Programmed Music

The above heading describes an annual course which has been given for several years at the Utrecht University Institute of Sonology. The course offers a theoretical explanation of algorithmic composition and practical exercises with "composing programs". These programs were developed for purposes of research before being made accessible to students. The investigation focused on the extent to which the composer can acquire consciousness of the compositional process, and on the feasibility of formalizing it, once such consciousness has been acquired. Within the scope of this research program I developed *Project 1*, *Project 2* and *SSP* (Sound Synthesis Program). I am currently working on a *Project 3*.

In order to give some idea of the nature of my investigations, I shall describe *Project 1* in more detail; an outline of *Project 2* and *SSP* will then suffice.

Project 1

Project 1 is based on the findings of serial composition technique, and aims at the experimental experience of chance-governed constellations of parameter values. Chance, in this instance, replaces the permutations to which the serial composer was accustomed to subjecting rows, the consequences of which action for the resulting constellations of material was scarcely more predictable than in the case of aleatoric manipulations. Just as serial technique soon abandoned the "pointillist" style in order to apply the organizational principle to pre-formed units, "groups", the idea behind *Project 1* likewise assumes that the unpredictability of chance will be neutralized by given lists of material and the appropriate selection of items from the lists, in order to facilitate the formation of medium-sized and larger form categories.

Interpretation

Project 1's approach to the problem may be described as "interpretation": this covers both the evaluation of the idea for a composition before the computer can process it, and the composer's evaluation of the tabular score generated by the program. *Project 1* thus fixes two steps of a process that ranges from the planning of material and form, via a draft score, its elaboration, revision and execution, to its hearing. The first of these two steps goes from the idea to the plan, the second from the draft score to its execution. Planning and elaboration, like the execution of the score or the listening experience, are seen as stages in the creation of an aesthetic object. These are the very steps which serial theory had already endeavoured to formalize. In *Project 1* the material's structure, that neutralizes chance, is brought about by internal and external factors.

Algorithms

Internal factors are algorithms, which the composer cannot influence; they might also be thought of as default input data for the program. The task of the prgram algorithms is to organize the material in the lower and middle echelons of the form; *Project 1* has no control over the overall form unless it is simply a chain of form-units. There is no clearcut distinction between lower and middle echelon form-units; the phrasing depends on random factors in the program and on the composer's subsequent interpretation. Technically speaking, the form results from the different lengths, and consequent overlapping, of the rows in which the individual parameter values are presented. "Natural" caesura occur when all (or most) row-sequences end simultaneously, a circumstance which it is feasible to employ in creating the form.

The creation of the form is also aided by distinguishing rows (only different values) and groups (only similar values), and by bridging the gap with intermediary steps. There are five steps in *Project 1*, linking the extremes which in program terminology are called "irregular" and "regular".

Interventions

External factors are interventions on the part of the composer affecting the lists of material or the control structure of the program. Intervention in the material affects the number and selection of instruments, tempi, entry delays, register numbers and loudness values. The composer's

interventions in the control structure affect the progress of the "regular" and "irregular" structural types and the intermediate steps. Without intervention, all the steps occur in a random sequence which ensures that every parameter is presented in all of its steps; in the default case this results in 7 "sections".

The composer can intervene by prescribing a particular sequence of steps for each parameter (omitting or repeating steps if he likes). Above all, he can intervene in order to coordinate the various parameters in terms of this typology.

Parameters

Breakdown: *Project 1* treats the following parameters:
INSTRUMENT, ENTRY DELAY, PITCH, REGISTER and DYNAMICS. Instruments are defined by name only, not with regard to their compass or other properties. – Entry delays indicate the distance from one entry to the next, not a tone's "duration", They are defined according to their relation to the metric unit, e.g. 1/2, 1/4, but also 3/7 or 3/2. The metric unit results from the respective "tempo". – The harmony is based on three-tone groups, assembled into twelve-tone complexes. A three-tone group contains a minor second and one of the two thirds and is transposed four times. Both ascending and descending intervals are used; the order of the four transpositions is random. (A revised version currently being tested allows the composer to choose among 48 interval constellations.) – The register information permits different "layers" to be fixed: particular octaves or instrument-typical pitch ranges. – The dynamics parameter is defined by traditional dynamic values. – The default input set provides 6 metronome values and 28 entry delays, 9 instruments, 4 registers and 8 dynamic degrees.

