Oscillations of a Parametric Mind

an essay on sound as thought and composed parametrically

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Abstract

The thesis looks at parametric thinking as one of the ways to compose and analyze sound, a way that opens up to others — integrates and is integrated by them.

Parametric thinking is situated within a broader theoretical context by drawing from the writings of John Cage, Gottfried Michael Koenig and James Tenney among and above others.

Parametric thinking, its correlates and implications are illustrated by an account on composing *either in itself*, a work for prepared piano, and by investigating the works and practices of composers Olivier Messiaen and John Cage.

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Dedicated to Sohrab and Edgars, for our discussions

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Prologue

On a warm afternoon in June of 2017, I was sitting on a park bench in *Landgoed Clingendael* trying to collect and formulate some thoughts for a text that should eventually be a starting point for my thesis. At that time, I thought I would write about how attempts to communicate via music fail, but does so in a marvelous way, giving rise to experiences one would not have access to otherwise. But my thoughts defied collecting and formulating; from whichever angle I would begin my approach, I would end up contemplating a single idea, as puzzling now as back then, the idea of 'sound'. Birdsong just above my head, and further away in a distance, the quiet drone of the not-so-distant highway, occasional laughter, cheerful shouting in the adjacent football pitch, the hour divided in two by a bell (or, perhaps, a couple of them following in close succession) of a church nearby — all this — the sounding of the world — brought into 'a harmony' by an act of listening.

During the cold and quiet nights of January, 2018, I began writing my thesis, with the aim of giving an account of bird song and call transcription, and how it can be a compositional attitude taking one further than a nostalgic retreat into a misconceived refuge of 'nature', how it can offer new ways of structuring sound, how it can problematize certain questions concerning the very practice of composition. My meditations on these topics were interspersed with listenings to countless recordings of birdsong choirs, and readings of not the most academic literature. Septimus Smith, one of the main protagonists in Virginia Woolf's *Mrs Dalloway* — a World War I veteran suffering from 'the deferred effects of shell shock' (Woolf [1925] 1992, 168) — a severe depression, is sitting on a bench in Regent's Park on a sunlit June afternoon experiencing a dazzling moment of interconnectedness:

> 'But they beckoned; leaves were alive; trees were alive. And the leaves being connected by millions of fibres with his own body, there on the seat, fanned it up and down; when the branch stretched he, too, made that statement. The sparrows fluttering, rising, and falling in jagged fountains were part of the pattern; the white and blue, barred with black branches. *Sounds made harmonies with premeditation; the spaces between them were as significant as the sounds.* A child cried. Rightly far away a horn sounded.' (Woolf [1925] 1992, 49, [my italics])

While working on the thesis, I have often returned to this fragment. It seems to resonate with (or foresee) certain attitudes put forward by John Cage that are dear to me and have influenced my thinking to a great extent.[1] Septimus Smith, unable to reconcile the new found interconnectedness, which no other, not even his wife, seem to comprehend, with the roles imposed on him by the society — that of a husband, that of an employee, that of a veteran, that of a sick man — takes his own life that very night. It might be a stretch, but I see Cage's work from the fifties onwards — his involvement with chance, indeterminacy, giving up ones likes and dislikes — as a sort of artistic 'suicide', an act of dissolving

[1] My main source of reference is *Silence* (Cage 1961a) — a collection of lectures and writings mainly from the fifties.

the boundaries between subject and object, art and life, intention and non-intention (Cage 1961a, 14), through which the composer's decomposing body fertilizes the soil for new creations, new lives to emerge.

The thesis does not reach much further than 'sound'. It is an attempt to look at the ways in which sound can be thought, and how in turn these ways influence what and how is composed. (The emphasis on parametric descriptions of sound has to be accounted for by the inclination to think parametrically in my own compositional process.) Throughout the course of writing, it seemed that I am doing preparatory work, that I have to account for 'sound', before I tackle the questions of (non)communication, representation and translation between different systems.[2] However, the opposite seems to have happened — (non)communication, representation and translation have become points of departure for examining the ways sound is thought, described and analyzed.

An asymmetry, a 'gap' between 'what is composed' and 'what is experienced' is one of the main concerns of mine. I see this 'gap' as an opportunity, not as a matter to despair over, in words of Christian Wolff — 'The ideas may have been clear, practical, muddled, complex, the actions of performance accurate, decisive, ineffectual, but there will always be sounds to listen to.' (Wolff [1958] 2017, 12) Perhaps, sounds do not make harmonies with premeditation, but whatever our premeditations, 'sound' is inescapable.[3]

The first chapter reconstructs the process of composing *either in itself*, a piece for prepared piano, and illustrates how theoretical thinking plays out in practice. By doing so, certain questions are introduced that form the basis of the second chapter in which I discuss some aspects of thinking sound parametrically. Additionally, I look at the works and methods of two composers — Olivier Messiaen (in relation to birdsong transcription and *Réveil des oiseaux*) and John Cage (in relation to the notion of 'parametric sound-space' and his *Variations II*).

There are 'spaces' within and in between the questions I have attempted to deal with — other questions of no lesser significance. Some 'spaces' may seem to be unbridgeable 'gaps'. My hope is that not much of the written will fall into these 'gaps' to be bridged at another occasion.

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[2] These were considered as my main topics at different times during the writing.

[3] And if sounds do make harmonies with premeditation, they need a Septimus Smith to hear them as such. Writing on experimental music of the late fifties Cage remarked that 'Here we are concerned with the coexistence of dissimilars, and the central points where fusion occurs are many: *the ears of the listeners wherever they are*. This disharmony, to paraphrase Bergson's statement about disorder, is simply a harmony to which many are unaccustomed.'(1961a, 12, my italics) And for Cage, sounding of the world ('all the rest that enters through the ears'(190)) is on an equal standing with music, experimental or otherwise.

Chapter I

either in itself *for prepared piano is the first from a collection of works — whatever is — for solo instruments or electronics (See* Appendix A*, for a sample page from the score,* Appendix B *features a sample page from the score of* or in another *for percussion). Its score consists of 25 A-3 sized pages, four sets of two staves on each one. The notation is parametric — spatial distances between events on the page, are to be interpreted as relative intervals of time. Relative, because no tempo is prescribed — any page can be played at a tempo chosen by the pianist. Likewise, no order in which the pages should be played is given; a reading of the work can consist of any number of pages played in any order within a time frame with no fixed lower or upper limits. The work was composed in the last months of 2016 and the first months of 2017. What follows is an account describing the process of its composition.*

Stage 1 - before composition

Is there a moment that can be described as being 'before composition'? Composition being a process, has no clear beginnings or ends, 'compositions' — the offspring of this process — are markers, consolidations of interests, ideas, concerns. The account given below, could have only been written after the fact, and even now, it is unclear how accurately it captures my thinking at the time, for the process itself changed me and my outlook on a variety of questions pertaining to sound and its composition. For the current purposes, composition is defined as an action, in this way the fluidity of a process is retained, while its directedness and finality are emphasized.

composition as action — encompassing a multiplicity of activities, unified in a single action in relation to its end, in being 'directed towards'. These activities, taking place on different planes and time scales, originate, interlock and terminate at specific nodal points. The agent (the one who acts), sets up relations between processes, concepts, things — between them and oneself. These relations yield other processes, concepts, things, some of them directly contributing to the unified single action of composition as directed towards sounding, some of them do not. All of them contribute to increased understanding of oneself and the world without.

The action of composing this piece is segmented in distinct stages, transition from one to another being marked by a significant realization or decision that distills and concretizes the object of composition. The first one — 'before composition' — is rather difficult to describe, it becoming a separate stage retroactively, after the first step is already taken. It is a background, soil fertilized by observations, speculations and intentions of varying degrees of exactness.

(1) What is known: a piece is to be written (a piece for a single instrument, a piece for a single performer).

implications:
(a) non-electronic means of sound production;

(b) a parameter space is to be determined by the instrument, sound is reduced to that carved out space which the instrument affords;
(c) a score is to be written;
(d) a single action, by a single agent at any given time.

(2) What is not known: instrument, no idea for a piece, no formal preconceptions.

implications:
(a) what is the space to be carved out is not known;
(b) there is no 'agenda', that is, no particular intention relating to structure and form of the prospective piece.

(3) Background - previous work, aesthetic preferences, readings at the time, listenings at the time.

(a) Previous work: A recently finished string quartet, which took its formal and structural basis from the concept of fractals - the correspondence between the micro and macro scales. A rigid grid, which was 'filled in'. The grid predetermined the rhythmical structures to smallest detail. The struggle was the articulation of these rhythms and finding a way to construct sound fields and events. Uneasiness about the use of pitch, a lack of rationale for choosing one means over others, leading to a reconsideration of pitch as a phenomenon and compositional parameter.

(b) Aesthetic preferences: Through previous work it had become clear that a harmonic interval (or verticality) — a simultaneous sounding of more than one tone — is the basic element to work with. A sequence of single tones — a monodic line — became almost an impossible formation. The closer the frequencies of the two (or more) tones constituting a sound, the more pregnant and sufficient it seemed.

(c) *On the Sensations of Tone*: In my quest to re-think the 'tone' I delved into writings of Helmholtz (Helmholtz 1912). The idea of basing pitch structures on relations found in the harmonic series became more and more attractive, especially, the differences and deviations from the equal temperament. The implicit tension between the nature of harmonically resonating sonic bodies and traditional conventions seemed to be a fruitful are for exploration. Not constructing a system (based on either equal temperament, or harmonic series), but exploring the grounds in between the systems, their imprecise correspondence.

Stage 2 - a 'work' begins

The intention of writing a piece became a directed process of composing a specific piece, while walking the streets of Wassenaar on a sunlit October morning in 2016.[1] It came through a realization that I want to write for piano – a coming together of interests (microtonality), purposes (writing a piece) and decision upon the instrument to write for (piano). This combination was sufficient for a work to begin.

'An 'Image' is that which presents an intellectual and emotional complex in an instant of time.' (Pound [1913] 1974, 4)

On that October morning, I encountered this 'Image'. Encountered, for I neither saw or heard, nor felt or sensed it. It presented itself as a whole (a complex). The action of composition, begun simultaneously with the 'Image' or, perhaps, immediately after its disappearance, was an attempt to actualize the 'Image', to reify it, return to it. The pursuit caused an array of questions and considerations, relations, possibilities and limitations to become actual. If nothing else, then the 'work' – the action – is becoming aware of them, and through becoming aware to take a further step in concretization. The questions focus attention, they differentiate the relevant from the irrelevant; an area of research and experimentation is magnified through limitation. The considerations and aesthetic inclinations inform the decisions on the importance of certain questions, relations, etc., and allow one to formulate even more concrete questions, relations, etc. The 'Image' guides the way, at least in the beginning, against it the decisions are weighed. Yet, with every decision taken, every further step of concretization, the initial 'Image' becomes blurred and distorted, fading away to be erased altogether when that which it gave rise to – the 'work' – is complete.

The inclination to work with complex, narrow intervals is set against the possibilities afforded by a piano – an instrument quantized to an equal-tempered semitone. The coming together of an instrument (piano) and the concept of microtonality establishes certain paths that can be taken, paths to which there would not be direct correspondences if the instrument to be used was not a piano. This convergence results in a system that is neither purely conceptual, nor barely physical, rather it is defined by its synthetic nature.

Microtonality is an inclusive notion, after all, it suggests a dissolve of the conventional discretizations, thus opening up a theoretically infinite space within a semitone. Yet microtonality has to be accessed somehow - an instrument, a practice has to be worked against. The elasticity of the instrument, practice determines how vast the microtonal possibilities are and what limitations are inescapable. Microtonality is like a focussing lens - it is a perspective through which relations are established. However, these relations exist in the

[1] It should be noted that walking is a compositional activity, no less important than constructing schemes and carrying out experiments. It has been of great importance in every work I have composed, and often it has solved problems that seemed unsolvable when at my desk or in a studio. It exemplifies the interpenetration of 'art' and 'life', their simultaneity.

parametric sound-space, in which sound-descriptions feature other parameters, such as, timbre, amplitude, and duration – parameters that determine the nature of sound in ways that are different, but no less important.[2] One does not have to consider all the parameters when building a compositional system, however, it is beneficial to be aware of them and their interconnectedness.

