

SOURCE-BONDING AS A VARIABLE IN ELECTROACOUSTIC COMPOSITION:

FAKTURA AND ACOUSTICS IN *UNDERSTATEMENTS*

Ilya Y. Rostovtsev, B.S.

Thesis Prepared for the Degree of

MASTER OF MUSIC

UNIVERSITY OF NORTH TEXAS

December 2010

APPROVED:

Jon C. Nelson, Major Professor

Andrew May, Minor Professor

Joseph Klein, Committee Member and Chair,
Division of Composition Studies

Lynn Eustis, Director of Graduate Studies in
the College of Music

James C. Scott, Dean of the College of Music

James D. Meernik, Acting Dean of the Robert
B. Toulouse School of Graduate Studies

Rostovtsev, Ilya Y. Source-bonding as a Variable in Electroacoustic Composition: Faktura and Acoustics in *Understatements*. Master of Music (Composition), December 2010, 36 pp., 4 illustrations, references, 17 titles.

Understatements for two-channel fixed media is a four-movement study of the sonic potential of acoustic instruments within the practice of electroacoustic studio composition. The musical identity of the entire composition is achieved through consistent approaches to disparate instrumental materials and a focused investigation of the relationships between the various acoustic timbres and their electroacoustic treatments. The analytical section of this paper builds on contemporary research in electroacoustic arts. The analysis of the work is preceded by a summary of theoretical and aesthetic approaches within electroacoustic composition and the introduction of primary criteria of sonic *faktura* (material essence) used in the compositional process. The analyses address the idiosyncratic use of the concept of *faktura* to contextualize and guide the unfolding of the work. The reconciliation of the illusory electronic textures and the acoustic sources that parented them may be considered the ultimate goal of *Understatements*.

Copyright 2010

by

Ilya Y. Rostovtsev

ACKNOWLEDGEMENTS

The sources for the composition required instrumental talents of Jonathan Jackson (percussion), Nicholas Kanozik (clarinet), and Sarah Page Summar (violin). Studio recordings were engineered by Jason Fick, Brian Hernandez, and Patrick Peringer.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	iii
LIST OF FIGURES.....	v
1. INTRODUCTION.....	1
2. THEORIES AND AESTHETICS OF ELECTROACOUSTIC COMPOSITION.....	2
2.1 Acousmatic Practice and Soundscape Composition.....	2
2.2 Spectromorphology.....	4
2.3 Faktura.....	7
3. ANALYTICAL APPROACHES TO <i>UNDERSTATEMENTS</i>	9
3.1 The First Movement.....	9
3.2 The Second Movement.....	13
3.3 The Third Movement.....	20
3.4 The Fourth Movement.....	26
3.5 <i>Understatements</i> as a Whole.....	30
4. CONCLUSION AND FURTHER RESEARCH.....	33
WORKS CITED.....	35

LIST OF FIGURES

Fig. 1, Perepelochka.....	9
Fig. 2, The spectral-smearing effect.....	15
Fig. 3, A hybrid gesture.....	21
Fig. 4, Digital presence in the quiet moments of movement [iii].....	23

CHAPTER 1

INTRODUCTION

Understatements for two-channel fixed media is a four-movement study of the sonic potential of acoustic instruments within the practice of electroacoustic studio composition. The odd-numbered movements explore the acoustic totalities of single instruments: in [i] a Belorussian Perepelochka (a zither toy instrument) and in [iii] a violin. The even-numbered movements explore closely related sound families: reeds of a clarinet and an accordion in [ii] and several percussion instruments in [iv]. The musical identity of the entire composition is achieved through consistent approaches to these disparate materials and a focused investigation of the relationships between the various instrumental timbres and their electroacoustic treatments.

The analytical section of this paper builds on contemporary research in electroacoustic arts. The analysis of the work is preceded by a summary of theoretical and aesthetic approaches within electroacoustic composition and the introduction of primary criteria of sonic *faktura* (material essence) used in the compositional process. The analyses address the idiosyncratic use of the concept of *faktura* to contextualize and guide the unfolding of the work.

CHAPTER 2

THEORIES AND AESTHETICS OF ELECTROACOUSTIC COMPOSITION

2.1 Acousmatic Practice and Soundscape Composition

Two principal philosophies receive substantial support in the scholarly discourse of electroacoustic music: the abstract expression of *acousmatic composition* and a contrasting approach of *soundscape art*. Acousmatic practice relies on the notion of *disembodied sound*: sounds whose sources are unclear to the listener. This may be achieved by using exotic sources (synthetic sounds, field recordings, etc.), and extensive digital alteration of sounds. Within this practice, the appropriation of sources devoid of musical purpose marks the proverbial fountainhead of its aesthetic.¹

The codification of listening became an integral part of the electroacoustic approach, as proposed by Pierre Schaeffer, the founder of *musique concrète*.² He developed four listening modes that define aspects of the listening process. Writings of the British electroacoustic composer and theorist Denis Smalley have further outlined listening approaches to disembodied sound constructions. The non-musical sounds that defined the early phases of *musique concrète* required new terminology. In place of traditional constructs of melodic and harmonic motion, the acousmatic sonorities are defined as *sound-objects*. Their properties of *space*, *behaviors*, *energy*, and *motion* define the musical functions of *gesture* and *utterance*.³ Although these low-level

¹Denis Smalley, "The Listening Imagination: Listening in the Electroacoustic Era," *Contemporary Music Review*, 13(2) (1996): 77.

²Marc Battier, "What the GRM brought to music: from *musique concrète* to acousmatic music," *Organised Sound* 12(3) (2007): 189-190.

³The technical terms used here are from "The Listening Imagination: Listening in the Electroacoustic Era."

theoretical constructs may be applied to traditional instrumental music, the approach primarily addresses the expanded vocabulary of the acousmatic sounds.

The concept of disembodied sound is revolutionary, but it is constantly tested by the tendency of the human mind to ascribe causality to sounds.⁴ This effect is referred to as *source-bonding*; its presence is often independent of the compositional intent, but its manipulation is an important part of the electroacoustic composer's art.⁵ Spatial location of disembodied sources is another important compositional opportunity: the human ear is quick to identify proximity and movement of sounds. Drawing from the listening experiences of the natural world, electroacoustic works synthesize virtual terrains, populated by acousmatic gestures.

Source-bonding effects allow non-traditional sounds to take the role of active communicators. Recordings of “sounds of a culture,”⁶ of natural phenomena,⁷ and of spoken text all provide identifiable, source-bound elements in electroacoustic works. The practice of soundscape composition explores the programmatic nature of representational sources. Its aesthetic goal elicits an effect of sonic presence. Soundscape composition emphasizes the dialectic between referential and abstract sounds, rather than the transformations applied to them.⁸ For instance, soundscape compositions may utilize a field recording to generate the aural experience of a physical location. They may also employ painstaking construction of a composed space, or adhere to the use of a digital process without disallowing the listener to connect the sounds with their environmental origin. Considering the wealth of exotic sources outlined in the discussion of acousmatic practice above, both acousmatic and soundscape approaches can be considered as inclusive umbrellas rather than exclusive aesthetic practices.

