LET ME MAKE IT SIMPLE FOR YOU

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
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For the Degree of

DOCTOR OF MUSICAL ARTS

By

R. Waschka II, B.M., M.M.
Denton, Texas
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This dissertation consists of three computer music-intermedia compositions and a discussion of each piece. Both the compositions and discussion have been presented in a concert/lecture fulfilling the requirements for the specialization program in computer music media. The works are *A Shakespeare Quartet* for four acoustic guitars, *A Noite, Porem, Rangeu E Quebrou* for instrument of low pitch range, tape and computer (optionally a more traditional score on paper may be used) and *Help Me Remember* for performer, Synclavier (r) (optionally on tape), interactive MIDI computer music system, and slides.

A Shakespeare Quartet is in four short movements and has a total duration of approximately eight minutes. A compositional algorithm involving averaging techniques was used to create the work.

A Noite, Porem, Rangeu E Quebrou has a duration of ten minutes and forty seconds. The score for the performer is produced in real-time by the computer and is read from the monitor screen. Algorithms involving a fractal dynamical system (the chaotic gingerbreadman) and Markov processes were used to create the piece.

Help Me Remember is divided into three sections, but performed without pauses. It has a duration of approximately twenty minutes. Rapid event deployment synthesis techniques are used in combination with fractal systems in this piece. A compositional algorithm based on the fractal system the "Henon Map" was invoked to compose part of the piece.

ACKNOWLEDGMENTS

Acknowledgments appear on the slides and as part of the text in the piece *Help Me Remember*.

PREFACE

This book constitutes the documentation for a dissertation, the main body of which consists of three musical compositions/inter-media works. Because musical notation is generally much more succinct than written discussion of music and because much of the music presented here is electronic and not notated in a traditional manner, the scores for these works have been placed in the Appendix in this documentation. The pieces, however, are the important objects, while the discussion chapters provide technical information on the creation and performance of these works.

In partial fulfillment of the dissertation requirements, the pieces were performed in a concert event on 12 February 1990 in the Merrill Ellis Intermedia Theater at the University of North Texas. The performances were preceded by a lecture on the methods used to compose and produce the works.

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CHAPTER I

INTRODUCTION

Overview

The three works that comprise the main body of this dissertation are: *A Shakespeare Quartet* for four acoustic guitars; *A Noite, Porem, Rangeu E Quebrou* for instrument of low-pitch range, computer, and tape; and *Help Me Remember* for real-time computer music systems, performer, and slides. Each of these pieces extends or makes a new application of a particular compositional algorithm or synthesis technique. Extensions and new applications are made to the compositional algorithms involving averaging techniques, to compositional algorithms involving fractals, and to granular synthesis techniques.

This introduction will provide background information on these techniques while each of the following chapters discusses, in detail, one particular work. The appendix contains scores for the three pieces.

Averaging Techniques

In *A Shakespeare Quartet,* averaging techniques are used as compositional algorithms. The averaging procedures are used to determine pitch choice and the density of events in the music. In a previous work, *Visions of Habakuk* (1987), for computer and MIDI synthesizer, I used averaging techniques to control the dynamic levels and the frequencies in various sections of the piece. Computation and sound production in *Visions of Habakuk* take place in real-time during performances. *A Shakespeare Quartet* has a fixed score, and the guitarists are required to make certain decisions in the performance of the piece. In addition to the procedures discussed in Chapter Two regarding averaging techniques, other possibilities are given in the appendix to Waschka and Ferreira (1988).

The use of averaging techniques as a compositional algorithm was suggested by the synthesis algorithm developed by Kevin Karplus and Alex Strong, (1983). This algorithm is particularly good for synthesizing sounds that are very similar in timbre to plucked-string sounds. It is also capable of producing certain percussion-like sounds.

Essentially, the Karplus-Strong algorithm consists of a random number generator, a delay line or buffer, and an averaging procedure. The random number generator produces a series of numbers that are sent both to the digital to analog converter and to the buffer. The numbers in the buffer are then averaged: the first with the second, the result replacing the first number; the second with the third, the result replacing the second number, and so forth. See Figure 1. The results of this averaging procedure are also sent to the digital to analog converter.

Random Numbers:	33 51 89 17
Results of First Averaging Procedure:	42 70 53 ...

Figure 1: Simplified example of a series of random numbers and an averaging of those numbers using the procedure described.

The first groups of numbers produce a "white-noise"-like sound, and the more iterations employed, the more harmonic and eventually, the more sine-wave-like the sound. These results are similar to the harmonic spectrum over time produced by typical plucked-string sounds, and therefore, the sound produced is also similar.

Detailed descriptions of the algorithm can be found not only in Karplus and Strong (1983), but also in Dodge and Jerse (1985). Numerous composers have used this synthesis technique. Perhaps the best example is *String Quartet* (1985) by Paul Berg. I know of no use of this technique as a compositional algorithm prior to *Visions of Habakuk* and *A Shakespeare Quartet.*

Fractal Processes

Fractals are produced by equations that when invoked recursively produce complex, self-similar results. When plotted graphically, they yield shapes that are of equal complexity on every scale (self-similar) and that are not simply one-dimensional, or two-dimensional, or three-dimensional objects, but of fractional dimension--hence the name. A lengthier discussion of fractals and their attributes is given in Chapter Three.

Fractals have been used as compositional algorithms by a number of composers. In an intuitive manner, composers have mapped fractal shapes that occur in nature (Austin 1981). Other composers have used fractals that do not have a specific origin in nature, such as Charles Dodge's use of the "von Koch Snowflake" in his piece titled *Profile* (Dodge 1988). Composers involved with fractal processes include George Lewis, Jean-Claude Risset, and Curtis Bahn (Bahn and Dodge 1986).

Most of the composers using some kind of fractal process have mapped the results of the iterations to make melodic lines. Many of the works have employed "1/f-noise", which Dodge describes as ". . . a phenomenon closely related to the creation of some geometrical fractals. . ." (Dodge 1988). The term "noise" is a technical and not an aesthetic term as used here. In this case, noise simply means unpredictable changes of a quantity varying in time. The 1/f-noise function, like other noise functions--"white", "brown", "pink" --features a particular relationship between past and current results. In the case of 1/f-noise, past results have a logarithmic correlation or influence on the current result. Richard Voss, who did the primary mathematical work on 1/f-noise, has claimed that the relationships generated by 1/f-noise mirror those of much music prior to the twentieth century (Voss 1988).

Algorithms for generation of 1/f-noise music based on Voss's algorithm (Voss and Clarke 1978, Gardner 1978) are given by McNabb (1981), Bolognesi (1983), and Dodge and Jerse (1985). Basically, each algorithm sets up a specific, partially deterministic, partially stochastic process in which the probabilities for small changes are greater than for large change. Additionally, the amount of change probable varies with time. For example, the 1/f-noise algorithm described by Bolognesi, simplified and re-written in "structured English", is presented in Figure 2 below:

1. In binary notation write out the decimal numbers 0-7.
2. Assign each digit to represent a six-sided die.
3. Roll all three dice for the 0 state.
4. Add the dice numbers; output the sum.
5. Go to the next binary number. Compare it to the previous number.
6. If a digit has changed from 0 to 1 or from1 to 0, roll the die associated with that digit.
7. Add the dice numbers; output the sum.
8. Check to see if this is the last binary number?
    - A. If no, go to step 5.
    - B. If yes, stop.

Figure 2: Algorithm given in Bolognesi (1983) rewritten in "structured English".

A sample run with typical output from such an algorithm is given in Figure 3.

binary numbers:	procedure:		output:
0 0 0	roll all 3 dice, result 5, 3, 4	5+3+4=	12
0 0 1	roll die 3 only, result 2	5+3+2=	10
0 1 0	roll dice 2 and 3, result 6, 3	5+6+3=	14
0 1 1	roll die 3 only, result 4	5+6+4=	15
1 0 0	roll all 3 dice, result 2, 1, 3	2+1+3=	6
1 0 1	roll die 3 only, result 4	2+1+4=	7
1 1 0	roll dice 2 and 3, result 2, 5	2+2+5=	9
1 1 1	roll die 3 only, result 1	2+2+1=	5

Output: 12 10 14 15 6 7 9 5

Figure 3: A sample run of the algorithm in Figure 2.

Similar algorithms have been used in the making of *The Empty Chair* (1986) by George Lewis, *Profile* (1988) by Charles Dodge, *A House Without Mirrors* (1988) by Waschka (1990), and *Cold Mountain* (1989) by Curtis Bahn.

The piece *A Noite, Porem, Rangeu E Quebrou* employs a different kind of fractal system known as the "chaotic gingerbreadman" (Devaney 1988). The chaotic gingerbreadman is a chaotic dynamical system in two dimensions which produces a fractal. The results of this process were used to create an on-going melodic structure for the piece. *A Noite, Porem, Rangeu E Quebrou* is the first use of this particular fractal structure in a musical composition.

The middle section of *Help Me Remember* also employs a fractal system, in this case the "Henon map" (Henon 1976) to produce melody-like lines. It, too, is a two-dimensional system. The Henon map is discussed further in Chapter Four. More significantly, *Help Me Remember* utilizes fractals in the construction of timbre and does so through the use of granular synthesis techniques.

Granular Synthesis Techniques and Rapid Event Deployment

Prior to the work described here, composers used fractals to generate melodies and, in certain cases, to determine the overall form of a work. Dodge's *Profile* is an elegant example of both: featuring 1/f-noise melodies layered according to a von Koch Snowflake pattern. Extending the compositional use of fractals to timbre construction required the employment of granular synthesis techniques and, in a MIDI Environment, Rapid Event Deployment techniques.

Granular synthesis is the creation of complex sounds through the use of "grains" of a few milliseconds duration. Generally these grains consist of very simple waveforms. Hundreds of these grains are sounded each second in order to create a complex timbre. Barry

Truax (1986) has implemented a real-time system for the realization of granular synthesis using a DMX-1000 digital signal processor.

