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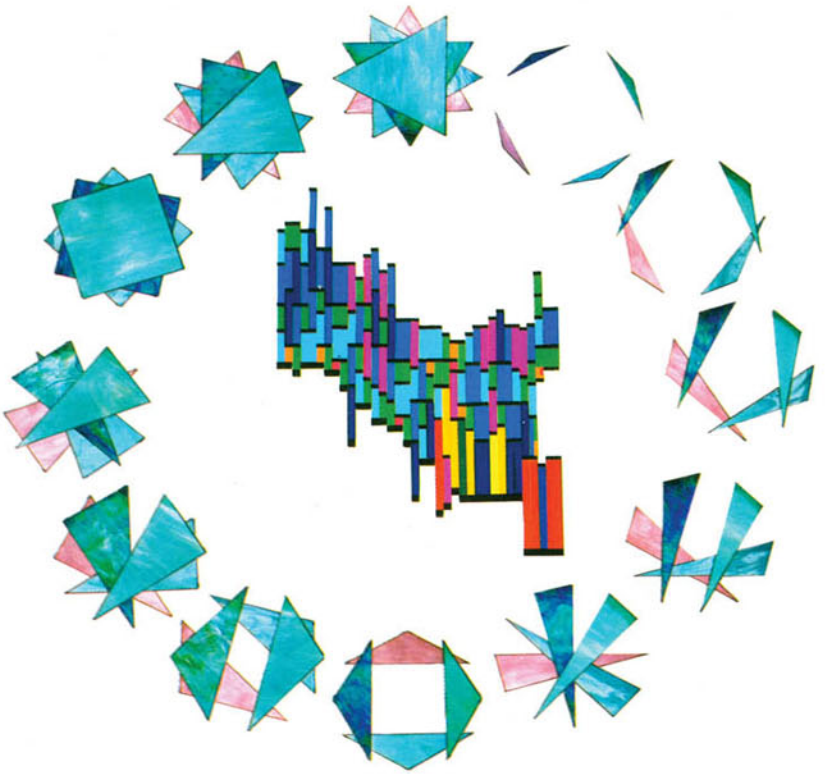

Peter Schat

The Tone Clock

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Peter Schat

Translated from the Dutch and introduced by Jenny McLeod

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NIGEL OSBORNE

PREFACE

On the occasion of the one-hundredth anniversary of Arnold Schoenberg's birth, an exhibition of his manuscripts, notes, sketches and documents was arranged in 1974 in the Van Gogh Museum in Amsterdam. The exhibition was opened by one of the then last-surviving disciples of the master, Max Deutsch. He did this with an unusual, prophetic tone, a tone that resonated with the great convulsions of the last days of imperial Vienna, the days of Franz Joseph, of Freud, Weber, Musil, Kloos, Kandinsky, and not least Schoenberg, Berg and Webern.

With great oratorical talent, Deutsch managed to convey to his audience something of the numinosity and awe felt by him and his fellow pupils at the appearance of the first twelve-note chord, the first twelve-note row, and at the proclamation of dodecaphony, through which a new democratic realm of the tones would be built on the ruins of the old feudal 'tonality'. The apotheosis of Deutsch's address, an address full of social symbolism and world perspectives, was his account of the death of Arnold Schoenberg: *"Und hat er vom Sterbebett dreimal nachdrücklich gerufen—Harmonie! Harmonie! Harmonie!"* (And from his deathbed, he called emphatically three times—Harmony! Harmony! Harmony!)

One might interpret these words in at least three ways: as a cry of despair, as an invocation, or as a cry of jubilation. I myself heard mainly an invocation, because my disappointment at the lack of harmonic differentiation in dodecaphony and serialism had not diminished over the course of the years.

In the year 1974, Célestin Deliège's *Conversations with Pierre Boulez* also appeared. In this, Boulez says: "If we can unite harmony with melodic line under laws common to both then we begin to find a solution that will considerably enrich the musical vocabulary." This also sounded like an invocation, like an incitement to bring to the light of day a solution to the harmonic problem.

After my teacher Kees van Baaren, it was Schoenberg and Boulez particularly who guided my development. It may be that the end-result might not have pleased any of the three. But they were such good teachers because they were the first to understand how essentially important it is for the development of music that every composer should discover his *own* voice.

The way to this discovery, the way to 'wholeness' and harmony, may seem crooked and contradictory in many respects, but in one sense it is always straight: as apparently the only way to that one goal. That wholeness, after all, also contains the experiences undergone on the way to that goal. These can at any rate be helpful in obtaining a better insight into the nature of the aim pursued. Harmony is after all a dynamic, not a static concept: in it, contradictory poles of musical energy are united—as, for me, and hopefully others, in the tone clock.

INTRODUCTION

Peter Schat has been known to the Western world for some time as one of Europe's major composers. His writings on music, however, are less well-known, Dutch being one of the more inaccessible languages of the world. Their quality may come as a pleasant surprise.