⁴James Andean, “The Musical-Narrative Dichotomy,” *Organised Sound* 15(2) (2010): 108.

⁵Denis Smalley, “Spectromorphology: explaining sound-shapes,” *Organised Sound* 2(2) (1997): 110-111.

⁶Hildegard Westerkamp, *Gently Penetrating Beneath the Sounding Surfaces of Another Place*, 1997

⁷Denis Smalley, *Empty Vessels*, 1997.

⁸Barry Truax, *Acoustic Communication* (Wesport: Ablex Publishing, 2001), 237.

Understatements approaches the electroacoustic medium with a goal of seeking interaction between the acousmatic and representational perspectives. Acousmatic presence is achieved by processing instrumental sounds. Non-instrumental *concrète* elements further expand the sonic language of the composition. The musical functions of sounds within the piece evolve from their deployment and transformation in sound and space.

2.2 Spectromorphology

Each of the musical instruments used as sound sources in *Understatements* was approached as a physical object first, and as a music-producing construction second. Many of the sounds would not normally be associated with the instruments that produce them (for example, percussive sounds on the body of a stringed instrument). These sounds are disembodied from the start; at the same time, their spectra are determined by the physical properties of the instruments.

The totality of the musical motion of the piece adheres to the acousmatic construct of *spectromorphology*. Denis Smalley defines spectromorphology as the means of interaction between sound spectra and the composer's methods of shaping spectra in time.⁹ Spectromorphology provides a theoretical framework for the musical appropriation of abstract sound-events: the emancipated sounds of *musique concrète* and acousmatic compositions favor abstract sound-evolution over time.¹⁰ Spatial illusions also adhere to a spectromorphological design: reverberant processes, for instance, apply selective prolongation of sounds to give an appearance of a surrounding space.

⁹Denis Smalley, "Spectromorphology: Explaining Sound Shapes," *Organised Sound*, 2(2) (1997): 107.

¹⁰James Andean, "The Musical-Narrative Dichotomy: *Sweet Anticipation* and Some Implications for Acousmatic Music," *Organised Sound*, 15(2) (2010): 108.

Spectromorphology is a versatile concept. Smalley's definition includes traditional musical behaviors, including pitch processes, textural strategies, and techniques of orchestration. The framework of spectromorphology addresses the gamut of spectral manipulations available in both traditional techniques and electroacoustic tools. It is an important generalization of sound events and their musical functions.

The technological aspects of electroacoustic music, however, cannot fully address questions of musical design; likewise, traditional concepts of music ignore the fact that instruments are themselves technological artifacts. The opportunities and limitations of any music-producing technology, instrumental or electronic, inform and filter the composer's craft. However, where instrumentalists seek stable and consistent designs, practitioners of electroacoustic music tend to fetishize the "cutting edge" of instrumental evolution. A focus on technology and technique pervades the culture of electroacoustic composition. This conditions the experience of both composer and listener, in ways that can detract from an awareness of conceptual design, form, pacing, and other crucial dimensions of the music. Traditional instrumental performers experience a similar occupational hazard of being distracted from the music by technical evaluation of a performance. Such *technological listening* may ignore the musical expression of an electroacoustic work completely.¹¹

Spectromorphological motions employed in *Understatements* often showcase the instrumental technologies of their acoustic and digital sources. In addition to the generation of abstract sounds and illusory models of spatial and behavioral properties, the technological presence and its effect on source-bonding phenomena are explored. Such *observed processes* discourage technological listening by integrating source sound, sonic transformation, and

¹¹Denis Smalley, "Spectromorphology: Explaining Sound Shapes," *Organised Sound*, 2(2) (1997): 108-109.

technological apparatus as defining features of spectromorphologies. Such subsets of motion will be referred to as *layers* in the remainder of the paper.

The *musical layers* of the work derive their spectromorphological behaviors from traditional models of pitch organization within rhythmic structures. The *acousmatic layers* are characterized by abstract motion of sound-objects. The observed processes allow for temporal traversal of sound-objects between these layers. Electroacoustic works focusing on the exploration of acoustic instruments (e.g. Luigi Ceccarelli's *Cadenza Esplosa* and Françoise Barrière's *3 modes d'air et de lamentations*) rely on studio-based mutations of their instrumental sources. In contrast, Åke Parmerud's *La Vie Mèchanique* explores traditional rhythmic structures within the acousmatic textures.

Similarly, the sound-design principles of *Understatements* form the majority of layers through electroacoustic production. Existence of musical layers within acousmatic settings and the transformations exhibited by the observed processes define the spectromorphological totality of the work. The framework of particular behaviors is derived through the observation of *faktura* as a compositional variable.

2.3 Faktura

Instrumental sources provides fertile but challenging materials for electroacoustic exploration. The challenges of approaching instrumental sounds acousmatically are twofold. Intrinsically, the listening imagination is instantly informed of the sound source upon recognition. At the same time, despite the familiar aspects of the sources, the musical sounds do

not inherently possess any circumstantial meanings appropriated within the narratives of soundscape works. The instrumental design embodies production of particular spectra, but in *Understatements* these are often extended to include sounds that are not traditional or even in some cases recognizable. This demands a compositional approach that addresses the entirety of each instrument's possibilities.

Therefore, the composition embraces the aesthetic concept of *faktura*, defined as a material essence of sources. Originally coined by the Russian Constructivists, the term in itself describes the totality of the observable surface properties. The aesthetic implications of the term are easily transferred onto the musical landscape due to the human ability to identify material properties of sounds. *Understatements* favors sounds showcasing tactile properties of instrumental construction, whether such sounds coincide with the designed function of an instrument or not.

Both the theoretical constructs of spectromorphology and *faktura* expand the artistic palette. In parallel to the spectromorphological modeling of musical behaviors (as discussed in the example of spatial illusions), *faktura* extends artistic strategies. Marc Battier's work appropriates *faktura* as an analytical method for electroacoustic music through the use of an expanded definition coined by constructivist Alexei Gan: "a material knowingly chosen and rationally deployed."¹² Battier proposes to reverse-engineer the initial ideas of the compositional process by investigating technological paradigms.¹³ Since there is no need to reverse-engineer the processes utilized in *Understatements* in light of the full disclosure, this text showcases the application of *faktura* as a unifying principle in generating a body of work from a variety of sources.

¹²Marc Battier, "What the GRM brought to music," *Organised Sound*, 12(3), 2007: 193.

¹³Marc Battier, "A Constructivist approach to the analysis of electronic music and audio art – between instruments and *faktura*," *Organised Sound*, 8(3), 2003: 254.

Large musical structures stem from the interactions of their component parts. The “rational deployment” of materials in *Understatements* supports a clear relationship between a sound source and its faktura. Formation of musical behaviors from physical properties, whether inherent from the musical function of a given instrument or from its material construction, adheres to tactile implications of faktura. The electronic processing of sources possesses two principal functions in spectromorphological formations: creation of acousmatic textures and synthesis of observable processes.¹⁴ Interpretation of the respective faktura of sources, processes, and acousmatic sounds determines context-relative functions that inform the musical motion of the work. The reconciliation of the illusory electronic textures and the acoustic sources that parented them may be considered the ultimate goal of *Understatements*.

