An Analysis of Karlheinz Stockhausen's *Traum-Formel*

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Introduction

The following chapters present an analysis of *Traum-Formel* (Dream-Formula 1981) a short work by Karlheinz Stockhausen for solo basset-horn. *Traum-Formel's* structure and musical material are derived from the formal scheme of Stockhausen's cycle of operas, collectively known as *Licht - Die Sieben Tage der Woche* (Light - The Seven Days of the Week) (1977-). Specifically *Traum-Formel* is a temporally altered realisation of the same material as *Luzifers Traum* (Lucifer's Dream) (1981) the first act of the opera *Samstag* (Saturday) (1981-4): the sixth opera in the cycle but the second to be composed.

Stockhausen's *Licht,* the composer's exclusive project since 1977, can be viewed as a summation of many of his achievements as a composer. Conceptually *Licht* also embodies much of what Stockhausen believes about the universe: it is both a spiritual statement and a dramatic work, as well as an extremely ambitious example of the post-war serial composers' ideal of a thoroughly integrated self-referential sound world. It has been Stockhausen's aim to achieve this high degree of integration through the use of a uniquely large scale pre-compositional plan in his construction of the opera cycle: a highly compressed serial three-part template known as the *Licht* 'super-formula'. This super-formula determines in multiple parameters the large-scale structure, middle level forms and note-to-note minutiae of the

whole cycle.

At the largest scale elements of the super-formula, which itself lasts exactly one minute, are stretched out over the entire duration of the cycle estimated to be over 16 hours. (Stockhausen plans the *Licht* cycle to be completed in the year 2002) The seven individual operas, each of which contain multiple statements of the super-formula material at different temporal levels, vary in length between 2 1/2 and 4 hours.

Therefore the nature of the cycle's construction implies that a study of the whole is in some respects also a study of its parts and vice versa. An analysis of *Traum-Formel* , then, is also to some degree a self-contained microcosmic analysis of the compositional strategies of the *Licht* cycle in its entirety. *Traum-Formel*, written in 1981, is however an early work in the development of the entire *Licht* plan and therefore can only represent developments in the use of the Super-Formula over the first five years of the *Licht* project.

All of Stockhausen's compositions since 1977 have either been part of the *Licht* project or directly connected to it in some way. Because of the highly restrictive nature of this undertaking the composer has conceived the work in a modular fashion: portions of it can be excerpted and performed as

'stand-alone' pieces with a life separate from that of the opera. In general, commissions during this period have also been absorbed into the opera's structure, giving it an extremely varied orchestration.

Traum-Formel is one of the small number of works Stockhausen has written since 1977 that are not directly part of the opera. It is an occasional piece, written in celebration of the birthday of his partner Suzanne Stephens. It was presented to her as a birthday present on July 28 1981 and is dedicated to her. She gave its first performance on June the 4th 1983 at West German Radio, Cologne, in a concert titled 'Nachtmusik im WDR' (Night Music at WDR).

The basset-horn has strong associations for Stockhausen, both personally and in relation to the opera cycle *Licht*. In *Licht*, the basset-horn is the instrument associated with Eve, one of the principal characters. Basset-horn performance is also, not coincidentally, a speciality of Suzanne Stephens. Stephens has to date performed the instrumental component of the threefold representation [1] of Eve in the *Licht* opera cycle. Many of the leading roles in *Licht* are performed by members of Stockhausen's close family and friends. This is a practice that has developed over a long period of performing his own music and is apparently a strong element of his musical philosophy.

It is necessary to find friends who are on the same wave-length and

who have not only the gift of improvisation, but also the gift of

intuiting music by listening to a musical organism which is shaped at

the moment of the performance. [2.]

The Stockhausen/Stephens relationship, which originated in the mid-1970s

has been an immensely fruitful one for the clarinet family's solo repertoire.

In addition to *Traum-Formel*, it has resulted to date in the creation of

Harlekin (Harlequin) (1976), *Kleine Harlekin* (Little Harlequin) (1977), *In*

Freundschaft (In Friendship) (1978), *Tanze Luzefa !*(Dance Luceta) (1978)

Amour (Love) (1976), *Susani* (1984), *EVAs Spiegel* (Eve's Mirror) (1984),

EVAs Lied (Eve's Song) (1986), *Xi* (1986), *Ypsilon* (1989) and *Freia* (1991).

The *Harlekin* works were written during a period of an increasing degree of

theatricality in Stockhausen's music. Suzanne Stephens' theatrical gifts have

been an important part of many of Stockhausen's works since this time.

Traum-Formel includes instructions to the performer to wear 'if at all

possible [sic] a blue-black, green-black glittering costume, nocturnal erotic.'

There are also instructions detailing the lighting design and the performer's

movements across the stage.

Traum-Formel is an extremely demanding work technically, encompassing

the basset-horn's entire range of four octaves. The range is required for structural reasons rather than display: the work is constructed from six contrapuntal layers and Stockhausen uses registral and timbral variation to differentiate these layers. The six layers are derived directly from the *Licht* Super-Formula and its skeletal version, the Kernel-Formula.

Stockhausen's personal concept of a musical universe is an unusually rich and consistent one. It is the synthesis of a long period of examination of a range of spiritual, scientific and aesthetic beliefs. A thorough analysis of *Traum-Formel* is greatly enhanced by an understanding of the conceptual basis from which the structural underpinnings of Stockhausen's language eminate. These include Stockhausen's worldview and how it has shaped the development of his musical language from 1952 until 1977; the incorporation of those concepts in the Licht Super-Formula; and the structure of the Super-Formula itself. This background in particular will enable meaningful conclusions to be drawn from the analysis about the implications of this compositional approach in the work *Traum-Formel* .

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Footnotes: Introduction

1. In *Donnerstag aus Licht*, each of the principal characters is represented by a

singer/actor, an instrumentalist and a dancer/mime.

2. Dufallo, Richard, 'Vibrato between Intuition and Mental Work'

Trackings: Composers speak with Richard Dufallo, New York: Oxford University Press,

(1989), pp. 209-210;

Chapter 1.

Stockhausen's Worldview

Stockhausen's adoption of a melodic formula as the central organizing principle of his musical language is a logical product of his exploration into the fundamental nature of sound and its organization. In the context of Stockhausen's overall vision, an examination of the worldview that informed and drove this exploration greatly enriches, and is in fact integral to, any discussion of the compositional techniques employed in his work.

Stockhausen has published his working notes and sketches in 10 volumes of *Texte zur Musik* (Writings on Music) since 1963. More than most composers he has laid bare the processes of his compositional practice and the reasoning behind them. In his 1994 article 'Stockhausen's Paradigm: A Survey of His Theories' [1], Coenen postulates a unified overview of Stockhausen's thinking by identifying the core elements of his world-view and how his musical language flows directly from them.

These elements make a useful starting point in an understanding of Stockhausen's music and its development. Coenen identifies four images or visual metaphors as archetypes in Stockhausen's worldview. These metaphors recur throughout Stockhausen's oeuvre at many levels: in his

working methods; in his own descriptions of his working methods and works; and often in the structure of individual works themdelves.

The four metaphors are:

- the vibrating universe

- the continuum

- the spiral

- the galaxy

The Vibrating Universe

Coenen identifies the   most important of these concepts for Stockhausen as being that the fundamental element of the universe is vibration.

There is a fundamental periodicity of the whole cosmos when it explodes and contracts - it *breathes*, God *breathes* all the time, naturally, periodically, as far as we can think. This is the fundamental of the universe, and all other things are partials of this fundamental - the galactic years and the years of the sun systems, etc. And going down to the atoms and even the particles of the atoms, there is always periodicity. [2.]

Every object in the world, down to the smallest atom, produces waves which can be transformed into acoustic waves. [3.]

Furthermore these waves are capable of bringing about change in our reality:

When a human experiences something acoustical, he will be changed, because he is modulated by the vibrations, all his atoms are modulated. [4.]

The counterpart to this 'vibrating universe' concept is that the music one creates has the ability to change perception, that is to modulate the vibrations of the universe. Stockhausen's creative work is characterised by the equal value it assigns to both the rationalist and intuitive approaches to composition. Stockhausen's definition of intuition is clearly linked to his concept of 'the vibrating universe'.

'Opening one's mind in order to receive more vibrations from the universe than one normally does. [5.]

Stockhausen's music despite having many highly rational experimental qualities in common with scientific method, is rarely without 'intuitive'

digressions that subvert the formal plan to some degree. These digressions

or 'inserts' (Einschübe) as Stockhausen terms them, have formed a

fundamental part of Stockhausen's musical language from his earliest years

as a composer.