This Truax implementation provides a number of control parameters for the user including number of voices, duration of grains, delay between grains, center frequency, and others. Truax has also designed and created a granular synthesis system that uses sampled sounds (1987). Pieces composed with these systems include *The Wings of Nike* (1987-88) by Truax and *Across Texas Shaking Comanche Rattles Our Mothers Chant Prayers* (1987) by Waschka.

Help Me Remember takes advantage of two extensions of the work described above. First, in 1986-87 the transfer of the granular synthesis concept to MIDI systems was investigated by Toze Ferreira and myself and found to be musically useful. Rapid Event Deployment was used extensively in my piece from this period, *Visions of Habakuk* (1987). The procedures, limitations, and results associated with this synthesis technique are described further in Chapter Four and in detail in Waschka and Ferreira (1988). Second, the combination of this synthesis technique with fractals was investigated in 1989 by Alexandra Kurepa and myself. The success of this project (Waschka and Kurepa 1989) allowed the use of fractals in a musically significant way on a micro level (timbre) as well as the mid-level (melodic) and macro-level (form). Thus, *Help Me Remember* features fractal systems functioning to produce both melodic and timbral structure.

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CHAPTER II

DISCUSSION OF *A SHAKESPEARE QUARTET*

Introduction

A Shakespeare Quartet, scored for four acoustic guitars, is in four short movements. Each movement has a duration of two minutes. There should be a very brief pause between the movements, which are titled

1. Sleep that knits up the ravelled sleave of care
2. It out-Herods Herod: pray you, avoid it
3. Sleep rock thy brain
4. Let it come down

The guitarists perform from the four corners of the performance space and thus surround the audience. In larger halls, the guitars may be amplified.

The first rehearsal may require a conductor to indicate the beginning of each five-second segment. Subsequent rehearsals should be conducted with indications for the beginnings of each thirty-second period only. Eventually, the players should be able to begin each movement together, move through it independently, stop when finished, wait for the others, and then begin the next movement together.

The Score

The guitarists perform from a complete score, which consists of four pages--one for each movement. A guitarist's part includes a line of music divided into four boxes with six numbers above each measure. The boxes contain a number of events: single pitches, dyads, or chords. Each of the six numbers above a box represents the number of events to be played in a five-second period. The events are to be selected at the player's discretion from within the box below the number. Thus, the six numbers together represent thirty seconds of events.

The work also includes a particular set of articulation rules, which vary from movement to movement. In the first movement, "Sleep that knits up the ravelled sleave of care," all single notes should be damped. In the fourth movement, "Let it come down," all articulations are at the discretion of the players except for the last thirty seconds of music which are played *legato*. The second movement, "It out-Herods Herod: pray you, avoid it," and the third movement, "Sleep rock thy brain," are played *legato* and *normale*.

Exceptions to these performance rules are outlined in the score and, for the most part, involve small boxes with a slash through the corner drawn around certain numbers in the score. If a number is inside a "slashed box," the number of events indicated should be played as rapidly as possible. This notation is used because of its similarity to the common "as fast as possible" notation indicated by a slash through a stem/beam for an individual note or group of notes (Stone 1980). The player need not begin at the outset of the five-second period but must play as fast as possible, once execution of that segment is begun. An additional exception requires that all durations within a five-second period should be of equal length in the third movement.

Compositional Techniques

My initial ideas for this composition resulted from the combination of two streams of thought. One stream consisted of my continued interest in averaging techniques as compositional algorithms (Waschka and Ferreira 1988), while the other stream was created by a quantitative study of density in the serial works of Stravinsky (Waschka 1989).

A number of averaging techniques were used in the composition of *Visions of Habakuk* (1987), a real-time piece written in the computer language Forth for Atari 1040st computer and Yamaha FB-01 digital synthesizer. In *Visions of Habakuk*, the averaging processes were used at times to determine the pitch choices and, at times, to control the dynamics of the various gestures. In *A Shakespeare Quartet*, the averaging procedures were applied to pitch classes and to density. While the averaging computations in *Visions of Habakuk* were done under the constraints of real-time work, the output for the *Quartet* was printed and then transcribed into a performance notation.

The Algorithm

The program allows the user to specify the pitch-class transposition level for a particular run. The pitch class chosen is then set to the number 0. The other integers indicate the number of semitones above this arbitrarily chosen pitch class. The output is given both as a series of numbers and as corresponding pitch classes. Figure 4 shows one line of output with pitch class G = 0:

10 9 1 7 4 2 f e g# d b a

Figure 4: One line of output with pitch class G=0.

The program allows the user to specify the initial seven numbers or to have them selected randomly by the computer. The program then generates four lines of output or the equivalent of one guitar part for an entire movement.

The actual averaging involves the following procedure: 1) The first two numbers are averaged, and the result replaces the first number of the series. 2) The second and third numbers are then averaged, and the result replaces the second number in the series. This procedure is repeated six times. 3) The seventh number is left unchanged, is not printed out, and is not translated into a pitch class name. Thus, the line of output after Figure 4 can be seen in Figure 5.

9 5 4 5 3 1   e c b c a# g#

Figure 5: The line of output that follows the output in Figure 4.

In this case, the unseen seventh number is 0. This process is repeated to generate the third and fourth lines of output and complete the run.

At this stage, the user may invoke a "shuffle" function to make use of the same initial seven integers in a different order or the user may change the seed numbers. Finally, when the pitch class names are translated into a performance notation, the choice of the exact pitch location and the use of single notes, dyads, or chords are made by the composer.

Use of the Algorithm

In *A Shakespeare Quartet*, the first movement uses one set of integers, shuffled, in all four parts. The seventh number is 0. Both the third and fourth movements are constructed in the same way. In the second movement, a different initial integer-series begins the four lines, and the seventh number is 11 in three out of four lines. The third guitar part uses 0 as the seventh number and is unusual because it is an exact retrograde of the program output. The transposition levels for the four movements of the work are E, A, D, and E, respectively.

Intuitive Decisions

The placement of slashed boxes for the numbers and the choice of dynamic levels for the boxes containing the pitches were chosen arbitrarily. The dynamic levels roughly follow a graphic pattern decided on at the very outset of the compositional process:

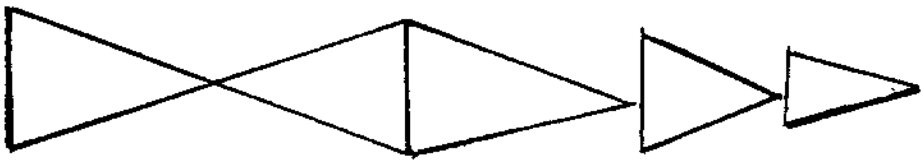

Figure 6: Dynamic levels graphic pattern.

Movement Titles

The titles of the movements were initially intended to be spoken or whispered by the guitarists at those times when they had a 0 in their part. Though the idea was abandoned, the titles remain as evocative, programmatic designators.

The titles, all of which refer to death in some way, are taken from *Macbeth* or *Hamlet.* Either the word "sleep" is invoked as a metaphor for death, or the phrase is associated in some way with murder. The title of the first movement is taken from the first scene of Act II of *Macbeth.* After murdering Duncan, Macbeth says to Lady Macbeth,

> Methought I heard a voice cry, *Sleep no more!*
> *Macbeth does murder sleep,*--the innocent sleep;
> Sleep that knits up the ravell'd sleave of care,. . .

The title of the second movement is taken from Scene II of Act III of *Hamlet* when Hamlet coaches certain members of the Players:

> Speak the speech, I pray you, as I pronounced it. . . . O, it offends me to the soul, to hear a robustious periwig-pated fellow tear a passion to tatters, to very rags, to split the ears of the groundlings, who for the most part, are capable of nothing but inexplicable dumb shows and noise: I could have such a fellow whipped for o'erdoing Termagant; it out-herods Herod: pray you, avoid it.

Hamlet thus warns the players against ranting like the Herod character in medieval mystery plays.

This particular biblical reference has additional twentieth-century resonance, because the contemporary poet Anthony Hecht has used it as a title for one of his poems (Hecht 1967). In this poem, the poem's narrator observes his children watching a Western film on television and enjoying the hero's ultimate victory. The narrator contrasts this scene with what actually happens in the adult world. The last stanza refers to the genocide that took place during World War II, and to childermas, the festival of the Holy Innocents that commemorates Herod's slaughter of the Hebrew children in an attempt to kill Christ and circumvent the prophecy that Christ would become King of the Jews (*Matthew* 2:16):

> And that their sleep be sound
> I say this childermas
> Who could not, at one time,
> Have saved them from the gas.

During the play within *Hamlet* (Act III, Scene 2), the Play Queen bids goodnight to the Play King:

> P. King: . . . My spirits grow dull, and fain I would beguile
> The tedious day with sleep.
>
> P. Queen: Sleep rock thy brain,. . .

While the Play King sleeps, he is poisoned by a third character, Lucianus.

The title of the fourth movement appears in *Macbeth* and is spoken by one of the murderers just before he assaults Banquo:

2nd Murderer: A light, a light!
3rd Murderer: 'Tis he.
1st Murderer: Stand to't.

Enter Banquo and Fleance with a torch.

Banquo: It will rain tonight.
1st Murderer: Let it come down.
[Assaults Banquo]

This title is also shared with a twentieth-century literary work, the novel *Let It Come Down,* by the American expatriate composer and author Paul Bowles.

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CHAPTER III

DISCUSSION OF *A NOITE, POREM, RANGEU E QUEBROU*

Introduction

A Noite, Porem, Rangeu E Quebrou (At Night, However, It Creaks and Breaks) is a work for unspecified instrument of low pitch range and tape, with optional computer. The performer's part varies depending on the instrument used.

The tape part was created on a Synclavier (r) system at the Center for Experimental Music at the University of North Texas. A compositional algorithm created by the composer invoking fractal processes was used to generate the tape material. The instrumental part makes use of other compositional algorithms that are designed for the particular instrument. The programs used to generate the tape material and the various instrumental parts are written in the computer language Forth and run on an Atari 1040st personal computer.

