Koenig

Composing with Algorithms

http://www.bjarni-gunnarsson.net

Koenig

"The Cologne studio looked down on composers that "only" had form problems. "Material fetishism" dates from then and could be understood as "form fetishism". Form was not mentioned at all, everything was material; sounds as well as the serial methods. Form was seen more as an automatic consequence of the treatment of material than as an independent category to which the fashioning of sounds ought to be subordinate. When forms were exposed at all they were simple concepts such as the crossform in Kreuzpiel or the group in Gruppen, in both cases they were derived from the treatment of the material."

History

Started working in the electronic studio of the **West German Radio** in 1954.

Studied programming at **Bonn University** in order to learn to use computers to facilitate compositional ideas.

Was invited in 1964 to the **State University in Utrecht**, to fill the vacant position of artistic director of the electronic studio (later called the Institute of Sonology).

Composed both electronic and instrumental music as well as writing pioneering and important composition programs, **Project 1**, **Project 2** and **SSP**.

Serialism

Serialism is *"more of a world-view or an aesthetic doctrine than the right way to compose."*

Serialism is not just about the 'series' but also about **quantization** and **differentiation**.

"Whilst many composers soon tired of standardization, differentiation is still possible without strictest serial treatment. Since then serial ideas have been based less on the series and more on the concept of difference."

"Both serial and electronic music are characterized by a high degree of formalization and mechanization."

Planning

Formalization and **mechanization** involves *planning*

"By planning I do not mean contriving systems which operate more or less automatically, but the translation of psychological perception values into technical work processes."

Planning can involve **rules**

"Composers who were unwilling to invent a personal serial system, perhaps even a new one for each composition, could not really compose serially."
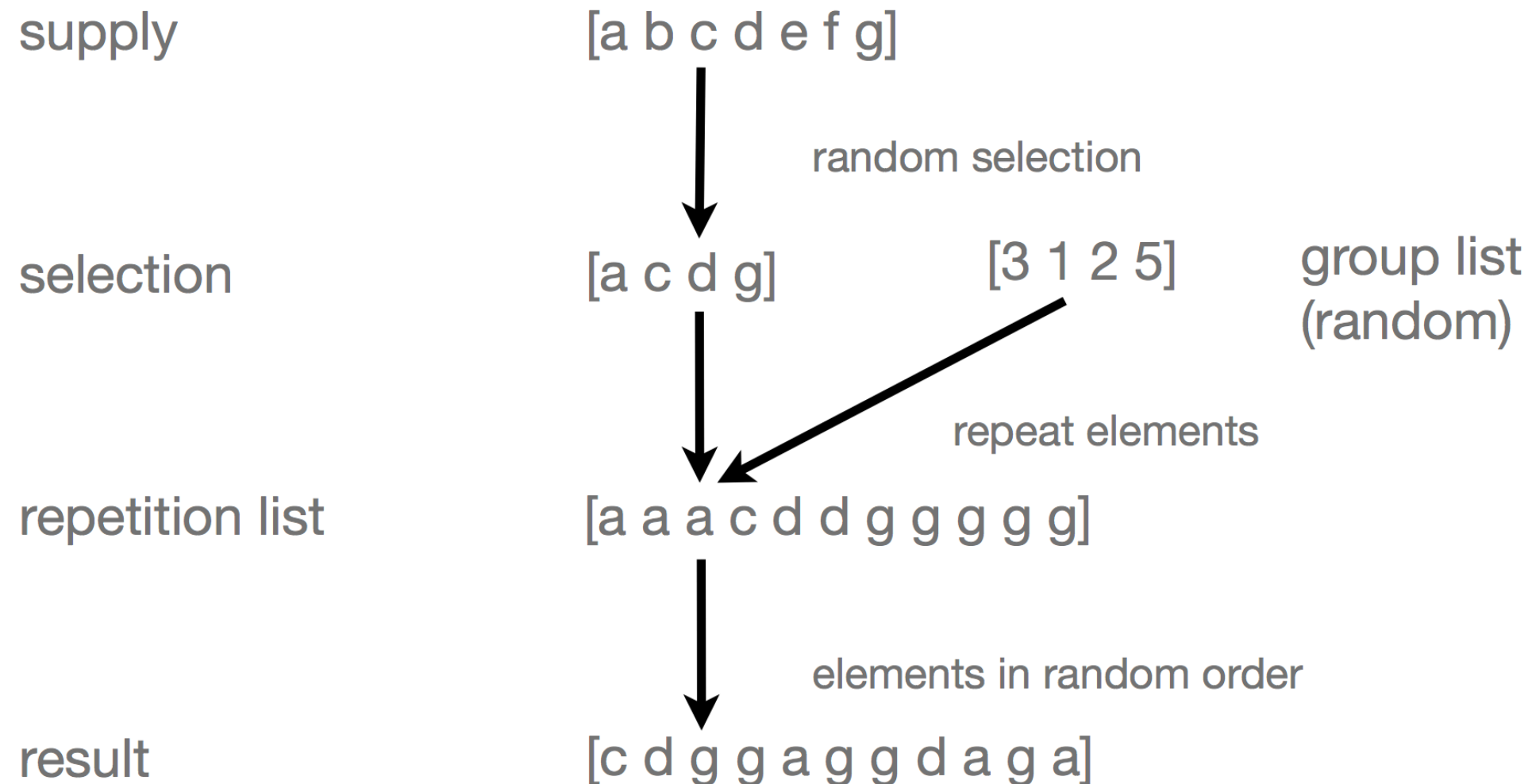
Material

