Algorithmic Composition – ”gestalt revolution“– a new approach to a unfied view on structuring diverse levels of musical composition

(Open Music and CSound)

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***Abstract* — Original method of revolving distinct structures, preserving their internal "gestalt“, mapped to: harmonic gestures, – ”quantised“ to 12-tet or free microtonality, rhythmic design, based on milliseconds or adapted to traditional mensural notation, overtone structures, e.g. resonance banks, based on frequencies or proportions, distributions and relations of musical formal elements. By ”reverse engineering“, starting from traditionally composed passages the author (composer/ pianist, synthesist) set out to systematize his research project and tried to apply methods from one field of the compositional process to any other. The method aims at a unified approach to generating musical material, controlling its mapping and application, synthesizing overtone spectra or the like and building form blocks.**

I. INTRODUCTION

History of the research project
—from aesthetic sensation to logical programming

Initially the author found some extraordinary phenomena of inner relationship while rotating chords in his compositional work. Starting from everyday methods like inverting chords, it turned out that –depending on the amount of "empty space“ between the chord notes– structures would emerge that contained a remarkable diversity of outer appearance while the acoustical results clearly showed inner similarities, reminding the listener of rotations of semantic identities, or even of revolutions of certain dimensions of space itself.

II. HARMONIC GESTURES

A. *12-tet tonality*

The revolution series of Fig.1 (Namarië-motif, taken from {Jürgen Schmitt: Namarië for soprano, piano and electronics}) can be expressed as a list of intervals:
starting from:
(3 4 2 4 3), 5 intervals, i.e. 6 notes,
moving to the first revolution: (8 3 4 2 4)
We might wonder where this 8 is coming from.
A simple example may explain what is happening here:

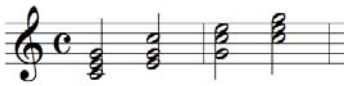

Fig. 2. This series of chord inversions can be seen as a rotation of intervals modulo 12.

Chord 1: intervals (4 3), chord 2: (3 5),
chord 3: (5 4), chord 4 = chord 1.
So our full list of intervals used is (4 3 5).
The conventional *inversion* of chords now can be seen as the simple process of *rotating* a list of intervals *plus* the *complement* to the nearest octavated note (seen from the bass note). Thus in traditional 12-tet chroma we rotate modulo 12. Starting from intervals vs. from series of absolute points, we apply a model with a close relation to space (Fig.3).

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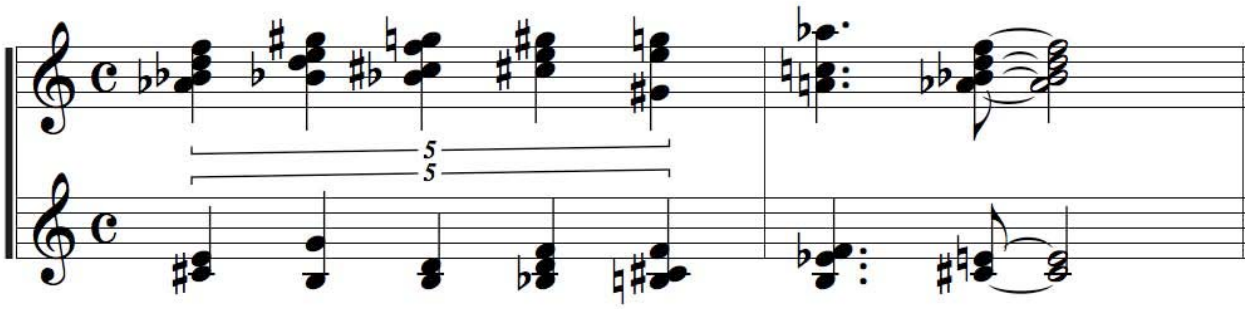

Fig. 1. This chord sequence, taken from the author's work "Namarië", is generated exclusively from the interval-list (3 4 2 4 3) and its internal "revolutions", see below.

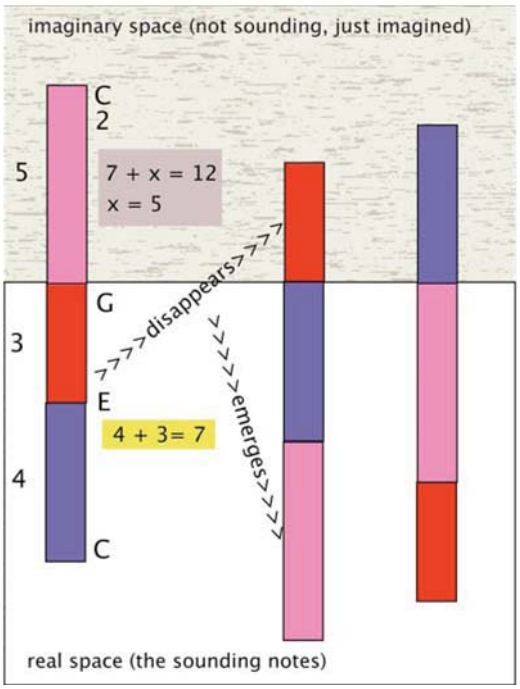

Fig. 3. The process of revolving chords including the imaginary complement

The next step to reach new aspects for composition takes the current position in space as a variable and develops new lines for moving according to aesthetical principles.