In the first part of this book, which focuses upon theoretical and technical matters, we can trace the development of a musical mind that never stopped hunting for a more systematic, more differentiated solution to the problem of chromatic harmony. A former pupil of Boulez (whom he describes as a 'stern guardian' of the musical language), Schat clearly inherited his master's concern for the state of the language: he continually stresses the composer's responsibility in this respect. Likewise he shares with Schoenberg, another such musical 'guardian' and guiding hand, a deep desire for musical order and coherence. Himself a fully-fledged note-row composer from his earliest days (to the point, as he says, where the series became a "sort of instinct" with him), he always saw the twentieth-century problem as a twelve-note one. No solution that did not involve all twelve notes was acceptable to him; at the same time, he found the methods of Schoenberg and Boulez themselves harmonically unsatisfactory.

The essays and articles here were written over a period of nearly thirty years, from 1963 to 1992. (Only the first eight [technical] chapters are arranged chronologically, however.) During this time, Schat's thought was to go through some quite radical changes. He was a confirmed serialist for a number of years, thus his ideas from that period (he has privately expressed some reservations about their tone) reflect much of the ethos of the time: the requirement for pitch-groups to be 'anti-tonal', the 'taboo' octave, the composition of his music at a desk, never at the piano. Yet at the same time, his mind was already protesting at the 'corruption' which arose in serialism through the manipulation of the note-row as a set of numbers, rather than as a relationship of musical pitches.

Thus he began to focus upon the *interval* rather than the single note, and upon interval-permutations rather than note-permuations—already an innovative and original approach. By 1966, in "Circular Fragment of a Theory", he was concentrating upon the symmetrical all-interval series, from which, through a set of permutations involving double rotations of the intervals, he obtained *four* related series (where normally a symmetrical series, which always contains its own six-note retrograde has only two forms, the O-R form and I-RI form). In this rather elegant contribution to traditional dodecaphonic theory, therefore, he was already thinking of the note-row in terms of

symmetry, of chromatic triads and their inversions, and of an inner mobility within the series, all of which were later to become integral elements of the 'tone-clock proper'.

At this point, however, Schat (along with Darmstadt in general) found only five of the twelve chromatic triads acceptable (quite apart from the fact that he had not yet isolated and named them all). Other note-relationships had too many 'tonalising, centripetal' effects to be accommodated in a musical universe conceived of as centrifugal, 'perpetually expanding', in line with the current cosmological concepts. In his system of cyclic *vertical* interval-permutations ten years later (see ''The Reason of a Dream'') he was becoming more democratic. Now a number of the remaining triads are also sprinkled about liberally in the form of six-note chords, although he is not yet actually thinking completely triadically. (Here is an interesting method for determining what might be described as the various [intervallic] 'modes of being' of a single chord [see Figure 3.6]). By the time we reach the formulation, in 1982, of what I refer to as the 'tone-clock proper', (see ''The Tone Clock''), the need for musical democracy has become absolute: all twelve chromatic triads are now present, named and accounted for, and none, theoretically at any rate, is preferred over another.

Meanwhile, Schat had begun to take singing lessons. This was to have a profound effect on him as a composer. After that, as he says, he began to sing to himself everything that he wrote, and now he composed exclusively at the piano. In short, over the years he gradually arrived at a point of view in many respects the opposite of that with which he began. At no point, however, did this imply any abandoning of technical considerations: he saw the problem rather as one of 'defeating [serial] technocracy with technique', a technique that would 'respond, instead of amaze us'.

His political thinking, the product of an uncommonly passionate social awareness, was to undergo a similar revolution. After violent and very active opposition to the Vietnam War (he was a leader in public demonstrations; the provo movement had its headquarters in the basement of his Amsterdam house) and a passing love affair with Cuba (a country he visited twice), he became disillusioned by the later developments of the communist dream and was eventually reconciled to liberal democracy as the more hopeful path for humanity. It is not, certainly, that his basic aims actually *changed* throughout all of this: any person who has not stopped thinking will usually find himself obliged to change his mind about many things, as experience and his critical

faculty set before him all that is insufficient and unsatisfactory in his current ideas. But the *purpose* of that change, whether musical or political, always remains the same: the hope of achieving a better solution.

The tone clock, for Schat, was to become that 'better solution'. And on this subject a little discussion may be helpful, since a number of rather far-reaching implications are involved which Schat himself, essentially a practical musician, takes so for granted by now that he does not always dwell on them at much length.

There are two main aspects to the tone clock itself: it is a twelve-note harmonic system; but it is *also* a chromatic 'map', a tool providing a systematic and comprehensive view of the whole chromatic territory.

Schat isolated and named the twelve chromatic triads, as I have said. This, when one thinks of it, was a very logical step; one wonders now why it did not happen sooner. We had already named three of the triads (the old major triad and its inversion the minor triad, and the augmented and diminished triads). It might well appear that the next step was to name *all* of them, rather than to reject the triadic concept altogether and backtrack to the interval as the common (analytical) unit, as the practice has been in this century.