> The whole *Einschub* 'insert' technique goes back to *Kontra-Punkte* and
>
> even to *Drei Lieder* which I wrote very fast during the college vacation
>
> ... and which is based directly on the overwhelming experience of inner
>
> sound visions which are stronger than your own will... On the other
>
> hand, you are an engineer, you do mental work, and there is
>
> sometimes a conflict between the two: you have overall visions,
>
> images which make demands of a kind you cannot yet realize, and
>
> they lead to the invention of new technical processes, but then the
>
> technical processes go their own way and become the starting point
>
> for other techniques which in turn provoke new inventions and you find
>
> yourself bombarded with images again. [6.]

The Continuum

Coenen also places at the centre of Stockhausen's worldview the basic

assumption 'that everything can always be seen in a new perspective.' [7.]

Coenen calls this Stockhausen's 'progressive reality'.

Every aspect in the world can be seen as a point on some continuum, which means: as a gradation of at least two extremes. [8.]

Coenen argues that it is possible to observe the musical ramifications of this assumption manifesting itself as a constant attempt by Stockhausen to transcend orthodox opposites in successive works: thus placing them on a continuum.

His compositions to 1977 repeatedly challenge commonly accepted dichotomies by identifying them as part of a continuum: for example pitch/rhythm in *Kontra-Punkte* (Counter-Points) (1952-3) *;* and sound-vowels/noise-consonants in *Gesang der Jünglinge* (Song of the Youths) (1955-6)(discussed by Stockhausen in his essay: *'Music and Speech'* [9.]*)* .

Serialism is viewed by Stockhausen as a method for exploring the continuum metaphor, and therefore it is necessary to think of it as a general principle in his works, rather than having a connection to the Schoenberg methodology. In Stockhausen's words:

Serialism is only a way of balancing different forces. In general it means simply that you have any number of degrees between two extremes. [10.]

Serialism then is for Stockhausen merely a way of codifying difference in order to transcend it. Coenen labels these stages [11.] in Stockhausen's serial thinking as:

- innovation - to take or create a dualism as a starting point
- integration - to create a scale between the two extremes of the dualism
- recursion - to consider the created scale as a starting point for a new dualism

The outcome of this strategy is evident in the development of Stockhausen's musical language and is illustrated most graphically in the transcendent progression of his formal structures. Each new structural approach developed by Stockhausen during the 1950s and '60s was superseded by one that took his previous structure as given and the basis for a new continuum. For example, one crucial line of development begins with the formal organization of points of sound in *Kreuzspiel* (Crossplay) (1952) , to groups (groups of points) in *Klavierstück I* (Piano Piece I) (1955) , to 'moments' (groups of groups) in *Momente* (Moments) (1962 - 64/69), to processes in *Plus-Minus* (1963) (transcending musical material by controlling their organization but not their content), to formula (synthesizing a process with musical material).

The Spiral

Coenen suggests that Stockhausen's concept of the spiral combines the

circle, 'the act of construction, of integrating all elements into one

continuum', with the arrow, reflecting 'the innovating force, the act of

listening, of enlarging one's consciousness' [12]. This concept is analogous

to the way that periods of 'innovative' works exploring a logical progression

of the composer's ideas have been mediated during his career by

'integrative' periods of reflection and consolidation.

The first of these periods was in 1961-6 and resulted in the revision of

several works and the completion of several unfinished works. Interestingly,

this period of consolidation was immediately preceded by the composition of

Originale (1961), Stockhausen's first major exercise in music-theatre, and

an early forerunner of the *Licht* drama. *Originale* sought to create a

'synchronous combination of all the arts' [13] in a manner more akin to a

Cagean 'happening', than the opera/music theatre tradition. However,

Maconie has suggested that it also marked the beginning of a line of

compositions involving the 'inventive co-operation of performers ' that led to

the intuitive text compositions and the 'more refined choreography of *Inori*

(Adorations) (1973-74) and *Licht* .' [14]

The second period of re-appraisal (in 1970) resulted in the re-adoption in the

work *Mantra* of the concept of the melody-formula first employed in *Formel* ,
a short orchestral work from 1951. The final period, only seven years later,
was the most far reaching. Stockhausen re-assessed the many facets of his
musical language from 1951 to 1976, a 25-year period he considers to be
the first half of his working life, and developed the concept of the 'Super-
Formula' which in a sense is a synthesis of many of the important features
of his music to that point. This decision enshrined the Super-Formula as the
generating kernel of his entire creative output for the next 25 years.

The Galaxy

The last concept compares the structure of human perception of reality to
the structure of the universe itself:

> all things are related to each other, like planets and stars are, but that
> at the same time there is some grouping, that some planets belong a
> little bit more to each other and that some stars with their planets form
> galaxies. [15.]

The galaxy concept is clearly analogous to that of the formula: a template
consisting of events related to one another in varying degrees, from which
the fabric of all larger scale structures is constituted. It is also an accurate
analogy of the relationship between the various temporal levels of *Licht*. In

fact, the analogy could even be extended to the 'social' organization of the *Licht* project itself - comprising Stockhausen, his partner, family, close friends and more distant associates.

The significant decision on the composer's part to restrict himself to a single structural principle and more importantly to a single structural template, the Super-Formula, was in part based upon his belief in the renewal of the human spirit every seven years. The numerological significance of his 49th (7x7) year falling in 1977 was apparently irresistible. [16].

This recognition and formalisation of the overall structure of his musical development over an entire lifetime says much about the high degree of integration between Stockhausen's life and art. It is also a keen indicator of the depth from which Stockhausen's convictions emanate and is crucial to understanding his adoption of the seemingly restrictive concept of a 'Super-Formula' to act as the well-spring of the second 25 years of his creative life.

Footnotes: Chapter 1

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1. Alcedo Coenen , 'Stockhausen's Paradigm: a Survey of his Theories' *Perspectives of New Music'* 32 No. 2   (1994), pp.200-225

2. Jonathan Cott, *Stockhausen: Conversations with the Composer* (London: Faber and Faber, 1974), p. 27

3. Cott, p.79

4. Karlheinz Stockhausen, *Texte zur Musik 4 1970-77*   (Cologne: DuMont Buchverlag, 1978), p.395

5. Ibid., p.569; paraphrased in Coenen, pp. 210-211

6. Karlheinz Stockhausen and Robin Maconie, *Stockhausen on Music* (London: Faber, 1988), pp. 135-6

7. Coenen, p.206

8. Coenen, p.208

9. Karlheinz Stockhausen, ' Music and Speech' *Die Reihe 6 (Speech and Music)*   (Bryn Mawr: Theodore Presser,.1964) pp. 40-64

10. Peter Heyworth, *'*Spiritual Dimensions' *Music and Musicians* 19 no 9 (1970), p. 34

11. Coenen, p. 210

12. Coenen, p. 208

13. Hans Richter: *Dada Arts and Anti-Arts* (London: Thames & Hudson;1965);

14. Maconie pp.116-117

15. Coenen, p.209

16. Michael Kurtz, (trans. Richard Toop), *Stockhausen: a Biograph*y London: Faber and Faber 1992 p. 4

Chapter 2.

Concepts Central to the Melody-Formula

Stockhausen's earliest works reflect the spirit of the times, a collective will to create a genuinely new musical language after the horrors of the Second World War. For Stockhausen and many others, such as Boulez, Berio and Nono, the path forward was clearly through serial structuring of all musical parameters. Stockhausen's first encounter with Messiaen's proto-multiple-serial work *Mode de valeurs et d'intensites* (Mode of Values and Dynamics 1949) and his enthusiastic description of its novel 'pointillist' texture as 'a fantastic music of the stars' has been described by Toop. [1]

In this short study for piano, Messiaen resolved to some degree the integration of musical structure in several musical parameters by employing as the source materials three 'modes' in which each degree is assigned a fixed pitch, duration, dynamic and register. Interestingly, this piece, which had 'opened to Stockhausen the means for a serial organisation' [2] of all parameters, shares a three-part pre-compositional structure with the *Licht* cycle.

Example 1. *Mode de valeurs et d'intensites'* three part structure

In *Kreuzspiel* (Crossplay) (1951) Stockhausen begins his exploration of this same territory. Messiaen's notion of creating musical structures that are formally consistent in a number of parameters was a key influence in Stockhausen's early musical development.

The following survey of Stockhausen's concepts and the compositional techniques that flow from them will be illustrated by key works. The absorption of these techniques into the language of the *Licht* Super-Formula will also be examined. Crucial to this discussion is *Mantra* (1970), the work that crystallized many of Stockhausen's post-1970 melody-formula techniques .