Koenig: *"Artistic endeavor seemed impossible without a precise definition of material."*

The concept of material is not limited to sounds but also includes **compositional methods** and **rules**.

Randomness as a control structure

Example of method for *Streichquartett 1959*
(based on a description by Essl)

supply   [a b c d e f g]

                                    random selection

selection   [a c d g]   [3 1 2 5]   group list
                                                        (random)

                                    repeat elements

repetition list   [a a a c d d g g g g g]

                                    elements in random order

result   [c d g g a g g d a g a]

Paul Berg

Terminus

Koenig's last last electronic composition in **Cologne**.

The title refers to giving up any further attempts to realize a truly continuous sound with the electronic studio.

"The formal construction of Terminus was based on the fact that transformations of sound material which in its turn is already transformed keep on moving further away from the initial material. It was to be expected that the sound material would first differ because of transformation, but would later forfeit these differences because common characteristics caused by transformations dominate the original charakteristics of the "Urklänge".

Terminus

The initial material consists of **five sine wave glissandi**. Each sine wave has to start its glissando from a prescribed basic frequency.

No sine wave is allowed to become higher than the highest one or lower than the lowest one, so that the spectrum is unambiguously defined in the pitch range.

The five frequencies are: *331, 443, 592, 793, 1062 Hz.*

Transformations change the "original":. The following are used:
Transposition, **Filtering**, **Reverberation**, **Ring modulation**, **Chopping**, **Cutting** and **permutation** and **Synchronisation**.