It is true, of course, that the augmented and diminished triads were commonly regarded as a chromatic alteration of the natural triad and a dominant substitute respectively, thus as still fundamentally bound to the old diatonic tonality, so that there is no doubt a good case for the necessity of this long period in which the interval predominated. Yet at the same time, Debussy, in particular, had already well and truly liberated the above triads from any such connotations of *functional* diatonic tonality, for in his work they most commonly exist in their own right, and not simply as a substitute for the natural triad. Indeed, in respect of the chromatic triads, Debussy is undoubtedly the most important precursor, for they all appear in his music, used, moreover, in ways which indicate quite clearly that he was aware of them as independent entities. A tone-clock analysis of this music is generally far simpler, far more sensible and illuminating, than any attempt at a 'traditional' analysis, and considered in these terms it emerges as much less 'vague' than is commonly supposed.

The fact that Schat's classification is *absolute* (i.e., there *are* no other triads) means that there is no combination of chromatic notes (apart from the intervals, naturally, which have long been classified) that cannot be accounted for in terms of the triads, generally more succinctly than is possible using just the interval. One's overall view of the chromatic region is thereby simplified, in that the pitches can be perceived in terms of a unit larger than the interval; at the same time, what is perceived is more complex, in that a triad is more

complex than an interval. Moreover, whether consciously or not, *every* composer uses the triads, they are common to *all* our music (unless one has abandoned the twelve notes altogether); thus once one has become familiar with all of them, it is much easier to see the relationship between one work and the next, or between one composer and the next. One can much more readily *locate* the pitch-elements of a given work in relation to a *total* chromatic picture. Therefore to my mind a knowledge of the chromatic triads has the potential to revolutionise the way we analyse (and also, for performers, the way we *learn*) twentieth-century music in particular. If the triads are taken up in this way, this in its turn will naturally affect the way we as composers *think* about music, perhaps in ways that some may not care for; and yet the new clarity that emerges in one's chromatic perceptions amply compensates for what might seem an undesirable standardisation or generalisation. (The latter can then be counteracted consciously if one wishes, surely not such a bad thing.)

But the tone clock, I have said, is also a chromatic harmonic system. Schat imagines each triad as a base-unit generating its own 'chromatic tonality': twelve triads, hence twelve chromatic tonalities.

He discovered that *each* of the chromatic triads (with one significant exception), when multiplied, or 'steered', by a particular symmetrical tetrad—that is to say, when transposed four times onto its four notes—reproduce amongst themselves all twelve notes of the chromatic scale, without any note-repetition. In short, he found that there was actually a *chromatic equivalent* to Rameau's *diatonic* theory; for in the latter, we may recall, the natural major triad, when transposed onto the tonic, dominant, and subdominant respectively, produces all the notes of the *diatonic* scale (with two note-repetitions)—and the roots, or 'steering-notes', of the triads are likewise in a symmetrical relation to one another (see Chapter 7, Part I).

Where the chromatic triad concerned is invertible (for not all of them are), the original and the inversion are generally each included twice. The symmetrical *steering* tetrad (no matter which it is) is always in a *different* 'tonality' from that of the triad it steers, thus a whole great network of 'natural' tonal interrelations emerges. Certain tonalities, for instance, can be steered by the same symmetrical tetrad; thus they are naturally related *to each other* through the fact that they share a common steering. Any natural order of this kind is surely grist to the mill of the composer, who can use such inherent vertical-horizontal relationships to endless structural advantage, as many of Schat's examples demonstrate (see ''Symposion'', for instance).

The twelve-note tonalities (or 'hours', as Schat calls them) formed by the above steerings are conceived of not as 'melodic' twelve-note rows but as

harmonic fields, whose sub-fields (the constituent triads) may come in any order; likewise the notes *within* the triad may occur in any order, vertically or horizontally.

By an impressive imaginative stroke, Schat extended into the chromatic realm exactly the same principles of note- and chord-mobility that applied in the old diatonic system. And furthermore, it works—for it was not merely the 'external application' of an abstract idea. (With the latter, indeed, music can be *made* to perform almost any imaginable contortion). Rather, the concept evolved gradually in Schat's own work, in line with his need to discover a more deeply 'responsive' musical technique. By comparison with the rigidly fixed note-order of the Schoenbergian method, the potential for spontaneity and flexibility in the chromatic composing process is thus enormously enhanced, whilst cohesion is maintained at the *deepest* level by the harmony, or tonality, just as it was formerly in the diatonic system. ''The tone clock is to the Viennese School as Rameau was to the Netherlands Schools'', writes Schat. Exactly that, and to my mind an evolution in principle of a similar order.

