9 The Serial Music of Karlheinz Stockhausen

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Karlheinz Stockhausen was one of the first European composers to write serial music (or – to distinguish it from the dodecaphony of, for instance, Schoenberg, Berg, and Webern – multiple serial music). He is also one of its most high-profile representatives: for Stockhausen, serial thinking was a complex and life-long 'mental attitude' which went beyond composing (Stockhausen 1963i: 48; Stockhausen 2014c). With the start of serial composing in the early 1950s up until the end of his life, Stockhausen played a role in countless compositional, technical, and aesthetic innovations, something which is also reflected by a range of new terms applied to his musical works. Such terms include point music, group composition, statistical field composition, moment form, process composition, variable music, formula composition, scenic and multi-formula music, and more. In a nutshell, it can even be said that Stockhausen's entire work is marked by serial thinking, even if some phases – such as his 'intuitive music' – seem distinct at first glance. The chronological cornerstones of his serial work comprise the ensemble piece *Kreuzspiel* (1951) and the *Klang* cycle – *The 24 Hours of the Day* – which came about between 2004 and 2007. Below follows a necessarily brief walk through the work, which stops at selected points, which will serve to explain the foundations and the constants, but also the creatively changeable dimensions of Stockhausen's serial thinking.

In summer 1951, Stockhausen participated in the Darmstadt New Music Courses for the first time. He met the Belgian Karel Goeyvaerts (cf. Delaere 2010 and 2011; Misch and Delaere 2017), who had the first (multiple) serial composition in Europe under his belt with his Sonata for Two Pianos, which he had just completed. Goeyvaerts studied at the Paris Conservatory until 1950, where he became familiar with Olivier Messiaen's 'Mode de valeurs et d'intensités', which inspired him to create the sonata. In Darmstadt back in those years, there was much being said about the twelve-tone music of Arnold Schoenberg, Alban Berg, and Anton Webern. With the 'Mode', Messiaen went one step further than the composers of the Vienna School, who had only arranged pitches in rows: he organised the parameters of pitch, duration, volume, and attack intensity in the form of 'modes'. Goeyvaerts took the step towards *complete* serial design in

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the second movement of his sonata. Fascinated by the novelty of this music, following the 1951 Darmstadt Courses Stockhausen composed *Kreuzspiel* for oboe, bass clarinet, piano, and three percussionists, his first own comprehensive serial composition. In the run-up to 1953, other works of this type followed in close succession: *Spiel* for orchestra (1952), *Schlagquartett* (1952, revised in the same year as *Schlagtrio* for piano and two timpanists), Klavierstücke I–IV (1952–3), *Punkte* (1952/62) and *Kontra-Punkte* (1952–3), as well as the electronic *Studie I* (1953) and *II* (1954). Stockhausen soon described these works as 'point music', a term Herbert Eimert had coined in 1952, to describe the auditory impression of isolated successive tones. At the same time, Stockhausen wrote his first theoretical essays, in which he attempted to explain and clarify the new type of composition.

Basic aspects of his serial thinking were distinct even in *Kreuzspiel*, in that the serial organisation of a composition always represents a complex and procedural structural principle which arose from a superordinate work idea. From individual elements to large shapes, everything musical in the work is there to be seen, and with this the entire serial organisation is in a coherent context. In *Kreuzspiel*, for example – as the title indicates – it is about the 'idea of a crossing of temporal and spatial processes . . . in 3 stages' (Stockhausen 1964c: 11). Stockhausen selected a twelve-tone series as the basis of the regulations to be applied to the material, which he linked with two groups of six different dynamics, twelve intervals, and twelve durations (Blumröder 1993: 39–56). With this, though, following additional serial predeterminations with regard to the musical material, at the stage when the music would be played the matter was not one of initial exposure of the initial series with subsequent derivations or permutations; rather, it was about the procedural emergence and passing of the initial series, whereby it undergoes an 'inner change' (Blumröder 1993: 56).

