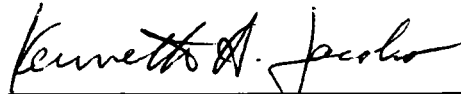


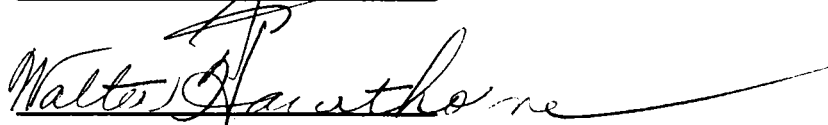
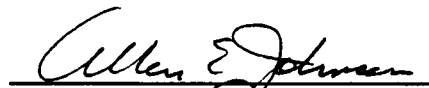
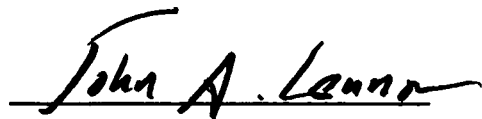
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I am submitting herewith a thesis written by William P. White II entitled Reverie of War for percussion ensemble and tape. I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Music.



Kenneth A. Jacobs
Major Professor

We have read this thesis and
recommend its acceptance:



Accepted for the Council:



Associate Vice Chancellor
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REVERIE OF WAR
for Percussion Ensemble and Tape

A Thesis
Presented for the
Master of Music Degree
The University of Tennessee, Knoxville

William P. White II

December 1991

ABSTRACT

The purpose of this study is to examine the instrument and tape compositions, Déserts by Edgar Varèse, Kontakte by Karlheinz Stockhausen, Lamination 1 by Morton Subotnick, Through the Hourglass (Concerto for Bb Trumpet and Tape) by Kenneth Jacobs, and Reverie of War for percussion ensemble and tape by William P. White II, for their discrete compositional and notational characteristics. Problems of composing for this medium will be discussed and Reverie of War for percussion ensemble and tape will be placed in historical perspective.

Edgar Varèse's Déserts is included in this study because it was the first composition for instrument and tape. Karlheinz Stockhausen is included because of his leadership in the early development of electronic music, especially with respect to combined instrument and tape pieces. Otto Luening describes Stockhausen as:

. . . the boldest, the most energetic, the most dedicated, and single-minded exponent of the Cologne School which is at present (1954) the German School of Electronic Music.¹

In addition, Stockhausen's Kontakte for percussion, piano, and tape features an unusual but easily readable pictorial score.

Morton Subotnick is included in this study for several reasons. First, he has been described as "the composer who writes music that people even like that usually hate electronic music."

¹Otto Luening. Juilliard Review, "Karlheinz Stockhausen," 6: 10 -11 Winter 1958/59.

His music is also endowed with electronic virtuosity: precise, even glittering compositions whose professionalism stands head and shoulders above most of the music of his electronic peers.²

Second, in Subotnick's composition Lamination 1, the tape and orchestra have countless points of interaction and synchronization.

Kenneth Jacobs' work Through the Hourglass gives a current (1990) perspective on instrument and tape compositions and demonstrates how this genre (and electronic music in general) has come full circle in musical development.

The primary means of acquiring data was the examination and comparison of the scores and recordings of the above works for their compositional and notational characteristics.

Several conclusions can be made from this study. First, the development of technology of musical electronics has greatly influenced composers in the field. Second, upon an examination of the works included in this study, one can see how instrument and tape works have evolved in a circular fashion; from the instrument having the primary line to the tape having the emphasis and a return to instruments being the essential element. Finally, the problems of synchronizing live instruments with prerecorded tape are numerous, and the techniques used by each composer to overcome these problems are varied.

²Herbert Russcol. The Liberation of Sound, (Englewood Cliffs: Prentice Hall, Inc., 1972), p. 154.

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I. HISTORICAL DEVELOPMENT OF ELECTRONIC MUSIC AND INSTRUMENT AND TAPE COMPOSITIONS

For the purposes of this study, electronic music is regarded as music that contains electronically generated timbres and concrète (natural) sounds. These timbres are created with analog or digital sound generating devices and are organized and recorded by tape recorder or computer.

While electronic music was and is considered a significant new musical source that composers may choose to explore limitless timbres, one drawback is often the lack of performers and stage activity when a prerecorded composition is premiered. Many composers have recognized this problem and have begun to combine other art forms with electronic music performances. As composers added other media, such as film, slides, light shows, and live instruments, the demand for such music has grown. This study will examine the problems posed by live electronic music with respect to composition and synchronization.

Following are three definitions of live electronic music:

... a performance of electronic music in which all of the music is produced live by synthesizers or other electronic instruments. Another meaning of live electronic music is the live performance by one or more performers using acoustic instruments or voice, along with a prerecorded tape. Still another definition could be a combination of acoustic instruments with live performing electronic instruments.¹

¹ Barry Schrader. Introduction to Electro-Acoustic Music. (Englewood Cliffs: Prentice Hall, Inc., 1982), pp. 2 - 3.

For the purposes of this study, acoustic instruments performing with a prerecorded tape (hereafter *instrument and tape compositions*) will be examined.

The earliest example of this genre is a composition entitled Déserts by Edgard Varèse composed between 1949 and 1954. The work completely avoids the problems of notation and synchronization in composing for instrument and tape, by simply isolating the live instruments (the instruments never play at the same time as the tape). This will be discussed in more detail in Chapter 3.

Otto Luening and Vladimir Ussachevsky founded the Columbia-Princeton Electronic Music Center in 1951 and collaborated on several works.

Rhapsodic Variations (1953) for orchestra and tape was the first of the Luening/Ussachevsky collaborations and was the first work produced at the Columbia-Princeton Center. The tape plays simultaneously with the instruments and displays extensive hocket-type characteristics between live and prerecorded instruments.