These principles of note-mobility could only emerge in the first place because, by the time of Rameau, the natural triad had achieved an *abstract existence* of its own, such that variations in its note-order did not affect its essential unity, its basic tonal nature. Now, with Schat in the last quarter of the twentieth century, the *chromatic* triads have achieved their own abstract existence. This is timely and rational, moreover it *feels* right, for by now we can all of us easily sense the uniqueness, the individual character, the essential *tonal unity* of each of the chromatic triads. We may call to mind D.H. Lawrence's dictum (quoted by Schat, and singularly significant in the development of music): ''The ideas of one generation become the instincts of the next''. Let us now imagine a musical future in which we have *all* acquired as complete a grasp, *instinctively*, of the *twelve* triads and the principles of *chromatic* tonality as we presently have of the old natural triad and diatonic tonality (in Rameau's own time so novel a concept that it aroused violently partisan arguments). The tone clock is musical civilisation on the move.

There is a significant difference in this harmonic system, however, and that is that there is *no inherent tonic*. (Actually, no more was there in the old diatonic system for the 'tonical' hierarchy only arose there through the crystallisation of certain *habits*, that is, through a style-based *preference*—as opposed to any innate *necessity*—for certain melodic/harmonic conventions over other possible combinations—but that is another story.) However there is certainly a 'nodal' quality to the harmonic changes, a sort of harmonic fibre in which the changes can be felt as swinging from one 'node' to the next, in the same *sort* of way that the old dominant and subdominant chords, for example, 'swing about'

the tonic, although we are in fact (tone-clock) worlds away from diatonic tonality. The harmonic *articulation* is equally clear, and for the same reason: namely, that the harmonic deep structure is consistently *symmetrical.*

What is most interesting, however, in view of this symmetrical deep structure, is that in his actual *music* Schat rarely focuses upon the symmetries themselves. Webern, for example, who in his twelve-note music made such habitual use of the symmetrical series, also focused upon the symmetrical motivic properties of the series to engender the actual musical *structure.* In Schat's music, by contrast, although the same symmetrical motivic properties are invariably *present* (due to the inherent nature of the 'pure' tone-clock tonalities), they have now become *absorbed into the language.* Schat simply takes them for granted, using them in fact to write overtly free and asymmetrical music, in much the same way, for instance, that composers of the past took the inherent symmetries of the diatonic system for granted, and treated them simply as a paradigm from which some real music had then to be created.

This seems to me an evolution (one might even say a liberation) of quite a fascinating kind, for we have here the *independent existence* of a comprehensive chromatic deep-structure network (namely, the entire tone-clock network) with its *own* consistency. The individual work can then take this as its starting-point in any way the composer chooses (using only one or two tonalities, say); it no longer needs to *establish* this network, to focus upon it, or to 'prove' it, for (by virtue of what we already *know* about the network) consistency at the deepest level has already been conclusively demonstrated and can thus be assumed.

The steering principle sits at the heart of the tone clock. In the simplest sense, it is as old as the principle of organum. There the upper line paralleled the lower at the interval of a fifth—or we could say in tone-clock terms that it is an *interval*-steering, of a fifth 'steered by' the given melodic notes. The same principle reasserted itself in the theory of Rameau, in the form, for instance, of the natural triad steered by the diatonic scale (giving us the common chords) and by the circle of fifths (steering at a *deeper* level, giving us the cycle of keys). Schubert, Chopin and Wagner enlarged upon the steerings (adding new root-movements) and upon the chords themselves (adding German and Neapolitan sixths, and the augmented triad), Chopin, Liszt and Mussorgsky upon the scales (adding pentatonic, wholetone, and 'modal'). Debussy expanded both chords and steerings again to include all the chromatic triads, in his manifold parallelisms. Messiaen with his modes created a specific set of steerings: each group of 'limited transpositions' forms a deep-level steering, and within every individual mode, a single group (an interval, triad or tetrad) is steered symmetrically through a number of

transposed repetitions (steering on a higher level). Boulez took up the principle anew, in the form of the 'blanket' multiplication technique he refers to as *frequency multiplication.* And with Schat, behold its most recent transformation. (This bird's eye view omits the finer points, naturally, but still it gives a fairly general picture.)

Steering is actually the most fertile of compositional principles. One of its prime strengths is that it operates on a series of different *levels.* The individual notes of the triads (or groups) within any given harmonic field *always* have the power to 'sprout' new groups of notes on a *higher* steering level, or conversely, the triads themselves can always be reduced to their 'generators' or steering notes (or 'roots') on a *deeper* steering level.

The existence of steering levels was the mainspring of the old diatonic system. There the cycle of fifths steered the *keys* on a deeper level, and formed the *primary triads* on a higher level, and then the secondary dominants on a higher level again. The primary triads reduce in terms of their notes to the diatonic scale. The diatonic scale steers the natural triad again, producing the common chords, which in their turn 'sprout' melodic lines, and so on.

