FINAL PROJECT REPORT

CORT LIPPE
21-3-83

"COMPOSITION USING PR2"

INTRODUCTION

It has been said that there are two kinds of intellectual knowledge: scientific and philosophical. This seems to be much too simple a statement of categories; but, be that as it may, it has often been said that scientists often lack the benefits of critical reflection and evaluation concerning their work while philosophers are deprived of the technical competence needed to communicate conditions of knowledge. Since I am neither a scientist or a philosopher; but an artist, I hope that this report will be read simply as a progress report on artistic activity. The fact that some of these activities involve the use of modern technology does not qualify me as a scientist. The espousing of aesthetic beliefs does not qualify me as a philosopher.

PROJECT OVERVIEW

This report represents an accumulation of ideas resulting from approximately seven months of work with the compositional program PR2. The first three months of this project were spent in familiarizing myself with the mechanisms of PR2. This period of work was didactic in nature. I presented a mid-project report (18-8-82)(see appendix I) which gave an overview of my work up to that point and my projected plan for future work with PR2; as well as presenting, on a rhetorical level, some thoughts and observations about working with a compositional program and PR2 specifically.

This present report is a final project report on my work with PR2 at the Institute. But this is not the "final" report of my project work. As stated in the mid-project report, the next step of my work was the creation of a musical composition. This has proceeded in two phases: (1) use of the computer at the Institute in conjunction with PR2 to create data in the form of printouts, and (2) production of a composition via interpretation of the aforementioned data. Since the second phase of this work does not require futher use of PR2 or a computer, continuation of work under the auspices of the Institute is not necessary. Yet, I plan to present the Institute with a final report concerning my composition- including a score, documentation, and analysis of input and its relation to the final output (the composition)- when the last phase of work is complete. Since a final composition does not exist yet, this present report will avoid any attempt at discussing a composition; but rather, will focus on the use of composing programs, and in particular, PR2.

THE COMPUTER AS TOOL

David Joravsky, in a review concerning artificial intelligence and neuro-psycology stated:

"So far, computers have revealed the human essence in the way that hammers and saws and all our other tools reveal it. They are invented to do the job the mind-brain-hand finds incongenial or difficult or impossible; yet nevertheless strives to do. Computers and other machines may therefore be able to show us not what the mind is but rather what it is not, the endless number of other things it aspires to create in spite of itself."(1)

One of the activities of the mind is the creation of music. I am not sure if the computer can show us what music is- this is not even an interesting question for me- (nor is a model of 'human compositional processes'); but computers certainly allow us to explore various aspects of music in a unique manner because "they...do the job our mind-brain-hand finds incongenial or difficult or impossible".

PROGRAMMED MUSIC: KOENIG AND PR2

For Koenig, PR2 is an important tool for setting up the boundaries of a form scheme by specifying general parametric possibilities, general ranges, which when realized with the aid of controlled random decision-making by the computer will display various aspects (or dimensions) of prescribed input data. *"The purpose of PR2 is to calculate musical structure variants"*.(2). In PR2 numerous variants can be calculated from one set of input data. The variants all exist on the same hierarchical level and can be compared with each other on a one-to-one basis. (See figure 1.) PR2 was designed with this idea in mind. This is a rather simplified explanation of Koenig's approach to programmed music in PR2, but sufficient as a model from which to compare my approach to using PR2. (For a more in-depth explanation see 'ELECTRONIC MUSIC REPORTS 3, PR2', the introduction.)

METHODOLOGY

My work of a didactic nature which took place during the first three months of this project was somewhat in the spirit of Koenig's approach to programmed music in PR2. This was done purposefully to explore PR2 within the framework of its author's aesthetic approach. (The author's asthetics cannot be completely disengaged from a compositional program- no matter how general the intention.) Later, upon beginning compositional work, my approach would not have differed too greatly except for one important factor: the present version of PR2 has the possibility for rapid sound playback of results. Output data can be represented as sound or as printed tables. Instead of receiving a stack of printouts which must be interpreted and converted into some sort of musical score (a time-consuming process) one just can push a button and hear the results of PR2. (Since I am of the first 'television generation' the ease with which results can be obtained is welcome.) The output can be listened to, changed (via the input), and listened to again and again virtually in a 'real-time' environment. (Since there are such widely varying definitions of the phrase 'real-time environment' in the computer music world which seem pointless to argue over, suffice it to say that my estimation of 'real-time' extends loosely to waiting for sounding results for about as long as it takes to drink a cup of coffee.) Anyway, this is a luxurious situation compared with the user environment of PR2 for the last 10 to 15 years. (It seems unnecessary to detail the obvious dangers of this luxury for the user because of the ease with which 'instant' music can be produced.)