On a more general level, in his essay on the 'Criteria of Point Music', Stockhausen speaks of the 'subordination of tones to a unified principle', hence *idea* of the work. Important factors here include the 'singularity' of the work idea, and 'lack of contradiction' between the idea and the material regulations and the equality of all individual parts. The 'single element', in turn, is 'the tone with its four dimensions: duration, intensity, pitch, colour' (Stockhausen 1963e: 18–19). As a matter of fact, in the case of 'point' compositions, an individual sound is the largest unit. This is because the determinative procedure aims to tie together different sets of characteristics that emerge at the interfaces of individually characterised single tones. In contrast to earlier composition methods, the individual tone acquires

a completely new status in that it carries within the idea of the whole thing – by which it was generated – as a structural moment. In his 'Work Report' (on work undertaken between 1952 and 1953), Stockhausen formulated this as a premise of point composition: 'To begin with, all form should set out from the point from the individual tone – and flow back into it' (Stockhausen 1963a: 36).

This new type of concentration on the individual tone as the 'largest formal unit' can also be explained by the demand for 'unification' and 'lack of contradiction' within the superordinate structural principle, since the functional tonality of the tones is no longer determined by that which goes before and after them (Stockhausen 1963f: 76). With this, an additional aspect comes into play: the expansion of serial composition to all sound parameters meant a radical abandonment of previously regulative techniques of musical organisation. Stockhausen was well aware of this fracture: following the period of the Nazi dictatorship and the Second World War, he intended to preside over a rebirth of music with serial composing. In 1953, he emphatically wrote in the essay 'On the Situation of the Métier': 'It should not be forgotten, however, that seldom has a generation of composers had so many opportunities and been born at such a fortunate point in time: The "cities are erased" and we can start from scratch again irrespective of ruins and "tasteless" remains' (Stockhausen 1963i: 48). For Stockhausen, serial composing was a 'new musical language', which, after the 'derailment of German Romanticism' (Stockhausen 1963i: 48), opened up the possibility of overcoming subjective and national tendencies:

> Around 1950 a new generation began the formulation of a new musical language which contained all the basic premises to allow the creation of a new, collectively supranational and largely supra-personal language. Terms such as 'point music' and 'serial music' were chosen to describe it, and if the term 'European' hadn't gone to the dogs economically and politically, one might indeed talk of a 'European music'. (Stockhausen 1964f)

Like other composers, Stockhausen appealed to Anton Webern in particular: it was in Webern's twelve-tone works that he saw an expanded compositional predetermination, if still bound to the idea of the series, most strongly mapped out. Stockhausen also analysed Webern's music from a serial perspective: in the Concerto for nine instruments op. 24, 'some once-chosen *Gestalt* (theme, motive)', in Stockhausen's eyes, was no longer essential. What was essential was 'rather the proportional sequence chosen for pitches, note values and dynamic levels'. The 'Schoenbergian thematic serial principle' was replaced by a procedure whereby a certain

number of parameters – in a constantly changing combination – served as a sort of 'structural mediation' (Stockhausen 1963g: 26). While Stockhausen felt a 'contradiction' between the use of twelve-tone series and the recourse to traditional principles of sentence formation and form design in the case of Schoenberg, Webern's music offered him a starting point which he viewed as legitimate from the perspective of musical history. With the first serial point compositions, traditional '"Gestalts" – themes, motives, objects' have been replaced by 'a series of the most latent and striking transformations and renewals'. 'The same thing is never heard twice', Stockhausen insisted. 'Yet we have the distinct feeling that we do not fall out of an unmistakable, extremely unified construction. A hidden cohesive force, related proportions: a structure. Not the same Gestalts in a changing light, but instead: various Gestalts in the same light that permeates everything' (Stockhausen 1963a: 37).