With the creation of Musica su Due Dimension for flute and tape in 1952, Bruno Moderna became the first composer to employ extensive interplay between the solo instrument and the tape. He solves the compositional problems in the following manner:

First, there is only one performer, avoiding a compounding of the problem of coordination created by using several performers. Second, the relationship between the flute and tape are somewhat relative; the flutist must follow the tape to a degree, but the coordination is not precise. Third, the flute does have solo passages, so the performer is not always locked into the curious position of being a soloist who must follow the accompaniment.²

²Barry Schrader. p. 163.

In 1955, Luciano Berio joined Maderna in the Milan Studio di Fonologia Musicale of the Radio Audizioni Italiane (RAI). Berio, greatly influenced by a 1952 Luening and Ussachevsky concert of electronic music in New York, composed chamber works for instruments and tape such as Differences (1958 - 9) in which he explored spatial effects in the tape and unusual instrument combinations for the time (e.g., flute, clarinet, harp, viola, and cello).

During the 1960s, composers began to explore the possibilities of altering the sound of acoustic instruments while they were being played on stage. Karlheinz Stockhausen composed several such works, the first of which, Mikrophonie I, was composed in 1964 and employed two microphones placed before a large tam-tam. The microphones are processed by filters and amplifiers, which are controlled by two operators. The filters and amplifiers are manipulated in such a way as to create new timbres during the performance. The second, Mixtur, also written in 1964, processes the live instruments using ring modulators.

Since timbre is dependent upon overtone structures, any alteration of their inherent harmonic content generates new instrumental timbres.³

The third, Mikrophonie II, ring modulates singers' voices with a Hammond organ to produce new timbres.

A natural extension took place in the decade of the 1970s when composers began to explore the use of *control tracks* on tape. Control tracks are not supplied for audio reproduction but act as real-time processing agents to alter the sounds made by the instrumentalists. The problem with this genre is that the control track is prerecorded and entirely inflexible, and the performer cannot

³Ernst, David. Evolution of Electronic Music. (New York: Schirmer Books, 1977), p. 167.

hear the information until he plays, making cues inaudible.

Morton Subotnick, founder of the San Francisco Tape Center in 1959, composed After the Butterfly (1979), which is one of the few compositions to confront this genre. The work is scored for clarinet, trumpet, trombone, percussion instruments, and the control track, which Subotnik named *ghost tracks*.

Subotnick has facilitated coordination in After the Butterfly by providing exact timings in the score and by using a conductor. Subotnik has also created musical cues by having periods of unprocessed sound. For instance, when, on a long-held note, the sound of the trumpet changes from a modulated timbre to a normal timbre, an aural or musical cue is apparent to all the performers.⁴

With the invention of the portable or voltage controlled synthesizer in the 1960s by Robert Moog and David Buchla, University electronic music studios proliferated. During the 1980s, an additional technological breakthrough extended the possibilities of electronic composition to amateur composers. *Musical Instrument Digital Interface* (MIDI) made the portable synthesizer an inexpensive investment, and at the same time created a more accurate instrument with a means by which individual synthesizers, computer systems, and processing equipment could be coordinated.

Digital music systems were introduced in the late 1970s and were perfected in the 1980s. New England Digital's *Synclavier II*, and the *Fairlight Computer Music Instrument* made it possible to see graphic representations of timbre parameters and were the first *workstations*⁵ to appear on the market.

⁴Barry Schrader. p. 170.

⁵This term is used to describe an electronic device which includes a sound generating section, a digital recording section (sequencer), and in some cases an effects processing section.

Synchronization of live instruments with such instruments is only a matter of recording a metronome generated by the sequencer built into the workstation. While the performance is underway, the sync tone, recorded on a multi-track tape machine or generated in real-time, is only heard by the musicians through headphones, making a conductor unnecessary.

With continued changes in the technology of music during the early part of the 1990s, instrument and tape compositions potentially can be more expressive musically. The technology has increased the control which a performer has over the taped portion during a live performance. Foot pedals connected to a computer or hardware sequencer can now control the tempo of the electronic material; the performer may tap his foot on the pedal at the desired tempo and the computer follows. Now, the performer has total control of tempo and may achieve a higher degree of expressiveness. Personal computers have reduced the cost of computer music down, thus benefiting home musicians.

II. EXAMINATION OF COMPOSITIONAL TECHNIQUES EMPLOYED IN FOUR WORKS WRITTEN FOR LIVE INSTRUMENTS AND TAPE

The first composition for instrument and tape was Edgar Varèse's Déserts. The instrumentation includes two flutes, two clarinets, two horns, three trumpets, three trombones, bass tuba, contra-bass tuba, piano, numerous percussion instruments, and two magnetic tapes of organized electronic sounds transmitted on two monophonic channels.

Varèse composed the instrumental portion first; the tape portion was completed in 1954. The live instruments and the prerecorded tape never play simultaneously; thus, problems of synchronization do not exist. The work is performed in the following alternating fashion:

- 1) instruments play bars 1 - 82
- 2) tape portion begins on fourth beat of bar 82
- 3) instruments enter when tape portion is finished at bar 83
- 4) second tape section begins on second beat of bar 224
- 5) instruments enter when tape portion is finished at bar 225
- 6) third electronic section begins on fourth beat of bar 263
- 7) final instrumental section enters when the tape portion is finished at bar 264 and plays to the end

The only coordination between the tape and the live performers required are three cues at the end of each tape portion. A tape operator signals the conductor to cue the performers when the tape portions are finished.

The notational aspects employed in Déserts are traditional. Since the tape and live instruments never play simultaneously, no aural cues are needed, and

the problems of notating timbral changes can be ignored (see Figure1). This composition can be performed without tape if the tape portion is not available, a further indication that the live instrument parts and tape parts were composed independently.

