[31]

As with the human voice and traditional instruments, these sources can be recognizable or significantly unrecognizable as to obscure the originating source of the sample.

Hugh LeCaine, inventor of the Electronic Sackbut in 1948 among other electronic instruments, uses only a single drop of water as the sound source in his brief composition *Dripsody*. This piece was written in 1955 and is a tape piece that employs variable playback speed. In the excerpt provided in Audio Example 16 the listener will hear the opening of the piece. *Dripsody* starts with the sound of a single drip, the original sound source, which is then immediately multiplied, sounding almost cricket-like. The single drop of water is transposed at higher and lower frequencies, and as the piece continues

[31] Michel Chion, "Concerning the Use of the Term "Sound Material" in Tape Music: A New Definition of Musique Concrète" in *Structure and Perception of Electroacoustic Sound and Music,* Sören Nielzén and Olle Olsson, eds. (Excerpta Medica: Amsterdam, 1989): 26.

the frequency range expands with the incorporation of glissandi. Although *Dripsody* derives all its material from one sound, it is manipulated and varied rhythmically to create a template of various-pitched water-drops of differentiating timbres, at times rendering the source unintelligible. Peter Manning notes of LeCaine's work, "His treatment of timbre and pitch organization is most sensitive, displaying a coherence which arises naturally out of the sound shapes themselves, rather than some predetermined formalistic structure."[32] With *Dripsody*, LeCaine created a rich, textural listening environment that evolves from a drop of water.

John Cage's *Williams Mix* is another tape piece composed in 1952. It uses a variety of found sounds, in fact 500 to 600 sounds that were recorded by Louis and Bebe Barron. The sounds were then categorized into groups: city sounds, country sounds, electronic sounds, manually-produced sounds, including the literature of music, wind-produced sounds, including songs, and small sounds requiring amplification to be heard with the others. Cage notes of his work with tape music:

> The chief technical contribution of my work with tape is in the method of splicing, that is, of cutting the material in a way that affects the attack and decay of sounds recorded. By this method I have attempted to mitigate the purely mechanical effect of electronic vibration in order to heighten the unique element of individual sounds, releasing their delicacy, strength and special characteristics, and also to introduce at times complete transformation of the original materials to create new ones.[33]

Audio Example 17 presents an excerpt of the opening of *Williams Mix*. The listener will hear a plethora of samples, some that are intelligible such as frogs croaking, manipulation of people speaking, a piano, and construction sounds, while other sounds are rendered unintelligible, leaving them to sound purely electronic. The samples are spliced in such a manner that the progression of events seems chaotic. The sense of chaos comes from Cage's use of the I-Ching (Chinese Book of Changes), which forms the structure of the

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[32] Peter Manning, *Electronic and Computer Music.* 2nd ed. (Oxford University Press: Oxford, 1993): 185.
[33] John Cage, liner notes taken from *The 25-Year Retrospective Concert of the Music of John Cage,* 16. CD WER 6247-2.

piece indeterminately.[34] The listener is constantly drawn into the piece with his/her attention drawn to the familiar sounds juxtaposed with the unfamiliar.

Another, more recent piece that uses the sounds of nature is Brian Eno's *Unfamiliar Wind (Leeks Hills). Unfamiliar Wind* is on the album *Ambient Four: On Land*, which was released in 1982, the fourth and last installment of a series of ambient albums.[35] The pieces on this album represent places from Eno's childhood; Leeks Hills is a forest close to Eno's childhood home. *Unfamiliar Wind* is intentionally supposed to evoke the sounds of the forest and uses samples of frogs, insects, spinning plastic tubes, bass guitar, and synthesizer. Eno states that his music is "figurative music, because it is very much an attempt to paint a picture."[36] Matthew Weiner notes of the works on the album:

> Their musical renditions derived not from visiting [the place] but rather spotting them on the map and 'imagining where and what they might be'. … By weaving dense sonic tapestries that appeared static from afar but upon closer inspection were in a constant state of microscopic transformation, Eno was essentially forcing the audience to examine the broader soundscape.[37]

Audio Example 18 provides an excerpt of the opening of the work, which begins with an ambient pulsating "ohh." Then at thirteen seconds the listener will hear a "bird" call, almost inaudible and therefore on a background layer. At fourteen seconds, growing out of the pulsating "ohh," comes what sounds like water splashing or waves crashing played on a loop, and faint frog croaks. Again at twenty-two seconds the bird calls return and at twenty-eight seconds comes a loud bass sound. From the excerpt the listener can hear frogs, exotic birds, an ambient "ohh," and electric bass juxtaposed together on foreground and background layers to create a true sense of wilderness.

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[34] Known for composing using the element of indeterminacy, which creates compositional processes that are beyond the composer's complete control, Cage used the I-Ching in a number of his compositions, such as *Music of Changes* and *Imaginary Landscape No. IV* for 12 radios.

[35] The series of ambient albums began in 1978 with *Music for Airports, The Plateaux of Mirror* followed next in 1980, and the third album was released in 1981 titled *Day of Radiance.* Ambient music, a term coined by Eno, is a genre of mood inducing music that generally evokes an atmospheric quality. Eno's conception of ambient music is "endless, relatively unchanging moods." Matthew Weiner, Taken from http://stylusmagazine.com/feature.php?ID=1250 (accessed 09/26/2008).

[36] Mark Prendergast, "Brian Eno: 'A fervent nostalgia for the future' – Thoughts, Words, Music and Art. Part One." Taken from http://music.hyperreal.org/artist/brian_eno/interviews/sosl.html#On-Land (accessed 09/26/2008).

[37] Weiner.

Denis Smalley's *Empty Vessels* composed in 1997 uses the resonant sounds produced from large garden pots as the sound source. However, as Smalley notes, he recorded the sounds from the pots outside his home London, capturing sounds from the environment as well.

> The empty vessels of the title are some large garden pots from Crete and an olive jar from Turkey. Recordings of the air resonating in these vessels provided the starting-point for the piece. Since the recordings were done in my garden in north London, sounds from the environment (rain, birds, airplanes flying overhead) were also captured by the microphones inside the pots, and changes in the timbre of these sounds resulted from the interaction with the filtering effect of the resonant vessels. These 'natural' transformations were extended through computer treatments of the sources, and they also suggested relations with very different types of resonant sounds.[38]

Audio Example 19 is an excerpt from the middle of *Empty Vessels,* chosen so the listener can hear the sounds recorded in nature juxtaposed with the manipulation of the resonant pots. At nine minutes the listener hears a combination of sounds, the continuous sound of the resonating garden pots layered with rain and bird sounds. Then at 9:45 the sound of an airplane can be heard which is followed by a harsher, sharper manipulation of the pots at 10:08. Although Smalley's intention was to record the large pots, he allowed the natural sounds of his recorded environment to be heard as well.

Stephen Vitiello's *Marfa Mix,* written in 2003, is also another piece that captures environmental sounds, as with *Empty Vessels*, however this was Vitiello's original intention for the composition. The sounds for *Marfa Mix* were recorded in Marfa, Texas using the artist Donald Judd's sculptures in order to catch sounds resonating off the art. The work has gone under several revisions, and the excerpt featured here presents the beginning conception of the work.[39] *Marfa Mix* begins with a sample of a train, the listener hears the train's whistle blow and moving on the tracks, as heard in Audio Example 20. Then at 1:04 the listener hears railroad crossing signals juxtaposed with birds chirping, a new event, which draws the listener's attention from the train tracks. The train sounds far off in the distance and then this sound metamorphoses to what sounds like a car zooming by at 1:47. The car sound pans from left to right and then

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[38] Denis Smalley, liner notes taken from *Denis Smalley Sources/scènes*. CD IMED 0054.

[39] This excerpt of *Marfa Mix* was released on *An Anthology of Noise and Electronic Music/Fourth A-Chronology 1937-2005.* The complete work, in six movements, can be found on the album *Listening to Donald Judd* released in 2007.

occurs again, panning right to left. Then new sounds are introduced to the listener, which are not as recognizable as the opening's train sample. At 2:00, underlying the sounds on a background level is an electric hum, followed three seconds later by the sound of "shoes" walking on a hard surface. In this example, Vitiello uses a variety of sampled found sounds taken freely from the environment that are all familiar to the listener. At each new onset of a sonic event, the listener's attention is drawn to the new event, placing the preexisting event briefly on a lower perceptional level. As a result, the events heard throughout the work intertwine on various levels of perception.

Ussachevsky's *Wireless Fantasy,* composed in 1960 at the Columbia-Princeton Electronic Music Center, is a tape piece that uses recorded signal taps as its sound material. An interesting and different sample to use in a composition, Ussachevsky chose this particular source because the piece was actually commissioned by a group of early radio researchers called the De Forrest Pioneers, named after Lee De Forrest, inventor of the vacuum tube.

> The piece is meant to evoke the early period of radio communication by using wireless code as a primary sound source. For this purpose, Ussachevsky recorded signals tapped out by and early radio pioneer, Ed G. Raser, on old spark generators in his W2ZI Historical Wireless Museum in Trenton, New Jersey.[40]

Not only does Ussachevsky use signal taps, he also juxtaposes a fragment from Wagner's *Parsifal*, which is manipulated to sound like short-wave transmission. The piece opens with the *Parsifal* sample and then the distinct sound of a wiretap is heard layered on top, as heard in Audio Example 21. The tap fades out at twenty-five seconds leaving just the continuous *Parsifal* sample. At thirty-five seconds more wiretaps are heard layered above *Parsifal*, but this time the timbre is manipulated, giving the taps a harsher, electrifying quality. This excerpt features unique sound sources—wiretaps and a Wagner sample—illustrating that the composer can incorporate any number or variety of sound sources. While *Parsifal* is rendered unrecognizable, the wiretaps incorporate both recognizable and unrecognizable renderings.

Composers also use samples of older traditional compositions as a source of found sound, as noted above in *Wireless Fantasy*. James Phelps's *Chordlines,* composed

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[40] Eric Salzman, liner notes taken from *Vladimir Ussachevsky: Electronic and Acoustic Works 1957-1972.* CD CRI 813.

in 1990*,* uses a sample of “Coro e cavatina” from Rossini’s *La Cenerentola,* heard in Audio Example 22. From the brief excerpt of the beginning of the piece the listener will first hear a bell-like shimmer that lasts for one second coupled with a low bass rumble that is sustained. These two events are easily distinguishable from each other because of their different timbres and the brief presence of the shimmer. The shimmer returns at six seconds, this time sustained, and at ten seconds resonating “toy” piano sounds can be heard. Interestingly, with this piece the listener is completely unaware of the use of the Rossini sample because Phelps has transformed the original source to the point of unintelligibility. However, Pauline Oliveros’s *Bye Bye Butterfly,* written in 1965, incorporates a segment from Puccini’s *Madam Butterfly* and is an intelligible sample from the opera, as heard in Audio Example 23. (This piece is also discussed in its entirety later in Chapter Four.) At 3:25 the Puccini sample enters over an already existing high-pitched ringing electronic sound. The sample features a chorus with orchestra and is reverberated and echoed to sound as if it is pulsating. At 3:56 we hear a high-pitched glissando that leads into a sample of a soprano singing. Then the various glissandi that are heard throughout the piece become manipulated and sound almost like someone screaming. These screaming glissandi are juxtaposed with samples from the record. While Puccini’s sample in manipulated by electronic means, the sample is still intelligible. As we have seen as a recurring theme, composers either leave their source material recognizable to the listener or render it so as to create new sounds. When utilizing found sounds the composer has an infinite number of possibilities for sources of sounds, even the use of prerecorded work. As noted in Chapter One, Judith Lochhead investigated a composition by Charles Dodge’s titled *Any Resemblance is Purely Coincidental*, which also features the use of a prerecorded sample.[41] Dodge’s piece is for piano and tape, including a sample of Enrico Caruso singing “Vesti la giubba” from Leoncavallo’s *Pagliacci*. Lochhead discusses the opposition that is created from the use of older music–Caruso’s sample–and new music–electronics.

The previous analyses illustrate how composers may utilize various aspects of recorded sound in the compositional process. A large number of compositions include the

[41] Judith Lochhead, “’How Does It Work?’: Challenges to Analytical Explanation,” *Music Theory Spectrum* 28/2 (Fall 2006): 233-254.

voice. The two other categories of *musique concrète* include the use of traditional instruments and found sounds. In general, the samples will be presented to the listener as either recognizable or unrecognizable sources. In addition, electronic compositions present the composer with the opportunity for using and creating new sounds in a now limitless sound palette. Recorded samples can be a prominent feature of the composition, like a soloist, or intertwine with the electronics. The listener, when the samples are intelligible, will recognize the sounds through familiarity, which helps to identify and segment these sounds as sonic events. When sounds are rendered in such a manner that they are no longer recognizable, other elements based on differentiating musical parameters allow the listener to identify these sounds as events, as illustrated in the analyses.

Purely Electronic Sounds as a Sonic Event

The previous categories discussed demonstrated how composers draw upon particular resources, such as the voice, traditional instruments, or the sampling of pre-existing recordings, in the compositional process. Nonetheless, some of the pieces mentioned in the previous sections included sonic events that were created by purely electronic means. Therefore it is only fitting that several works that were solely created electronically are now considered. Electronic works that incorporate the voice or a clarinet, for instance, bring a sense of familiarity to the listener, but electronically-produced sounds offer a sound palette of an infinite number of musical possibilities. When listening to works of this category the listener may encounter unfamiliar soundscapes and will need to identify what the sounds are that they are hearing. Although the listener is not necessarily going to know how each sound was created by electronic means within the compositional process, the listener can describe the sound(s) that they hear. On the other hand, composers themselves who have worked extensively in this genre, or listeners who have special knowledge, may recognize the means used to produce a particular sound and/or composition. For instance, one could recognize the use of a particular synthesizer or understand the programming behind a sequence of events. Nevertheless, it is useful to assign a particular sonic event an associative name to categorize it in order to follow its progression within the work, as illustrated in the previous categories. Although the process of creating the sonic events may be completely unknown to the listener, the sounds may still sound familiar and easily describable. For instance, as mentioned previously, there may be sounds like "woos," "rattling metal," or "insects." There is no universal method for applying descriptive names to musical events and various descriptions can be used to recognize a single event. It depends on the content of the composition and the listener's perception of the sonic events.

Richard Devine's *Tetrad,* from his 2005 album *Cautella*, is an electronic composition that was composed with purely electronic sounds, and upon the first hearing presents the listener with new, unfamiliar sounds. The following analysis will illustrate how the experience of the listener can shape and form a descriptive analysis of the piece. With multiple listenings, the sonic events reveal themselves to the listener and the listener begins to comprehend the form and content of the composition. *Tetrad* opens with a continuous, evolving "ahh" sound that is immediately layered with more sporadic sonic events as heard in Audio Example 24. (This piece is also discussed in its entirety in Chapter Four.) These events are sporadic because they are short sounds that suggest an ametrical pulse and employ various computerized, machine-like timbres. The sporadic sounds continually change in timbre, which demands a highly experienced, technologically advanced listener to truly decipher what is taking place compositionally. However, the difficulty of computer jargon does mean that we cannot discuss the piece to discover its musical structure. Both of these sonic events, the continuous sound layered with the sporadic sounds can be placed on the foreground layer of perception because one can equally attend to either one. These two events are separable due to their contrasting rhythmic nature, one continuous and one sporadic, and the fact that their onsets are not the same. Nevertheless, the sporadic events are perceptually more prominent because it is a new sound layered upon a preexisting sound; our attention is momentarily drawn to the new event. The overall sense of meter at the opening of this work is ambiguous. The sporadic events feature various timbres that sound electronic, and once the listener is accustomed to the hearing the sporadic sonic events, they can be heard as an ongoing chain of various timbres via the concept of good continuation. With more listenings of the piece the contrast becomes a familiar musical aspect.

Hubert Howe, noted for his work in computer music programming, composed *Timbre Study No. 5* in 1991 using Barry Vercoe's CSOUND software. This piece is an example of an electronic work that employs sine waves generated from various partials of the overtone series to produce assorted timbres ranging from soft, resonating bells to harsh, sawtooth wave-like sounds. Howe notes of his work:

> One of my abiding concerns in computer music has been the creation of original and unique sounds, which neither imitate musical instruments nor are modeled after natural or "concrete" sounds. These sounds were conceived in a purely speculative manner, where I simply decided to try out some ideas to see what they sounded like and began to feel that I was onto something good. The fundamental timbral resource for all musical sounds is the overtone series, but there have been few attempts to structure and use it in the way that these compositions do.[42]

Timbre Study No. 5 is an example of a how a composer can create new timbres for the listener to hear and demonstrates how sounds can evolve and grow from one another. Audio Example 25 provides an excerpt of the opening of the piece. This piece is a study of evolving timbres, as the title suggests, in which the sounds grow from and build upon each other. Sine waves of various pitches and timbre fade in and out, sometimes building upon one another to create a new timbre or a denser texture. Each time a new onset occurs the listener's attention is drawn to that sound, and one's attention seems to shift between various levels of perception. The continuous evolution of sound creates an ametrical rhythmic quality, but momentum is conserved because of the work's ongoing chain of changing timbres.

Morton Subotnick is known for his work at the San Francisco Tape Music Center from 1961 to 1966, working closely with Donald Buchla and his synthesizers. His composition *The Wild Bull,* composed in 1968, was generated by the Buchla synthesizer, when electronic sequencers were still new. It is in two movements, Part A and Part B. (Part A will be discussed in its entirety in Chapter Four.) The composition features a wide range of complex sounds derived from a single source. As noted by Manning:

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[42] Hubert Howe, liner notes taken from *Overtone Music*. CD CPS-8678.

> *The Wild Bull* (1968), a commission from Nonesuch, is characterized by more elaborate applications of sequencer control, resulting in intricate and imaginative shapings of the sole sound source, a sawtooth oscillator. The rapid interplay between different dynamics and timbres generates a string rhythmic drive which at times created the feel of a free jazz improvisation.[43]

The piece begins with a sound of a sawtooth wave that glissandos down in pitch, sounding like an airplane taking off, as heard in Audio Example 26, an excerpt from the opening of Part A. Lasting for about twelve seconds, the sound is continuous and pans to the right. Interspersed with moments of silence, which creates segments, this sonic event occurs two more times. Subotnick notes of the opening:

> The first part of this work was almost complete when I came across [the poem] *The Wild Bull.* I was very impressed by the poem and quickly began to feel an affinity between the poem and the composition I was working on… in fact, the first three notes of the work seemed to me a kind of human/wild-bull moan.[44]

Following the "bull" moans at 1:10, a single sound, like a slamming door, is heard. The sound is reverberated and echoes for several seconds. The "door" is heard again, and a third time at 1:17 where the sound is repeated continuously and transforms into a harsh, high-pitched sawtooth wave at 1:20. The high-pitched event is layered with sporadic electronic sounds that contrast the harshness of the sawtooth wave, presenting hollow, resonate spurts of sound. Although either sonic event could capture our attention, the high-pitched event may be more prominent because of its extreme register and piercing quality, which also segments it from the previous door sounds. At 1:30 the sawtooth wave transforms into a timbre less harsh than before, but still layered with sporadic, staccato, resonating sonic events; the change of timbre creates another segment. At the same time a lower pitched dampened and hollow continuous sound occurs. As the "hollow" sound continues it changes in pitch. The harsh sawtooth waves continue, and at times glissandos up in pitch, recalling the sound of a wild animal howling. Figure 3.6 provides a listening score for the excerpt of *The Wild Bull.*

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[43] Manning, 183.
[44] Morton Subotnick, liner notes taken from *Morton Subotnick: Silver Apples of the Moon/ The Wild Bull.* CD WER 2035-2.

Electronic sounds	*bull* |------▶------| *bull* |--------▶----------| *bull* |-----▶------|
Time in seconds	0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 ▶
Structure	Section 1 segment --------| (silence) segment -------------| (silence) segment ------| (silence)

Electronic sounds	door (echo) | | door; door*high pitch sawtooth |-----|------------------------|----------|--------|-----------|------------|-----------|------▶ howl howl howl howl howl (less harsh) sporadic events |--▶ hollow |--▶
Time in seconds	70 75 80 85 90 95 100 105 110 115 ▶
Structure	Section 1 cont. segment ----------------| segment------------| segment --▶

Figure 3.6: Listening score for *The Wild Bull* excerpt

The Wild Bull is a piece that is produced from a single sound source, yet that source is manipulated in such a way as to create new sounds. In some instances the sounds heard may seem similar to something heard in everyday life or in a natural environment, like slamming doors or howling animals.

The previous analyses present works that are composed of sounds created solely by electronic means. In some instances the listener will hear new, unfamiliar sounds, while at other times the composer may manipulate a sound in such a way as to produce a sonic event that is similar to a sound found in the natural environment. While some sonic events may be familiar and easily recognizable by the listener, such as the use of the voice or a sample of a train, other sounds may seem foreign. By becoming familiar with a piece of music through multiple listenings, the sonic events that are found within the composition can be cataloged by the listener through descriptive means. Once sonic events are identified and segmented, the sounds can then be traced within the composition, providing a deeper understanding of the structure of the work. There are a number of factors that influence how listeners segment sonic events from one another, including timbre, pitch, rhythm, and onsets of the sounds. In addition, there are psychological factors such as the Gestalt principles of perception that are involved in making decisions of segmentation. Nonetheless, each individual composition will "speak" to the listener in order to reveal what constitutes a sonic event within the work. As the analyses have shown, the listener can partition compositions into two main categories – *musique concrète* and purely electronic derived pieces. Although two pieces may share a common source, the use of a voice or instrument for example, no two compositions will employ the sounds in exactly the same manner. As a result, the sounds heard in one composition will not be the same in another composition; therefore the structure of a composition lies in its own progression of sonic events.

CHAPTER 4

ANALYSIS OF ELECTRONIC MUSIC: CASE STUDIES OF COMPLETE WORKS

Formal Structures

When a listener hears the first movement of a symphony by Mozart, certain formal expectations are already implied. The listener would expect the music to unfold within the traditional setting of a sonata form movement—exposition, development, and recapitulation. Twentieth-century music, however, does not always conform to traditional formal structures, and this is particularly true of electronic works. Electronic compositions often require a new way of listening to the structure of a work. As Wayne Slawson notes:

> Without question musical structures of some degree of complexity—sonata movements by Haydn, for example—pose myriad problems of perception and conception on the part of the listener. Music that adds another whole dimension of independent structure—sound-color music, if you will—would apparently require even more of a conscientious listener's analytical ear, memory and intellectual capacities than music in which that dimension takes on a dependent role.[1]

Now that the listener may encounter a plethora of new sounds, the listener will need to devise new listening strategies. As a result, compositions of these types are typically partitioned into sections determined by the interaction of musical parameters that are evident within the work. In return, these sections have a relationship between them forming a cohesive whole. How many sections occur in the piece and the types of relationships they exhibit depends on the individual make-up of a composition.

Once the listener identifies the sonic events in an electronic composition, through numerous attentive listenings as illustrated in the previous chapter, the events can be

[1] Wayne Slawson, "Sound Structure and Musical Structure: The Role of Sound Color" in *Structure and Perception of Electroacoustic Sound and Music,* Sören Nielzén and Olle Olsson, eds. (Excerpta Medica: Amsterdam, 1989): 21.

catalogued for further investigation. The sonic events that occur within the composition function together in time, even if they are in opposition, creating the formal design of the work. Taking note of the formal design of the work allows the listener to come to a deeper understanding of the overall structure of the work. One primary factor that would influence the listener to divide the work into sections is the aspect of continuity versus discontinuity. The same aspects that allow the listener to identify and segment sonic events within an individual composition also influence the listener's perception of sections of the work on a larger structural level. Any change between musical parameters within the composition, such as a change in pitch, register, contour, volume, duration, repetition, use of particular motives, and especially the use of timbre, can determine how listeners partition a composition into various sections. In addition, a change in texture, different onsets, and silence can also influence listeners to separate one section of sonic events from another. These changes conform to Gestalt principles of perception, in particular similarity and proximity, which aids the listener in understanding why certain partitions can be made.[2] Gestalt principles other than similarity and proximity also factor into segmenting a piece into formal sections. A particular section of music may return later in a composition, creating a sense of familiarity on a structural level. Or, for example, a number of sections could return in sequential order creating a sense of good continuation. Nonetheless, as with identifying sonic events, the formal structure of a composition will depend solely of the content of the individual composition.