Back to the Namarië-example we explain the concrete mapping of the revolutions in space:
again the rotations, now complete:
starting from:

(3 4 2 4 3)	5 intervals, i.e. 6 notes,
(8 3 4 2 4)	the 3 disappears and the 8 emerges out of imaginary space
(3 8 3 4 2)	the 4 disappears, the 3 reappears, etc.
(4 3 8 3 4)	
(2 4 3 8 3)	
(4 2 4 3 8)	
(3 4 2 3 4)	

The sum of the sounding intervals here is 16,
so the complement needed is 8 (24 - 8).

When we look at this slightly modified appearance of our c-major example (Fig. 4.) we begin to realize the true potential of this seemingly limited method.

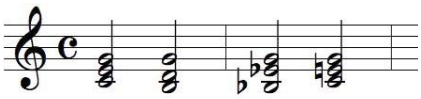

Fig. 4. C-major-triad, revolved

We have intervals identical with the above example: Chord 1: intervals (4 3), chord 2: (3 5), chord 3: (5 4), chord 4 = chord 1. The difference is obviously the course of the top line, providing us with a chromatic harmonic progression, while inputting only c-major and the method of progression, programmed in an OpenMusic (Ircam)-loop.

The author has implemented so far the following variants of his chord revolution concept, one was picked up by *Len Sasso*, who even programmed a realtime-version in the environment of the *Logic*-sequencer (Apple), available for free from Len Sasso's and the author's websites (s.below):

Variants of chord revolution:

Narrow revolution, i.e. the ambitus remains constant, possible with fixed upper note or fixed lower note,

Wide revolution, fixed upper or lower note, or with fixed centre of ambitus. And of course any free running top lines, bass or ambitus centre lines.

Two additional examples:

Fig. 5. Narrow revolution, again (3 4 2 4 3)

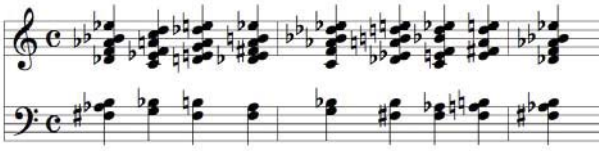

Fig. 6. Ambitus-centre fixed, (2 3 2 4 3 2 5)

B. Free microtonality

As mentioned above we realize this project in OpenMusic and CSound as tandem combination. The flexibility of OpenMusic makes it an ideal tool for generating CSound scores, otherwise often a painstaking procedure.
(Aspects of sound synthesis will be discussed below.)

So with a couple of mouseclicks we can move to the fascinating field of microtonality, rarely ever treated with compositional freedom and aesthetical ease comparable to the traditional tonal mappings.

This microtonal chord sequence (Fig. 7.) will be used to feed the harmonies of a fof-generator ensemble. We get a kaleidoscoping sequence of inner stringency.
It's frequency list looks like:

((565.1424794922331 533.4234693979596 493.8833012561241 475.2262851126147 440.0 415.3046975799451) (576.1292130769883 533.4234693979596 513.2727774134913 475.2262851126147 448.55388322894373 384.52011738339183) (576.1292130769883 554.3652619537442 513.2727774134913 484.4649899993829 415.3046975799451 391.99543598174927) (598.7476000767258 554.3652619537442 523.2511306011972 448.55388322894373 423.37848823342387 391.99543598174927) (598.7476000767258 565.1424794922331 484.4649899993829 457.2740594540111 423.37848823342387 407.3848734064078) (610.3876388373318 523.2511306011972 493.8833012561241 457.2740594540111 440.0 407.3848734064078) (565.1424794922331 533.4234693979596 493.8833012561241 475.2262851126147 440.0 415.3046975799451))

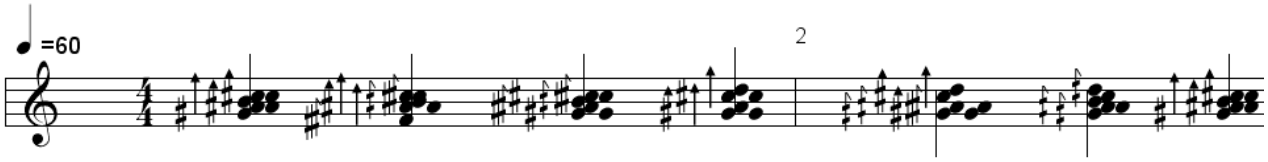

Fig. 7. Original intervals (3 4 2 4 3), now compressed to 1/3

Next we construct a sequence up one level in hierarchy (a revolution of revolutions), where every cycle is scaled according to a number from our list (3 4 2 4 3), now used to control the compression of the ambitus of frequencies (1/3 1/4 1/2 1/4 1/3).

