

"MAIDEN VOYAGES" - A SCORE
PRODUCED WITH MP1

Sever Tipei
Associate Professor
School of Music
University of Illinois

MP1 is a program for Computer-Assisted Composition which has been used since 1973. It is a "work in progress" in the sense that new features have been added continuously during these years while a number of changes and developments are equally contemplated both in the near and in the distant future. Papers describing MP1 have been presented at the "Second Music Computation Conference", University of Illinois, 1975, and at the "International Computer Music Conference", North Texas State University, 1981. What follows is an example of how some of MP1's capabilities were put to work during the realization of a piece, MAIDEN VOYAGES, written for the "25th. Anniversary of the Experimental Music Studios" Concert, University of Illinois, February 1984. The work is available on a two record album dedicated to the occasion.

1. THE COMPREHENSIVE APPROACH

The score for MAIDEN VOYAGES was generated entirely with MP1: no symbol was added "by hand" and no adjustments of the computer output were made. Incongruences that developed during the writing of the piece were dealt with in the only two ways considered ethical from the point of view of Computer-Assisted Composition: fine tuning the input data and modifying existing routines or adding new ones capable to produce the desired result. MAIDEN VOYAGES is scored for eight parts (voices) sharing five parameters, as shown in figure 1:

PARTS	PARAMETERS
1-Trumpet	1-Time (Durations)
2-Piano right hand	2-Pitch
3- " left hand	3-Intensity
4-Slide projector right	4-Timbre/Semantics
5- " " center	5-"Effects"
6- " " left	
7-Tape channel right	
8- " " left	

figure 1

The basic structure of MP1 reflects the assumption that music can be described as a collection of events in a multidimensional vector space. The number of parameters - dimensions of the vector space - may vary from piece to piece as long as it

is equal to, or larger than 2, and includes time as the first parameter. Although these restrictions have both theoretical and operational <raisons d'être>, I believe further commentaries are not required since most musicians will intuitively agree on their usefulness. The maximum number of dimensions is restricted only by compositional criteria or by concerns of a practical nature such as availability of computer time and memory. Since the sound parameters considered represent an analytical/creative tool, and do not attempt to be an accurate picture of the physical (acoustical) phenomena, their choice becomes part of the subjective compositional process whose scope is to create a world parallel to what is usually called reality.

An obvious advantage of basing the computations on the abstract concept of vector space is that it allows the handling of any type of event taking place in time, including "non-musical" ones, like slide projections (see figure 1). John Cage will certainly be pleased to find out that, seen from this perspective, everything becomes music. The strictest and most elaborate - although not the only one - correspondence between instrumental sounds and slides occurs at the timbral/semantic level (parameter number 4), as illustrated in figure 2.

The piano is partially prepared and the timbres generated by both piano and trumpet have been arranged in an ordered sequence which goes from "dry" and distorted sounds to "richer", undistorted natural sounds. The content of the slides is also arranged in an ordered sequence starting with events of planetary consequence (sunsets) and getting closer and closer to the world of humans. The move is, in both instances, from alien to common. This analogy makes possible the treatment of each slide as a sound in the musical composition or, even better, as an event in the five dimensional vector space that characterizes MAIDEN VOYAGES.

2. RANGES

As expected, one of the simplest ways of controlling the musical material in MP1 is through ranges. They vary according to the part and the parameter considered (min. and max. values valid for the entire piece), but they can also fluctuate according to what is needed in different sections

TIMBRE/SEMANTICS

	Piano	Trumpet	Slides	Symbol	
0	Percussion wood	Mouth piece	Sunsets/Dark	WOOD	0
1	" pins	Valve click	Mountains	PRCP	1
2	" metal	Ring	Winter scenes	PRCM	2
3	Plucked string	Cuivre	Water/Stones	PS/C	3
4	Gliss on string	Sound bend	Reflexes in water	BEND	4
5	Harmonics	Multiphonics	Trees and Water	HARM	5
6	Prepared rubber	-----	Trees in season	RUBR	6
7	" metal	-----	Ruins	PREM	7
8	Stopped string	Mute 1	Streets	MUT1	8
9	Una corda	Mute 2	Social/Political	MUT2	9
10	Ordinario	Ordinario	Nudes	ORDP	10