Terminus
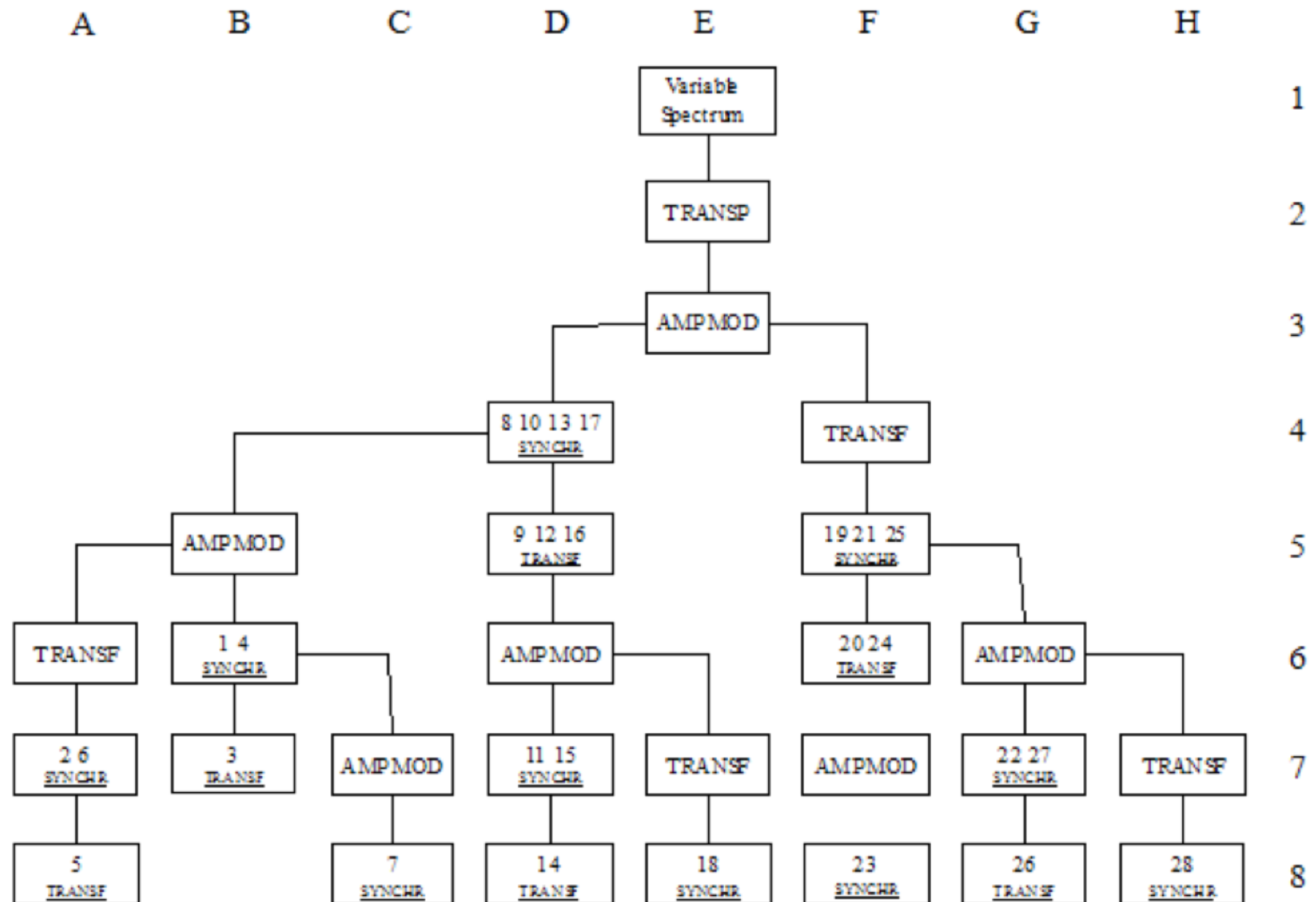
Terminus

Scheme: start in each sub-section with the lowest line index and use the "permitted" material (underlined in the generation diagram), paying no attention to the columns. Then find the next line containing "permitted" material and use it, if it consists of several parts, from left to right. If more "permitted" items of material should be found "above" some material (same column, lower line index), they are added immediately (in decreasing line index order).

Sub-section 1	line 6:	B6
	line 7:	A7 − B7, B6
	line 8:	A8, A7 − C8
Sub-section 2	line 4:	D4
	line 5:	D5, D4
	line 6:	−
	line 7:	D7, D5, D4
	line 8:	D8, D7, D5, D4 − E8
Sub-section 3	line 5:	F5
	line 6:	F6, F5
	line 7:	G7
	line 8:	F8, F6, F5 − G8, G7 − H8

Funktionen

VFG used to created **curves stored** and used both for sound and control.

Variants ware produced and from those sound-structures by using 36 different patches (*rm*, *filtering*, *reverberation* and *rhythmicising*)

The result was cut, combined and ordered by using chance operations from a computer program.
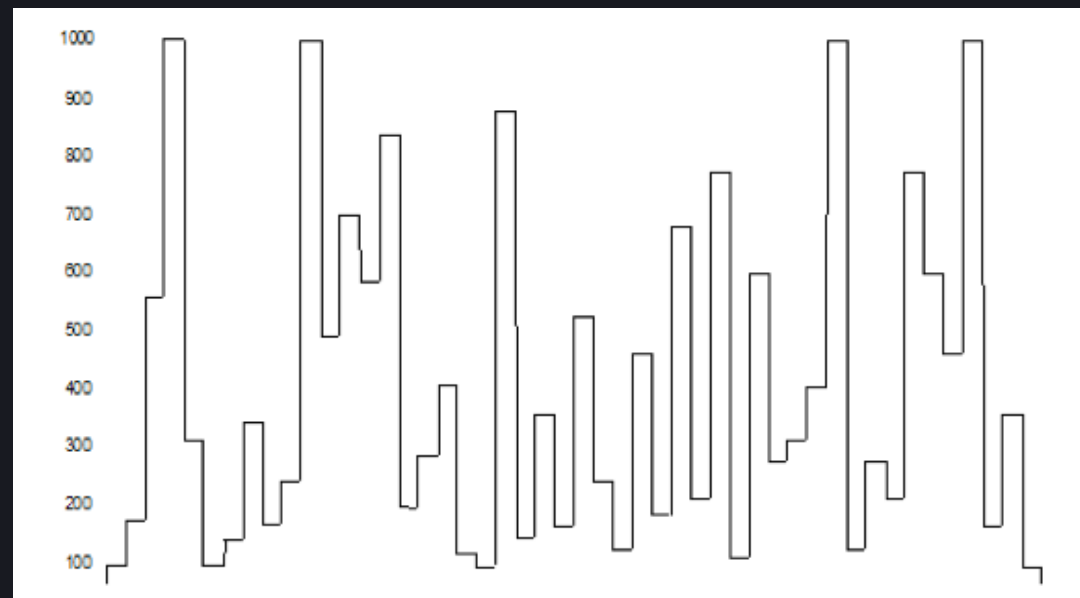
Koenig - Funktion Grün (1967)

Compositional rules

Three main avenues:

1. **Analysis** of existing music of the past and present. Given the music, find the rules.