Register

Register plays an important role in the Super-Formula . Each of the three super-formula strands is allotted a specific register as one of its characteristic features. In *Traum-Formel* the register of each strand is of crucial importance as all the material is presented on the same instrument. In both *Traum-Formel* and *Licht*, register becomes one of the key determinants of identity in contrasting the musical material. The use of register as a structural determinant dates back to *Kreuzspiel.*

In *Kreuzspiel*, a dramatic process of registral cross-over of musical material is played out. The manipulation of pitch and rhythm is not unlike that of other contemporaries such as Boulez in *Structures 1a* (1952). However Stockhausen, partly influenced by his colleague and Darmstadt roommate Karel Goeyvaerts, uses register as one the main structural principles. The registral cross-over occurs as a result of the deployment of material on the piano in an X-like shape - starting at the extreme ends of the keyboard, moving to include the middle register and then out again to its extremes. In the second section the material is deployed in the inversion of that structure (a diamond shape) and its 'interversion' (a combination of the X-like shape and the diamond) in the final section.

One of the resultant features of this process is that the two wind instruments
replace notes of the piano as they fall within their range, creating melodies
that are not serial in themselves, but are the result of serial procedures.
These 'accidental' melodies forced Stockhausen to confront the question of
thematic writing: at the time anathema to the aims of the post-war avant-
garde.

Example 2. Resultant melodies in *Kreuzspiel*

Thematic Composition

The idea of a melody-formula, a direct contrast to the 'pointillist' language of *Kreuzspiel*, first appears in Stockhausen's second mature work *Formel* (Formula) (1951). This orchestral work sought 'to express the transition of groups of pitches rather than individual pitches, from the vertical to the horizontal in a serially more systematic fashion'. [3.]

Melody formula is employed significantly differently in *Formel* than in Stockhausen's post-1970 works: the unfolding of the 'melody' is controlled by an expanding serial process and a registral form is deployed in a similar way to *Kreuzspiel*. It expanded *Kreuzspiel's* construction to include melodies - 'like little crystalline blooms' [4. -] rather than points. However, the use of ornaments in particular and the recognition of a horizontal 'melodic' dimension in general were both important precursors of Stockhausen's next significant foray into melody-formula composition, *Mantra,* almost 20 years later. It is also important to note that Stockhausen was dissatisfied with the result and withdrew *Formel* until 1974 after *Mantra* had been written, on the grounds that it was 'much too thematic' .[5.]

Arguably the use of melody and traditional notation in 1970 appears to contrast greatly with the language of Stockhausen's music in the last years of the 1960s. Some of these 'intuitive' text scores, for example *Aus dem*

Sieben Tagen (From the Seven Days) (1968) and *Für Kommende Zeiten*

(For Times to Come) (1968-70), contain notated musical material but most

of them consist of instructions akin to meditation exercises intended to open

the performers mind to intiution. However it is here that Stockhausen's

return to thematic thinking actually surfaced again in the work *Japan,* one of

his 'intuitive' texts from *Für Kommende Zeiten* . Maconie has suggested that

the musically transcendent nature of these pieces made it natural, perhaps

even necessary, to return to thematic composition.

> Stockhausen's interest in 'tunes' - melodies - came about in large
>
> measure as an outgrowth of his most radical music of the sixties,
>
> the so-called Process Plans - ironically, the most extreme
>
> manifestation of the above-mentioned athematic stance. In this type
>
> of composition, it is only possible for the listener to follow the
>
> processes if the material itself is sufficiently memorable. It is only
>
> natural that this should have lead Stockhausen back - however
>
> unconsciously - to thematic composition. [6.]

In *Mantra*, a 13-note serial melody (the first and last notes are the same)

generates the form and process of the work. The formal structure is derived

from the expansion of the pitch and rhythmic material described below and

the process, in this case the development of the material is derived from the

melody's ornamentation. The *Formel - Mantra* relationship has been recognized by Stockhausen - 'it was only after the composition of *Mantra* this it became clear to me that all the features of *Mantra* are already anticipated in Formel' [7]. Toop's demonstration of 'thematic' similarities between the two works [8] suggests the relationship may not have been entirely retrospective.

Stockhausen had broken with the Avant-Garde practice of avoiding consonant intervals in his *Zeitmasse* (Time-measures) (1955-6). *Mantra* breaks with this practice to a even greater degree: thirds and sixths make up six out of twelve of the intervals in the melody. It is memorable, a 'melody' in the traditional sense.

Example 3. The Pitch structure of *Mantra*, showing intervals of 3 and 4 semitones.

Mantra's relatively small range (a major ninth) also contributes to its 'melodic' character. In *Mantra* the limited range was necessitated for structural reasons: one of the features of the melody's' expansion' is multiplication, and therefore widening, of its intervals.

Stockhausen's embrace of melody peaks with the 12 sometimes folk-like themes of *Tierkreis* (Zodiac) (1975-6) . Like those of *Tierkreis* , the Super-Formula melodies are necessarily distinct: representing not just a musical idea but also a physical character from the opera. Unlike the 12 *Tierkreis* melodies, the Super-Formula is also conceived to function as a single polyphonic, in fact poly-parametrical, statement.

Melody/Series Divisions

Stockhausen also introduces other significant new features in *Mantra*. The melody is divided into four sections (containing 4, 2, 4 and 3 notes respectively) that Stockhausen terms 'limbs'. The limbs are separated by four periods of silence of varying lengths.

Example 4. The four mantra-melody limbs and their inversion

At least on the surface, series divisions occur naturally in the Super-Formula, as it is a template for seven operas. Therefore, for the most part, the Super-Formula's limbs are used to mark the boundaries of *Licht*'s operas, acts and acenes. . There are 18 'sub-limbs' in total. In the same way that the three melodies are integral because they each characterise one of

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the main protagonists, the sub-limbs, by partitioning regions of varying

activity in each melody, have important implications in the articulation of the

cycle's plot. These implications and the small number of deviations

Stockhausen makes from the limb-boundaries, will be discussed in more

detail in chapter 4.

Polyphony

Superficially the three-part Super-Formula might be supposed to have

derived from the two-part melody of *Mantra*. However, in *Mantra* the two

part melody is in fact two statements of the same material: the melody is

accompanied by its own inversion. The order of the limbs in the second

layer is displaced so that each limb of the top layer is accompanied by a

different limb in the lower layer.

Example 5. Displacement of limbs in *Mantra*

The use of multiple 'melodies' presented in polyphony occurs first in the

Tierkreis related works, the music-theatre fairy tale *Musik im Bauch* (Music

in the Belly) (1975) and Stockhausen's 'most substantial tape electronic

composition ' [9.] to that point, *Sirius* (1975-7). In both works, versions of the

Tierkreis melodies are the basis of all the musical material. The melodies

determine many levels of musical structure, but not yet in such a systematic

fashion as *Licht*. The existence of three separate but simultaneous serial

formulas in *Licht* is a logical development from these works. In *Licht* both

the musical and dramatic parameters are more systematically derived from

the same source .

Expansion and Contraction of Musical Materials

The avant-garde serial movement pursued a parity 'of organization at every

level of music from timbre to super-structure' [10.] with almost religious zeal. It

was a holy grail that was the musical equivalent of the 'unified field theory'

of physics. A crucial event in the development of this idea occurred during

Stockhausen's 1958 lecture tour of the United States, when he spent long

periods listening to the slowly evolving sounds of aircraft engines and

considering the relationship between the nature of the microstructure of

sound itself and macrostructure.

These observations resulted in a synthesis of his understanding of temporal

structure and timbral structure: horizontal and vertical. They were an

extension of what he had already established in the electronic studio: that it

was possible to accelerate impulses to the point where we perceive them as

a single tone, and equally to decelerate a tone to a point at which its

constituent waveforms begin to be perceived as a series of impulses. In a

manner analogous to the pitch/rhythm continuum, timbral formants could be

slowed down into the temporal domain of harmonic structure and vice versa.
[11.]

This experience led to a series of works in the late 1950s exploring this

discovery: *Kontakte* for piano, percussion and electronics (1958-60), *Zyklus*

(Cycle) (1959) for solo percussionist and *Refrain* (1959) for piano,

vibraphone and celesta. In particular *Zyklus* and *Refrain* offer two

complementary explorations of the relationship between timbre and

structure. *Zyklus*, employing nine super-imposed waves of activity for the

nine sets of percussion sounds, creates an analogy of spectral analysis

where a complex sound is represented as a number of superimposed sine

waves of varying frequency, amplitude and phase. In this sense it puts a

single synthetic waveform under the microscope and expands it into the

domain of formal structure . *Refrain* implies the opposite extreme: a time-

scale of perception so compressed that formal structures are condensed

into 'ringing tone mixtures'. [13.] (Maconie)

In *Mantra* the concept of expanding musical materials is shifted to the middle-ground. Instead of a timbral combination, the characteristics of each mantra-melody note of the two-part 'mantra' melody-formula which is heard at the beginning of the work, is itself later expanded so that each note and note length of the mantra melody becomes the transposition and section duration of the expansion which follows. The harmonic structure of *Mantra* is a temporal expansion of the opening melody. In addition, each section of the harmonic structure is a complete statement of the entire formula, with its pitch transposed to the corresponding note and its duration transposed according to the note's length.