figure 2

RANGES - Durations

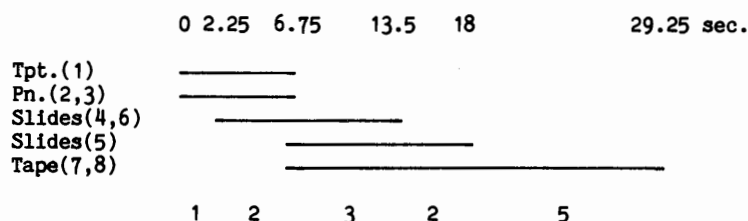


figure 3

of the work. (For instance, in MAIDEN VOYAGES, the pitch material for both trumpet and piano constantly expands from a rather limited number of possibilities in the first bars, to all pitches available on these instruments at the end). A quick look at the kind of durations - min. /max. values for the entire piece - used for all parts shows that, although slides are treated as sounds, the ranges of their durations set them apart. Each part is given a distinct personality: a longer time is needed to comfortably assimilate the content of a slide than that of a sound.

The longest durations (figure 3) belong to the tape which consists only of drones made out of filtered noise: they "bathe" the background of the entire piece. Their frequency band varies considerably, but in slow motion compared to other events.

As it can be seen from figure 4, the piano has the

most extended pitch range, that of the trumpet includes pedal tones, and the slide projectors' values at the second parameter remain constant at an arbitrarily chosen value (0).

Similarly, the intensity assigned to the slide projections is kept constant (at ff: the maximum luminosity available) while the tape plays all the time ppp, one step softer than the softest instrumental sound. Finally, at the fourth parameter, TIMBRE/SEMANTICS, the tape has again a constant value and so does part number 5, the central projection. The reason is a compositional one: the central projection does not display realistic pictures of nature, humans or objects, like the other two, but consists of sketches, diagrams and pages of computer output related to the way the piece was composed - a commentary reminiscent of Conceptual Art.

RANGES - Second Parameter

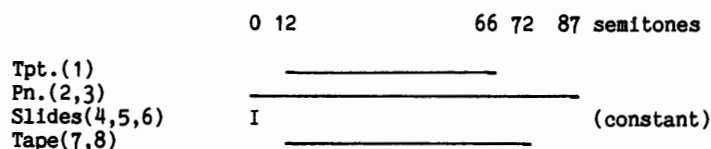


figure 4

RANGES - "Effects"

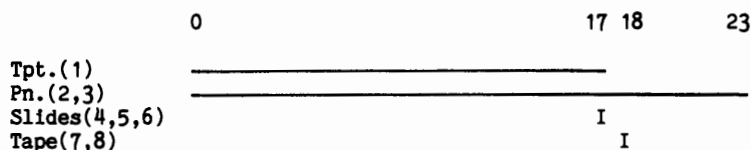


figure 5

"EFFECTS"

	n		k
0	Non vibrato	NV	0 Single SNGL
1	Poco vibrato	PV	1 Interval INTV
2	Vibrato molto	VM	2 Cluster/Chord CLST
3	Tremolo (ord.)	TREM	
4	" wire brush	T/WB	
5	" finger nails	T/FN	
6	" finger (flesh)	T/FF	
7	" mallet(s)	T/ML	

figure 6

The fifth parameter, rather loosely called "Effects" for a lack of a better term (see figure 1), includes ways of playing which have to do with vibrato and with the number of sounds being heard simultaneously at the same part. It applies only to the trumpet and piano, the slides and tape being given the constant values of, respectively, 17 and 18.

The table in figure 6 describes the "effects" and shows that their ordering involves a congruence relation mod. m, a tool musicians use all the time when dealing with pitch classes and octaves.