The image shows a musical score excerpt from Karlheinz Stockhausen's *Déserts*, measures 218 to 222. The score is written for five parts: 1 Timp (Tympani), 2 Timbl. (Timp. sticks), 3 Cenc. B. dr. (Cencerre, B. drum), 4 Guiro, and 5 W. dr. (Wood drum). The tempo is marked as 100 beats per minute. The key signature is one flat (B-flat). The time signature changes from 3/4 to 2/4 at measure 219, and back to 3/4 at measure 221. The score includes various musical notations such as notes, rests, and dynamic markings like *pp* (pianissimo) and *ff* (fortissimo). A specific instruction for the Timp part at measure 221 reads "Take slap stick: secco". The score is divided into measures 218, 219, 220, 221, and 222, with measure numbers 218, 219, 220, 221, and 222 written above the staves.

FIGURE 1 Excerpt from *Déserts*.

Karlheinz Stockhausen, a German composer and theorist, was born August 22, 1928, in Burg Mödrath, Germany. While in college at Cologne Hochschule für Musik, he studied composition with Frank Martin. Stockhausen studied the serial works of Schoenberg and Stravinsky, but Webern proved to be the most significant influence on his music. While in Paris in 1952, he studied with Messiaen and Boulez and worked at the French radio studio of *musique concrète*. In 1953, he returned to Cologne and worked in the West German radio studio for electronic music. In 1957, he was invited to teach composition at the Darmstadt summer courses where, over a period of three years, he acquired renown as a teacher. Six years later he founded the Cologne Courses for New Music.

Obviously, Stockhausen was involved in many innovations in electronic music. Live electronic music, a form of live performance with acoustic instruments played into a microphone and then processed by electronic components, was perhaps his boldest technical innovation.

Kontakte, (1958 to 1960) by Stockhausen, is one of the most remarkable instrument and tape compositions, because of the extensive interaction between the tape and live instruments and because of the notational devices. The work was composed in what Stockhausen calls *Moment Form*; he explains this concept in the following manner:

Each moment, whether a state or a process, is individual and self-regulated, and able to sustain an independent existence. The musical events do not take a fixed course between a determined beginning and an inevitable ending, and the moments are not merely consequents of what precedes them and antecedents of what follows; rather the concentration on the Now---on every Now---as if it were a vertical slice dominating over any horizontal conception of time and reaching into timelessness, which I call eternity: an eternity which does not begin at the end of time, but is attainable at every *moment*.²

The instrumentation for Kontakte consists of piano, percussion instruments, and prerecorded tape sounds created at the Cologne studio. Percussion sounds are divided into six types: "metal sound, metal noise; skin sound, skin noise; wood sound, wood noise." The percussion instruments, along with special effects (such as clusters, trills, tremolos, and pedal techniques played by the piano) evoke countless associations with the tape. Simultaneous clusters in the tape and piano also support strong relationships between the two media. Subtle indefinitely-pitched electronic sounds are often in counterpoint with

²Karl Wörne, Stockhausen Life and Work, (Berkeley and Los Angeles: University of California Press, 1973), p. 46 - 47.

similar-sounding percussion instruments. For example,

Electronic and instrumental sounds are blended so that their autonomy is replaced by their interchangeability within a timbral continuum that ranges from dull to bright. Instrumental characteristics are given taped elements through envelope control and filtering; while percussion and piano, due to their inherently rich harmonic content, assume the nature of electronic sounds when played in an unconventional manner.³

The percussion and piano parts use standard pitch notation with a *timeline*⁴ expressed in minutes and seconds. The percussionist receives instrument and mallet information through pictorial symbols. Perhaps the most impressive aspect of Stockhausen's use of notation is the pictorial procedure in which the sounds are represented (see Figure 2).