This technique is elaborated in *Inori* , in which each note of the 13-note melody has its own tempo as well as rhythmic duration.

Example 6. *Inori's* multi-parameter Formula

An individual note's tempo, if perceived at all at this micro-level, is similar in

scale to the temporal displacement of a single component note of a beat

subdivision. The tempo-series becomes an important feature though when

the melody is expanded, or to use the composer's term, is 'projected' to

Inori's length of 67 minutes. In effect this expansion assigns the note's

tempo to a duration 60 times longer. (The seven additional minutes

comprise inserts and other non-formula materials.) The rationale behind the

organisation of the tempo series was developed early in the composer's career and continues to be considered one of his most radical and brilliant innovations.

The Tempo Series

In the tempo series, Stockhausen sought to create the closest possible analogy between the parameters of pitch and tempo. The series is constructed using the same ratios as those that exist between pitches in the natural harmonic series. For example a pitch octave C_1 to C_2 bears a ratio 1:2 in the harmonic series. In Stockhausen's tempo series this ratio would be expressed as M.M. 60:120. If frequency doubles every octave then tempo can be expressed in the same way.

Table 1 below lists the 12 semitones of an octave with the fundamental note repeated an octave higher (C_1 as base pitch), the approximate ratios between the base pitch and the given pitch, their (approximate) expression in tempo (M.M.60 as base tempo) and the 'tempo octave' frequently used by Stockhausen:

Table 1. Stockhausen Tempo Series and its derivation from harmonic ratios

Pitch	C_1	$C\#_1$	D_1	$D\#_1$	E_1	F_1	$F\#_1$	G_1	$G\#_1$	A_1	Bb_1	B_1	C_2
Ratio	1:1	16:17	8:9	5:6	4:5	3:4	7:10	2:3	9:14	3:5	4:7	8:15	1:2
Tempi	60	63.57	67.35	71.35	75.6	80.1	84.86	89.91	95.25	100.92	106.93	113.29	120*
Stock. tempi	60	63.5	67	71	75.5	80	85	90	95	101	107	113.5	120

* The tempi are expressed in equal temperament (12 equal steps per octave) in contrast to the ratios which give the whole number ratios for intervals. That is why C_1 to G_1 (2:3) gives a tempo of 89.91 not 90: the fifth is slightly flat in equal temperament.

Serialisation of tempi in Stockhausen's music dates back to *Kontra-Punkte*, which employs six tempi: quaver equals M.M. 120; 126; 136; 152; 168; 184 and 200. The six tempi relate to the pitches C (M.M. 120) C# (M.M. 126) D (M.M. 136) E (M.M. 152) F# (168) G (M.M. 184) and A (M.M. 200), but Stockhausen has used approximations to fit in with standard metronome tempi, a system he was to drop in his *Klavierstuck V* in favour of the more exact expressions listed in the table.

In the Super-Formula the tempo octave ranges between M.M. 45-85 with M.M. 60 as the opening tempo. The tempo of each section in *Licht* however is 'transposed'. So that a *Licht* section that has been expanded from a Super-Formula section with a tempo of M.M. 71 for example would have an opening tempo of M.M. 71 corresponding to a tempo octave of M.M. 53.5 - 101. Tempo is consequently transposed in the same way as a series may be transposed to begin on any pitch.

Ornaments and Accessories

In *Mantra* the role of ornamentation was further expanded into the
structural/formal domain to the extent that each note of the melody is
associated with a particular form of ornamentation: periodic repetition;
accent at the end of the note; normal; grace-note; tremolo/chord; accent at
the beginning of the note etc. The 'forms', far from being merely decorative,
play an integral part in the development of the piece with each becoming the
focus of a development of the melody in the expanded version.

Example 7. Ornamentation of the *Mantra* Formula

In post-*Mantra* works ornamentation becomes more elaborate, and
sometimes generates material additional to formula notes. Stockhausen
calls this elaborated form of ornament an accessory. Coenen traces the
appearance of the 'accessory' to the process phase of Stockhausen's
composition (*Plus-Minus* is the first score in which accessories are
mentioned). Coenen also makes the link between these accessories and

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Stockhausen's exploration of electronic music [12], suggesting that many of

these accessories have counterparts in that medium: echo and pre-echo -

the unwanted side effects of tape recording (spillage); coloured fermata -

tape hiss; scale - the glissando effect when a tape is started mid-note.

Dynamics

 In *Mantra*, in addition to the paramenters mentioned, each note is also

associated with a particular dynamic or dynamic shape: crescendo;

decrescendo or sforzando etc. The dynamics are extrapolated onto the

larger scale form in the same way as the other parameters.

Example 8. Dynamics in the *Mantra* formula

Again, *Inori* significantly increases the complexity of Stockhausen's

treatment of dynamics. The dynamic of each formula-note in *Inori* modifies

the individual dynamics of each full-length 'projected' section and each

section also contains a statement of the full dynamic structure of the formula

.

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For example a pianissimo in a section that corresponds to a formula-note that is assigned fortissimo (an *ff -pp*) will be louder than a pianissimo corresponding to a formula-note that is assigned pianissimo (a *pp-pp*). This distinction necessitated the creation of a 60-level scale of dynamics that is linked directly to the orchestration.

Example 9. One of *Inori's* sixty level dynamic scales

In *Inori* , dynamic level and timbre are bound together by the inherent dynamic qualities of each instrument. This makes explicit one of the fundamental problems of orchestration: that although the marking **forte** is conceptually the same for each instrument, in terms of physical volume of

sound it may mean something quite different. For example the quietest

marking has a single flute playing **pp** while the loudest has the entire

orchestra playing **ff.**

The seating of the orchestra is also so arranged as to link the spatial

dimension together with dynamics and timbre: the instruments with a

naturally softer dynamic spectrum are placed at the outer edges of the

orchestra; those with louder dynamics to the centre of the orchestra.

Therefore there is an inherent tendency for the orchestral sound to fill the

entire spatial, dynamic and timbral spectrum in louder passages. [13.]

Spatial Dimensions

The use of the spatial dimension as a musical parameter has been an

important element in Stockhausen's music since his early electronic work

Gesang der Jünglinge. In its original form the work is presented with five

speakers. Each individual speaker projects a single track of tape, making

the work antiphonal in nature. However the spatial deployment of material

was strictly according to a serial plan: the first time this musical dimension

had been integrated into the structural organisation of a serial work.

The movement of sound by 'panning' or varying signal levels between

speakers was achieved by the composer in his next major electronic work

Kontakte (Contacts) (1958-60). The spatial dimension is, however, not integrated directly into the *Licht* Super-Formula, presumably because pre-planning the spatial positioning for a seven day opera-cycle that is intended to take 25 years to write, would place insurmountable restrictions on the dramatic action. However specific spatial plans for sections of the opera deriving from the Super-Formula have been employed. The fact that spatial organisation has continued to be an important consideration for Stockhausen is signified by his recent development of a new sound projection system with 8 banks of speakers: Octophony, used for the electronic music of the opera*Dienstag* (Tuesday) (1977-91).

Traum-Formel, a solo instrumental work without amplification is necessarily limited in its possibilities in terms of spatial organisation . Despite the limitations there is a spatial dimension to the work, albeit more theatrically than as a dynamic component of the musical structure.

Timbre

Gesang der Jünglinge was also informed by the fact that in 1954 Stockhausen attended lectures in communication theory given by Werner Meyer-Eppler. His study of speech sound classification when combined with his own electronic music experiments greatly clarified Stockhausen's understanding of the relationship between harmonic and inharmonic sound.

One of the most important areas of study was the 'distinctive features

theory' developed by Morris Halle and Roman Jakobson which is used to

create meaningful distinctions between vocal sounds. Moreover, this theory

provides a very useful analogy for the world of sound in general.

 Maconie has noted the similarity between the 'tonal hierarchy' diagram

Stockhausen uses in his sketches for the work *Momente* (Moments) (1962-

64/69) and the Halle-Jakobson 'structured classifications of speech sounds.

'13.