In the early 1950s, Stockhausen consequently understood the serial organisation of material as 'a sort of support that keeps us from slipping'. To him, in its strictest form, it was necessary to retain this support until one was able to speak the new musical language 'without mincing matters' (Stockhausen 1963i: 48). However, in all Stockhausen's work, he never viewed his serial organisational forms as a rigid grid. Flexible handling of pre-established organisational structures is most clearly evident in the numerous 'inserts' in his works (cf. Assis 2016). At the end of the 1970s, Stockhausen confessed that he had initially composed his works in one go before considering them 'finished', but then, occasionally, 'almost in a state of fear that the whole thing was too theoretical', withdrew to consider 'sound ideas' which were 'not accommodated in the system' (Stockhausen 1989c: 323). In *Gruppen* for three orchestras, for example, in the highly complex four-part serial work structure, three longer free musical sections were inserted (cf. Misch 1999b). Only with this alternating combination does the work gain its specific dramaturgical element, something which is possible only because of the temporary rejection of serial strictness. Elsewhere, what this means is that 'inserts are always what are left out during the planning stage. They are not just events; they are always the events which are missing. . . . Inserts are the necessary additions in an organism' (Stockhausen 2014j: 311). Stockhausen's hint that he always composed the large form of a work 'intuitively and the microstructure mentally' (Stockhausen 1978b: 577) complements this description of the relationship between serial order and compositional freedom.

Although early serial composing was based on the model of twelve-tone music, and the starting point was often a series of pitches, from the start

composers acknowledged the challenge of finding comparable and above all practical forms of organisation for the other parameters: length, volume, timbre, and so on. Simply dividing these parameters, like pitch, into twelve equal parts led to unsatisfactory results, since an addition of rhythmic values does not correspond to the logarithmic principle of twelve tempered halftones within an octave. With *Kreuzspiel*, Stockhausen limited the dynamics to six values, which he used twice. In Klavierstück III, the 'specific organisation of the material, and as such the entire composition' are based on the principle of a serial order each element of which comprised three determinants (Blumröder 1993: 123). These include, for example, three dynamic values (piano, mezzo forte, and forte), three metric units of three, four, and five eighth values expanded into a series by multiplication, and a pitch organisation based on two sets of three four-tone groups and two three-tone groups, alongside permutations in units of three and so on (cf. Blumröder 1993: 123–37).

The serial organisation of *Kontra-Punkte* for ten instruments, on the other hand, is based on units of six. Stockhausen initially formed, for example, six different timbres: '3 different types of pairs of wind instruments and 3 string instruments with strings which are struck, plucked and stroked'. In the course of the work there unfolds a process which begins 'in a diverse world of sound', in which all timbres are to be heard; gradually the timbres are subtly reduced, until only 'a unified, unchanged output can be heard', the struck strings of the piano (Stockhausen 1964h: 20).

In 1953, with *Studie I*, Stockhausen composed the first piece of electronic music comprised solely of sine tones. Until this point, the parameter of timbre had been something that was not serially determined in compositions for traditional musical instruments, and this allowed electronic media to create completely new and work-specific timbres. What served as a starting point for *Studie I* was a sequence of five proportions which resembled a falling minor tenth (12:5), rising major third (4:5), falling minor sixth (8:5), rising minor tenth (5:12), and falling major third (5:4). A frequency selected at the beginning was multiplied with the factors of these proportions (Stockhausen 1964b: 24), so that further permutations for a sufficiently large number of frequencies could then be derived from the resulting frequency series. With the help of a permutation procedure based on a series of six, sound mixtures were then formed from the frequencies. The principle of 'mixing sound mixtures from simple tones' generates the 'mould construction' of the entire composition: '*Sounds form sound mixtures* ("Sound groups" – vertical); *sound mixtures form sequences* ("sound groups" – horizontal); *sequences form structures* ("sequence

groups" – horizontal or vertical); meaning that a uniform proportion of the whole work can be determined from a *group series*' (Stockhausen 1964b: 26; Stockhausen's italics).