2. **Introspection**, the composer/programmer analyses his own experiences

3. Making **limited models**. Given the rules, find the music.

Project One (1964)

Overall form is divided into 7 sections where each section is assigned a value between 1-7 (**irregular** -> **regular**) for each parameter.

Parameters generated with random selection principles that are calculated <u>independent</u> of each other.

Ranges 5-7 contain repetitions, ranges 1-3 contain no repetition and range 4 contains both regular and irregular features.

Project One (1964)

Very little support for **user input** (number of points per section, 6 tempis, values for entry delays and random start number).

The program **outputs lists** of (non-overlapping) points.

Branching table

PROJECT 1XM

VERSION NUMBER (START) = 1
REPETITION RANGE   = 1
NUMBER OF SECTIONS   = 7
NUMBER OF LINES   = 54

BRANCHING TABLE

INSTRUMENT	1	3	6	4	2	7	5
ENTRY DELAY	6	3	7	5	4	1	2
PITCH	1	2	3	4	5	6	7
REGISTER	2	7	6	5	1	3	4
DYNAMICS	5	2	7	6	3	4	1

SECTION 1

Instrument		Tempo	Entry Delay	Pitch	Extra	Register	Dynamics
1 *	6	52.0 *	1/1	* G		7	* MF
2	7		1/1	A B D E F# G	1 3 5 2 6 4	6 4 4 7 5 7	MF
3	3		1/1	A#		5	MF
4	1		1/1	C		4	MF
5	4		1/1	C# D#	1 2	5 4	MF
6	5		1/1	* B C#	2 1	6 6	* F
7	2		1/1 3	A# D# C D F	3 2 5 4 1	5 7 7 5 6	F
8	9	34.5 *	1/5	G		4	F

...

Form

Form emerges during **planning** and **realization**

Form was not really a topic in Cologne because everybody was concerned with <u>material</u>. Form was taken for granted for how could one recognize art if it had no form. The concept of material was not limited to sounds but also included compositional methods and rules.

Form is a <u>process</u> that (or result of process leaving its trace) that starts with inspiration and proceeds with design, execution, correction, and performance of music.

Form

"'Form' is no longer the personal manner in which the musical material is presented or the listener's perception is guided, rather, it is the rationally discernible, reproducible effect, detached from the composer, of an organized system imposed on arbitrary material."

"Form, here, is not merely a vessel, but a process that starts with the composer's inspiration ad proceeds by way of design, execution, correction, and performance to the listener's ear and judgment. The conflict [between idea and its representation in time], then, ... is due to the elimination of the composer during an important phase of the process."

Form

"Even composers who like to experiment will want to bear responsibility for the aesthetic result, and will therefore try to come to terms with their own form criteria. In doing so, they enter territory that is at least as close to interpretation as to composing."

"Computer music involves a strategy which, freed from the psyche of the human composer, can be taken over by an algorithm. In the algorithm, the elements and methods (selection, permutation, conditional branching in the working schedule) are redefined. The result of algorithmic composition can be converted into performance categories that are foreign to it: voice leading, phrasing, and playing technique…")

Project Two

Based on a **database** of **parameters** and a structuring method for selecting and combining the parameters.

The basic idea is of **selection**.

A composer selects values for parameters to use in a composition. He then applies selection principles to choose from those values how and when they will occur.

Project Two

The user (composer) answers many **questions** (about 60) which will determine the generated output.

Layers can be created and **variants** from the same input as well.

Parameters are calculated within a **hierarchy** and can have a specified relation determined in the database.