The influence of communication theory on Stockhausen's musical thinking

was far reaching. It immediately informed the composition of *Gesang der*

Jünglinge, one of the chief aims of which was to integrate so-called sound

and noise as well as 'concrete' and synthesized sound.

 In Stockhausen's 'process' works of the 1960s - *Plus-Minus* (1963),

Prozession (Procession) (1967), *Kurzwellen* (Short-Waves) (1968), *Spiral*

(1968), *Pole* (Poles) (1969-70), *Expo* (1969 -70) - the performer is instructed

'how' to modify their musical material, but generally not 'what' that material

should be. The notation for how to modify musical material utilises the same

plus-minus indicators as Halle and Jakobson.

Example 10. Stockhausen's tonal hierarchy' diagram and Halle Jakobson 'structured classifications of speech sounds ' diagram
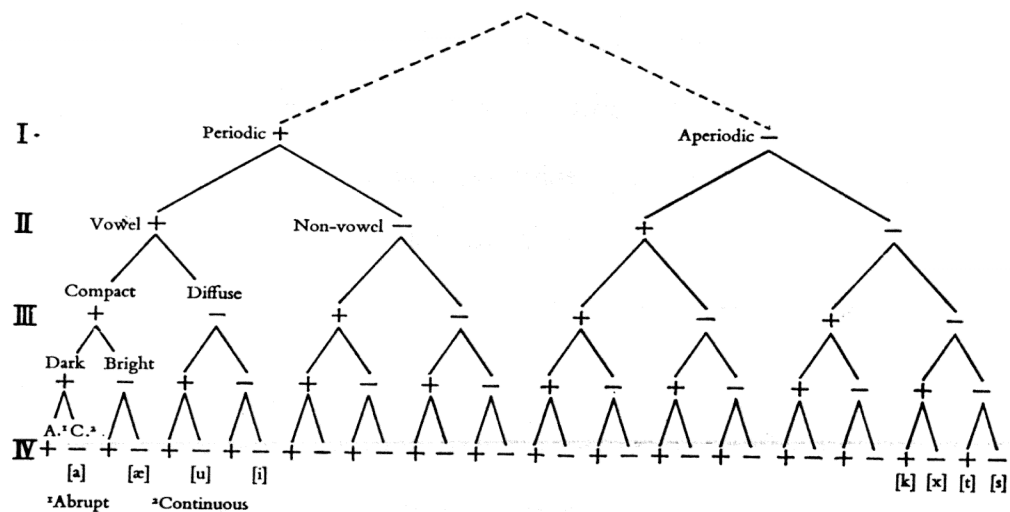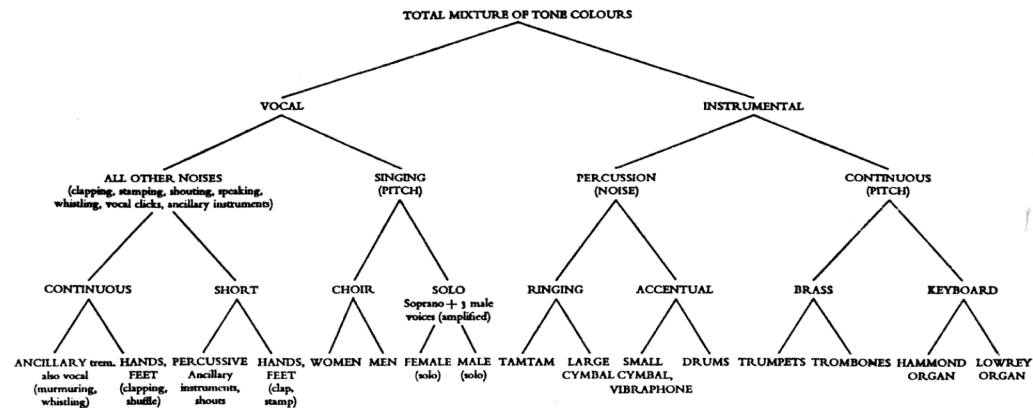
Stockhausen also integrates abstract vowel and consonant fragments using international phonetic script into his choral/orchestral piece *Carré* (Square) (1959-60). Phonetics also inform Stockhausen's use of vowel sounds to classify and integrate tone colours in the formula of *Inori*, a technique that was expanded in the *Licht* Super-Formula. In *Licht,* however, vowel formants appear to be used as part of the ornamental structure, rather than

as one of the foundation parameters such as pitch, rhythm and dynamics:

that is, their use is not associated with every single note event.

Furthermore the *Licht* Super-Formula also incorporates actual words (all

numbers). It also makes a distinction between 'normal' sounds, noise events

such as clicks , 'coloured noise' and silence. These aspects will be

discussed in detail in the chapter 5.

Gesture

Another important new feature incorporated in *Inori* is the use of an 'action-

melody' of silent gestures to be performed by one or two solo dancer-mimes.

The gestures are derived from the prayers of world religions. The use of a

mime-dancer returns in *Licht,* where the central characters are each

represented by a dancer-mime, a singer-actor and an instrumentalist-actor.

The integration of theatrical gestures with gestures that are inherent in

musical performance probably begins with *Zyklus* . In this work the cyclical

musical structure is physically played out both in the circular arrangement of

percussion instruments, and the fact that in order to play the instruments as

they appear in the score the percussionist must turn in a complete circle

finishing where s/he began.

The transition from works that are clearly theatrical music such as *Zyklus* to

those that are clearly musical theatrics such as such as *Musik im Bauch*

(Music in the Belly) (1975) is gradual. It has been influenced both by

Stockhausen's desire to keep exploring new territory: the dramatic

relationship between the music, the performer and the audience is obviously

very crucial territory. The composer's increasing theatricality has also

presumably been influenced by the performers with which he has worked.

The most important of these have been the members of his own 'live

electronics' group during the 1960s, and lately the key players in the *Licht*

opera: Suzanne Stephens (Eve), his son Markus (Michael), Michael Struck

(Luzifer) and also Kathinka Pasveer.

Footnotes: Chapter 2

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1. Richard Toop, *Messiaen, Goeyvaerts, Fano, Stockhausen, Boulez* in Perspectives of

New Music 13 no. 2 (Fall-Winter 1974) pp.141-69

2. Griffiths, p.50

3. Maconie, p.53

4. Richard Toop, 'O Alter Duft': 'Stockhausen and the Return to Melody' *Studies in Music X*

(University of Western Australia) (1976), p. 79

5. Toop, p. 80; also Maconie, p. 23

6. Maconie, p. 265

7. Toop, p. 83

8. Toop, p. 83

9. Maconie, p.247

10. Maconie, p.100

11. Karlheinz Stockhausen *The Concept of Unity in Electronic Music* Perspectives of New

Music 1 no. 1 (Fall 1962) pp. 39-48

12. Coenen, p.214

13. Maconie, p. 130

Chapter 3.

The *Licht* Cycle

Stockhausen's *Licht* Cycle must be seen in an historical context as one of the most significant undertakings by a major artist in the twentieth century. *Licht's* central theme, 'the white light understood as God, spirit of all universes' [1.] and subject matter 'the evolution of mankind' [2.] place it in the same mythic and archetypal territory as one of the nineteenth century's most monumental undertakings - Wagner's *Ring* cycle.

More importantly *Licht* is a culmination and synthesis of Stockhausen's spiritual and intellectual life journey. The medium of opera/music theatre, with its multi-dimensional qualities and ability to portray abstract and concrete concepts, was an obvious choice for the purpose of synthesizing his musical and spiritual beliefs. Interestingly Stockhausen, often viewed as an iconoclast, chose the medium most associated with conservative forms of music making, but in so doing anticipated the its resurgence as a form of expression in the 1980s.

In *Licht,* Stockhausen draws on concepts and practices from a number of major world belief systems. Primarily, aspects of the Judeo-Christian tradition are referred to: Archangel Michael, the face of God and his

incarnation as a human on Earth; Eve, the mother of mankind and Lucifer who 'wishes to tempt humans and all living things into disbelief'. [3.] Early sketches[4] show a plan to have a fourth central character of Biblical origin, Adam. Later Stockhausen decided that the characteristics of Adam and Michael could be combined.

The Hindu/Buddhist concept of reincarnation, central also to Stockhausen's own belief system, appears as a given in the cycle: Lucifer appears incarnated as a squid-human at the beginning of the opera *Montag.* The birth of mankind as the result of a titanic battle has overtones of the Hindu Mahabarata; and Kathinka's Chant draws on elements of *The Tibetan Book of the Dead*. Most importantly the cycle reinforces the ideas of human unity and balance essential to Stockhausen's own world view. Several commentators have also pointed to *The Urantia Book,* which Toop describes as 'transgalactic theology' [5.] , as a source of material for *Licht's* plot [5.].