¹⁴Since the analyses deal with compositional approaches, the studio processes of pre- and post-production are omitted from the discussion entirely. The functions of noise-removal or pre-mastering optimization of the final mix for loudspeakers are assumed to be purely technical and provide as much musical function as would the lifting of the curtain prior to a musical performance on a stage.

CHAPTER 3

ANALYTICAL APPROACHES TO *UNDERSTATEMENTS*

3.1 The First Movement

The opening movement sets forth the conceptual parameters for sonic exploration in *Understatements*. The texture-driven narrative of the first movement is constructed from a minimal set of materials that represent the faktura of a Perepelochka (see Figure 1). A set of source-behaviors is defined by the temporal implications of the instrumental faktura, the latter characterized in this case by the twelve strings and the wooden body of the instrument. The compositional design is dedicated to showcasing tactile properties within a moving, kinetic narrative.¹⁵



Figure 1: The Perepelochka derives faktura from its physical construction.

¹⁵The emphasis on motion in the first movement was inspired, in part, by Palle Dahlstedt's *Gummi (Rubber)* (1996).

In the early stages of this composition, the use of faktura as a compositional parameter dealt solely with the acoustic whole of a given physical object. Therefore, the musical motions of the movement are characterized by a trio of acoustic behaviors inherent to the instrument: percussive string and body taps, pitched sounds of plucked strings, and noise-behaviors of scraped strings and body. The musical layers are defined according to the acoustic faktura. Particularly, string taps provide raw material for rhythmic constructions; pitched sounds of plucked strings are assembled within larger harmonic structures; and tactile noises of the instrument define source-textures for extended digital manipulations within the movement. The musical functions of these elements vary. For example, the rhythmic element acts as a foreground in the beginning of the piece, as a supporting texture undergoing temporal transformation during the middle section, and as the rhythmic and textural counterpoint in the ending.

The composition of the form promotes unique tactile displays within each section of its ABCB'(C) structure. The introduction of the rhythmic content in the opening section (A: 0:00-0:59) prepares the exploration of identical rhythms within melodic plucked-string settings in the penultimate section (B': 4:48-6:45). The second section (B: 0:59-2:26) consists of three chordal structures, each characterized by contrasting behaviors of electroacoustic motion. The acousmatic treatment of these behaviors within the fourth section (B') preserves the original order introduced in the second section. The third section (C: 2:26-4:48) abandons conventional musical motion in favor of a continuous *ritardando* of the mechanical rhythms of tapped strings set against a new texture of the "wind," which also closes the piece.

The prominence of the contrasting "wind" section (2:26-4:48) illustrates the conceptual approach to *Understatements* as a whole. The acousmatic nature of sonic forms invites a shift in

the listening paradigm of the audience. In contrast to the predominant presence of rhythmic and pitch-oriented contours that characterize the first two and a half minutes of the piece, the understated motion of the new textural contours dramatically alters the spectromorphological profile of the music.

The “wind” sound is a deeply processed sound of both the strings and the body of the instrument rubbed with metal objects; however, this relationship is not perceptible. Prior to the wind section, the piece relies on observable processes for textural evolution. The chords depart from the established sound of plucked strings (0:45-0:57) without facilitating a method of arrival. Source-bound elements (plucked string chords) undergoing observed processes remain source-bound despite the presence of surreal spectromorphologies.

In case of the “wind” section, the dramatic arrival is facilitated by the lack of an observable process. The decision to generate wind textures painstakingly from Perepelochka sources, rather than using a field recording, is consistent with the compositional constraint of showcasing *faktura*. A field-recorded wind sound embodies the physical movement of large air masses, the spatial properties of a physical terrain, and the technologies used to record it; it has its own *faktura*, one markedly different from that of the Perepelochka samples. While the relationship between these samples and the derived wind sounds cannot be directly perceived, the implications of another source sound could be quite perceptible.

By generalizing the above, functions of process may be defined for the entire work. The *instrumental faktura* (defined as source-bound awareness of the sound-generating bodies) are expected to remain bound to the source regardless of the process, provided that the latter may be temporally observed. In contrast, the *process faktura* (acousmatic spectromorphologies of digital processes created from instrumental sources) create disembodied sounds. The manifold of the

compositional space of the first movement is characterized by the union of instrumental and process faktura.

The musical events in the subsequent section (B') showcase the interaction between these theoretical constructs. The prolongation of an ephemeral chime (generated with the Perepelochka) exhibits process faktura, creating an acousmatic environment for the musical behaviors of plucked strings and tapped rhythms (4:48-5:35). Subsequent processing of noise-based motions of the rubbed strings showcases tactile functions of the resonating body of the instrument (5:35-5:56). However, the processing is relatively subtle compared to the acousmatic "wind" and chime prolongation. The preservation of instrumental faktura within processed sounds lies in their similarity to the acoustic source. For example, the granular renditions of plucked string behaviors in the introductory motion (0:36-0:45) exhibit instrumental faktura in preparation of the instrumental emergence (0:45-0:57). Decisions to utilize particular processes within the composition expand the musical behaviors of the instrumental sources.

The relationship between faktura functions and process-based spectromorphologies does not imply a steadfast rule. As long as the instrumental presence remains intact, the process remains observed. In an earlier example, the granular process provides a rhythmic counterpoint to tapped string contours, conceptually connecting noise-pitch explorations of the introductory rhythms within the penultimate section.

The movement is continuously obsessed with groupings of events into threes. Whereas (B) is comprised of three chords expanded with acousmatic prolongations, the opening section (A) employs a trio of events: acoustic faktura rhythms, a process faktura within the bombastic arrival, and a return to rhythmic content set against granular textures of string based behaviors - characterized as instrumental faktura exhibiting observed processes. The "wind" section (C)

features a trio of deeply processed sonic masses derived from string-scratches. The overall shape employs three separate events: slowdown of the rhythms, the sonic masses, and a repose prior to the conclusive section. The narrative, thus, is propelled by contrasting faktura behaviors.

The climax of the piece is the final “bombastic arrival” (of which there are also three) that terminates in reprising wind textures from (C). Contextual differences between these spectromorphologically similar arrivals outline approaches to repetition within *Understatements*. The penultimate hit provides an acousmatic setting for the transformation of the rhythmic contour texture from string taps to plucked rhythms. The opening hit establishes the presence of process faktura within the compositional language of the piece through interruption of the acoustic faktura of the opening rhythms. The climax concludes the acousmatic developments of process-functions within the piece. The “wind” reprise solidifies the abandonment of representational instrumentation in favor of acousmatic expression.

Through the use of contrasting functions of digital processing of acoustic sources, the first movement establishes a dialog between the acousmatic setting and the musical layers of the compositional space. The musical functions of the composed structures are derived from the relationships between the varied faktura.

3.2 The Second Movement

The second movement of *Understatements* explores a paradigm shift within the listening experience. Similar to the first movement, the composition uses musical, spatial, and textural progressions within sequential and contrapuntal models of sound organization. Unlike the first movement, however, the piece utilizes two instrumental sources: a clarinet and an accordion.