Stage 3(a) – re-composition of the piano

How to move away from the quantized 12-tone grid which is built into the design of a piano? Two solutions are considered: (1) retuning of the instrument; (2) accessing the partials of the strings.

Possible methods for introducing microtonal deviations:

(1) <u>retuning of the piano</u>

advantages:	disadvantages:
– uniform timbre – mobility of the pianist is not affected	–impractical –retuning is possible within a limited range, that does not overlap with my interests

(2) <u>accessing partials of the strings</u>

(a) manually

advantages:	disadvantages:
– timbre affected to a limited, variable degree – no string is fixed to a single partial	– mobility of the pianist is significantly reduced – only one or two partials can be accessed at a given moment - reduced complexity – limited precision, especially when accessing the higher partials

(b) by preparation

advantages:	disadvantages:
– mobility of the pianist is not affected – a high degree of precision and stability	– differences in timbre (unwanted components are introduced) – overall dynamic range is significantly reduced

After evaluating these possibilities, I decided on accessing the partials by means of preparation.

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[2] Microtonality, being a pitch-related concept, necessarily situates the composition process within a parametric space, albeit parametric space is only one of the possible 'spaces' or compositional attitudes through which composition is carried out.

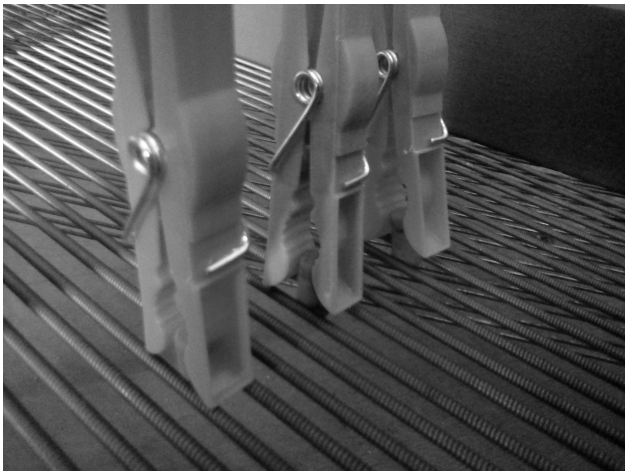
> ‘Piano tones are produced by vibrating strings. The vibrations of an ideal, flexible string held rigidly at both ends give a complex tone whose components are perfectly harmonic.’(Giordano 2015, 2359)

A string oscillates in countless modes of vibration - over its whole length, over a half, over a third, etc.; each of the modes correspond to one of the components of the string’s spectrum. If a string is touched at a nodal point[3] of one of these oscillations, all other components will be eliminated.[4]

Preparations

(1) double-stringed key: a stiff rubber eraser from the end of a pencil is placed between the two strings (of the same frequency) at the required nodal point; the tip of the eraser is clamped by a clothespin to fix it and provide additional weight (see Picture 1).

(2) single-stringed key: the clamps of a clothespin are inlaid with a soft, flexible rubber strip; the clothespin is clamped directly on the string at the required nodal point; between the wings of the clothespin a heavy piece of rubber eraser is inserted to fix it and provide additional weight (see Picture 2).



Picture 1 - preparations of double-stringed keys

Picture 2 - preparation of a single-stringed key

Different piano models have a different build. The metal frame (also called the plate or harp), responsible for keeping the strings in tension, can have different designs. Therefore, the range of strings accessible for preparation can vary. A survey of different piano models done by Luk Vaes (2009, 1031-1048) was consulted and a range that was available on all of them — the 20 lowest

[3] ‘Point, line, or surface in a standing wave where some characteristic of the wave field has essentially zero amplitude.’ — A definition given by American National Standards Institute. (American National Standards Institute. 2011. “node.” Accessed April 22, 2018. https://asastandards.org/Terms/node/.)

[4] Except those components produced by oscillations whose nodal points coincide with the nodal point touched.

strings of the piano – was found and decided upon as the range to be used for preparations. By applying preparations to piano strings, chimeric objects are created. The physical characteristics of them determined by such variables as string length, tension and stiffness, preparation weight, position and grip. The preparations were developed in an experimental fashion, that is, by trial and error. The materials – piano strings and clothespins, rubber erasers – were combined in different ways during a process guided by the ear.

Some observations:
(1) The longer and heavier the string, the heavier the preparation needed to stop a specific node.
(2) The heavier the preparation, the more unwanted (inharmonic) components are introduced.
(3) The ratio between the wanted/unwanted components in a sound changes in favor of the unwanted as one goes higher up the harmonic series.

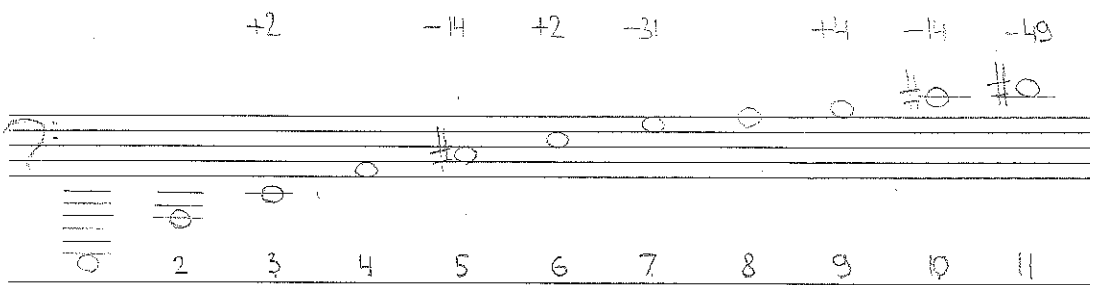
It was decided, that the 11th partial was the highest limit; if one would go further up the harmonic series, using preparations devised, one would find highly complex and inharmonic sounds, the specific partial having only a faint presence within this complex.

Stage 3(b) – piano re-composed, a system of elements created

Objective: collection of collections, a hierarchy – tones and their microtonal variants (accessed through preparation)

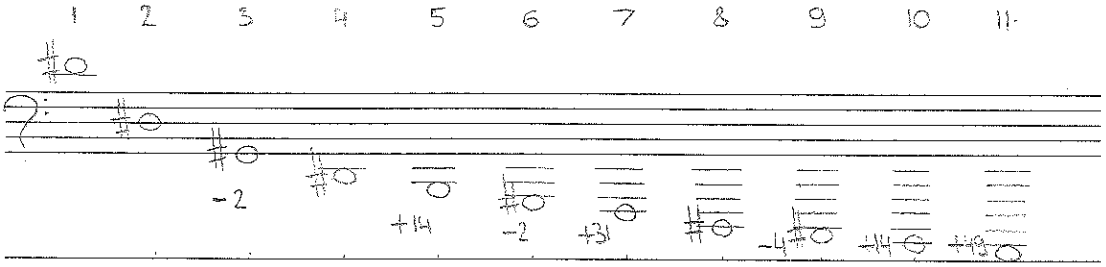
Considerations:
(1) Optimal use of the possibilities opened up by preparation (that is, as many strings should be prepared, thus securing the highest possible number of elements in the system).
(2) The system of elements should be uniform in respect of how the elements are arranged; no one element, or group of elements should be favored and given a dominant, centripetal role.

Limitations and constraints:
(1) 20 lowest strings (from A_0 to E_2) of the piano available for preparation.
(2) 11th partial is the highest to be accessed through preparation.



harmonic series on A_0 – the lowest string available for preparation

Below each note the number of the partial is given, above — the deviation in cents[5] from the equal-tempered tone available on the piano. It can be observed that in the given range of the harmonic series, the highest degree of deviation from the equal temperament is found in the 5th, 7th and 11th partials. It was decided to base the preparation scheme on these partials, thus introducing a layered hierarchy of microtonal deviations. The 11th partial is a 49 cents flat $D\#_4$, almost a quarter-tone below the actual $D\#_4$ as it is found in the octave above middle C. A_0 being the lowest string available on a conventional piano, 11th partial being the highest to be accessed through preparation, decision upon creating microtonal variations of tones by accessing them as 5th, 7th and 11th partials being made, it followed that $D\#_4$ is the lowest possible tone to be used.



undertone series[6] of $D\#_4$ — the lowest tone to be used

Above each note the number of the undertone is given, above (or besides) — the deviation in cents from the equal-tempered tone available on the piano. A harmonic series built on each element in the given undertone series will feature $D\#_4$ as its *n-th* partial (where *n* designates the element's position in the undertone series of $D\#_4$). It follows, that equal-tempered $D\#_4$ is accessible as the 5th harmonic of 14 cents sharp B_1, as the 7th harmonic of 31 cent sharp F_1, and as the 11th harmonic of 49 cents sharp A_0. The intent, of course, is the opposite: to access microtonal variations of the $D\#_4$, not the equal-tempered $D\#_4$ as a partial of microtonally deviant fundamentals. The relation has to be reversed — the fundamentals to be fixed to their closest equal-tempered strings. As a result the following collection of elements is obtained:

[5] 'Unit denoting a fraction of a semitone. 1 semitone = 100 cents.' — A definition given by American National Standards Institute. (American National Standards Institute. 2016. "cent." Accessed April 22, 2018. https://asastandards.org/Terms/cent/.)

[6] if the harmonic series is produced by multiplying the fundamental frequency by n, where n is a list of incremented integers starting from 1, the undertone series is its inverse — a frequency is divided by a list of incremented integers starting from 1

tone and its frequency (in Hz)	partial	resultant frequency (in Hz)	difference in cents
$D\#_4$ – 311.127	1st (unprepared)	311.127	0
B_1 – 61.7354	5th	308.677	-14
F_1 – 43.6535	7th	305.4555	-31
A_0 – 27.5	11th	302.5	-49

A collection of 4 microtonal variants of $D\#_4$ has been established, 3 of the 20 available strings have been prepared, meaning that 5 more collections of the same structure are possible. The 5 collections are created by chromatic movement up from the $D\#_4$ — E_4, F_4, $F\#_4$, G_4, $G\#_4$ (the same upwards chromatic shift is applied in the strings to be prepared). As a result, 6 collections of the same structural build have been created. The remaining 5 collections:

tone and its frequency (in Hz)	partial	resultant frequency (in Hz)	difference in cents
E_4 – 329.6	1st (unprepared)	329.6	0
C_2 – 65.4064	5th	327	-14
$F\#_1$ – 46.2493	7th	323.7	-31
$A\#_0$ – 29.1352	11th	320.5	-49
F_4 – 349.2	1st (unprepared)	349.2	0
$C\#_2$ – 69.2957	5th	346.5	-14
G_1 – 48.9994	7th	343	-31
B_0 – 30.8677	11th	339.5	-49
$F\#_4$ – 370	1st (unprepared)	370	0
D_2 – 73.4162	5th	367.1	-14
$G\#_1$ – 51.9131	7th	363.4	-31
C_1 – 32.7032	11th	359.7	-49
G_4 – 392	1st (unprepared)	392	0
$D\#_2$ – 77.7817	5th	388.9	-14
A_1 – 55	7th	385	-31
$C\#_1$ – 34.6478	11th	381.1	-49
$G\#_4$ – 415.3	1st (unprepared)	415.3	0
E_2 – 82.4069	5th	412	-14
$A\#_1$ – 58.2705	7th	407.9	-31
D_1 – 36.7081	11th	403.8	-49

Observations:

(1) The quantitative measurements (frequencies, differences in cents) of the system given above are based on an ‘ideal' situation in which piano strings are perfectly harmonic and the tuning of the piano corresponds directly with the theoretical model of equal temperament with a reference pitch of $A_4 = 440$ Hz. However, this ‘ideal’ situation differs from the way things are when it comes to ‘real’ pianos:

> ‘It is well known that the notes of a well tuned piano do not follow an ideal equal tempered scale. Instead, the octaves are “stretched”; that is, the frequencies of the fundamental components of piano tones that would differ by precisely a factor of 2 in the ideal case are separated by a slightly greater amount. This stretched tuning was noted many years ago by Railsback.’(Giordano 2015, 2359)

The Railsback curve (or stretch) is a statistical measure that describes the observed differences between common piano tuning and equal-tempered scale. The deviations in tuning are needed because of the inharmonicity of piano strings:

> ‘It is now widely accepted that this effect [stretched octaves] is caused by the inharmonicity of real piano strings. This inharmonicity is an important factor in piano design. [...] Real piano strings are not ideal; they have some stiffness, which causes deviations from the ideal harmonic spectrum.’(ibid.)