Project Two

PROJEKT 2
THE LIST-TABLE-ENSEMBLE PRINCIPLE
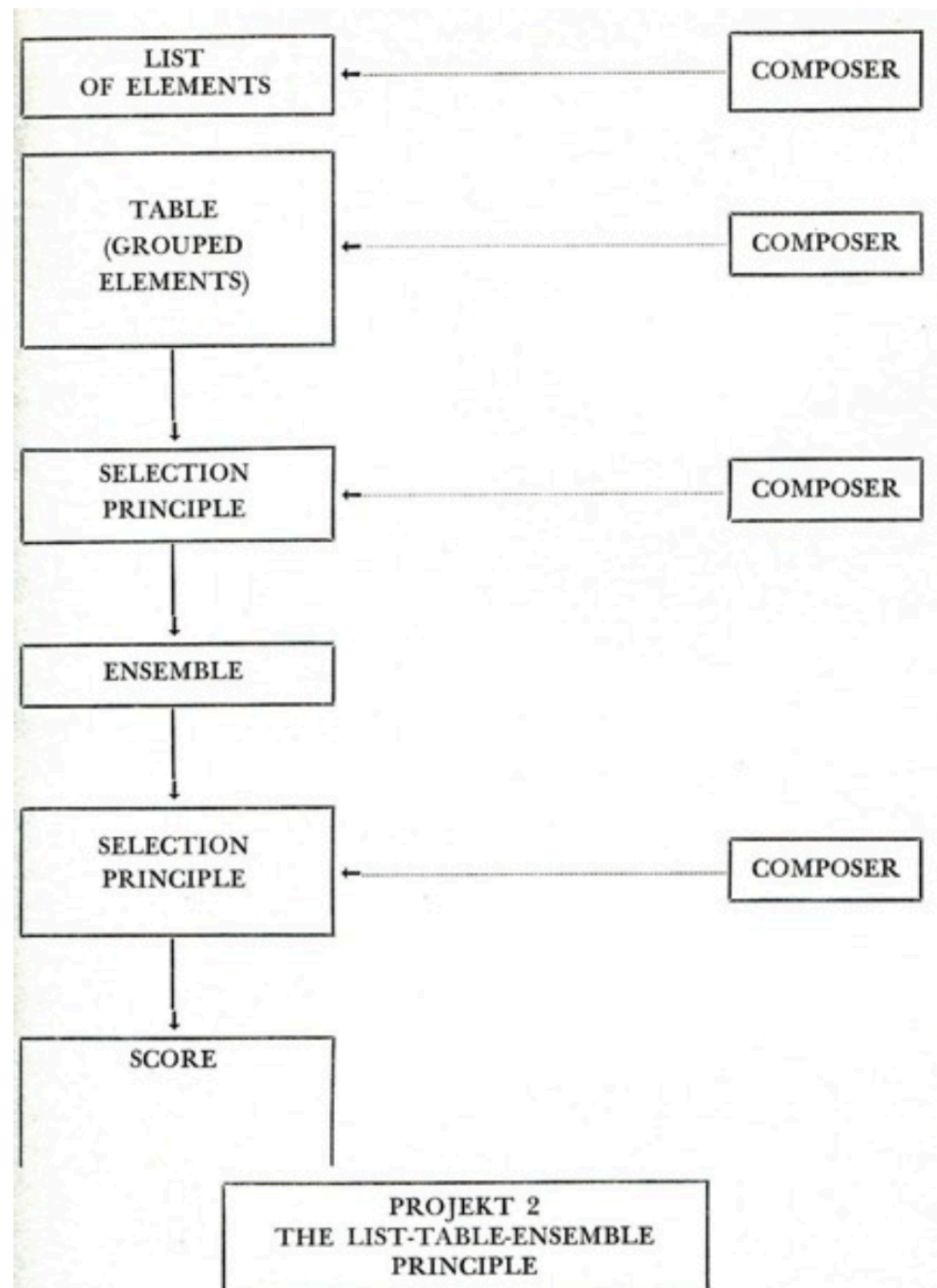
Fig. 1

Selection Principles

Sequence (a series of values)

Alea (random)

Series (random with repetition check)

Ratio (weighted random)

Group (repeating random values)

Tendency (random between changing boundaries)

Composition Processes

Interpolation

"from the outer limits of the total form into the inner areas"

Extrapolation

"from the interior towards the outside: from the individual sound to the group of sounds, thence to the super-groups, via sections to the total form."

Chronological-associative

"unfolds along the time-axis, thus being put in the position of the ideal listener... every event is given its irremovable place in time"
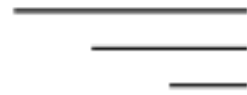
Blocks

"a part of a structure which requires complementing by other blocks but which is still complete in itself."