This type of real-time interaction with a composing program can be very valuable. In fact, it has shaped my entire working procedure in certain ways. My basic approach to PR2 began to resemble my approach to a real-time interactive environment as described in the final project report for my previous project here at the Institute (1-5-82). (See appendix II.) Koenig attempts to find a general musical structure which appears flexible enough to produce a group of variants which could be likened to the various members of a family- all being unique expressions of the same genetic stockpile using PR2. (See Koenig's composition "UEBUNG FUER KLAVIER" which was composed using PR2.) For my purposes, a general musical structure becomes the starting point for a compositional process in which the generalities (or broad boundaries) are constantly shifted in the direction of the more specific (more precise boundaries)- constantly being focused down- in a type of 'self-corrective' mode. This is done until the final range of random possibilities does not reflect so much one aspect of a structure; but reflects my intention for a somewhat specific structure. For my work the general is illustrated by the input data. An individual variant is a specific. This is a goal oriented, causal process. Another aspect of my approach considers input and output data as steps across time in which, in a feed-back situation, transformations took place from point 'A' to point 'B'. Often a set of input data was gradually altered and each resulting output became part of a musical 'chain' over time. (See figure 2.) The computer can be a valuable counselor in this process. Disciplines as diverse as physics, meteorology, and building construction have found the computer to be an invaluable tool- why not music also?

SIMULATION

Simulation is defined in computer science as the mathematical representation of problems allowing physical situations to be represented mathematically as a means of problem solving. Webster's Dictionary defines simulation as: *"the imitative representation of the functioning of one system or process by means of the functioning of another"*. A compositional program can allow one to examine problems which are not subject to direct experimentation. If composition can be viewed as a kind of problem solving (a one-sided viewpoint in my opinion, but sufficient at the moment) then a program such as PR2 enables one to reproduce or represent under what could be termed 'test conditions' various musical phenomena. The computer, due to its powers of simulation, can be utilized as an aid in compositional processes.

By the rapid simulation of numerous variants (via sounding output) and the many dimensions of a structure which can be presented, explored, and studied no implication should be construed that part of the computer's value is that of a 'time-saving' device. On the contrary, the implications of this experience have meant a lengthening of the compositional process for me. The responsibility of exploring this method of composing- the ability to be able to try out numerous possibilities in a short amount of time (a heuristic approach)- requires more time if it is to be used to its fullest advantage. A model musical structure can be constructed, predictions can be made, a multitude of variations in the initial structure can be tested; but, importantly, the time needed for working without a computer would make this type of compositional method prohibitive.

REACTIONS

In many ways, my methods were easily adaptable to PR2, but at times I found that I was attempting to use the program in a somewhat unidiomatic manner. Even when attempting things for which the program was not really meant, though, I found that I was able to produce successful results. One of the values of a compositional program can be its flexibility and usefulness in various situations.

I did feel some constraints because the program has no facilities for organizing variants from a higher level. Other global facilities could be convenient and useful; such as, the ability to be able to alter tendencies dynamically across time via transformation rules. I found that often I was more comfortable altering the description for a particular selection principle rather than the stockpile from which the selection principle could choose.

FINAL PHASE

The final phase of work will be the interpretation of the computed, printed data. This stage is the most important for me as a composer. Another kind of interaction between composer and machine takes place here. One is confronted with information which must be converted into another form, Conversion, in a mechanical sense, in which the machine is expected to give printouts to be directly translated for performers without the necessity for composer control would be lacking something, in my view. This conversion can best take the form of transformation. The process begins with composer-created input data.

The computer interprets and transforms this data. The output from the computer becomes input data for the composer to transform into a composition as another form of output. If the composition is for performers, instead of tape, then the composer's output (the composition) becomes the input for the performer who in turn, transforms this data into a sounding performance. In all stages of this process, the output stage can (by a feed-back process) return to the input level.(See figure 3.)

Musically meaningful data interpretation becomes an integral part of the compositional process. Just as the composer is the link between input and computer, he is also the link between computer and output. The creation of the rules of a composition is the first step, setting the rules in motion and studying the results is the second step, and lastly the reconfirmation of those rules, the rewriting, or even breaking of compositional rules is the most important stage of composition in programmed music.

NOTES

(1) Joravsky, David. "BODY, MIND, AND MACHINE" The New York Review of Books. 1982.