Furthermore, the piece integrates unrelated field recordings of non-instrumental sonic events, highlighting their similarities to the observed behaviors of acoustic sources. The movement uses spatial modeling as a compositional approach to structuring these varied sounds.

The *acousmatic space-form* is defined by Denis Smalley as an aesthetically created environment, which utilizes source-bondings and spectromorphological relations to structure perceptual contingencies.¹⁶ Sonic behaviors within the composed terrain thus communicate the properties of a space to an audience. Smalley points out that a complex sound space may not be perceived whole without familiarizing oneself with its component textures first.¹⁷

The slow progressions of the movement's spectromorphologies allow observations of the elemental qualities of a composed space. The experience is designed to provide adequate room for an exploration of the musical space without compromising composed musical layers that form the superficial narrative layer of the composition. Observable processes and process faktura establish formal functions within the movement.

As the introductory clarinet multiphonics (0:00-0:33) undergo mutations, the resulting unfamiliar textures transform the harmonic motion to a generalized element of a static background texture. To facilitate the mutation, clarinet multiphonics are rendered manually using a bank of 1024 sine oscillators to correspond to the respective frequency bins of the phase vocoder analysis. Due to the lack of sharp transients in the clarinet sources, the approach allows for a convincing computer-rendered clone of a multiphonic. The mutation process is facilitated by gradually detuning each of the 1024 oscillators slightly,¹⁸ thereby destroying the careful balance of a complex waveform created by a column of air. The resulting mutation (0:29-0:39;

¹⁶Denis Smalley, "Space-form and the acousmatic image," *Organised Sound*, 12(1) (2007): 40.

¹⁷ibid, 37.

¹⁸The range and direction of pitch-drift in each of the oscillators is determined randomly, as the textural aspect of motion supersedes particular chordal design due to an entirely atonal result.

0:59-1:09) may be observed in a spectrograph rendering of the sonic motion: Figure 2 illustrates the vertical displacement of complex spectra over time.

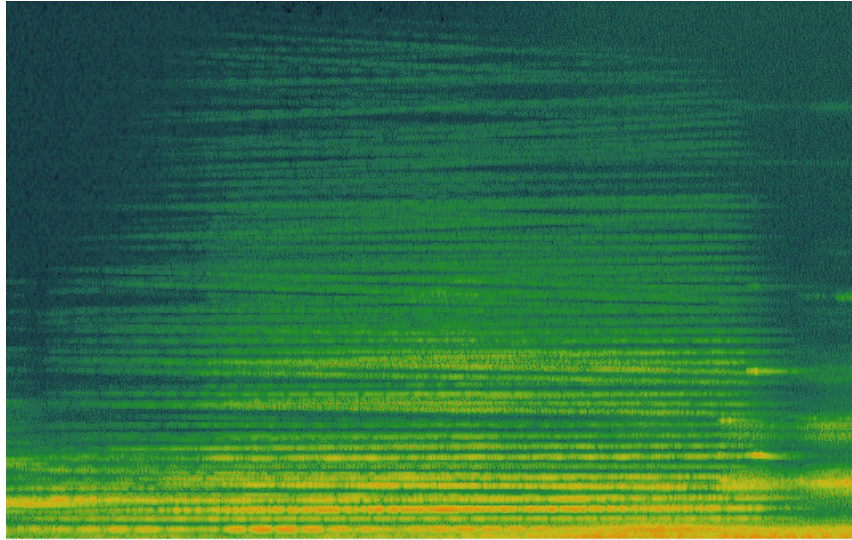


Figure 2: The spectral smearing effect, observed through vertical displacement of partial components of the piece.

Observations of the source-bonding effect in the spectral smearing process generate additional musical functions. Temporal observation of transformations creates a cognitive link between the source and its acousmatic destination. The substitution of accordion tones mutated without observed change, however, is perceived as a continuing motion of a retextured clarinet (1:07-1:18). The observation is largely informed by the relationships between the instrumental and process faktura outlined in the analysis of the first movement. To highlight the prevalence of the accordion-clarinet assumption within the music itself, the sound of the accordion evolves through an opposite process of pitch-shifting partials back to their original values (1:07-1:18).

The composition of the opening harmonic motion concerns itself with spatially placing independent multiphonics to actively facilitate creation of a meta-multiphonic. Spectral profiles

of multiphonics display rich dynamics within the partials of a complex chordal structure. Since the acoustics of multiphonics are informed by the physical space of the instrument, appropriation of multiphonics within a larger harmonic structure require spatial modeling. The sampled source multiphonics (prior to mutation) define the behavioral space¹⁹ of composed motion. The multiphonic mixture is facilitated by dynamic reinforcement of “shared partials” (observed through a spectral analysis of sources). Since spectral smearing destroys the harmonic profile of a sounding multiphonic, the processed multiphonics required a shift away from the foreground.

The background component of the formed accordion tone is thus hardly noticeable, despite providing an understated arrival of the textural progression. Compounded “smearing” effects shift the musical language from the acoustic faktura of the instrumental source into acousmatic functions of the process faktura. The observed process in this case retains a source-bound interpretation of the musical motion. The shift from the musical layer of representational sources into the acousmatic relations of mutated multiphonics occurs without the dramatic arrivals that characterize similar events in the first movement.

The creation of a spatial illusion becomes more challenging once the sounds become substantially disembodied. For example, an unfamiliar source processed with reverberant modeling may imply sustaining properties in the source sound itself rather than a spatial construct.²⁰ Due to the focus on the acousmatic listening experience in the second movement, the harmonic motion of the multiphonics is largely abandoned in the second section. The composition focuses on textural expansions of the sounding space.

¹⁹Defined by Smalley as a component of a space-form that maps the behaviors of signals (in this case, clarinet multiphonics) within the compositional space; Denis Smalley, “Space-form and the acousmatic image,” *Organised Sound*, 12(1) (2007): 36.

²⁰Natasha Barrett, “Spatio-musical composition strategies,” *Organised Sound*, 7(3) (2002): 315.

The implementation of acousmatic space-form within the construction of the movement reflects the compositional design. Smalley defines the *zoned space* as sonic properties implying territorial presence. The *signal space* is derived from spatial characteristics of sounding bodies. The musical narrative of the movement is derived from spatial construction. The introductory motion concerns itself with exposing sounds that span the signal space of the subsequent (more complex) space-form. Adhering to the meta-multiphonic space, the textural smearing of clarinet signals establishes them as distant layers, thereby establishing illusory zones of the composition. The second formal section of the movement increases the number of simultaneously sounding zoned spaces. The varied signal behaviors showcased through the introduction of acousmatic sources unrelated to either of the acoustic instruments provide the primary textural evolution of the movement.

The sonic behaviors of the accordion used in the recording session included non-musical sounds of the creaking leather strap. The acoustic faktura of the leather strap is unique to the accordion source within the composition, although its disembodied recording is not likely to be source-bound with ease due to the idiosyncratic nature of the source. The sounds of the strap, therefore, are treated as an acousmatic parameter. Concrete acousmatic sources used in the second portion of the movement are chosen based on their behavioral equivalence to the instrumental source of the accordion leather strap. The concrete layers include the sounds of ice cracking (4:05-4:22), the sounds of electrical wires (2:10-3:10), and the sounds of rain on a metal surface (3:49-4:20). Digital processes imposed on the concrete sources emphasize their behavioral similarities to the leather strap.