One innovation Stockhausen adopts in *Licht* is the 'three-fold representation' of each of the three principal characters as a singer, an instrumentalist and a dancer-mime. This arrangement obviously mirrors the structural organisation of the Super-Formula, but the suggestion of a 'trinity of trinities' has obvious Christian overtones. More significantly it may have been Stockhausen's interpretation of the Hindustani tradition that views music as

consisting of sung music *(gitam)*, instrumental music *(vadayam)* and dance *(nrityam)* that was an influence. Another interpretation might view this innovation as a representation of the Western concept of mind/spirit/body, where the conscious mind is represented by sung text, the spirit by abstract music and the body by physical movement. Whatever the source of this idea, *Licht's* multiple representation of characters is an innovation that breaks with the operatic tradition of the individual vocalist/actor, it has been suggested [7.], represents a potentially new direction in opera.

Licht also includes some more idiosyncratic innovations that characterize Stockhausen's playful approach to his material. For example in *Samstag* the opera orchestra becomes a physical representation of one of the characters: the face of Lucifer . The modular nature of the work has already been discussed, and in this most complex case the orchestral face of Lucifer divides into ten ensembles each named after a different facial feature. Each facial feature has its own section: the 'right eyebrow dance' for example is performed by a percussionist, six clarinettists and three bass clarinettists. In the finale of this section all of the groups play their material simultaneously.

Example 11. The Seating arrangement for the 'Face of Lucifer' from *Samstag*

Right Eyebrow

Left Eyebrow

② 1 Perc. | Clarinets 1 - 2 - 3 - 4 - 5 - 6 | Bass Clarinets 1 - 2 - 3

Basset-Horns 3 - 2 - 1 | Flutes 6 - 5 - 4 - 3 - 2 - 1 | 1 Perc. ①

Right Eye

Left Eye

Saxophones

④ 1 Perc. | Oboes 1 - 2 | Engl. Hn. 1 - 2 | Bassoons 1 - 2 | Cbsn.

Bass | Bar., Ten. | Alto 2 - 1 | Sopr. 2 - 1 | 1 Perc. ③

Right Cheek

Left Cheek

⑥ 1 Perc. | Trumpets 1 - 2 - 3 - 4 - 5 - 6 | Trombones 1 - 2 - 3

Trombones 3 - 2 - 1 | Trumpets 6 - 5 - 4 - 3 - 2 - 1 | 1 Perc. ⑤

Wings of the Nose

⑦ 1 Perc.

Upper Lip

Horns II
1 - 2 - 3 - 4

⑧ 1 Perc.

Horns I
4 - 3 - 2 - 1

Tongue
Piccolo Flute

Chin

⑩ 1 Perc. | Tubas 1 - 2 - 3 - 4 | Alto Trombones 1 - 2 | Baritones or Tenor Horns 2 - 1 | Euphoniums 4 - 3 - 2 - 1 | 1 Perc. ⑨

The 10 orchestra groups sit on 5 levels one above the other. On each level, the rear wall is formed as a sound reflecting shell. The whole should look like a giant human face with open, broad mouth into whose facial parts and facial colour the musicians with their instruments and costumes are integrated. The facial expression is a humorous smile.
There should be as many swing doors as possible in the rear wall behind the musicians, through which they can exit at the end.

The orchestral musicians later in the same opera engineer an strike, which in Stockhausen's plan causes the production to be relocated to a new venue for the final act. The strike is ingeniously incorporated into both the formal and dramatic structures of *Licht:* the new venue is a church where *Luzifers Abscheid* (Lucifer's Farewell) - the character's exorcism rite- can take place. The formal implications of the strike even have an impact on a derivative

work such as *Traum-Formel* as will be shown.

Traum-Formel is a modular offspring of *Licht,* containing, as it were, *Licht's* genetic material. *Traum-Formel* then is both a stand-alone work, which must of necessity be both internally consistent, logical and satisfying, and one which belongs to an extremely complex galaxy of works. Therefore details of the opera plot and an understanding of the characters play an important and perhaps indispensable part of the interpretation and understanding of this work. The extraordinarily detailed and sensitive account of the work on the Deutsche Gramophon [8.] recording by Stockhausen's partner and *Licht* collaborator Suzanne Stephens does much to reinforce this view.

The plot of *Licht* has been outlined neatly by Henning Lohner: [9.]

> The opera cycle is based on the interaction and conflict between three main characters. The Archangel Michael - the face of God, as he is named in early testimonies - is the creator of our local universe. Eve, the prototypical woman, is the spirit who continuously strives for the bettering of physical conditions for the people on earth. And Lucifer wishes to tempt humans and all living into disbelief.

The seven stations of this travelling universal theatre will show

Michael, Eve and Lucifer in conflict, transformation and incarnation

within the great game of evolution. *Dienstag* is the day of conflict

between Michael and Lucifer. Mittwoch becomes the day of

searching for a new world, in which all beings understand one

another. Donnerstag, Michael's day, is the day he becomes human

and travels to the earth. Freitag is the day Lucifer tries to win Eve

for his cause of rebellion. Samstag is Lucifer's day, the day of death

and the superseding of temptation, so that on Sonntag the mystic

marriage of Michael and Eve makes the rebirth of man possible,

culminating in Montag, Eve-day, the day of woman, the day of the

rebirth of mankind.

Although Stockhausen appears on course to complete the *Licht* cycle in

2002, the operas were deliberately not complete in calendar order. The

first to be written were the three 'character operas': *Donnerstag* (Thursday)

(1978-80) Michael's Opera and the day of learning, *Samstag* (Saturday)

(1981-84) Lucifer's Opera and *Montag* (Monday) (1984-88) Eve's opera and

the day of searching. These were followed by the day of conflict, *Dienstag*

(Tuesday) (1977-91) and *Freitag* (Friday) (1991-4); and the cycle will be

completed by the day of reconcilliation *Mittwoch* (Wednesday) (1992-98)

and the day of mystical union *Sonntag* (Sunday) (1998-2002).

Footnotes: Chapter 3

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1. Henning Lohner, 'Light Work' *Opera News 52* May (1988) p.15

2. Lohner, p.15

3. Lohner, p.16

4. Karlheinz Stockhausen, *Texte zur Musik 1977-84, 5: Composition* Cologne: DuMont Buchverlag 1989 p. 149

5. Richard Toop, 'On Writing about Stockhausen' *Contact 20* (1979) p. 25

Michael Kurtz, in *Stockhausen: a Biography* (London: Faber, 1992), p 246, adds the following insights: 'In the angelogy of the Christian Middle ages the Archangel Michael is described as the 'visage of Christ'. In *The Urantia Book* Michael is a 'Creator Son', 'ruler of our local universe of Nebadon.' Over a billion years he has made several 'bestowals', the seventh and last being his birth as a human, as 'Christ-Michael'.

6. For a detailed account of the plot of *Licht* see Bernard Pulham, *LIGHT: The Seven Days Of The Week* at http://www.geocities.com/Vienna/2047/licht.html

7. Stockhausen: *In Fruendschaft Traum-Formel Amour* (Wittengen: Deutsche Grammophon 1988) Tracks 12-15

Lohner, p.16

8. Although most accounts of the plot of *Licht* place the *Montag* opera at the beginning of the cycle, Stockhausen states in Texte 6 (p. 175) there is no one day that is designated as the starting point for *Licht*. . In this sense it follows the logic of Zyklus and Tierkreis both of which are cycles in which the performer and listener may make any point of entry.

Chapter 4.

The Structure of the Super-Formula

The Galaxy-form organisation of *Licht's* musical structure dictates that the musical balance inherent in the generative kernel will be embedded in all the works that flow from it. The formula concept as has been noted by Kohl [1] , is in essence a reversal of Heinrich Schenker's methods of analysis via reduction of complete works to an underlying skeleton. The comparison to Schenkerian analysis is heightened when it is considered that the *Licht* Super-Formula is both the literal (theatrical) and an abstract (musical) dramatic structure of the opera cycle. In this sense, *Traum-Formel,* in addition to containing the musical material of the Super-Formula, could also be said to contain to a degree its dramatic aspects albeit in an abstract form.

The Proportions of the Kernel-Formula

Stockhausen's development of the Super-Formula occurred principally between 1977 and 1978. He has called the first stage of its development, in which the initial pitch and duration relationships were developed, the Kernel-Formula [2]. (p.265) Sketches for the Kernel-Formula published in *Texte zur Musik* [3] show that Stockhausen began assembling the Super-Formula by defining the proportional distribution of the three 12 note series across the seven operas which are the limbs of the Super-Formula. This

sketch also appears to suggest contours for the melodic shapes of the
Formulae.