With the advent of the tone clock, we now see that the same *sort* of levels are inherent (and positively invite further development) in the chromatic realm as well. They actually result from the *the principle of harmony/tonality itself,* and not merely from *diatonic* tonality, which represents simply one limited manifestation of that principle in action. A linear, essentially contrapuntal technique such as that of the traditional dodecaphonic method has no such advantages; it is without harmonic *depth.*

Steering is a sort of musical equivalent of the 'life principle', as the power of a group of notes to manifest itself again and again at any point in the system by 'sprouting' from an already-existing note, i.e., by using that note as its 'generator' or steering note, and transposing itself accordingly so as suddenly to 'appear from nowhere'—or rather, from the one note that was already there.

Note, by the way, that in his "The Tone Clock" chapter, and also in his earlier analyses, Schat's steering generally takes place from the *uppermost* note of each group, rather than the lowest note (steering notes always appear as the *white* notes in his analyses). The reason for this is that the principle itself spontaneously evolved in this way, interestingly enough, in his own music. (See the chapters "First Symphony" and "Monkey Subdues the White Bone Demon", in which the steering technique is already well-developed, even though he had not yet arrived at the complete tone-clock scheme.) Unfortunately, it has also given rise to some confusion as to what steering actually *is.* Later on, he began to take steering from the *lowest* note as the 'norm' (although steering from an inner note, or from the upper note is still

quite possible). The advantage of taking the lowest note as the 'normal' steering note is that, after Rameau, this is what we are all accustomed to: we have habitually thought of the 'root' (or lowest note of the triad in its most compact form) as the 'generator' of the triad, thus the 'steering note' can be seen as a king of 'root' note.

It is worth considering Schat's relationship to Boulez in a little more detail, for the latter, as might be expected, had an extremely profound influence upon him. Those who later imagined that Schat had somehow 'betrayed the cause', had simply withdrawn from serialism in some kind of 'reaction', have failed to understand that he could never have moved away from Boulez without first coming completely to terms with him. Schat is not and will never be a reactionary: he suffers from no 'nostalgia for the past'. He is on the contrary acutely aware of and attached to the present. Indeed to my mind he understands Boulez very well, and has never ceased to hold him in the highest esteem, but he also understands himself very well.

Only through the greatest faith in oneself and the greatest intellectual and musical integrity is it possible to break through such an inordinately powerful influence as that of Boulez, and most who came within that dazzling orbit as young composers never achieved this. Schat (as one of few) faced up personally to Boulez for two years (no small matter, as anyone who has ever worked with this master well knows). He worked his way through serialism in depth, and only left it when he had 'reached the other side' in his own mind. He did not have an attack of nerves and suddenly start 'going backwards'. This is why his criticism of serialism is so very much to the point: because he know *so well* what he is talking about. It is also why I consider him a 'post-Boulez' phenomenon—all the more convincing for his own style emerging as so different from that of Boulez, so much broader and earthier. It could well be, as he says himself, that neither Schoenberg nor Boulez might much 'like' what he has done. But then old Johann Sebastian did not much like what *his* composer sons were doing either, although history proved to be with them.

Schat could not really warm to Boulez's fundamental idea of the series as a *hidden* generator. The reasons for this are partly temperamental and partly technical. By nature he is not attracted to any esoteric approach. He wants his musical techniques out in the open, observable, comprehensible, preferring to 'solve problems for the listener rather than create them'. Where Boulez favours a consciously structured complexity that 'resists easy comprehension', Schat can find as deep a mystery in simplicity—the eloquent magic of a particular turn of lift in Mozart, Schubert or Chopin, for example, (whose actual *language* is of course easily understood) as profound and impossible to explain as any deliberately overlaid complexity.

Whilst studying with Boulez in Basel in the early 1960s, Schat was naturally introduced to the latter's harmonic technique of frequency multiplication (FM; see "Afterword"). He was critical of it at the time for several reasons, but *particularly* because although the FM technique cannot function *at all* without the use of the octave in the first place, Boulez subsequently *eliminates* all octave-repetitions. What he *admits* at the deepest (hidden) level—the 'taboo' octave, no less—he *excludes* at the overt level. This is why it is well nigh impossible to trace the evolution of the sound complexes in his scores (unless one is prepared, perhaps, to devote one's entire life to the labyrinthine and long-suffering—though surely not unrewarding—exercise of becoming a 'Boulez specialist', something not generally practicable for the average composer.) Boulez had developed no *systematic* harmonic differentiation. For Schat, to whom pitch is the supreme element of music, these were disappointments and deficiencies; he saw a fundamental inconsistency *at the heart* of Boulez's pitch system, despite the technical and musical brilliance of the subsequent realisations. He found himself unable to pass quite so easily over the question of how one might arrive *in the first place* at the pitches one proposed to use.