By tuning the more inharmonic bass strings lower, the harmonic spectrum is realigned to those of the higher strings, thus reducing dissonances that would appear if the inharmonicity would not be taken into account.

(2) During the process of re-composing the piano, it was realized that the differences in timbral qualities introduced by preparing strings at different nodal points are far more perceptible than the microtonal nuances in pitch. Consequently the system of elements developed were to be defined by both of these parameters. This led to a shift away from the intention of basing the prospective work on pitch relations alone. The re-composition resulted in re-direction of the compositional process.

(3) The re-composition of piano left the greater part of its range unaffected, however, a decision not to use any of the keys and strings outside the established system of elements was made.

The system is as much discovered, as created. An approach that allows a process to alter its course is open to possibilities that can not be known beforehand. Misconceptions lead not only to dead ends, but to new points of departure. The ‘way things are’ (in this case, unforeseen timbral differences) is preferable to an ‘ideal’ (intentions ‘before composition’), because sound, after all, ideals need not be abandoned, they will find another occasion and better means to become realized.

Stage 4 — an analysis of the system of elements

$D\#^{1}$	E^{1}	F^{1}	$F\#^{1}$	G^{1}	$G\#^{1}$
$D\#^{5}$	E^{5}	F^{5}	$F\#^{5}$	G^{5}	$G\#^{5}$
$D\#^{7}$	E^{7}	F^{7}	$F\#^{7}$	G^{7}	$G\#^{7}$
$D\#^{11}$	E^{11}	F^{11}	$F\#^{11}$	G^{11}	$G\#^{11}$

The collection of elements (horizontal axis — pitch, vertical axis — timbre (numeral in superscript denotes the partial))

24 elements

These elements can be grouped following two fundamental parameters:
(1) pitch: 6 collections (denoted by pitch class) of 4 elements (differentiated by timbral qualities and frequency deviations)
(2) timbre: 4 collections (denoted by timbral qualities and frequency deviations) of 6 elements (differentiated by pitch class)

Each element is a discrete entity, qualitatively different from every other element. Quantitative differences appear when a relation between any two (or more) elements is compared with another relation between any two (or more) elements.[7]

6 equal-tempered intervals are available within the system of elements established:

interval	number of instances
unison (U)	6
minor second (m2)	5
major second (M2)	4
minor third (m3)	3
major third (M3)	2
perfect fourth (P4)	1

As can be seen, the greater the interval, the smaller the number of instances of it found within the system. Each of these intervals have 16 variants (except the unison, which has 6) defined by timbre relations, consequently, there is a total of 276 unique two-element sets.

[7] The term *interval* could be applied to the quantitative difference in both pitch and timbre. In what follows *interval* denotes only differences in pitch.

The system of elements can be differentiated (subsets of it devised) according to certain principles defined by two-element relations.[8] A couple are given:

- all the two-element sets featuring any variant of D#
- all the two-element sets featuring D#[5]
- all the two-element sets belonging to the collection denoted by perfect fourth
- all the two-element sets whose elements belong to timbre classes of 5 and 11

These subsets are not only theoretical entities, they describe parameter spaces that are qualitatively different from each other – structures built from them (and temporalized) would manifest different sonic qualities. Furthermore, subsets themselves include other subsets defined by other relations between the elements. Subsets can overlap.

Stage 5(a) – composition proper (considerations, observations)

(1) A survey or analysis of the 'material' (in this case, the system of elements), does not imply, but it might suggest possible directions for composition. The analysis itself, or rather the form it takes, expresses a certain frame of mind. The attention given to various kinds of relations between the elements, and the way in which elements themselves were defined, illustrate my tendency to approach composition from a formalistic angle.

(2) In the analysis of the system of elements, only two parameters – pitch and timbre, were considered, for they were sufficient to define the system. The parameters of duration and amplitude were left out.

(3) A number of subsets devised from the system of elements stand in different relations to each other. These relations can be described and analyzed, but they do not imply any course of action – an 'ought' can not be derived from 'is'. Deliberate decisions by the agent (composer) are needed to move from a static system to temporal ordering of events.

[8] It is only one of the possible ways to create sub-sets of the total; three-element sets could be used or any other kind of quantitatively definable set groups. As will be shown later, different ways of dividing up the total were used when composing the piece.

Stage 5(b) — from a static system to temporal ordering of events

(1) 25 subsets of the system of elements were devised to define the basic units of the piece; the subsets can be arranged in four groups[9]:

(a) single instance intervals
all the two-element sets featuring both:
- F and F# [minor second]
- E and F# [major second]
- F and G# [minor third]
- D# and G [major third]
- D# and G# [perfect fourth]

(b) 4-note clusters
all instances of:
- D#, E, F, and G#
- D#, E, F, and G
- D#, E, F#, and G#
- D#, E, F#, and G
- D#, F, F#, and G
- D#, F, G, and G#
- D#, F#, G, and G#
- E, F, F#, and G#
- E, F, G, and G#
- E, F#, G, and G#

(c) uniform timbre
all the elements accessed as:
- the 1st partial (unprepared)
- the 5th partial
- the 7th partial
- the 11th partial

(d) all instances of intervals
sets featuring all possible:
- unisons
- minor seconds
- major seconds
- minor thirds
- major thirds
- perfect fourths

(2) Each unit were to be structured and scored on a single A3-sized page of music paper consisting of 4 systems. The notation was to be parametric, meaning that spatial distances between events were to be interpreted as durations relative to the speed (tempo) at which the page was to be 'scanned' by the performer. Speed was to be kept constant throughout any single page, but different pages could be read at different speeds.

(3) No pre-determined rules about how to structure elements within a page (apart from those that followed from the nature of subset used) were formulated, allowing to explore widely different ways of structuring vertical and horizontal relations between the given elements. Likewise, no determined sequence of pages was decided upon, allowing the performer to create a unique reading.

(4) Consequently, each page could be composed separately, without having to align one page to another, or think about questions of succession and hierarchy — these aspects are left up to the performer.

(5) To account for even a single one of the pages a few hundred (if not thousand) words would be necessary. Suffice to say, the main structural idioms were those of serial organization, pattern-based sequence and variation. Chance procedures were often applied to determine the order of events and their relative durations.

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[9] Every subset in the (d) class actually features all the elements of the system; it is in the way structures are built within them that exemplify the importance of the interval kind.

(6) Through composing the individual pages it was realized, that the subsets determining the elements to be used in a page, not only suggested the relations these elements might be brought into, but that each page became a sounding of the particular element combinations; not unlike the mode of a gregorian chant becomes the focus of attention, when the movements within it are limited and subjected to sustained repetition.

(7) The overall structure (the sequence and durations of individual pages) is indeterminate, and is almost identical to that of Earle Brown's *Twenty-Five Pages*[10] — a piece with which I am familiar.

[10] 'The *Twenty-Five Pages* may be played in any sequence. Each page may be performed either side up. Events within each two-line system may be read as either treble or bass clef. The total time duration of the piece is between 8 minutes, 20 seconds and 25 minutes, based on 5 seconds and 15 seconds per two-line system as probable but not compulsory time extremities. A time structure in terms of seconds per two-line system may be pre-set by the performer or be arrived at spontaneously during the performance. The indicated note durations are precise relative to each other and to the eventual time value assigned to each line system.' (Brown, [1953] 1975)

Chapter II *Section A*

Sounding — Hearing — Listening

sound — a material reality; 'oscillation in pressure, stress, particle displacement, particle velocity, etc., propagated in a medium with internal forces (e.g., elastic or viscous), or the superposition of such propagated oscillation'[1]

sounding as an oscillation — eternal process extending in space and time, concurrent with existence itself, or rather an aspect of it

Sounding is a continuum and everything there is participates in it to a greater or lesser degree. The extent to which every object[2] takes part in it is determined by the intensity and frequency of the object's oscillation. From near stasis to earthquakes and beyond, from infrasound to ultrasound and beyond. At the extremes sound is not sound anymore, it melds into other aspects of existence and falls under other descriptions. It is almost impossible and, perhaps, meaningless to talk about sounding in its all encompassing nature. Distinctions are introduced, and the unified nature of sounding — the oscillation of everything — becomes a phenomenon.

sounding as a phenomenon — sounding differentiated

Sounding becomes a phenomenon when a pre-conceptual distinction between sound perception and sound production is made. This distinction correlates with the objectification of existence and is gradated, that is, the more complex the distinguishing entity the sharper the distinction (and with it a greater extent of objectification of existence). These gradations can be observed in different biological organisms in relation to their environment. In these organisms the capacities for sound production and perception are closely linked thus allowing like organisms to engage in acoustic communication.

hearing — or more precisely, passive hearing — a continuous process of receiving auditory stimuli

listening — or active hearing, being aware of what is heard; focusing one's attention to what is heard

> '*Hearing* is a physiological phenomenon; *listening* is a psychological act. It is possible to describe the physical conditions of hearing (its mechanisms) by recourse to acoustics and to the physiology of the

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[1] A definition given by American National Standards Institute. (American National Standards Institute. 2011. "sound." Accessed June 29, 2017. http://asastandards.org/Terms/sound-2/.)

[2] By object here is meant a limited chunk of material existence of any scope (both spatial and temporal). A bird, a city, a block of concrete — in this sense all of these are objects.

> ear; but listening cannot be defined only by its object or, one might say, by its goal.' (Barthes 1985, 245)

One does not have to be aware of hearing to hear. The eardrum resonates, signals are transmitted. Awake or asleep, at any moment there is a potentiality for a shift from passive to active hearing. Sometimes it is brought about from without and our will is not involved, sometimes from within and is intentional. The experience of this shift will differ correspondingly.

Listening is a process of becoming aware, a process of using the pre-conceptual mechanism of hearing to create abstractions, systematizations, centres of focus and areas of insignificance. It is a process of dissecting the unity that sound really is, into separate, yet interconnected qualities — intensity, pitch, timbre, et cetera. It is a process of localization and tracking of sound sources, searching out their causes; of decomposing the sonic panorama into its constituents, objectifying what is heard. All of these qualities and actions turn into variables and when brought into different combinations become modes of listening.

Not all modes of listening are created equal; some have a priority either because of the inner workings of the hearing apparatus, or because of a context (environment), or of a tradition, et cetera. But this is precisely why listening is active — it not only listens to something without, but also 'listens' to its operation; listening is being aware of the form it takes. Only when listening is aware, the hierarchy of the modes (itself a trace of evolution, biological and socio-cultural) can be broken and listener can move between them, or rather adjust the balance between them, for no one mode is the only one operating at any given moment.