Layers

"When I made my first electronic piece, which was only four minutes long[1], I spliced all the sounds onto several four-minute tapes which were then synchronized with the aforementioned "copy head". I thus had the pleasure of hearing my piece emerge layer by layer during this process without having to lift a finger myself."
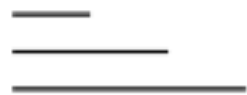
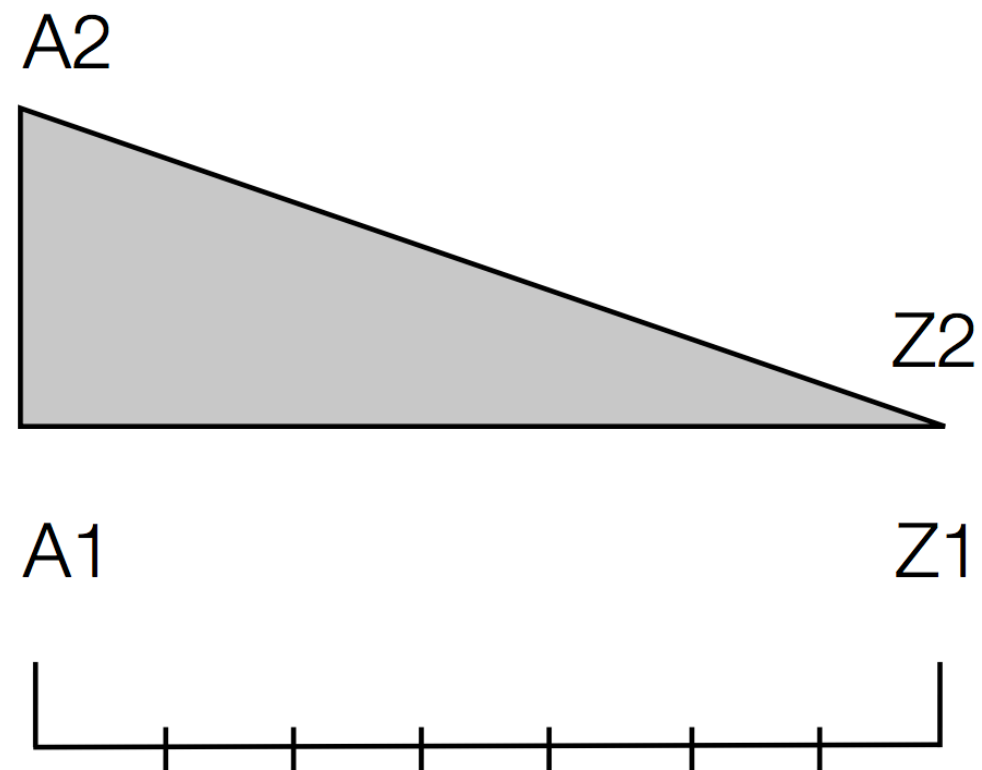sounds begin simultaneously · sounds stop simultaneously · symmetric superposition · serial distribution of points of entry

Tendency Mask

N, A1, A2, Z1, Z2

Mask divided into N parts. A random choice is made between the boundaries of the mask at any given time.

Paul Berg

Variants

Prototypes for musical activity are best suited to the forming of **variants**.

Variants can be understood as generated **instances** of the same compositional model.

Project 2 was capable of producing one or more variants of the structure being used.

Variants

In *Übung für klavier* the performer could choose between three variants for each of the twelve structures.

Variants can be understood as being the **actuality** of a **potential form**.

Complex Sounds

Permeability

- How a structure blends with others.