(Note, incidentally, that he sums up the above in only one or two sentences in his "Afterword", having a tendency now and then to begin his technical discussions at a level that benignly presupposes the reader has given the same consideration *he* has to the subject in question. Whereas, when it comes to the subject of Boulez's FM, I rather suspect that almost nobody has ever even *understood* it properly. It may help to realise that a similar compression obtains in some of the earlier technical discussion, that in a few sentences years of prolonged thought may be expressed, and thus that a healthy consideration of his comments, and also of the musical figures, will not go astray. In Part V of Chapter 7, for example, as another marked instance of this, quite an original and potent little interval-steering technique, not mentioned anywhere else, is suddenly tossed to the reader in just a couple of tiny examples [Figures 7.43 and 7.44].)

For all this, however, it seems unlikely that Schat's own steering-principle could have developed in the way that it did *without* the experience (if only as a subconscious memory) of Boulez's FM technique, for at least this must have set him thinking consistently and very specifically in terms of the vertical-horizontal idea of 'multiplication', which is as fundamental to the steering process as it is to Boulez's method. However in Schat's steering technique (as the fruit of this concatenation) vertical and horizontal elements remain quite distinguishable: nothing is subsequently 'eliminated' (in his basic tonalities there *are* no octaves) and there are no 'hidden operations'. From the point of view of clarity, economy, consistency and systematic differentiation,

it is surely an improvement on Boulez's system. And if one readmits the possibility of note-repetition (as he does, for example, in the *sixteen*-note field shown in Figure 7.24), then it can also *include* the latter. (In fact the tone-clock theory can in principle expand to subsume every earlier approach to harmony.)

Where Boulez sought to establish chromatic network for each individual work, Schat sought to discover an *overall* chromatic network, an underlying network which might in principle encompass *all* the possibilities, around which one might travel in all one's work one's whole life long. And it is clear enough that whilst there remains an enormous amount yet to unearth, Schat *has* actually succeeded in giving us the bare bones, the skeleton of this 'grand network', that is, he has identified a basic *conceptual framework* from which virtually limitless theoretical expansion can now proceed, and within which the music of the past can also be understood. As I see it, we have all *been* travelling around a sort of 'larger' tone-clock network for nearly a century—i.e., the network containing all the chromatic triads (and also many of Schat's twelve-note tonalities, for most of them have appeared quite spontaneously in the work of other twentieth-century composers—in my own even, more than twenty years ago, so that I experienced an unexpected sense of recognition, when I first came upon the tone clock).

It is immaterial that one might find these chromatic tonalities (as formulated in "The Tone Clock" chapter) awkward, difficult to work with, too restrictive, too democratic, too simple, and so on. This will certainly be so if one takes the most 'obvious' view of them, for to most of us, who are so familiar with Schoenberg's linear series, they will seem at first sight to be just a collection of twelve-note rows. One might use them once, perhaps, but after that, what could one do with them? This is *not* what they are, however, as I have said. Rather they are a set of harmonic paradigms, in exactly the same way that the triads of the old diatonic tonality form a paradigm. In the tone clock we see the 'common chords' of twelve transposable chromatic tonalities, compared with the *one* transposable tonality of the diatonic system (major and minor keys being simply different modes of this one tonality). And it goes without saying that the mere use of these will never be any 'infallible guarantee' of musical quality in one's work, for these in themselves are not music, any more than the old common chords ever were: the real music is yet to be made. One needs to look at them with a sense of their potential for *expansion*, by way of the steering principle.

In any case, nobody is necessarily obliged to work with the chromatic tonalities in this particular form (i.e., their most condensed form possible). I did not respond entirely sympathetically to all of them myself at the outset,

although Schat's network as a whole has grown on me almost unaware with time. I do find it particularly valuable as a point of reference, a sort of orientation-grid in an otherwise virtually uncharted sea of chromatic possiblities. But apart from that, what matters much more, are the *principles* that emerge here: the principle of *deep-level harmonic symmetry;* the concept of *chromatic tonalities* (in itself a stroke of genius) *dependent on the chromatic triads* (introducing the *grouping* principle, thence applicable to *other* groups of different sizes: intervals, tetrads, etc.); the principle of *mobility*—of the notes within the triad (or group), and of the triads (or groups) within the entire chromatic harmonic field; and the *steering principle,* the idea that different chromatic tonalities may *generate* one another. In these simple principles are enormous potential riches, for one can apply them in any direction one pleases (asserting one's own indisputable liberty) to create a virtually endless number of *new* harmonic fields, mixed or otherwise. I am fond myself, for instance, of fields composed not of triads but of symmetrical tetrads, whose inherent chromatic tonal properties are often richer.

Being at a greater distance from Schat's own evolution, I can see it more objectively perhaps than he can. Since his harmonic thought developed gradually from lesser to greater definition, it is natural enough that for him the end-point (almost the 'eternal city') of the 'tone-clock proper' might currently appear more meaningful, for only at this point did the 'whole' become clear to him. To me, however, this 'end-point' became more of a beginning-point, a sort of launchpad for my own tone-clock techniques and formulations, which rapidly became many and varied. And with the benefit of hindsight I now find his earlier, ostensibly 'less-realised' tone-clock techniques (as they appear in the opera *Monkey* for instance) just as interesting as his later 'strict' techniques for the freedoms-within-a-discipline that they suggest.