The following "case study" analyses will illustrate how the listener could go about constructing a framework for a given piece. As a result of several concentrated listenings, the listener can create a listening score, which in turn exposes formal structures of a composition, and allows other listeners to understand what the creator of the score observed about the piece. The pieces analyzed are presented in chronological order from the earliest to the most recent.

[2] For an explanation of Gestalt principles refer to page 47.

Otto Luening (1900-1996) *Fantasy in Space* (1952)

A pioneer of electronic composition, Otto Luening, along with Milton Babbitt and Vladimir Ussachevsky, helped develop the Columbia-Princeton Electronic Music Center in 1959, as mentioned in Chapter One. Luening's composition *Fantasy in Space*, also discussed briefly in Chapter Three, was written in 1952 at Henry Cowell's house in Woodstock, New York. Luening and Ussachevsky created their own studio there by utilizing a tape recorder, some wooden speakers, and carpet hung to the walls to dampen the sound. *Fantasy in Space* is a tape piece that uses a recording of the flute. As Peter Manning notes:

> At a composers' conference in Bennington, Vermont, Ussachevsky experimented with violin, clarinet, piano, and vocal sounds using an Ampex tape recorder, and Luening began to prepare a tape composition using flute as the source material. News of their work came to the attention of Oliver Daniel, who invited them to prepare a group of short compositions for inclusion in a concert to be promoted by the American Composers' Alliance at the Museum of Modern Art, New York, under the direction of Leopold Stokowski. The invitation was accepted, and Luening and Ussachevsky departed for the home of Henry Cowell at Woodstock, New York, where using borrowed tape recorders, they prepared pieces for the first public concert of Tape Music on 28 October 1952. Four pieces were performed: Ussachevsky, *Sonic Contours;* Luening, *Invention in 12 Notes, Low Speed,* and *Fantasy in Space,* the last work being the product of his earlier experiments with flute sounds at Bennington.[3]

For *Fantasy in Space*, Luening recorded himself playing the flute and then rerecorded over each to create a flute quartet. The pitch content is mostly tonal with some dissonance and could be easily transcribed. However, the various layering of flute recordings allows Luening to decide how much manipulation he wishes to apply to each sample. Luening takes advantage of the opposition between manipulated and non-manipulated sounds in this piece, which correlates to the formal structure of the work. Although the piece is brief, less than three minutes, it can be heard in three sections with an introduction and codetta that dovetail with each other. On the highest level of structure, the dovetailing allows the listener to hear the piece as one whole because of its brevity. However, the

[3] Peter Manning, *Electronic and Computer Music*. 2nd ed. (Oxford University Press: Oxford, 1993): 89.

dovetailing does not always occur on the same perpetual level of sound; what was previously prominent shifts to a lower level of perception or vice versa. Figure 4.1 on page 97 provides a listening score corresponding to the narrative that follows and Audio Example 1 presents *Fantasy in Space* in its entirety.[4] Figure 4.1 can be followed while listening to the Audio Example to assist in comprehending the progression of sonic events.

Fantasy in Space starts with a single flute ("Flute 1") playing two melodic pitches, a semitone apart, followed a second flute ("Flute 2") that is lower in pitch. Flute 2 also plays two melodic pitches a semitone apart, but now also harmonized. Both flute sounds are reverberated and echoed. Flute 1 then restates the same two pitches, as does Flute 2, creating a call and response between Flute 1 and 2. However, each time Flute 2 is heard one more pitch is added. At twenty-two seconds a third flute ("Flute 3") is heard with a brighter sound and less reverberation than the previous flutes. At the same time Flute 1 and 2 shift into the background continuing to be echoed. At thirty seconds from out of the background comes a descending scale, which introduces a fourth flute ("Flute 4"). This rendering of Flute 4 has the least amount of manipulation applied to it. Two descending scales are first heard by Flute 4 followed by a series of rising and failing contours through scalar motion. While Flute 4 is on the foreground level with a bright, clear presence, the other three flutes have faded into the background creating a continuous, reverberated, and echoed sound of flutes that imitate Flute 4, and form a contrapuntal texture. As the flow of background flutes continue, Flute 4 then has percussive staccato sounds at fifty seconds. The percussive sounds change to trills at 1:04, which gradually increase in succession of speed. The listener can hear scales, layered with the trills, on the background level at 1:10. The accelerando of trills leads to the next section of the work at 1:19. Here, an original folk-like melody composed by Luening is heard and the trills meld in to the background swirl of flute sounds. The flute heard playing the melody does not have any electronic manipulation applied to it, giving it a clean, pure sound. Underneath the folk melody is a background of manipulated flute sounds that pulsate, present descending scales, and eventually begin to ascend upward in pitch.

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[4] For an explanation of the listening scores refer to page 63.

At 1:55 as the folk melody ends, Flute 4 returns to present the listener with percussive staccato sounds and trills similar to what was previously heard. The continuous contrapuntal background of reverberated and echoed flutes is also still present. Then at 2:08 the percussive sounds return, which did not occur in the previous section, leading into ascending and descending scalar passages. The scalar passages slow down allowing the scales to metamorphose into a melody. The melody is reminiscent of the folk melody previously heard and ends the work as a little codetta.

The overall formal structure of *Fantasy in Space* can be viewed as ternary with an introduction and codetta. The opening call and response of Flute 1 and 2 function as an introduction. When viewed in retrospect, the first section, which begins at thirty seconds, is similar to the third section, which begins at 1:55, creating sections A and A'. The second section, B, begins at 1:19 with the entrance of the folk melody. As is traditional with ternary forms, the B section contrasts with the encompassing A sections. In this section the opposition of manipulated sound versus non-manipulated sound is at its peak. The beginning of the work slowly introduces this opposition to the listener: Flute 3 is noticeably "cleaner" than Flute 1 and 2, and Flute 4 is "cleaner" than the third, while the flute heard playing the folk-like melody does not include any manipulation. In addition, the B section is the most melodic of the sections, presenting Luening's original folk-like melody, while the A sections present the listener with scales, percussive staccatos, and trills. However, a connecting thread of all three sections is the imitative background texture of flutes. As noted previously, the scalar passages in A' slow down, transforming into a melody reminiscent of the folk melody creating a codetta that is related to the B section.

While listeners may think that approaching a piece of electronic music brings certain aspects of structural unfamiliarity, common formal designs, such as ternary, may still apply. Repetitions of sections or motives are still explored, creating a sense of similarity within compositions. As well, in retrospect certain openings of pieces may seem to function as an introduction, or endings may revisit a past event incorporating the function of a coda. From the listener's perspective, works that incorporate this kind of formal design instill a sense of familiarity.

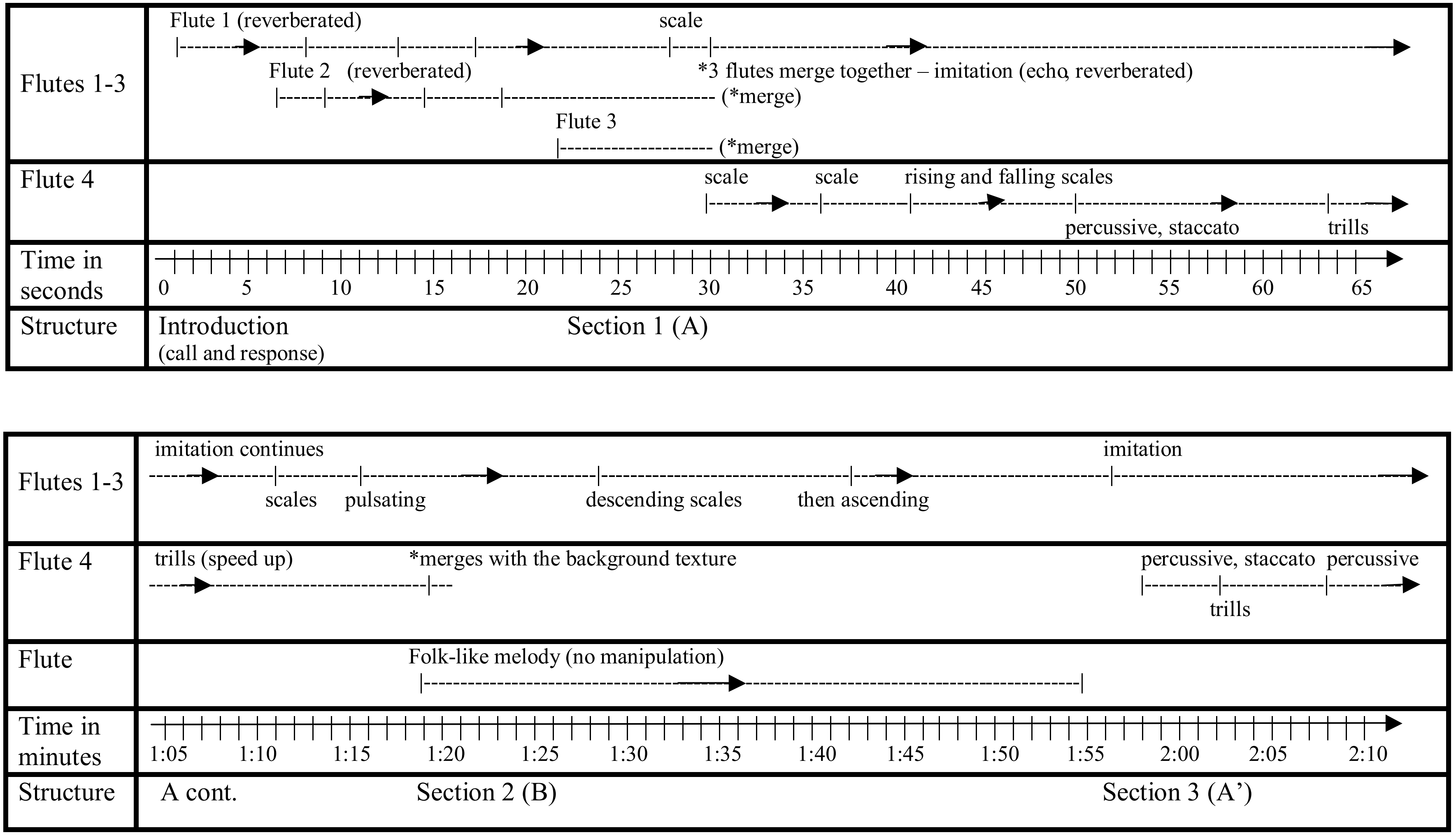

Figure 4.1: Listening score for Otto Luening's *Fantasy in Space*

Figure 4.1 – continued

Flutes 1-3	imitation continues; scale; (fade out)
Flute 4	percussive, staccato; scales; scale; *melody
Time in minutes	2:10 2:15 2:20 2:25 2:30 2:35 2:40 2:45 2:50 **2:53**
Structure	A' cont. Codetta

Pauline Oliveros (b.1932) *Bye Bye Butterfly* (1965)

Pauline Oliveros is not only a composer of electronic music, but also an accomplished accordion player. She is one of the original founders of the San Francisco Tape Music Center (SFTMC) along with Ramon Sender, as mentioned in Chapter One. As Joel Chadabe notes:

> At the San Francisco Conservatory, Pauline Oliveros and Ramon Sender pooled equipment from, as Oliveros out it, "hither and yon," and on December 18, 1961, organized a tape concert called *Sonics I*, with works by Sender, Oliveros, Terry Riley, Phil Winsor, and an improvisational piece for instruments and tape played by Sender, Oliveros, Riley, Winsor, and Laurel Johnson. Soon after the first concert, Sonics formed as a group, consisting initially of Sender, Oliveros, Johnson, and Winsor, soon to be joined by Morton Subotnick and Tony Martin.[5]

The group Sonic would later become the SFTMC. When the SFTMC moved to Mills College in Oakland, Oliveros became its first director. In 1985, Oliveros founded The Pauline Oliveros Foundation, which is known today as the Deep Listening Institute, Ltd. As noted from their website, "Deep Listening Institute, Ltd. fosters a unique approach to music, literature, art, and meditation, and promotes innovation among artists and audiences in creating, performing, recording, and educating with a global perspective."[6] Oliveros is currently on faculty still at Mills College and also at Rensselaer Polytechnic Institute in New York.

Pauline Oliveros's *Bye Bye Butterfly* was composed in 1965 at the SFTMC using real-time manipulation. Oliveros notes:

> *Bye Bye Butterfly* was composed in 1965 at the San Francisco Tape Music Center studio using two Hewlett-Packard oscillators, two Ampex stereo tape machines, a phonograph and record, and patch bay. The piece was played in real time and recorded. All material was delayed by stringing tape from the supply reel of the first tape deck to the take-up reel of the second tape deck. Signals from the first track were patched from the second machine back to the second track of the first

[5] Joel Chadabe, *Electric Sound: The Past and Promise of Electronic Music.* (Prentice Hall: New Jersey, 1997): 85-86.
[6] Taken from www.deeplistening.org. (accessed 02-11-09).

> machine and from the second track back to the first track to achieve a crisscrossing delay pattern. There was no mixer.[7]

In fact, Oliveros basically found a record lying around the studio, which happened to be Puccini's *Madame Butterfly,* played it, and manipulated the source in real-time as noted in Chapter Three. Again Oliveros states:

> I made 'Bye Bye Butterfly' as a real-time studio performance. In the days of the so-called classical electronic studio, real-time performance was rare. I invented a technique that allowed me to play my pieces instead of cutting and splicing them. I wanted to add a record to my 'mix' of tape-delayed sound, so I picked up a record that was lying around in the studio and put it on the turntable. … Then I improvised with it in real time.[8]

From the onset of the piece one can even hear the sound of someone putting on a record player.

Bye Bye Butterfly can be divided into three sections, which centers on Oliveros's use of the Puccini sample, in particular the opposition of the intelligible versus unintelligible use of the found material. Although this piece can be partitioned into three distinct sections, the overall form presents an arc-form since the piece opens with a defining high-pitched electronic sound and ends the same way. Figure 4.2 on page 103 provides a listening score corresponding to the narrative that follows and Audio Example 2 presents *Bye Bye Butterfly* in its entirety. Figure 4.2 can be followed while listening to the Audio Example to assist in comprehending the progression of sonic events.

The piece opens with a very high-pitched, thin electronic sound created by an oscillator. At five seconds a low buzz occurs for just a second, which transforms into an even higher pitched sound than heard in the opening. The second higher pitched sound fades out leaving the opening high-pitched sound. At thirty-one seconds one can hear a scratch, which perhaps is a result from simply playing the record. As the high-pitch sound continues, the listener feels a certain amount of anticipation wondering, "What will the high-pitch sound turn into or progress to in the future?" This anticipation culminates at fifty seconds when the high-pitched sound gets slightly louder and eventually glissandos

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[7] Pauline Oliveros, DVD liner notes provided in *The San Francisco Tape Music Center: 1960s Counterculture and the Avant-Garde,* David W. Bernstein, ed. (University of California Press: Berkeley, 2008): 296.
[8] Pauline Oliveros, Liner notes from OHM+: The Early Gurus of Electronic Music. Ellipsis Arts CD 3691, 2000.

up, then down. As the high-pitched sound glissandos down, the listener hears it evolve into more electronic sounds at a lower pitch that pulsates. Then a new sound is heard at 1:04; an electronic sound that has a harsh, sawtooth-like timbre, which is echoed and repeated. This echoing is coupled with panning, which draws the attention of the listener and incorporates the aspect of space. With the entrance of the new sound, the higher pitch comes back, but it is thicker sounding in texture, and glissandos up and down. As well, the lower, pulsating sound fades out. When the glissandi stop at 1:25, the listener is left with just a high-pitched sound similar to the opening. Again the presence of just the high-pitched sound instills a moment of anticipation for future sounds and the listener begins to feel that perhaps this high-pitch sound is a driving compositional force within the work. At 1:44 the high-pitch electronic sound glissandos up and then down again evolving to the lower frequency range. Along with the lower frequency electronic sound is a pulsating effect juxtaposed with high-pitched glissandi that are echoed. At two minutes the lower frequency fades out leaving the higher frequency, which continuously glissandos up and down. By now the listener is most likely aware that Oliveros is experimenting with the use of frequency within this work, evolving from high to low and vice versa with the use of glissandi.

Entering quietly back in at 2:09, the lower frequency occurs on the background level of perception. The higher frequency continues to glissando down, and in doing so middle range frequencies are now apparent. Once the higher pitch glissandos down to the middle range, the sound is then echoed as if it is pulsating. These mid-range frequencies thicken the texture and create a sense of relief from the use of a continuous high-pitched event. Then at 2:22 a low frequency, thick sounding, is heard which also pulsates. The low sounds are juxtaposed with mid-range sounds and at 2:31 higher frequencies return. These sounds all pulsate and glissando up and down. The listener may begin to feel as if the higher frequencies are going to finally subside, at 2:45, and the lower pitch frequencies are going to dominate, but the high-pitched sounds reenter, and continuously glissandos up and down. At 3:05 the lower frequencies fade out and the high-pitch sounds prevail without the glissandi, again reminding the listener of the anticipation created from the previous segments of just the high-pitch sound. However, the listener is unaware that the sonic events occurring in the composition thus far are going to change drastically.

As the high-pitch continues, a bass thump enters at 3:16, which is then echoed and panned to the left and right channels, in retrospect preparing the listener for a new event. Then at 3:25 an actual audible sample from *Madame Butterfly* is heard, which is surprising considering the sound palette up to this point. The sample features the orchestra and chorus and is reverberated and echoed to sound as if it too is pulsating. Not to be outdone, a high-pitched glissando at 3:56 leads into a portion of the sample, which features a soprano singing. Juxtaposed with the sample are glissandi that become manipulated and sound almost like someone screaming, reaching a high point at 4:46. Then at 5:00 the screaming glissandi are coupled with low pulsating frequencies, which at this point (due to familiarity) allows the listener to switch his/her attention either to the continuous use of the sample or to the low- and high-frequency electronic sounds. By 5:15 the frequency range evens out to the middle and at 5:35 the pitch glissandos up and down three times. The middle range has a buzzing quality to it, almost as if it were trying to overshadow the singing soprano. Then at six minutes the mid- and low-range frequencies become prominent all the while the Puccini sample fades more and more into the background. By 6:35 the recognizable use of the Puccini sample had faded away, leaving the listener with a low, pulsating sound, surprisingly not the recurring high-pitch event. Nonetheless, over the next twenty seconds the pitch gradually gets higher, and while the higher pitch is maintained, at seven minutes a descending glissando reintroduces the lower frequencies. The screaming glissandi reenter at 7:10 with the underlying pulsating bass, and with each “scream” the pitch gets higher and higher until eventually all that is left is a high-pitch sound reminiscent of the opening (7:36). Then at 7:48 the underlying bass fades out leaving just the high-pitch sound to take over and close the work.

Bye Bye Butterfly can be partitioned into three sections, which are defined by Oliveros’s use of the sample. While it is certain that Oliveros is using concrète sound for the entire composition, *Madame Butterfly* is not apparent until Section 2, which begins at 3:25. In the first and the third sections, the third beginning at 6:30, the listener cannot necessarily tell that the sound source is a sample from Puccini’s *Madame Butterfly.*

Overall, this work is an exploration of pitch—from extreme high to low frequencies—coupled with the exploitation of a sound source. According to Oliveros, "I didn't realize it at the time, but 'Bye Bye Butterfly' was a remix, a precursor of sampling, which is now so prevalent. It was a pivotal piece, a farewell to classical music and, at the same time, an assimilation of it."[9]

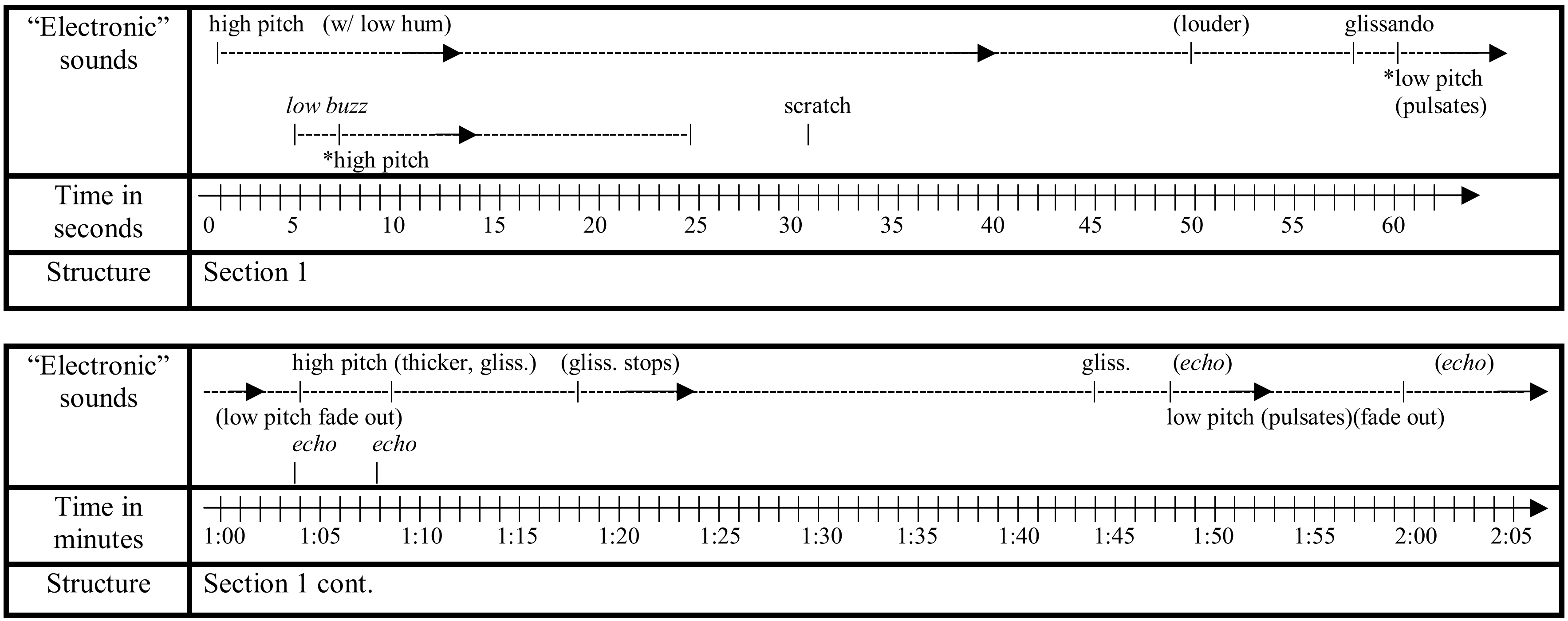


Figure 4.2: Listening score for Pauline Oliveros's *Bye Bye Butterfly*

[9] Oliveros, liner notes.