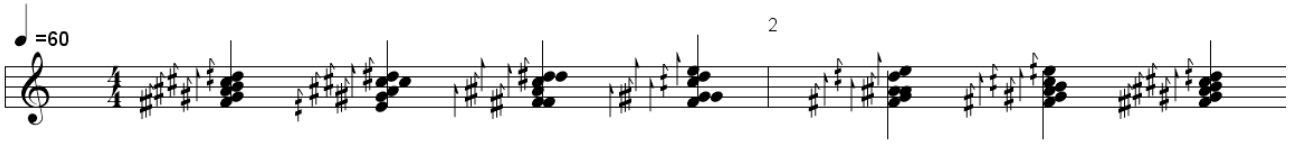

Fig. 8. State ”1/2“: intervals (3 4 2 4 3) compressed to 1/2, same ambitus centre axis as figure 7

III. RHYTHM

A. *Whithout quantisation*

While this method (narrow revolution, Fig. 9.) can provide us with lively varying results that can be used even as markers indicating the start times of form blocks (top hierarchy), the façettes of wide revolution yield much more surprising material because again we get control over the dimension of rhythmic *space* itself.

Fig. 9. Onset times (narrow revolution)

B. *Mensural notation*

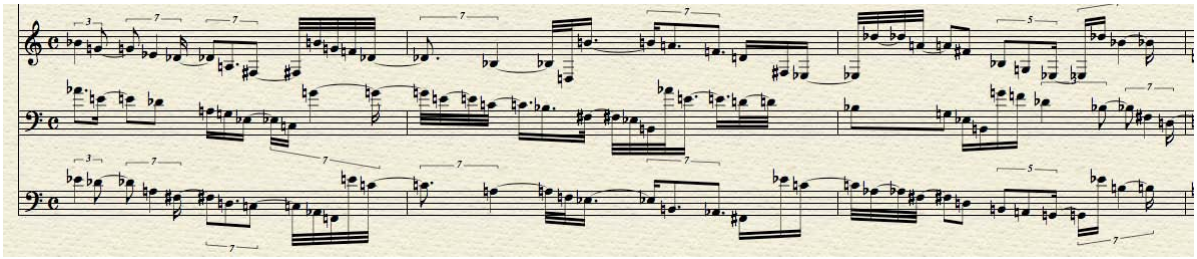

Fig. 10. starting from (3 4 2 4 3), sometimes extending the structure with the same elements, mapped to pitch and rhythm, we soon end up with a rich polyphonic texture, here as an arpeggio of a harmonic field.

IV. SYNTHESIS OF OVERTONE SPECTRA USING HARMONIC PRINCIPLES

At present we use three models of CSound synthesizers, all referring to the construction of overtone distributions, we moreover aim at composing overtone progressions.

A fof generator ensemble; it produces sets of fomants alluding to human vocal sounds. We use it via OpenMusic to organize the large amounts of data necessary to generate convincing music. Also we concentrate on transitions of formant choirs, establishing organ points of fundamental frequencies, over which overtone modulations and figurations are placed.

A sinusbank synthesizer; starting from Risset's gong studies we present in-depth experiments of moving overtone complexes, individually applying portamenti and most importantly structuring independent decay envelopes.

A resonance filterbank instrument; using analysis data of piano strings (frequency, amplitude, bandwith). Here our experiments showed surprisingly "natural" sounding results with sensations of inner relationship, like with the harmonies mentioned above. Having access to all relevant data of sound synthesis not at all guarantees success in wisely managing compositional tasks, i.e. to compose suggestive sonic fibres.