The title is a line taken from the poem *Campo de Batalha* (Battlefield) by Tomaz Kim (Joaquim Fernandas Tomaz Monteiro-Grillo). Kim was born in Lobito, Angola, in 1915 and died in Lisbon, Portugal, in 1967. He was Professor of English and North American Literature in the Faculty of Letters at Lisbon.

The Score

The score for the performer may be generated and read from a computer programmed to produce it graphically on the computer terminal screen in real-time, or it may be printed out and read in the traditional manner.

The Optional Traditional Score

Depending on the instrument, the performer is expected to choose a different pitch, group of pitches, or series of pitches for each line of instructions. The player is also expected to choose appropriate durations, with the restriction that each group of instructions must fill the allotted time. A stopwatch is helpful in this regard. Rests should be freely interpolated between some of the lines.

The score includes, therefore, a timing for each section, followed by general verbal instructions indicating relative speed, dynamic level, and general pitch range for the entire section.

Each section includes fifteen instructions, which are idiomatic methods of tone production available on the instrument being used. These instructions specify various timbral aspects of the sound by indicating dynamics, articulation, or extended playing techniques. See Figure 7. Of course, these instructions, dependent as they are on the specific timbres and techniques of particular instruments must be altered for each new instrument used to perform the work.

A number of scores can be created and transcribed into the notation shown in Figure 7:

1:50--4:00

slow and quiet, low pitches:

circular bowing
arco normale
circular bowing
repeat note p with sfz attack
arco normale
repeat note p with sfz attack
arco normale
circular bowing
repeat note p with sfz attack
circular bowing
arco normale
arco normale
arco normale
arco normale
arco harmonics

Figure 7: One possible section from the score for a string bassist or 'cellist.

The performer would then have a choice of scores and could play different versions depending on the hall or the performer's preference.

The Computer Score

The preferred performance system uses a computer to produce the score in real-time. The program created for this purpose was written in the Forth computer language and runs on an Atari 1040st computer. When a computer is used to produce the score in real-time, the score will vary with each performance.

The program is initiated with a single-word command--"noite." The performer then presses the carriage return key at the same time that the tape portion of the piece is started. Initially, three commands appear on the screen. The performance instruction at the top of the screen is performed immediately by the player. Two other performance instructions are also visible on the screen. The program keeps track of the timing of the piece. When the time comes for the second instruction to move to the topmost position, the other instruction moves up, and a new instruction appears at the bottom of the screen. The player then performs the topmost instruction. The performer should incorporate silences into the part but should follow the timing indicated on the screen reasonably closely.

Performance Notes

The performer, regardless of instrument, should attempt to blend dynamically with the tape. The performer should not be in the forefront of the sonic landscape with the tape in the background. The performer should strive to listen attentively to the timbres he or she creates in order to make the sounds as timbrally interesting as possible. It is not the intent of the work to replicate the sound of the performer's instrument, thereby creating a fusion between the tape and live performance and making use of the audience's difficulty in distinguishing the two. Nevertheless, the performer must be sensitive to the melding of the timbres and dynamics of the tape and those of the performer's instrument. It is especially important in this regard for the player to perform the extended techniques called for with conviction.

Stage Set-up

The computer system should be in the center of a completely dark stage. Once in position, the player will be able to see using only the light radiating from the computer terminal screen. The performer, if not using an electronic instrument, may need to use a microphone, but amplification should be used only in large halls. The tape portion of the piece is in stereo, and a conventional stereo play-back sound system should be employed. See Figure 8. If four speakers are available, the stage configuration shown in Figure 9 is preferred.

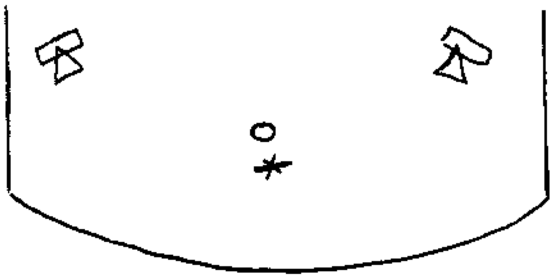

Figure 8: Stage set-up for stereo version.

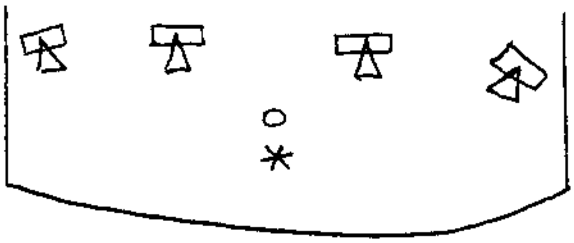

Figure 9: Stage set-up for a quadrophonic performance.

Compositional Techniques

The tape part for *A Noite, Porem, Rangeu E Quebrou* was generated using an algorithm based on the mathematical concept of a fractal. Fractals can be defined as self-similar objects whose

Hausdorff dimension is not an integer (Fischer, Smith 1985). Many of the descriptions below are based on the writings of Robert Devaney and Richard Voss in *The Science of Fractal Images* (1988).

Fractal Geometry

The word "Fractal" was coined by the mathematician Benoit Mandelbrot (Mandelbrot 1977) to describe geometric shapes that are self-similar or "scaling" and that possess non-integer (fractional) dimensions. These shapes have ancestors that were identified around the turn of the century: Cantor sets, Peano curves, Weierstrass functions, Julia sets, curves without derivatives, and space filling lines. These curves, sets, and functions were sometimes referred to as "monsters" and were examined by G. Julia (1918) and P. Fatou (1919) among others. Work in this field flourished from around 1910 until 1925 and then died out. Most of these mathematical constructs were not extensively plotted because of the intense computational effort necessary. Renewed interest in these objects was stimulated by Mandelbrot's mathematical results and the wide availability of sufficiently powerful computers, which make it possible to plot graphics rapidly. The pictures achieved with these methods make an immediate and strong argument for the ubiquitous presence of fractals in a wide variety of natural shapes, including trees, leaves, clouds, island and mountain shapes, land and sea scapes, and lava flows.

Self-similarity

The two related aspects, self-similarity and fractional dimension, are described below in an intuitive manner, through examples, and by comparison with Euclidean geometry.

Euclidean shapes generally become smoother and simpler under magnification of specific parts. Thus, when a select portion of a rectangle is magnified, it will appear as two parallel line segments. Further magnification reduces the rectangle to a single line segment.

Fractals display a different property. Upon magnification, each successive view reveals a similar appearance and similar amount of detail. In fact, each magnified subset of the original looks like, or is visually identical to, both the whole and every other subset.

This property can be illustrated with a relatively simple example: the von Koch snowflake curve. This curve consists of a single triangular shape recursively replacing a single line segment.

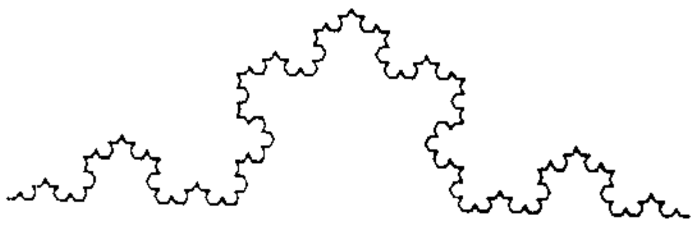

Figure 10: The von Koch snowflake (from Voss 1988).

A line segment is divided into thirds and the middle section is replaced with two equal segments that form part of an equilateral triangle. See Figure 11.

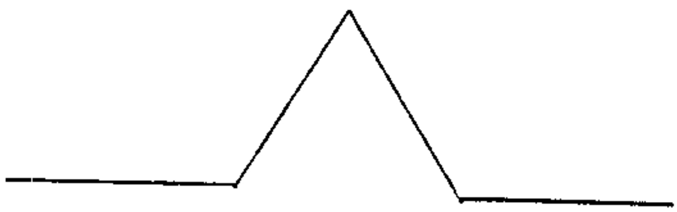

Figure 11: Initial replacement.

This replacement is, then, continually repeated so that the total length approaches infinity, resulting in the addition of detail and the creation of a fractal. Figure12 shows the next iteration of this process.

Figure12: The next iteration.

Continued recursion will result in a curve that displays the same amount of detail at every magnification and also displays self-similarity at every level. In this case, the segments are not only similar, but identical, yet the object has an unexpected complexity and even "naturalness." These two attributes, a close likeness to shapes found in nature and the construction of these complex shapes through the use of relatively simple formulas applied recursively, are typical of fractals. The second property makes fractals appropriate for exploration with the help of computers.

The dimensions associated with Euclidean shapes are familiar: a line segment is a one-dimensional object, a square is a two-dimensional object, and a cube is a three-dimensional object. Like a fractal, a line segment possesses a certain scaling quality. If divided into seven equal segments, each resulting segment is similar, in fact, identical. A one-dimensional object divided into N parts is scaled by the ratio

$$r = 1/N$$

or

$$r = 1/N^1.$$

Thus,

$$Nr^1 = 1.$$

In this case, $7(1/7)^1 = 1$. For a two-dimensional figure, such as a square, divided into four equal parts is scaled by the ratio

$$r = 1/N^{1/2} .$$

See Figure 13. Thus, $N(r^2) = 1$, or, in this case, $4(1/4^{1/2})^2 = 1$.

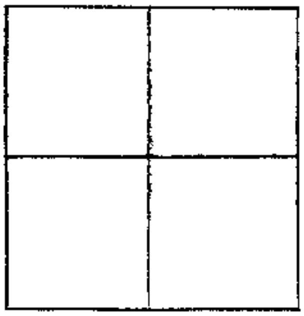

Figure 13: A scaled square.