Figure 4.2 – continued

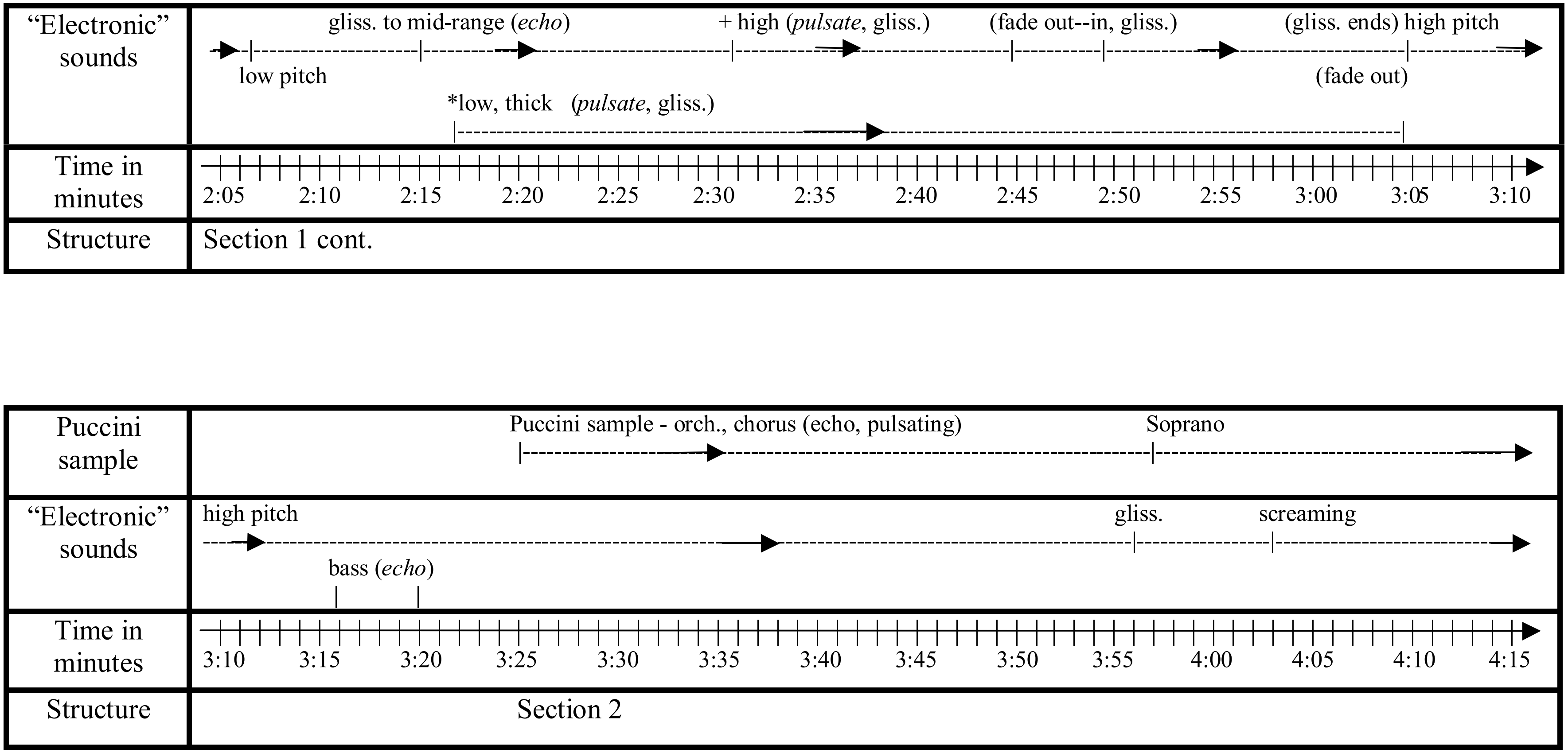
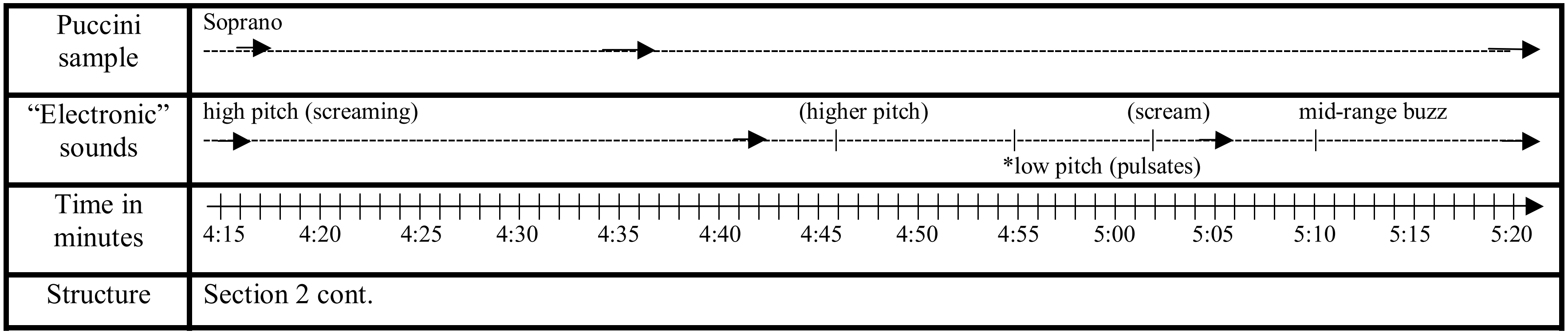


Figure 4.2 – continued



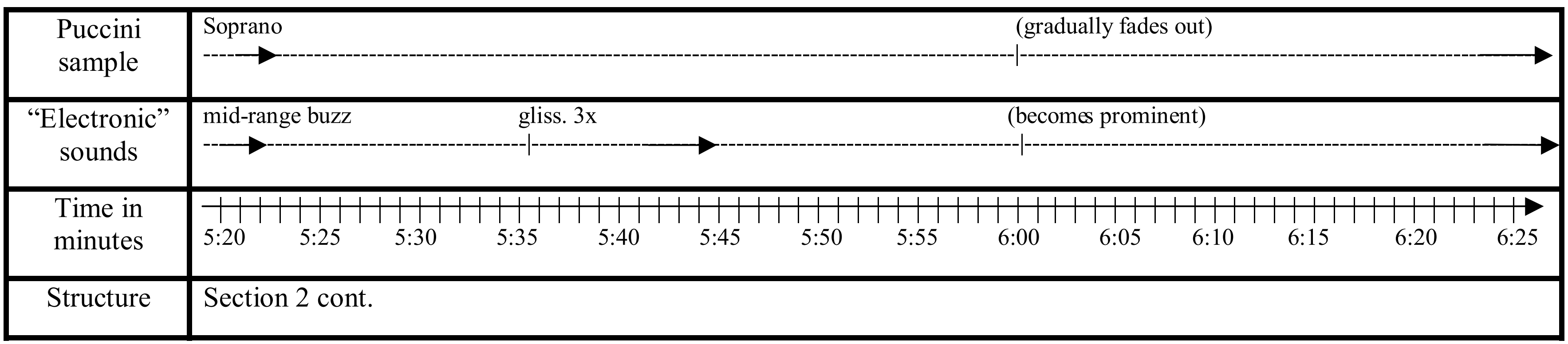
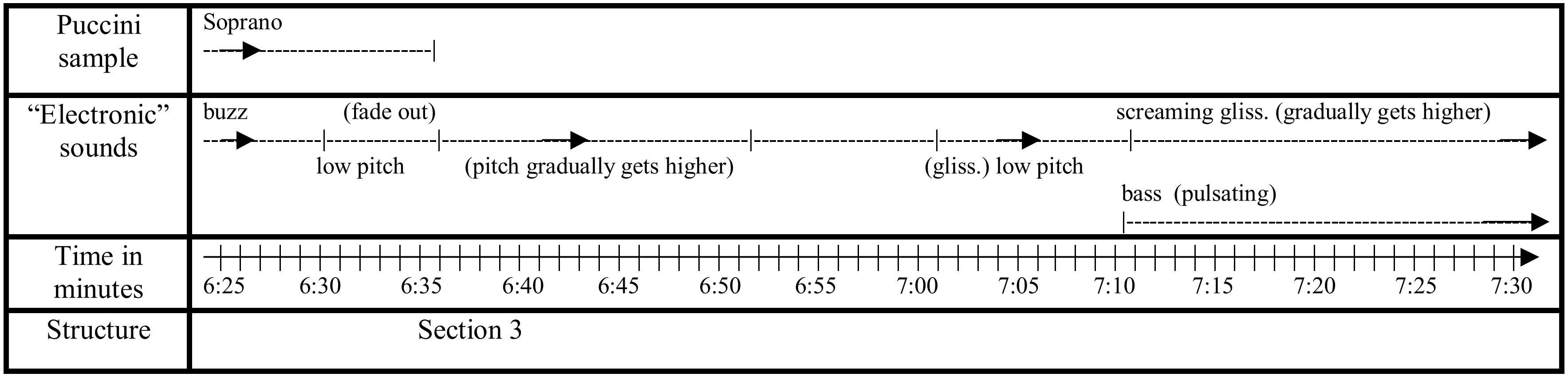
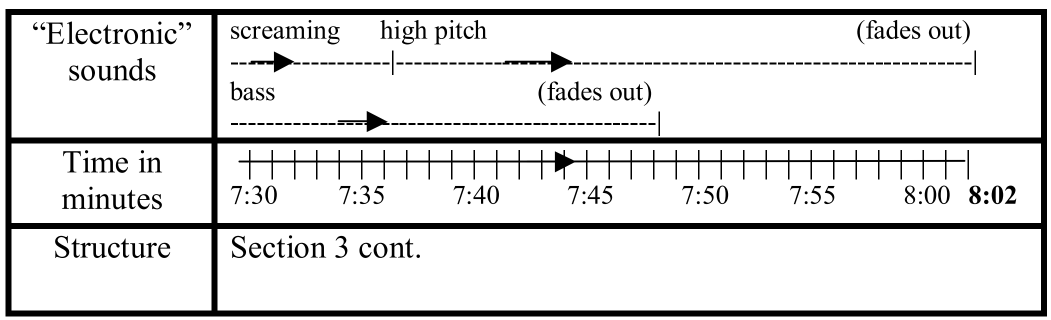


Figure 4.2 – continued





Morton Subotnick (b.1933) *The Wild Bull*, Part A (1968)

Morton Subotnick, along with Pauline Oliveros, is known for his work at the San Francisco Tape Music Center, which included working closely with Donald Buchla and his synthesizers. In 1966 when the SFTMC moved to Mills College in Oakland, Subotnick moved to New York to develop another studio at New York University based on a Buchla system. His composition *Silver Apples of the Moon* (1967), which utilized a Buchla synthesizer, was the first electronic composition to be commissioned by a record company, Nonesuch Records. Today, Subotnick is associated with the California Institute of the Arts (CalArts) and also maintains a website—www.creatingmusic.com—which is an interactive site for children to create and learn about music.

Subotnick's composition *The Wild Bull,* composed in 1968, was also generated by the Buchla synthesizer, when electronic sequencers were still new. It is in two movements, Part A and Part B, of which Part A will be discussed in its entirety here and Part B briefly at the end of the analysis; the opening of the piece is also discussed in Chapter Three. *The Wild Bull* composition features a wide range of new complex sounds derived from a single sawtooth wave. The piece can be divided into three sections that all evolve from one to the other, which makes it difficult at times to recognize that a new section has begun. The most important factor in determining the structure of this work lies in the opposition of chaos versus stability. Figure 4.3 on page 111 provides a listening score corresponding to the narrative that follows and Audio Example 3 presents *The Wild Bull*, Part A in its entirety. Figure 4.3 can be followed while listening to the Audio Example to assist in comprehending the progression of sonic events.

As noted previously in Chapter Three, *The Wild Bull* begins with a sound of a sawtooth wave that glissandos down in pitch, sounding like an airplane taking off, or as Subotnick notes, a "wild-bull moan."[10] The bull moans repeat twice with interjected

[10] "The first part of this work was almost complete when I came across [the poem] *The Wild Bull*. I was very impressed by the poem and quickly began to feel an affinity between the poem and the composition I was working on… in fact, the first three notes of the work seemed to me a kind of human/wild-bull moan." Morton Subotnick, liner notes taken from *Morton Subotnick: Silver Apples of the Moon/ The Wild Bull*. CD WER 2035-2.

moments of silence followed by a new sound, a slamming door, at 1:10. Similar to the bull groans, the "door" is heard repeated twice and is reverberated and echoed. The third occurrence of the door sound transforms into a harsh, high-pitched sawtooth wave at 1:20. This event is layered with hollow, resonating sporadic electronic sounds that contrast the harshness of the sawtooth wave, which is more prominent because of it high-pitched piercing quality. Then the sawtooth wave transforms to a less harsh timbre, including a lower pitch dampened, continuous sound. The sawtooth wave then begins to glissando up in pitch, recalling the sound of a wild animal howling.

The animal howls continue, recurring more frequently in time, then stop at 2:19. A second later another animal howl is heard panned to the right speaker and a new sound is introduced at 2:23, an "outer space shimmer." The continuous low-pitch "hollow" sound still remains on a background level. The shimmer repeats at 2:26 held out for four seconds and then interjects four more times, with the fourth time being held out as well. Meanwhile, at 2:45 the hollow sound transforms to a harsher timbre, almost horn-like, which brings that event from the background to the foreground level because of the change of timbre. While the attack of each onset has a harsher quality of timbre, the decay of the sounds goes back to the warm, hollow timbre. This provides a forward momentum and connection between the segments. Nonetheless, the harsher "horn" timbre begins to prevail around 3:26, coupled with bull groans, and proceeds continuously, changing in pitch, with several interjections of the shimmer. At 4:00 the harsh horn timbre begins to transform with a surge of the hollow timbre. Then a fight for prominence emerges as loud statements of each timbre, harsh and hollow, are heard which decay to its opposite sound quality. This creates an opposition between the harsh and hollow timbres of sound. All the while, the interjections of the shimmer are present almost as if trying to tame the opposition.

A complete transformation of sound then takes place. When a shimmer is heard at 4:38, the harsh horn quality tries to overtake it, which leads to a metamorphosis into rhythmic, sporadic electronic sounds at 4:46. The sounds are a melting pot of harsh, ringing, bright, percussive sawtooth waves, with moments of chaos. The bull groans continue eventually transforming into an underlying continuous bass-pitched "rumble." As the melting pot of sound continues, a remnant of the shimmer is heard at 5:07 and again six seconds later. At 5:37 the melting pot of chaos pauses, releasing a high-pitch shimmer which then leads to a ruckus of "bass players practicing" with spurts of electronic "shock" at 5:38. The ruckus is ametrical with sporadic, percussive onsets. The texture increases in intensity, speeding up rhythmically and getting higher in pitch, while recalling the quality of the shimmer timbre heard previously (in particular at 7:10). At 7:58 a lower pitch timbre becomes sustained, creating a "rumble" coupled with sporadic percussive shimmers. At 8:11 the shimmers glissandos up and down in pitch, while the rumble transforms into sporadic events.

The sporadic events then begin to evolve into a hollow quality. At 8:28 a "gong" attack is heard, stopping the melting pot of chaos that ensued beforehand. The gong is repeated a second later and then after a moment of silence, three gong hits are heard reverberated starting at 8:37, which are left to fade out into silence at 8:50. The gong brings a moment of peace from the previous melting pot of chaotic sounds. The gong reenters presented with more manipulation, being echoed and transforming into bull groans similar to the opening of the work. The bulls continuously groan until 9:24 when a high-pitched reverberated shimmery clang is heard and has a decay in which dampened clang shimmers are echoed within. The clang repeats seven times until 10:02 when a new timbre is heard with faint clanging. The new sound is like a deflated horn that soon transforms into bull groans at 10:07. Another bull groans at 10:14 while the clangs continue. Then the bull timbre transforms to include the harsher horn timbre quality at 10:21 and again at 10:26, reminding the listener of the opposition of harsh and hollow qualities of timbre that occurred earlier within the work.

A weaving texture of sound is then created when struggles for prominence ensue among the sounds. At 10:36 the clang becomes more prominent and defined, coming into the foreground, as the horn and bull momentarily fade into the background. Then a bull is heard on the foreground at 10:42, and at 11:26 the bull and horn sounds become prominent still layered with sporadic clangs. There is a continuous flow of sound with the bull, horn, and clangs all interjecting, which creates the weaving texture. Prominent bull groans can be heard at 12:24 that fade out, and six seconds later, which decays. At this point the bull groans have prevailed within the weaving texture, although the horn timbre makes one last interjection at 12:45. The bull groans continue with the final two left to decay, ending the work at quietly 13:05.

The Wild Bull is a composition derived purely of electronic sounds created from a Buchla synthesizer. The formal structure of the work is ternary, dividing into three sections that all create an opposition of stability versus chaos. The first section explores the sounds of bulls and wild animals. The second section dovetails into the first section beginning at 4:38 when the horn timbre, which becoming more prominent, transforms into a melting pot of chaos. In this section, the change of timbre and also the ensuing chaos of sounds create a discontinuity of ideas that were features in the first section. However, Subotnick includes shimmers similar to those found in the first section to create a connection between the two. Then the third section, which begins at 8:28, is absent of the melting pot of chaos. This section recalls the bull and horn timbres heard in the first section, thus giving the piece an overall A B A' formal structure.

In comparison to Part A, the second movement, Part B, shares similar musical elements. Familiar timbres are present such as animal howls, bull groans, and harsh horns versus hollow qualities. However, a percussive, metallic sound and also a more defined rhythmic aspect can be heard in this movement. The opposition of chaos versus stability is also evident in Part B, and what is particularly interesting is the incorporation of this opposition within each movement. Part A featured a melting pot of chaos in the middle section of the work. Part B, which can also be partitioned into three sections, features moments of chaos in the first and third sections.

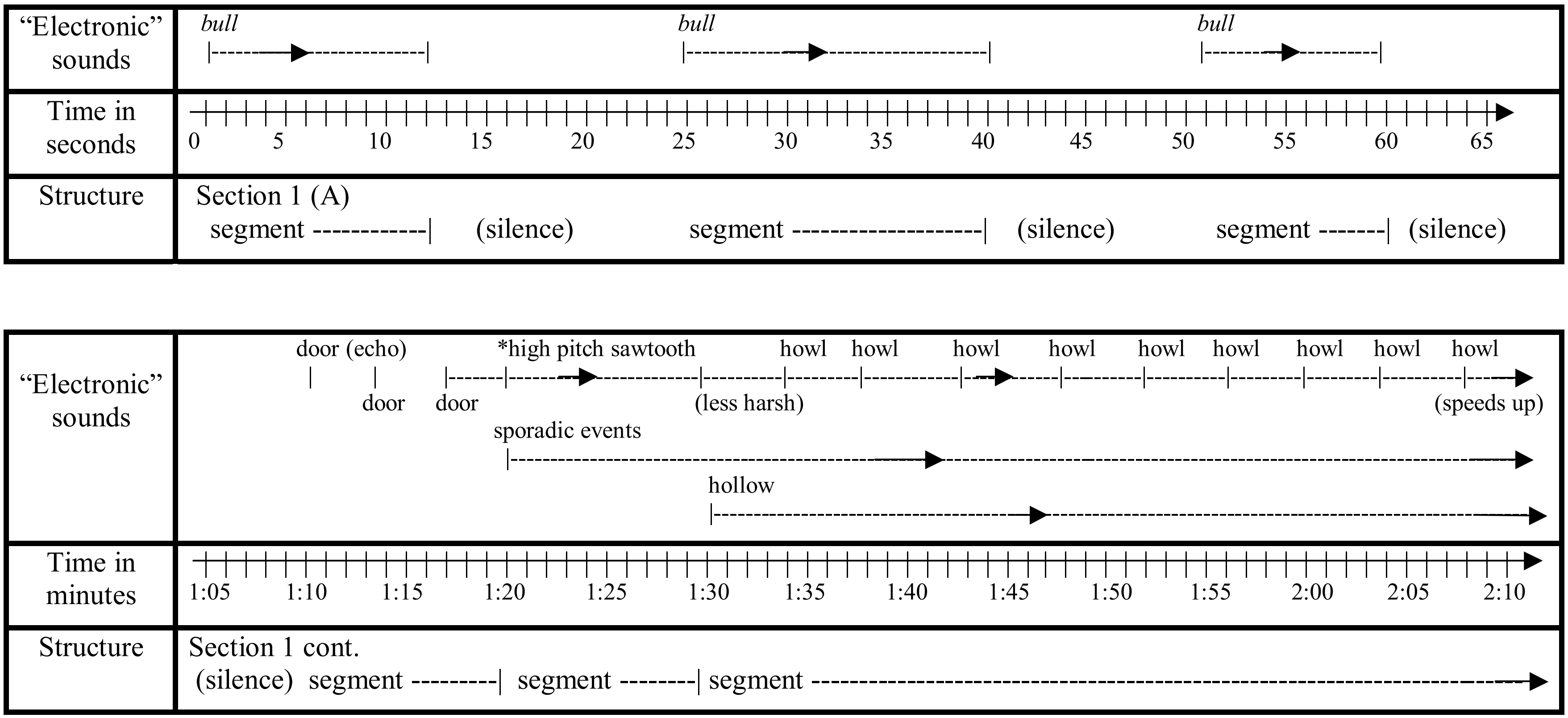
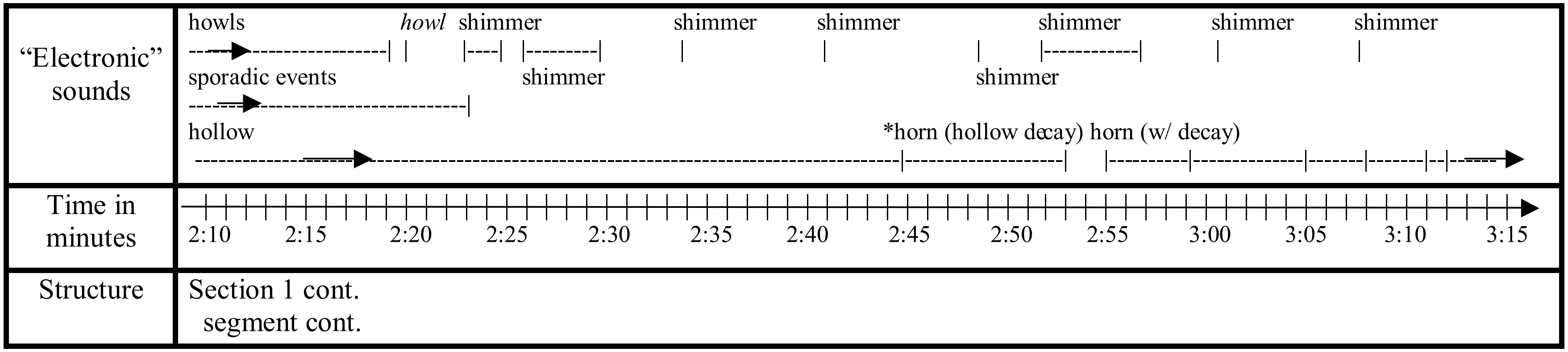