In the temperate system, a pitch can be written as $a=km+n$ where n is the pitch class, k the octave number and $m=12$. In figure 5, $m=8$, $17=2X8+1$ and $18=2X8+2$ or, in other words, the value assigned to the slides is equivalent to a cluster played in normal fashion (poco vibrato) and the value assigned to the tape, to a cluster with a lot of reverberation. All MP1's operations allow for the presence of congruence relations mod. m at all parameters. In MAIDEN VOYAGES such relations are defined at parameters 1,2 and 5. As in the case of pitch, they represent different levels of approximation the composer can control independently.

3. SIEVES AND PATTERNS

The handling of sieves in MP1 has been discussed before (Tipei, 1981). MAIDEN VOYAGES uses a number of 43 weighted sieves which help organize the piece both by carving into the available material and by imposing an hierarchy on those elements which are allowed to pass. The pitch sieves shown in figure 7 are employed in the first bars of the piece; note the emphasis, through the assigned weights, on F-C

for the trumpet and on A-E in the piano part.

Sieves are an efficient tool especially when used to correlate two or more parameters. Such a link is established between the fourth and the fifth parameters for trumpet and piano in order to discard impossible pairs like "sound bend - interval" for trumpet and "plucked string - wire brush tremolo" for piano.

In MAIDEN VOYAGES, all sieves are constructed in such a way as to accommodate the patterns that are used concurrently with them. A pattern can be described as a motive, theme, tone row, etc. depending on its length and function in the piece. In more general terms, it is a recognizable figure, defined at all parameters, which is fed-in before computations begin and can be reproduced with variable degrees of accuracy (Tipei, 1975). When the accuracy is low, only the pattern's flavor transpires - isolated intervals or short strings of sounds -, a situation which may interest a composer in search for either smooth transitions from one pattern to another, or for ways to create variations (distortions) of a given entity. If 100% accuracy is desired, the usual algorithm is abandoned and a special subroutine, UPDATE, takes over. It is this subroutine that had to be expanded during the writing of MAIDEN VOYAGES in order to accommodate the dual requirement of copying exactly a given pattern in the context of a complex sieve.

For instance, it is not difficult to match a sieve containing most elements possible in the range with a tightly packed pattern of a few notes only. Also, there are reasonable chances of success in matching either a sieve with a great number of elements uniformly distributed over the entire range with a large ambitus pattern containing skips

PATHS through time zones

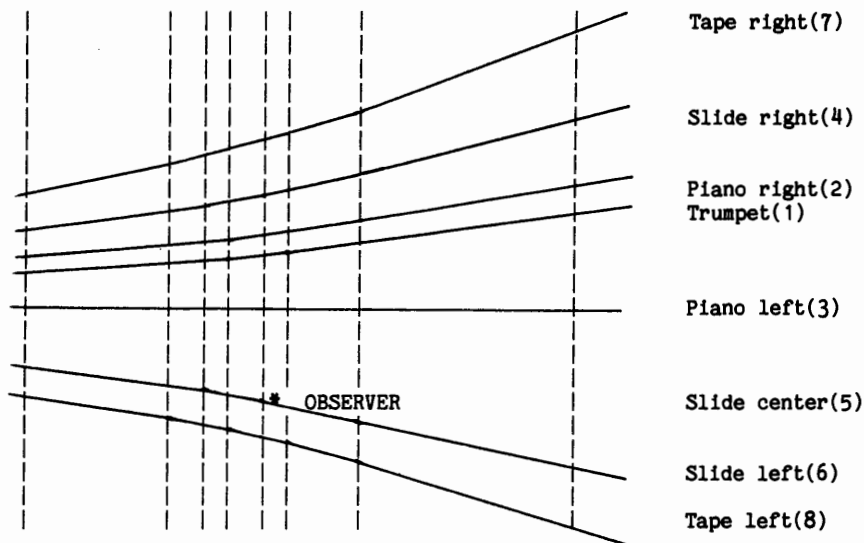


figure 9

range, at all parameters and only the successful tries are retained. A random procedure, which may or may not take into account a ranking of the valid alternatives, decides which variant will be adopted. In programming terms, this is rather elaborate and tedious, making one humbly remember the apparent ease with which the human mind performs similar operations.