Table 2. Proportional distribution of 12 tone series across the seven *Licht* operas and melodic shape contours

	Mo*	Di	Mi	Do	Fr	Sa	So	Total
MF†	3	2		4		1	3	13
EF	2	1	3	1	1	2	2	12
LF	1	3		2	1	3	1	11

* in all tables Operas will be referred to by the first two letters of their German Names

† in all tables MF = Michael's Formula   EF = Eve's Formula   LF = Lucifer Formula

Even at this early stage, the dramatic structure of the opera cycle is implicit in the musical material: Michael's Formula has 13 notes endowing it with circularity (the first and last notes are the same) and all the symbolism of perfection and completeness; Lucifer's 11 notes render it incomplete and imperfect; Eve's formula, representing the mediating force in the cycle, contains an even number of notes and at least one note present in each limb of the Formula; Michael's formula contains the most notes of the three formulae in his character opera *Donnerstag* and also in the *Montag* and *Sonntag* ; Lucifer's Formula contains the most notes in his character opera *Samstag; Mittwoch ,* the opera with the least conflict also contains the fewest number of notes; and only the Eve and Lucifer formulas have notes in *Freitag,* the opera concerning Lucifer's temptation of Eve.

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In another sketch the operas *Dienstag/Mittwoch* and *Freitag/Samstag* are combined to reveal a symmetrical pattern to the note distribution. The number two is stated first in the Eve Formula, then in the Michael Formula, finally in the Lucifer Formula and is not stated in the next column. Assuming that the last vertical column of three numbers is as a return to the initial state, the same process is repeated for each of the four numbers.

 This 'magic square' ingeniously creates a different arrangement of notes vertically in each column and horizontally distributes 13 notes in Michael's Formula, 12 in Eve's and 11 in Lucifer's.

Table 3. Patterns in the distribution of notes across the Super-Formula

	M	T+W	T	F+S	S	Total
MF	3	2	4	1	3	**13**
EF	2	4 (1+3)	1	3 (1+2)	2	**12**
LF	1	3	2	4 (1+3)	1	**11**

Kohl has shown that partitioning the Formulae into limbs or sub-groups of 5, 4 or 3 notes separated by silence, creates a similar 'magic square'. [4.]

Table 4. Kohl's 'Magic Square' style pattern in the distribution of Super-Formula Limbs

	1st Limb	2nd Limb	3rd Limb	
MF	5	4	3(+1)	12 (13) pitches
EF	3	5	4	12 pitches
LF	4	3	5 (-1)	12 (11) pitches
	12	12	12	
	pitches	pitches	pitches	

By March 1978 the complete Kernel triple-formula in the final transposition was complete. It included the register of the pitches, dynamics and the melodic contours suggested in the earlier sketch [table 2]. The Kernel is divided into seven 'day' sections (two of which are subdivided) and is 36 beats in length. *Sonntag,* Michael and Eve's mystical union is clearly the longest of the operas, followed by the three 'character' operas.

Table 5. Proportional Length of Super-Formula opera limbs

Day	M	T	W	T	F	S	S	Total
No. of Beats	5 (4+1)	2	2	5	3	7	12 (6+6)	36

The first sketches for the pitch structure recorded in *Texte* [5] were a major third lower than the final version. The sketch gave letter names only.

Table 6. Initial Pitch Structure Sketch for *Licht* (on Bb not D).

	M	D	W	D	F	S	S
MF	Bb F F# E A		V	Ab C Eb B	V	C#	G D Bb
EF	Ab C	B	Bb Db D	F#	G	F A	Eb E
LF	Eb	D Db G	V	A F	E	C B G#	F #
no. of pitches	**6**	**6**	**3**	**7**	**2**	**6**	**6**

The Kernel-Formula is saturated with two pairs of inversionally related trichord types 014/034 and 015/045 as Kohl has shown. [6.]

Table 7. Showing the horizontal arrangement of pitches in the Super-Formula (C = 0) and the occurrence of 034/014 underlined and 045/015 trichords underlined in bold.

	1	2	3	4	5	6	7	8	9	10	11	12		13
MF	2	9	10	8	1	0	4	7	3	5	11	6	(5†)	2
		015		045				014				034		
EF	0	4	3	2	5	6	10	11	9	1	7	8		
		034		034		**045**								
LF	7	6	5	11	1	9	8	4	3	0	10			
					145			034						

† The note F is repeated out of sequence in the Michael Formula

In addition the 034 combination of pitches C Eb E , is contained in the each of the character operas: Michael in *Donnerstag* (the motive includes a G);

Eve in *Montag* ; and Lucifer in *Samstag.* The fact that Lucifer's version is an imperfect retrograde is important to *Traum-Formel,* as it is quoted in the closing section.

It is also possible to divide the Kernel-Formula into three 12-tone sets: *Montag* and *Dienstag* contain all 12 notes, as do *Mittwoch/Donnerstag/ Freitag* and *Samstag/Sonntag*.

Table 8. Showing the vertical and horizontal arrangement of pitches (C = 0) and the occurrence 043 (C E Eb) motive (boldened) in each Formula.

	M/D							W/D/F					S/S			
	1	2	3	4	5	[4	5]	6	7	8	9	[8	9]	10	11	12	13
MF	2	9	10	8	1			**0**	**4**	7	**3**			5	11	6	2
EF	**0**	**4**	**3**			2	5	6	10	11			9	1	7	8	
LF	7	6	5	11				1	9	8		**4**	**3**	**0**	10		

The vertical considerations are of less importance in individual component parts of the opera however, as although the background formulae 'chords' are fixed, the middle and foreground formulae are transposed independently. For example in *Traum-Formel* Michael's Formula is transposed up a minor third and Lucifer's Formula up a semitone so the intervals between these two formulas are a tone greater than they were in the Super-Formula, and the complete Eve Formula is not used at all.

One of the critical differences between Stockhausen's formula composition and serial composition is the treatment of pitch. The formula is 'thematic',

that is it assumes that the direction of the interval between two notes is part of its identity. Certain intervals are characteristic of each Formula. In the Michael Formula the perfect fourth is prominent, as are thirds in the Eve Formula, while intervals of the major seventh and augmented fourth are most abundant in Lucifer's Formula.

There are obvious symbolic/psychological and dramatic implications behind identifying characters with certain intervals. Michael's interval occurs earliest in the harmonic series, followed by Eve's, and then Lucifer's, putting the three characters on a continuum of simple to complex relationships to the fundamental. In addition the intervals carry more nebulous symbolic overtones within the context of Western music: the perfect fourth - the holy perfect interval; the third the most soothing and 'human' interval; the augmented fourth - the devil's interval and the major seventh the most dissonant and difficult interval.

This more thematic approach is reinforced by Stockhausen's identification of 'head motives' for each character. These consist of three (in Lucifer's case four) notes of each character's Kernel-Formula. Stockhausen treats them as motives in that both their pitch and rhythmic material is always retained. Lucifer's Head motive forms part of the musical material of *Traum-Formel*.

Example 12. Super-Formula Head Motives

The dynamic structure of the kernel differentiates seven dynamic levels:

ppp; *pp; p; mp; mf; f;* and *ff.* In addition Stockhausen makes limited of use of

traditional 'hairpin' dynamic modifiers. Each of the three formulae contains

the complete dynamic set from *ppp* to *ff*. There are 18 dynamics in each

part, the same as the number of notes (taking into account repeated tones):

this is not self-evident as not every note is given a dynamic marking.

As with the parameters previously discussed, dynamic structure is a

determinant of the characterization of each formula as well as the dramatic

structure of the cycle as a whole. This parameter will be discussed in greater

detail in regard to the Super-Formula where these traits are even more

obvious.

The tempo structure was evidently not added until the full Super-Formula

plan was developed. [7.] It uses a 12-degree tempo series based on M.M. 45

as the slowest tempo and M.M. 85 as the fastest.

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Table 9. The Super-Formula Tempo Series

	1	2	3	4	5	6	7	8	9	10	11	12
SF	45	47.5	50.5	53.5	56.5	60	63.5	67	71	75.5	80	85

Ingeniously, despite the existence of 18 tempo changes and 12 different

tempi, the Super-Formula's 60 beats also take exactly 60 seconds.

Table 10. Tempo structure of the Super-Formula

Mo			Di	Mi		Do			Fr	Sa				So		
†60	I	**63.5**	I 53.5 II	**63.5**	II 50.5	I 47.5	II	60	I 85	I 60	I 45	I 60	II 56.5	II 71	I 75.5	I 80 II **63.5**	I 67 I 60

† Tempos of M.M. 60 underlined and tempos of M.M. 63.5 in bold

The two tempi that predominate are in the centre of the 12 degree tempo

series: M.M. 60 which occurs 5 times and takes up 29% of the total duration

of the Formula; and M.M. 63.5 which occurs 3 times and takes up 25% of

the total duration. All other markings occur only once and none takes greater

than 7% of the total length. *Donnerstag* contains the greatest number (5)

and variation in tempi (the fastest and slowest markings alternating with the

most average).