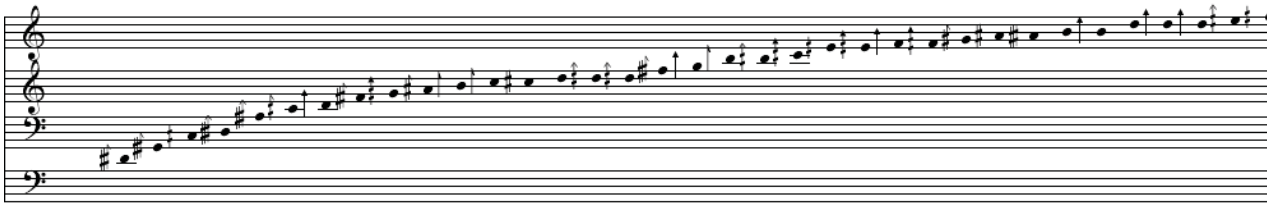

Fig. 11. Frequency analysis data of a piano sound, unprocessed

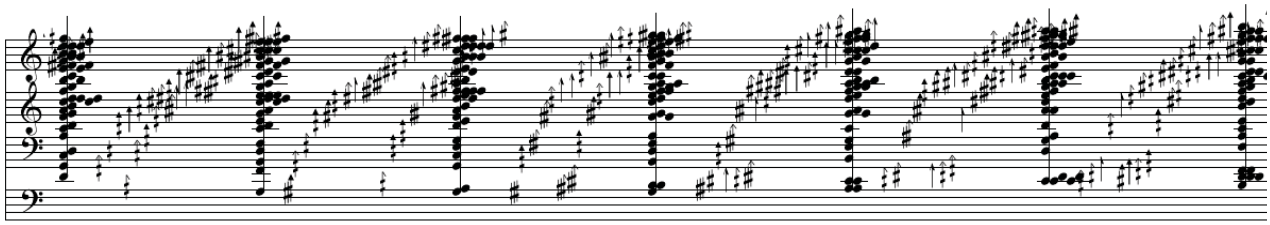

Fig. 12. Some rotations of the above overtone distribution; of course restricting to certain regions is advisable at times.

We work at building an OM-library "gestalt-revolution", where the outcome of our experiments will be formulated and made available for people interested.

V. Distributions and Relations of Musical Formal Elements

The tempo space, likewise subject to a process of revolution, represents the top
hierarchy level and in our current experiments goes through one cycle, identical to the duration of the whole piece.

This upper tempo space contains further spaces or planes. It provides the onset times of the major formal blocks. The downstream tempo planes, whose number is given by the rotation of the "numbering structure", comprise the start signals for the revolutions of the various rhythm planes.

We now use two variants:
Each starting point triggers one cycle of the whole episode (sum: 17 entities), the layers starting later use an adequate compression, so all layers finish at the same time. Or each layer follows its independent course, also using an individual tempo.

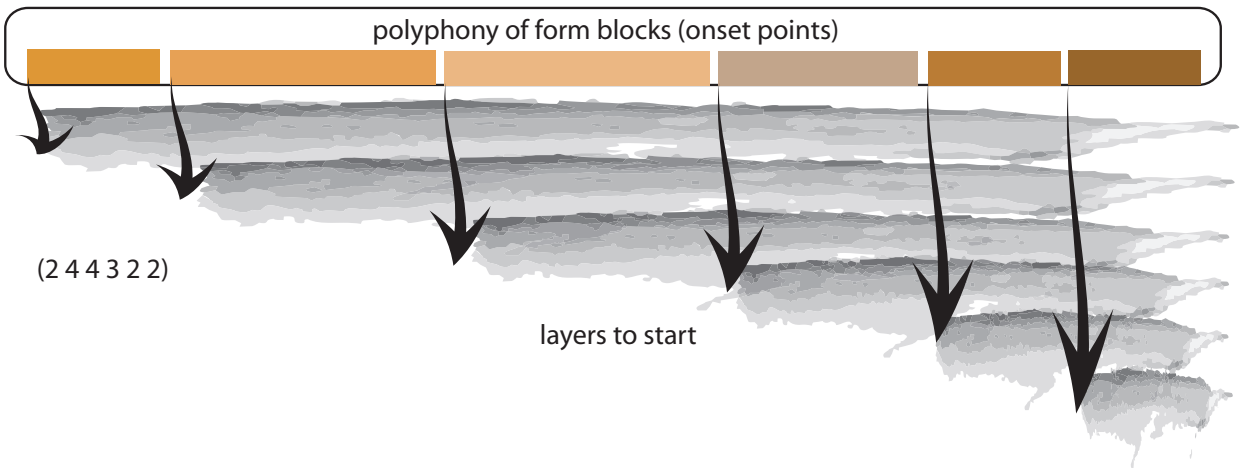

Fig. 13. Rotation of form blocks.

VI. Conclusion

Our ultimate aim certainly would be to reach a situation with each and every hierarchy level logically and aesthetically so well organized –in organic interdependence– that by exchanging the initial set of numbers for a new one we would get an equally pleasing result, thus really being able to to hear and enjoy the *quality* of numbers.

Links

To download the Logic-sequencer live version of Len Sasso‘s ”chordrevolver“ –programmed by him following my idea– you might visit Len Sasso's website:

www.swiftkick.com

or my own site, where you also will find more detailed score and audio examples:

www.juergen-schmitt-komponist.de