Figure 4.3: Listening score for Morton Subotnick’s *The Wild Bull* - Part A

Figure 4.3 – continued



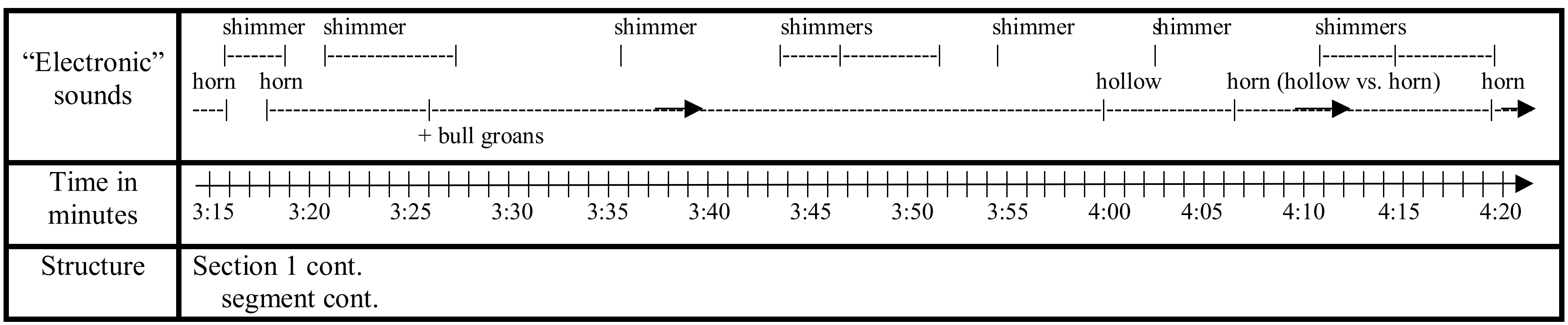


Figure 4.3 – continued

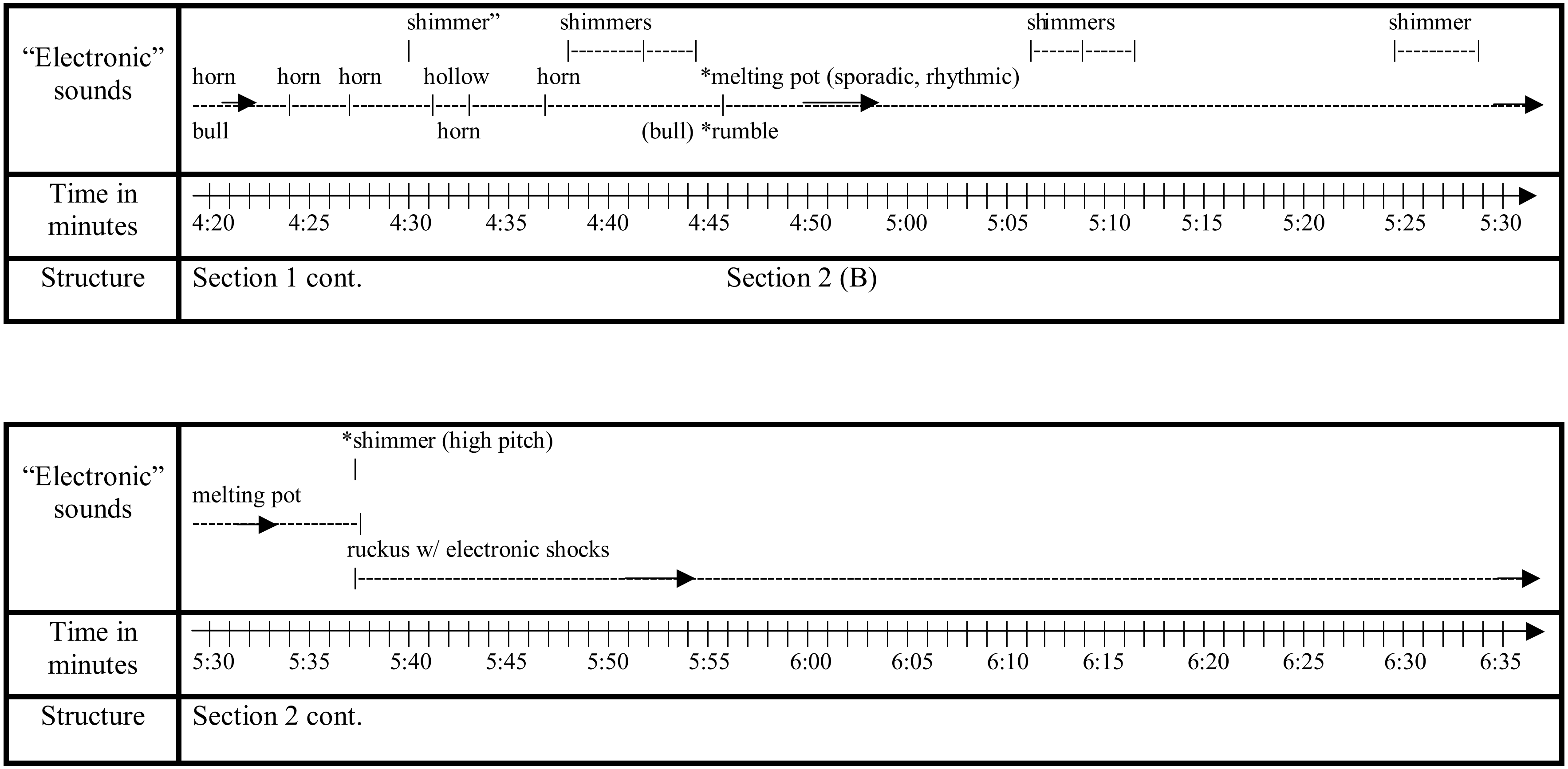


Figure 4.3 – continued

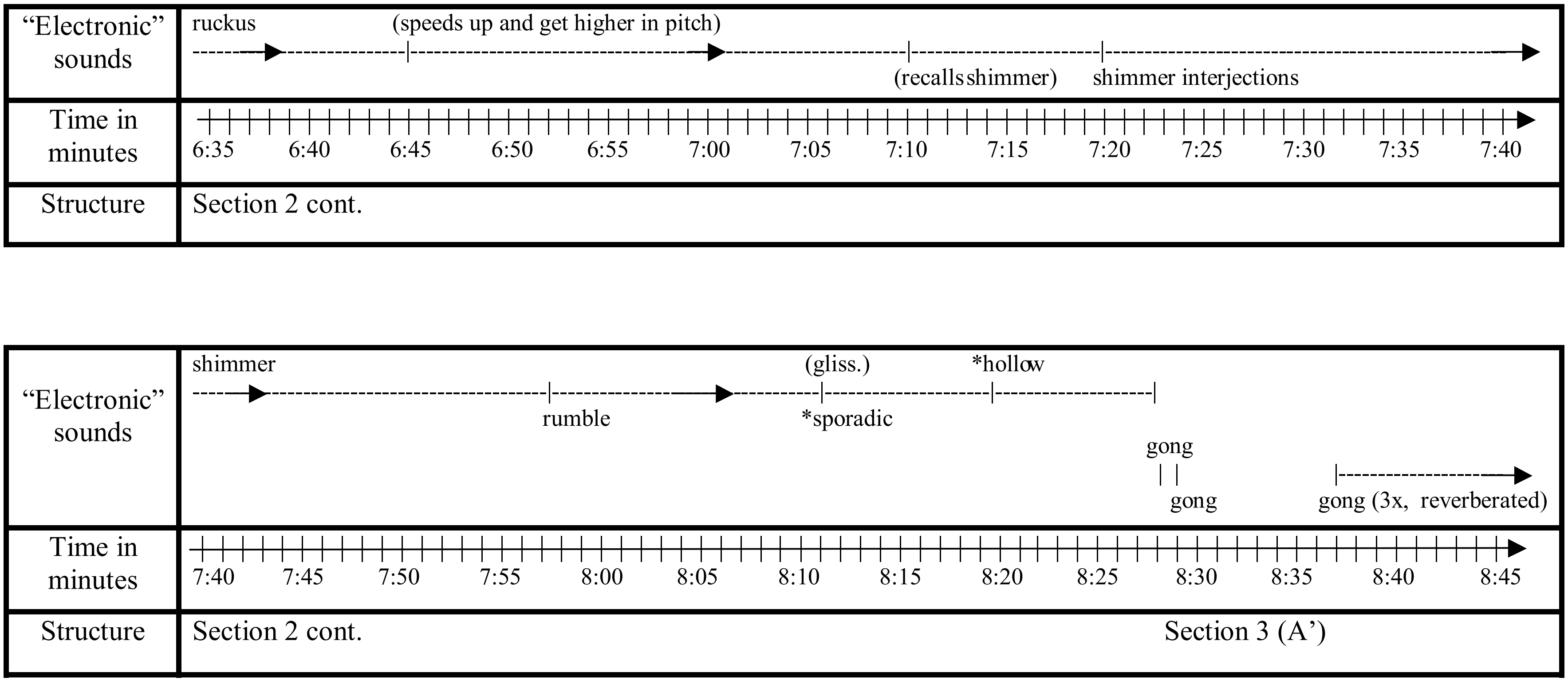


Figure 4.3 – continued

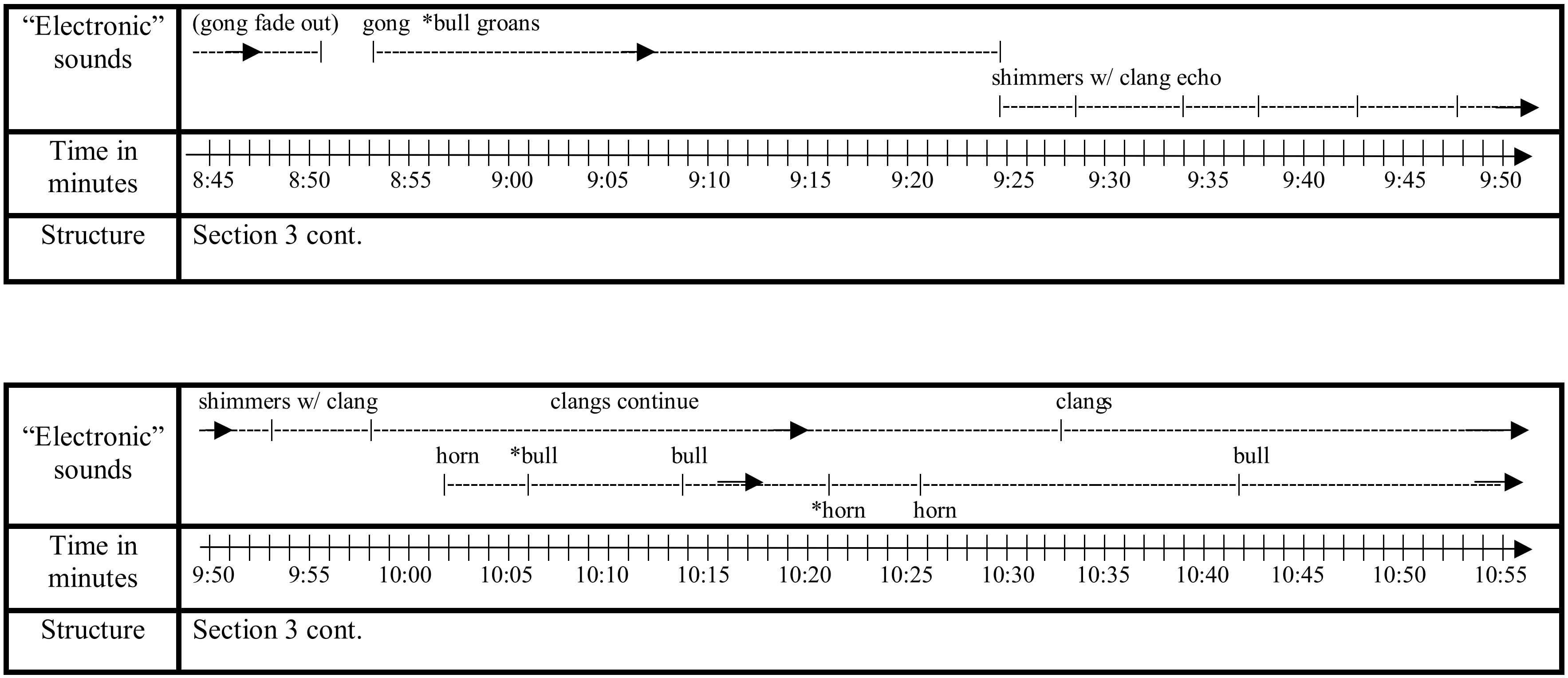
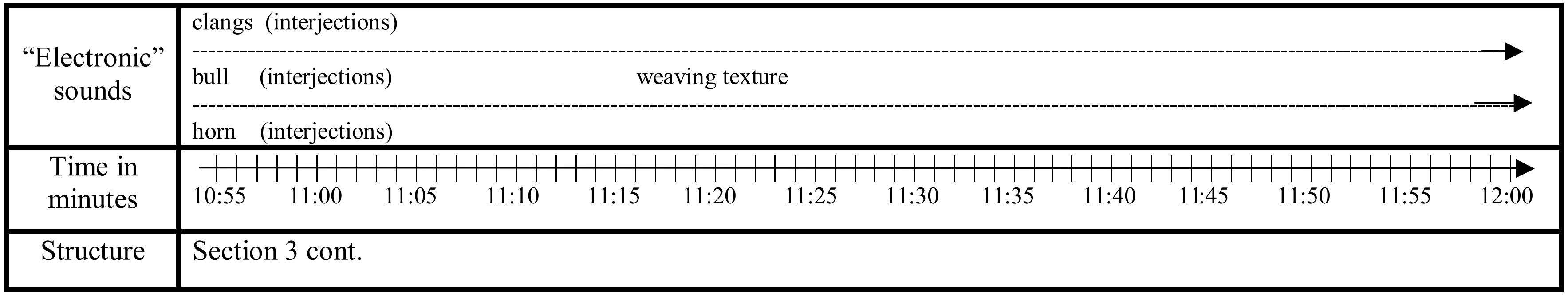
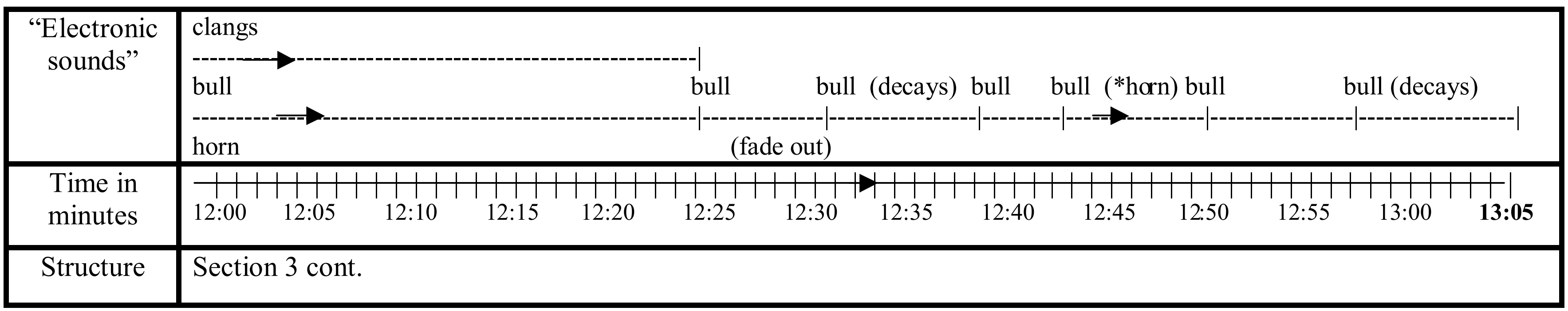


Figure 4.3 – continued





Anna Rubin (b.1946) *Crying the Laughing and Golden* (1982-83)

Anna Rubin first began composing for traditional acoustic instruments before turning to electronic compositions. She studied in California at Cal Arts and also Princeton University. Her teachers included Pauline Oliveros, Mel Powell, Leonard Stein, and Morton Subotnick. Rubin also studied with Ton de Leeuw in the Netherlands. As noted by Elizabeth Hinkle-Turner, "Rubin's compositions are lyrical, dramatic and heterophonic in style, and her electro-acoustic pieces are often inspired by vocal models."[11] She is currently on faculty at the University of Maryland-Baltimore County.

Rubin's *Crying the Laughing and Golden*, written in 1982-83 and discussed in Chapter Three, is an electronic composition that incorporates a sample of a woman's laughter. Rubin worked on the composition at the Sweelinck Conservatorium, where she recorded the laughter of a woman who worked in the café. As noted by Rubin:

> While the work is composed of both concrete and synthesized materials, most of the sonic material is derived from the fragmentary sounds of a woman laughing and whispering, and manipulated through a variety of studio techniques including multi-layering, filtering, manipulation of tape speed, and distortion. The work is a sonic journey into a woman's unconscious, evoking at various points feelings of joy, violence, sensuality, fear, and calm.[12]

Crying the Laughing and Golden is in three sections, which dovetail, or overlap, each other and create a progression of sounds that continually evolve. Figure 4.4 on page 121 provides a listening score corresponding to the narrative that follows and Audio Example 4 presents *Crying the Laughing and Golden* in its entirety. Figure 4.4 can be followed while listening to the Audio Example to assist in comprehending the progression of sonic events.

Crying the Laughing and Golden opens quietly with sounds that evoke frogs and crickets reminiscent of a night outdoors. These sounds pan back and forth from the left and right channels, which draws in the listener's attention through the use of space. At

[11] Elizabeth Hinkle-Turner. "Rubin, Anna." In *Grove Music Online*. *Oxford Music Online*, http://www.oxfordmusiconline.com/subscriber/article/grove/music/49204 (accessed February 17, 2009).
[12] From Anna Rubin's program notes. http://www.oberlin.edu/con/bkstage/199904/rubinconcert.html (accessed January 22, 2008).

twenty seconds, the “insect” sounds begin to fuse together and multiply for a denser, more chaotic group of sound. Here, the panning stops and the volume becomes increasingly louder. At forty-nine seconds a new sound is added to the denser electronic sounds. This sonic event is a hollow, pulsating sound, almost spaceship-like; since it is new the listener’s ear is immediately drawn to it. The new “spaceship” sound is juxtaposed with the preexisting denser sounds, which places it on the perceptual foreground level of the listener’s attention.

At 1:07 a whispering voice fades in joining the sound palette while the insect and spaceship sounds momentarily fade out. The whispering is unintelligible and obviously manipulated electronically, and the listener is immediately drawn to the voice placing it now on the foreground level of perception. For the next fourteen seconds, the insect and spaceship sounds fade in and out as the whispering voice fades out and in, respectively, creating a weaving tapestry. Then the insect sound completely fades out, while the spaceship remains barely audible, and the manipulated voice becomes the prominent feature. A new sound enters at 1:43, a very soft electronic sound, in the background and sounds almost like the wind blowing. With the new sound, the whispering voice transforms to sound similar to the insect sounds from the opening of the piece. The “whispering insects” are panned back and forth from the right and left speakers, again drawing the listener’s attention through the aspect of space. Quietly introduced to the sound palette are “wooden chimes,” which are placed perceptually on a background level. At 2:24 the whispering voice fades out and another new electronic sound enters the picture that starts off high pitched and glissandos down. This new sound is then immediately transformed to introduce woman’s laughter at 2:28. The wood chimes continue along with the laughter. Ten seconds later the laughter fades out and the whispering voice reminiscent of the insects returns.

At this point the listener can begin to hear a relationship of similarity between some of the sonic events that are perceived thus far. The opening insects and the whispering voice are manipulated and transformed together in such a way that they sound familiar to one another and the use of a whispering voice and laughter both represent the same source—a human voice. If the listener recognizes these connections then the future progression of the work lies in the transformational relationships between the sonic events. For the next minute, the two uses of the voice, whispering and laughing, fade in and out and are juxtaposed with each other and the wood chimes. The voices at times sound muffled, reverberated, and echoed. Interestingly, when the whispering voice is juxtaposed with the laughter, the whispering is panned from left to right and right to left, creating an ominous sense of space and specifically drawing the listener's attention to it as if in opposition to the laughter, thus creating a contrast to the similarity of the source.

While the whispering insects interject with the laughter, a new sound occurs at 3:30 over the voice, this time the wooden chimes have transformed to also incorporate the sound of "metal chimes." (The wooden chimes can still be heard on the background level of perception.) With the addition of the metal chimes the electronic sounds of the voice become denser and louder, and the wooden chimes meld into the whispering insects. Continuing an ongoing flow of transformations, the whispering insects in turn transforms into harsh "ticking." At 4:00 the hollow spaceship sound heard earlier reenters, employing the aspect of similarity. The other sonic events begin to fade out and what sounds like a helicopter "winding up" can be heard. Then everything becomes quiet, and at 4:20 only the laughter returns manipulated with the use of reverb and echo. This then evolves back into the helicopter sound and the helicopter sound tries to take over the laughter, evolving into clanging metal "popcorn." To continue the stream of transformations, the popcorn event evolves back into the helicopter sound at 5:18, which in turn then evolves into the whispering voice three seconds later. In a sense this chain of sonic events comes full circle, but instead of returning to the laughter the listener hears whispering. When the whispering enters the helicopter/popcorn fade out only to fade back in five seconds later and continue to evolve to include a harsher quality.

The laughter enters in at 6:07 and the other sounds fade out while the voice multiplies with the use of reverb and is manipulated to begin to sound more metallic. A high-pitched "ohh" enters softly placing perceptually on a background level. A sustained yet pulsating electronic sound soon enters joining the "ohh" on the background level. These two background sounds then push their way to the foreground as the metallic voice sounds fade out (6:55). After a moment of chaotic sound, the listener is left with a serene pulsating sound with an "ohh" sound that glides up and down in pitch. However, this serenity does not last long and at 7:29 the sound of the whispering voice enters ominously only through the right channel and then pans to the middle eventually fading out. Then at 7:53 the insects quietly enter dovetailing the "ohh." As the "ohh" sound fades out, the listener is left with only the pulsating sound and the insects. The piece ends quietly, as it began, with only the sound of insects fading away (9:00).

In retrospect, this composition can be divided into three sections that provide an overall arc form. The notion of an arc form pertains to *Crying the Laughing and Golden* opening with what sound like insect sounds, which then evolve and progress through a variety of other sounds, only to return at the close of the piece. The piece opens with an introduction in Section 1, if viewed in retrospect as introducing the listener to the incorporation of the voice at 1:07. A partition can be placed at this point because of the entrance of a new, yet familiar sound to us all—the whispering voice. The first section evokes insects and perhaps a spaceship, and draws in the listener's attention with the entrance of the voice. The listener will recognize the human voice being manipulated electronically, and is left to question, "How will this familiar sound evolve and progress?" As the section continues the whispering voice is eventually manipulated to sound similar the opening insect sounds. The first section dovetails into the second section at 4:01 with the fade-out of the electronic sounds and the "winding up" of the helicopter. However, the entrance of the laughing at 4:20 from a quiet place officially denotes the new section. In contrast to the first section, the second presents events of harsher timbral qualities—clanging popcorn and evolving helicopters—surrounded by laughter and whispers. As well, the second section dovetails with the third section. In the third section the voice becomes more metallic and computerized sounding, coinciding with the harsher qualities exhibited within the section, which then leads to the high-pitched "ohh" sound that marks the third section at 6:25. The opening of this section presents a sea of voices and resonating "ohhs," opposing the harsher quality of timbres previously heard. As the section progresses events eventually evolve back into the sounds of insects, reminiscent of the opening of the work. Although this piece is easily partitioned into three sections because of the contrast of the sonic events' timbral qualities, there is a constant evolution and progression of the sounds heard. For instance, whispers transform into insects, wooden chimes evolve into metal chimes, and events become harsher in timbral quality. It is no surprise that the events heard in the sound palette of *Crying the Laughing and Golden* can be related to each other, incorporating the aspect of similarity and familiarity, due to the fact that the sound source is from a woman laughing. Without prior knowledge of the piece the listener may assume that the sonic events that occur in this piece are built from the first sounds of frogs and crickets, and that Rubin is manipulating them to create other timbres. The insects turn into whispering, laughter, chimes, and helicopters, all of which evolve from one another, providing an ametrical flow of unified events.