 In general the tempi alternate faster then slower, tending to slower

markings towards the beginning of *Donnerstag* and tending to faster

markings toward the final act of *Samstag.*

The Proportions of the Super-Formula

The Super-Formula elaborates the material from the Kernel-Formula, adding pitch and rhythmic, tempo, dynamic, articulation and timbral information. Although the proportions are maintained, the new material makes the Formula two thirds longer (60 beats from the original number of 36). It can be categorized into four types of musical material:

1. Nuclear notes - the notes of the kernel formula forming the serially organized structure sometimes rhythmically elaborated;

2. Accessories - material that adds to the characterization of the nuclear notes. In *Licht* Stockhausen employ five types: Variation; Scale; Echo; Modulation; and Wind;

3. Silences - an absence of sound that is often given structural importance by its use in marking the end of a limb;

4. Coloured silences - 'silences' filled with inharmonic sounds such as speaking, clicking or kissing sounds.

The full Super-Formula as notated by Stockhausen is given below. For the most part operas are now marked by thick barlines and Acts by single barlines. The deviations will be discussed in Chapter 5. There are a total of 18 limbs. The four elements - notes, accessories, silence and coloured silence - have been annotated on Stockhausen's score.

Example 13. Super-Formula with annotated Musical Elements

The arrangement of these elements is calculated to give the greatest possible variation in type of material and in its duration as in the 'magic squares' above.

Table 11. Duration of elements of musical structure in the three Formulas showing type of Accessory and Coloured Silence. [8]

MF (in crotchet beats)

Note	4		2	2 1/2	2 1/2		3
Accessory (type)	3 VAR.		5 ECHO	2 1/2 SCALE	11/2 MOD	2 WIND	
Silence		1	2		3		4
Coloured Silence		2 KL†	3 [s]		5 ta		

† tongue click

EF (in quaver beats)

Note	7	4	3	2	1	5	8	6
Accessory (type)		5 VAR.	6 MOD	3 ECHO		2 WIND	4 SCALE	
Silence	3			1		8		
Coloured Silence		5 noise gliss	4 kissing noise	3 KL	8 gliss of coloured noise	8 breathe through instrument		

60

LF (in crotchet beats)

```
Note        5          2              4                                        3    7

Accessory   2   3      5                   2 1/2_____ 1 1/2      2_____1
(type)      MODSCALE  VAR                       ECHO                 WIND

Silence                    2              1

Coloured                   3                              2         2
Silence                    call                           call      call numbers
                           Numbers                        voicelessly voicelessly
```

The five varieties of accessories mentioned by Stockhausen in relation to

the Super-Formula are:

    1. Modulation - in each case meaning timbral modulation through

    flutter tonguing;

    2. Scale - a fast scale-like passage used as an introduction to

    nuclear notes or as a bridge between nuclear notes;

    3. Variation - improvisatory style variation of the pitches in the

    previous (and sometimes following) limb: not always retaining their

    register;

    4. Echo and pre-echo - repetition of nuclear notes with each repetition

    at a softer dynamic and sometimes timbral level;

    5. Wind - soft noise-like sounds instead of a silent pause: for example

    blowing air audibly through the instrument. The 'wind' accessory is

always notated with a pitch which should be discernable.

The exact relative durations of notes of the Kernel-Formula are retained in

the Super-Formula, however there is significant additional rhythmic material. In a general sense the Lucifer Formula is clearly the most complex, including quintuple, septuple and undecuple divisions. Kohl states that this 'reflects Lucifer's love of the complex, according to Stockhausen's characterization of him. ' [9.] Michael's Formula includes many triplets and only one quintuplet (as part of the 'variation' in bar two) Dotted rhythms are its most distinctive rhythmic characteristic. Eve's formula contains nothing more rhythmically complex than a triplet (if the sextuplet mordant figure in bar 1 is regarded as rhythmically identical to two triplets): it is the most rhythmically regular of the three, but interestingly also contains the most freely notated passages (for example the 'noise-gliss.' and glissandi of coloured noises mentioned above).

There is a substantial amount of regular reiteration of notes, for example the undecuplet in the first bar of Lucifer's formula. The penultimate bar of the Lucifer Formula also contains what amounts to a written out rallentando.

Each of the three formulae contains the complete dynamic set from *ppp* to *ff* : the Michael Formula is the most dynamically detailed of the three, followed by Eve's Formula. The Lucifer Formula is the only one of the three to contain combined dynamics such as *fpp* in bar 2 and *fppp* in bar 17. Each Formula has a bar containing the entire dynamic range: Michael in the second bar of

the *Donnerstag* Limb, and both Michael and Eve in the Act of *Sonntag*;

Lucifer in a *ppp* to *ff* crescendo in the second Act of *Montag.*

Surveying the dynamic profile of each opera reveals that each character

predominates dynamically in 'their own' opera: Eve in *Montag*; Michael in

Donnerstag; and Lucifer in *Samstag. Mittwoch* (the day of reconcilliation)

and *Freitag* (the day of temptation) are generally 'less eventful' dynamically

than the other days, while only *Donnerstag* (Michael's incarnation on Earth)

and *Sonntag* (Michael and Eve's Mystic union) contain every dynamic

marking. It is interesting to note the close mirroring of dynamics between

Michael and Eve in *Sonntag:* their Mystical Union.

The Super-Formula is a highly variegated structure with strong inherent

dramatic characteristics. Whether it is variegated and dramatic enough to

sustain 7 operas is a question that is impossible to answer until the first

complete performance of *Licht*. The next chapter will examine how these

features are transposed to a work of less ambitious proportions.

Footnotes: Chapter 4

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1. Jerome Kohl, 'Into the Middleground: Formula Syntax in Stockhausen's *Licht'*

Perspectives of New Music 28 No. 2 (1990), p. 265

2. Kohl, pp. 265-266

3. Karlheinz Stockhausen, *Texte zur Musik 51977-84', : Composition* (Cologne: DuMont

Buchverlag 1989), pp. 145-159

4. Kohl, p. 267

5. Karlheinz Stockhausen, *Texte zur Musik 5 1977-84* , p.153

6. Kohl, p. 267

7. The derivation of the actual order of tempi is not entirely clear from the sketches shown

in *Texte 5.* One sketch (p. 159) shows the operas placed in order according to length,

given a central pitch and then a transposed pitch which determines how the tempo will vary

from a norm of M.M. 60. For example *Samstag's* pitch transposition is four semitones, so its

tempo is transposed up four steps.

Tempo Transpositions in the Super-Formula

Day	So	Mo	Do	Fr	Sa	Di	Mi
Duration	11	10	9	8	7	6.5	6
Central Pitch	C	Eb	F	G	F	A	Eb
Transposition	Db	Eb	F	G	A	Bb	C*
Deviation	+1	0	0	0	+4	+1	-3
Tempo	63.5	60	60	60	75.5	63.5	50.5

* later changed to D, but without altering the Tempo proportionally.

Stockhausen's sketches from *Texte* 5 (p.159) then show a scheme in which a set containing all interval classes between 0 and 6 is deployed across the formula and each opera is given a principal pitch/tempo (usually its first note). Subsequent notes in the opera result in proportional transpositions of the principal tempo.

Tempo Transposition in the Super-Formula

Mo				Di		Mi			Do					
Eb	E	Db	‖	**Bb**	‖	**D**	B	‖	**F**	B	**F**	C	**F**	‖
60	63.5	53.5		63.5		50.5	47.5		60	85	60	45		60
0	+1	-2		0		0	-4		0	+6	0	-5		0

Fr			Sa				So		
G	F#	‖	G#	**A**	A#	‖	**Db**	(Eb)	(C)
60	56.5		71	75.5	80		63.5	67	60
0	-1		-1	0	+1		0	+2	-1

8...The Structure of the Super-Formula is discussed in greater detail in the following two articles :

Michael Manion, *Introduction to the Super-formula of* **Donnerstag aus Licht,** Ideas and Production: A Journal of the History of Ideas 11 (1989): pp.73-84

Rudolf Frisius, *Komposition als Versuch der strukturrellen und semantischen Synthese: Karheinz Stockhausen und sein Werk-Projekt* **Licht,** Neuland Jahrbuch 2 (1981-82): pp.160-78

9. Kohl, p.273