Generative processes in Stockhausen's

*Lichter - Wasser*

Oscar Bianchi

Submitted in partial fulfillment of the requirements for the degree of Doctor of Musical Arts in the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY

2013
ABSTRACT

Generative processes in Stockhausen's

Lichter - Wasser

Oscar Bianchi

An overview on a highly intertwined generative system through Stockhausen's late piece Lichter - Wasser (1998-1999). Lichter - Wasser is a work that constantly attempts to conjugate the contemplation and the paroxism of an ur-element, the so called super formula, with the long sought utopia of the infinite progress of perception faculties (a journey formally began in 1955 with Stockhausen’s composition Gruppen, for three orchestral groups).
# Table of Contents

## I Introduction

1. Why *Lichter - Wasser*? ................................................. 2

## 1 Chapter 1

1.1 *Licht* ................................................................. 3

1.2 *Sonntag aus Licht* .................................................. 4

## 2 Chapter 2

2.1 Generative processes in the opera cycle *Licht* ................. 5

2.2 The nuclear formula .................................................... 6

2.3 Nuclear formula / super formula relationships .................. 8

2.4 The super formula ..................................................... 13

## 3 Chapter 3

3.1 The super formula defines the cycle LICHT ...................... 19

3.2 The super formula defines *Lichter - Wasser* .................. 20

3.3 Notes about durations and tempi in *Lichter - Wasser* ........ 22

3.4 Super formula developments for *Sonntag aus Licht* .......... 23

## 4 Chapter 4

4.1 Super imposed projections in *Lichter - Wasser*: waves and bridges. ...... 26

4.2 *Lichter - Wasser* form .............................................. 30
4.3 Formulas in Lichter - Wasser's score

5 Chapter 5
5.1 Spatial performance
5.2 Spatial composition
5.3 Criticism on spatial material

6 Chapter 6
6.1 Intuitive listening and acousmatic conception
6.2 Pointillism à la Weber: unconscious tribute
6.3 Stockhausen's late processes: sacred generative

7 Chapter 7
7.1 Bibliography
Lichter - Wasser: CD cover (Stockhausen Stiftung, Kürten)

for

soprano, tenor

orchestra and synthesizer

(duration: approximately 52 minutes)
Introduction

Lichter-Wasser is the first section of the opera SONNTAG aus LICHT. Composed in 1998-1999 and commissioned by the national South German radio (SWR) for the Donaueschingen Music Days, its world premiere took place on October 16, 1999 at the Baar gymnasium of Donaueschingen. Performers were Barbara van den Boom (soprano), Hubert Mayer (tenor), Antonio Pérez Abellán (synth) and the SWR Baden-Baden / Friburg Symphonic Orchestra conducted by Karlheinz Stockhausen. Sound engineers were Michael Acker (sound spatialisation) and André Richard from the Experimental Studio of the Heinrich Strobel fundation of Friburg.

I.1 Why Lichter – Wasser?

My reasons for choosing this particular work are the following:

-Its hybrid form. Lichter - Wasser is the first part (the first movement) of a larger work, the opera Sonntag aus Licht (Sunday of Light). It is also a ‘stand-alone’ piece (it can be performed independently from its parent opera).

-It unravels formal issues that underscore a highly intertwined system, which connects material, form and spatial trajectories through generative processes.
- It conjugates 'quasi devotional behaviors' between a fundamental material (the so-called *nuclear formula* and *super formula*, chapters 2 and 3) and an idealistic perspective of listening (spatial composition, chapter 5). This being said, it represents a sort of emancipated proposal from *Gruppen*’s time concerning an ideal advancement of cognitive awareness.
Chapter 1

1.1 Licht

Stockhausen began to compose LICHT (the seven days of the week) in 1977 using the super formula, a formula composed of three simultaneous formulas. Licht is a cycle of seven operas with a total duration of roughly 29 hours, each representing a day of the week. In the cycle Licht, each week’s day is associated with a specific color, symbol, plant or animal. The following scheme outlines some of these features.

<table>
<thead>
<tr>
<th>Day</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Eve’s day – opal and silver – light green – day of birth</td>
</tr>
<tr>
<td>Tuesday</td>
<td>day of the dispute, day of the war – red – conflict</td>
</tr>
<tr>
<td>Wednesday</td>
<td>day of collaboration – bright yellow</td>
</tr>
<tr>
<td>Thursday</td>
<td>Michael’s day – light blue, purple – day of life and learning</td>
</tr>
<tr>
<td>Friday</td>
<td>the temptation of Eve by Lucifer – orange</td>
</tr>
<tr>
<td>Saturday</td>
<td>Lucifer’s day – black – day of death and resurrection</td>
</tr>
<tr>
<td>Sunday</td>
<td>mystical union between Eve and Michael – gold</td>
</tr>
</tbody>
</table>
Stockhausen stated that unlike traditional opera, many individual scenes and acts from Licht could be presented as separate pieces of quasi concert performance. Every kind of Wagnerian parallel should therefore be dropped in such a context. Licht embodies music and religious thoughts that draw inspiration from a variety of sources, including the science of cosmology. Elements from "The Urantia Book" (cosmology science of Urantia Brotherhood of Chicago, USA) are particularly influential. In this book, the archangel Michael is described as a "vision of Christ" and as a "Creator Son," the head of our universe who represents, in Stockhausen intentions, the progressive forces of development. Lucifer is the antagonist. Eve strives towards a renewal of the "genetic quality" of humanity through the procreation of a "musical human race." Unlike Wagner’s anti-Semitic criticism, Stockhausen seems uninterested in political theories and racial issues. As Licht grows in form, Stockhausen’s desire to “bring cosmic music to humans and vice versa” becomes increasingly clear.