4. MUSICAL FORM

Regardless of style, what is usually called musical form represents the result of changes occurring at all structural levels, a cumulative effect toward which all variables concur. Abrupt, clear cut alterations taking place simultaneously at most levels, mark the beginning of new sections. Sometimes one level becomes predominant; for instance in late 18th. century music, the harmonic progression is the decisive factor, the key to formal analysis, while texture, dynamics, instrumentation, etc. redundantly cooperate.

There are no abrupt changes in MAIDEN VOYAGES and, although all of them are precisely defined and occur at a limited number of moments in the work, the redundancy between parameters is rather low. From the vantage point of traditional music, it could be described as a through-composed piece; a more accurate account should also mention that it represents a continuous process characterized by slow, smooth transformations. This process takes place in an imaginary space on which a number of "time zones" are defined (see figure 8). Their boundaries consist of samples taken at irregular intervals; the values obtained are considered, for convenience, constant up to the next sample. The "time zones" and the samples show an evolution from simple to complex (i.e. from regions containing a small number of different elements to regions

containing a large number of different elements), and from potential structure to lack of it passing through an area of tightly structured events.

Seven paths traverse this imaginary space fanning out toward the right side of figure 9. Their musical correspondent is a collection of seven parts, with the trumpet (part 1) in the middle, surrounded by piano right hand (part 2) and piano left hand (part 3) then by the slide projection right and slide projection left (parts 4 and 6) and with the two tape channels at the extremities (parts 7 and 8). The central projection (part 5) is a fixed point situated between the slide projection left and part 3 (piano left hand). It is the privileged point of view of an OBSERVER watching the evolution of the other seven parts, the subjective perspective of the composer while writing MAIDEN VOYAGES.

Now, the OBSERVER takes his own samples of events created by the seven travels through the time zones, establishing points on the paths which are simultaneous (see figure 10). The measure of the distance between two adjacent samples is given by the angle between them. Their magnitudes are: 14° , 7° , 21° , 14° , and 34° , corresponding to the proportions: $2/13$, $1/13$, $3/13$, $2/13$, $5/13$. As in the case of time zones, a sample value is presumed either constant during the interval, or changing gradually until it meets the new value. It should be clear from figure 10 that a modification, either in the OBSERVER's position or in the orientation of the 90° angle (formed by the first and the last sample) with respect to the time zones, will result in a different perception of the seven paths. The counterpoint created by the fact that within any given angle each path traverse a different region of space and time, will be altered, too.