(2) Koenig, G.M. "PROJECT 2, A PROGRAME FOR MUSIC COMPOSITION". Electronic Music Reports 3. Institute for Sonology. 1970.

FIGURE 1

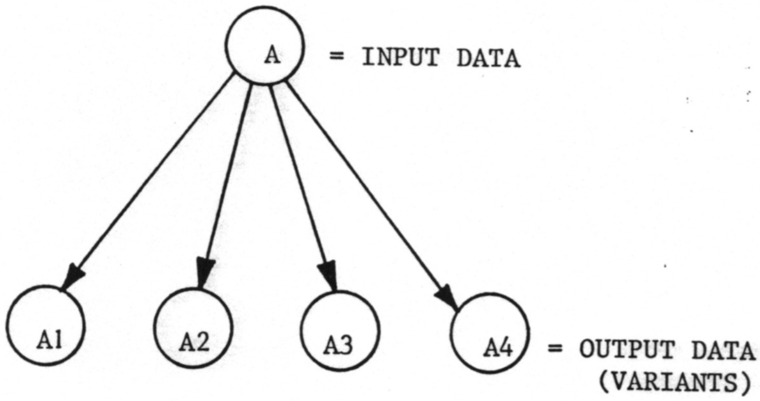
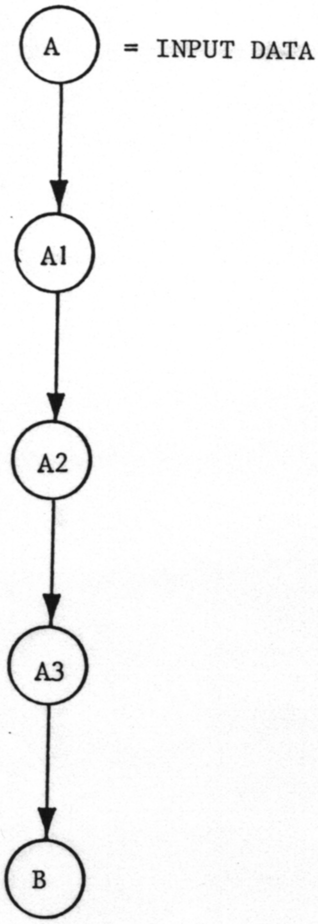