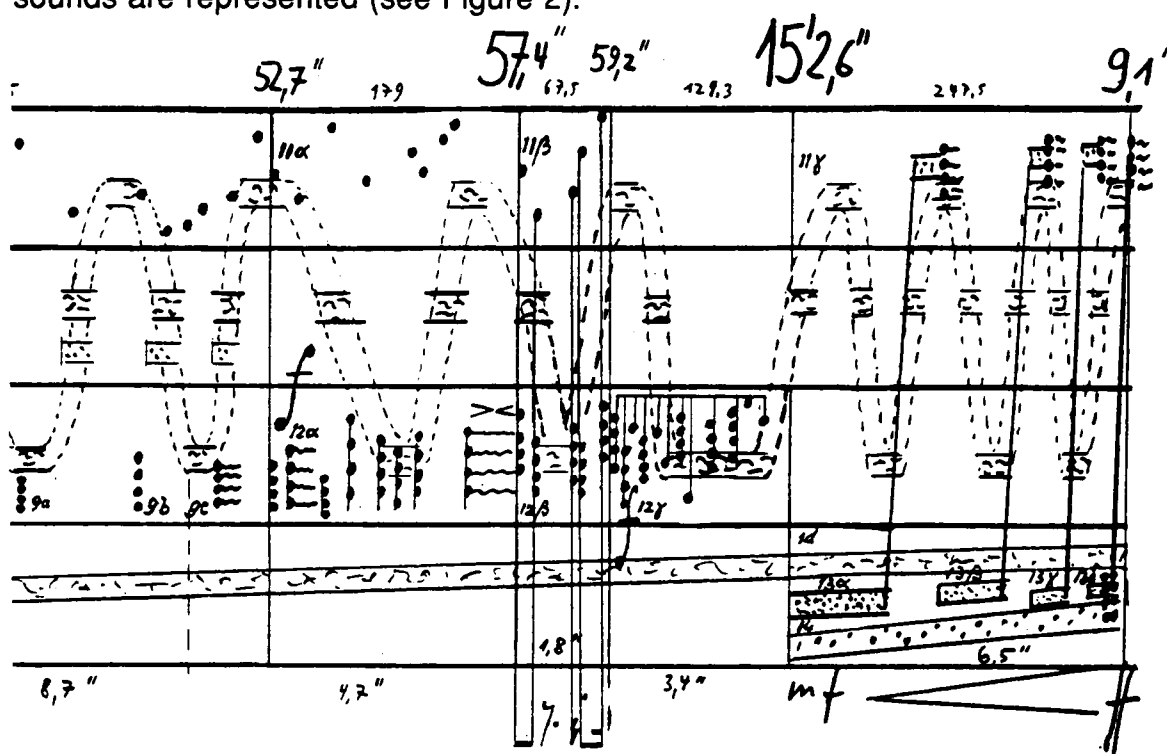


FIGURE 2 Excerpt from Kontakte.

³David Ernst, The Evolution of Electronic Music, (Collier Macmillan Publishing Co., Inc., 1977), p. 127.

⁴Timeline notation - Synchronization by minute and second markings.

Stockhausen has represented, simultaneously, the most aurally obvious elements of the sound (pitch changes, direction, tempo, dynamics) with the nature of the timbre. ...when one looks at the score and simultaneously hears the associated music, a visual-aural correspondence is intuitively comprehended.⁵

The score includes pictures of the equipment Stockhausen employed in Kontakte and gives detailed instructions for realizing the tape sounds. Each electronic module or component is described in great detail and given a pictorial symbol to be used in the patch diagrams. The idea of this section of the score is to give instructions to composers who wish to realize the sounds themselves (for pedagogical purposes).

Morton Subotnick, an American avant-garde composer and teacher, was born April 14, 1933, in Los Angeles, California. He studied at the University of Denver and at Mills College under Darius Milhaud and Leon Kirchner. He first began to work with electronic music while at Mills College. Subotnik taught at Mills College from 1959 - 1966, at New York University from 1966 - 1969, and at the California Institute of the Arts in Los Angeles from 1969 to the present. While at Mills College, he founded and directed the Mills College Performing Group for New Music. Along with Pauline Oliveros and Ramon Sender, he established the San Francisco Tape Music Center in 1961.

Lamination 1 for orchestra and tape, was composed in 1966; the tape portion was a work unique unto itself and written two years earlier under the title Silver Apples of the Moon, Part 1. The instrumentation includes complete woodwind, brass, and string sections, mandolin, numerous percussion instruments, and a stereo two-track tape recorder with amplification.

⁵Barry Schrader, p. 165 - 166.

The coordination of the orchestra and tape is extensive and strict. Roughly, three-quarters of Lamination 1 is synchronized by standard meter markings, while the remaining quarter uses a timeline expressed in seconds. The tape is doubled and sometimes imitated during the work by the live instruments. Even though the tape and orchestra parts were not composed simultaneously, there are clear and unmistakable relationships. Instrumental special effects are abundant and all have timbral correspondences in the tape:⁶

Tremolo = Amplitude Modulation
Muting = Filtering

Fluttertonguing = Modulation
Blowing through the
Mouthpiece = White Noise

Woodwind effects

rattle keys
flutter tonguing
clap hands
snap fingers
blow air through
instrument without
producing pitch

Brass effects

pedal tones
flutter tonguing
clap hands
snap fingers
mutes
slap mouthpiece
pronounce "sss" into
mouthpiece

String effects

col legno
sul ponticello
play behind bridge
harmonics
mutes
tremolo
glissandi
pizzicati
slap body of bass

The tape's notation employs only three symbols: one indicating undefined pitch by an upward pointing arrow; a circle attached to a vertical line indicating white noise; and a box with a horizontal line denoting sustained wavering pitch (see Figure 3). Treble and bass clefs are occasionally used in the tape portion when stationary pitches are present.



FIGURE 3 Excerpt from Lamination 1.

⁶David Ernst, p. 146 - 147.

Kenneth Jacobs was born September 13, 1948, in Indianapolis, Indiana. He studied with Warner Hutchinson at New Mexico State University where he received his Bachelor of Arts and Master of Music degrees. While earning a Doctorate of Music Arts at the University of Texas, Austin, he studied with Karl Korte, Thomas Wells, and Kent Kennan. He has written many types of electronic music, multi-media works for slides and tape, instrument and tape works, and tape works, as well as purely instrumental works. He currently directs the electronic music program at the University of Tennessee, Knoxville.

His work, Through the Hourglass, was completed in June of 1990 and is scored for trumpet and tape. Like Déserts, Dr. Jacobs composed the instrument parts before the tape.

The notational characteristics of Through the Hourglass are in some ways traditional and in some ways not. Although the timbres are active (constantly evolving), interesting, and well-polished, all are pitch-based, excluding the need to devise a system of notation for the timbral changes, such as Stockhausen provided in Kontakte. Jacobs' work is metered throughout and uses standard metric designations. Because of its broad pitch range, the tape portion is given a grand staff in the score and supplies the performer's cues (see Figure 4).

The most refreshing characteristics of this work are the ways in which tempi and moods are handled. So many times the missing aspect of electronic works, whether for instrument and tape or tape alone, is the apparent disregard of tempo and mood, giving the works an unemotional quality. Dr. Jacobs employs score expressions such as *burdened*, *hopefully*, *determined*, *troubled*, *anguished*, among others, to communicate to the performer the appropriate actions to execute on his or her instrument. Aside from Reverie of War, no

other work in this study has this kind of score expressions. Simultaneously, frequent tempo changes are employed. The combination of score expressions and tempo changes gives Through the Hourglass an emotional impact similar to traditional acoustic music.