Listening — Objectifying — Speculating

(A) 'According to the first [type of listening], a living being orients its hearing (the exercise of its physiological faculty of hearing) to certain *indices*; on this level, nothing distinguishes animal from man.' (Barthes 1985, 245)[3]

(B) 'A similar or analogous organ [to human ear] is to be found also in more primitive beings and here the function of this organ is clear: it *warns* the organism of danger and makes it aware of the presence of food etc. This is the primary function of our hearing organ.' (Tempelaars 1996, 1)

(C) 'One does not know when a sound may occur: when it occurs it gives notice of an event in the environment and not merely of its permanent existence: and since

[3] 'This first listening might be called an *alert*. The second is *deciphering*; what the ear tries to intercept are certain *signs*. Here, no doubt, begins the human.[…] Finally, the third listening, whose approach is entirely modern (which does not mean it supplants the other two), does not aim at—or await—certain determined, classified signs: not what is said or emitted, but who speaks, who emits.' (Barthes 1985, 245-46)

an event, i.e., a change in the environment, may always be of vital import, ears have to be open always for this contingency.' (Jonas 1966, 137)[4]

All of the above references emphasize the most basic mode of listening – it serves to situate the perceiver within the environment, establish an awareness of change in it, allowing it to thrive and survive. These are functional descriptions, sound is one variable among others (other senses, that is), a means to, not an end in itself. The objectification happening on this level is one of creating, or detecting, physical objects and separating the self from the without, through coordination of senses - 'an ear alone is not a being' (Cage 1961a, 31).

An organism not only perceives, but produces sound. A sound produced by me is also perceived by me; this is a special case in which I am directly aware of the source and cause on one hand, and the effect – sound produced, on the other.[5] I speculate that because of this feedback loop, (1) the grasp of causality, and of the environment and one's relation to it, is deepened – physical objects and other beings become more familiar by extrapolating this experience of being aware of the links between production and the produced; (2) (and this is a consequence of (1)) the possibility of conceptually separating the effect from its source and cause, of prioritizing and utilizing it, arises and with it the access to investigation of the nature of sounding. Sound can be thought and listened to in itself only after the primary function of hearing is satisfied, when one is 'safe' to contemplate.[6]

Two classes of objects and events within the material reality are established, the difference between them being one of function rather than of kind: (1) objects and events that produce sound; (2) events that are sound. Sound belongs to the material world just as much as a stone does. Two stones (2 objects) are hit against each other (event) and produce sound (event). It is supposed that material reality (stones and sounds) has an existence independent of the act of perception[7], while the distinctions and individuations between objects, events,

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[4] The essay *The Nobility of Sight: A Study in the Phenomenology of the Senses* is discussed in detail by Brian Kane (2014, 135-36)

[5] The notion of thinking sound in terms of *source*, *cause* and *effect*, is taken from Brian Kane's book on acousmatic sound *Sound Unseen* – 'In the physical world, sounds are produced when one object activates another. [...] Sounds are emitted at the intersection of an action and a body. Thus, one might posit a simple law: Every sonic effect is the result of the interaction of a source and a cause. Without this interaction, there is no emission of sound.' (Kane 2014, 134)

[6] Brian Kane emphasizes the gap between source and cause on one hand, and the auditory effect on the other. For him, the objectification of sound is a consequence of this - 'The underdetermination of source and cause motivates a reification of the sonic effect. By bracketing an effect from its source and cause, I transform a sound from an event into an object.'(Kane 2014, 8) Eventually, we both end up with sound as an abstracted object, even if for different reasons.

[7] Even if the 'kind' of existence they have is not fully known.

or an object and an event are not observer-independent, they are composed.[8] The functional difference creates two areas of focus — the production and the produced, these are then mirrored in two ways of thinking sound: (1) emphasizing and investigating the means of production; (2) emphasizing and investigating the sonic effect. The first is more concerned with particular objects and actions (pianos, circuits, muscular contractions, limb movements), and therefore with particular sonic effects. The second is concerned with sounding as a phenomenon and thus with properties of sound as such. The two modes of thinking sound are interrelated and a clear-cut line of separation is difficult to draw, especially when it comes to practice, i.e. composition, but a relative prominence of one over the other does influence the nature of the sounding contributed, and therefore, the experience of a listener.

The sounding of the world is a notion, that enters my compositional work and thought by placing it in relation to phenomenon of sound. First and foremost, it is an attitude — not a practical one, but, if you will, metaphysical. Sounding of the world comes after the fact: after Bach and Cage, after Spinoza and Bergson, after Pythagoras and Helmholtz, through them, and a multitude of others, this notion becomes a possibility. Everything that is heard, is heard through the sounding of the world, everything that is composed flows into it. Sounding of the world does not have to enter into one's consideration when composing, but the composed will enter the sounding. Its inevitability, its omnipresence is precisely what allows one to ignore it, to continue with one's practice, to compose, to 'get things done'.

[8] The manner of composition is to large extent conditioned by context — it is beneficial to see stones as objects for practical reasons, it might be beneficial to view them as events for philosophical or artistic purposes.

All sound practice can be characterized as ultimately being directed towards an experience in which sound is the stratum in relation to which the experience as an undifferentiated whole unfolds.

> *A sounding; radiates through space, unravels in time, is being heard.*

This experience, even if to some extent shared, is never universal and always particular due to the inevitability of the self as distinct from the others. Consequently, an experience is always fluid, always in the making — it can never be pre-composed, the nature of it can not be intended.

> *A number of listeners; each at a different spatial location, to each this moment is the present of a life lived, the most recent addition to a stream of experience and is shaped by it.*

What is composed then? Relations between processes, things, concepts that are combined to form a system whose operation yields sonic results. The system might involve human agents (performers), things or bodies (instruments, loudspeakers), tools (microphones, software), theoretical concepts (thinking in parameters), its operation guided by instructions (score, computer program).

> *The source of the present sounding: a violin being bowed, struck, plucked; the player might be following a score; the score might consist of notes, written indications, graphic symbols. Whatever the precise state of affairs, there is a source from which a sound emanates, and something that causes a sound to emanate, and someone who hears it to emanate.*

The process of composition is carried out by an agent having a particular stance — a position from which the myriad of things and processes are set into relation and a system designed, securing the transfer from an atemporal plan to a temporal process of sounding.

> *The composition behind the present sounding, the stance of composer: the sounding itself, unraveling in time, is a whole, yet behind it a complex set of relations between things, concepts and processes that to a great extent condition the experience. Nevertheless, a listener has only partial access to the workings behind the scenes.*

A gap between what is being composed and what is experienced opens up. One could be composing sequences of notes, one could be composing physical gestures, one could be composing waveforms, but the experience would never be of notes, gestures or waveforms. Conversely, two soundings of the highest similitude (for every sounding is unique, however close it may come to a resemblance of another) could be brought about by two significantly different systems.

> *A score for the present violin sounding might consist of sequences of notes having certain pitch, duration, dynamic curves. Execution of it would entail a set of actions - movements of the bow, movements of fingers, each action marked by relations between parameters — angle of the bow, pressure of the bow, placement of the left hand fingers, et cetera. Conversely, a score might consist of instructions specifying these parametrically described actions. A translation from one score (or system) to the other is possible. However, it is never exact — a multitude of translations are possible.*

Although the process of composition is carried out from one of these perspectives (or a combination of them), it is mirrored in the others. A discrete interval under one description might be a continuous movement under another.

Analysis — Parametric Sound-Space

> '[Analysis] operates always on the immobile. [...] The real, the experienced and the concrete are recognised by the fact that they are variability itself, the element by the fact that it is invariable. And the element is invariable by definition, being a diagram, a simplified reconstruction, often a mere symbol, in any case a motionless view of the moving reality.' (Bergson 1912, 47-48)

> 'We have in fact attained a level of knowledge at which scientific objects are what we make them, neither more nor less. [...] Objectivity becomes the purer as it ceases to be passive in order to become more markedly active, as it ceases too to be continuous in order to become more clearly discontinuous. We *realise* our theoretical thought by degrees. We end by extracting complex phenomena from their own particular time — a time that is always vague and indistinct — in order to analyse them in an artificial time, a time we determine, the time of our instruments. We are able to slow down, accelerate, or immobilise the most varied temporal phenomena.' (Bachelard [1936] 2000, 77)

Sound as an object — 'a motionless view of the moving reality' — is extracted from the sounding — a process, having its time, its *duration* — 'variability itself'. Through extraction — analysis, the object is constructed, its nature determined by the manner of construction, there being as many possible constructions as methods of analysis. Analysis is guided by intention, carried out by a method, supported and effected by a system; it is a mixture of concepts, tools, dispositions. All this can be equally well said about synthesis — composition, only the direction is changed — a move from the 'element' to 'variability itself'. Decomposing sound into parameters is a common and useful kind of analysis. It is inherent in the tradition of musical practice (at least in the Occident) through the history of notation; it has an important role in

science — sound being only one of phenomena that undergo ‘parametrization' in course of their analysis.

(A) ‘The characteristics of every sound depend on the way in which the sound was produced. Each art-form exploits its special production methods in order to endow the phenomena with unmistakable characteristics. Artistic economy demands that the means be appropriate to the end, and that the exploitation of the means be an end in itself.’ (Koenig 1963, 1)

(B) ‘PARAMETER. Any distinctive attribute of sound, in terms of which one (elementary) sound or sound-configuration may be distinguished from another.‘ (Tenney [1961] 1988, 92)

(C) ‘Analysis of the musical sound into its "parameters" — in instrumental music theoretically more preached than practised — is in electronic music a fact by virtue of its production method. Pitch, loudness and duration are "set" on independent pieces of equipment.’ (Koenig 1963, 2)

(D) ‘The situation made available by these means [magnetic tape] is essentially a total sound-space, the limits of which are ear-determined only, the position of a particular sound in this space being the result of five determinants: frequency or pitch, amplitude or loudness, overtone structure or timbre, duration, and morphology (how the sound begins, goes on, and dies away). By alteration of anyone of these determinants, the position of the sound in sound-space changes. Any sound at any point in this total sound-space can move to become a sound at any other point.’ (Cage 1961a, 9)

The parametric sound-space. The systematic isolation of musical parameters (pitch, dynamics, timbre, duration, above others) as a compositional method fully emerged in the years following the Second World War (although, it can be observed in the works of Webern, for example in his *Symphony Op. 21* [1928], and in the music of Varèse, albeit in a less systematic way), it is related to serialism, to electronic music (works produced in Cologne), to Messiaen (*Mode de valeurs et d’intensités* [1949]), to Cage (*Music of Changes* [1951]). Parameters become measurable scales, continuous or discrete, in which single points (or lines between them) determine a state of the respective property of a sound situated in a multi-dimensional space — the number of dimensions corresponding to the number of parameters. This parametric space is a metaphor. It is true, sounds could be represented as shapes occupying this space, and modifying these shapes within the space would allow a systematic (but not necessarily) investigation of variations and transformations; however, the importance lays not in a graphical interrelation, but in isolation of parameters — dissection and design of sound, that places the effect prior to source and cause, prescribes result not means.

Thinking in parameters, naturally, involves the examination of these parameters, both individually and in relation to others. Thinking in parameters involves examination of *relation*. The importance of these examinations lay in how they inform the compositional practice.