As is shown based on these short work contexts, the term 'series' rapidly undergoes a modification with the advent of Stockhausen's serial composing. It no longer refers only to pitches, durations, volumes, and timbres; rather, it refers to the sequences of numbers and proportions which generate the structure of the entire composition. In 1953, Stockhausen's overall definition of the 'serial principle' is:

> that *for a given composition a limited set of* different *magnitudes* is chosen; that *these magnitudes are proportionally related;* that they are arranged in a definite succession and in definite intervals; *that this serial selection is made for all elements* of the composition; that from these 'basic series' further series of superordinate Gestalts are composed that are themselves serially varied; and that the *proportions of the series constitute the comprehensive structural principle* of the work to be composed and lend it the necessary formal consistency. (Stockhausen 1964b: 26)

One key work that fully implements this principle is *Gruppen*. The core of the work is one half of a symmetrical all-interval series, from which the entire work structure was derived, as if from a genetic code. As in *Studie I*, Stockhausen used mainly the interval proportions of this series: he transferred them in consistent ratios and in this way generated a structural space–time continuum (cf. Stockhausen 1963h; Misch 1998 and 1999b). This also solved two fundamental problems. For one, there existed a convincing classification system for the time level comparable to the pitches, with which Stockhausen worked from a permanent octave, which – like the pitch octave – is divided in logarithmic intervals and is transposable. Also, the new organisational system generated larger formal units. The details of these longer musical sections were handled by Stockhausen partially in accordance with statistical criteria – only the framework conditions were determined by the superordinate plan. The single tone was no longer the largest unit to be formed; rather, it was a so-called group of tones. The dominant experiential qualities of these group continued to be determined serially: 'Soon, however, I broadened the exclusively "point" conception of form. I hit upon *group composition*. In group series, pitches are grouped together according to mutual superordinate characteristics. And yet the individual pitches, which are to be heard grouped together, are still the point of departure' (Stockhausen 1963f: 76).

At the start of the 1950s, Stockhausen had postulated a system of strict handling of the row-bound organisational forms, for the purpose of

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avoiding echoes of the previously regulative musical language. During the 1950s, he gradually loosened his self-imposed strictness; however, he did it without abandoning the essential principles behind his serial thinking. One consequence on a technical level was the development of group composition. However, the complexity of serial notation influenced not only audio perception but also musical interpretation. After all, an extreme differentiation in the rhythmic area brings with it 'factors of uncertainty', which influence 'temporal precision . . . in performance' (Stockhausen 1963h: 126).

In order to ensure creative use of this inaccuracy, Stockhausen responded with statistical determinations of musical properties, and introduced the term 'field' into his terminology: 'series of field sizes' and 'field proportions' operate in '*statistical field composition*'; the abrupt 'shift from "point" to "statistical" temporal perception' was 'yet a further motive for statistical field composition' (Stockhausen 1963h: 129). 'The statistical conception of form works with *approximative determinations*. It deals with *degrees* of density of note groups; degrees of pitch register, of direction of motion; degrees of velocity, of change of velocity, of average intensity, of change in intensity; degrees of timbre and of timbral mutation', Stockhausen stated (Stockhausen 1963f: 77).

Aleatoricism, polyvalence, and variability are effective both at micro and macro levels in many of Stockhausen's compositions. In *Zeitmasze* for five woodwinds (1955–6), there exist five different 'pace settings' (the time measurements of the title) which combine precise time determination with flexible time design – 'played sequentially and simultaneously': '1. twelve tempos on a chromatic scale between single and double speed (bb. 60–120), measured according to clock time; 2. As fast as possible; 3. Start extremely quickly and slow down approx. four times; 4. Start at a speed approx. four times slower until 'as fast as possible'; 5. As slow as possible' (Stockhausen 1964g: 46; cf. Kohl 2017).

For the electronic composition *Gesang der Jünglinge* (1955–6), Stockhausen had a boy sing verses from the Apocrypha to the book of Daniel. Even though he introduced the creation of unknown, never-before-heard timbres into electronic music, this was when the human voice was, for the first time, included in the context of the new medium. The sung recordings were subjected to an extensive serial design process, which operated with, for instance, a series of seven intelligibility levels (cf. Stockhausen 1964i, 1964a, and 1964e; Decroupet and Ungeheuer 1998; Heike 1999; Toop 1981). There is also a mediation between electronically generated sounds and sung speech sounds, music and speech, sinus tone complexes and sung chords, and so on. Much is serially scaled and formed,

while other things are designed according to statistical criteria. In *Gesang der Jünglinge*, space is also used as a musical parameter for the first time in Stockhausen's output: in the four-channel (originally, five-channel) composition, the sound results are distributed across the four tracks of the recording and over the four loudspeakers during performance in a concert hall, according to serial criteria. In this way, the work constitutes the prelude to a series of other Stockhausen pieces which are composed as space music (cf. Stockhausen 1963d; Misch 1999a).