The musical score is written for two parts: Trumpet in B-flat and Tape. The Trumpet part is in treble clef with a key signature of one sharp (F#). It begins with a tempo of 40 and a dynamic of *mp*. The score includes the instruction "STRAIGHT MUTE" and the word "burdened". The tempo changes to 52 with the instruction "poco rit." and the word "hopelessly". The Tape part is written in two staves, treble and bass clef, with a key signature of one sharp. It features a long, low, sustained note in the bass staff that spans the first two measures. The score is divided into three measures by vertical bar lines. The first measure has a tempo of 40 and a dynamic of *mp*. The second measure has a tempo of 52 and the instruction "poco rit.". The third measure has a tempo of 52 and the instruction "hopelessly".

FIGURE 4 Excerpt from Through the Hourglass.

III. EXAMINATION OF COMPOSITIONAL TECHNIQUES EMPLOYED IN “REVERIE OF WAR FOR PERCUSSION ENSEMBLE AND TAPE”

Reverie of War for percussion ensemble and tape was composed at the University of Tennessee, Knoxville, and was completed March 12, 1991. The University of Tennessee Percussion Ensemble gave the premier performance on April 19, 1991.

Although Reverie of War is a programmatic work, it does not make reference to the Gulf War which was being fought during the time of its creation; instead, it addresses the problems of veterans who have fought in past wars.

With respect to the program, the work's basic structure is based on the following moods in cyclic form: complacency-agitation-horror-agitation-complacency. Reverie of War attempts to take the listener through the experiences of veterans who encounter these states of mind. Each of the four sections reflects one of these emotions.

The full instrumentation of the work is as follows:

Percussion 1 - vibraphone, suspended cymbals, and 2 conga drums.

Percussion 2 - marimba, large gong, and 2 different pitched hand drums.

Percussion 3 - field snare, wood block, and a bell tree.

Percussion 4 - timpani (set of 4).

The instrumentation for the work was chosen primarily to depict war.

Percussion instruments became the natural choice for several reasons.

Percussion has had a long, historical association with wars; the snare drum in particular seems to evoke associations with the military. As with many works written for percussion ensemble, the percussion could have abrupt dynamic changes as well as subtle mallet manipulations (rim shots, different hardnesses of the mallets, and playing with the opposite end of the mallets) for special effects suggesting wartime activities.

The stage arrangement of the performers was also a consideration; frenzied activity by a percussionist tends to reinforce the program. Spatial effects on the tape are often duplicated in the percussion; marimba and vibraphone exchange lines of music to obtain a panning effect across the stage. Refer to the score on page 26 in measures 12 and 13 in the appendix for an example.

The tape sounds were created with the varied moods in mind. All of the timbres were constructed on an Ensoniq VFX-SD digital workstation. The dynamics of this particular instrument lent itself well to the programmatic idea of the work. Pitched-based sounds were used to depict familiarity and complacency, while relatively unpitched sounds were used to depict the war itself. To accomplish a smooth progression from soothing pitched sounds to agitated unpitched sounds, an interim set of sounds was created that contained some pitch relationships but at the same time included a clouding of timbre and pitch.

Instead of creating synthesized sounds which had clear timbral relationships with the instruments, as in Lamination 1, the choice was to use sounds that would contrast with the percussion. Although there were, at times, moments in which the timbres of the percussion imitated the timbres of the tape, the purpose was to provide interesting contrast. For example, when the tape

sounds are dark (i.e., heavily filtered), the percussion is bright (wood block, field snare, and marimba). When complex timbres are employed (i.e., intricate, slowly evolving sounds), short staccato-like passages for the percussion are used so that the tape becomes foreground and the percussion becomes background. (Please refer to page 39, measure 121 of the score for an example.) Although the tape tones in this section are represented as single pitches in the score, timbres as well as pitches are constantly evolving.

The timbres synthesized for Reverie of War are very much interrelated. Similar envelopes were applied to many aspects of the timbres, making this a primary means of binding the tape together. For example, a single envelope controlling filter variation on one sound might control pitch variation on another. At one time or another, this technique was applied to most parameters available on the VFX-SD. Entire sections of the tape were organized by specific envelopes. For example, section two employs basically short, abrupt envelopes, while section three employs long, slowly evolving envelopes.

Aside from the standpoint of the program, the principles of the Fibonacci series is an overriding compositional procedure applied in Reverie of War. The series is employed in aspects of the work, including structure, meter and tempo changes, textural characteristics, and melodic material. (See Figure 5 on the following page for a complete listing of Fibonacci characteristics.)

Structurally, three of the four sections fall on or near a Fibonacci number. Measure one, of course, marks the beginning of the work and section one. Section two begins at measure 54 with a bar of rest preceding it to set-off the section clearly. The recapitulation, or section four, begins in measure 220 which is exactly 34 bars from the end.

<u>MEASURE NUMBER</u>	<u>FIBONACCI NUMBER</u>	<u>EVENTS</u>
1	1	quarter = 72, Introduction includes all melodic material, 4/4 meter.
3	3	gong introduced.
5	5	first theme in tape part.
13	13	vibraphone melodic run with a push to new key center in 14.
54	55	meter change to 10/8 and melodic material changes.
89	89	high tension with dynamics and instrumentation.
185	(89)	second high point of the work; roughly 1/3 from end.
198	(55)	tempo change to quarter = 120; material brought back from measure 26.
220	(34)	quarter = 72 and full recap.; bars from the end.
233	(21)	vibraphone melodic run with a push to a new key center; 21 bars from the end.
246	(8)	timpani solo to the end; 8 bars from the end.

FIGURE 5 Fibonacci Series employed in Reverie of War.