In this case, the instrumental and process faktura outlined in the discussion of the first movement do not apply to the compositional technique. Since the equivalence of sonic behaviors

is sought prior to the appropriation of the concrete materials, they may be thought of as *behavioral faktura* of the compositional space. To avoid potential confusion with the established parameter of process faktura, behavioral faktura observes similarity within unrelated sources, and deploys the new sounds to synthesize an illusion of process, textural expansion of original source(s), or acousmatic arrival indicative of the primary function of process faktura outlined in the analysis of the first movement.

The binary form of the movement, thus, is characterized by the abandonment of the representational progressions of the multiphonic harmonies of the first two minutes of the piece in favor of the dominant space-form of acousmatic materials. The sections are reconciled by the continuing approach of structuring the acousmatic elements within the illusory space of a meta-multiphonic. That is, the concrete sounds and process faktura multiphonics continue to adhere to harmony in accordance to the behaviors of clarinet multiphonics (1:53-2:55).

New acousmatic textures are obtained by feeding “smeared” copies of source clarinet multiphonics into a physical model of metallic cymbals. New textures provide unique spectromorphological profiles, which define the acousmatic musical motion within the second section (2:10-2:55). The mixture of behavioral faktura, concrete elements, acousmatic surrogates of clarinet multiphonics, and acoustic faktura of the accordion bellows effectively expands the acoustic space.

The signal space of processed clarinet textures remains zoned within the expansive landscape consisting of natural and technological noise. The spatial properties of the second section, however, do not abandon faktura approaches established previously. The tactile function of materials is present within the natural and technological behavior faktura. The spatial presence of the sounding process faktura of clarinet materials is informed by the spectral characteristics of

clarinet multiphonics, and thereby embodies the acoustic faktura of the movement's sources. Since the signal space of the opening section of the piece employs strictly instrumental sources, the primary spatial transformations of the piece distance the listener from the instrumental faktura of the source instrumentation

The persistence of the spatial construct demands acousmatic deployment of its components. Accordingly, the traditional musical behavior of clarinet timbral trills is approached acousmatically. The behavioral faktura of the motion is present within the rhythmic qualities of low-frequency sub-tones within the movement. The generation of the rhythmic process faktura within the physical-modeling transformations of source multiphonics precedes the acoustic source of timbral trill (3:00-3:42). Its presence within the expanded space occupies the zoned signal space of the distant clarinet and therefore can only occur at low dynamic levels.

The acousmatic functions of process and behavioral faktura establish the guiding principles for the placement of sounds within sound-spaces. For instance, a behavioral similarity between the timbral trills and the naturally occurring tremolo of several pitches of an old accordion was identified early in the compositional process. Due to the persistence of traditional musical functions in instrumental sources, attempts to integrate such behaviors in the acousmatic space conflicted with the established motions of the movement. The signal zones, once identified, possess autonomous behaviors that reinforce their acousmatic function.

Since behavioral faktura concerns itself with spectromorphological motions rather than source-bonding, the piece adheres to the original compositional intent within its acousmatic motion. The closing low-frequency motions inherit their temporal contours from the accordion tremolos. Envelope following used in the rendering of the final motion links the behavioral

faktura of an instrumental event (in this case, an accordion tremolo) with the process faktura of an acousmatic synthetic source (4:22-5:01).

The second movement demands acousmatic listening. Continuous textural expansion of the acousmatic space-form within the movement, achieved by process and behavioral faktura, borrow their constructions from the acoustic faktura of the clarinet multiphonics. Manipulations of source-bonding provide new methods for composing with faktura.

3.3 The Third Movement

The third movement explores the narrative application of the interactions between the instrumental and process faktura. Derived in its entirety from the acoustic sources of violin recordings, the piece adheres to a highly structured constructivist aesthetic. Within its design, the piece sets identifiable, source-bound sounds within the colorful subtlety of textural expansions and observable processes.

The studio capture of the ephemeral technique of *col legno battuto* performed on a violin establishes the largest subset of acoustic sources utilized in the movement. The pitch material of an individual percussive gesture is determined by the physical forces and location of the bow on the string. From the practical point of view, due to a limited control of the pitch and rhythm variables of the technique, any of the *col legno* gestures may be considered, to a large extent, aleatoric. The fixed-media approach effectively transforms each of the aleatoric *col legno* gestures into a controlled concrete source.

The principal harmonic motion of the piece was achieved through experimental structuring of the original *col legno* gestures. The approach favored primitive computer manipulations of the

sound files: creating chordal structures of multiple col legno gestures,²¹ reversals of individual motions, and “hybrid” sounds achieved by rapidly cross-fading through carefully selected subsets of multiple gestures, as illustrated in Figure 3. The manipulations are non-exclusive, as hybrid forms may contain reversals within its elements. Furthermore, multiple hybrid gestures may be arranged into chords.

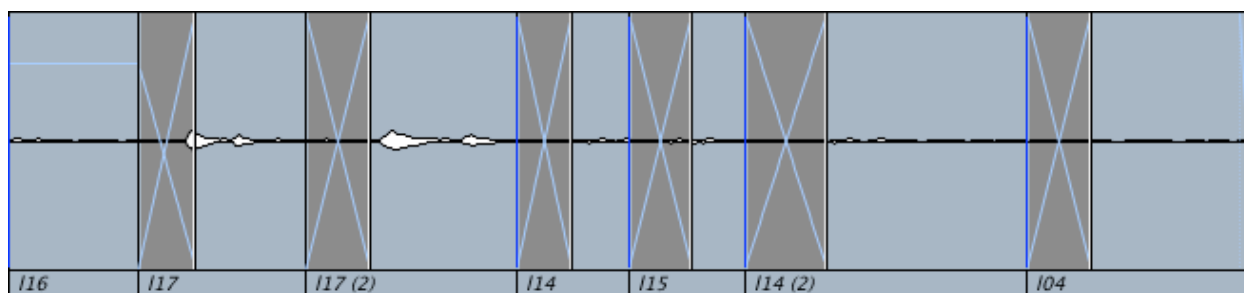


Figure 3: The hybrid gesture, as implemented in Cubase.

The pitch language adheres to the sounding behaviors of the violin performance and therefore is the primary indicator of the acoustic and instrumental faktura.²² The Bartók pizzicato (00:19) and the sound of delicate bowing of the strings length-wise (favoring noise textures over pitch resonance) provide additional displays of the tactile properties of the violin body itself (2:31-2:47, 2:55-3:33). Impulse-responses of the wooden body were generated by striking the instrument and blowing air through its f-holes. Through the process of convolution, the faktura properties of these impulse responses could be applied to deeply processed sounds.

²¹Invisible manipulations of the temporal qualities of gestures necessary for the correct delivery of the chordal structures do not possess a musical function and therefore are omitted from the discussion.

²² Considering the above discussion of the aleatoric nature of the technique, the very behavior of source gestures is reflective of tactile properties: the pace of the bouncing, preserved whenever possible, provides an aural showcase of string tension and gravitational force, regardless of the correct source-bonding on behalf of the listener.