1.2 Sonntag aus Licht

Stockhausen ended the Licht cycle in 2003 by completing Sonntag aus Licht, the last opera of the cycle. The opera Sonntag aus Licht is composed of five different sections:

Lichter -Wasser
Chor-Gruppen
Licht-Bilder
Duft Zeichen (der sieben Wochentag)
Hochzeiten in zwei Welten
Chapter 2

2.1 Generative processes in the opera cycle Licht

The following scheme reflects the intertwined generative processes that exist between the lowest (material) and the highest (opera cycle) levels of music. All levels of music representation, from raw material to the ultimate formal representation (the opera cycle), are deeply connected in a consequential and relative linear path. The following paragraphs and chapters explore features of this process and bring to light connections between the material level and the production of the final score of Lichter - Wasser.

1 NUCLEAR FORMULA
   ↓

2 SUPER FORMULA
   ↓

3 LICHTER - WASSER (Scene 1 of Sunday of light)
   ↓

4 SUNDAY OF LIGHT (opera)
   ↓

LIGHT (cycle)
2.2 The nuclear formula

The nuclear formula (Kernformel) represents a proto formula or initial material; an ur-element that pre-establishes the super formula (see page 14). Composed before the super formula, the nuclear formula is thought to contain fundamental material concerning pitches, dynamics and rhythm (Stockhausen public conference, 6 August 2001, Kürten).

As noted on the first staff of the diagram above, the nuclear formula lays out seventeen notes for the Michael formula and twelve notes for the Eve formula. The sum of these notes is twenty-nine, a prime number that refers to the number of orchestra parts in Lichter – Wasser. The number twenty-nine also refers to the duration (in hours) of the entire cycle. Both Michael's and Eve's nuclear formulas include defined durations and dynamics. Each duration is a different length, suggesting rhythmic serialization. According
to the following chart, which employs a value of sixteenth notes as its basic unit, starting
from the seventh sound of Michael's nuclear formula there are repetitions on the durations
of 2, 4, 6, 8 and 10 (corresponding respectively to eighth, quarter, dotted quarter, two
quarter and two quarters plus an eighth note). The dynamics follow a similarly loose serial
principle (some repetitions start from sound 12). Consequently, it can be deduced that
lengths and dynamics in the nuclear formula serial processes are relatively loose.

<table>
<thead>
<tr>
<th>Sound</th>
<th>Unit (sixteen note)</th>
<th>Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>p</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>ppp</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>ff</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>mf</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>&lt;</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>f</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>mp / pp</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>ppp&lt;&lt;&lt;&lt;</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>p</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>f</td>
</tr>
<tr>
<td>14</td>
<td>10</td>
<td>mp&gt;&lt;</td>
</tr>
<tr>
<td>15</td>
<td>6</td>
<td>mp / pp &lt;</td>
</tr>
<tr>
<td>16</td>
<td>2</td>
<td>mf &lt;</td>
</tr>
<tr>
<td>17</td>
<td>16</td>
<td>ff &gt;</td>
</tr>
</tbody>
</table>

Michael's nuclear Formula durations / dynamics

Michael's and Eve's nuclear formulas seem to be derived from the same tone row (drafted
in-between the first and second staff of the diagram on page 7). In Michael's nuclear
formula, (first staff of the diagram on page 8) the first three notes are retrograded from the
first three notes of the drafted row. Michael's circled sounds 4, 5 and 6 correspond with
sounds 4, 5 and 6 of the drafted row. In Eve's nuclear formula, the first 3 sounds (circled
sounds 1, 2 and 3) correspond with the first, third and fifth pitches of the drafted row. Eve's
circled sounds 3, 4, 5 and 6 correspond to the fourth, fifth, sixth and seventh pitches of the
row. Therefore, one can assume that both Michael's and Eve's nuclear formulas share
pitches from the same row. In this case, it is interesting to follow how this proto-material,
as laid out in the nuclear formula, comes together in the super formula.

### 2.3 Nuclear formula / super formula relationships

Comparing Michael's nuclear formula (page 7, first staff) with Michael's super formula, (page 14, first staff) shows that music materials (fragments of Michael's nuclear formula) are incorporated into the super formula with all of their initial information (pitch, dynamic and rhythm) and eventually 'expanded' through specific transformations. These specific transformations are processes of a different quality than those, which usually characterize the transformations of the serial process (permutations, proliferations, transpositions, inversions, etc.). Michael's super formula on the first staff on page 14 (which is transposed a minor third up compared to its nuclear formula) is an example of these processes. It is comprised of altered and transformed elements from its nuclear formula such as the following:

- There is an improvisation on sounds 1, 2 and 3 at measure 2 of the super formula (circled numbers at the top of the nuclear formula). This occurs after measure 1, where the first three notes of the nuclear formula fragment are entirely reported. Often referred to as ornamentation in renaissance terminology, this improvisation is a sort of animated garland around these three pitches:

![Measure 1 and 2 of Michael's super formula](image)
- There is a colored pause (percussive sound) at measure 3 of Michael's super formula:

![Measure 3 Michael's super formula](image)

- There is a written echo effect of sounds 4 and 5 of Michael's nuclear formula (i.e. the repetition of the same fragment with decreasing dynamics) at measure 5 of Michael's super formula:

![Measure 5 of Michael's super formula](image)

- Sounds 6 and 7 of Michael's nuclear formula are repeated in measure 9 of Michael's super formula with their minor 6th interval filled by a scale:

![Measure 8 and 9 of Michael's super formula](image)

- There is a rhythmic modulation of sound 8 of Michael's nuclear formula in measure 12 of Michael's super formula:

![Measure 12 of Michael's super formula](image)
- Sound 9 of Michael's nuclear formula is anticipated in measure 14 of his super formula with what has been referred to as an Anti-echo:

Measure 14 of Michael's super formula

- Sound 10 of Michael's nuclear formula is treated with rhythmic pulse:

Measure 15 of Michael's super formula

- At measure 19 of Michael's super formula, there is an oscillation between sounds 15 and 16 of Michael's nuclear formula:

Measure 19 of Michael's super formula

- Sound 17 of Michael's nuclear formula becomes the object of dynamic modulations at measure 19 of Michael's super formula:

Measure 19 of Michael's super formula

Stockhausen refers to the altered elements marked above in italics as “variety” (Stockhausen public conference, 6 August 2001, Kürten), since they generate
new combinatorial and transpositional possibilities beyond the traditional parameters of
pitch, durations and dynamics. It is also interesting to note that the pitches from the first
system of the nuclear formula are used for the initial duet (Anfangs-Duett) of Lichter-Wasser.
A small note on the left side of the second staff of the nuclear formula (page 7) shows the choice of using the synthesizer at the place of tape. The synthesizer seems to be the best representative of the nuclear and super formula, being capable of infinite ‘stretching’ processes (it can hold long durations, as seen on the score example at page 12) and of slowly modulating the sound by varying its properties (Lichter - Wasser score):

*Lichter - Wasser* score, measure 559, synthesizer sound choice detail

*Lichter - Wasser* score, measure 692, synthesizer sound choice detail 2
2.4 The super formula
In 1977, Stockhausen received a commission to compose a new work to be presented at the National Theatre in Tokyo. He wrote Der Jahreslauf (The Course of the Years) for gagaku orchestra and ballet.

While working on this project, the composer is said to have had a vision that Der Jahreslauf would become an integral part of a larger work. Following this event, Stockhausen wrote drafts for Licht in a temple in Kyoto. During this time, he referred to Der Jahreslauf as Hikari, which means “fast light” in Japanese. Given that Stockhausen composed what is now called a super formula, a music nucleus made up of three superposed formulas, drafts for this composition remain valid musical material.

The super formula, composed after the nuclear formula, lasts about one minute at chromatic tempi (time scales first described in the composer's famous article, "... How Time Passes..." - Stockhausen 1957 – a system largely used in compositions such as Gruppen, Klavstücken. IX, Tierkreis) range between 45 and 85. Based on Stockhausen’s fundamental assumption, that in the realm of pitch and time we perceive proportions rather than differences, chromatic tempi are a series of tempi obtained out of a logarithmic relationship. This logarithmic relationship is governed by the same proportion (the same ratio) as a tempered harmonic series (log12 of 2) and intertwines pitch with time. Here is an explanatory chart from Die Reihe:
In the super formula (page 14) there are twelve different metronomic main tempi ranging from 45 to 85. Michael’s, Eve’s and Lucifer’s formulas are each comprised of twelve pitches:

Stockhausen conceived the super formula as a polyphony (or juxtaposition) of three different layers of music that he called formulas (Michael’s formula, Eve’s formula, Lucifer’s formula). These formulas are derived in part from transformations of the nuclear formula.
(as seen in chapter 2.2). When analyzed horizontally, all three formulas display three important characteristics:

- The first formula, *Michael's formula*, is a sort of polarized melody with mostly ascending and descending fourth intervals.

- The second formula, *Eve's formula*, has an ascending character largely characterized by intervals of a third.

- The third formula, Lucifer's formula, favors intervals of minor seconds, major sevenths, and sort-of-expected tritons.

Compared to the traditional series conceived from early Stockhausen compositions, these three formulas exhibit a more diverse set of qualities. Stockhausen claims that since the end of 1960's, systematic processes for producing material have increased dramatically. This goes beyond methods of measurement such as melody, rhythm, harmony, timbre, movement in space and speed of sound in space, to include qualities such as degree of renewal, degree of surprise, degree of decay and degree of growth. Stockhausen inserted some of these other qualities, which he called "bridges" or "entries," in the super formula for Licht (page 14). A particularly good example of this phenomenon occurs with *scales* or half scales. In each of the three super formulas there is a different kind of scale (descending or ascending). For example, in Eve's formula at measure 6, the four sounds D, Eb, F and Eb, suggest a shadow of an Eb minor scale emphasizing on its leading tone. In Lucifer’s formula at measure 3, a total chromatic scale is achieved if all grace notes are taken into account.
A second quality in the super formula is that of echoes (double echoes, triple echoes and in one case even quadruple echoes). In Michael's formula at measures 5, and in Eve's formula at measure 6, such echoes are not considered repetition but rather fading-out echoing material.