(I) A distinction is made between sound as perceived and sound as measured.[9] Sound is perceived as having pitch and loudness, while its frequency and amplitude are measured.[10] It does not mean that there is a one-to-one correspondence between a parameter in one domain and its resemblant in the other (Tenney [1961] 1988, 105), neither does it mean that one should be chosen over the other as framework for building a parametric space and relations within it. The reason for choosing one or the other is often linked with the intentions and means of the composer. The analogue studio with its oscillators, amplitude modulators and filter-banks suggests thinking in frequencies and amplitudes; the musical score with its staves and notes might better accommodate a pitch-oriented thinking. Yet, these are not rules, but rather conventions, that might or might not be followed. Two examples:

(a) In *Meta + Hodos* James Tenney constructs a 'conceptual framework for musical description and analysis' (Tenney [1961] 1988, 56), influenced by and applying methodology found in the theories of Gestalt psychology. His later theoretical works (such as *Form in Twentieth-Century Music* (Tenney [1969-70] 2015, 150-65) and *John Cage and the Theory of Harmony* (Tenney [1983] 2015, 280-304) focus on certain aspects of the music composed and experienced. His contribution to the understanding of pitch-based relationships, described in *John Cage and the Theory of Harmony* and arising from his studies of intervalic relationships found within harmonic series and the recognition of two-dimensional nature of pitch[11], is an example of thorough investigation. Moreover, in his music Tenney demonstrate his findings with an utmost clarity, without lapsing in dry formalism (or if it is formalism, it is never dry) — *Critical Band* [1988] is an excellent example.[12]

(b) The inter-relatedness of parameters (both within a domain, 'musical' or 'acoustical', and across them) and their discrepancies can become an object of composition as in Stockhausen's *Kontakte* [1958-1960]. I am, of course, referring to the section midway in the piece where a gradually descending tone finally becomes a pulse. By change in an 'acoustical' parameter — frequency, a transition from one 'musical' parameter — pitch, to another — rhythm (structured

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[9] A differentiation emphasized by Tenney in *Meta + Hodos*, the system he builds being based on the '"subjective" or *musical* parameters (e.g., pitch, loudness, etc.) as distinct from "objective" or *acoustical* parameters (frequency, amplitude, etc.).' (Tenney [1961] 1988, 103)

[10] A further difference is the reducibility of acoustical parameters (frequency, amplitude) to more basic entities and their relations (displacement, time). Both Koenig (1970, 14) and Tenney ([1961] 1988, 111) refer to this.

[11] The two dimensions being *pitch-height* (the absolute value from low to high) and *pitch-chroma* (the cyclic nature of pitch, octave equivalence). (Tenney [1961] 1988, 105)

[12] 'Perceptually, the form of the work results from the gradual transition from the dense clustering of pitches near the beginning — the total pitch-range of which does not exceed the limits of the "critical bandwidth" of the opening A-440 (a "major second" above and below) — to the larger intervals that, as the work proceeds, increasingly emerge from the texture as harmonic relationships.' (Gilmore 1995, 494)

duration), takes place. An inter-relation of two parameters within a single domain is observable in Stockhausen's *Gruppen* [1955-57], for which he devised a twelve-step duration series corresponding to the equal-tempered division of twelve semitones of an octave (as described in '..... how time passes .....' (Stockhausen 1959, 10-40)).

Investigations of the nature of parameters give rise to new theories and beliefs that inform the compositional practice. A crucial role here is played by the analysis itself, that is, how the unity of sound is differentiated. There is an intention behind every analysis; there are the peculiarities of the analyst — even if the objective of two analysts would be the same, the relative importance attributed to specific relations within the analyzed would most likely be different. A great deal depends on the complexity of the analyzed, as it begins with what can be comprehended. Is it really sound itself that is analyzed or is it the context in which it is found (or the means through which it is found)? Sound as an oscillation, sound as a percept, sound as the composed, sound as a symbol, et cetera — how much of 'sound' is there in these analyses? Analysis of sound is also an analysis of that which is not sound, approached through it, perhaps, an attempt to break the surface and reach beyond the immediately present. The multitude of possible methods and analyses lie in the analyzed. The analyst (the composer, the acoustician, the philosopher) conceives a way to divide things up and proceeds accordingly. A survey of divisions leads to questioning the divisions, to seeing how different divisions give different results.

Intention — Non-Intention

Cage thought that not all parameters were of equal importance to structuring sound and honored duration as the supreme parameter, for only duration can account for 'the opposite and necessary coexistent of sound' — silence (Cage 1961a, 63). However, a re-evaluation of silence, stimulated by Cage's experiences in anechoic chamber, shifts the distinction from sound/silence, to intention/non-intention (13-14). And a return to pre-hierarchical situation takes place, for if 'there is no such thing as silence' (191) and 'something is always happening that makes a sound' (191), this sound has not only duration, but loudness, timbral qualities, et cetera.

The non-intended — sounding of the world — within which musical work is situated, offers a sonic abundance that can be integrated within a compositional framework and redraw the lines between 'musical' and 'non-musical' — an extension of what music can be, of what can be composed. The non-intended can be accounted for by the perceiving mind or by scientific measurement and parametrized respectively.[13] In doing so the parametric framework is extended and re-focussed: the role of pitch is challenged by noise in its gradations and flavors, the spatial aspect (distance between sources, sources and listener)

[13] Parametrization is, of course, only one of strategies that could be taken. However, I would say that the history of music in 20th century, especially the latter half of it, could be characterized by opening up to sound in its inexhaustible richness and the subsequent re-evaluations of sound as a phenomenon. (be more clear)

becomes ever more important, structuring densities (both vertical and horizontal) enters the method, becomes a form-making process. For the parametric mind 'silence' is a gain. The non-intended, or rather the sound world brought in with its recognition, not only extends the limits of what can be described (and therefore prescribed), but also asks the question — 'what is it, that is intended?' and its correlate 'what is it, that is composed?'

Everything intended, either a specific action or a specific result, coincides with a set of multiple actions and results not intended. If one intends a certain result (this pitch, this loudness, this duration), the actions necessary for attaining the result (bow pressure, speed, etc.) are implied, while not being the object of this intention. The opposite — intending an action without directly intending its result — is equally possible. The implied actions and results are never fully determined by the intention, but their correlation, at least within the boundaries of a musical practice traditionally conceived, is sufficiently precise for this under-determination not to be given much thought.[14] To be sure, the implied is only a peculiar subset of the non-intended, it is a shadow following the intended, a byproduct. Cage's non-intended is essentially sonic (Cage 1961a, 8), the distinction I draw between the intended and the implied is not necessarily so, although because of its occurrence within a compositional practice, it manifests sonically.

The more complex the intended, the greater the gap between it and the implied. This gap can be seen as a problem to be solved, leading to development of complex systems of ever-increasing degrees of precision (computer programs, musical scores of high specificity). Conversely, the gap can be embraced, leading to a truly experimental separation of intentions and implications. To bring back a distinction introduced earlier, either the source and cause, or the effect, can be the objects of composition. Yet there is another possible reaction to the gap — it can itself become the object of composition. By that I mean, composition as a creative exploration of the links between the intended and implied, the action and its result, the means of production and sound seen (heard) separately from them. Composition as a process of analysis, formalization, exploration, the outcome of which feeds back into that which was to be analyzed, formalized and explored — the sounding.

Returning to Cage. *4'33"* is a celebration of sound not intended, yet the *intention* hanging above it — appreciation of the sounding that envelopes the living at every moment, is almost pedagogical and even therapeutic.[15] By bringing the 'world' into the concert hall, Cage hopes for a reciprocative action on part of the listener. However, it is important to note, as Tenney does, that 'Cage's "renunciations" since 1951 should therefore not be seen as

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[14] Or when it is given a thought, it is called music criticism.

[15] 'This turning [towards sound not intended] is psychological and seems at first to be a giving up of everything that belongs to humanity — for a musician, the giving up of music. This psychological turning leads to the world of nature, where, gradually or suddenly, one sees that humanity and nature, not separate, are in this world together; that nothing was lost when everything was given away. In fact, everything is gained. In musical terms, any sounds may occur in any combination and in any continuity.' (Cage 1961a, 8)

“negations” at all but rather as efforts to *give up the old habits of negation* — the old *exclusions* of things from the realm of aesthetic validity, the old *limitations* imposed on musical imagination, the old *boundaries* circumscribing the “art of music.”' (Tenney [1983] 2015, 285) A remarkable parallel to Cage’s ‘renunciations' is found in the work of Olivier Messiaen, especially in his application of birdsong transcription as a compositional method. Messiaen’s music from the early fifties, coinciding with Cage’s turn to sounds not intended, just like *4’33”* [1952], brings the ‘world’ without into the concert hall, albeit in a more ‘musical’ and less provocative way — through birdsong.

Both Cage and Messiaen introduce new methods of composition, thus giving another angle from which to approach sound and its construction, its description and prescription. In Messiaen’s case I want to emphasize the move from 'found sound’ (birdsong — the sounding of the world) to structures of relations between the parameters — pitch, rhythm, timbre — that can be separated from their source and cause. In Cage’s case — a move from spatial relations between undefined elements (by means of graphical notation) to a questioning of the ways sound is thought and composed.

During the process of transcribing bird songs and calls that were to appear in *Réveil des oiseaux*[16], Messiaen witnessed a multitude of dawn choruses.[17] One can imagine that not only any of two choruses were not the same, but that the conditions in which they took place were different — the environment, air temperature, lighting conditions, to name a few. Because of the task at hand — transcription, the observations might have revolved around the behaviors of certain bird species, cross-species communications, temporal and dynamic relations.[18] The observations and the myriad of particular transcriptions derived might have been sufficient to acquire a general notion as to how a dawn chorus unfolds. It need not be an intentionally formalized, systematized understanding, a synthesis of an intuitive grasp and specific observations is enough.

There is no such thing as pure observation. It is a convergence of the object of perception as independent from the observation, and the observers attempt to make sense out of it, to represent it to one's understanding.[19] Just as in the case of bird song and call transcriptions, that inevitably are bound to the sign system (musical notation) in which they are encoded, the proceedings and relations observed within a dawn chorus are closely linked to the intentions that lay behind the act of observation itself. Setting out to compose a dawn chorus presupposes hearing the dawn chorus as composed — each song a constituent within the whole.

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[16] Composed in 1953, for piano and orchestra (Messiaen 1955). According to the composer 'In *Réveil des oiseaux*, the presentation is much more accurate: there's really nothing but bird songs in it, without any added rhythm or counterpoint, and the birds singing are really found together in nature; it's completely truthful work. It's about an awakening of birds at the beginning of a spring morning; the cycle goes from midnight to noon: night songs, an awakening at four in the morning, a big tutti of birds cut short by the sunrise, forenoon songs, and the great silence of noon.' (Messiaen & Samuel 1994, 131)

[17] 'Dawn chorus singing is a striking behaviour pattern, performed by some temperate-zone and tropical songbird species, as well as a few non-passerine and non-avian species. In a typical chorusing songbird species, all territorial males in a neighbourhood synchronously start singing 30 to 90 minutes before sunrise. During the ensuing chorus period, song rate, singing diversity and song complexity reach maximal levels.' (Burt & Vehrencamp 2005, 320)

[18] For a comprehensive account of dawn chorus and its functional role in avian life see the above quoted paper *Dawn Chorus as an Interactive Communication Network* by John M. Burt and Sandra L. Vehrencamp and its extensive list of secondary literature. (2005, 320-343)

[19] '[Something] is wrong with the very notion of copying any of the ways an object is, any aspect of it. For an aspect is not just the object-from-a-given-distance-and-angle-and-in-a-given-light; it is the object as we look upon or conceive it, a version or construal of the object. In representing an object, we do not copy such a construal or interpretation — we achieve it.' (Goodman 1968, 9) Although, in the above passage Goodman is concerned with the ocular, the same holds true for the aural.

registration — a process by means of which a data structure is derived from the sounding at a particular time and place

Registration includes such methods as transcription and recording. It is instigated by an agent, who decides upon the method used and designs a system to carry it out. The outcome of the process is creation of a data structure, existing within a specific sign system.

transcription — a method of registration; defined by its outcome being a data structure in a form of music notation

method — a specific technique governing the way in which registration takes place

The choice of method is closely linked to the intentions of the registrar. The method and the sign system in which the resultant data structure will exist are coupled. By committing to a specific method and sign system, one commits to certain conventions and limitations. Conventions, because the sign system is not exclusive to the specific act of registration, limitations, because a sign system has its limits that determine the possibilities of what can be encoded.

system — a network of interrelated decisions, actions, tools and operators that takes care of the process of registration

<u>transcription</u>
operators: the one who transcribes
tools: a pencil, music paper
actions: listening, notating

The transcriber dissects the sonic panorama, focuses attention to that portion of it which is to be transcribed — perhaps, a song of a specific bird. The bird sings, the transcriber transcribes — a pencil rapidly moving across a sheet of paper. All the other constituents that participate in the sounding at the specific time and location are filtered out. In the case of transcription, the agent both designs the system and actively participates in its operation, because of this, the system can undergo changes in its mode of operation without there being any conscious or planned acts of revision — the relationship is fluid.