The compositional process involved two phases of dealing with the musical material: the structuring of acoustic elements into *source variations* and a linear narrative of electroacoustic processes subsequently imposed on them. As mentioned above, the primitive nature of electronic processes utilized in the creation of source variations allowed for maximal capitalization of the instrumental faktura. However, this also allowed for the exploration of the musical function imposed by the process faktura of sound-reversals. The harmonic profile of the original source structure (0:00-0:52) is repeated verbatim during the secondary section characterized by the prominence of reversed motions (0:52-1:25). Despite the repetition of the harmonic content, the phrasing was purposefully altered: original gestures facilitating localized climaxes were treated as incidental transitions while the previous transitory elements of the source variations were emphasized as arrivals (without reversals applied). Borrowing from the traditional terminology, musical functions of antecedent and consequent phrases were reversed.

Due to the simplicity of sound-reversal technique, its process faktura remains source-bound within the listening imagination. The musical reversal of antecedent and consequent phrasing, however, illuminates complex behaviors within the *col legno* sources. The unpredictable pitches that end each gesture do not facilitate arrival-functions within the section. Prominent repetitions of the source variations at the end of the section (1:11-1:24) highlight the repetitive harmonic structuring of the movement.

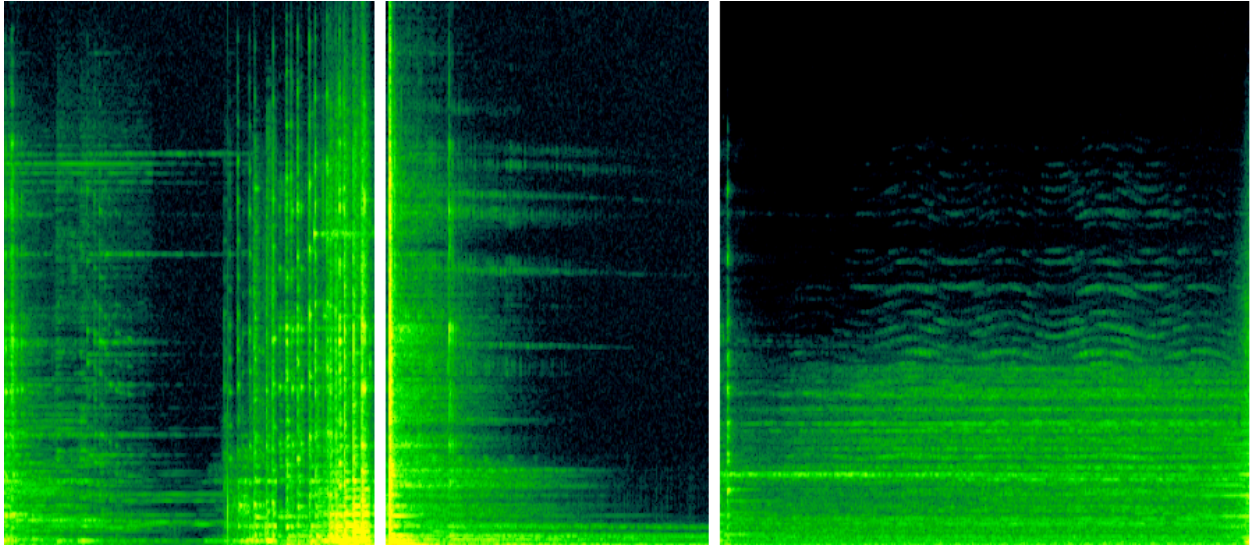


Figure 4: The audible presence of digital function within the quiet moments of the third movement.

The digital processes imposed on the violin sources within the movement favor an understated presence instead of the intense contrasts of process faktura. Short moments of quiet stasis, which follow the motivic units of rapid behaviors, reveal the digital presence. Figure 4 shows spectral analyses of three such quiet moments during which the digital textures are most audible. The first showcases sustaining functions of reverberation; the second introduces pitch-wise drift in reverberant materials, the third exhibits complex spectral motions within the pause. Evolutions of the sustaining processes are explored seamlessly throughout the movement. The textural variance within observed processes relies on subtle use of resonant filters, comb filters, and ring modulation. Low frequencies were generated using several physical models of a drum membrane.²³

²³ To facilitate the generation of the drum membranes, a generalized algorithm was implemented. Written in PHP, the script generalizes the CSound code of a drum membrane model written by Jon Nelson to facilitate parametric constructions of congruent mesh models.

Digitally altered copies of the source materials sustained with reverberation techniques produce the illusion of a transforming space. Due to the fragility of spatial illusions, the mixing of texturally varied reverberant prolongations required low amplitudes.²⁴ Similar approaches were utilized when dealing with drastically mutated *col legno* sources. Due to the abundance of processing techniques during the first half of the movement, the subtlety of their presence in the piece is crucial to the preservation of the designed motion within the source variations. Furthermore, the instrumental faktura showcased by the musical motions of the acoustic *col legno* retains the source-bonding effect throughout the deeply processed second half of the movement.

The final section of the piece masks the original sonic properties of source variations in favor of two simultaneously occurring processes, separated within the stereo mix by hard panning (1:43-2:55). The left channel is occupied by enharmonically tuned comb filters, which generate a combined effect of an organic metallic resonance. The right channel exhibits waveshaping and ring-modulation distortion of the original sound, bringing attention to a digital presence. The process faktura of the simultaneous delivery of the two, however, is not concerned with a comprehensive communication of its compositional structure as much as with the experience of a texturally complex whole.

The prevalence of source-bonding within the third movement diminishes acousmatic expression. As with the plucked string materials of the first movement that retain their source-bonding throughout the processing of chordal structures, the instrumental faktura of the *col legno* materials remains prominent. Ironically, much of the motion within the third section is composed from hybrid gestures. Acoustically impossible progressions through gestural subsets are accepted as sounding sources, even though they do not adhere to the physical properties of the gestures

²⁴Natasha Barrett, "Spatio-musical composition strategies," *Organised Sound*, 7(3) (2002): 315.

deployed in the section. The effect of source-bonding in the final section of *col legno* materials does not provide an adequate departure from the acoustic faktura of the musical texture.

Amplified delicate sounds of the length-wide bowing of the strings function as counterpoint to the rhythmic *col legno* progressions. The ending of the movement is created from several pitch-shifted copies of these resonant noise-textures, convolved with the impulse responses of the tapped body (2:55-3:43). While the technical approach is focuses on the tactile faktura properties of the violin, the use of noise within the composition does not provide a link with the acoustic instrumental faktura of the source.

Considering the textural variance presented in the closing motion of the *col legno* variations and the acoustic properties of the final sound, the conclusion of the movement underlines several practical implications of source-bonding within the electroacoustic listening experience. First, the persistence of the behavioral consistency enables the audience to correctly identify the sources in spite of textural variance. Second, the listener's ability to source-bond is largely dependent on the musical function of the faktura elements within a space, rather than through observations of the acoustic presence alone. The latter is responsible for the potential disconnect between the acoustic ending resonance and the perception of a violin within the listening imagination of an audience. The former reinforces the importance of dramatic (non-gradual) arrivals outlined in the analytical discussion of the first movement. The conclusion of the piece functions as a textural arrival point of the composition, despite its adherence to the acoustic faktura.