Other sound qualities are determined by what Stockhausen defines as modulation, meaning a note that is modulated both dynamically and on a timbral level or in glissandi (two examples are in Lucifer's formula measure 2 and in Eve's formula measure 5). Another sound quality that Stockhausen uses is the anticipation of a note called an anti-echo (Michael's formula measure 14). Stockhausen also employs new sounds such as colored silences. One can generally group these sounds into a category more widely known as noise (breath, whistles and all sorts inharmonic consonants, etc).

There are also a number of cross-formula relationships, such as between Eve's formula at measure 2, where there is a major 6th / major 3rd interval (C / lower E, C / higher E), and Michael's formula at measure 7 (C / lower E). By including many of these musical qualities in the super formula for Licht, Stockhausen was able to develop multiple types of musical material from his original nuclei over the course of twenty years.

It is interesting to note that when listening to Lichter – Wasser, a sense of harmonic fields emerges quite clearly as an unavoidable consequence of setting pitch field in the super formula. At the beginning of Michael's super formula, the indulgence towards certain pitches (at measure 2 of the super formula pitches such as D, A and Bb become effectively polarizing material) affect their use in the final score. In the following example, which corresponds to measure 87 of the score, the insistence between Michael and the first orchestral group towards pitches such as B, F# and G (which are the first three notes of Michael's super formula transposed a minor third down) establishes within the texture a clear 'shadow' of G major (B being the third and F# being the leading tone):
Lichter - Wasser: score measure 87, Michael's 10th Wave, High
Chapter 3

3.1 The super formula defines the cycle LICHT

The super formula (as noted on page 14) is made up of a total of sixty notes (quarter) with different metronomes. The various metronomes all refer to the central super formula metronome (60). According to the composer, each quarter note of the super formula corresponds to sixteen minutes. This information is of fundamental importance in understanding the entire form of the opera cycle LICHT, as well as the time and form relationships between each different work (sections and internal relationships). The composer divided the super formula into seven sections or fragments. Each of the seven sections corresponds to one of the seven operas of the LICHT cycle. The composer’s technique for this division does not follow any particular musical structure. Rather, it is super-imposed and creates one fragment made by four bars (measure 8-12), three fragments made by three bars (measures 1-3, 14-16, 17-19) and three fragments made by two bars (measures 4-5, 6-7, 12-13). The following diagram shows the selection of bars within the super formula and the associated opera, as well as the durations in quarters and in minutes:
3.2 The super formula defines *Lichter - Wasser*

According to the above scheme, the largest section of the super formula is associated with the opera *Sonntag aus Licht* and, with a length of twelve quarters, is the longest of all seven sections. The following scheme on page 22 provides a detailed account of how these last three bars of the super formula have been further divided to provide formal and material references for each of the five sections of *Sonntag aus Licht*. Five mini-sections are thereby created. These five mini-sections correspond to the five sections of the opera itself: the first two quarters of the super formula selection for *Sonntag aus Licht* correspond to *Lichter - Wasser*, the following two to *Chor - Gruppen* (*Sonntag aus Licht*'s second section), the following two to *Licht - Bilder*, the following two to *Duft Zeichen* (*der Wochentag 7*) and the final four quarters to *Hochzeiten in 2 Welten*. 

---

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>OPERA</th>
<th>QUARTER NOTES</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2-3</td>
<td>Montag aus Licht</td>
<td>10 (x 16 minutes)=</td>
<td>160 minutes</td>
</tr>
<tr>
<td>4-5</td>
<td>Donnerstag aus Licht</td>
<td>7 (x 16 minutes)=</td>
<td>112 minutes</td>
</tr>
<tr>
<td>6-7</td>
<td>Mittwoch aus Licht</td>
<td>5 (x 16 minutes)=</td>
<td>80 minutes</td>
</tr>
<tr>
<td>8-9-10-11</td>
<td>Dienstag aus Licht</td>
<td>9 (x 16 minutes)=</td>
<td>144 minutes</td>
</tr>
<tr>
<td>12-13</td>
<td>Freitag aus Licht</td>
<td>8 (x 16 minutes)=</td>
<td>128 minutes</td>
</tr>
<tr>
<td>14-15-16</td>
<td>Samstag aus Licht</td>
<td>9 (x 16 minutes)=</td>
<td>144 minutes</td>
</tr>
<tr>
<td>17-18-19</td>
<td><em>Sonntag aus Licht</em></td>
<td>12 (x 16 minutes)=</td>
<td>192 minutes</td>
</tr>
<tr>
<td>TOTAL</td>
<td>LICHT</td>
<td>60 (x 16 minutes)=</td>
<td>16 hours</td>
</tr>
</tbody>
</table>
Super formula for *Sonntag aus Licht*. Stockhausen Stiftung Archiv (Kürten)
3.3 Notes about durations and tempi in Lichter - Wasser

The durations in the diagram on page 21 do not correspond to the effective final durations because there are tempo changes that affect the final form. If the metronome rises above 60, the length of the section will be shorter. For example, in the scheme of the super formula for Sonntag aus Licht on page 22, the base metronome (not the transposed one) of Lichter-Wasser is 63.5. Consequently, the first two quarters of the first section of Sonntag aus Licht (second bar of last system) will have a duration of slightly less (i.e., 0.94488, i.e., 60/63) than one second each. In this case the duration for Lichter - Wasser will be 30'2". If the metronome were 60, Lichter - Wasser would last thirty-two minutes (sixteen minutes for two quarters). However given that the metronome is slightly higher, the duration of Lichter-Wasser is 30'2", or (0.94488 x 2 / 4) x 16 minutes. For the same reasons, the following sections of Sonntag aus Licht such as Düfte Zeichen, would last 28.66' when the metronome is 67.