It was mentioned before that all changes of values,

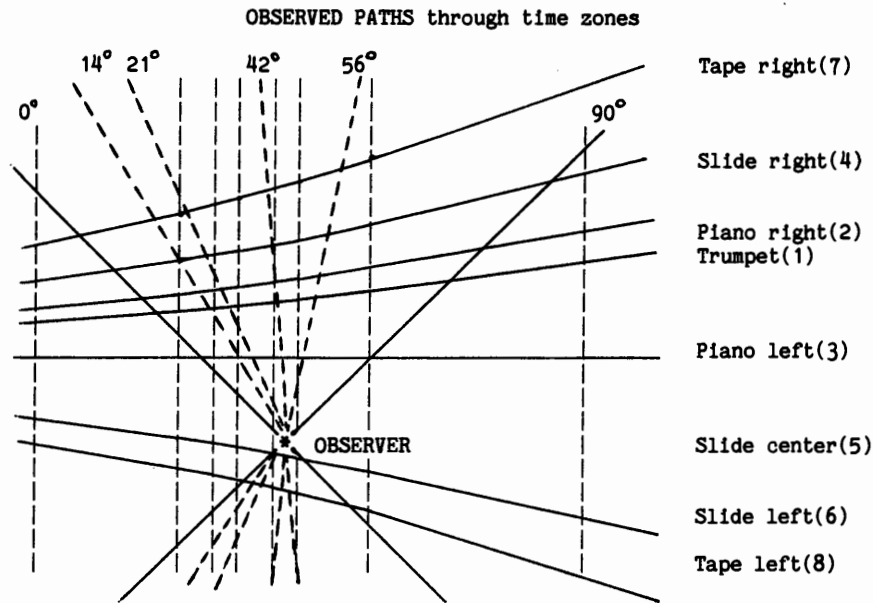


figure 10

DENSITIES

	0	14	21	42	56	90	
Trumpet	.083	.784	.378	.432	.176	.192	1
Piano right	.722	.976	.492	.705	.244	.444	2
Piano left	.517	.624	.402	.787	.376	.318	3
Slide right	.749	.736	.276	.952	.164	.198	4
Slide center	1.000	1.000	1.000	1.000	1.000	1.000	5
Slide left	.175	.336	.540	.744	.116	.450	6
Tape right	1.000	1.000	1.000	1.000	1.000	1.000	7
Tape left	1.000	1.000	1.000	1.000	1.000	1.000	8
	5	8	3	5	2	3	

figure 11

for all variables, occur at moments defined as simultaneous by the OBSERVER's sampling. However, densities are the only feature consistently redundant with the procedure: none of the other variables have a change of value at each of the six moments: 0°, 14°, 21°, 42°, 56°, 90°. This way, the form of the piece is the result of a cumulative effect, density being its predominant component. The table in figure 11 shows the densities which correspond to sampling moments. The Slide projection center (5) and the Tape(7,8) have no rests, so their values are constant (1.000). For the other five parts, random numbers were used to determine the actual density, but they were modulated by a series of proportions insuring that the average density reaches a peak at 14° and diminishes continuously up to the end of the piece, while following a wave-like movement.

The values in the table are valid only for narrow regions around the sampling moments. In between,

they are modified to obtain a smooth transition from one value to the next. As a result, MAIDEN VOYAGES becomes a through-composed piece, a continuous process hiding the sectional structure of the data gathered through the OBSERVER's optic.

5. HOMOLOGIES

Even a reader who is only marginally familiar with contemporary physics will detect similarities between the above description and ideas proposed around the beginning of the century. The motto on the score, a quote from A. Sommerfeld's comments on a paper by H. Minkovski, underlines such analogies:

"reciprocal relations between world-lines"
(or world-points) as
"the most perfect expression of physical laws".
(Einstein, Lorentz, Wyl, Minkowski, 1952)

Indeed, the seven paths and the observer are seven world-lines and one world-point in the spacetime defined by the vector space in which MAIDEN VOYAGES exists. (The element of order of all real things is a "world-point", i.e. a place at a definite time, and the "world-line" is the history of a moving point). The composition is a view of this spacetime as seen by the OBSERVER. Further equivalences could be found between the drifting apart in time of the world-lines - or parts - (see figure 9), and the expanding universe; between the soft noise of the tape enveloping everything, and the cosmological background noise coming from all directions, residue of a primeval explosion; between the region of 100 accuracy of pattern reproduction occurring approximately 2/5 from the beginning of the piece, and the fact that - it seems - conditions for the appearance of intelligent life (structure, rational/deterministic thinking) become ripe somewhere around the mid-life point of a solar system; and between the ever increasing complexity and randomness in the piece and the existence of a time asymmetry as implied by Boltzmann's Second Law of Thermodynamics.

However, MAIDEN VOYAGES is no closer to program music than, lets say, most of Edgard Varèse's pieces, inspite their intriguing and suggestive titles: the homology is established on a more fundamental level. As Schopenhauer pointed out, music has the priviledge of being capable to deal with abstract concepts while having an immediate, sensorial impact. In periods such as the Middle Ages and Renaissance - to take only a familiar example - western music has reflected the description of the world provided by religion, the molding force in society. Nowadays, science

supplies a more adequate explanation of the universe and of our place in it and, while concerning itself with the phenomenal world, it includes topics considered for long the exclusive domain of mysticism, like creation. There is no reason why music should still echo the mentality of centuries ago instead of being congruent with our present understanding of the world.

MAIDEN VOYAGES is an attempt at that, and MP1 has proven to be a very appropriate tool when operating with notions like randomness, entropy, chains of events or structured patterns as well as with smooth, continuous transformations between such states. It is a flexible and sophisticated instrument able to accurately translate into music the vision which animates MAIDEN VOYAGES.

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