As in Déserts, I have used traditional notation; the pitched percussion instruments (vibraphone and marimba) use their appropriate clefs, while the unpitched percussion instruments use an uncleffed staff to notate several instruments. While Déserts avoided notational problems, such as audible cues and transposed pitch in the tape, by never combining the tape and live instruments, Reverie of War had to address them. The tape portion of the score is notated with standard pitched clefs (grand staff) even when timbrally changing sounds with little or no pitch elements are performed. These categories of electronic sounds are given a relative pitch (low or high) and are notated with standard rhythmic symbols. (See page 39 of the conductor's score, measures 121 - 184 in the tape part, for an example). Traditional notation gives a sense of familiarity to the performers and enables an advanced high school or college-level ensemble to read the work with confidence.

Reverie of War is metered throughout, as is the case in Through the Hourglass. Although the section beginning at measure 121 on page 39 of the score may not sound strictly metered, every entrance of the percussion instruments is critical to the continuity of the work and follows an audible cue in the tape. Through the Hourglass has similar crucial instrumental entrances performed sometimes with no audible cue or with a preceding silence.

IV. CONCLUSIONS

The works included in this study indicate (generally) that as technical advances in musical electronics provide new expressive means for sound generation and reproduction, composers have included more dialogue between the live instruments and the prerecorded tape.

Notational schemes devised by electronic music composers have demonstrated a circular evolution from traditional practices to pictorial/indeterminant ones, (e.g., Lamination 1), back to traditional practices. Déserts employed traditional notation because it needed no cues to coordinate live instruments with the tape. Kontakte used an elaborate, pictorial notational system in which cues were given to the musicians aurally. Through the Hourglass and Reverie of War return to traditional notation with the tape parts written on a grand staff.

Another conclusion concerning notation relates to the type of sounds required for a live electronic work. If unpitched sounds are predominant, a composer must create a system (pictorial or a hybrid between pictorial and traditional) in which symbols cue the performer, (e.g., Kontakte). When more pitched timbres are added, the need for pictorial representation becomes unnecessary, as in Reverie of War and Through the Hourglass. The sounds themselves have evolved from abrasive, abstract, and unpitched to heavily filtered, polished, and/or pitched.

The most important structural devise employed in Reverie of War is the use of the Fibonacci series. Three of the four sections fall on a Fibonacci number as do the two climaxes (texturally the densest portions) of the work.

With respect to notation, Déserts, Through the Hourglass, Reverie of War, and Lamination 1 to a lesser degree, all employ standard notation. With the exception of Déserts and Through the Hourglass, the tape and instrument parts carry equal importance; this is especially true in the case of Reverie of War.

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APPENDIX

Performance Notes

Instruments:

Percussion 1

Vibraphone
Sus. Cymbal
2 Congas

Percussion 2

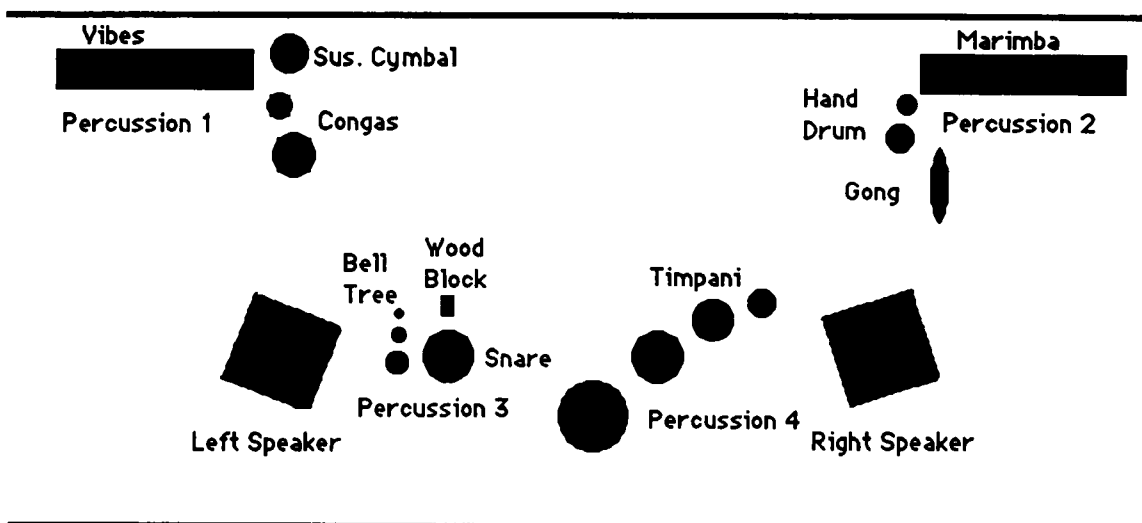
Marimba
Large Gong
2 Hand Drums

Percussion 3

Field Snare
Wood Block
Bell Tree

Percussion 4

Timpani
(30, 28, 26, 23)



This particular stage arrangement is important to facilitate spatial effects between live instruments and prerecorded tape.

Notation:

Percussion 1: When a treble clef is employed, vibraphone is to be played. When an uncleffed staff is employed, congas occupy the "A" and "C" spaces ("C" being the higher pitched conga) and the suspended cymbal occupies the "G" line.

Percussion 2: When a grand staff is employed, Marimba is to be played. When an uncleffed staff is employed, Hand Drums occupy the "A" and "C" spaces ("C" being the higher pitched) and the Gong occupies the "E" line.

Percussion 3: The uncleffed staff is arranged as follows: What would be the "B" line is the Field Drum, the top "F" line is the Bell Tree, and the top "G" space above the staff is the Wood Block.

General Statements about notation:

- 1) When a solid diagonal bar is found, repeat the pattern just preceding it.
- 2) When a "///" marking is found, continue "rolling" the note until the tie is broken.