A *musical,* a *workable* twelve-note solution, a solution communicable technically without a whole concomitant string of musical incomprehensibilia, a solid discipline that could inspire as much as it taxed, this is what I was looking for. Only a practical, down-to-earth solution would do. In the principles of the tone clock, I found it. It is true that I have also had to work rather hard to formulate from all this a system that suits me personally and that might open up more possibilities for others—but this is very satisfying work.

Schat's isolation of the twelve chromatic triads in particular was to have a profound effect on my subsequent harmonic thought. For as I became familiar with all the triads (or rather, with the *names,* since I was already acquainted—as indeed we all are—with all of the actual triads, although it had never dawned upon me for a moment that there were only *twelve* of them),

I found myself acquiring an overall grasp of the whole chromatic territory that was hitherto inconceivable.

The real point in all this, as every psychologist will attest, is that it is very difficult to think clearly about or even to *remember* properly entities for which one has *no names*. If this were not the case, then we would surely all have realised long before this that there *are* only twelve triads. In fact, this is now the most common response I meet, when I am asked in conversation to explain the tone clock: Only twelve triads?! Why didn't anybody realise it sooner! But in fact we did not realise it: somehow, there just 'seemed to be more' of them.

The gradual transformation in one's musical thinking brought about by a thorough familiarity with the chromatic triads (and the application of this to an analysis of one's own music, for instance, or of twentieth-century music in general) is very far from being the incidental affair it might appear on the surface. ''The step from two to three, from interval to triad, is a giant step in music'', writes Schat. From my own experience, I can likewise confirm that a cultivated awareness of the triads was to prove an extremely crucial step for *me* in the chromatic world, and this after some thirty years of composing.

I have also been rather intrigued by the way in which (apparently) *any* harmonic fields based on the symmetrical tone-clock principles do actually operate as a 'generator', as Schat claims—that is, they tend to throw up musical ideas of themselves, as one plays with them. Certainly one has to 'make the theory one's own' before this happens—to become familiar with it, to regard oneself as the legislator, making one's own 'rules', expanding and perhaps redirecting it to suit oneself—but that it does happen there is no doubt. This is a powerful argument in favour of Schat's contention that with the tone clock we *are* indeed dealing with the 'deep structure' of the chromatic scale. (Mathematically, in fact, this is already established in terms of the triads, though there is a great deal *more* to this deep structure when one considers the intervals and the tetrads as well.)

Of course no system, thank heaven, will ever turn anyone into a composer. 'Recipes' for composition are always an illusion, whether one's own or anyone else's. But solid techniques are as invaluable as they are rare. What most distinguishes Schat's techniques here is their *musicality*: they are not abstracted (as many earlier twentieth-century techniques were) from an actual conception of musical pitch (as in serial 'filtering', for example); and they immediately suggest a host of musical applications.

Be it also understood that any valid technique must be *separable in principle* from the actual music in which one might discover it—so that whether or not

one responds to the *style* of Schat's own music is likewise irrelevant (although I find much of his music very impressive). We are talking here about a harmonic paradigm, something *deeper* than style; just as the paradigm of the diatonic common chords served formerly as the basis for innumerable composers whose styles varied enormously. My own composing style, for example, is very different from Schat's; yet as soon as I heard his *Second Symphony*, I recognised immediately that there was some authentic harmonic principle at work here from which I too could benefit, if only I could get a technical grip on it.

Can the tone-clock theory meet the general need for a differentiated chromatic harmonic system? My own conviction that it has at least this potential was the reason for my learning Dutch and undertaking the present translation. Had I not worked with the theory myself, this belief would have no real foundation. But indeed, I found it so congenial that I have literally worked with nothing else since I first came to know it. (Of course, I am also by nature a harmonic composer—true of Schat as well, but not of every composer—which partly explains its attraction.)

Presently there is a crying need for a solid chromatic discipline which can help the smaller composer, in particular, to be himself, to find his own real voice—a flexible, intelligent, *musical* discipline, as apt for simplicity as it is for complexity. "Nobody can write anything simple any more", says Schat. If so, it is a terrible loss—but of course, it is not and never will be so. In any age of great musical complexity, as history has demonstrated more than once, simplicity reasserts itself as a counterbalance. (It has happened twice already, in fairly extreme forms, in our own century: with the East European 'cluster'—school in the sixties, and the American minimalist school in the seventies.)

It would be terribly foolish of us to maintain that only the greatest composers matter. They do, of course, matter very much indeed, but the point must surely be that integrity is not the province only of the great (nor only of the 'serious' musician, if it comes to that). How *could* it be?! If this were the case then most of us might as well give up right now.