Briefly formulated, *Project 1* composes a chord sequence. The sizes of the chords depend on the indices of the entry delays selected for them. It is up to the composer to divide the chords into voices and add the durations of the tones. Although he enjoys considerable freedom, he is still bound by the constellations of the parameter values. It turns out that the selection principles (between "regular" and "irregular") and the material lists to which they apply, exert considerable control on the random decisions in terms of a composed formal structure.

Project 2

The homophonic principle of *Project 1* is contrasted by the more polyphonic principle of *Project 2*, which permits the composer to specify the material to a further degree, in 8 parameters, and to choose between 6 selection principles. Four of these selection principles are essentially aleatoric and hence not susceptible to the time-direction, the fifth does take the time-direction into account ("tendency"), and the sixth leaves the choice to the composer. The parameters are interdependent to a considerable extent; the composer determines the degree of dependency.

Polyphony

Project 2 can be called polyphonic although basically, like *Project 1*, it only produces chord sequences. However, the chords are "scored", i.e. distributed among a number of instruments. In addition, several chord or tone sequences can be superposed. Harmony need not be added until the end, so that all the layers are subordinate to the harmonic plan.

There is a choice of three principles for the harmony: working with chords, a row or an interval matrix. The composer is free in his choice of chords, row-tones or matrix data.

In addition to the entry delays, duration is also an independent parameter; so are rests, which can be inserted in the rhythmic context.

Variant production

"Variants" replace the "sections" of *Project 1*. Their task is not to present a prescribed number of options, but to assess the scope of the formal directives issued in lists of material and selection principles. For this purpose, each list can be given a "table" containing any amount of pre-selected list items. The parameters are supplemented by total durations and metronome values, stored in lists. The choice of pre-selected material needed for each variant is determined by one

of the aforementioned selection principles, so that there are several options between chance and total control.

Sound control
Both programs have been furnished with a sound system, to facilitate control of the material lists and their effect on the total structure. The sound system consists of 6 VOSIM generators which can be controlled in respect to the rhythm, dynamics and harmony of the computer-generated score. Sound spectra can be stored in a library and assigned to the instruments of the score for purposes of sound output.

SSP

My sound synthesis program *SSP* endeavours to transfer the generating principles of musical form to sound synthesis, and hence has common links with electronic music which, particularly in its developmental phase in Cologne, stressed the inseparable unity of sound and sound structure. My aim was to apply the idea of a form-generating principle, as can be studied in *Project 1* and *Project 2*, to the genesis of sound; the changing sound-field should represent the development of the form "directly", as it were, without being communicated by musicians and traditional instruments. The renunciation of this form of communication entails the renunciation of instrumental sounds, since their imitation would have been distracting. (Electronic music was similarly radical in its avant-garde period.)

For the sake of experiment in this area, the only sound parameters I allowed were amplitude and time: a particular change of amplitude occurs in each time-section. Time-sections and amplitude steps are selected from lists and assembled into sound segments. Sound segments may be combined in any order into longer sounds or sequences of sounds. In this way – in keeping with the negation of the act of instrumental performance – the differences between the individual sounds vanish, even the individual sounds vanish; what remains is "sound" in perpetual motion.

In practice, the execution of these ideas was restricted by the available computers, whose core memory was too small. I have nonetheless been able to use the *SSP* program in the classroom to demonstrate the problems involved. It has also been used to realize a number of compositions.

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Compositions

With *Project 1*:
Kim Ericson, *Crossings Over*
G.M. Koenig, *Segmente 1-7*
- *Segmente 99-105*
- *3 ASKO Pieces*
Harold Schellinx, *Page 21*

With *Project 2*:
G.M. Koenig, *Übung für Klavier*

With *SSP*:
Paul Berg, *Mandolin*
Robert Rowe, *Blue Flute*
David Theriault, *One Room to Another*