REVERIE OF WAR

WILLIAM P. WHITE

$\text{♩} = 72$ *Reflectively*

Vibes
Sus. C
Conga

1 Vibes *mp* 3 5 Sus. C *p* *mf*

Marimba

Hand Drum

Gong

Gr. *mp* *mp*

Wood Block
Bell Tree
Snare Drum

BT *mf* *mf*

Timpani

Timp. *pp*

Tape

mp

//

Perc. 1

7 9 11 *p* *mf*

Perc. 2

Perc. 3

BT

Perc. 4

Tape

Perc. 1 Vibes *p* *mf* *mp*

Perc. 2 Ma. *mf*

Perc. 3 BT SD *mf mp*

Perc. 4 *mp*

Tape *mp*

//

Perc. 1 15 17 Vibes 19 *mp*

Perc. 2 Gg.

Perc. 3 *mf* *p* BT *mf*

Perc. 4

Tape

Vibes

Perc. 1 *mf* 21

Perc. 2

Perc. 3 WB *mf*

Perc. 4

Tape

//

Perc. 1 23 25 *f*

Perc. 2

Perc. 3 SD *p*

Perc. 4

Tape

A

$\bullet = 120$ *Aggressive* ₂₇ 29

Perc. 1

Perc. 2 *Ma.*

mf

Perc. 3 *mf* *mf*

Perc. 4 *mf*

Tape

// *f*

Perc. 1 31 33

Perc. 2

Perc. 3

Perc. 4

Tape

Vibes

Perc. 1 *mf*

Perc. 2

Perc. 3

Perc. 4

Tape

35 37

//

Perc. 1

Perc. 2

Perc. 3

Perc. 4 *mp f*

Tape

39 41

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

43

45

//

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

47

mp *f* *mp*

f

Perc. 1

mp *f* *f*

Perc. 2

Perc. 3

f *mp*

Perc. 4

f *mp* *ff*

Tape

mf *pp*

// B

Perc. 1

mf *pp*

Perc. 2

Gg. HD

mf *mf*

Perc. 3

WB

mf

Perc. 4

mp

Tape

57 Sus. C 59

Perc. 1 *p* $\swarrow$ *mf*

Perc. 2

Perc. 3

Perc. 4

Tape

//

61 to Conga 63

Perc. 1 *p* $\swarrow$ *mf*

Perc. 2

Perc. 3

Perc. 4

Tape

Ca. 65 67

Perc. 1 *mf*

Perc. 2

Perc. 3

Perc. 4

Tape

//

69 71

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

73 Perc. 1 *f* *mp*

Perc. 2

Perc. 3 BT *mf*

Perc. 4

Tape

//

77 Perc. 1 *f* *mf*

Perc. 2

Perc. 3 *mf* *mf*

Perc. 4

Tape

81 Vibes 83

Perc. 1 *mp*

Perc. 2 Gg. *mf*

Perc. 3 BT *mf* SD *mp*

Perc. 4 *mp*

Tape

//C

85 87

Perc. 1

Perc. 2 choke choke choke choke

Perc. 3 *pp* *ff*

Perc. 4 *mp* *ff*

Tape *mp* *ff*

Perc. 1

ff

Perc. 2

p *mf* *ff*

Perc. 3

ff

Perc. 4

ff

Tape

//

Perc. 1

93 95 *mf*

Perc. 2

choke *mf*

Perc. 3

f

Perc. 4

f

Tape

87 99

Perc. 1

Perc. 2

choke

Perc. 3

pp

Perc. 4

mp

Tape

mp

//

101 103

Perc. 1

fff

Perc. 2

choke

mf

Perc. 3

fff

Perc. 4

fff

Tape

fff

Detailed description: This musical score page contains two systems of staves. The first system covers measures 87 to 99. It includes staves for Perc. 1, Perc. 2, Perc. 3, Perc. 4, and Tape. Perc. 1 has a continuous eighth-note pattern. Perc. 2 has a 'choke' instruction and a specific rhythmic pattern. Perc. 3 and Perc. 4 have more complex rhythmic patterns. The Tape part provides a harmonic background. Dynamics include *pp* for Perc. 3 and *mp* for Perc. 4 and Tape. The second system, separated by a double bar line, covers measures 101 to 103. Perc. 1 and Perc. 3 play very loud, dense patterns marked *fff*. Perc. 2 has 'choke' instructions and a melodic line marked *mf*. Perc. 4 and the Tape part also feature *fff* dynamics.

105 107

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

fff

//

109 111

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

mf

choke

mf

pp *mp*

113 115

Perc. 1 *mp* *f*

Perc. 2 choke choke

Perc. 3

Perc. 4

Tape

//

117 119

Perc. 1 *D* *90 Aggressive*

Perc. 2 let ring *mp*

Perc. 3 BT

Perc. 4 *mp*

Tape *mp*

121 123 125 Ca. 127

Perc. 1 *mf* 3

Perc. 2

Perc. 3 SD *mp* *f*

Perc. 4 *mp* *ff*

Tape *mf* *ff*

//

WB 129 131 133

Perc. 1

Perc. 2 Gg. *f*

Perc. 3 WB *f* SD *mf* *ff*

Perc. 4 *f* 3

Tape 3

135 137 139

Perc. 1

Perc. 2

HD

ff

Perc. 3

WB

f mp f mp

Perc. 4

f

Tape

mp

//

141 143 145

Sus. C choke choke

Perc. 1

mp f mp

Perc. 2

Gg. HD

mf f

Perc. 3

SD r.s. WB

f mp f mp

Perc. 4

f

Tape

f

41

choke

147 149 151 to brushes

Perc. 1 *f mp f ff*

Perc. 2

Perc. 3 SD r.s. BT SD *f mf f*

Perc. 4 *f* 3

Tape

mp

//

153 155

Perc. 1

Perc. 2 Ma. *mf* 3 Gg. *mp mf*

Perc. 3 BT SD BT WB SD *mf mf mf*

Perc. 4 *f* 3 *mp*

Tape

157 158

Perc. 1

Perc. 2

Ma.

mp *f*

Perc. 3

f 3 T.S. T.S. T.S.