<u>Notes on the process of registration</u>[20]

(1) Registration begins with the realization that a sounding environment, something without, is beautiful and worth listening to; that this sounding can be as important as the music of a composer laboring for years in the quiet of the studio. This sounding is full of communication, full of noise. But those are not musical communications, and it is not intentional noise. Something that does

[20] The account of transcription as registration I give, is idealistic, it proposes an attitude that I find attractive and fruitful, and it is not necessarily shared by Messiaen. However, his remarks about the truthfulness of *Réveil des oiseaux*, cited above, point to a certain degree of commonality.

not strive to become music, becomes such when there is one to hear it as such. Registration is, perhaps, an attempt to share this joyful discovery with others.

(2) Withoutness supposes separation. The registrar assumes the role of a mediator, a documentarist — one who does not create impressions or expresses sentiments. The discovery of sounding out in the field, or in the restlessness of a city would be sabotaged if it were to be exploited in such ways. Registrar has to be precise, to stay true to the actual sounding in order to (re)create a sonic environment.

(3) The consequence is twofold. The notion of what music composition can be is extended. The notion of what music is is extended. The mediation does not have to be successful for this to occur. The listener does not have to realize that he or she is listening to a transcription. Ambiguity, always present in music, is an asset, it is the fundament that grounds the unfolding of possibilities to create something that has not been heard. After all, it would be ungrateful and didactic to impose a prescribed way of listening, especially when this very same nebulous relation between the sounding and its interpretation was what gave rise to the recognition of music existing without.

(4) The more precise and true to the sounding it registers, the more radical are the implications of a registration.

If, as in the case of *Réveil des oiseaux*, the constituents (individual bird songs or calls) are first extracted from their environments, and later sequenced and juxtaposed to create a composition, the documental approach could extend to the latter stage. And to a certain degree it does — the segmentation of *Réveil des oiseaux* in sections corresponding to time periods from midnight to dawn, from dawn to sunrise, and from sunrise to noon, closely corresponds to circadian rhythm as observed in spring in France, albeit considerably compressed (an approximate ratio of 1 to 36). Furthermore, the order in which bird songs and calls appear in the piece, roughly corresponds to the patterns observable in nature. However, in neither of the stages Messiaen's methods are purely documental, compositional decisions, whether conscious or not, find their way into these processes.

Notes on transcription

(1) Of all the possible soundings one could transcribe, birdsong is certainly not of the elementary kind. An air conditioner, a transformer, although sounding within an environment, are far less influenced by it, they could be moved to a location entirely different and still go on droning and buzzing in much the same way as before. Not so with birds. Birdsong is a kind of communication. There is a context, an environment. Oftentimes the bird transcribed is engaged in communication with other individuals. A bird listens, a bird responds. A bird reacts to various other stimuli - light, wind, humidity, possible dangers, et cetera.

(2) Music notation is primarily a means of communication between musicians and composers. Throughout centuries it has taken on different forms to serve

different traditions and conceptions. Birdsong transcription has never been one of them, and even if one was to design a system specifically for that, more likely than not, a translation into a more conventional kind would have to take place. Perhaps, it is even desirable, this new notation, because every translation renews and extends the conventional system.

(3) Sonic environment, music notation, a human being. During the process of transcription, these three elements, each of them having existence outside of it, come together. They influence each other and the outcome of the process. To notate a birdsong, one has to hear it through the medium. One has to hear sequences of notes, intervalic relationships, crescendos and diminuendos, accents and rhythms. But even before that, one has to isolate the song that one transcribes, remove it from its environment. Transcription is abstraction, reduction to the bare essentials, to patterns of interrelated parameters.[21]

Notes on the outcome of registration

The outcome of every act of registration can be described as existing in at least two ways:

(I) It exists as an artifact; this particular set of pencil marks on this particular page, this particular pattern of magnetized ferric oxide on this particular tape.
(II) It exists as an abstract, yet particular, entity; a data structure — a particular complex of relations between elements in a sign system.

The two modes of existence are closely related. The sign system holds within itself potentiality for every possible configuration of its elements. Within the sign system there is a data structure corresponding to every possible registration - the ones that have already taken place, ones that will take place in the future, ones that will never take place. For the potentiality to become actualized as a data structure, a decisive and unique action has to occur — this particular act of registration. The abstract comes into being through the concrete, the physical — the artifact, and is accessed through it.

(1) Every particular registration establishes a set of relations between past, present and future. The sounding is a process necessarily present by definition; The very act of registration looks forward to another time and place; the data structure created persists through time eternally — it holds a memory of what has been, and serves as a script to what will be; the complementary process to registration — interpretation, is the actualization of the possible encoded in the script; the resultant sounding, always in present, refers back to a time past. An entanglement of tenses.

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[21] 'With the immediate and present data of our senses, we mingle a thousand details out of our past experience. In most cases these memories supplant our actual perceptions, of which we then retain only a few hints, thus using them merely as "signs" that recall to us former images. The convenience and the rapidity of perception are bought at this price; but hence also springs every kind of illusion.' (Bergson [1896] 2005, 33)

(2) A registration is a documentation. It registers a sounding at specific place and time. It is concerned with the particular and presupposes an attitude that is more or less objective. Clearly, there is not one ideal documentation, there never is. Because of this, registration is as much an account of the registrar's dispositions as it is of the sounding. Consequentially, documentation, no matter how precise or scientific in its execution, is always an act of creation.

(3) A registration is a script. A script is to be executed, instructions encoded in it to be followed. Both a recording and transcription are characterized by their being directed towards an interpretation, of sonifying the encoded. If the sounding registered was one and unique, the interpretations are infinite. Only partially, this has to do with the consistency (or lack thereof) on part of the interpreter, whether it be a machine or a human being; the change of time and place is enough.

(4) In between being a documentation and a script, the registration as a data structure can be subjected to transformation. Each transformation is paralleled with creation of a new structure derived from the original. The greater the transformation, the less resemblance the resultant sounding will bear to the sounding documented.

The sign system through which transcription is made — traditional music notation — could be seen as a parametric sound-space, its two dimensions, vertical and horizontal, representing pitch and time, while other symbols are employed to specify such parameters as loudness (dynamics) and timbre. This sound-space is history-laden — there is a tradition, a culture that has shaped it and has been shaped by it. The focus is set on the encoded (music), that which makes the encoding possible (notation) is often neglected and taken for granted. Throughout my account of registration/transcription, I have emphasized the importance of a documental attitude — precision, being true to what is registered. One could question whether transcription as a method satisfies the criterion for accurate representation (especially when compared to recording)[22], however what matters is the *attitude* — it induces registrar to work against the limits of what is possible.[23] Viewed from the perspective of medium — music notation as a sign system and the parametric sound-space it represents — transcription can be seen as a move away from the utility of the system, foregrounding of the system, opening up of the system through disturbing it. Through transcription (1) the system's limitations are illuminated (for example, the quantization of both pitch and time); (2) the kinds of structures are created, that would not come into existence by any other means — each birdsong transcription establishes a unique set of relations within and between the parameters.

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[22] 'Realism is relative, determined by the system of representation standard for a given culture or person at a given time.' (Goodman 1968, 37)

[23] 'You must have an extremely experienced ear and be capable of very quickly writing down something retained while listening to something else that will also be retained; so it's double work for the brain, rather tiring.' (Messiaen & Samuel 1994, 93-94)

In *The Logical Structure of the World* (Carnap [1928] 2005), Rudolf Carnap outlines a framework from which such a logical construction might take place – an integrated system of objects and concepts[24] that would account for physical, psychological and socio-cultural phenomena and would offer a possibility of deriving and constructing one from another, thus furthering our understanding of the world and processes that define it.[25] The fundamental characteristic of a constructional system is that 'a step-by-step ordering of objects in such a way that the objects of each level are constructed from those of the lower levels' (6) is possible and 'because of the transitivity of reducibility, all objects of the constructional system are thus indirectly constructed from objects of the first level. These *basic objects* form the *basis* of the system.' (6) The basic objects are divided into *basic elements* and *basic relations* (that hold between these elements)(98-99). From these it is possible to construct objects on ever higher levels through application of ascension forms[26] (47), securing the premise that 'objects of a constructional system are complexes of the basic objects of the system' (62). To simplify, if such a system were to be successfully built, it would be possible not only to reduce biology, to chemistry, to physics, et cetera, but also to reduce statements about psychology and culture to statements about natural sciences.

Carnap's project is quixotic and, perhaps, misguided, yet the rigor of his method is admirable and insightful. It is not difficult to see certain analogies between Carnap's *Aufbau* and the theoretical writings of Tenney (especially his *Meta + Hodos*) and Koenig, both of whom I have referred to above. A more striking parallel is found in the compositional practice of John Cage, in his *Variations II* ('for any number of players and any sound producing means' (Cage 1961b)):

'Six transparent sheets having single straight lines, five having points. The sheets are to be superimposed partially or wholly separated on a suitable surface. Drop perpendiculars from the points to the lines (where necessary to extensions of the lines). Measure the perpendiculars by means of any rule, obtaining readings thereby for (1) frequency, (2) amplitude, (3) timbre, (4) duration, (5) point of occurrence in an established period of time, (6) structure of event (number of sounds making up an aggregate or constellation). A single use of all the sheets yields thirty determinations. When, due to (6), more are necessary, change the position of the sheets with respect to one

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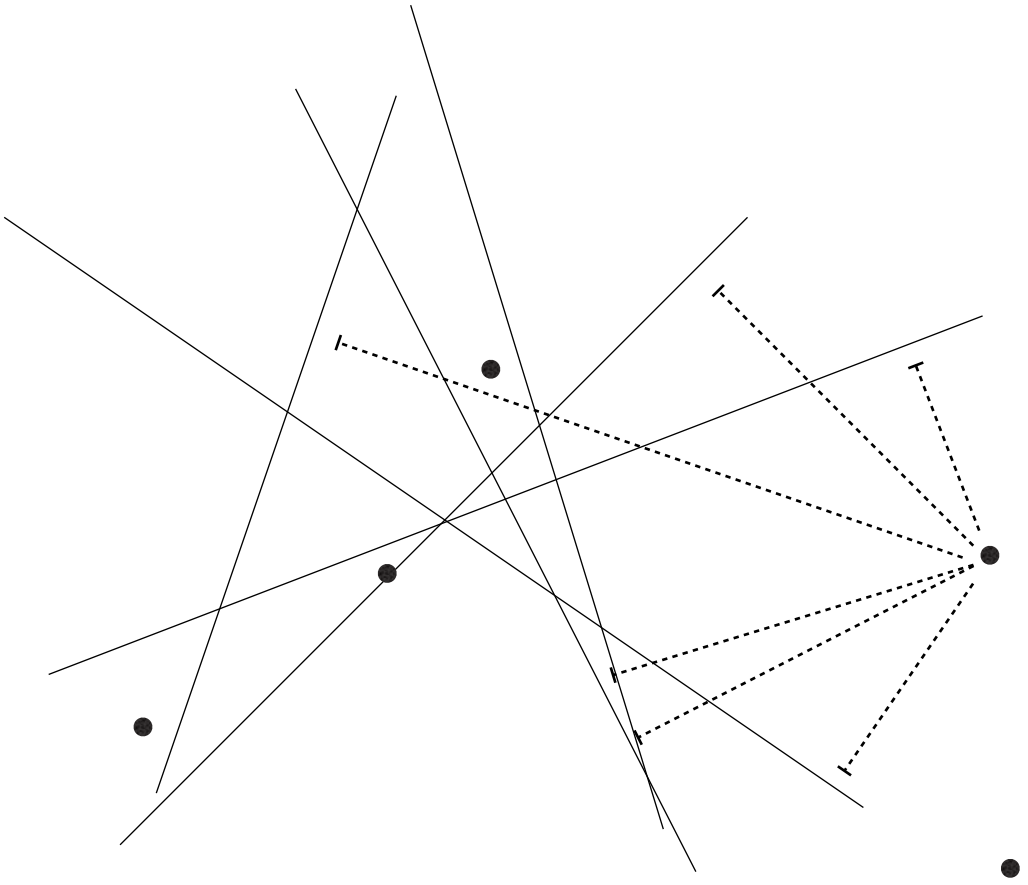
[24] 'The word "object" is here always used in its widest sense, namely, for anything about which a statement can be made. Thus, among objects we count not only things, but also properties and classes, relations in extension and intension, states and events.' (Carnap [1928] 2005, 5)