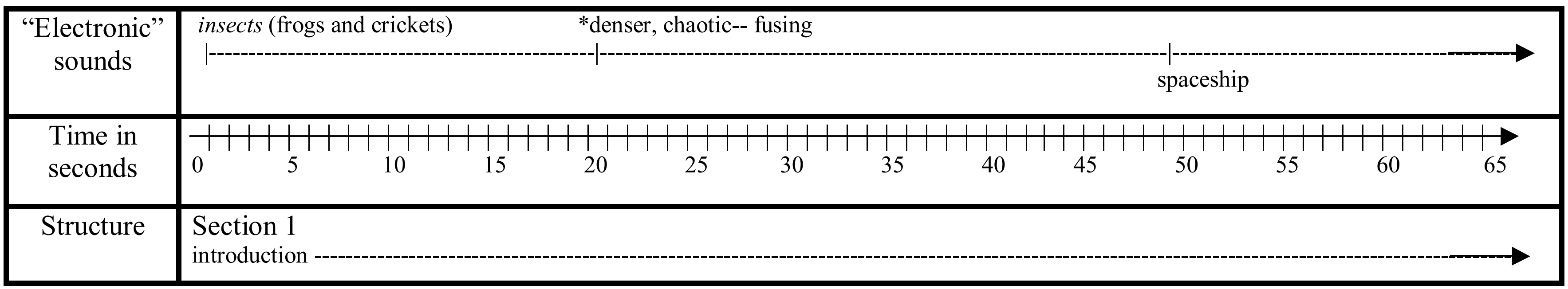
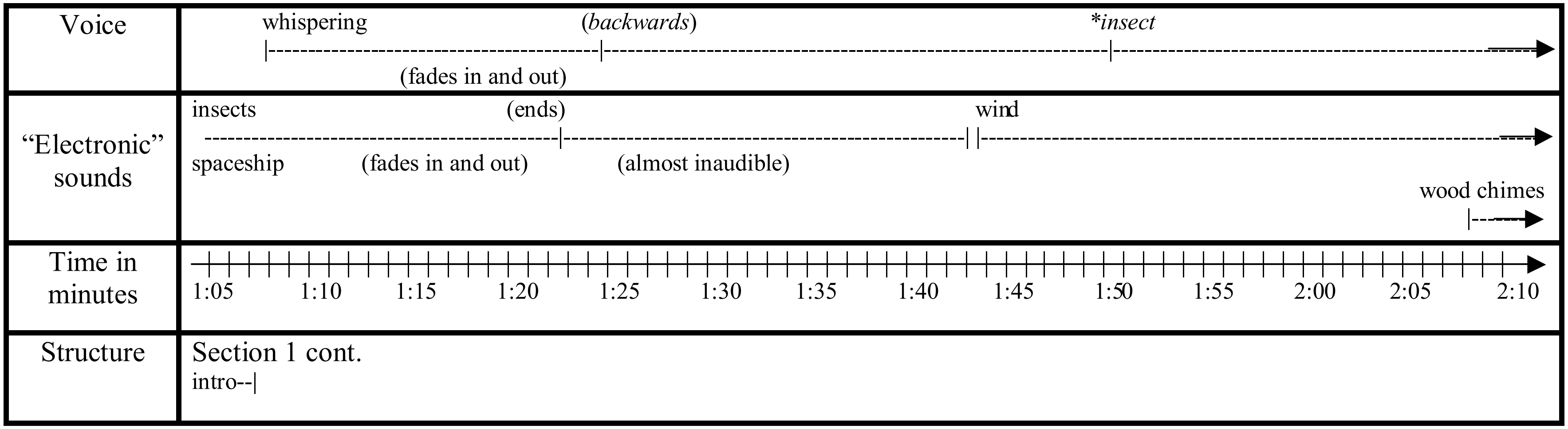


Figure 4.4: Listening score for Anna Rubin's *Crying the Laughing and Golden*

Figure 4.4 – continued



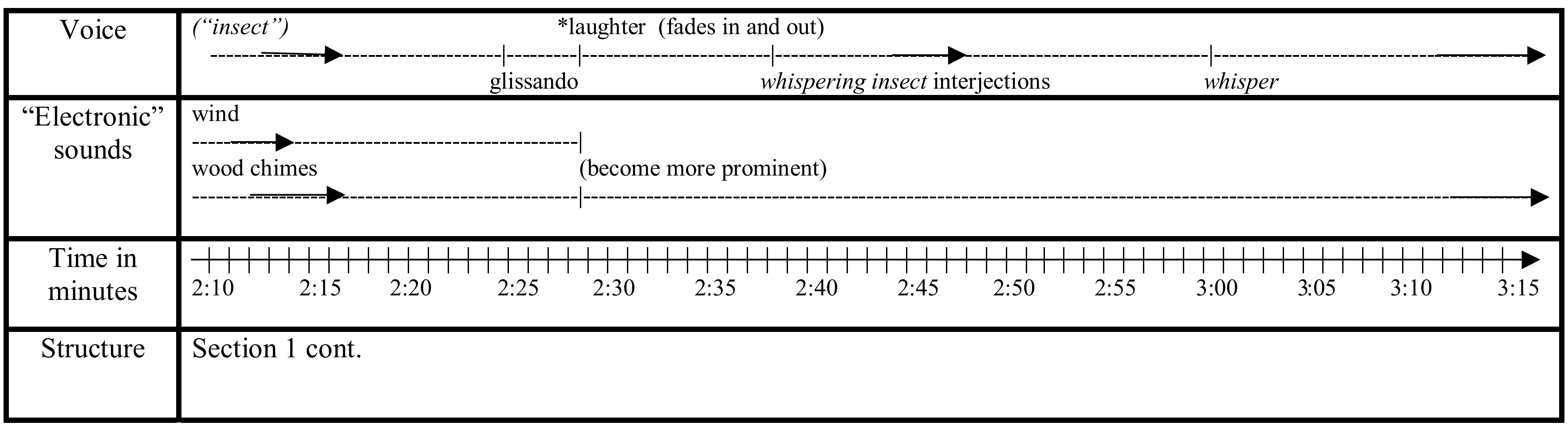
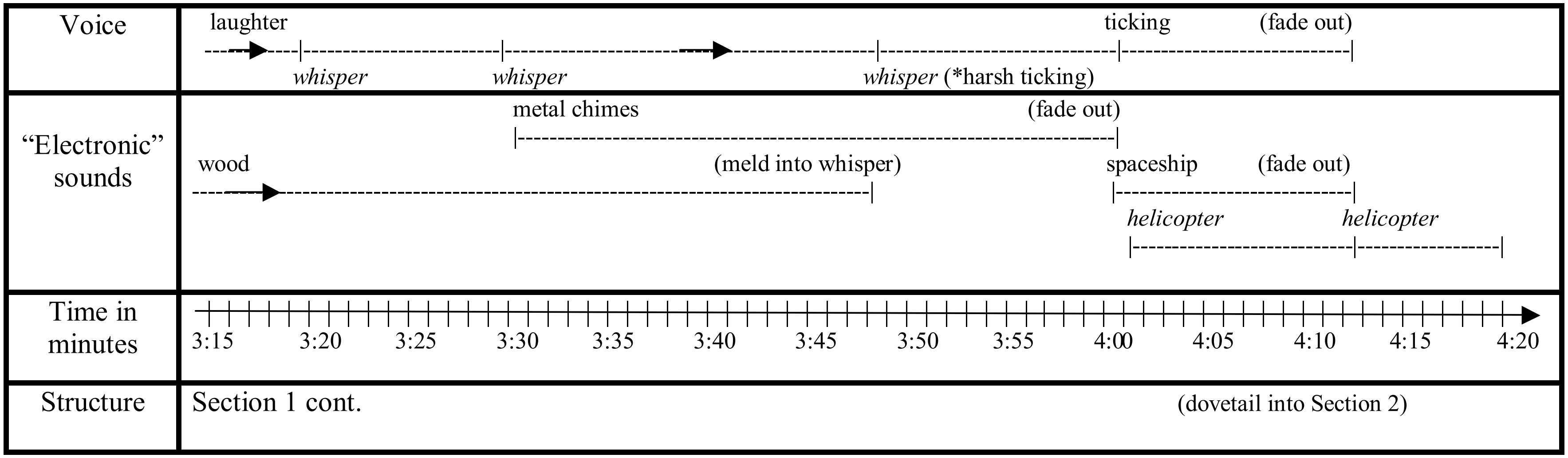


Figure 4.4 – continued



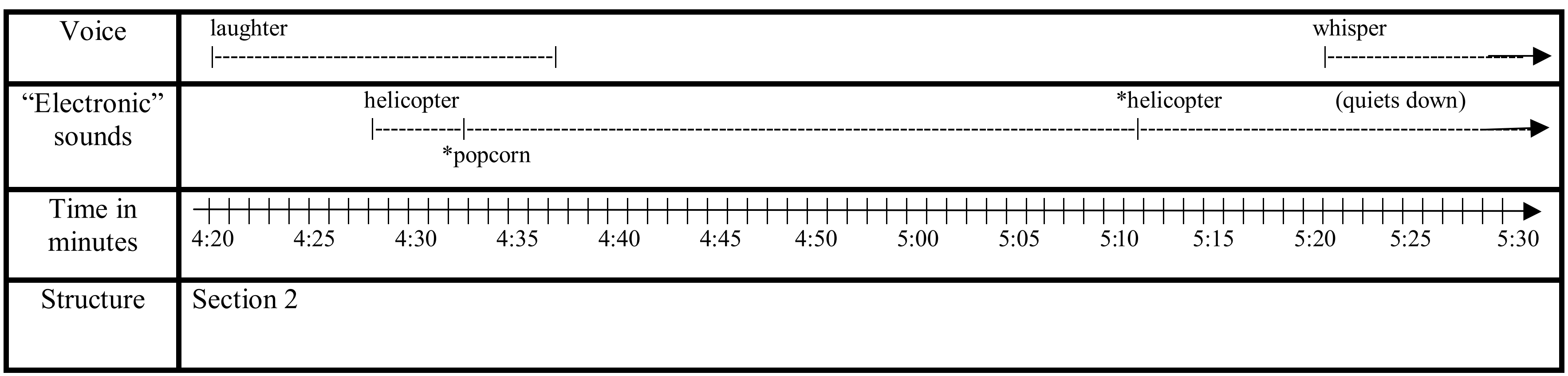


Figure 4.4 – continued

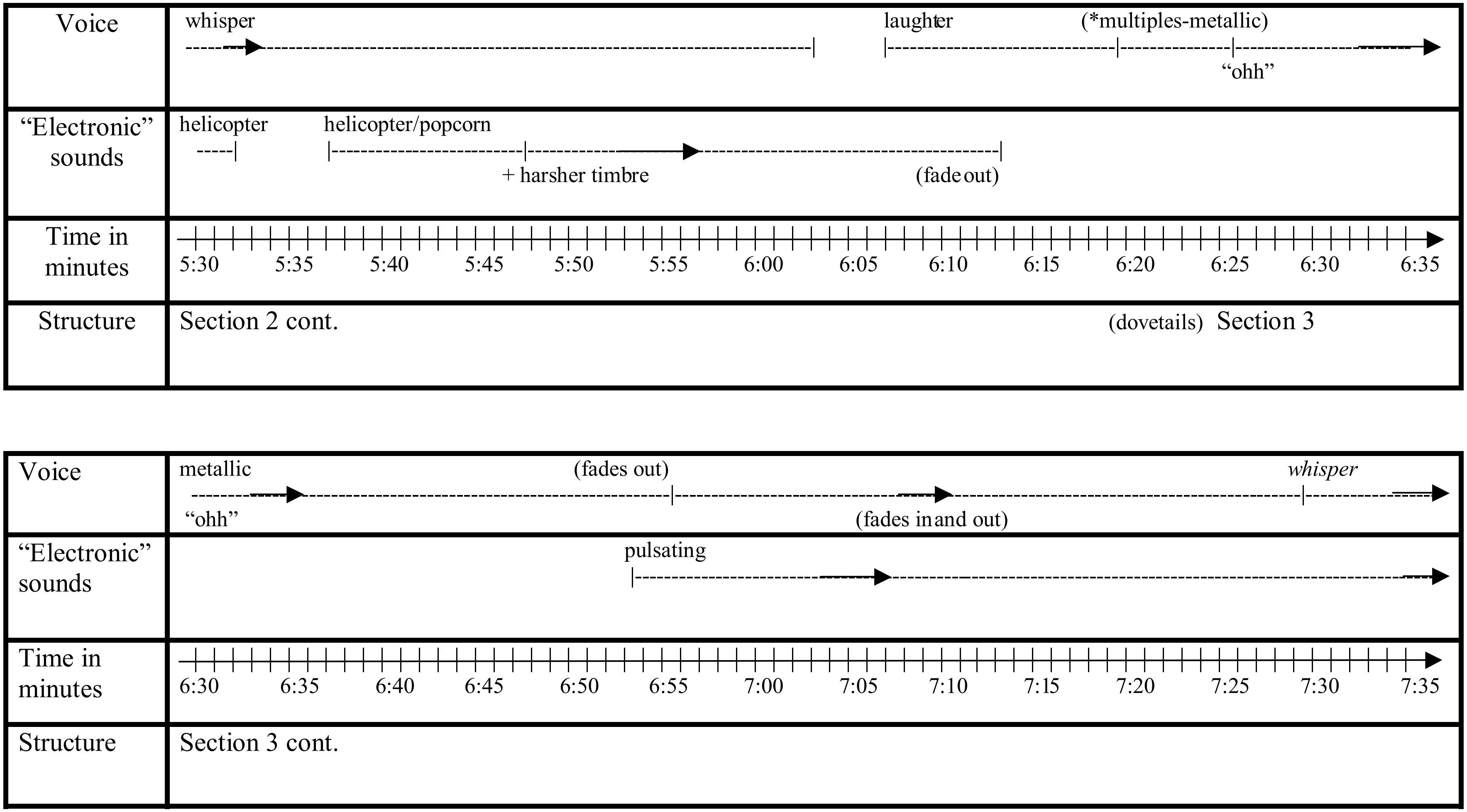
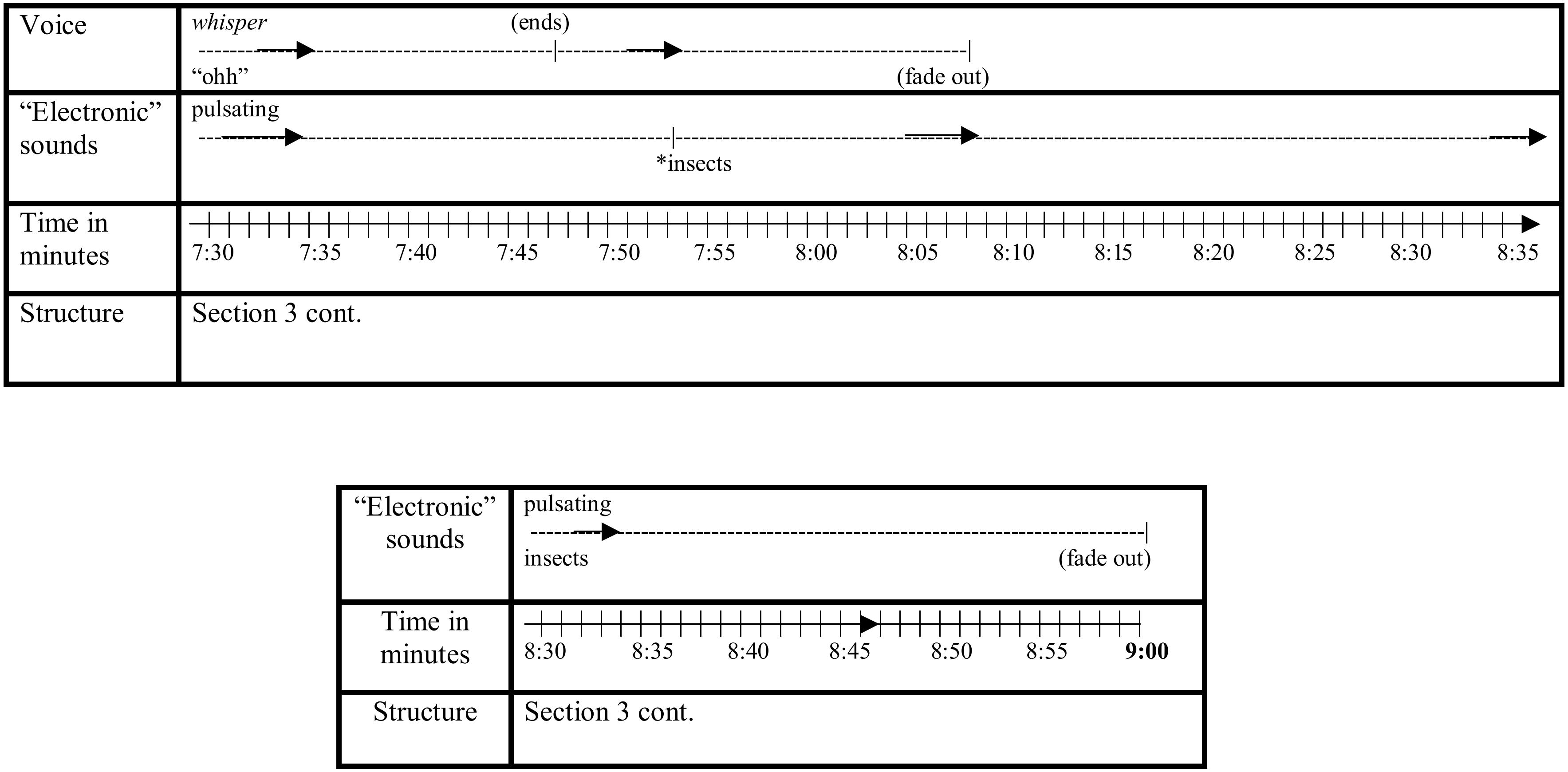


Figure 4.4 – continued



Trevor Wishart (b.1946) *American Triptych* (1999)

Trevor Wishart is a freelance composer based out of York, England, whose compositions deal mainly with the manipulation of the voice. Not only is Wishart known for his compositions, but he also written extensively about his own philosophy of music in *On Sonic Art,* which incorporates a phenomenological stance to music, and also about the technique of composing with digital audio in *Audible Design.*[13] He is also currently composer-in-residence at the University of Durham.

Wishart notes regarding his own works:

> I very often use the human voice (sometimes my own, sometimes live performers like 'Electric Phoenix' or 'Singcircle', sometimes voices from the media, or from the local community), for two reasons. On the one hand the voice is much more than a musical instrument. Through speech it connects us to the social world, and thence to the traditions of poetry, drama, comedy, etc. It reveals much about the speaker, from gender, age and health to attitude, mood and intention, and it also connects us with our Primate relatives. The listener recognizes a voice even when it is minimally indicated, or vastly transformed, just as we recognize faces from very few cues. And the average listener will be affected by e.g. a vocal multiphonic, an immediate empathic or guttural link, in a way which they will not be affected by a clarinet multiphonic (appreciated more in the sphere of contemporary music aficionados). At the same time, apart from the computer itself, the voice is the richest sound-producing 'instrument' that we have, generating a vast variety of sounds from the stably pitched, to the entirely noisy, to complex rapidly-changing multiphonics or textures of grit and so on. This is a rich seam to mine for musical exploration. … But all sound materials are different, and it is not possible to predict, except in the most obvious ways, what will arise when one begins to transform the sounds. So I spend a lot of time, exploring, playing with, the sources, transforming them, and transforming the transformations, and gradually a formal scheme appropriate to what I discover, and to those particulars materials, crystallizes in the studio.[14]

Most importantly, Wishart notes that using voice samples allows the listener to identify the source, even if it manipulated electronically and rendered through processes of transformation. If a composer utilizes such a source, the listener will be able perceive it

[13] Trevor Wishart, *On Sonic Art.* Simon Emmerson, ed. (Harwood Academic Publishers: Netherlands, 1996). *Audible Design.* (Orpheus the Pantomime: York, UK, 1994).
[14] Interview with Trevor Wishart by Matteo Milani and Federico Placidi - U.S.O. Project (Unidentified Sound Object), January 2009 Taken from http://usoproject.blogspot.com/2009/01/interview-with-trevor-wishart-pt1.html (accessed 02-17-09).

as a sonic event within the piece. In addition, the particular voice sample(s) used can instill various intertextual meanings among listeners, which in turn can reveal multiple interpretations. This concept is especially true for *American Triptych.*

Wishart's *American Triptych,* composed in 1999, uses samples of three historical American figures—Martin Luther King Jr., Neil Armstrong, and Elvis Presley—all of whom represent the American Dream in different ways, and therefore generate various social and cultural connotations among listeners. While the samples are cut up, truncated, and manipulated in various ways, they are not rendered completely unintelligible. Knowing the source of the samples helps the listener identify and catalogue the sonic events as they occur. Throughout the work the texture and layering of events continuously change, at times creating a sense of chaos, as mentioned with the excerpt in Chapter Three. This piece can be divided into four sections, which coincide with the use of the particular samples. Figure 4.5 on page 133 provides a listening score corresponding to the narrative that follows and Audio Example 5 presents *American Triptych* in its entirety. Figure 4.5 can be followed while listening to the Audio Example to assist in comprehending the progression of sonic events.

American Triptych begins with the sample of King saying, "Let freedom reign" three times. However, the first two occurrences only present the listener with a snippet of the sample, "Let free." With the first occurrence of "Let free" the "ee" is stretched out and manipulated giving it a ringing quality. The "ringing" begins to sputter down leading into a second hearing of "Let free" at twenty-five seconds. This time "r" from the word "reign" is stretched out changing the timbre to a brighter, yet harsher, resonating sound; the whole word "reign" is not yet heard. The ringing pulsates and again sputters down to introduce the third occurrence of "Let freedom reign" at fifty seconds. The sample is heard in its entirety slightly slowed down with reverberation. Here "reign" is stretched and transforms into a high-pitched ticking sound that pans first to the right then left and then back to the right speaker, fading out.

While up to this point the listener has only heard King's voice, a sample of Elvis abruptly enters with King's sample, "Let freedom reign" at 1:16. The listener hears a snippet of an Elvis sample, "bomp," which is looped at times sounding as if it is bouncing while "reign" is held out. By now the listener is accustomed to how the King sample is manipulated, and with the entrance of Elvis's sample, places it on the background level. The Elvis sample is new, sporadic, and at times bounces, drawing the listener's attention. While the Elvis loop continues it is juxtaposed with interjections of King's "Let freedom reign" coming to the foreground. A surge of sound that descends in pitch can be heard at 1:36, and is silenced by an Elvis "bomp" layered with the remnants of manipulated King samples. While "Let freedom reign" continues to interject, the third occurrence leads into another surge of sound that then fades into the background and is not silenced by Elvis as previously before. This surge eventually transforms into a texture of blended samples creating a sea of controlled chaos of pulsating, swarming loops. The sea of sound is stopped by King this time stating "Let freedom reign" in which the "reign" transforms into a siren that is held out and pulsates at various speeds. While Elvis and King have stopped the chaos that ensued previously, their efforts are thwarted when a thick texture of chaos abruptly enters featuring stretched-out King samples with chaotic snippets of Elvis samples that at times loop at 3:15. The chaos eventually thins out, leaving a high-pitch remnant of King's ringing with percussive, sporadic Elvis snippets interjected with "bomp" looping. This becomes reverberated and stretched to sound warm and resonant, and in retrospect, ends the section.

Preceded by a second of silence, the second section of the work introduces and features Neil Armstrong's radio transmission sample. At 4:12 a clear, distinct sample of Armstrong can be heard, but two seconds into the sample in starts to sound distorted via manipulation and a dampened high-pitched "ticking" can be heard panning back and forth between the speakers from right to left. While the ticking is heard on a background level, the listener is still drawn to this event as it moves in space. Emerging from the reverberation of sound comes a warm hollow sound at 4:38. Then at 4:45 with a high-pitch "glitch" of transmission comes a dark, loud "rumble" of sound low in pitch. The rumble accompanies sporadic manipulations of Armstrong's transmission. And just as it entered, the rumble leaves with a high-pitched glitch at 5:06.