Susceptibility

 - How structures complement each other, interpret each other

Coalescing

- The penetration of two susceptible structures

Direct and indirect complexity

- How sounds are compared in similarity
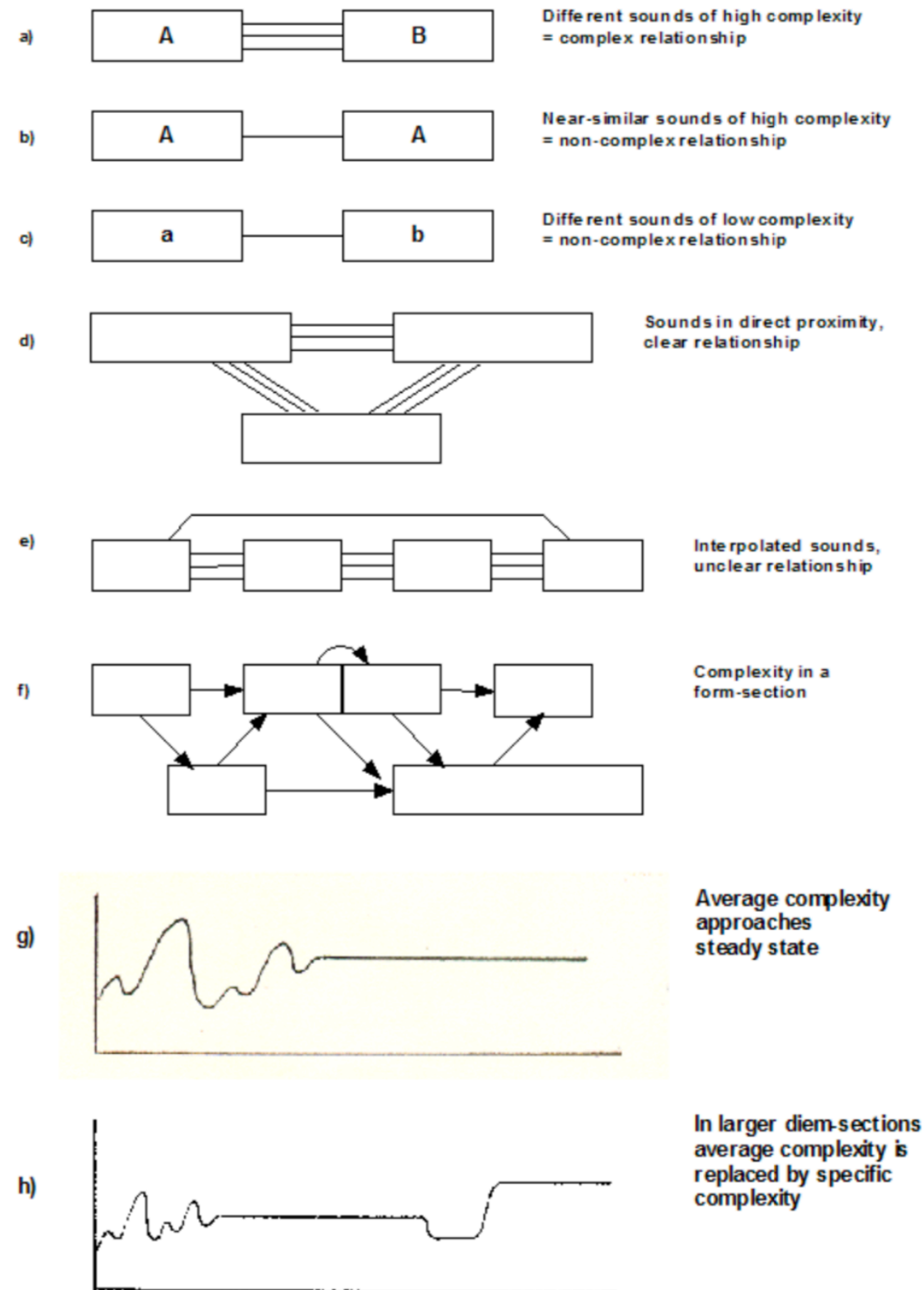
Complex Sounds

Fig. 2 – Complexity in several form-sections

Rules

"Repeated application of a model under changed circumstances makes its limits clearer: accumulation and correlation of the results cause the model to reveal itself and at the same time the extent to which it coincides with a part of musical reality. In this it may even transcend the reality experienced up to that point by exposing context which had escaped analytical scrutiny."

"The analytical task - given the music, find the rules - is reversed: given the rules, find the music."
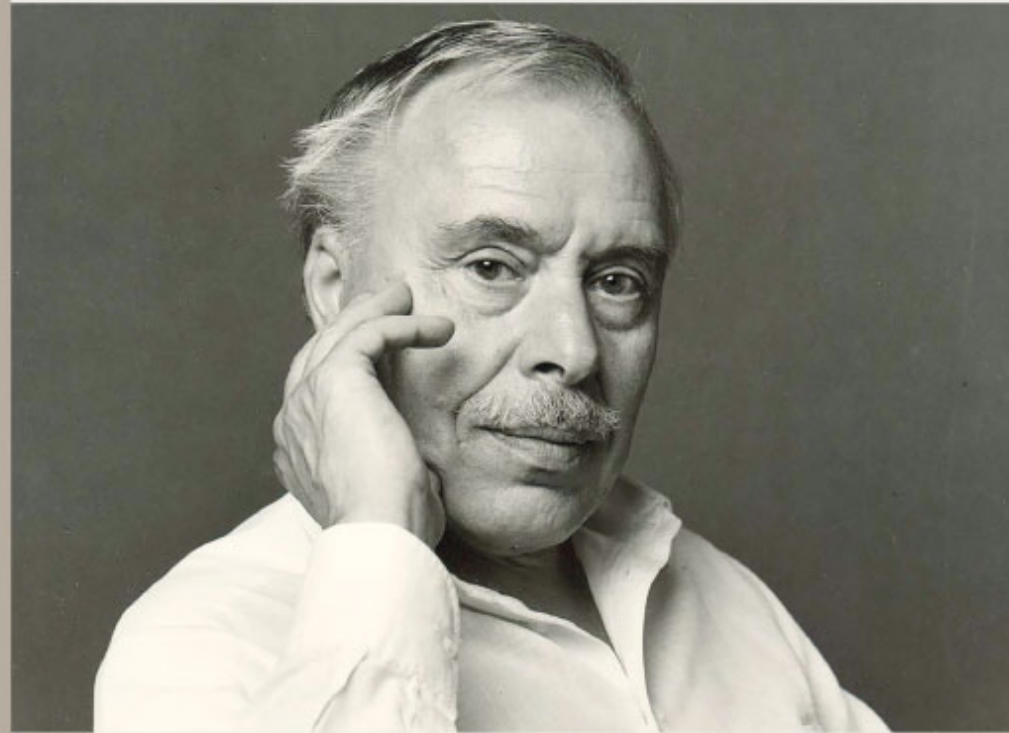
Gottfried Michael Koenig
Process and Form:
Selected Writings
on Music