"...everything I do in LICHT are transpositions..." (Stockhausen public conference, 6 August 2001, Kürten).
3.4 Super formula developments for *Sonntag aus Licht*

Developments of the super formula, 1 of 2. Stockhausen Stiftung Archiv (Kürten)
The Licht opera cycle is projected in *Sonntag aus Licht* because it is the last opera of the cycle. The idea of the super formula being made up of sixty units is projected into the twelve-quarters selection of the super formula for *Sonntag aus Licht* (as seen in the last system on page 22). As a result, the entire selection is augmented five times. The multiplier brings the twelve quarters of *Sonntag aus Licht*'s section to sixty.

When the augmented counterparts that measure 10 quarters (first and second staves in diagram on page 24) are compared with the two-quarter length of Michael's and Eve's selections of the *Lichter – Wasser* super formula (second measure of the last system in the diagram on page 22), the 5x augmentation relationship becomes apparent:
Super formula for *Lichter - Wasser*, detail, second bar of last system. Length of pitches B and G (Michael's and Eve's sample pitches) is two quarters.

Developments of the super formula, detail, measure 1. Sample pitches from the super formula are the same but their length is augmented five times: they last ten quarters.

Instead of using traditional terms such as augmentation, Stockhausen refers to this process as stretching (literally expansion, lengthening). He clearly borrows terminology from electronic music procedures.

The schemes on pages 24 and 25 (developments of the super formula 1 and 2) show how the super formula selection for *Sonntag aus Licht* uses the same subdivision at the same points of the mini-section (the selection of the super formula for *Sonntag aus Licht*, last system on page 22) to create 6 sections (*Lichter-Wasser, Chor-Gruppen, Licht-Bilder, Duft Zeichen (der sieben Wochentag, Hochzeiten in zwei Welten)* of ten quarters each.
Chapter 4

4.1 Super imposed projections in *Lichter - Wasser*: waves and bridges

Stockhausen drafted the following diagram where several superimposed processes appear (page 30) in order to 1) create a formal structure throughout the composition of *Lichter - Wasser* and 2) continuously project the two formulas (Michael's and Eve's formulas) in musical form. Stockhausen unveils his wish to produce twelve formal sections for Eve and twelve formal sections for Michael (twenty-four sections in total) in the first two lines of the top left part of the diagram (as well as in the middle of the same diagram). The composer thereby divides the number twenty-four into twelve different parts with different lengths; generating a sequence of 4, 2, 1, 2, 1, 1, 4, 2, 1, 1, 1, 4 lengths for Michael and a sequence of 4, 3, 1, 2, 2, 1, 1, 2, 1, 2, 1, 4 lengths for Eve. These two sets of proportions allow the composer to project Michael's and Eve's formulas into the greater form (actual music sections) by assuring the presence of twelve different representations of the formula and by defining a sort of counterpoint of proportions (called *projections* by Stockhausen) between them. This formal process is superimposed and a common length of 4 is present at the beginning and end of both sequences.

In the middle of the diagram on page 30, this super-imposed structure becomes a counterpoint of two sets of proportions (Michael's and Eve's) with meeting points. The composer called each section (the outcome of super-imposed process) a wave.
The vertical dotted lines in the central part of the scheme (circled blue and yellow numbers on page 30) define the points of contact between the twenty-four projections of the two formulas. Stockhausen called these meeting points *bridges* (Brücken). In the six *bridges* (which represent these points of contact) as well as in the entry duet (Eingang duett), the entrance, and the final duet (Schluss duett), only the nuclear formula is used (and not the super formula). This makes clear that the generative processes associated with the super formula concern only *waves* and not *bridges*. The meetings points (*bridges*) are constant reminders of the original source (the nuclear formula).

Above the circled blue numbers in the center of the diagram on page 30 there are astrological symbols. Stockhausen associates astrological symbols with each of the twelve sections or *waves*. Each section is dedicated to a planet and this affects the spatial behaviors of the formulas (see chapter 5, page 41).

The durations of the two formulas are gradually "animated" from the indivisible durations of the formula in the first wave (the formula in its original state) until reaching the maximum subdivision possible in the last (twelfth) wave. This is reflected in the lower left part of the scheme on page 30 in the twelve *waves* (wellen). When the orchestral pace of two different *waves* is compared with its equivalent reference (as seen in the diagram on page 30), the 'animation' suggested from Stockhausen sketches (right column of the following example) corresponds to an intensification of activity and movement in the score (left column of the following example).
**Lichter - Wasser**: score page 14, Michael's 4th wave. High instrumental section detail. Sequence of quarter notes.