Although the third movement is particularly specific in its choice of materials and its allocation of the processing mechanics, its compositional methods support the claims made in the analyses of the first two movements despite the lack of acousmatic sources. A source-bonded

approach to electroacoustic writing utilizes the listener's assumptions of the instrumental sources inherent in the gestures, even when presented with texturally variant man-made structures. The listener's interpretation of sonic realities, therefore, is largely dependent on his or her familiarity with the instrumental sources, and the exhibited sonic behaviors that define the materials of composition.

3.4 The Fourth Movement

The first three movements of the piece rely on the effect of instrumental source-bonding in their narratives. It suffices to say that behaviors of sonic motion are greatly contingent on the interaction between the three types of faktura. Musically driven by spectromorphological relations, the final movement of the piece creates an acousmatic terrain.

The source recordings include a concert bass drum, a snare, a tam-tam, and a Tibetan singing bowl. With the exception of the bowl, a DPA 4060 miniature microphone was taped to the surface of each of the instruments during recording. Sounds were generated by dragging a rubber ball on the surfaces of the snare and the bass drum. The tam-tam and the singing bowl were also bowed. Resulting sounds showcase the instrumental surfaces. Additionally, the singing bowl was placed on the membranes of the concert bass drum and the snare, facilitating recordings of *acoustic interactions* between the instruments. These interactions provide an inherent link between the instrumental totality of the piece.

The basic principle behind the electroacoustic exploration of the surface-noises lies in expansion of the audible masses, both in the creation of a vast composed space as well as in the synthesis of massive sounding bodies. However, the temporal domain was preserved in its entirety, regardless of pitch-alterations imposed on the sources. The illusion of enlarged objects

within a massive space, characterized by the extensive use of reverberation and an abundance of sub-sonic growls, facilitates an illusion of rapid motions due to the preservation of the temporal domain.

The subsonic masses (generated with the singing bowl, rubbed concert bass drum, and tam-tam) that dominate the opening exhibit process faktura (0:00-0:25). However, acoustic properties of these sources remain audible despite the extreme lowering of pitch-materials. To facilitate a dialog between the textures, the low materials were processed to generate similar sounding masses.

Digital manipulations of sources were inspired by acoustic interactions between the drums and the singing bowl (behavior faktura). Filtering out the rich enharmonic overtones of a bowed tam-tam creates a sound similar to the rubbed bass drum. Inversely, tuning multiple copies of a concert bass drum drone as a non-harmonic overtone models the spectromorphology of the bowed singing bowl. The textural unity of the components is reinforced by the similarity of processes. For example, the effect of chordal dissonance used to synthesize the tam-tam drone out of concert bass drum samples is also applied to the original pitched bowings of the tam-tam.

The foreground motion of deeply processed tam-tam materials in the opening section of the piece is set within the acousmatic soundscape consisting of transformed bass layers (0:25-1:06). The musical motion is achieved through the textural variance within a limited set of source-behaviors. The subtle differences of the low materials alone, derived from the temporal preservation of source-motions, add layers of expressive variance to the sounding masses.

Due to the abstract sound-design, the musical motion of the movement adheres to the acousmatic space-form for its construction.²⁵ Smalley's constructs of a zoned space and behavioral space are easily identified: the low-energy bass drones span the former; the latter is

²⁵Denis Smalley, "Space-form and the acousmatic image," *Organised Sound*, 12(1) (2007): 36.

created through the kinetic presence in the upper range. The rhythmic contours of the processed tam-tam and the singing bowl provide active layers within the spectromorphological profile of the composition. The upper partials of the bass drones provide the details of the *proximate space*.²⁶

The approach solidifies the representational layer of programmatic sound – ignoring such functions from the compositional point of view risks an impractical abandonment of the created acousmatic imagery. The preservation of the musical layer is at the mercy of the “perceptual dominance” of synthesized terrains. For instance, while the composer may equate the opening sounds to warm gusts of air preceding an underground train (and thereby weaves the programmatic narratives to reflect upon these findings), later sections explore acousmatic properties of programmatic sounds.

The musical layer of the fourth movement deals with abstract sounds that have no immediate programmatic functions. Similar to the third movement, the low-energy “rests” sustain the components of the preceding sound masses, revealing component textures (e.g. at 2:30). The spectromorphological profile within such moments inherits its behaviors from the acoustic sources. The contrasting units of alternating “solo” sounds and sound-masses are compositionally approached as audibly different in their behaviors.

Although soundscape functions are presented within the piece, the composer’s familiarity with the sources allows for a limited interpretation of the resulting. The sonic motion is shaped with a concrete goal to continuously reveal sound components or to introduce new combinations

²⁶The definition of the term follows from its literal meaning: the space in close proximity to the listener, without being close enough to be considered *personal*. Smalley’s terminology is certainly poetic: the lack of scientific precision in this case allows the model to adhere to fundamental principles of spatial regard without sacrificing of the inherent freedom of the composer to remain the arbiter of the created experience.

of elements. To an extent, the compositional process within the acousmatic textures of the piece is quite similar to the methods employed in the (mostly representational) third movement.

Like the previous movements, the fourth movement seeks a unique texture that generates a narrative arrival. The outwardly digital bass sound (3:01-3:29) is generated through the process of spectrally mixing two sounds of the concert bass drum drones.²⁷ Although these hybrids are subsequently pitch-shifted downward, the overtones generated by the artifacts of phase-vocoder processes are responsible for the digital presence. As before, the presentation of unique sounds without showcasing the steps necessary for their synthesis is treated as an effective method to propel the audience into a new sonic territory.

The movement's sources are explored through acousmatic transformations, programmatic behaviors, and abstract motions. The processing masks the sources to favor acousmatic listening. The entrance of the Tibetan singing bowl, in turn, provides a subtle, understated climax. This use of the singing bowl is a thematic reversal of the "wind" arrival of the first movement. Both function as formal parameters defined by the textural context of the pieces. The first movement shifts the focus from the instrumental to the process *faktura*. The final movement reveals an acoustic source within the acousmatic setting.

The idiosyncratic behavior of the singing bowl's tone-generation informs the digital processing employed within the section. The circular rubbing of the bowl generates a series of closely-spaced bell-like pulses, occurring whenever the physical motion of the performer conflicts with the vibrations of the bowl. Such moments were cut out, pitch-altered, and prolonged with reverberation on top of the acoustic motion (3:29-4:35). The processing of the original take is minimal, establishing dialog between the instrumental *faktura* of unaltered source and its digital doppelgangers.

²⁷ *pvmix* opcode is utilized in CSound, no pitch-shifting was imposed on the sources

The final chord of the movement recalls the most abundant construction of the entire composition (4:40-5:30). Its chordal character, however, elucidates the process, as new pitches are derived from copies of the pitch-shifted bowl outlined above. The application of the process on a spectrally simple source clarifies pitch-wise departures. The dual function of this process is reflected by its context: the process obfuscates complex materials occurring sparsely, and clarifies itself through a gradual unfolding of simple harmonic content.