Stockhausen designated the location at or from which sound is generated a "topic" (Stockhausen 1963d: 152–75), which is to say an additional new parameter in addition to pitch, volume and timbre. The spatial dimensions were gradually expanded, a function not least of the available technical possibilities: *Telemusik* (1966), *Kontakte* (1958–60), and *Hymnen* (1966–7) are four-track; *Sirius* (1975–7) is eight-track; in the opera cycle *Licht* (1977–2003), there is a cubic loudspeaker model in *Oktophonie* from *Dienstag aus Licht*; the electronic music with sound scenes from *Freitag aus Licht* is twelve-track. The pinnacle of spatial polyphony is represented by *Cosmic Pulses*, the thirteenth hour of *Klang* (2004–7): Stockhausen composed twenty-four sound layers, each of which has its own tempo, overlapping with the others in the piece and, then, a total of 241 different 'space orbits' (Stockhausen 2014b: 65), distributed over eight speakers, for the individual sections of these sound layers.

If the large-scale layout of a composition is variable, then Stockhausen would also speak of 'polyvalent form' in such cases (cf. Stockhausen 1963b: 241). Klavierstück XI (1956) is probably the best-known example. This is composed of nineteen musical sections which are irregularly distributed on the score sheet. The interpreter can start with any group and also connect the following sections together 'unintentionally' (Stockhausen 1964j: 69). The sound groups are serially composed in detail and precisely notated, but superordinate qualities, such as tempo, the basic dynamic degree, and the attack intensity, are only determined by the respective previous group.

The *Momente*, that is 'moments', for soprano, four choir groups, and thirteen instrumentalists (1961–2) (Stockhausen 1964j, 1971b, and 2014h), too, are 'no finished work with a clearly defined beginning, form flow and end; rather, they are an ambiguous composition of independent events' (Stockhausen 1964l: 130). The idea of the 'moment' continues the group principle in technical terms, except with a higher level of serial 'freedom' and technical independence. The *Momente* combine many of Stockhausen's compositional experiences since 1951. In this regard, they are key, not just with respect to length and complexity. One central aspect is

the 'abolition of the dualism between vocal music and instrumental music, between sound and silence, between sound and noise' (Stockhausen 1964l: 130). Stockhausen transferred numerous qualities of electronic music into vocal composition, thereby establishing 'sounds scales' of 'articulations' and 'noises' (Stockhausen 1964l: 131–2). Using their hands, feet, and mouths, choir singers continuously generate noises, with and without aids. Underpinning this are scales which provide unvoiced, noisy consonants between vocal and instrumental sounds, and vowels between breathing and singing.

In the 1960s, there were two trends to be observed in Stockhausen's musical work which reflected further relaxation of the initially strict rules of serial composition. For one, in electronic compositions like *Telemusik* (1966) and *Hymnen* (1966–7), he fell back on already existent forms of so-called 'found music' (cf. Stockhausen 1971d; Erbe 2004). For a second, he granted far-reaching freedoms to those who interpreted his instrumental works. In *Telemusik*, forms of cult and folk music from different countries served as source material; in *Hymnen*, the source material was forty or so national anthems from all over the world, 'the most familiar music imaginable' (Stockhausen 1995: 122). While such a recourse to traditional, pre-existing musical material was something that Stockhausen could hardly have conceived of in the early 1950s (cf. Stockhausen 1971d: 80), in the context of increasing globalisation and mobility, he would establish a new, integrative concept of 'world music' or rather 'universal music' associated with the utopia 'music of the whole world, all countries and races' (Stockhausen 1971d: 75; cf. Schumacher 1998; Gruber 1998; Heile 2009). Also, the serial handling of material properties would became increasingly multipurpose on the path to technical composition from 1970 onwards: in *Hymnen*, Stockhausen developed the 'intermodulation' procedure, with which, for example, 'the rhythm of a hymn was modulated with the harmony of another hymn, and the result was in turn modulated with the constellation of timbres and with the melodic course of electronic sounds' (Stockhausen 1971c: 98).