**Lichter - Wasser**: score page 41, Michael's 10th wave. High instrumental section detail. Sequence of eight-notes triplets, four sixteen-notes and two eight-notes triplets.

Projection into **Lichter - Wasser** form. Detail from Michaels' 4th wave: please note the sequence of four quarter notes.

Projection into **Lichter - Wasser** form. Detail from Michaels' 10th wave: please note the sequence of eight notes triplet, four sixteen notes and two eight notes triplets.
4.2 Form in Lichter - Wasser

The entrance of instruments (Eingang) follows the initial duet (Anfangs - Duet). Michael's and Eve’s twelve waves begin simultaneously and separate polyphonically (as seen in the middle of the diagram on page 30) to meet in six starting points connected by six bridges. The exit (Ausgang) of the instruments begins at bar 692 and is followed by the final duet (Schluss-Duett).

SECTIONS (measure):

1. Initial duett .......................................................... [00:00:00]
2. Entrance (m 14) ....................................................... [00:01:53]
3. 1. MICHAEL – Welle / 1. EVA – Welle (m 87) ............... [00:06:46]
4. First bridge (m 145) .................................................... [00:10:30]
5. 2. M – Welle / 2. E - Welle (m 152) ............................. [00:10:52]
6. 3. M – Welle (m 183) ............................................... [00:12:53]
7. Second bridge (m 204) ............................................. [00:14:07]
8. 4. M – Welle / 3. E - Welle (m 220) ............................. [00:15:13]
9. 4. E – Welle (m 241 to the second) .............................. [00:16:29]
10.5. M – Welle (m 255) ............................................. [00:17:41]
11. Third bridge (m 338) ............................................. [00:19:03]
12. 6. M – Welle / 5. E. Welle (m 318) .......................... [00:20:34]
13. 7. M – Welle (m 338) ............................................. [00:21:29]
14. 6. E – Welle (m 353) ............................................. [00:22:56]
15. 7. E – Welle (m 374) ............................................. [00:24:34]
16.8. E – Welle (m 393) .................................................. [00:25:56]
17.8. M – Welle (m 408) .................................................. [00:27:30]
18.9. E – Welle (m 427) .................................................. [00:28:40]
19. First Announcement (m 448) ................................. [00:29:45]
20. Forth bridge (m 461) ................................................. [00:31:07]
21. Second Announcement (m 484) .......................... [00:32:32]
22. Forth bridge, second time (m 493) ....................... [00:33:44]
23. Third Announcement (m 517) .................................. [00:35:05]
25.10. M – Welle (m 559) .............................................. [00:37:42]
26. Fifth bridge (m 583) ................................................. [00:39:27]
27.11. M – Welle / 12. E – Welle (m 595) .................. [00:40:09]
28. Sixth bridge (m 621) ................................................. [00:41:21]
29.12. M – Welle / 12. E – Welle (m 630) .................. [00:41:54]
30. Exit (m 692) ............................................................ [00:45:47]
31. Final duett (m 728) .................................................. [00:48:09]
4.3 Formulas in Lichter - Wasser's score

Following the initial duet (Anfangs duett), an orchestral group composed of high-pitched instruments is associated with Eve, while an instrumental group composed of low-pitched instruments is associated with Michael. Both groups enter the concert hall and play two nuclear formulas, with each instrument playing the formula that it has been associated with until the end of the section. In the Entrance, Eve's instrumental group plays Michael's nuclear formula while Michael's instrumental group plays Eve's nuclear formula. The formulas are repeated in the event that the twelve or seventeen notes of these formulas have already been played. A circle around the abbreviation of the instrument marks the instrumental entrances in both groups:

![Image of score page 2, measure 14, High instrumental section (Eve's section) detail]

Lichter - Wasser: score page 2, measure 14, High instrumental section (Eve's section) detail

![Image of score page 2, measure 14, Low instrumental section (Michael's section) detail]

Lichter - Wasser: score page 2, measure 14, Low instrumental section (Michael's section) detail
During this second episode of *Lichter - Wasser*, called Entrance, there exist two levels of representation of the nuclear formula. Moreover, at measure 85 (see example on page 35), with the juxtaposition of all pitches composing the two formulas, the total chromatic (cluster) and full orchestral tutti is achieved. This juxtaposition represents the mystical union between Michael and Eve.
Lichter - Wasser score page 5. The total chromatic at measure 85 represents the mystical union between Michael and Eve.
It is important to note the constant speculative process (mirroring) that takes place between the two soloists and two orchestral groups. In the initial duet (see following example) the tenor sings the original Michael nuclear formula and the soprano sings her own Eve nuclear formula. On page 2 of the score (second example) the opposite occurs: Michael sings Eve's formula with her previous texts, while the ensemble plays the notes of the opposite nuclear formula (the group associated with Michael's plays Eve's formula and vice versa as seen in examples on page 34).