After second of silence, at 5:08 another clear, distinct sample from Armstrong's transmission coupled with the same ticking sound that pans from right to left speakers is heard. The silence segments the previous series of events from the upcoming events, however the return of Armstrong's transmission corresponds to the aspect of familiarity.

In addition, this new segment of events introduces the listener to Armstrong's famous words, "The eagle has landed." This is followed by electronic chaos that enters abruptly at 5:15. This chaos is a loud, thick texture of melded, chaotic samples that calm down by fading out around 5:35 allowing Armstrong's transmission to stand out through the chaos. Not only are the King and Elvis samples tackling with chaos, as noted within the first section, but Armstrong is as well. At 5:40 the chaos abruptly enters again, only to have Armstrong's transmission come to the foreground as it fades out stating, "The eagle has landed." But the chaos is not finished. The transmission then transforms into a growing mass of chaos, only to be silenced by a glitch at 6:00. At the same time, a continuous sound is heard, like a lit fuse that transforms into a pulsating "tick" that ascends in pitch and pans to the left and right speakers. This ticking reminds the listener of the previous ticking (heard coupled with Armstrong's transmission at the opening of the section), but instead of occurring on a background level, this ticking is prominent. Then the listener hears "The eagle has landed," which is reverberated and echoed several times layered with the ascending tick. It seems as if Armstrong has settled the continuing opposition of chaos, however after the fuse sound reenters, chaos abruptly returns at 6:30 and ends five seconds later with a glitch.

Continuing after a second of silence, a third clear, distinct Armstrong transmission is heard coupled with ticking that pans between the speakers. Again, the silence segments the previous events from the upcoming events, however this segment along with the previous two are all related because of the use of a clear, distinct Armstrong transmission at the opening. Nonetheless, this time the ticking begins to surge ascending in pitch with a glitch interjection at 7:05. Then the ticking grows into a thicker texture becoming a prominent feature and metamorphoses into a resonant hollow sound. This then fades into a loop of Elvis "bomps" at 7:24. Three seconds later, the King sample is reintroduced. A call and response then occurs between the Elvis and King samples. Here, anticipation sets in, the listener has heard King and Armstrong coupled with Elvis, but will the Elvis sample be a prominent feature and have its own divisible section of music? Only in retrospect will this question be answered.

At 7:30 the listener hears a variety of events, juxtaposed and in succession. First, King's sample "Let freedom" is heard with the "ee" part of the text held out, followed by a short staccato “bomp” from Elvis, and then a snippet of Armstrong’s radio transmission. Although these events take place in a matter of seconds, all three are decipherable as events because of the different subjects used for sampling and the various timbres they create. “Let” is then heard three times juxtaposed with a loop of Elvis’s “bomp,” the third states “Let free” with the “ee” text held out. Again in a matter of seconds, the sounds fuse together chaotically; Armstrong’s transmission can be heard as an undertone to the chaos. At 7:45 new text is heard from King’s sample, "From every mountainside,” juxtaposed with the chaos, as if not to completely subside to the chaos. The insertion of this event and the change in text places it on a foreground level while it is present. This sample is also different from the previous voice sample of King because here the sample sounds non-manipulated, whereas “Let freedom” was spliced and extended at times. After the new text is heard, “Let free” with the “ee” part held out occurs again, juxtaposed with Armstrong’s transmission and an interjection from Elvis with a “bomp.” Here, “ee” changes in timbre slightly, now sounding with a resonating high-pitched ringing.

At 7:56 a transformation of sounds occurs. The Elvis loop sounds muffled and fades in with King interjections, and then the timbre changes and becomes more resonated and warm, almost shimmering. At 8:01 a harsher rumbling mass of sound fades in until six seconds later, when “Let free” stops the rumble, followed by bouncing “bomps” from Elvis. This leads to a sporadic mixture of all three samples juxtaposed. Just as if it seems that all three samples are going to be engulfed in the chaos, King is heard with interjections of Armstrong’s transmission. However, a surge of sounds is heard at 8:32 in which all the samples seem to explode from each other, creating a thick texture of sound. Intertwined in the thick texture are events of bouncing “bomps,” Elvis loops, interjections of radio transmissions, and the familiar King sound manipulation with an interjection of “From every mountainside.” Some of these events are repeated. Then this thick wall of sound fuses into white noise at 9:16 in which the white noise takes over the samples panning back and forth between speakers, sounding as if it is landing and taking off. Not to be subdued, the surge of sound returns at 9:50 overcoming the white noise. “Let Free” is heard with the “ee” part held out with interjections of “Let” layered with a loop of radio transmission. At 10:13 “bomp” is heard and then becomes looped, leading to “Let freedom reign” with “reign” held out. Now “Let” interjects over the sound of “reign” being held out, which eventually fades out leaving a second of silence at 10:41.

Although moments of chaos have tried to overtake the intelligibility of the sound sources, both and King and Armstrong have been prominent features within a section of this work. The moment of silence creates another new section, and perhaps this section will focus on Elvis. At 10:42 Armstrong is heard layered a sample of Elvis that sounds harsh with a buzzing quality. At 10:57 a glitch is heard, stopping the Elvis layer while the Armstrong sample continues being echoed and reverberated with glitch interjections. Then at 11:31 a fusion of sound is heard, which has a harsh buzzing quality. Hidden in this fusion of sound are “bomp” loops from Elvis at 11:51, perhaps waiting to come out. When the fusion stops at 11:55, Armstrong enters again coupled with the ticking background and glitches. At 12:15 the fusion fades back in, followed by “Let free” with “ee” held out at 12:28 and an Elvis loop at 12:33. The addition of the two samples all fuse together to create one wall of sound, but each sample can still be identified because of its different initial onset. Eventually the fusion quiets down and “Let” is heard juxtaposed with a glitch. Then Armstrong’s transmission with ticking continues with interjections of “Let” coupled with the glitch. The ticking begins to surge again, ascending in pitch, which brings it to the foreground. When the ticking is at its loudest, at 13:09, a King sample is heard this time with new text, “When we let,” which is multiplied and transforms into a swarming sound that is stretched up and down in pitch, cutting out the middle frequencies. The swarming transforms into bell-chime-like sounds. Elvis finally interjects with a loop at 13:41, only to meld into bell-chimes, which in turn take on a brighter quality in timbre. At 14:00 a pronounced “Let freedom” is heard which is held out over the bell-chime sound. King’s sample pulsates and fades out leaving a looped transmission of static over a resonating and pulsating, warm, hollow continuous sound at 14:20. These events fade out, ending the work at 15:00.

American Triptych can be divided into four sections based on Wishart’s employment of the three particular samples used for the piece. Each section also features an opposition of chaos versus stability. The first section of this work focuses on a sample of Martin Luther King, Jr. with interjections of snippets from Elvis’s sample. The second section follows a second of silence, which creates the division, and largely features Neil Armstrong's radio transmission sample, a contrast to the first section. This section can be segmented into three smaller sections, each apparent by a second of silence, as previously mentioned. In addition, each section begins with a clear, distinct sample from Neil Armstrong's transmission. The first smaller section includes glitches and rumbles, whereas the middle section highlights the opposition of Neil Armstrong and chaos. The third section focuses on the glitches and chaos. Now that two sections have been presented, the first featuring King and the second Armstrong, the listener could now anticipate that a section featuring Elvis samples would be heard next, if one were aware of the three subjects being used as source material, but that is not the case. Instead, all three samples are explored in the third section. The third section begins at 7:24 with an Elvis loop, which plays with the listener's expectation who anticipates hearing Elvis dominate. However, King and Armstrong quickly enter the sound palette. Even more so, this section seems to feature King again because in this section the text, "From every mountainside," is heard for the first time, drawing attention to the sample and its source. The fourth section, following a second of silence, which creates the division, begins at 10:42. Here, Armstrong and the Elvis sample are juxtaposed together; the Elvis sample has a different timbre, a harsher quality, almost as if to say "When is it my turn?" Like section three, the fourth section also explores all three samples. Only in retrospect does the listener realize that the Elvis sample was not used as a prominent feature in only one section, but instead interjected throughout all sections of this work. Not only do the three samples used in *American Triptych* conform to the formal structure of the work, but they also play with the listener's expectation of formal design.