Stockhausen's instrumental compositions of the 1960s were marked by a significant increase in interpretational freedom. In parallel, the term 'organism', which Stockhausen was already using in previous contexts as far as characterisation of his works was concerned, gained greater significance. Process compositions such as *Plus–Minus* (1963), *Solo* (1965–6), *Prozession* (1967), *Kurzwellen* (1968), and *Spiral* (1968) are based on serially designed form gradients which are 'enlivened' in detail by those performing, allowing one to experience the 'structure formation process',

which is to say 'the emergence and fall of multi-layered processes' (Stockhausen 1971f: 86). The processes applied in the scores enable individual 'multiple interpretations', as well as the integration of newer, unspecified materials for the creation of 'musical beings' or 'living organisms' (Stockhausen 1971e: 40). Live electronic media are also frequently used. The scores now define, for example, 'structural parts' and 'shape types', and the 'overall trend resulting from changes' or 'level of change', such as through 'transformation signs' (like plus and minus symbols) (Stockhausen 1971e: 43–6), which can mean higher, louder, longer, greater and lower, quieter, shorter, less. Unpredictable materials frequently considered by Stockhausen include sound outputs from a shortwave receiver: interpreters look for an output from the radio device and respond to it according to the fixed process given in the score.

The creative role granted to performers as the work was played peaked at the end of the 1960s in the text compositions that Stockhausen brought together under the description 'intuitive music'. These are purely verbal instructions which – when following the basic principle of serial scaling – form the opposite end of the spectrum from the strictly structured selective compositions of the early 1950s. The interpretations of these texts should not be improvisations of material already known; rather, they should continue to live up to the dictum of innovation by sharing experiences about 'the limited scope of the rational'. Following the many 'stages of primarily rational music', Stockhausen was now concerned with 'discovering different archetypes of musical processes through the different texts, each of which leads to their own musical happenings' (Stockhausen 1971a: 124). The zeitgeist of such years is also reflected in the spiritual dimension, in which one may find elements of the 'intuitive': traces of Fluxus and Happenings, hippies, the Vietnam War, the sexual revolution, and the student movement can also be found in Stockhausen's work.

However, once again, the 'mental-spiritual [*das Geistig-Geistliche*]' facet hints at another constant which has not yet been discussed: Stockhausen's music, from his first work to his last, features a religious overtone (cf. Stockhausen 2014g: 214 and 2014e; Peters 1999 and 2003; Ulrich 2006). Stockhausen originally grew up in a Catholic environment, in the Bergisches Land near Cologne. In a way that paralleled his own life experiences, and encounters with other countries and cultures, later on in his life he would distance himself from Catholicism in favour of an expanded universal belief. The conviction that the universe is sensibly ordered by the divine was and remained a central factor. The same principle of divine order and perfection is reflected in the small and the large,

and in nature and art. However, music is not just a depiction of cosmic order; at the same time, it also serves as a tool of ongoing worship of God. This conviction is the main thread of all Stockhausen's works and at the same time the cornerstone of his serial thinking. After all, from the start, Stockhausen understood the overriding structural principle of a work as a reflex of the 'universal order'. As early as 1953, he was occupied with the question of why composers attempted to organise 'everything existing in a composition . . . by one unified principle' (Stockhausen 1963i: 46), which is to say '*the proportions of the series*':

> Evidently, self-contemplation and the awareness of a universal, planned order go 'further than ever' and, with this, the desire to give the individual tone a very specific sense that transcends momentary saturation and the mere play of organising and combining; a sense, that is, of *music as a conception of that comprehensive 'global' structure in which everything is embraced*. (Stockhausen 1963i: 46–7)

This view is just as central to intuitive music as it is to the formula composition developed by Stockhausen from 1970 onwards (Stockhausen 2014e: 151–2).