For a three-dimensional figure, a cube divided into eight equal parts is scaled by the ratio

$$r = 1/N^{1/3}.$$

Thus, $N(r^3) = 1$, or in this case, $8(1/8^{1/3})^3 = 1$. One can now generalize that for an object of N parts, each scaled down by a ratio r from the whole

$$N\,r^D = 1.$$

The fractal (similarity) dimension D can now be defined as

$$D = \frac{\log N}{\log 1/r}.$$

With this information, one can calculate the fractal dimension of the von Koch snowflake. Each segment of the von Koch curve is divided into 4 parts, and each of these sub-segments is scaled down by 1/3 from its predecessor. This yields

$$D = \frac{\log(4)}{\log 1/1/3}.$$

or

$$D = \frac{\log (4)}{\log (3)} .$$

Therefore, the fractal dimension of the von Koch snowflake is approximately 1.26185. . .

What does it mean to say that this is a greater-than-one-dimensional object, but less-than-two-dimensional? Bearing in mind that this construct requires that the number of replacements or iterations approaches infinity, Francis Moon (1987) explains that "One way to interpret the fractal dimension of the Koch curve is that the distribution of points covers more than a line but less than an area."

Fractals and Dynamical Systems

Processes that evolve over time are called dynamical systems.

The Dow Jones average is a relatively simple illustration of a dynamical system, while music is a complex illustration. One of the goals of mathematicians studying dynamical systems is to predict the long term behaviour of a system. As might be expected, some dynamical systems, such as the moon's orbit around the earth, are more predictable than others, such as currency exchange rates. One of the most important recent discoveries is that simple, deterministic systems may behave unpredictably or randomly.

The succession of points that results from the iterations of a particular starting point in a dynamical system is called its "orbit." The dynamical system T defined by $f(x) = (x+1)(.5)$ and an initial value of $x = 7$ will serve as an example. The resulting orbit is

$T(7) = 4$
$T^2(7) = 2.5$
$T^3(7) = 1.75$
$T^4(7) = 1.375$
$T^5(7) = 1.1875$
$T^6(7) = 1.09375$
$T^7(7) = 1.046875$
and so forth.

It seems clear that $T^n(7)$ tends to 1 as n approaches infinity. Because the orbit of 7 in dynamical system T is predictable, it is called a stable orbit. In some cases, such as the cosine function, all orbits--

for all initial values--are predictable; in other words, all orbits are stable.

Of course, not all orbits of all dynamical systems are stable, and naturally enough, these orbits are called unstable. Devaney (1988) defines an unstable orbit as ". . .one for which, arbitrarily close to the given initial input, there is another possible input whose orbit is vastly different from the original orbit." A simple squaring function is unstable--for example, the dynamical system S, where $f(x) = x^2$. If the inital value is 1 the orbit will remain at 1, in other words; it is a fixed point. However, if the inital value of x is greater than 1, S^n tends to infinity, whereas if $0 < x < 1$, then S^n tends to 0.

In such systems, it is important to know the set of all points whose orbits are unstable. The *chaotic set* consists of all points whose orbit is unstable. As Devaney points out, "This is where fractals enter the field of dynamical systems. Very often, the set of points whose orbits are unstable form a fractal. So these fractals are given by a precise rule: they are simply the chaotic set of a dynamical system."

The Chaotic Gingerbreadman

The particular formulas invoked in *A Noite, Porem, Rangeu E Quebrou* are those of the chaotic dynamical system known as "the chaotic gingerbreadman." This chaotic set is in two dimensions and when plotted on a graph, resembles a gingerbreadman with its head oriented towards the intersection of the x and y axes. See Figure 14.

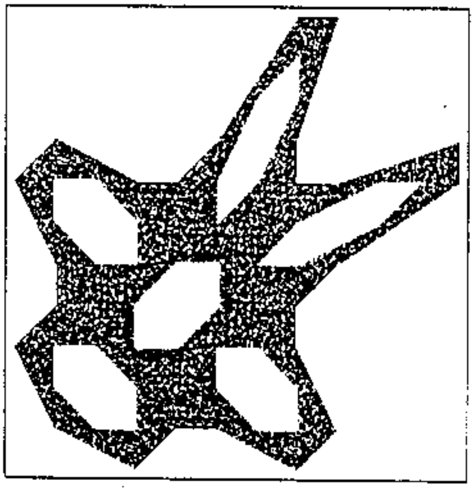

Figure 14: The chaotic gingerbreadman (from Devaney 1988).

The dynamical system is given by

$$X_{n+1} = 1 - Y_n + |X_n|$$

$$Y_{n+1} = X_n \ .$$

The mapping of the plane is stable in certain regions and chaotic in others. For example, the point (0,0) generates a set of points that are periodic with a period of six. The points are (0,0); (1,0); (2,1); (2,2); (1,2); (0,1). As it turns out, the points on the boundary of the gingerbreadman are periodic--these points form the outline of the gingerbreadman. Outside these stable regions lies a succession of chaotic regions.

Compositional Algorithms

Initial points that do not have stable orbits, but are close to one of these stable points, display interesting characteristics when mapped to musical events. Research using "Rapid Event Deployment" techniques in a MIDI environment (Waschka and Ferreira 1988) and mapping to pitch and pitch deviation produced sounds that maintained a certain timbral "near stability" for certain periods of time. After hundreds or thousands more iterations, the orbit "breaks down"--the bandwidth of the sound becomes very large. Hundreds of thousands of interations later it may return to an almost periodic sound, another "near stability", but grouped around a different set of points. These results are described in Waschka and Kurepa (1989).

Further discussion of this timbral application of chaotic dynamical systems can be found in Chapter Four. This piece, however, uses these iteration equations to generate melodies and not timbres.

A Noite, Porem, Rangeu E Quebrou uses a particular set of several hundred iterations of the chaotic gingerbreadman that results from an inital point of (-0.01, 0.0). The iterations used have a starting point several hundred iterations into the sequence and include a critical section in which the results move away from a certain "near stability" and then "breakdown"--in this case the range of the mapped results expands dramatically. These iterations were mapped to frequency to produce a long melodic construct, which continues throughout most of the piece.

The score for the soloist is generated using a Markov process, or Markov chain algorithm (Ames 1989). A Markov porcess is a conditional probability that is characterized by the relationship

$$P_{ijk} = P_{ij}P_{jk} .$$

As Dodge and Jerse (1985) explain, "That is, the probability of the sequence ijk is the same as the product of the probability that j will follow i and the probability that k will follow j." It is thus a first-order random process and can be completely described by a first-order transition table.

The program used in *A Noite, Porem, Rangeu E Quebrou* allows for twenty distinct performance commands. These performance commands can be easily changed within the program, depending on the instrument of the soloist.

The chain is organized in two groups that have no common members. Once within a group, the program will provide only performance commands drawn from that group. The subcommands within the command "noite" executed by the performer move the working of the chain from one group to the other at the appropriate time. A simplified example of this type of algorithm is diagrammed below:

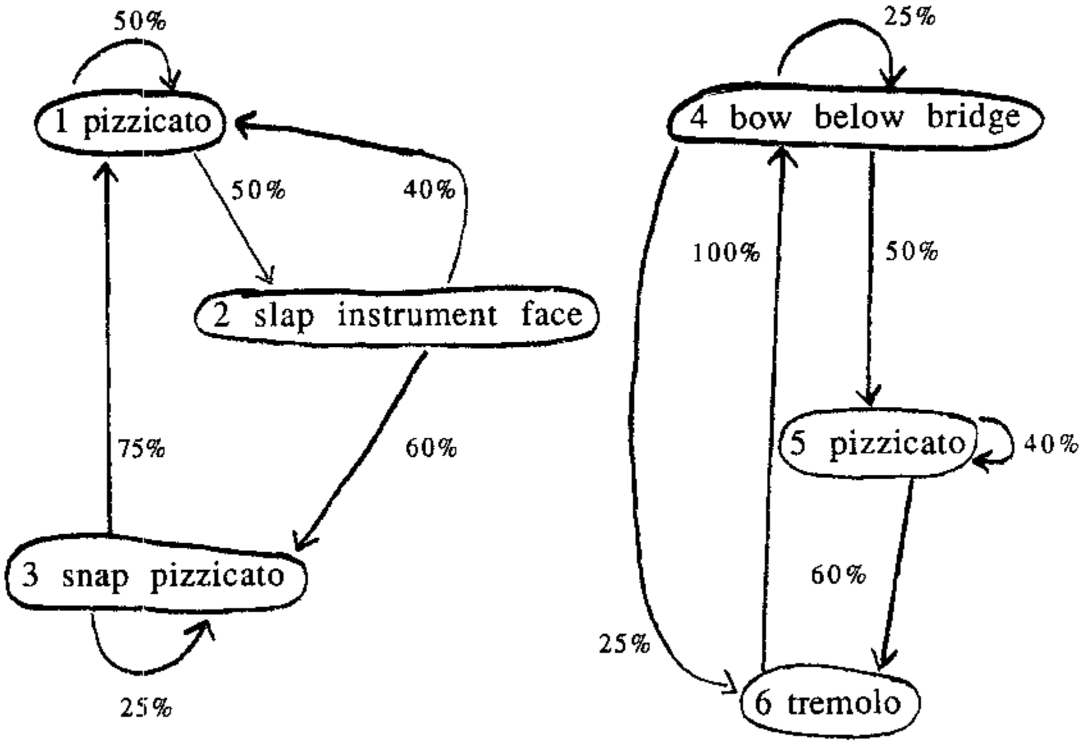

Figure 15: A simple Markov chain diagram.

In this figure, the arrows indicate the possible sequence of commands (command 1: pizzicato will never be followed by command 3: snap pizzicato) while the numbers next to the arrows indicate the probabilities associated with moving from one command to the next.

This diagram indicates a division similar to the division in the program for *A Noite, Porem, Rangeu E Quebrou.* Group 1 (commands

1, 2, and 3) does not share a common member with group 2 (commands 4, 5, and 6). The computer must, therefore be programmed to move from one group to another. The division in this example allows the composer to know that while in group one only non-bowed sounds will result. Furthermore, the composer will know that when re-seeded with a group two location, the commands will include bowed and non-bowed sounds.