Perc. 4

f *f*

Tape

//

161 163

Perc. 1

Perc. 2

Perc. 3

T.S. T.S.

f 3 *ff*

Perc. 4

3 3

Tape

165 167

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

WB SD r.s. WB

p *f*

//

169 171

E Ca.

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

SD

pp *f*

mf *ff* *mp*

173 175

Perc. 1

Perc. 2

Gg.

p *mp*

Perc. 3

mf

Perc. 4

Tape

//

177 179

Perc. 1

Perc. 2

mf

Perc. 3

f

Perc. 4

Tape

181 183

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

f

ff

//

185 187

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

ff

choke

choke

ff

3 3 3 3

189

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

Measure 189: Perc. 1 (rest), Perc. 2 (rest), Perc. 3 (rest), Perc. 4 (quarter note G2, quarter rest), Perc. 5 (quarter note G2, quarter rest). Measure 190: Perc. 1 (rest), Perc. 2 (rest), Perc. 3 (rest), Perc. 4 (quarter note A2, quarter note B2), Perc. 5 (quarter note A2, quarter note G2).

//

191

193

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

Measure 191: Perc. 1 (rest), Perc. 2 (rest), Perc. 3 (rest), Perc. 4 (quarter note G2, quarter note A2), Perc. 5 (quarter note G2, quarter note F2). Measure 192: Perc. 1 (rest), Perc. 2 (rest), Perc. 3 (rest), Perc. 4 (quarter note E2, quarter note D2), Perc. 5 (quarter note E2, quarter note C2). Measure 193: Perc. 1 (rest), Perc. 2 (rest), Perc. 3 (rest), Perc. 4 (quarter note B1, quarter note A1), Perc. 5 (quarter note B1, quarter note G1).

195 197

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

p

F
// $\bullet = 120$ *Aggressive*

199 Vibes 201

Perc. 1

Ma.

Perc. 2

Perc. 3

Perc. 4

Tape

mf

mf

ff

mf

SD

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

mf *p* *mf*

203 205

//

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

ff *mp* *ff* *mp* *ff*

207 209

♩ = 90 Calming

211 213 215

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

mf

mp

//

G

217 219 Vibes = 72 Reflectively 221 223 Sus. C

Perc. 1

mp

p

Perc. 2

Gg.

mp

Perc. 3

BT

mf

Perc. 4

mp

Tape

ppp

p

225 227

Perc. 1 *mf* *p* *mf*

Perc. 2 *mp*

Perc. 3 *mf*

Perc. 4

Tape

//

Vibes. 229 231

Perc. 1 *mp*

Perc. 2 Ma. *mp*

Perc. 3 *mf*

Perc. 4

Tape

Perc. 1 233

Perc. 2

Perc. 3 BT SD

Perc. 4

Tape

mp *mf* *mp* *mf* *mp* *mf* *mp*

//

Perc. 1 235 237

Perc. 2

Perc. 3 BT

Perc. 4

Tape

mf *p* *mf* *mp* *mp*

239 241

Perc. 1

Perc. 2

Gg. *mp* Ma. *mf*

Perc. 3

WB *mf*

Perc. 4

Tape

//

243

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

H Ca. 245 247

Perc. 1 *mf*

Perc. 2 HD *mf*

Perc. 3 SD BT *p* *mf*

Perc. 4 *mf*

Tape

//

249

Perc. 1

Perc. 2

Perc. 3

Perc. 4 *mp* *f*

Tape

Time: 11.31

251 253

Perc. 1

Perc. 2

Perc. 3

Perc. 4

Tape

mp

p

p *f* *mp*

The musical score consists of five staves. Perc. 1 is a single staff with measures 251 and 253. Perc. 2 is a grand staff with a treble clef on the top staff and a bass clef on the bottom staff. Perc. 3 is a single staff. Perc. 4 is a single staff with a bass clef. Tape is a grand staff with a treble clef on the top staff and a bass clef on the bottom staff. Dynamics include *mp*, *p*, and *f*. Perc. 4 has a crescendo from *p* to *f* and a decrescendo to *mp*. Perc. 3 has a decrescendo from *mp* to *p*. Perc. 2 has a decrescendo from *mp* to *p*.

April 4, 1991
Knoxville, TN

VITA

William P. White II was born in Knoxville, Tennessee, on May 30, 1962. He graduated from Doyle High School in 1980, where he was a member of the concert and marching bands and various choral organizations. He entered the University of Tennessee, Knoxville where he participated in concert band, marching band, the University of Tennessee Symphony Orchestra, synthesizer ensemble, and various brass ensembles. He was a member of Phi Mu Alpha Sinfonia music fraternity and accepted a band scholarship in the fall of 1981. While an undergraduate, several of his original electronic compositions were presented in concert, including The House of Usher, The Seven Planets of the Ancients, (multi-media), and Winter's Secrets (multi-media). He received a Bachelor of Music degree (with honors) with a concentration in Electronic Music Composition in August of 1985. The following month he entered the Graduate School to begin work toward a Master's degree in music, having accepted a graduate assistantship with the Music Department.

In July of 1986 he married and subsequently moved to Nashville, Tennessee, to work in the recording industry. In August of 1990, Mr. White was again offered a graduate assistantship in music from the University of Tennessee, Knoxville Music Department and was readmitted to the Graduate School. Reverie of War for percussion ensemble and tape was performed on April 19, 1991 by the University of Tennessee Percussion Ensemble and conducted by Mr. White.