The motions of the fourth movement are investigated through the acousmatic presentations of source behaviors. The composition incorporates soundscape designs through appropriations of representational sounds. Throughout the movement, the dialog of process and instrumental faktura provides textural variance to the acousmatic technique.

3.5 *Understatements* as a Whole

The central concerns of *Understatements* remain clear despite expansive compositional approaches utilized in the creation of its movements. The work concerns itself with the relationship of traditional musical contours and acousmatic textures. The dominating processes responsible for the extended textural profile of the piece provide consistent acousmatic functions. Additionally, the formal considerations of the movements and the pacing thereof establish a clear progression through the varied terrains of *Understatements*.

Establishment of acousmatic process faktura in the discussion of the “wind” texture of the first movement highlights the acousmatic approach. Space-form constructions within the second movement showcase instrumental faktura sources within the acousmatic developments. Acoustic

sounds of the first two movements create dramatic shifts between the source-bound events of instrumental and process faktura.

The instrumental presence explored in the third movement abandons acousmatic dominance in favor of electroacoustic structuring of acoustic elements. The process functions employed within the *col legno* gestures exist with variable levels of subtlety. The acoustic fixation of the third movement is contrasted with the acousmatic forms of the final movement. However, the electroacoustic production of the final movement uses acoustic events that exhibit acousmatic function.

The piece favors prolonged chordal structures. The first, second, and fourth movements depend on prolongations of complex spectra. The third movement creates chords from the *col legno* gestures. The presence of discrete percussive pulses within the first and fourth movements provides additional similarity. The rhythmic structures of the first movement are generated entirely from discrete pulses of tapped strings. The motion is composed through the manual structuring of motions throughout the movement. In contrast, the gestures of the *col legno* variations provide concrete rhythmic profiles exhibiting acoustic faktura. The rhythmic process and acoustic faktura of the fourth movement (deployed in “train”-like rendering of the tam-tam textures, the ringing highlights of the singing bowl performance, and the static pulses generated by the contact of the drum membranes with the edges of the singing bowl) are integrated appropriations of purely physical phenomena. The rhythmic motion of the entire piece gradually abandons the impositions of the composer’s rhythmic design in favor of concrete rhythmic structures of the physical origin.

The utilization of the acousmatic space-form within the composition of the second movement is born out of the analytical observations of the behaviors of the motion of layers

within the first movement. Expansive dynamic presence and spatial distances between the sounding components, in turn, inform production of the third movement. The subtle layers of processed *col legno* gestures establish spatial function without direct reliance on the space-form within the musical construction. From the sound design perspective, the even-numbered movements depart from the instrumental sources substantially, while the odd-numbered movements showcase inherent connections between the representational instrumentation and the abstract unfolding of the process faktura. Evaluations of faktura relationships between the processes and acoustic materials provide the composer with an intermediate step in evaluating musical functions of constructed materials.

CHAPTER 4

CONCLUSION AND FURTHER RESEARCH

The choices of the musical materials and their deployment are primary concerns of the electroacoustic practice, parallel to Gan's definition of *faktura*.²⁸ In *Understatements*, the use of *faktura* proved to be an effective method of functional evaluation of musical properties. Through consistent approaches in evaluating musical functions of appropriated sounds, the composer remains informed of the structural functions within a work in progress.²⁹

The analytical section of this paper took seed from necessary analyses employed during the compositional process. The *faktura* approach may inform compositions outside of fixed-media practice. For instance, the compositions for live instrumentation with live electronics may be informed and structured by the contrasting roles of instrumental and process *faktura*. Deployment of concrete materials within such settings showcases behavioral *faktura*. While particular solutions to reconcile the musical functions of *faktura* properties within *Understatements* remain indicative of the composer's aesthetics, appropriations of *faktura* as a set of criteria within the practice of composition remains useful. Acoustic works adhering to acousmatic principles of abstract motion (such as Helmut Lachenmann's approach of *musiqie concrète instrumentale* and Tristan Murail's spectral compositions) may adopt the *faktura* criterion presented in the analytical section.

The *faktura* approach presented here facilitates an acousmatic experience. Evaluation of *faktura* properties as musical function relies on active dialog between the abstract layers of the composition. While exploring representational aspects of recorded sounds, and occasionally

²⁸“A material knowingly chosen and rationally deployed.”

²⁹ Konrad Boehmer, *Electroacoustic Music: Analytical Perspectives*, ed. Thomas Licata, “Koenig – Sound Composition – Essay,” (Wesport: Greenwood Press, 2002): 61.

invoking the possibilities of soundscape design, *Understatements* extends ideals of acousmatic composition, illuminating the breadth of its expressive potential.

WORKS CITED

- Andean, James. "The Musical-Narrative Dichotomy: *Sweet Anticipation* and some Implications for Acousmatic Music." *Organized Sound* 15(2). Cambridge University Press, 2010.
- Barriere, Françoise. *3 Modes d'air et de lamentations*. On *Compendium International 2006 Bourges*. Bourges: Mnémosyne Musique Media, 2006.
- Barrett, Natasha. "Spatio-musical Composition Strategies." *Organized Sound* 7(3). Cambridge University Press, 2002.
- Battier, Marc. "A Constructivist Approach to the Analysis of Electronic Music and Audio Art - between instruments and *faktura*." *Organized Sound* 8(3). Cambridge University Press, 2003.
- Battier, Marc. "What the GRM Brought to Music: From Musique Concrète to Acousmatic Music." *Organized Sound* 12(3). Cambridge University Press, 2007.
- Ceccarelli, Luigi. *Cadenza Esplosa*. On *Compendium International 2006 Bourges*. Bourges: Mnémosyne Musique Media, 2006.
- Dahlstedt, Palle. *Gummi (Rubber)* (1994-96). On *E1999:1*. Stockholm: Elektron Records, 2001.
- Gayou, Èvelyne. "The GRM: Landmarks on a Historic Route." *Organised Sound*, 12(3), 2007.
- Kendall, Gary. "Meaning in Electroacoustic Music and the Everyday Mind." *Organized Sound* 15(1). Cambridge University Press, 2010.
- Licata, Thomas. *Electro-Acoustic Music: Analytical Perspectives*. Westport, CT: Greenwood Press, 2002.
- Sandred, Örjan. "Approaches to Using Rules as a Composition Method." *Contemporary Music Review*, 28(2), 2009.
- Smalley, Denis. *Empty Vessels* (1997). On *Sources/scènes*. Montreal: Empreintes Digitales, 2000.
- Smalley, Denis. "Space-form and the Acousmatic Image." *Organized Sound* 12(1). Cambridge University Press, 2007.
- Smalley, Denis. "Spectromorphology: explaining sound-shapes" *Organized Sound* 2(2). Cambridge University Press, 1997.
- Smalley, Denis. "The Listening Imagination: Listening in the Electroacoustic Era." *Contemporary Music Review* 13(2), 1996.

Truax, Barry. *Acoustic Communication*. Westport, CT: Ablex Publishing, 2001.

Westerkamp, Hildegard. *Gently Penetrating Beneath the Sounding Surfaces of Another Place* (1997). *On Into India*. New Westminster: Earsay Productions, 2002.