[25] See Part I Chapter A (Carnap [1928] 2005, 5-10)

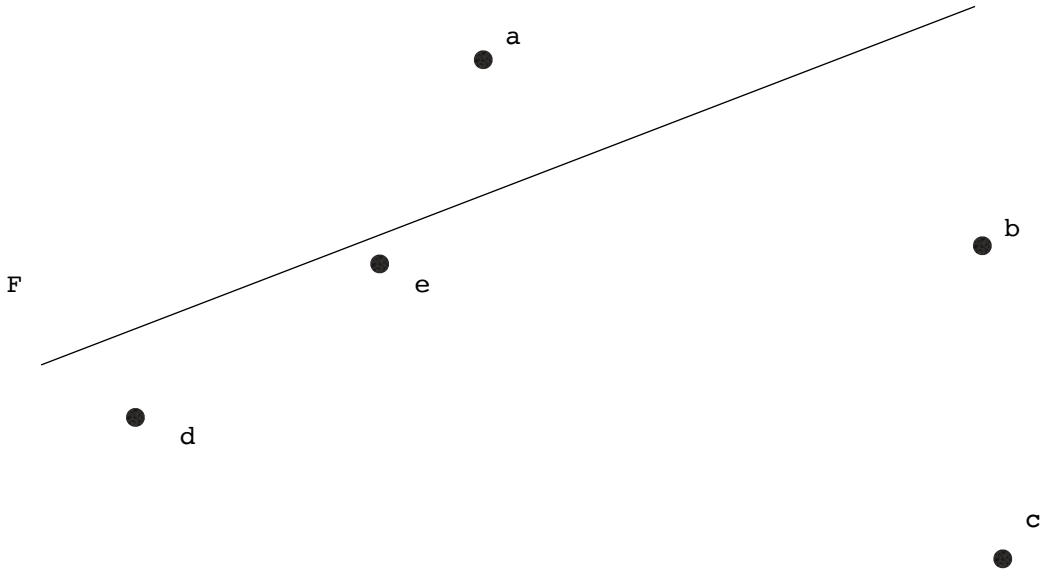
[26] The only two ascension forms necessary for constructional system are *class extension* and *relation extension* (Carnap [1928] 2005, 12). These forms are utilized to create *definition in use*, through which an object on a higher level is expressed by objects on a lower level – 'every definition in use indicates that a propositional function which is expressed with the aid of a new symbol means the same as a propositional function which is expressed only with the older symbols.' (67)

another before making them. Any number of readings may be used to provide a program of any length. If, to determine this number a question arises or if questions arise regarding other matters or details (e.g. is one of the parts of a constellation itself a constellation, or aggregate), put the question in such a way that it can be answered by measurement of a dropped perpendicular.' (Cage 1961b)

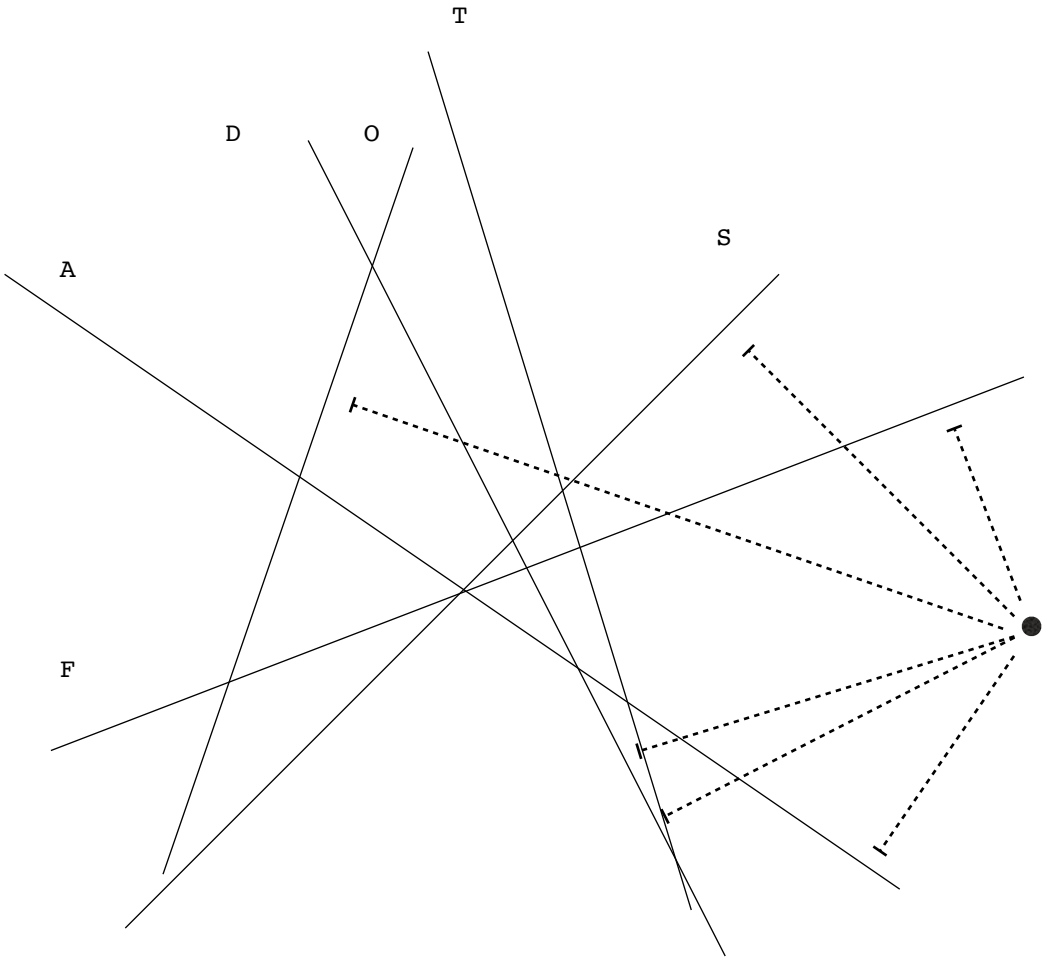
As James Pritchett attentively observes 'the notation of Variations II, because it allows any configuration of dots and lines, can describe any sound. [...] Given this enormous flexibility, it is not an exaggeration to say that Variations II encompasses any piece of music that could possibly be created. All that is required is that the parameters of the music be identified and measured in the proper way.' (Pritchett 2001, 2) It is unclear, whether Cage intended *Variations II* as meta-structure for all possible orderings of sonic events, I would not rule that out; it would be an apt compliment to *4'33"*. And just like Cage's 'silent piece' it poses an array of questions; to name a few – what is it that is composed? what is 'a composition'? what is structure? what is a score? To keep in line with the thread of thinking, composing sound in parameters, I will examine the construction of a parametric space that has to take place in a process of realizing the piece.



[Fig. 1] A chance-determined distribution of six lines and five points. The dotted lines mark the perpendiculars to be drawn from a single point to every line



[Fig. 2] A simplification of Fig. 1, showing only one line and five points



[Fig. 3] A simplification of Fig. 1, showing only one point and six lines

First observations:

(I) Any configuration of the lines and points establishes a set of spatial relations: (a) between the lines; (b) between the points; (c) between any one point and every line; (d) between any one line and every point.

(II) There are no measurements to be made in the case of (a) and (b), however, these relations can possibly influence the statistical distribution of sonic events derived from the score.[27]

(III) There are properties (parameters), but no property descriptions. The structure of elements is defined not by individual or absolute values, but by their relative differences.[28]

(IV) There are no given rules for measurement. Each line is a 'point' of reference within the ascribed parameter.

(V) Each point (according to parameter (6)) can consist of a number of elements — points; to determine their values a new configuration of lines and points have to be established.

A series of steps are to be taken to determine the particular values of the parameters defined by the relations of points and lines:

> Step 1: An arrangement of lines and points has to be made.
>
> Step 2: Every parameter has to be paired with a single line. This can also be done before making an arrangement.
>
> [The first two steps present four possible combinations of chance and choice, for each of the two steps can be carried out in either manner; there are no specifications on whether the arrangement or the attribution of parameters has to be chance-determined or not.]
>
> Step 3: By 'dropping perpendiculars' displacement of every point from every line is measured (thirty measurements).

At this stage every point is defined by six numerical values; each line associated with five numerical values. In Fig. 2 five points are scattered around a single line (frequency), four of these points are on one side, one on the other. A question occurs: is there a differentiation to be made between negative and positive displacement? The answer to this question is closely related to the first step to be taken in order to define the respective parameter range.

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[27] For example, two closely situated points will yield close measurements in every parameter, thus favoring a certain type of a sonic event.

[28] 'A *property description* indicates the properties which the individual objects of a given domain have, while a *relation description* indicates the relations which hold between these objects, but does not make any assertion about the objects as individuals. Thus a property description makes individual or, in a sense, absolute, assertions while a relation description makes relative assertions.' (Carnap [1928] 2005, 20)

Step 4: Each line has to be given a determinate reference value. It can either determine (a) a limit — lowest possible frequency, shortest possible duration, or (b) a fixed value within a range that extends above and below it — 400 Hz, 3 seconds. Naturally, in the case of (a) all displacements are positive (or negative) — the placement of the point on one or the other side of it are ignored. The opposite is true in case (b), additionally it has to be decided which side of the line is the positive and which negative.

[Cases (a) and (b) present two different strategies for determining a parametric range, which are pertinent to keep in mind in contexts other than the present one.]

The five numerical values (displacements of the points) associated with each parameter (line) have a certain hierarchy, if ordered, every point (in relation to this line) is defined not only by the displacement measured, but also by its place in the hierarchy.

Step 5: A decision regarding continuity or discreteness of every parameter is to be made: (a) the parameter range can be continuous; (b) the parameter range can be discrete. In case (a) every point will extract a value from a continuum (which is to be described below). In case (b) every point is assigned a value.

[Case (a) allows a design of a continuum which is consistent with the initial spatial relations, furthermore any new point added to the arrangement would receive a specific value (this can be of importance because of parameter (6)). In case (b) the points are no longer related to each other (and the line in question) by their values of displacement, but by their hierarchy (which is derived from the initial arrangement). Consequently, values assigned to them can be chosen more freely, albeit some general rules are to be followed. A third option, middle ground of sorts, can be conceived — one could establish a continuous range, find values of every point and round them to the nearest discrete unit, creating a pseudo-continuum.]