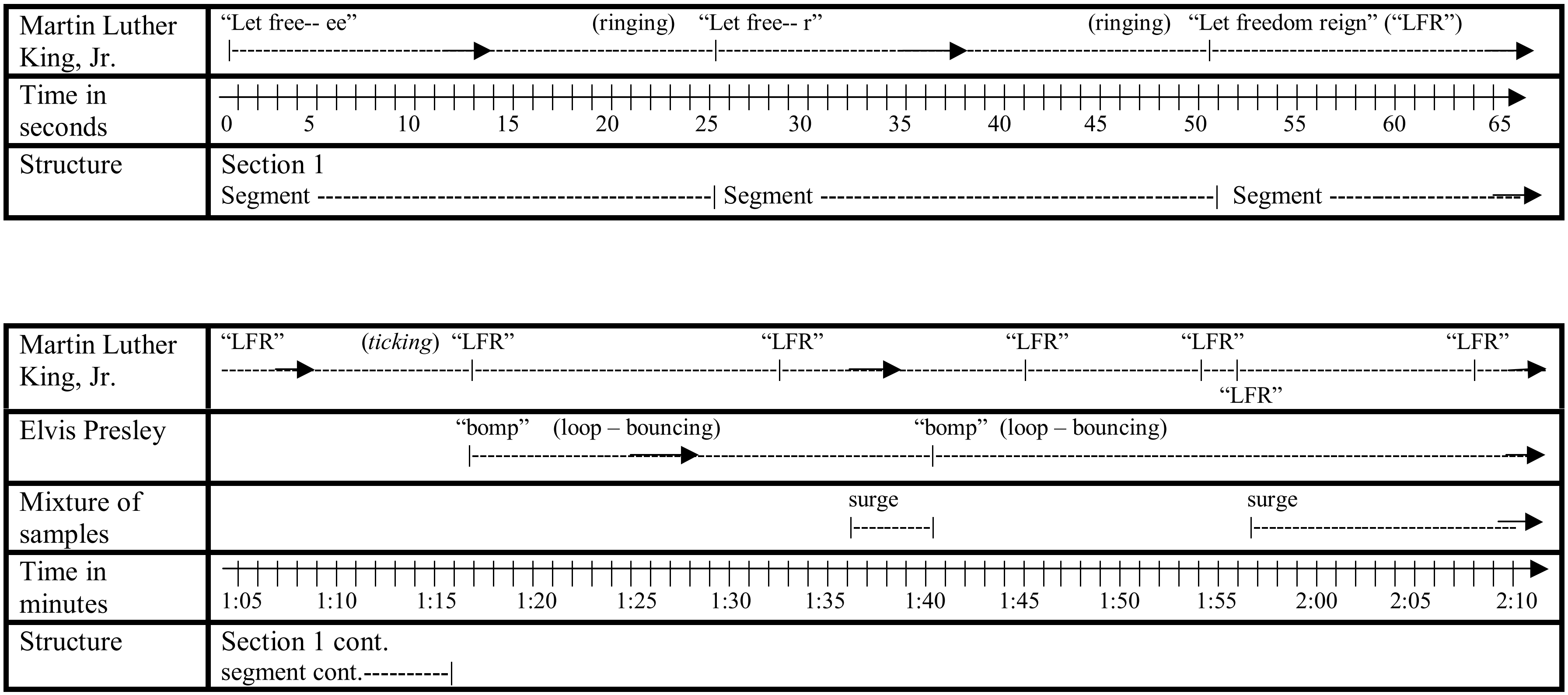


Figure 4.5: Listening score for Trevor Wishart's *American Triptych*

Figure 4.5 – continued

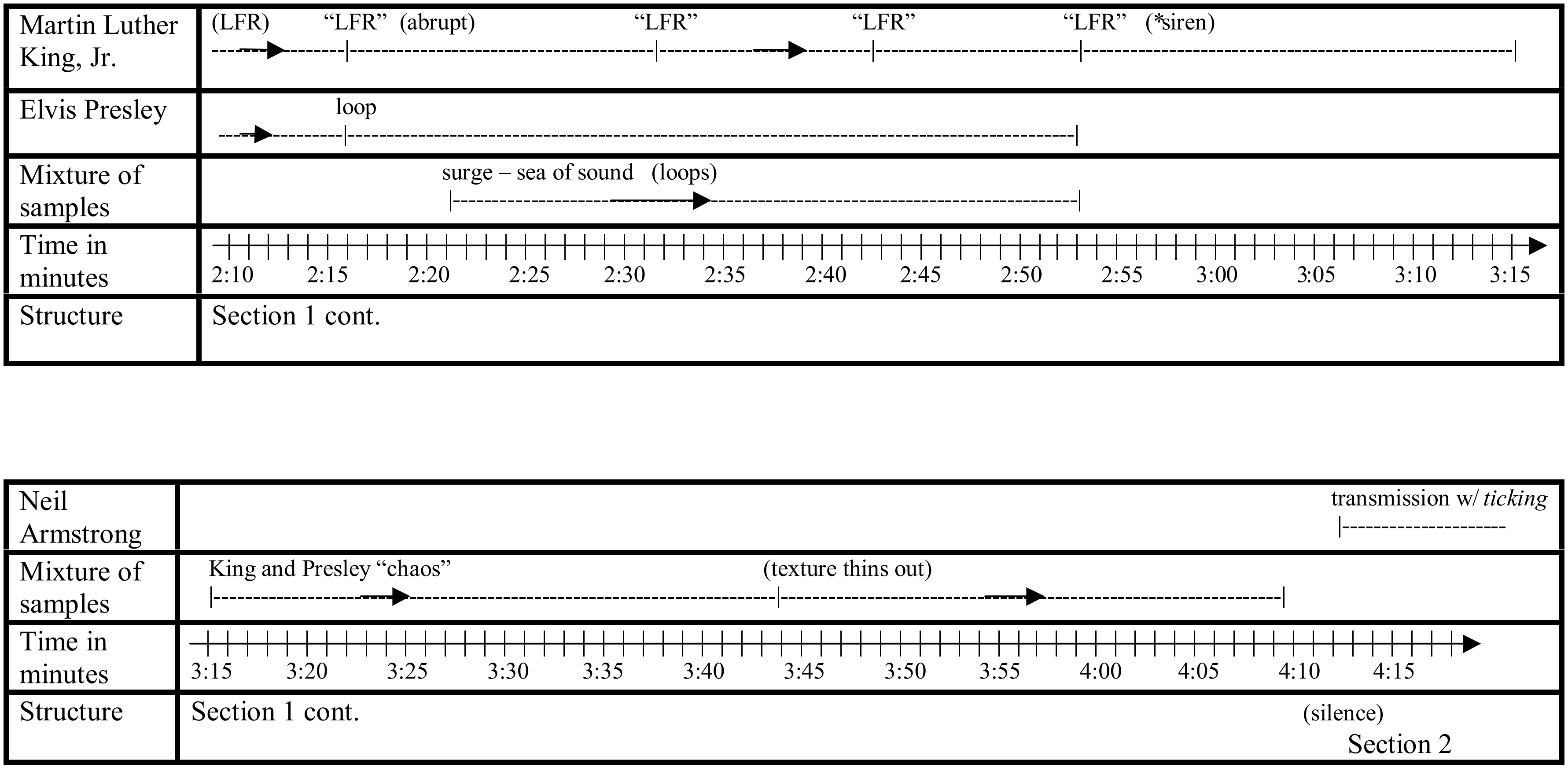


Figure 4.5 – continued

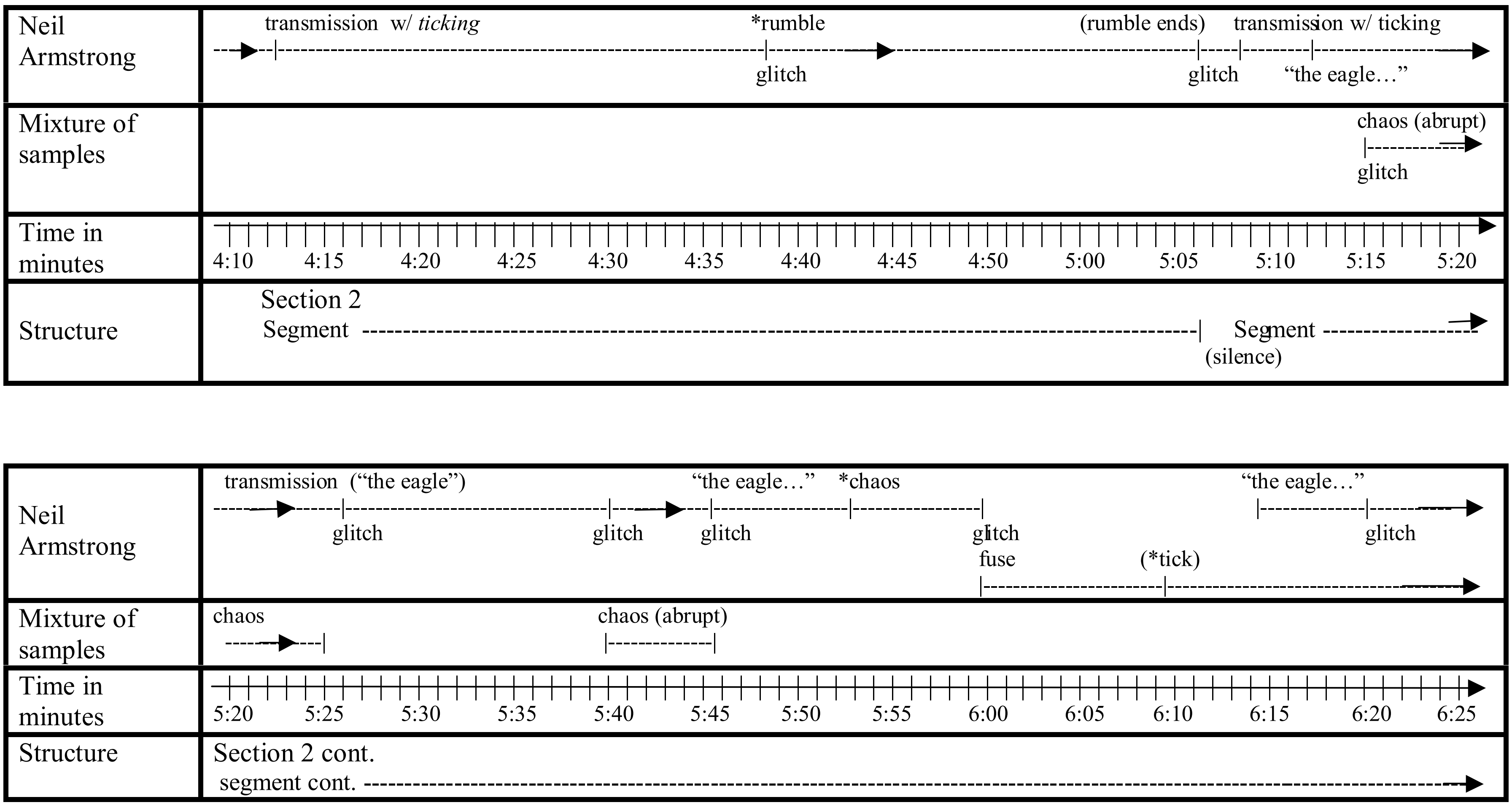


Figure 4.5 – continued

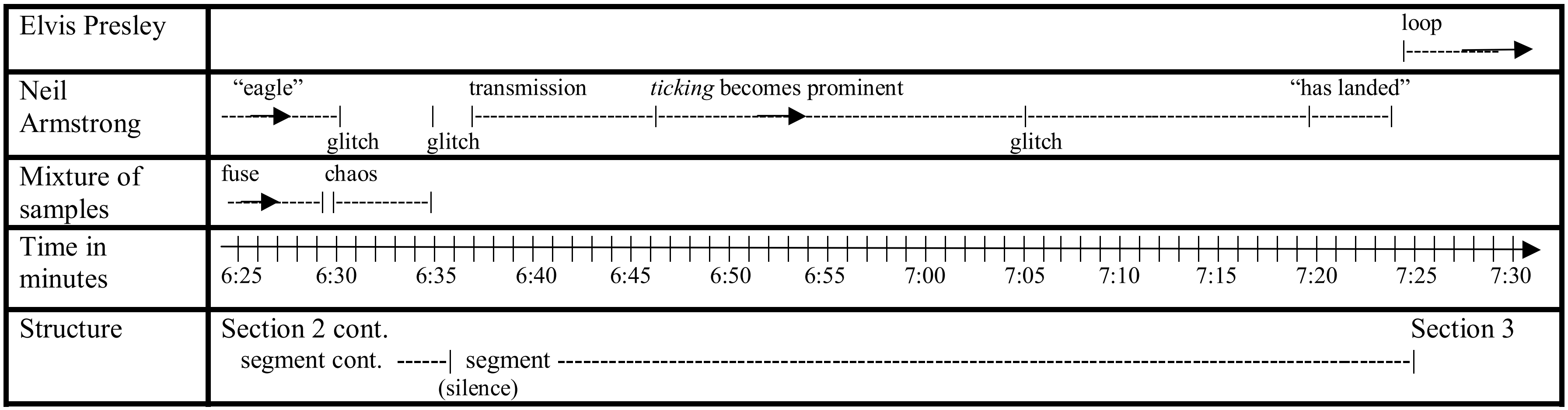


Figure 4.5 – continued

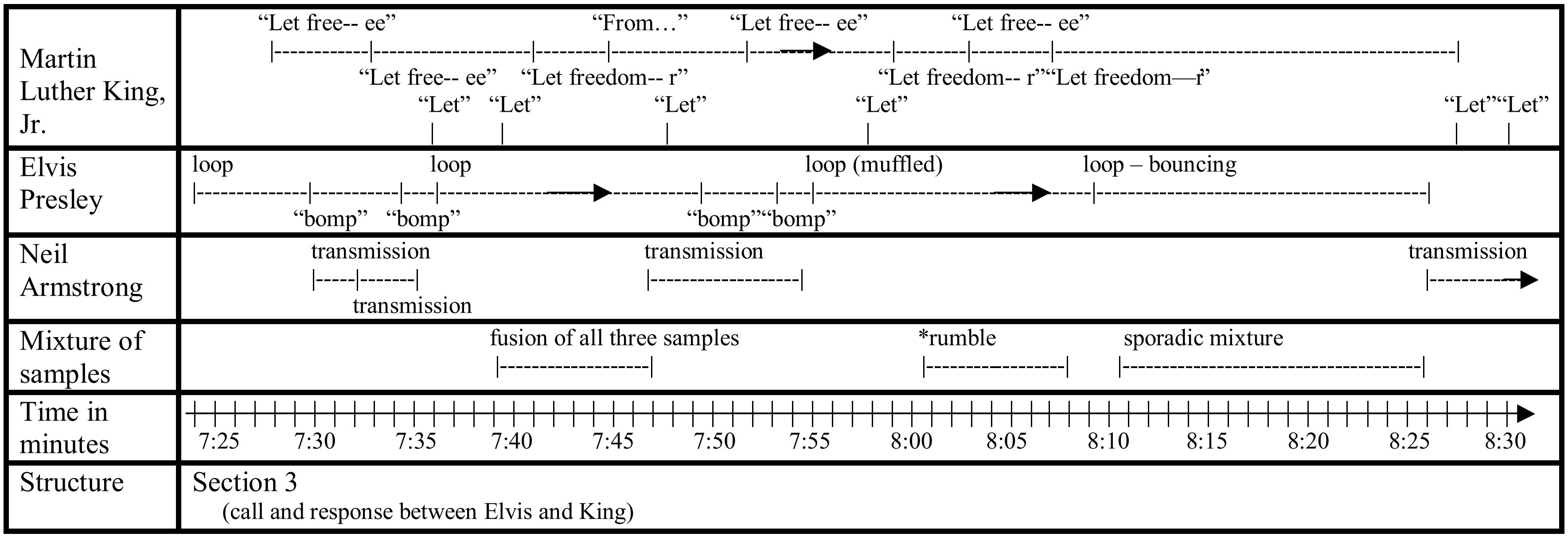


Figure 4.5 – continued

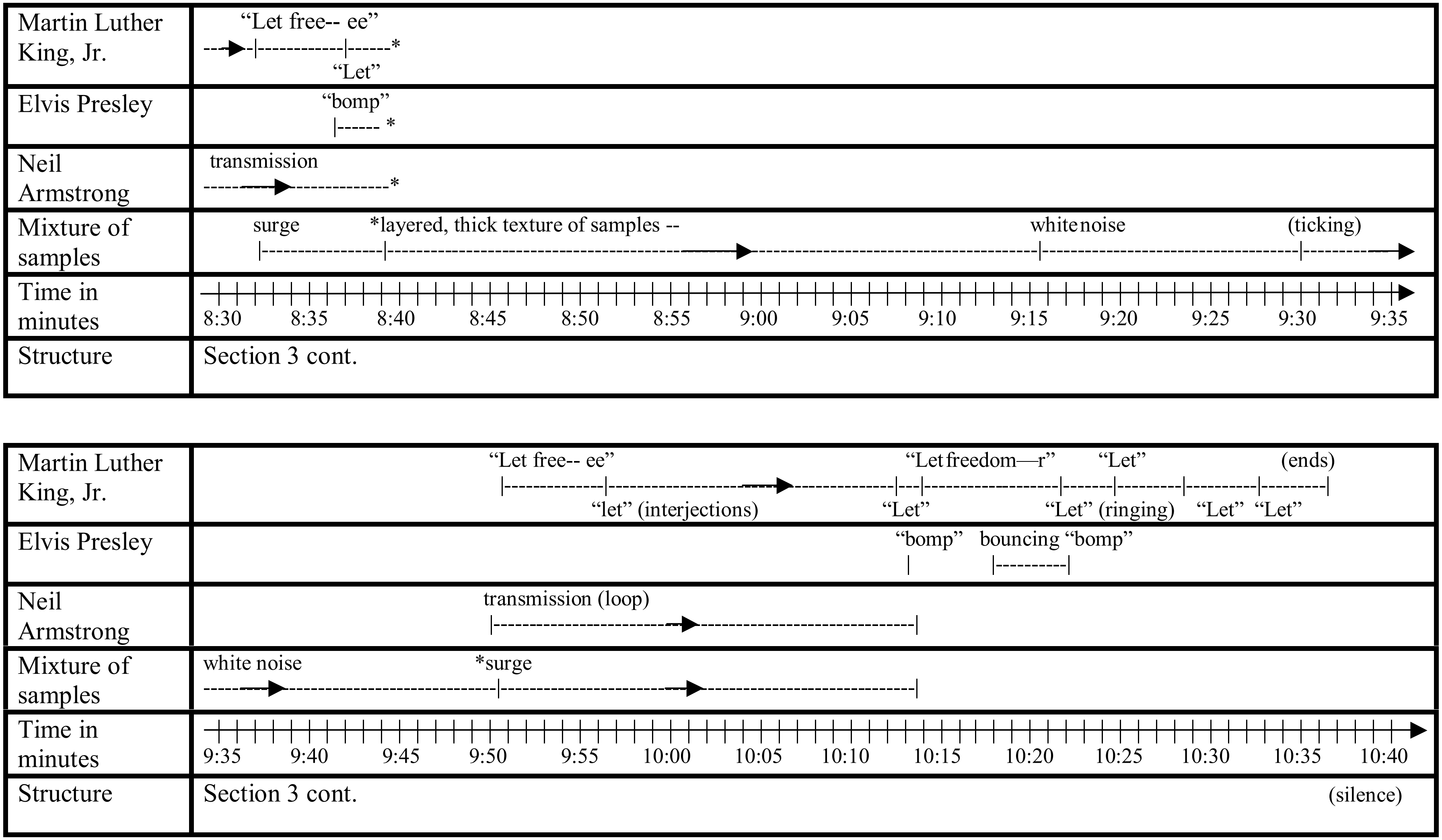
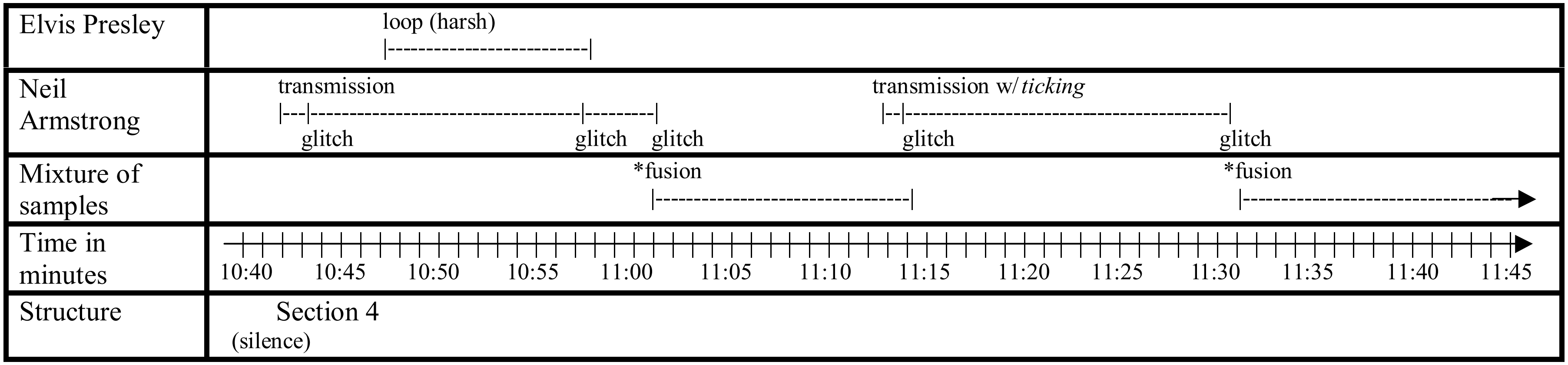


Figure 4.5 – continued



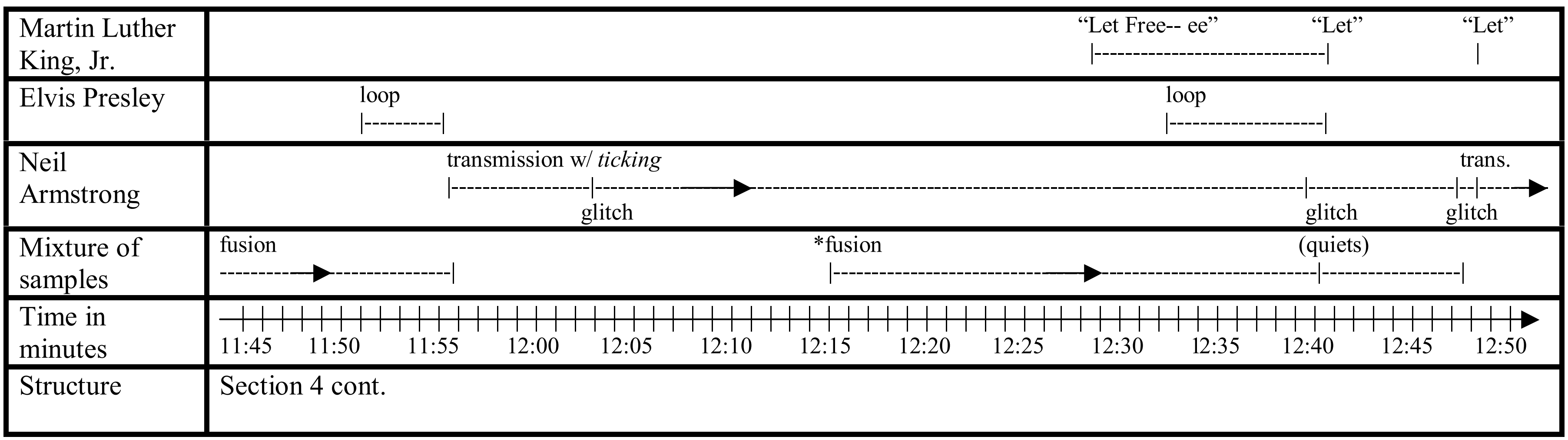


Figure 4.5 – continued

Martin Luther King, Jr.	"Let"	"Let"	"When we let" |----- (bell-chime) |-----→
Elvis Presley	loop (fade into chimes) |-----|
Neil Armstrong	transmission w/ *ticking* ---|---|---| glitch glitch glitch
Time in minutes	12:50 12:55 13:00 13:05 13:10 13:15 13:20 13:25 13:30 13:35 13:40 13:45 13:50 13:55 →
Structure	Section 4 cont.

Martin Luther King, Jr.	--→-- "Let freedom reign" |-----→-----|
Neil Armstrong	*static transmission |-----→-----|
Time in minutes	13:55 14:00 14:05 14:10 14:15 14:20 14:25 14:30 14:35 14:40 14:45 14:50 14:55 **15:00**
Structure	Section 4 cont.

Richard Devine *Tetrad* (2005)

Richard Devine's *Tetrad* from his 2005 album *Cautella* was released on the independent label, Sublight records. Devine is an electronic music composer who crosses between electronic "art music" and electronic dance music. Devine states, "My intentions are not to really make people dance, but to engage the listener in a surround-sound experience of acrobatic sound textures."[15] It becomes apparent when one listens to a variety of Devine's music that he is not your typical DJ of dance music. His soundscapes not only encompass rhythmic drive, but also ametrical evolutions of sound.

Devine began composing electronic works around 1993 starting with the computer program called Csound (a sound synthesis software created in 1985 by Barry Vercoe, as mentioned in Chapter One). Today, Devine's compositions incorporate a number of programs and software from Kyma to Max/MSP. He uses Native Instruments applications such as Reaktor and Absynth, which not only provide an infinite number of sounds, but also allow composers to create their own. Devine credits Karlkeinz Stockhausen and Morton Subotnick as influences and studied their works while in high school. Devine notes, "I was totally blown away by their use of constantly evolving timbres and panning movements."[16] Devine also notes how John Cage's concept of sound influenced his music: "Being exposed to Cage forced me to expand my consciousness and enhance my appreciation of the sounds–intended or accidental–that are always around us, and helped me compose works that use conventional and unconventional instruments alike. All sounds are acceptable musical materials."[17] Of his own music, Devine states:

> I am trying to create music that experiments with time fields, shifting timbres and different rhythmic placements within space. … My music can take many turns and morph into different entities all in a split second. If I were to describe it in my own words it would be intricately layered, precisely organized, highly synthetic,

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[15] Ron Mwangaguhunga, "Richard Devine: Devine DJ." http://www.macdirectory.com/music/RDevine/Index.html (accessed 03/2006).
[16] *ibid.*
[17] Stephanie Jorgi, "Richard Devine: Intention and Accident." http://www.audiohead.net/interviews/richarddevine/index2.html (accessed 03/2006).

> rhythmically articulated, intensely programmed, controlled yet chaotic, organic yet machine-like.[18]

The preceding commentary reveals Devine's appreciation of the diverse sound palette that is possible with electronic music. *Tetrad*, which literally means a group of four things, is divisible into four sections that change in texture, timbres, and meter. Figure 4.6 on page 145 provides a listening score corresponding to the narrative that follows and Audio Example 6 presents *Tetrad* in its entirety. Figure 4.6 can be followed while listening to the Audio Example to assist in comprehending the progression of sonic events. The opening of *Tetrad* was also discussed in Chapter Three.

Tetrad opens with a continuous, evolving "ahh" that is immediately layered with more sporadic sonic events that continually change in timbre, placing them on a foreground layer of perception. The overall sense of meter at the opening of this work is ambiguous because of the continuous event layered with the more sporadic events. Before continuing further into the piece, I will take time now to focus on the short, sporadic sonic events mentioned in order to discover what comprises these musical moments, and also to illustrate the level of detail the listener could attend to while listening to this work, or any piece for that matter. The first timbre, which sounds computerized and electronic, is heard four times, rising and falling in contour. The fourth iteration is then echoed three times. This presentation is heard only in the right stereo channel. Then slightly before seven seconds into the piece a new distinct timbre can be heard, but it still sounds like it is a computerized sound. This timbre contains higher frequencies then the previous sound and has a slight reverberation. This new timbre is first presented in the left channel and then immediately panned to the center. These ongoing sporadic events of sound are panned to both channels throughout their occurrence, affecting our sense of musical space and perceptual prominence.

Continuing at nine seconds, a soft bass sound can be heard twice, placed perceptually on a background layer. The higher pitched sonic events, heard previously, transform into "video game" sounds at about thirteen seconds, and at sixteen seconds two distinct "bong" sounds are now coupled with the bass sounds, previously heard. It is interesting to note that the bass now is layered with the higher pitched bong sounds, they

[18] Mwangaguhunga.

are more perceptually apparent. A lot has taken place sonically within the last seven seconds, but a basic perceptual description would identify sporadic sonic events of various timbres (layered above a continuous “ahh” sound) that transform and develop to form an ongoing chain of progression.

Twenty-one seconds into the piece the continuous “ahh” sound fades out for one second and a distinct sound, like the closing of a door, can be heard. Then the continuous “ahh” sound returns layered with sporadic sonic events, illustrating the principle of good continuation and resulting in the perception of similar and familiar events. Again in this procession of sounds, a background bass sound can be heard slightly after twenty-three and twenty-five seconds.

Thirty-nine seconds into *Tetrad* the pulse in conjunction with the sonic events becomes less sporadic. The following events take place very quickly, functioning as a transition, and suggest a triple pulse. First, three metallic sounds with reverberation occur in succession, followed by three sounds each of different timbres, but still sounding electronically manipulated. At forty-one seconds the continuous “ahh” sound fades out at the onset of three repetitions of yet another timbre. Then three car horns can be heard followed by various timbres of sonic events continuing in a sporadic manner similar to the beginning of this work. However, the continuation of events seems less sporadic here because they still evoke a triple pulse. At forty-four seconds the continuous “ahh” sound returns, still layered with the sporadic events, which again demonstrates similarity and familiarity aspects of the music, and the principle of good continuation. Although one could attend to either musical layer, the continuous “ahh” or the sporadic events, our attention now is directed slightly to the continuous “ahh.” This event fades in and out, which causes one to perceive the change in the overall texture and attend to what is causing the texture to change. This is similar to how our attention is attracted to the use of left and right channels. Accordingly, the principles of common fate and familiar configuration are evident since the texture changes in the same way each time. Considering the chain of events thus far, one has come to expect that the continuous “ahh” will fade out and return, creating the familiar texture of continuous “ahh” and sporadic events.

A new event, a "razor sharp glissando" that rises in pitch, can be heard in the background slightly after fifty-seven seconds and lasts for about two seconds. In retrospect the new sonic event prepares the listener for a change in texture altogether, as soon as Devine establishes a progression of events, they will change. Slightly after sixty-one seconds into the piece, the continuous evolving "ahh" transforms into the razor sharp glissando, recalling the continuous aspect as a musical element. With the change of texture, one can assess that a new section has emerged in the composition that dovetails with the previous section. Layered with the razor sharp glissando is a distinct rhythmic pattern of sonic events, which are only heard through the left channel. Similar to the previous texture of sonic events, these two new events can be segmented as distinct because of their rhythmic nature. Although the timbre still varies, the short, rhythmic sonic events have become less sporadic and are unified as a sonic event due to good continuation, familiarity, and similarity. Perceptually, the evolving razor sharp glissando and the rhythmic sonic events can both be placed on the foreground, as were the previous events, since the listener can equally attend to either one as well.

At about 1:19 in the piece the texture changes yet again, but this section does not overlap with the previous section. A distinct rhythmic presentation of electronically manipulated sonic events are apparent, but a continuous layer of sound as heard previously is not present, thwarting the listener's musical expectations. This section has a definite rhythmic pulse, suggesting a quadruple meter, and in retrospect (or with multiple listenings) the previous section has a pulse as well. However, the earlier presentation of sonic events suggests more complex syncopated rhythmic elements then this presentation of events. As a result the piece becomes less rhythmically ambiguous as it progresses. Right before 1:30, reverberation is added to the sounds, creating a denser texture reminiscent of the complexity of timbres that were heard in the beginning of the work. The reverberation also recalls the aspect of a continuous musical layer, which was absent at the opening of this particular section. The reverberation involves filtering out the higher frequencies, leaving the lower and middle ranges, and the piece ends with the decay of reverberation.

Tetrad divides into four sections—two similar sections followed by two different sections—through the opposition of texture, meter, and the contrast of continuous and sporadic/rhythmic, short computerized, machine-like timbres. The first two sections both contain the sporadic presentation of sonic events, however a division coincides with the fading out of the continuous "ahh" sound at forty-one seconds. Although there is also a fade out at twenty-one seconds, the second occurrence is longer therefore more apparent to the listener, and this moment also coincides with the tapering of rhythmic ambiguity, which functions as a transition. The third section begins at sixty-one seconds with the entrance of the razor sharp glissando and the fourth, which changes in timbre and has the clearest pulse, is at 1:19. Overall this piece can be viewed as the evolution of rhythmic ambiguity into rhythmic clarity. The first section is ametric, the second section incorporates pulses of three but is not in a strict triple meter, the third section becomes rhythmically defined including syncopated rhythms, and finally the last section has a clear steady quadruple pulse.

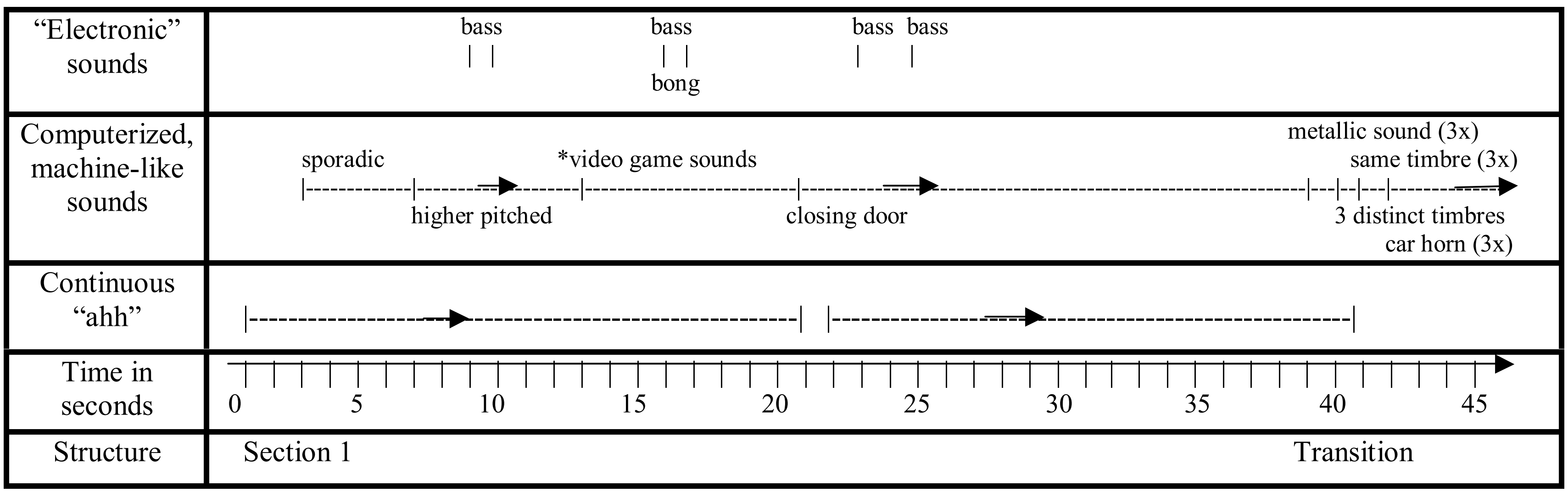
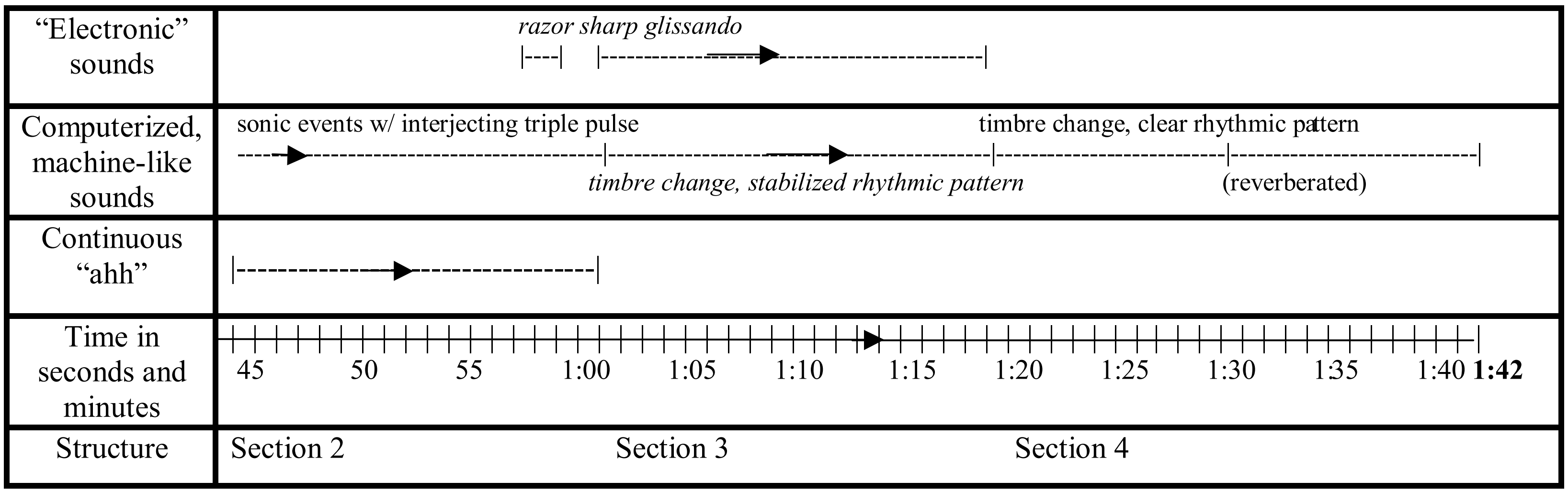


Figure 4.6: Listening score for Richard Devine's *Tetrad*

Figure 4.6 – continued



By employing a phenomenological approach in the previous analyses, the listener is able to construct an analytical description and a listening score on the basis of concentrated listenings. The narrative seeks to discover the structure of a work, and aids in the listening process of a music that is complex and may be unfamiliar to the listener, such as electronic music. Electronic works could also incorporate traditional instruments, the voice, and found sounds—sounds that are familiar to the listener, but may also be used in such a way as to render them unintelligible. As well, the average listener does not necessarily understand, or even know, the technical processes that are involved in creating a piece of electronic music. The technical language of electronically derived music cannot only be daunting to the listener, but it also may not provide any musical relevance to the listener. Furthermore, an experiential perspective is vital in the majority of these case studies, where a score is not available.

First, the listener must understand how to listen to electronic music by identifying and segmenting sonic events within a composition. The listener can begin to understand electronic works by utilizing two primary categories of sonic events—purely electronic sounds or sounds of *musique concrète*. Sounds that fall into the latter category can be further divided into the use of voice, traditional instruments, and found sounds. While a composer could incorporate any mixing and mingling of sound, electronic or concrète, the listener can begin to categorize the sonic events and catalog them for further investigation. Factors such as varying onsets of events, differences and/or changes in timbre, rhythm, texture, pitch, and contour can cause the listener to identify and segment various events. Once the listener has a firm grasp of the sonic events that comprise the make-up of a composition then the listener can start to draw connections as to how those sonic events function within the larger structure of the work.