Timbres

The melodic construct that continues throughout most of the piece is presented using a synthesized timbre that includes an attack similar to that of a plucked-string instrument. The timbre has a repeat function, chorusing, and a number of oscillators independently controlled with regard to frequency modulation, envelope, and amplitude. Other timbres present in the work include sustained frequency modulation (Chowning 1973) and additive synthesis (Risset 1969) instruments.

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CHAPTER IV

DISCUSSION OF *HELP ME REMEMBER*

Introduction

Help Me Remember is a work for performer, computer music system, and slides. Optionally, it may be presented with a reduced computer music system, performer, slides and computer music on tape. The piece has a duration of approximately twenty minutes.

Help Me Remember is a broad attempt to summarize some of the most important things I know about composing. Additionally, the piece serves as a platform for political and social commentary. Consequently, parts of the piece, especially the text, will change with time. Portions of the text that deal with these aspects of music and life should be changed and updated to focus on current events. The work includes slides and theatrics. The performer must be capable of acting; voice inflections, stance, movement and facial expression are very important.

Rather than provide a detailed chronological description of the piece with explanations of the techniques used embedded within that description, this chapter includes a short general survey of the work, preceded by brief notes on the forces required to mount the piece and on the sections within the piece. There follows an explanation of the techniques involved in the production of the music. This explanation cites specific passages where the techniques are used.

Forces

Help Me Remember is scored for a computer synthesis system including a New England Digital Synclavier (r) and a MIDI system consisting of an Atari 1040st computer, a Yamaha FB-01 synthesizer and a Digigram MIDI-Mic, performer, shaker, and slides. Optionally, the Synclavier (r) parts may be played from a tape recording. The performer is required to speak, to play the percussion instruments, and to control various aspects of the computer synthesis system.

Help Me Remember employs the Synclavier's (r) digital sampling and real-time performance capabilities. The MIDI system operates as a real-time interactive system using programs written specifically for this work.

Parts of the music are generated in real-time by various compositional algorithms, while other parts are sequences, composed intuitively or through the use of compositional algorithms prior to performance and stored in one of the computers. The programs used in composing this piece were written in the Forth computer language by the composer and executed on the Atari computer.

Sections

Although *Help Me Remember* is a single, continuous work, it contains three distinct sections: "Listening," approximate duration five to seven minutes; "Looking," approximate duration eight to nine minutes; and "Dancing," approximate duration six minutes.

Description

The first section, "Listening," features the performer rapidly and repeatedly speaking the sentence "Let me make it simple for you." The same sentence has been previously sampled using the Synclavier (r) and is available to the performer at the Synclavier (r) keyboard. The performer uses the Synclavier (r) keyboard to manipulate the sampled sentence in various ways.

In addition to speaking and playing the Synclavier (r), the performer also shakes the shaker and, at one point, must start the program on the Atari by pressing the carriage return key on the computer keyboard. Once activated, the program takes in pitch and amplitude information in the form of MIDI data from the MIDI-Mic. The program sends out MIDI data to the Yamaha synthesizer to create melodic constructions based on the words spoken by the performer.

The slides shown during this portion of the piece contain comments by various people on composing and composers.

The second section, "Looking," makes use of sequences stored in the Synclavier (r). While this music proceeds, the performer reads various texts. These texts may include a list of names of people who have been influential or helpful in my development as a composer. Their mention in this part of the piece functions as a citation, an acknowledgement, and a brief thank-you note. The performer need not pronounce these names if they appear on the slides used in the piece. Other portions of the text comment on social or political subjects of current interest or on music, composing, and composers. The Synclavier (r) music in this section makes use of a percussion "riff" from a Fleetwood Mac blues song called, "Looking for Somebody" (Green 1967) and also features a compositional algorithm based on the fractal system called the "Henon Map" (Henon 1976). The MIDI system produces sounds using the Rapid Event Deployment technique (Waschka and Ferreira 1988).

The slides shown in this section include the list of names described previously, as well as statements on music, composing, and composers. If the performer speaks the names, they are not spoken at the same time or in the same order as they appear on the screen.

The music in the third section, "Dancing," uses a synthesis procedure that combines the fractal system known as the "Chaotic Gingerbreadman" (Devaney 1988) with Rapid Event Deployment techniques. This music is produced by the MIDI system while the Synclavier (r) plays stored sequences of intuitively composed music. The timbres employed in the Synclavier (r) part include mutated, resynthesized percussion timbres, frequency modulation timbres, and additive synthesis timbres. The performer speaks and controls the MIDI synthesis system from the computer keyboard.

The text and slides in this section comment on various aspects of music and dance.

Compositional Algorithms

Compositional algorithms employed in the piece include the serial extraction from a buffer procedure (Koenig 1970) and use of an algorithm based on the Henon map.

Serial Extraction Algorithm

A brief description of the random serial extraction algorithm used in *Help Me Remember* is given below in a simplified version..

This algorithm is used in the first section of the piece, "Looking," and runs in real-time on the Atari system. As the performer speaks, the MIDI-Mic converts the sound into MIDI pitch numbers and sends the numbers to the Atari. These numbers constitute the input.

This algorithm produces a series of notes, drawn from the input, in a random order but without repetitions. The musical output that results is a melody based on what the performer has said, but is not a direct mimicking of the pitch of the speaker. The basic material is there but slightly scrambled. The performer does have a certain amount of control over the synthesizer. For example, speaking in a low-pitched voice will put low-pitched notes into the buffer, but the order of their appearance will not be predictable. See Figure 16.

1. Fill a one-dimensional array with input MIDI numbers.
2. Sort the array and place the note numbers in a separate small array.
3. Set X equal to highest index number in the small array.
4. Generate a random integer between 0 and X.
5. Use that random number to identify one location in the note number buffer (small array).
6. Sent the note number in the identified location to the MIDI synthesizer to produce sound.
7. Exchange the selected note number's location with that of the note number in the X location in the buffer.
8. Reduce the value of X by 1.
9. If X = -1, then stop; otherwise repeat steps 4 through 9.

Figure 16: Simplified version of random serial extraction algorithm.

The array's size is purposefully kept small so that its output and the resulting synthesizer sound will always follow close behind the speaker's sound. Thus, the program produces a melodic accompaniment to the speaker based on the speaker's pitch and tempo.

Precedents for the use of the sound of a speaking voice as MIDI input data include the pieces *More Adult Music* by Toze Ferreira (1987) and *Smalltalk* by Paul Lansky (1988).

The Henon Map

The other compositional algorithm employed in this piece is based on the Henon Map, a fractal producing dynamical system defined as

$$x_{n+1} = 1 + y_n - 1.4x_n^2$$

$$y_{n+1} = 0.3x_n \quad .$$

See Figure 17.

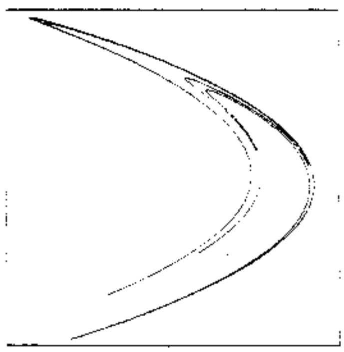

Figure 17: The Henon Map (from Henon 1976).

The system features a strange "attractor," meaning that different starting points, if part of the set, always produce the same set but in a different order. This attribute is interesting from a compositional viewpoint, since it suggests the possibility of knowing the set a particular value will come from (mappable to pitch, duration, and other parameters) without knowing in what order the values will appear.

In the case of *Help Me Remember*, the "x" values were mapped to "P" or Pitch lines in the Synclavier (r) Script language, while the "y" values were mapped to the "T" or Timbre lines. In the Synclavier (r) system the timbre line scales real-time effects present in a timbre. Thus, a Timbre line value of "55" attached to a particular note means that the real-time effects associated with the timbre playing that note will be invoked to the extent of 55 percent of their usual value.

This mapping results in a lively and wide-ranging melodic structure which begins near the start of the second section, "Looking," and develops throughout most of that section.

Synthesis Techniques

Synthesis systems and techniques used in this piece include resynthesis of sampled sounds using the Synclavier (r), manipulation of sampled sounds (again, using the Synclavier(r)), additive synthesis (Risset 1969), frequency modulation (Chowning 1973), Rapid Event

Deployment (Waschka and Ferreira 1988), and the use of a fractal system, "The Chaotic Gingerbreadman" (Devaney 1988) in conjunction with Rapid Event Deployment (Waschka and Kurepa 1989).

Resynthesized Sounds

The term, "resynthesized sounds" refers to sounds sampled (digitally recorded) and then analyzed so that a computationally more efficient and flexible synthetic copy can be made. In this case, this work was done on the Synclavier (r) system. Resynthesized sounds occur throughout the work. One example of such a sound, and the alteration done to it, is the percussion-like sound that begins section three. This timbre was originally a resynthesized snare drum sound. I altered the envelopes on various parts of the timbre in order to produce the sound heard in the piece.

Manipulated Sampled Sounds

One particular sampled sound, my voice saying, "Let me make it simple for you," was used without being subjected to a resynthesis process. The sampled voice part is manipulated in real-time by the performer during the first section of the piece "Listening." The manipulations consist of pitch transposition (use of a slower sampling rate) looping, and splicing.

The performer uses the Synclavier (r) keyboard to invoke the pitch transposition. The console above the keyboard is used to record the sounds made and to create a loop, causing the sounds recorded to repeat. The performer continues to record sounds played at the keyboard after the looping function has been invoked. Since the Synclavier (r) is set-up to handle only one sampled sound at a time (monophonic sampling system), the newly recorded sounds replace the previous sounds. Thus, the performer splices in parts of the sentence, replacing other parts and creating a complex line that includes parts of words, parts of the sentence, and the entire sentence. Much of the sound produced is unintelligible as language because of the splices or the slow rate at which the sampled sound is replayed or both.