FIGURE 2

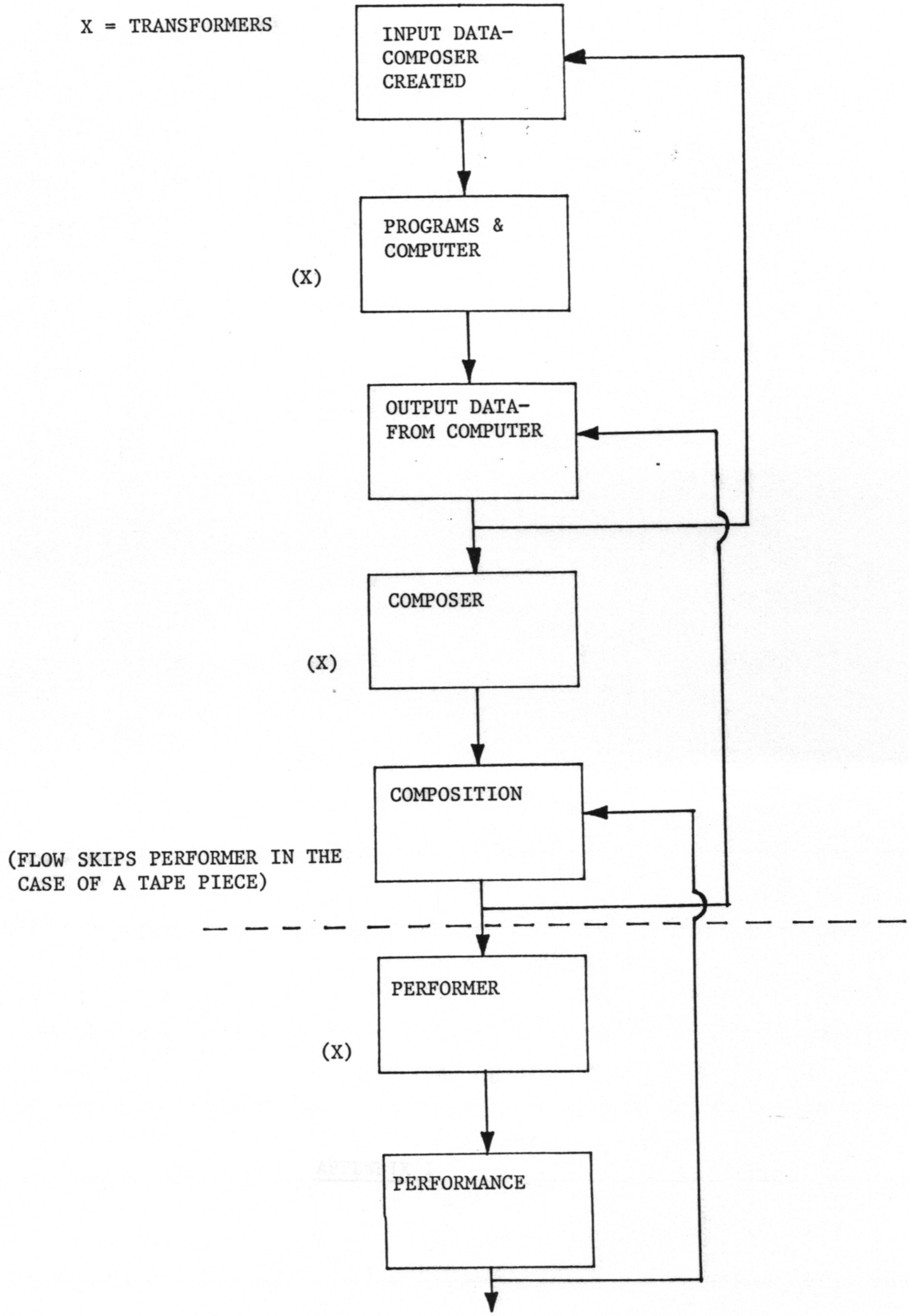


IN FIGURE 2 A1,A2,A3,& B CAN BE VIEWED IN TWO WAYS:

(1) A1,A2,A3 ARE ALL STEPS IN A HEURISTIC METHOD WITH B BEING THE ONLY FINAL OUTPUT.

(2) A1,A2,A3 ARE ALL OUTPUT DATA (VARIANTS) WITH B REPRESENTING THE FINAL VARIANT IN A TRANSFORMATIVE PROCESS OVER TIME.

FIGURE 3



X = TRANSFORMERS
INPUT DATA-
COMPOSER
CREATED
PROGRAMS &
COMPUTER
(X)
OUTPUT DATA-
FROM COMPUTER
COMPOSER
(X)
COMPOSITION
(FLOW SKIPS PERFORMER IN THE
CASE OF A TAPE PIECE)
PERFORMER
(X)
PERFORMANCE

APPENDIX I

This report represents an accumulation of ideas and results of approximately three months of working with the compositional program PR2. The type of work in which I am involved is didactic. This is a sensible working procedure regarding initial work with PR2. The program is complex and not an easy question/answer sort of program. A large amount of time and study are necessary in order to understand its operational mechanics; not to mention the learned ability of prediction as to results. It is necessary to become familiar with a large amount of input data. Calculation and understanding of the results is yet another necessity. A further complexity is that there are a great many interrelationships amongst the input data. Prediction and interpretation of these connections among and between input data is still to be studied.

The entire program is based on a hierarchical approach to music. One slight change can have an obvious or subtle effect on all other input data. Herein lies the major area for study. The idea of 'variants' which is basic to the aesthetic philosophy of Mr. Koenig is at the very core of PR2 - inherent in the basic structure of the working of PR2.

In the past three months I have attempted to familiarize myself with individual input possibilities.The first phase of study had been successful: an understanding of the technics and mechanics of program use. The second phase is beginning now: an approach to the program as a musician. I say musician, not composer, which may be a fine distinction in some ways,but one that I think is important. To further my understanding of the program it is necessary to explore musical production via musical ideas and goals. (I leave the word 'musical' undefined here to avoid taking this report into areas other than the main subject at hand.) Since the hierarchy and interrelationships in the program refer finally to actual musical parameters, this 'musical' perspective is significant. Only with experience, and hopefully success, in this area has been achieved can I step into the final role as a 'user' of PR2: composer. The final result of study would be ideally a composition which can be of great use in determining the value of compositional programs in general, PR2 specifically, and myself as a user of PR2.

As has been stated, PR2 is a complex program with many possibilities. The freedoms are not limitless though. As with any compositional program (no matter how general) the creator endows the program with certain aesthetic ideas, a particular aesthetic perspective. This can be accomplished on a very conscious level, or on the opposite extreme, unconsciously. Nevertheless, the combination of the author's aesthetics with purely practical considerations make up the limitations which any compositional program has.