There are several interesting ceremonial aspects associated with the performance of *Lichter – Wasser*. Seventeen blue lights are placed near each of the instruments of a higher register. They correspond to the seventeen notes of the Michael formula. Twelve green lights, placed near each of the twelve low instruments, correspond to the twelve notes of Eve's formula. The soprano (Eve) turns on the lights associated with each of the
circled instruments in Michael's formula. Michael also does this with the instrumental group associated with Eve. The entrance of each individual instrument coincides with the illumination of the lights. Towards the end of the piece, performers, one after another, stop playing, take a sip of water and then continue playing their pedal notes.
Chapter 5

5.1 Spatial performance

The positions of the instruments can be seen in the following diagram. The musicians play standing up facing the conductor who occupies one of the walls of the room. The audience is seated in eight triangles facing the center.

There are twenty-nine orchestral parts. In the score, the orchestra is divided into two staves. The seventeen highest instruments are grouped in the first staff and the lowest
twelve instruments in the second (see detail of one orchestral group in the example below). When each instrument should play is indicated between the two staves. Every single note belonging to Michael's or Eve's formulas appears in each one of the two staves.

In most of the *Lichter – Wasser*, individual notes belonging to each of the two formulas are transferred from instrument to instrument. Starting from bar 87, each of the twenty-nine parts reads from the shared staff (see following example). This allows each musician to play their individual notes within the context of the general piece, contributing in this way to the continuity of spatial melodies.

Fragments of spatial trajectories are noted within rectangular diagrams above the orchestral staff. They identify the location of the starting note (in space) and other upcoming spatial trajectories (in the following example, in the first left rectangular diagram the spatial melody moves from the second flute through the fifth violin until the entry of the clarinet):

![Lichter - Wasser, score measure 87 (high instruments orchestral section detail)](image)

The positions and movements of the singers are also carefully notated in the score in a rectangular diagram at the left of the singer staves:
5.2 Spatial composition

The diagram on page 42 illustrates how the individual notes in both formulas move from instrument to instrument in two separate spatial levels. There are two trajectories for each wave that are drawn in two different colors. The diagram shows some of the pre-established spatial movements drafted by the composer that affect the choice of instrumentation for specific notes in the formula. The diagrams concerning the rotations in space of the spatial melody are related to the rotations of the nine planets and sixty-one moons of our solar system. Michael and Eve sing the names of the planets and moons as well as their astronomical characteristics and significances. The path associated with the movement of each formula, called a Welle (wave), is shown in the diagram on page 42. Based on this information, it is clear that the rotation of planets and moons that Stockhausen selected must have inspired the general concept of waves. Together with the superimposed projection of the formula (diagram page 30), this concept then inspired the formal structure of the whole piece (page 31-32).
Despite a thoughtful and elaborated method of generating material out of established elements (the super formula as well as the projection of the super formula), the fundamental concept of Lichter - Wasser feeds into the composer's desire for the audience to experience specific astrological events such as the rotation of the nine planets and sixty-one moons of our solar system. The audience is briefed on the specifics and significances of these planets and moons through the sung text.

*Lichter - Wasser: measure 351, detail. Michael sings: 'the biggest moon in the solar system'.
Lichter - Wasser: spatial movements. Stockhausen Stiftung Archiv (Kürten)
The journey from Gruppen started in 1957 through to the present analysis suggests that, in this context, composition is not conceived as a solipsistic act that supports a singular relationship between the composer and the music material. Rather, it is a strategy focused towards the listener and is meant to trigger perceptive paths in music. This concept is directly related to Stockhausen’s vision of a new education of listening. Such an aural education, according to Stockhausen, would occur due to a utopia of the infinite progress of perception faculties, such as a spontaneous detection of spatial melodies throughout simple points (single notes issued from orchestral sources), and the capacity to refer the music (what is heard during the performance) to source elements like the super formula (Stockhausen public conference, 6 August 2001, Kürten).

5.3 Criticism on spatial material

In this particular context, criticism often arises concerning the material employed for spatial purposes: the point and the single note (most of the time). Although Stockhausen adopts a two stave system to notate the entire orchestra, thus graphically projecting the idea of melodic continuity (expressed in points), the vacuum that would occur in a full staff representation (i.e. multiple staves each corresponding to individual instruments) would better match the public’s perception of this orchestral sound: isolation and fragmentation. The isolation of the point contrasts with the apparent fluidity of spatial movements (as shown in the diagrams on page 42), perceptively invalidating the notion of movement in favor of source-finding activity.
Chapter 6

6.1 Intuitive listening and acousmatic conception

According to the composer, one of the main objectives in Lichter - Wasser is to investigate sound in terms of space. This occurs mostly as a dialogue between orchestral elements, as well as between singers and orchestral parts. A highly sophisticated plan embraces the study of spatial movements; a sound in constant motion becomes the epicenter of such research. Given his commitment to electronic music (beginning in the 1950's), Stockhausen often highlighted works that dealt with multiple source activities (Octophonie from Dienstag aus Licht asks for multiple speakers placed on both the ceiling and on the floor of the hall). This illustrates the composer's commitment towards a multidimensional listening approach. There no longer exists a physical - and sometimes emotional – separation between audience and performer, a separation often dictated by the distance between the stage and the audience, which jeopardized physical and emotional involvement. The presence of sound sources (speakers or real performers) located behind, beside or within the audience, projects the listening experience into a dimension of unparalleled participation. The public itself takes an active part in the ritual, living the experience without the detachment of a single observation.