Rapid Event Deployment

The technique to which the name "Rapid Event Deployment" in a MIDI environment was given consists of choosing a basic instrument definition for a synthesizer and then sending 150-300 or more events per second from the host computer to the synthesizer via MIDI. The resulting sounds vary decidedly depending on the instrument definition chosen, on whether that instrument definition is changed in the course of the gesture, on the particular algorithm used for pitch determination, and on the various MIDI techniques used in sending the information. The acoustical result ranges from intense streams of sound to massive "cloud-like" sonorities.

Descriptions of the acoustical results of Rapid Event Deployment can be aided by use of the terms and analysis used by John MacKay (1984) in his study of high densities of sonic events. MacKay notes that many of the psychoacoustical phenomena associated with high density textures are attributable to the bandwidth of the sound. Similar results are noticed with the Rapid Event Deployment technique.

Creation of sounds with narrow bandwidths (less than a perfect fourth) produces an extremely intense sound similar to MacKay's description of ". . . a distorted unison in which a lower tone is blurred or shadowed by an upper tone in close proximity." Also, using this synthesis technique can produce the effect called "massing." MacKay states that "massing" takes place when the density becomes such that "there is no longer any apparent 'space' between the grains . . .". He goes on to point out that "At the extremes of the massed densities (upwards of 100 gps [grains per second]), further increases in the rate of succession cause increases in the loudness and distortion of the sound mass rather than actual perceptions of increased density." This description corresponds with some of the results achieved through Rapid Event Deployment synthesis techniques.

As mentioned previously in Chapter One, Rapid Event Deployment can be seen as an extension and application of the granular synthesis concept (Gabor 1947, Xenakis 1971, Roads 1978, Truax 1986 and 1987). The development of this technique, the MIDI procedures involved, the results, and the limitations are discussed in Waschka and Ferreira (1988).

In *Help Me Remember,* Rapid Event Deployment techniques are used to produce "cloud-like" sonorities in the second section, "Looking". The performer invokes these timbres from the keyboard of the Atari computer.

Fractals and Rapid Event Deployment

The third section of this piece, "Dancing", uses a fractal system together with Rapid Event Deployment Techniques to produce fractal timbres. As discussed in Chapter One, composers had previously used specific fractal systems to develop and determine various parameters of a work. Generally, these efforts have been devoted to organizing the melodic and rhythmic structure of a work into complex, but self-similar patterns, or to modeling and mapping fractal patterns present in nature. In both cases, other processes, including intuition, were used to design the timbral aspect of the music.

Applying fractals to music is different than applying them to a static visual. In the visual realm, the general structure of the entire work is perceived at a glance. In music, the listener may not know, or be able to guess, the general structure until an entire work is complete. Even the smaller, localized structures may require several seconds or even minutes to be assimilated. Furthermore, Bruno

Degazio (1986) has argued that there are other problems in describing how we hear a music, and the processes at work within that music:

> The fact is that, unlike a work of visual art, the various levels of musical structure are not perceived in the same way. The problem may be succinctly described as a perceptual discontinuity between structural levels.

Degazio also pointed out that if fractal techniques were applied to timbre, the perceptual discontinuity ". . . would become extreme, however, and would surely be the first problem addressed." The combination of these factors produced the resulting problem of how to apply fractals to timbre construction in a musically meaningful way.

The striking visual images generated by fractal processes feature hundreds and thousands of points resulting from hundreds and thousands of iterations. This point-oriented concept suggested the necessity of producing hundreds of sonic events in a short time period in order to present a clear "sound image" of a particular fractal process. This increased speed of events allows the listener to bridge the perceptual discontinuity mentioned above, to step back from the moment-to-moment events and hear the overall structure of the fractal. This solution, to apply granular synthesis concepts and Rapid Event Deployment techniques in particular, to the fractal systems is described in Waschka and Kurepa (1989). In *Help Me*

Remember, one particular result from this study is applied.

The chaotic gingerbreadman is a fractal producing dynamical system defined as

$$X_{n+1} = 1 - Y_n + |X_n|$$

$$Y_{n+1} = X_n .$$

More information on this particular system is given in Chapter Three.

I discovered that when using this system certain initial points such as (-0.01, 0.0), that are close to points that generate stable orbits such as (0.0, 0.0), produce interesting timbres. These timbres may sound stable and periodic for some time, but eventually "breakdown", producing wide bandwidth "noisy" sounds. If the iterations are allowed to continue, the timbre may further evolve by becoming almost stable again for relatively long periods of time, or for brief moments. The sound may continue a relatively "noisy" pattern with a smaller bandwidth, the sound might maintain a wide bandwidth but feature predominantly low frequencies, or perhaps high frequencies. In other words, the algorithm provides a lively, interesting, and unpredictable sound. However, one can repeat a given sound by simply starting with the same initial values and iterating the same number of times.

Three types of mapping strategies were explored using this two-dimensional system. In one case, the sets of paired values were mapped as pitches and programmed to sound together, with equal durations for both values in the pair and varying durations from pair to pair. A second technique employed one value to designate a MIDI number or frequency, while the second value was used as a small-scale deviation or pitch bend value. The third technique employed the values as pitch and velocity data, respectively.

Pitch can be controlled by adding or subtracting a constant to the resulting MIDI numbers or by invoking the octave transposition functions on various MIDI synthesizers.

These timbres are utilized in the third section of Help Me Remember, titled "Dancing." They are invoked by the performer using the keyboard of the Atari computer. The sounds called for are "cloud-like" timbres which feature movement from near stability to "chaos" and back.

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APPENDIX

Scores for

A Shakespeare Quartet

A Noite, Porem, Rangeu E Quebrou

Help Me Remember

A Shakespeare Quartet

for

Four Guitarists

Rodney Waschka II

1989

1. Sleep that knits up the ravelled sleave of care
2. It out-Herods Herod: pray you, avoid it
3. Sleep rock thy brain
4. Let it come down

A SHAKESPEARE QUARTET

Instructions

Each page contains a line for each guitarist and has a duration of approximately two minutes. Thus, the work has a total duration of approximately 8 minutes.

Each line of 4 boxes, together with the 6 numbers above each box constitute one part. Each box contains a number of events: single pitches, dyads or chords. Each of the 6 numbers above a box represent the number of the events to be played in a five-second period. Thus, the 6 numbers together represent 30 seconds worth of events. The events are to selected at the players discretion from within the box below the number.

Articulation

In the first movement all single notes should be played pizzicato. In the fourth movement all articulations are at the discretion of the players, except for the final thirty seconds, in which the articulation should be legato and normale. The second and third movements should be played legato and normale.

Rhythmic Exceptions

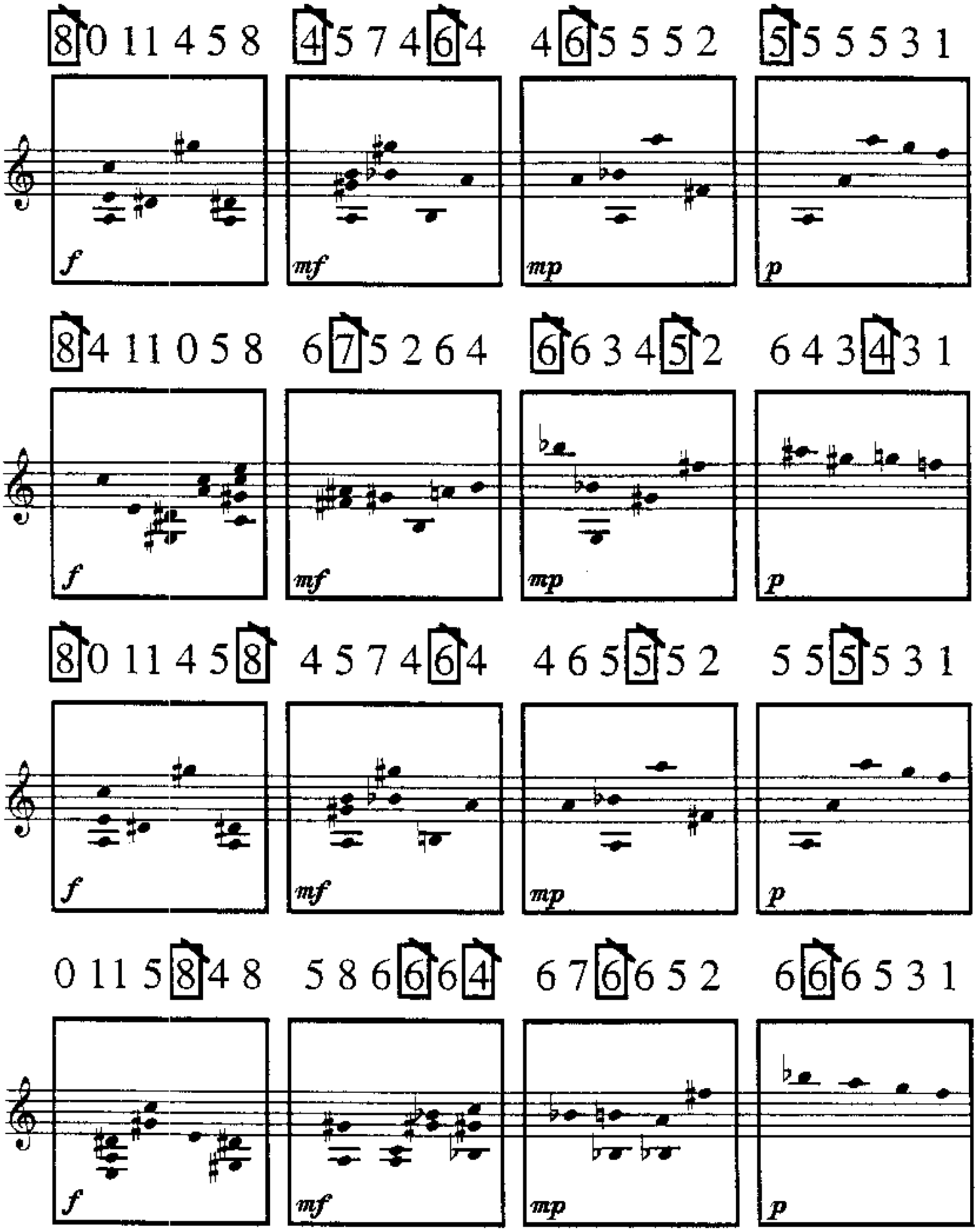
If a number is itself boxed, with a slash through the corner of the small box, then the number of events indicated should be played as rapidly as possible. The player need not begin at the outset of the five second period, but must play as fast possible once he or she begins to execute that segment.