Methodologically speaking, I decided to avoid approaching the program with too many preconceived ideas or with any sort of compositional plans or strategies. Instead, I have chosen to begin at simple starting points in the program and have tried to move in different directions until a path reaches an outer boundary of the program (either/and an aesthetic or practical limitation). Interestingly, these limitations became easier to foresee and predict as my experience has increased. In many cases the predicted limitations began to shape my working procedure, causing me to avoid reaching a supposed limitation (similar to recursive division by two). In this way the limitations took on new meaning, more as mental abstractions than as something concrete.

On a more personal, yet somewhat philosophical level, the question of just who is the 'composer' when one is using a compositional program (myself?, Koenig?, the computer?) is an important one. Since PR2 allows a user the two extreme possibilities of total control by the composer or total control via random choice by the computer with the flexibility for anything between these two 'extremes', a user can be lead to believe that there is nothing between himself and the computer. The program becomes invisible. At one point I thought that tests made at either extreme would reveal (or allow to surface) the work which was Koenig's in terms of 'fixed program characteristics'. This approach gave me a deeper understanding of some of the essentials of PR2. But the lines between composer (program user), computer (program), and author (of the program) are inherently blurred. Subject/object relationships are sets which intersect in great complexity. This may be analogous to the relationship between a composer and an instrumentalist working in close collaboration on a composition. If the intrumentalist is capable, then many of his ideas may be embodied, via the composer, in the composition. While, in turn, the instrumentalist's ideas are of course shaped by his instrument. The piece may end up being a collaborative effort among composer, performer, and instrument. I think a similar situation exits in using a compositional program.

The success of a compositional program lies in its ability to show a user different aspects of his compositional ideas. I hope to have more insight into this area of study in the next few months.

Cort Lippe
18-8-82

APPENDIX II

WORKING PROCEDURE

My working procedure has involved a great deal of heuristic activity. The interaction between composer and computer in a real-time environment can become very close. This does not seem unusual when the musician's relationship with, for example, the piano (another machine) is considered. The possibility of implementing a compositional idea, listening to the result, and having the potential to alter the result in a short amount of time enables one to form a relationship with the computer of an almost symbiotic nature, especially when the potential exits for altering the original idea and/or results. Futhermore, particularly when using stochastic procedures, the computer's interpretation of a musical idea can, in turn, effect and influence the composer's original idea so the man/machine alliance can become an enriching experience for a composer.

Historically, this heuristic approach has been an important working method for composers- especially in times of stylistic or technological flux- and allows for a great deal of experimentation and development that cannot take place in an environment of less immediacy in terms of compositional work and sounding result. (The example of Haydn at Esterhazy is obvious. Would the classical orchestra-basically still in use today- have developed as quickly from the Baroque ensemble without this type of working environment?)

Since input/output procedures are quite straightforward in FORTRAN I have usually employed a real-time score-like commentary of running, sounding programs which give various information on such things as: present variable values, locations within sections of programs, choices made by the computer, etc. Also, composer input while programs are sounding is possible. This allows for futher in depth interaction and man/machine communication. (Especially of value in a stochastic environment.) (See figure which follows.)

Note: A more detailed explanation of the heuristic working method I have outlined here will be given in connection with the written illustration of a specific program.

OBSERVATIONS

One provocative idea that has arisen from my experiences is: just what are the limits and possibilities of machine choices (in terms of stochastic procedures)? In my experience, the constant composer interaction on all levels of composition seems not necessarily to negate the idea of random processes; but at least to alter what is meant by a random process involving the computer. If I repeatedly use the same seed value for random number generation and constantly shape and sculpt the sound output via the refinement of random choices until I am satisfied with a final, repeatable result that expresses my musical intent, then is there anything random about this result? This is meant as a rhetorical question, but it is thought provoking...

Cort Lippe
Composition Description
March 1983

ABSTRACT

This paper describes the approach and methodology used to produce two compositions, "VOSIVE I" and "VOSIVE II", at the Institute for Sonology.