Most often the listener will divide the composition into sections that relate to each other, even if the relationship is in opposition. A key factor in determining the partition of a composition into various sections includes the aspect of continuity versus discontinuity. Changes in any musical parameter, such as pitch, rhythm, and most importantly timbre, can cause the listener to divide one section of music from another section. As well, sections that return or are similar to previous sections will also cause the listener to create a division. From the previous case studies, the listener hears that such elements as rhythm (as in *Tetrad*), the particular use of samples (as in *American Triptych* and *Bye Bye Butterfly*), or contrasting timbres (as in *The Wild Bull*) can create formal divisions within a composition. Electronic works may also provide a sense of continually evolving sounds (as in *Crying the Laughing and Golden*), in which the formal structure entails the aspect of dovetailing. In addition, electronic compositions can conform to standard formal structures as illustrated in *Fantasy in Space*, which employs a ternary structure.

In the process of listening certain psychological factors are present clarifying how and why we hear music in certain ways. The preceding analyses also demonstrated how all five of the Gestalt principles aid in identifying what the musical elements are and how they function within the composition. It is also apparent that these principles work in conjunction with each other. While these principles aid the listener they are not detrimental to the listener's knowledge in understanding how electronic music works. Ultimately it is this kind of multi-faceted comparative process that will most readily yield a formal understanding of an individual composition.

CHAPTER FIVE

CONCLUSION

A phenomenological approach allows a listener who seeks to discover the structure of a piece of electronic music a way to discuss this genre of music more readily. Allowing the experience of the music, the final product of a composition, to act as a tool for understanding the music, a listener can bypass the technological language of electronic music and yet still uncover the musical structure of the piece. This type of approach encourages and prioritizes an analytical perspective derived from the listener's point of view. To be sure, one listener's interpretation may not be the same as another's, but because of intuitive musical decisions, different interpretations and investigations of electronic works can create an even deeper, multi-faceted understanding of the genre and act as a way to open up a discussion of these works.

The previous analyses illustrated how to identify and segment sonic events in order to place them within a larger structural framework. While each individual composition will present its own unique arrangement of events, common compositional aspects are evident among electronic works. One generalized aspect that seems to be a common thread among the analyses is the composer's use of opposition—in other words, the contrast of particular musical elements found within the composition. Whether it is contrasting timbres (hollow or soft versus harsh qualities) or rhythms (continuous versus sporadic events), the particular rendering of sound sources, chaos versus stability, or even traditional instrumentation juxtaposed with electronics, this opposition can be viewed as a driving force within the work. In addition, this opposition creates a way for the listener to perceive sectional divisions within a piece.

Each of the six pieces that were discussed in Chapter Four presented an element opposition, some elements similar among compositions and others unique to the individual piece. Otto Luening's *Fantasy in Space*, which samples a flute, presents the opposition of both manipulated, yet still recognizable, and non-manipulated renderings of the sound source. As a result, the contrast allows the listener to hear three distinct sections in the work. On the other hand, Pauline Oliveros's *Bye Bye Butterfly*, which samples a recording of a Puccini opera, highlights the intelligible and unintelligible use of the source dividing the work into three perceivable sections. Similar to Luening's work, Oliveros's also incorporates the aspect of opposition through the particular rendering of the sound source. Both Morton Subotnick's *The Wild Bull* and Trevor Wishart's *American Triptych* feature the notion of stability versus chaos. At moments in each work sounds meld together or implode, becoming dense in texture and creating a sense of chaos in the progression of sounds. Stable moments perceptually present a more methodical sequence of events, but that is not to say that chaos is not an intentional compositional process and an integral part of the work's structure, as each of these pieces demonstrates.

Silence, new events, stark contrasts of timbres, changes in meter, rhythm, pitch, register, or contour, sparse versus dense textures, and/or abrupt changes in musical parameters, all aspects of discontinuity, are elements that can create sectional divisions on both large and small structural levels within a composition. Nevertheless, musical contrast is not the only factor that determines sectional divisions; the return of particular material and recurring motivic ideas can also create sections that provide a sense of similarity within the work. Both *The Wild Bull* and *Fantasy in Space* present repetition of motivic material exhibiting ternary formal designs. In *American Triptych,* a moment of silence provides a division creating Section 1 and 2 within the piece. Further, a different voice sample is featured in the new section. Also in Section 2, moments of silence create smaller segments within the section and each segment opens with a familiar rendering of the sound source, creating a sense of similarity between the segments within the larger section. Richard Devine's *Tetrad* juxtaposes sporadic and continuous sonic events, exploring a rhythmic aspect in which the rhythmic pulse becomes more defined as the work progresses, creating an opposition of rhythmic ambiguity. Sectional divisions can be perceived in this work correlating to this opposition as well as changes in timbre.

When a new sonic event enters the sound palette the listener's attention may be immediately drawn to it, particularly if the event has a louder dynamic, a contrasting timbre, and/or contrasting rhythmic quality. Other factors that draw the listener's attention include the aspect of spatialization, which involves the composer's use of panning and/or creating a sense of depth through foreground and background layers. As the analyses illustrate in both Chapter Three and Four, the listener can perceive multiple layers of sonic events with varying degrees of salience. The familiarity of the sonic event itself—particularly the use of a recognizable sound source, the voice or a flute, for instance—can be a factor. The compositions investigated in this project demonstrated that a wide variety of source material could be used, from the harp to frogs to wiretaps to a recording of Puccini, whatever the composer feels compelled to incorporate in the work. High versus low-pitched events, particularly when in juxtaposition, can also draw the listener's attention, such as low "grumbles" or high "screams," like the "animal howls" in *The Wild Bull* or the "screaming" glissandos and exploration of extreme high and low frequencies in *Bye Bye Butterfly*. As well, because of the composer's ability to create and manipulate sounds with electronics, sounds commonly transform or evolve from one another creating an ongoing progression of sound. Timbre manipulation or distortion, creeping in from a soft dynamic, evolving or melding sounds, thickening of textures, or the simple use of a glissando can create the aspect of transformation.

Anna Rubin's *Crying the Laughing and Golden* features the use of a voice sample, which is used to derive the majority of the sounds heard within the work. Because of this, sounds of "insects" transform from whispers and glissandos evolve into laughter. The voice sample is manipulated and distorted through a variety of techniques creating a continuous evolution of events. In addition, the contrast of intelligible and unintelligible use of the sound source instills a sense of familiarity to the listener when he/she hears the distinct use of whispering or laughing. The process of evolution through sound in conjunction with the contrasting use of timbres creates sectional divisions can be perceived in the work that overlap or dovetail with each other. Likewise, two compositions by the same composer may share a common compositional source or sonic event (such as the use of a clarinet sample), but the compositional output can be completely different. For instance, both of the two works by Paul Lansky discussed in Chapter Three incorporate a sample of the female voice. One piece incorporates electronic sounds with intelligible, yet manipulated and spliced voice samples, while the other work includes unintelligible voice samples, one layer of percussive snippets juxtaposed with continuous "ohhs."

By taking an experiential approach, the previous analyses have presented a method for codifying sonic events and identifying them within a composition, beginning with two primary categories of events—concrète or electronic. Each analysis is unique to the individual composition, but this study of works has demonstrated a number of general analytical assumptions that can be made about this genre of music. Opposition of musical elements and a multi-faceted employment of transformation are two prime findings. Particular attributes of the sonic events create divisions between other events and allow listeners to make perceptual judgments about structural aspects. The electronic medium makes a plethora of new sounds available to composers, creating a vast land of new soundscapes for not only the composer, but also for the listener. The compositions investigated provided examples of the various methods used to produce these works—tape, various programs and software, synthesizers, the personal studio—to illustrate that although there are diverse methods, analytical considerations can still be made about the genre. In the process of concentrated yet "open" listenings to various electronic pieces, psychological factors of perception can explain how and why we hear music in certain ways. The listener can intuitively and objectively come to know how a composition "works" through multiple concentrated listenings. A phenomenological approach to electronic music that relies on the listener illustrates how an experiential perspective can lead to a deeper analytical understanding of the genre of electronic music and individual compositions.

A question that is relevant to professional analysts and to students at every level is, "How do I approach a genre of music that in most cases is new to me?" Twentieth-century music presents particular challenges because there are a number of compositional strategies and soundscapes employed. A phenomenological approach is viable for these particular challenges that are raised since the listener can approach a piece music intuitively, as well as objectively, to identify what structural features provide us with insight into the composition. As Gregory Danner notes:

> Phenomenology can provide the procedure for analyzing and comparing the many divergent styles of music in our time, including even the most experimental

> electronic and computer music, since traditional notation is not at the heart of the theory – only sound alone.[1]

A phenomenological approach is viable not only for electronic music, but for any genre of music. Listening to music is a vital part of any analysis. While the notes on a staff or symbols in a graph may represent visually what can be heard, it does not fully capture what the listener *will* hear. From an experiential perspective the listener can use his or her own narrative of the composition, produced from numerous concentrated listenings, to construct a listening score, which creates a notational representation and aids in the listening process for music that is complex and may be unfamiliar. The analyses in this project incorporated listening scores, created from a listener's perspective (my own), which present the listener with the progression of events heard, and outline structural divisions found within the particular composition. This type of analytical representation and approach is beneficial particularly for analyses of music that does not conform to the standard five-note staff notation, for example World Musics or Popular genres. In return, the score can benefit not only the listener, but also other listeners in the understanding, sharing, and teaching of music that calls for new listening strategies and fall outside traditional notation.

Any genre of music can be approached phenomenologically. As Mary Simoni states:

> Just as the written word alone does not exclusively impart meaning, musical representation does not solely communicate compositional intent. Whether musical representation consists of nuemes, notes on a staff, or graphics, we are obliged to look beyond these visual artifacts and listen carefully to fully understand the music. … This practiced balance among representation, compositional intent, and human perception is why music analysis is truly an art about an art.[2]

Electronic compositions, a genre of music with such a special reliance on the ears, phenomenology proves to be a valuable tool for the analyst. Listening to music is a vital tool for every musician, whether it is listening in the practice room, a lesson, studying your favorite recording, going to a concert, or for analytical observation. As analysts, we

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[1] Gregory Danner, "A Phenomenological Approach for Teaching Twentieth-Century Music Analysis," *Journal of Music Theory Pedagogy* 5/1 (Spring, 1991): 92.

[2] Mary Simoni. "Introduction" to *Analytical Methods of Electroacoustic Music*. Mary Simoni, ed. (Routledge: New York, 2006): 1.

are not only concerned with how to understand music, but also how to convey every aspect of our musical impression(s) to others. Any twentieth-century composition introduced to the listener has the potential to suggest its own particular analytical approach, and some find this overwhelming or pointless. As Danner notes:

> Introducing new music, in particular, warrants special attention. If we, as theory instructors, focus only on the empirical evidence of a composition—its melodic organization, harmonic language, compositional strategy, etc.—then the [listener] comes to think of new music as merely abstruse technique.[3]

Aesthetically, music is about taste and preference, but knowing how to listen to a particular genre of music can enhance one's appreciation and understanding of a piece of music or a certain composer. By allowing one's aural experience to be a viable analytical approach we can then encourage listeners to think actively about their musical experiences.

Electronic music is a complex genre of music, which prompts such questions as "What are the sounds being employed? How are these sounds being manipulated? How can I identify them as sonic events? How do we segment these events? What makes an event different from another? And ultimately, how are the sounds organized within the musical context?" Once the listener understands how to go about listening to electronic music, one can then begin to answer these questions.

[3] Danner, 92.

APPENDIX

Chapter One:

Milton Babbitt (b.1916)

Vision and Prayer (1961) available on *Milton Babbitt* released on Composers Recordings Incorporated CRI 521 (1988).

Ensembles for Synthesizer (1964) available on *New Electronic Music From Leaders Of The Avant-Garde* released on Sony Music Entertainment SICC 78 (2002, Reissue).

Pierre Boulez (b.1925)

Répons (1981-84) available on *Pierre Boulez: Répons / Dialogue de l'Ombre Double (20/21 series)* released on Deutsche Grammophon CD 457 6052 (1998). This recording also received a Grammy in 2000.

John Cage (1912-1992)

Imaginary Landscape No. 1 (1939) available on *The 25-Year Retrospective Concert of the Music of John Cage* released on Wergo WER 6247-2 (1994).

Williams Mix (1952) available on *The 25-Year Retrospective Concert of the Music of John Cage* released on Wergo WER 6247-2 (1994).

Charles Dodge (b.1942)

Any Resemblance is Purely Coincidental available on *Any Resemblance is Purely Coincidental* released on New Albion Records NA 043 (1994).

Halim el-Dabh (b.1921)

Wire Recorder Piece (1944) is available on *An Anthology of Noise and Electronic Music/ Fourth A-chronology 1937-2005* released on Sub Rosa SR 250 (2006).

Paul Lansky (b.1944)

As If (1981-82) available on *The Virtuoso in the Computer Age (I) – CDCM Computer Music Series Vol. 10* released on Centaur Records, Inc. CRC 2110 (1983).

Alvin Lucier (b.1931)

"I am sitting in a room" (1970) available on *I am sitting in a room* released on Lovely Music, Ltd. CD 1013 (1990).

Philippe Manoury (b.1952)

Jupiter (1987/ rev. 1992) available on *Philippe Manoury - Jupiter; La Partition du Ciel et de l'Enfer* released on Musidisc (1999).

Olivier Messiaen (1908-1992)
Oraison (1937) available on *An Anthology of Noise and Electronic Music/ Fourth A-chronology 1937-2005* released on Sub Rosa SR 250 (2006).
Turangalîla-Symphonie (1946-48) available on *Messiaen: Turangalîla-Symphonie* released on Naxos CD 1504867 (2000).

Luigi Nono (1924-1990)
Omaggio a Emilio Vedova (1960) available on *Luigi Nono: Complete Works for Solo Tape* released on Stradivarius STR 57001 (2007).
Steve Reich (b.1936)
It's Gonna Rain (1965) available on *Steve Reich: Early Works* released on Nonesuch Records CD 9 79169-1 (1992).

Jean-Claude Risset (b.1938)
Little Boy (1968) available on *Jean-Claude Risset: Songes, Passages, Computer Suite From Little Boy, Sud* released on Wergo WER 2013-50 (1988).
Mutations (1969) available on *An Anthology of Noise and Electronic Music/ Fourth A-chronology 1937-2005* released on Sub Rosa SR 250 (2006).
Contours (1982) available on *New Music Series Volume 1* released on Neuma Records CD 450-71 (1988).

Clara Rockmore (1911-1998)
The Art of the Theremin: Clara Rockmore (Rockmore, Theremin and Nadia Reisenberg, piano) released on Delos International CD 1014 (1977).

Luigi (1885-1947) and Antonio Russolo (1877-1942)
Corale (1921) available on *An Anthology of Noise and Electronic Music/ First A-chronology 1921-2001* released on Sub Rosa SR 190 (2002).

Walter Ruttmann (1887-1941)
Wochenende (1930) available on *An Anthology of Noise and Electronic Music/ First A-chronology 1921-2001* released on Sub Rosa SR 190 (2002).

Pierre Schaeffer (1910-1995)
Etude aux Chemins der Fer (Railroad Study) (1948) available on *OHM: Early Gurus of Electronic Music: 1948-1980* released on Ellipsis Arts CD 3690 (2000).

Pierre Schaeffer and Pierre Henry (b.1927)
Symphonie pour un Homme Seul (1950) available on *Symphonie pour un Homme Seul/ Le Voyage* released on Philips CD 464 533-2 (2000).

Karlheinz Stockhausen (1928-2007)
Studie I (1953), *Studie II* (1954), and *Gesang der Jünglinge* (1955) all available on *Stockhausen: Elektronische Musik 1952-1960* released on Stockhausen – Verlag CD Stockhausen 3 (1991).

Edgard Varèse (1883-1965)
Poème Électronique (1957-58) available on *An Anthology of Noise and Electronic Music/ First A-chronology 1921-2001* released on Sub Rosa SR 190 (2002).

Iannis Xenakis (1922-2001)
Diamorphoses (1957-58) available on *Xenakis: Electronic Music* released on Electronic Music Foundation Ltd. EMF CD 003 (1997).

Joji Yuasa (b.1929)
The Sea Darkens (1987) available on *Computer Music Currents Volume 7* released on Wergo WER 2027-2 (1990).

<u>Chapter Three:</u>

Milton Babbitt (b.1916)
Philomel (1962) available on *Philomel* released on New World Records CD 80466-2 (1995).
Vision and Prayer (1961) available on *Milton Babbitt* released on Composers Recordings Incorporated CRI 521 (1988).
Audio Example courtesy of New World Records.

Benjamin Broening (b.1967)
Nocturne/Doubles (2001) available on *Music from SEAMUS (Society of Electro-Acoustic Music in the United States) vol. 13* CD EAM-2004 (2003).
Audio Example courtesy of Benjamin Broening.

John Cage (1912-1992)
Williams Mix (1952) available on *The 25-Year Retrospective Concert of the Music of John Cage* released on Wergo WER 6247-2 (1994).
Audio Example courtesy of Copyright © by Henmar Press, Inc. All rights reserved. Used by permission of C.F. Peters Corporation.

Eric Chasalow (b. 1955)
Suspicious Motives (1999) available on *Left to His Own Devices* released on New World Records CD 80601-2 (2003).
Also available on *Music from SEAMUS vol. 11* CD EAM-2002 (2001).
Audio Example courtesy of New World Records.

Mario Davidovsky (b.1934)
Synchronisms No. 6 (1970) available on *The Music of Mario Davidovsky, Volume 3* released on Bridge Records, Inc. CD 9171 (2005).
This recording also includes *Synchronisms No. 5* (1969) and *Synchronisms No. 9* (1988).

Richard Devine
Tetrad available on *Cautella* released on Sublight Records SLR 601 (2005).
Audio Example courtesy of Richard Devine.

Brian Eno (b. 1948)
Unfamiliar Wind (Leeks Hills) available on *Ambient Four: Land* (1982) released on Astralwerks Records (1982).
Copyright permission request in progress.

Hubert Howe (b.1942)
Timbre Study No. 5 (1991) available on *Overtone Music* released on Capstone Records CD CPS-8678 (2001).
Audio Example courtesy of Hubert Howe.

Paul Lansky (b.1944)
Notjustmoreidlechatter (1988) available on *More Than Idle Chatter* released on Bridge Records CD 9050 (1994).
Six Fantasies on a Poem by Thomas Campion, "Her Voice" (1978-79) available on *Fantasies and Tableaux* released on Composers Recordings Incorporated CRI 683 (1994).
Audio Examples courtesy of Paul Lansky.

Hugh LeCaine (1914-1979)
Dripsody (1955) available on *Anthology of Canadian Music: Electroacoustic Music* released on Radio-Canada ACM 37 (1990).
Copyright permission request in progress.

Otto Luening (1900-1996)
Fantasy in Space (1952) available on *Pioneers of Electronic Music* released on New World Records CD 80644-2 (2006).
Audio Example courtesy of New World Records.

Otto Luening and Vladimir Ussachevsky (1911-1990)
Incantation (1953) available on *Pioneers of Electronic Music* New World Records CD 80644-2 (2006).
Audio Example courtesy of New World Records.

James Mobberley (b. 1954)
Spontaneous Combustion (1991) available on *Music from SEAMUS vol. 1* CD EAM-9301 (1991).
Audio Example courtesy of James Mobberley.

Paul Oehlers (b.1971)
Archetypal Infusion: MemEry2k (2000) available on *Music from SEAMUS vol. 11* CD EAM-2002 (2001).
Audio Example courtesy of Paul Oehlers.

Pauline Oliveros (b. 1932)
Bye Bye Butterfly (1965) available on *OHM: Early Gurus of Electronic Music: 1948-1980* released on Ellipsis Arts CD 3690 (2000).
Copyright permission request in progress.

James Phelps (b. 1954)
Chordlines (1990) available on *Music from SEAMUS vol. 1* CD EAM-9301 (1991).
Audio Example courtesy of James Phelps.

Russell Pinkston (b. 1949)
Gerrymander (2002) available on *Music from SEAMUS vol. 13* CD EAM-2004 (2003).
Audio Example courtesy of Russell Pinkston.

Anna Rubin (b.1946)
Crying the Laughing and Golden (1983) available on *Electric Music: Anna Rubin and Laurie Hollander* released on Capstone Records CPS-8743 (2004).
Audio Example courtesy of Anna Rubin.

Denis Smalley (b.1946)
Empty Vessels (1997) available on *Sources/scènes* released on Empreintes Digitales IMED 0054 (2000).
Copyright permission request in progress.

Morton Subotnick (b.1933)
The Wild Bull (1968) available on *Morton Subotnick: Silver Apples of the Moon The Wild Bull* released on Wergo WER 2035-2 (1994).
Audio Example Courtesy of WERGO/Schott Music & Media, Mainz, Germany, www.wergo.de and Morton Subotnick, Morton Subotnick: "The Wild Bull" from the album: *Silver Apples of the Moon / The Wild Bull* (WER 2035 2).

Vladimir Ussachevsky (1911-1990)
Of Wood and Brass (1965) available on *Vladimir Ussachevsky: Electronic and Acoustic Works 1957-1972* released on New World Records CD 80654-2 (2007).
Wireless Fantasy (1960) available on *Vladimir Ussachevsky: Electronic and Acoustic Works 1957-1972* released on New World Records CD 80654-2 (2007).
Audio Examples courtesy of New World Records.

Stephen Vitiello (b.1964)
Marfa Mix (excerpt, 2003) available on *An Anthology of Noise and Electronic Music/Fourth A-Chronology 1937-2005* released on Sub Rosa SR 250 (2006).
Marfa Mix (version 4) available on *Listening to Donald Judd* released on Sub Rosa SR 245 (2007).
Audio Example courtesy of Stephen Vitiello.

Trevor Wishart (b.1946)
American Triptych (1999) available on *Voiceprints* released on Electronic Music Foundation Ltd. EMF 029 (2000).
Tongues of Fire (1995) available on *Voiceprints* released on Electronic Music Foundation Ltd. EMF 029 (2000).
Audio Examples courtesy of Trevor Wishart.

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BIOGRAPHICAL SKETCH

Megan Fogle began studying the violin at age 8, which eventually led to her entering the music program at University of North Florida before transferring to Stetson University. At Stetson University she received a BM in Music Theory and Composition, studying with Noel Painter and Kari Juusela. Works completed at Stetson University include the essay “Examining a Major/Minor Duality within Corigliano’s Sonata for Violin and Piano,” and compositions such as *Beautiful* (Electronic), *Sich Graman* (Speaker, Violin, Cello, and Piano), *The Sounds* (For Prepared Piano), and *The Note* (Baritone and Cello). Continuing her education at Queens College, City University of New York, she received a MA in Music Theory. Studying with Joseph Straus, William Rothstein, and David Gagne, she completed essays such as “Exploring the 5/7 Cycle in Tan Dun’s Ghost Opera” and “The Special Relationship of a Semitone in Rochberg’s String Quartet No. 3.” Returning to Florida, she then entered in Florida State University’s Ph.D. program for Music Theory. While at Florida State University she received a Graduate Assistantship, teaching written and aural theory within the core undergraduate curriculum, and was nominated by her students for Florida State University’s Outstanding Teacher Assistant Award. Her choice of dissertation topic was prompted in part by her experience as a composer, both acoustic and electronic, which began during her undergraduate studies. Along with her interests in twentieth-century music in general, including the pop genre, she is also interested in the symphonic and string quartet traditions, which stems from her previous training as a violinist.