In the third movement all durations within a five-second period should be of equal duration, however, the durations need not fill the entire five-second period.

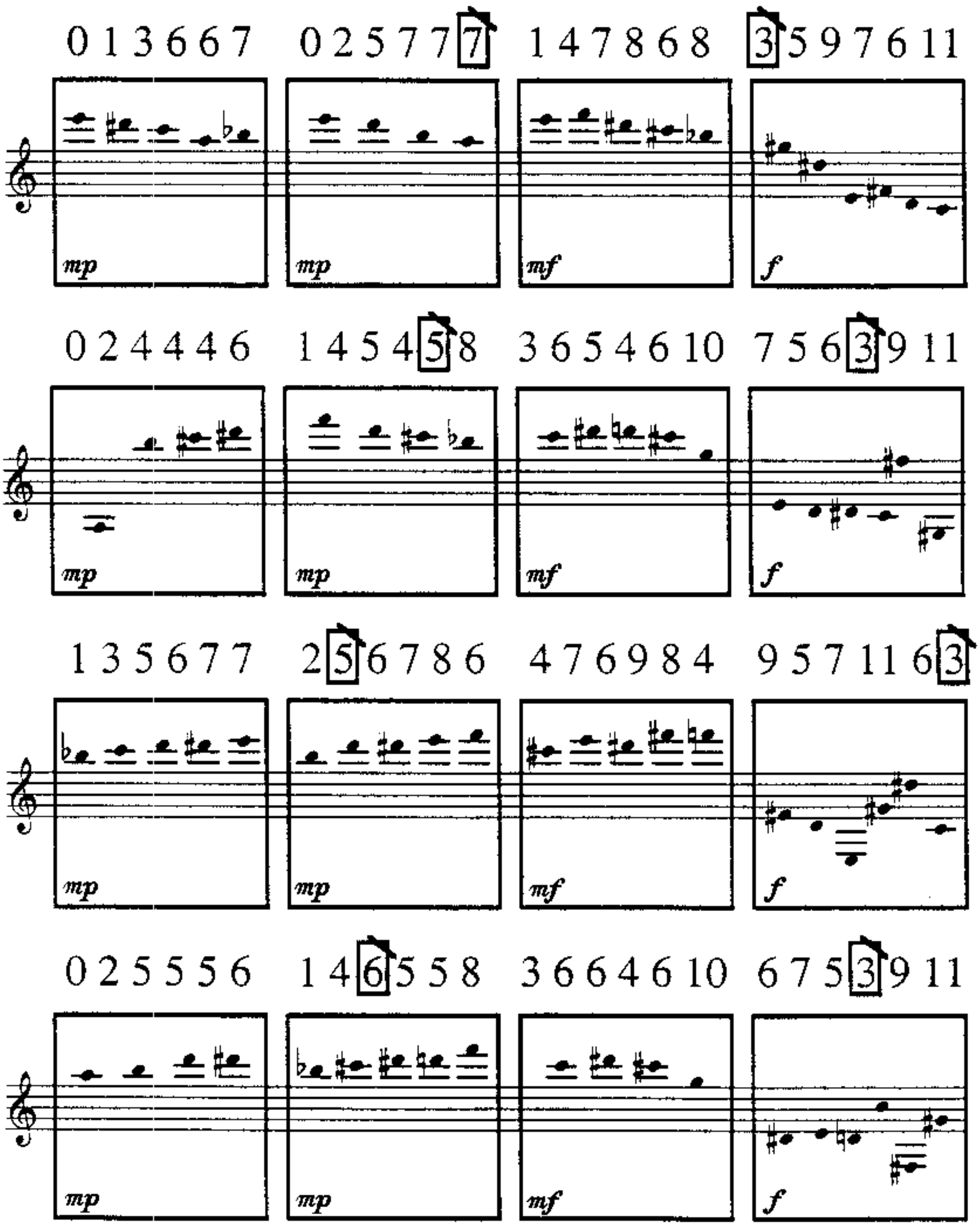
Performance

The first rehearsal may require a conductor to indicate the beginning of each 5 second segment. Subsequent rehearsals should be conducted with indications for the beginnings of each 30 period only. Eventually, the players should be able to begin each movement together, move through it independently, stop when finished, wait for the others and then begin the next movement together attacca. The guitarists should be seated around the audience. Do not hesitate to use microphones if the sounds cannot be heard.

I. Sleep That Knits Up the Ravelled Sleave of Care

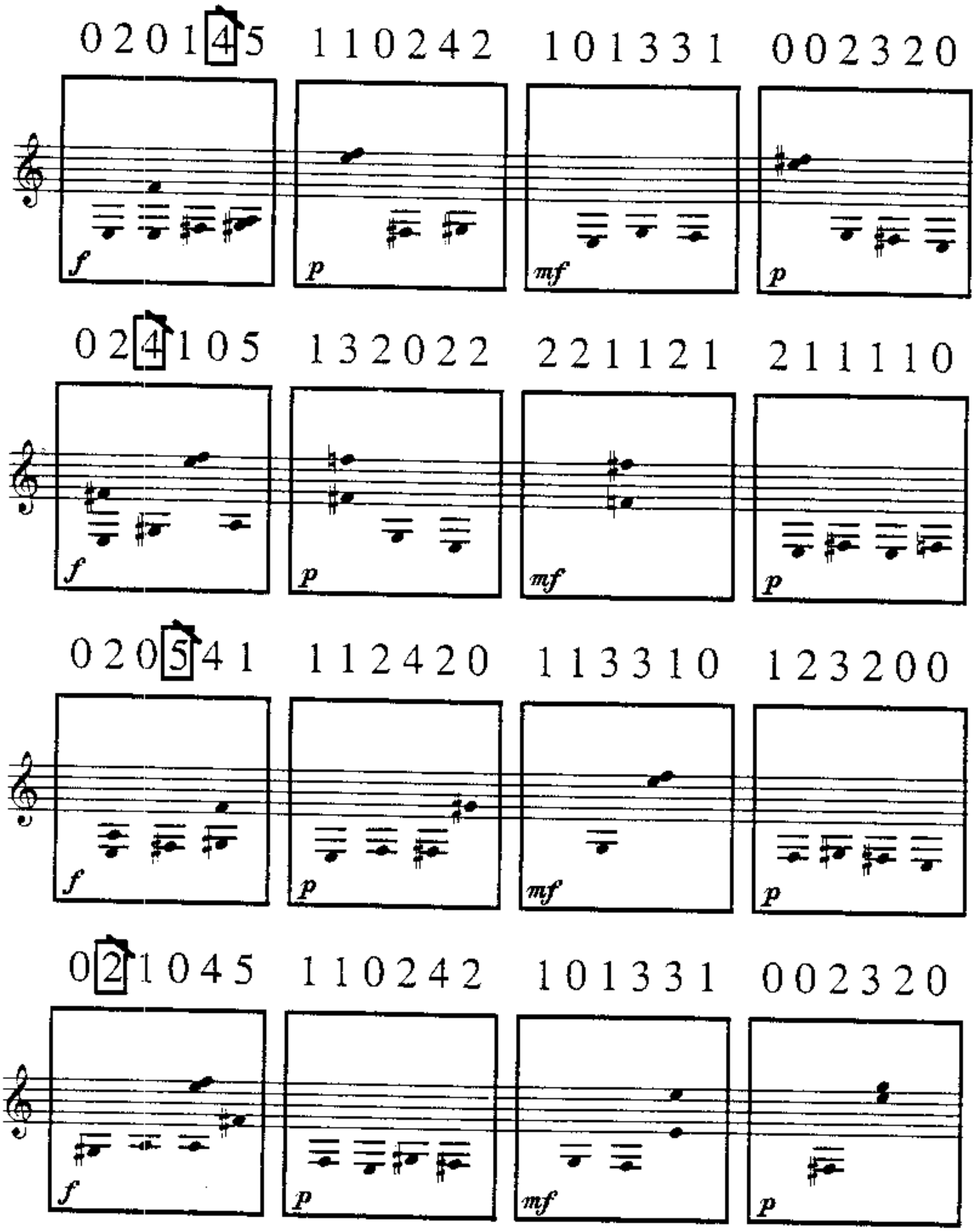


II. It Out-Herods Herod: Pray You Avoid It



III. Sleep Rock Thy Brain

IV. Let It Come Down



A Noite,
Porem,
Rangeu E Quebrou

1989

for instrument of low pitch range,
tape, and
computer (or traditional paper score)

Rodney Waschka II

A Noite, Porem, Rangeu E Quebrou
(1989)

Rodney Waschka II

A Noite, Porem, Rangeu E Quebrou (At Night, However, It Creaks and Breaks) is a work for tape, instrument of low pitch range and computer. The computer produces and displays the score in real-time for the player. Optionally, the score for the performer may be generated and produced on paper as a print-out which can be read in a traditional manner.

The performer's part varies depending on the instrument used. The performer is expected to choose a different pitch, group of pitches, or series of pitches, for each line of instructions. When the computer is used to produce the score, the appropriate durations and timings are controlled by the computer program. The performer should execute the command displayed at the top of the monitor screen's display. Two commands will be displayed below that command. At the appropriate time, the command at the top of the display will disappear and be replaced by the command which was previously below it. A new command (to be executed in the future) will appear near the bottom of the display.