The decision to be made in Step 5, has to be informed by at least two considerations: (a) the nature of the parameter in question; (b) the intended means of production (instrument-system[29]):

(1) Frequency considered as a parameter presents no difficulties for establishing a continuum, so the decision will depend upon the intended means of production. For example, piano has 88 keys, dissecting the available frequency range (from 27.5 Hz to 4186 Hz) in a corresponding number of discrete steps. A true continuum is not possible, however, a close approximation — pseudo-continuum — is likely. If one would realize a reading of *Variations II* for five cymbals, a discrete frequency range would be more than probable.

(2) Amplitude is similarly flexible for minute gradations, however two factors are to be considered: (a) precise proportions of amplitude are difficult to

[29] instrument-system = 'any number of players and any sound producing means'

perceive, hence problematic to produce (by a human agent); (b) the conventional notation system is discrete (the dynamic markings such as *pp* and *f*; crescendos and decrescendos fill in the marked out spaces between them), making it difficult to prescribe exact values. Moreover, the discrete and ambiguous natures of *piano* and *forte* suppose and cultivate thinking in relational terms. Neither of these problems occur in electronic domain.

(3) Timbre might be the most problematic of parameters. Koenig wonders whether timbre can be viewed as an individual parameter at all, due to its supposed fixity in instrumental music (which has proven to be a misconception) and its synthetic nature (determined by 'compositionally linking parameters or individual sound-components') in electronic music (Koenig 1963, 3, 16–18). Tenney sees timbre as a multi-dimensional parameter.[30] Perhaps, more than any other parametric range to be established, the one for timbre will have to rely on the intended means of production. A parametrization (analysis and formalization) of the possible timbral qualities of a given instrument-system has to be carried out. This might include a survey of the known playing techniques and discoveries of new ones, devising synthesis procedures, constructing systems for sound transformation, and countless other operations. In most cases, the parameter range of timbre will be discrete or pseudo-continuous.

(4) Duration and (5) Point of Occurrence can be easily determined as either continuous or discrete, for both can be described and prescribed as simple numerical values. It might be relevant to consider the relationship between the two: both parameters are fundamentally concerned with durational, thus structural, aspects of realization and both are measured by the same standard (seconds and minutes). The two ranges could be identical, they could partially overlap, or be completely separate. The nature of their correlation will to a great extent influence the structures, their density or sparsity (both vertical and horizontal).

(6) Structure of Event has to yield an integer value, but apart from this quantization, no other problems are encountered.

> Step 6: Parameter ranges are established, parametric values ascribed to every point. The procedures for creating (a) a continuous or pseudo-continuous range, and (b) a discrete range, differ.
>
> (a) To create a continuous or pseudo-continuous range, it has to be arithmetized — that is, every element (point, line, lower and upper limits) are to be represented by numerical values. Only if this condition is met, a transfer function can be specified. Line as a reference point can coincide with one of the limits, it might not (see Step 4). This means that either one or both of the limits have to be

[30] 'The multi-dimensionality of timbre is due to the fact that it is determined in a complex way by our perception of a large number of acoustical features, which may be subsumed under three categories: (1) the steady-state *spectrum*, (2) various kinds of steady-state *modulations*, and (3) transient modulations or *envelopes*.' (Tenney [1961] 1988, 104)

virtually embedded into the arrangement of points and lines. The greater the distance between the limits, the smaller the range occupied by the points. The 'total' range of each parameter is determined by the limitations of the instrument-system, yet the limits of each specific parameter range are defined by the interpreter, they can coincide with the 'total' range or delineate a subsection of it. In the most simple case ($y = a \cdot x$), the transfer function just scales the values (by the factor 'a'), so that from differences in centimeters (or inches, or whatever measure has been used), differences in seconds or hertz are obtained, without a change of the proportional relations between the elements. Other functions ($y = a \cdot x^2$; $y = a \cdot (b^x-1)/(b-1)$; etc.) could be used, and it might be beneficial to use them. If a parameter range is to be pseudo-continuous a list of every discrete step within it is necessary, so that the 'imprecise' values of points obtained after the transfer can be matched with the discrete values closest to them.

(b) A discrete range could be characterized as an ordering of distinct states. To establish this range, it is not obligatory to arithmetize the values of elements, yet a certain hierarchy that would represent the gradations of the parameter in question has to be maintained. The three points - *e, b, c* in Fig. 2 are successively further away from the line, if states were attributed to them, the state of point *b* would have to be in between the states of points *e* and *c*. The fourth point - *d*, should represent a state in between those of *e* and *b*. Returning to an example given earlier — a realization of *Variations II* for five cymbals, the range of timbre parameter might be described by five different types of mallets ranging from soft to hard.

After these six steps have been carried out, parametric values for each of the five points are found. Nevertheless, the points do not yet prescribe sonic events to take place. This is so, because of the parameter (6) — 'structure of event (number of sounds making up an aggregate or constellation)'. If for a given point in the initial arrangement of lines and points, this value is greater than one, a new arrangement of lines and the necessary number of points has to be made, yielding another set of measurements and necessitating another run through the six steps described above. It is likely that parameter ranges are going to be changed, so that the parameter values of the new points would be scattered around the parameter values of the initial point.

The above analysis of *Variations II* is not focussed on the statistical characteristics of the possible sonic outcomes[31], neither does it study any one particular realization[32], rather it is an analysis of parametric thinking as such carried out by tracing the steps that might be taken to translate spatial relations into a sounding.

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[31] See DeLio 1984, 9-27.

[32] See Pritchett's analysis of David Tudor's interpretation (Pritchett 2001)

Further Observations:

(VI) If the parameter ranges are not coordinated while being established, a situation in which a seemingly impossible sonic event is prescribed might occur (a tension between values of two or more parameters). For example, a 'constellation' of sounds to be played on a violin within a time frame that is too short. The 'problem' can be solved by either re-designing the parameter ranges and their coordination, or by accepting the challenge — finding creative means to overcome seemingly impossible situations. Either of the two solutions can yield valuable insights and results.[33]

(VII) The option for at least 'one of the parts of the constellation' to be 'itself a constellation, or aggregate', introduces a possibility to derive an infinite amount of structures from a single initial arrangement of dots and lines.

(VIII) Any question regarding the realization of the piece (and as it can be seen above, there are many) is to be put 'in such a way that it can be answered by measurement of a dropped perpendicular'. There is a question but not yet an answer — a measurement by dropping a perpendicular would make sense only if the outcome of the measurement (answer, solution) is not known beforehand. All this might seem trivial, but Cage does nowhere else specify that any actions or decisions have to be determined by chance; only this remark at the very end of the instructions suggest the interpreter to make chance-determined decisions.

(IX) Scarcely any determinations relating to the characteristics of any parameter, can be made without considering the means of production. This leads back to Koenig's observation that 'characteristics of every sound depend on the way in which the sound was produced' (1963a, 1). Realizing *Variations II* is a situation of reverse-engineering, of re-aligning an abstract representation of sound (its characteristics defined by spatial relations) to specific means of production.

The questions *Variations II* poses — what is it that is composed? what is structure? what is a score? — can not be answered definitively, but when applied to a particular — *Variations II*, the answers indicate what *could* be composed, what *could* be a structure, what *could* be a score.

(X) *Variations II* is a composition, it is a structure and it is a score, but all three of them presuppose further compositions, structures and scores. It is as if *Variations II* would be hanging in mid-air between a philosophical thought and a proper composition.

(XI) *Variations II* epitomizes the gap between the abstract and the concrete, by asking the interpreter to bridge it. As shown in my analysis, this endeavor raises questions about how sound is analyzed and formalized, questions that have to be answered by the interpreter. The success or failure of any given

[33] In a recent lecture on Stockhausen's music given by the cellist Arne Deforce, a discussion concerning *Klavierstück I* ensued. Someone remarked that the music was 'inhumane'. Listening to the piece and following its score, I thought that it was questioning what it is to be a human, what can a body (and mind) do?

realization of *Variations II*, will to large extent depend on the interpreters engagement with these questions.

(XII) In his instructions, Cage acknowledges the impossibility to arrive at a concrete sounding through a handful of parametric measurements alone, he expects that there will be questions and advises the interpreter to put any one of them 'in such a way that it can be answered by measurement of a dropped perpendicular'. Consequently, all the aspects of composition become *parametrized*. A leap from acoustical or musical parameters to the broader sphere of *compositional parameters* takes place.

(XIII) Compositional parameters include the parameters used to describe and prescribe sound, but are not limited to those.

Philosopher Nelson Goodman sees artistic practice as one of the 'ways of worldmaking', along with science and language (Goodman 1978, 2-5). Unlike the one imagined by Carnap, these worlds coexist and are not necessarily reducible to a single base (2-5), they are ways of looking upon reality: 'The many stuffs — matter, energy, waves, phenomena — that worlds are made of are made along with the worlds. But made from what? Not from nothing, after all, but from other worlds. Worldmaking as we know it always starts from worlds already on hand; the making is a remaking.'(6). In *Variations II*, Cage does not furnish a ready-made world to be entered in the cornucopia of worlds made and re-made, he offers a lens through which world-making can be examined. Through examination and subsequent actions a variety of worlds are to be made — 'Perceiving motion [...] often consists in producing it. Discovering laws involves drafting them. Recognizing patterns is very much a matter of inventing and imposing them. Comprehension and creation go on together.' (Goodman 1978, 22, [my emphasis])

Epilogue

> 'I came to the conclusion that in any project we design and develop, the size and degree of complexity of the information and control systems inscribed in it are the crucial factors, so that the all-embracing and absolute perfection of the concept can in practice coincide, indeed ultimately must coincide, with its chronic dysfunction and constitutional instability.' (Sebald 2002, 392-93)

Austerlitz, the eponymous protagonist of Sebald's novel is lead to these thoughts by his experiences in the new-built (1996) Bibliothèque Nationale complex in Paris, but a like statement would not be out of place in a discussion on music of the postwar avant-garde, or the grandiose philosophical projects carried out by the logical positivists in the first decades of the previous century.[1] However, 'the gap', to revisit a notion advanced in the introduction and referred to in other sections of this text, has no far reaching damage when it comes to music and its composition; the recognition of its presence causes a reaction that furthers the practice and our understanding of it. It is a situation which not only leads to greater comprehension, but also gives more freedom to the composer (and the more freedom the composer has, the more should be given to the listener). This freedom is a responsibility.

Cage's statement that 'Until I die there will be sounds. And they will continue following my death.' (1961a, 8), the recognition of what I have called the sounding of the world, has to do not only with the fact that 'there will always be sounds to listen to' (Wolff [1958] 2017, 12), but that the intentions of a composer are situated within a context of sounding that not only exceeds one's lifetime, but the domains of culture and tradition. Intentions both influence and are influenced by the sounding of the world, that is singular (though differentiated in space and time), and shared. Integrity and awareness are as important as technique and method.

It might be the case, that the notion of 'the gap' is of a great personal significance, because I have spent the better part of the last four years writing music I yet have to hear. Nevertheless my disassociation from the experience of it, has only strengthened my bonds to 'sound', whether it be through experimental procedures (as in the case of preparing piano, described in Chapter I), or by theoretical endeavors — thinking sound, the ways it can be described and prescribed (as I hope to have shown in Chapter II). The thoughts, observations and speculations put forward in this text are thoughts of a mind in transition from somewhere to who-knows-where, a movement arbitrarily interrupted, only to continue its course at the very next moment.

> 'From a certain point on, there is no more turning back. That is the point that must be reached.' (Kafka [1931] 2006, 7)

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[1] Along with Carnap's *The Logical Structure of the World*, the attempt to ground mathematics in symbolic logic — *Principia Mathematica* by Russell and Whitehead is an excellent example.

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METAL TUBES

VIBRAPHONE

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ARP(A♯-C)

ARP(D♭-B)