wolke

```
(
NP(\iop, {|freq=78, mul=1.0, add=0.0|
    var noise = LFNoise1.ar(0.001).range(freq, freq + (freq * 0.1));
    var osc = SinOsc.ar([noise, noise * 1.04, noise * 1.02, noise * 1.08],0,0.2);
    var out = DFM1.ar(osc,freq*4,SinOsc.kr(0.01).range(0.92,1.05),1,0,0.005,0.7);
    HPF.ar(out, 40)
}).play;
)


(
NP(\dsc, {|freq = 1080|
    HPF.ar(
        BBandStop.ar(Saw.ar(LFNoise1.ar([19,12]).range(freq,freq*2), 0.2).excess(
        SinOsc.ar( [freq + 6, freq + 4, freq + 2, freq + 8]),
        LFNoise1.ar([12,14,10]).range(100,900),
        SinOsc.ar(20).range(9,11)
    ), 80)
    ;
}).play;
)
```

```
var <>pindex, <>cindex;

initialize {
    if(pindex.isNil, { pindex = 1000 });
    if(cindex.isNil, { cindex = 2000 });
}

clearProcessSlots {
    pindex = 1000;
    (this.pindex - 1000).do{|i| this[this.pindex+i] = nil; }
}

clearOrInit {|clear=true|
    if(clear == true, { this.clearProcessSlots() }, { this.initialize() });
}

transform {|process, index|
    if(index.isNil && pindex.isNil, {
        this.initialize();
    });

    pindex = pindex + 1;
    this[pindex] = \filter -> process;
}

control {|process, index|
    var i = index;

    if(i.isNil, {
        this.initialize();
        cindex = cindex + 1;
        i = cindex;
    });

    this[i] = \pset -> process;
}
```

Exercises

```
(
NP(\depfm, {|freqMin=5, freqMax=20, mul=20, add=80, rate=0.5, modFreq=2100, index=0.3, amp=0.2|
    var trig, seq, freq;
    trig = Dust.kr(rate);
    seq = Diwhite(freqMin, freqMax, inf).midicps;
    freq = Demand.kr(trig, 0, seq);
    HPF.ar(PMOsc.ar(LFCub.kr([freq, freq/2, freq/3, freq/4], 0, mul, add),
    LFNoise1.ar(0.3).range(modFreq,modFreq*2), index) * amp, 50)
}).play;
)
```

Exercises

1. Create three collections of pre-selected pitched and a process that will play first some events from the first collection, then some from the other and finally some from the third. The way notes are selected should be different at each time.

2. Create a process consisting of two layers where one plays low notes and the other high notes. A tendancy mask should be created for controlling the balance between the two processes. It should start by favouring high notes and end towards low ones.

3. Create a chord progression where the duration of each chord increases in time. The pitches that form the chords should be selected from a predefined group(s) of pitches.

Exercises

4. Implement a process that selects durations from a collection of pre-defined durations (rhythmic values). To the selected duration a variable number should be added each time. This number should be very small in the beginning of the process but increase as it unfolds.

5. Implement a tendency mask for frequency and duration values where the high and low boundaries are determined by a random walk.

6. Implement a sequence of chords where the number of notes a chord consists of is low at the start of the process but increases as it unfolds.