When the more traditional score is used, the player must choose appropriate durations for each line of instructions with the restriction that each group of instructions must fill the allotted time. A stopwatch is helpful in this regard.

In either case, rests should be freely interpolated between some of the lines.

LIGHTING

When the computer is used, the performance should begin in darkness. A pale, colored light should slowly begin to illuminate the player after the performer has been playing for approximately one minute (two minutes and fifty seconds from the beginning of the piece). The light should slowly increase in brightness until at approximately five minutes and thirty seconds the light is at full intensity. (Even at full intensity, the light should not be "bright".) After six minutes the light should be slowly dimmed so that after eight minutes the performer is once more in darkness.

If the more traditional score is used, the same procedure should be followed. However, the player will need a stand light in order to read the score.

In either case, a dark red color is suggested for this light.

PROGRAM NOTE

A Noite, Porem, Rangeu E Quebrou was composed for string bassist George Dimitri. The first performance, however, was given by David Cason in Corpus Christi, Texas, at the Del Mar College Contemporary Music Festival in November, 1989.

The tape part was created on a Synclavier (r) system at the Center for Experimental Music and Intermedia at the University of North Texas. A compositional algorithm written by the composer and featuring fractal processes (the "chaotic gingerbreadman") was used to generate the tape material. The instrumental part makes use of other compositional algorithms which are designed for the particular instrument.

The title is a line taken from the poem *Campo De Batalha* by Tomaz Kim (Joaquim Fernandas Tomaz Monteiro-Grillo).

A Noite, Porem, Rangeu E Quebrou

Performer's Part
for optional performance without computer.

A Noite, Porem, Rangeu E Quebrou (At Night, However, It Creaks and Breaks) is a work for tape and unspecified instrument of low pitch range. The performer's part varies depending on the instrument used. The performer is expected to choose a different pitch for each line of the instructions. The player is also expected to choose appropriate durations, but with the restriction that each group of instructions must fill the allotted time.

Below is a part for String Bass or 'Cello:

0:00 - 1:50 TACET

1:50 - 4:00
slow and quiet, low pitches:

arco normale
arco normale
high note: staccato, trill, staccato
arco normale
arco normale
arco harmonics
arco normale
arco harmonics
repeat not p with sfz attack
circular bowing
arco normale
repeat note p with sfz attack
arco normale
repeat note p with sfz attack
lowest note

4:00 - 4:40
fast and loud, high and low pitches:

harmonic glissando
arco normale
bow on bridge
double stop arco
tremolo
double stop arco tremolo
arco normale
tremolo
lowest note
arco normale
high note: staccato, trill, staccato
slow glissando
arco normale sfz dim. p
arco normale pp cres. ff
bow below bridge

4:40 - 6:50
slow and mf, low pitches:

arco normale
arco harmonics
arco harmonics
arco normale
arco normale
arco harmonics
arco normale
arco harmonics
high note: staccato, trill, staccato
arco normale
lowest note
high note
arco normale
circular bowing
arco normale

6:50 - 9:00
slow and quiet, low pitches:

circular bowing
arco normale
circular bowing
repeat note p with sfz attack
arco normale
repeat note p with sfz attack
arco normale
circular bowing
high note: staccato, trill, staccato
arco normale
arco normale
arco normale
arco harmonics

9:00 - End TACET

HELP ME REMEMBER

for performer (voice, shaker, computer control),
interactive MIDI system (with a pitch to MIDI converter),
Synclavier (r) (optionally on tape),
slides

in three sections:

Listening
Looking
Dancing

Rodney Waschka II
1990

Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. IT'S DIFFICULT simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. IT'S RIDICULOUSLY DIFFICULT you. Let me make it simple for you.Let me make it

HELP
ME
REMEMBER

is scored for a computer synthesis system including a New England Digital Synclavier (r) and a MIDI system consisting of an Atari 1040st computer, a Yamaha FB-01 synthesizer and a Digigram MIDI-Mic, performer, shaker, and slides.

Section 1 Listening

Approximate duration 5-6 minutes.

The performer repeatedly and rapidly whispers pianissimo:

Let me make it simple for you.

While continuing the above activities, the performer initiates the interactive MIDI system by pressing the "return" button on the MIDI system's computer keyboard. The MIDI synthesizer begins to generate melodies.

The performer gradually crescendos and begins to shake the shaker:

After some time, while maintaining the speaking rhythm previously established, the performer recites:

IT'S HARD make it simple for you.

This phrase should be occasionally inserted into the repeating pattern throughout the remainder of the section. For example:

Let me make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.

Et Cetera.

After some time, while maintaining the speaking rhythm previously established, the performer recites:

IT'S DIFFICULT simple for you.

This phrase should be occasionally inserted into the repeating pattern throughout the remainder of the piece. For example:

Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. IT'S DIFFICULT simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S DIFFICULT simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.

Meanwhile, the performer continues to shake the shaker. This continues for some time.

After some time, and while continuing to speak and shake the shaker, the performer should begin to play the Synclavier (r) keyboard. The prepared timbre should be a sample of the performer reciting "Let me make it simple for you." The performer should play low-pitched sounds first.

Soon after beginning to play these sounds the performer should execute the Synclavier (r) commands which create a recording loop. The loop should be approximately 15-30 seconds long. The performer should continue to play the keyboard, gradually using more and more of the higher pitches.

During this period of time the performer should be speaking at a loud dynamic level. The performer may now occasionally interject the phrase:

IT'S RIDICULOUSLY DIFFICULT you.

For example:

Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S RIDICULOUSLY DIFFICULT you. Let me make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. IT'S DIFFICULT simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you. Let me make it simple for you. IT'S HARD make it simple for you. Let me make it simple for you.Let me make it simple for you.Let me make it simple for you.Let me make it simple for you. Let me make it simple for you.

Et Cetera.

After some time, the performer should stop playing the Synclavier (r). After some time, the performer should stop the recording loop. After some time, the performer should stop the interactive MIDI system program by pressing any key on that computer's keyboard. After some time, the performer should speak at lower and lower dynamic levels. The performer should stop shaking the shaker. After some time, the performer should whisper. After some time, the performer should start the Synclavier (r) sequence for the second section and stop talking.

Throughout this first section of the piece several slides are shown. These slides contain the words, "Let me make it simple for you." in various fonts and colors. Other slides shown during this section feature comments on the nature of composing.

Section 2 Looking

Approximate duration 8-9 minutes

In this section, the performer should make a few (not to many) comments on the political and social situation in the world and particularly in the country the performer considers home. These comments should be extremely topical.

Other comments should be made on the nature of composing (again, not too many). These should include various important things that the performer has read or heard that have influenced the performer. Examples are given below:

It's ok to have politics in a piece.

It's ok to have sex in a piece. Well, not exactly to HAVE SEX in a piece, but to discuss sexual things -- there ARE laws after all.

As Toze Ferreira said, "Every piece is a seduction, Rodney. Some people try to seduce with ugly music, some people try to seduce with pretty music, and some people try to seduce with boring music. That's all."

I'm fed up!

As Paul Berg said, "All composers make the same two pieces over and over again. Or maybe, it's just one piece over and over again. I'm not sure."

To paraphrase Richard Ford, "In art you need that play of light and shadow otherwise things become too difficult to continue. And there's nothing like marriage for that play of light and shadow."

Morton Feldman said something like,"What do they want? I mean, if, in a piece, you give them a little ugliness, something soft, something loud, and a little beauty, what more do they want?"

Mr. Feldman, they want to dance.

Other possibilities might be found in books such as *The Triggering Town* by Richard Hugo.

In this section, the slides will contain the names of various people who have been influential or helpful to the performer. The performer should announce that these acknowledgements will appear in this section. If slides are not available, the names should be pronounced by the performer. The following list should be used as the basis for these acknowledgements. The names in the first group must appear or be recited. If a name is unfamiliar to the performer in the second group, a substitute may be chosen for that name or it may be skipped.

First Group:

Tom Waits
Tom Clark
Charles Ives
Toze Ferreira
Jack Kerouac
Robert Johnson
Charles Simic
Alexandra Kurepa
Miguel de Unamuno
Charles Dodge
Richard Hugo
Allen Ginsberg
Morton Feldman
Frank O'Hara
Paul Bowles
Mike Gyra
Muddy Waters
Jerry Hunt
Cecil Adkins
Paul Lansky
Peter Green
Richard Sale
Rodney Waschka (not me, my father)
Daniel Brandt
Laurie Anderson
Larry Austin
Richard Ford
Paul Berg
Edward Abbey
John Lee Hooker
Conlon Nancarrow
Peter Garland
Robert Ashley

Second Group:

John Neuberger
Harry Partch
Phil Barham
Martin Bartlett
Marija Bozic
Helma Kaemerer
Svetozar Kurepa
Luciano Berio
Frank Gyra
Malena Kuss
Andreja Malirsh
Clarence Barlow
Tone Loc
George Dimitri
Graham Phipps

At intervals during this section the performer uses the MIDI system to invoke Rapid Event Deployment synthesis sounds. These sounds should be used sparingly.

Slides

Throughout this section slides are shown which include the names listed above and the various comments on the nature of composing.

Section 3 Dancing

Approximate duration: 6 minutes

During this section, which begins with the altered snare-drum sounds of the Synclavier (r), the performer speaks and controls the MIDI system from the keyboard of that system's computer.

The performer should recite a few (not too many) comments regarding composing. If possible, these comments should be related to dance.

The performer may encourage the audience to dance in the aisles or on the stage.

In addition, the performer enters commands into the MIDI system that cause it to produce Rapid Event Deployment sounds. These commands specify the length of the sound object. The program uses the fractal system known as the chaotic gingerbreadman to produce these sounds. The sounds should be used sparingly.

The performer may leave the stage before the music has stopped.

Slides

Throughout this sections slides are shown that contain the word "dance" in various languages. Other slides shown display comments on composing, particularly as it relates to dance.

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