INTRODUCTION

Since my arrival at the Institute over 2 years ago, I have been interested in the VOSIM sound production system developed by Kaegi with the assistance of Tempelaars and Scherpenisse. VOSIM is an economical approach to sound synthesis and has yielded some interesting results. Yet, my early attempts with VOSIM did not produce satisfactory results. Later, I realized that my difficulty lay not with the oscillators themselves; but, rather with the various existing programs written at the Institute to be use with the VOSIM oscillators. All of this software (designed for the general user) necessitates the description of 'instruments' which can be used to 'play' a user-created 'score' to produce sounding output. This approach is based on a clear division between instrument and score much in the manner of conventional instrumental music. (The main difference being that the composer creates instruments as well as a score.) Because instrument descriptions are static, this approach is tied more closely to instrumental music then MUSIC V which allows for a general instrument description which can change according to certain programmed conditions.

PROGRAMMING PARADIGM

An active branch of work in the computer music field advocated by various groups and individuals, including Andy Moorer, Curtis Abbott, and individuals working at the Institute, (which, interestingly enough, along with VOSIM is almost uniquely pursued at the Institute in a certain form) is the approach within a 'programming paradigm'. With this approach a programming language is used to describe musical structures, events and sounds. The separation into the catagories of instrument and score can be more blurred. A clear instrument definition is not necessary or necessarily desirable, and a separate score (having a clear parallel relation to instrumental music scores) is likewise neither necessary or necessarily desirable.

ACOUSTIC MODELS

Acoustic models may be valuable for inderstanding aspects of sound synthesis and the acoustics of convential instruments, but only in the same way that the study of common practice harmonic rules is valuable technical training for a composer: both are important background information which can serve to allow composers to break new musical ground. But the use of common practice harmonic rules or acoustic models may not necessarily produce either the most interesting music or sounds.

REAL-TIME

Within the programming paradigm, real-time sound production of musical structures with the computer has interesting implications: the execution, by the computer, of instructions produces sound. It does not produce a table or list of samples which are stored for later conversion into sound. This approach yields an interesting set of problems in terms of program run-time speed and its relationship to sound output and musical time; especially when output is via a DAC, but also in the case of hardware oscillator configuration usage.

NON-STANDARD

One characteristic of the programming paradigm approach pursued at the Institute has been a general avoidance of acoustic models for sound production. Various models, including ones based on programming models found in the computer science field have been experimented with. This has given rise to the term 'non-standard' synthesis since most 'standard' computer music synthesis has historically relied on acoustic models. Any futher description of the 'non-standard programming paradigm' approach is unnecessary here. The work of Berg, Eliëns, Koenig, van Prooijen, and Rowe is amply documented here at the Institute.

PERSONAL WORK

My work with the VOSIM oscillators has been via the 'non-standard programming paradigm' approach. I chose to work in real-time and for that reason used the 6 COMPOSITE VOSIM oscillators (to allow for a maximum density of 6 voices). To produce sound each oscillator must be loaded with 7 18-bit words of information (42 total words for a 'chord' of 6 voices). Each of the 7 words is packed in a particular way with various data for an oscillator.(A total of 19 variables is packed into the 7 words.) Using FORTRAN there was ample time to produce values, organize them, and pack them for 6 oscillators. (Six voice 'chords' could easily be produced at a rate of speed high enough to produce sidebands.) Small MACRO-15 subroutines were necessary only to load, start, and stop the oscillators. The 7 18-bit words required for an oscillator to produce sound contained the combined instrument/score information produced via FORTRAN. The limitations inherent in a fixed (or static) instrument description and a separate score were easily avoidable since I controled musical structure from lowest to highest levels (sounds to overall formal elements).

Thus, I was able to control, at all times, just how much of an instrument description, score definition, and relationship and interaction between instrument and score I desired. The work took place within an interactive, heuristic environment in which stochastic procedures were employed in a constrained manner. An ongoing commentary via the terminal gave 'score' information in real-time on such things as: present variable values, locations within sections, computer-aided choices, etc. Eight possible timbral types or classes (ranging from general to specific in definition) were employed in two kinds of groups: similar or dissimilar. Larger structural aspects and the relationships between and amongst sections were decided in real-time via a combination of composer specification and computer control within the limits of a pre-defined general scheme. Density, frequency, duration, entry delay, amplitude, articulation, and timbral characteristics (envelope, amount of modulation and type, harmonic/inharmonic content, etc.) were also chosen in real-time by a combination of composer and computer via interactive compositional subroutines.

Since I feel it is important in my music to avoid the pitfalls of imitating instrumental music (in terms of basic parameters such as: pitch, duration, dynamics, etc.) and also important to avoid the limitations of acoustic models in producing music electronically (if electronic music can hope to have an exploratory function and individual identity separate from instrumental music) this approach allowed me to produce satisfactory results without being confined to a traditional instrumental approach.