The year 1970 marks a climax in Stockhausen's compositional career. The Federal Government sent him to the world exhibition 'Expo 70' in Osaka, Japan, as a prominent representative of the German music scene. In the spherical concert hall – built by the architect Fritz Bornemann in line with Stockhausen's plans for Germany's contribution – his works were presented for five-and-a-half hours a day for almost six months. It was a site for listening to a compilation of electronic and current instrumental compositions which were projected to the public through loudspeakers in surround sound. In this environment, following a long phase of indefinite, polyvalent and intuitive music, Stockhausen once again composed a comprehensive, serially determined work: *Mantra* for two pianos. For the first time, a so-called formula served as the musical nucleus of the work. The principle of composing with one or more formulas characterises Stockhausen's work from *Mantra* onwards, right up until the completion of the *Licht* heptalogy.

Stockhausen had defined the serial thinking of the 1950s as a dualistic kind of thinking based on gradual mediation between opposing pairs, but, in contrast, he also described formula composition with the metaphor that, now, it was possible to transform 'a mouse in a glass' (Stockhausen 2014a: 193; cf. Stockhausen 2014d: 274–5). The term 'formula' suggests different things: the magic formula in the sense of a magic word, a formula as known from a scientific perspective, but also Einstein's dream of a universal

formula (Stockhausen 2014d: 275). For Stockhausen, formula thinking was, at the same time, a global constant, which can be traced back to Franco-Flemish isorhythm, to Indian ragas and talas or to archetypes of Chinese or Greek music. Johann Sebastian Bach, Olivier Messiaen, and Anton Webern were Stockhausen's key figures in music history, and they knew about 'the ancient tradition of forming things with archetypes', he claimed (Stockhausen 2014i: 28). Stockhausen regarded formula composition as a 'differentiated further development of serial music . . . including the intermediate stages (namely: aleatoricism and indeterminacy or variable determinism)' (Stockhausen 2014i: 26), which brings back some essential qualities of pre-serial music which had previously been in a state of paralysis: melody, echoes of tonal harmony or the use of key intervals of tonal music, repeatability, singability, and tangible, concise figures and variative shape formation (cf. Stockhausen 2014k: 307–8). Nevertheless, the formulas themselves and the act of composition comply with serial regularities which are highly complex. A formula is no abstract sequence of sound properties, but rather a musical structure which is catchy, melodic, rhythmically specific, and individually characterised in many different ways. All musical characteristics, which were initially determined in mutually independent series of numbers and proportions when serial composition first started, are now synthesised in the formula (cf. Stockhausen 2014f: 254).

After Stockhausen had written works using a formula – such as *Mantra* (1970), *Inori* (1973–4), and *Sirius* (1975–7) – between 1977 and 2003 he composed his opera cycle *Licht*, based on a unique so-called 'super-formula'. The super-formula for *Licht* is a three-part melodic structure lasting around one minute, which served as a matrix for the twenty-nine-hour heptalogy. In addition, the action of the cycle is included, at an embryonic level, in the music-genetic material of the super-formula. In the term 'multi-formular music', Stockhausen summarised the further development of formula technology thus:

> *Multi-formula music* works with three or more *formulas*, the synchronous combination of which leads to a *super-formula*. . . . *Multi-formular composition*, following a long historic turn of the expansion spiral (increasingly complicated proportions in rhythm metrics, melody harmonics, timbristics, dynamics and typology; including all serial extensions up to extremely aperiodic, aleatory, momentary and universal-stylistic), picks up where classic two-subject matter stumbled in favour of a processual, discursive formation. . . . *Multi-formular music* is the polyphonic integration of all musical achievements of the twentieth century. (Stockhausen 1989a: 667)

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The three levels of the super-formula represent the three main characters of *Licht*: Eva, Michael, and Luzifer. Each formula is based on core pitch material: Eva's melody has twelve chromatic semitones, Michael's has thirteen, and Luzifer's has eleven. Seven horizontal sections make up the basic material for the seven opera days. On the basis of the core pitches, Stockhausen composed 'core formulas' for Michael, Eva, and Luzifer, which differed melodically, rhythmically, and dynamically. These were supplemented by a variety of musical characteristics and events unique to each one. Each formula includes not only pitches, durations, intensities, timbres, and (where appropriate) spatial positions. Also included are echoes and pre-echoes, improvisations, scales, pure and timbred breaks, modulations, rhythmic characterisations, sounds, and semantic details.