Despite a known confrontation that the composer had in 1953 with Armin Schibler in Darmstadt (where Stockhausen lectured on Webern's concerto for 9 instruments op.24, stating that the structural proportions of this work are antecedents of timbre/electronic composition; this sparked Schibler's criticisms about the risk of dehumanizing music and
reducing it to pure mathematics through such analysis), Stockhausen has always believed that: "... in electronic music generators, recorders and speakers have to shout out what musicians are not able to. In instrumental music, on the other hand, the musician helped by their instrument and by notation should produce what electronic music will never be able to generate, imitate or reproduce ... ".

Following this event, Stockhausen strengthened the foundations (further laid out during the late '60s in works such as *Hymnen*, for electronic and optional live performers) of an intuitive concept of listening. The ultimate result of an aural experience, according to Stockhausen, must be spontaneous; listening should never be subject to any purely intellectual investigation.

Stockhausen's choice to place the orchestral performers of *Lichter - Wasser* among the audience, aligns itself with the ideas of acousmatic theory. The root of the original acousmatic theory lies in an ancient Pythagorean concept: the idea that listening deprived of sight produces greater attention towards sound, be it words (i.e. spoken by speakers, through speeches, etc) or organized sound (music, noise). Such a practice places the orator behind a curtain in order to encourage audience members to avoid any sort of visual distraction (ie: loosing concentration and intellectual resources towards the most important and intimate aspect of any speech or prayer). The presence of musicians among the audience, as demanded by Stockhausen for *Lichter – Wasser*, does not make the musicians invisible, but rather encourages the spectator to avoid a single vantage point that occurs when musicians are all placed on a stage. The quasi-invasive presence of musicians, besides answering to the premises of spatial composition, can make it impossible to detach in the same way as when sound sources are placed on the stage.
6.2 Pointillism à la Webern: unconscious tribute?

As previously noted, although Stockhausen adopts a two stave system to notate the entire orchestra, thus graphically projecting the idea of melodic continuity (expressed in points), the vacuum that would occur in a full staff representation (i.e. multiple staves each corresponding to individual instruments) would better match the public's perception of this orchestral sound: isolation and fragmentation. The isolation of the point contrasts with the apparent fluidity of spatial movements (as shown in the diagrams on page 42), perceptively invalidating the notion of movement in favor of source-finding activity.

The pointillist nature of the orchestral behavior (one note out of a melodic line is often played independently) does not suggest an ideal of melodic continuity. The spatial separation that lags between notes emboldens the distinctive character of the sound sources; instruments that connect through single notes. This behavior does not perceptively favor fusion and homogeneity, characteristics that should be encouraged for spatialised sounds.

6.3 Stockhausen's late processes: sacred generative

Stockhausen's fundamental need for generative processes is rooted in the post-war Darmstadt school manifesto, which called for systematic procedures. This manifesto was
created in direct response to the post-WWII philosophical acknowledgment that humans had lost, among other things, their chance to decide or to favor. Adorno’s celebration of amnesia at the zero degree (seen as holding on a single, given, immutable element, a starting point after a *tabula rasa*) still resonates in this work by means of an endless reference to continuous generative processes.

I would call Stockhausen's compositional behavior, especially during this late phase of his career, *sacred generative*. He works within a system that is centered on a combination of religious components (a blessed illumination - a *satori*) and logical workmanship made by calculations and processes (whose blind commitment could also be seen as devotional). The contemplation of a given element, whether it comes out of an illumination, a vision, throwing of dices or observation of nature, expresses the degrees of religious adoration towards an hybrid moment of truth: the super formula. Thanks to its mixed nature (half of it is derived from the nuclear formula's serial information, half of it is made by playful musical element called *variety*, pages 10-13), the super formula creates a dual reference for the composer. To find an idiosyncratic counterpart in another field of creation, it is interesting to consider the Swiss Alps contour. This contour became the largely exploited envelope for *Gruppen* in the same fashion that the Spanish Catalan architect *Antoni Gaudi* took organic geometry (such as the hyperbolic paraboloid) as his own sort of super formula in the naturalist period. Stockhausen's super formula embodies elements of *variety*, as he himself stated and as is made visible in the score. Its sacredness is made unquestionable because it is unveiled out of an act of revelation - a claimed illumination, which remains absolute by being given to the artist through the irrational (a vision in a temple in Kyoto apparently informed Stockhausen about the role and the essence of the super formula).

Accepting the aesthetic randomness that comes as consequence of generative operations
(such as combinatory processes or augmentations) is also plausible as a sort of contemplative acceptance.
Preliminary sketches for Lichter - Wasser. Stockhausen Stiftung Archiv (Kürten)
Chapter 7

7.1 Bibliography

- Karlheinz Stockhausen: "...wie die Zeit vergeht..." in vol. 3 of Die Reihe (Texte 1, 99–139) 1957


- Etienne DARBELLAY, « Une lecture de "...wie die Zeit vergeht..." de Stockhausen », Contrechamps, n°9, Paris, L'Age d'Homme, 1988, p. 143—168

- Andrea Lanza, Il secondo Novecento. Kerlheinz Stockhausen: Composizione 'PER GRUPPI'. Ultimo Volume. EDT


- 2001 Stockhausen Kurse Kurten. (Stockausen Stiftung)

- Stockhausen Stiftung Archiv (Kürten)