Ultimately, the super-formula for *Licht* results from the vertical combination of the three individual formulas. All musical contexts of the opera cycle are generated from them, the compositional structure becoming increasingly condensed and moulded through segmentation, spreading or compressions, concatenations, overlaps, transpositions, insertion of segments, and other procedures. Musically, each formula represents one of the three main figures: Eva's formula is particularly melodic, featuring rising-falling-rising fine glissandi, with a central interval of a major third. The direction of Michael's formula is a descending one: characteristic intervals are fourths along with a 'floating tritone' at the end; the main characteristic is the dynamic; the formula contains a triple echo. The Luzifer formula melody begins with tone repetitions in elevenths, followed by a passage which 'jumps up twice and falls each time thereafter', and is pervaded by dissonant intervals like sevenths and tritones, along with odd-numbered rhythms such as fifths, sevenths, thirteenths, or 'irregular complexity' (Stockhausen 1989b: 357–8). Luzifer's formula also includes noises, unvoiced consonants, improvisations, and a double falling echo. The three cosmic spirits Eva, Michael, and Luzifer appear in the various sections of the opera, where they sing, play, and dance.

The movements of the musicians are normally fixed in terms of composition. The figure of Eva is linked to the basset horn, Michael is connected with the trumpet, and Luzifer's instrument is the trombone. For each day of the week there are individual timbres, symbols, scents, elements, and more, depending on the topic of the weekday. For the events in *Licht*, Stockhausen drew on numerous cultural and historical sources, such as religions, mythologies, fairy tales, or collectives of literature. Even biographical information was included in the scenario. In *Licht*, Stockhausen consistently put forward the basic idea that manifested itself

in his earliest years of composing: he wanted to 'develop worlds from one core'. That is to say, '*Licht* is nothing more than a galaxy developed from a single core formula' (Stockhausen 2014i: 26). Stockhausen's music, which is neither expressive nor subjective or emotional, aims at what is universal, timeless, binding for all. This characteristic is reflected not least in the temporal cycles which are the subjects of his compositions: in *Sternklang* (1971) Stockhausen translated constellations into notes; *Sirius* (1974–7) is a work about the four seasons of the year; *Tierkreis* (1974–5) is music dedicated to the twelve zodiacal signs; *Der Jahreslauf* (1977/91) illustrates the temporal course of millennia, centuries, decades, and years; the *Licht* cycle stages the seven days of the week. The last major cycle, incomplete at the time of Stockhausen's death, *Klang*, is dedicated to the hours of the day, but ends with the twenty-first hour, *Paradies*. In *Klang*, Stockhausen returned to a simpler serial process based on a double all-interval series. The sketches of the *Klang* cycle show that most of the hours were composed without complex predeterminations. As Stockhausen put it in the 1950s, stating it as the goal of serial notation, he wrote *Klang*, so to speak, 'as if one had grown a beak' (Stockhausen 1963i: 48).

Looking back at Stockhausen's complete oeuvre, the consistency and scope of his serial thinking are conspicuous. The associated 'mental attitude' can be described as a fruitful mixture of deep faith, well-founded knowledge about the cosmos and nature, and an almost inexhaustible artistic creativity and creative power, coupled with the standard of always making heard something musical that was new and unknown, again and again. One of the essential premises of serial composition lies in equal rights for all elements of a work while at the same time allowing for consideration of their diversity. This is associated with a departure from the hierarchical thinking that characterises tonal music above all else. Stockhausen was deeply convinced of the sustainability of serial thinking, not least because it opened up a wide range of compositional integration options and rejects subjective expression in favour of general, cosmic truths.