It is hardly true that in the serious music of the twentieth century we have all magically become 'individuals' and there is no longer any 'common practice': there are rather a number of streams today, each of which displays, to some extent a stylistic vocabulary shared by all its adherents, thus presenting the *appearance*, at least, of a number of 'languages' or 'common practices'. However if these general languages do not have sufficient substance, sufficient cohesion and integrity, says Schat, then composition itself will gradually break down, the art will disappear—particularly, I would add, when the few major composers tend to have their own private, highly-developed techniques which

virtually nobody else can understand in much detail for they are realised in so esoteric a fashion as to be largely incomprehensible to the rest of us. In such a situation, what of technique are we transmitting to the oncoming generations? (A number of young composers have confided to me their disappointment in teachers who awarded them 'high marks' for work which they knew in their hearts was insubstantial, simply because they had made the 'right' superficial gestures.)

Musical brains that have not, and will never have, the intellectual capacity of a Boulez—and, God forbid, nor *should* they have. Imagine the state of contemporary literature if every writer felt constrained to be a James Joyce! They have nevertheless for decades been attempting a sort of pseudo-complexity, a superficial imitation of the most obvious vocabulary characteristics of a handful of contemporary masters (for whom, by contrast, such characteristics are entrely real and substantial)—which are easily enough absorbed, for indeed they are not so complex at all. When such 'complexity' becomes a 'virtue' in its own right, without any deeper logic or necessity behind it, then the rot has surely set in. With minimalism, by contrast, at the other end of the 'content-spectrum', an equally exaggerated 'simplicity' seems to have become just as fashionable a virtue.

Thus it is Schat's contention that the 'breakdown' in the art of composition is already well under way. There is on the one hand (in serialism) a hugely complex differentiation that has in general become purely decorative (a severe case of music 'developing itself to death'), and on the other hand (in minimalism, particularly), a still generally insufficient differentiation.

The tone-clock theory, which on the whole sits in between both these extremes in that its operation can be as simple or as complex as one cares to make it, provides a fresh approach to the pitch problem. Due to the fact that the theory accounts in principle for *all* the pitch possibilities, it can accommodate any composer, whatever his preferences. (And once again I will stress the significance of the *tone-clock principles* over Schat's own personal application of them, for the latter is simply *his* vision of what is possible.) The tone clock can be taken as an 'approach' as much as a 'system', for even as a system it is wide open to further development. And it makes no particular proclamations in respect of style. Schat sees it more in relation to serious contemporary music, but I can see it as an avenue for the more adventurous jazz spirits as well, one or two of whom indeed are not so far away from it even now. (Tone-clock improvisations will certainly be the potential fruit of an *instinctive* grasp of the chromatic triads, anyway.)

Suppose you, the composer-reader, have minimalist sympathies, then it might occur to you to apply the tone-clock principles in a more limited way,

using *fewer* than twelve notes. This too will work perfectly well, just as it worked for the natural triad and the seven notes of the diatonic system. (One could always use a *different* triad or group, with a different symmetrical steering, resulting in a new set of less than twelve notes.) Schat, as an inveterate twelve-noter himself, might not exactly 'approve', but he is still bound to uphold art as the 'realm of freedom'. And in any case, the clock principles seem to have such large implications and potential that no one individual can possibly ever claim them as 'his' (any more than the old tonal system ever 'belonged' to Rameau). Neither does Schat do this; he is here simply passing them on to any composer interested to do the best he can with them.

Although no specific consideration is given here to the *asymmetrical* possibilities, these by extension are also perfectly available—and their nature is all the better perceived through a familiarity with the symmetries (asymmetry being *defined* by symmetry, as its *absence*). The permutation factor in the tone-clock theory means that great many note-complexes which we would formerly have regarded as 'asymmetrical' prove actually to have a symmetrical deep structure.

That the tone-clock principles themselves can be fairly readily grasped even by musical laymen, Schat demonstrates in his unique "Chromatica" chapter, comprising a series of articles that first appeared (as most of these chapters did) in the cultural supplement of the national Dutch daily *NRC Handelsblad*. Here, with characteristic enterprise, he actually succeeded in giving 'composition lessons' in the newspaper (albeit with sometimes less than spectacular results—thus also demonstrating that although the clock principles might be easily enough comprehended, it is not nearly so simple to put them into effective practice. But when was it ever easy to write good music?)

For my own part I think the composer in search of fresh ways of thinking about chromatic pitches may well find here something of the same food for though that I have, if he does not expect solutions on a silver platter (as if there could ever *be* any such solutions in this difficult age), and if he puts his own creative intelligence and imagination to work to see how he might best take advantage of what he finds here.

At the same time, I should also reiterate that it was Schat's *sounds* (in the *Second Symphony* and the first scene of *Symposion*, particularly) that made the first real impact on me. Prior to that I had read his "The Tone Clock" article and was already curious. But when I *heard* these harmonies, I was astonished at their richness and clarity, and at the 'rightness' of the way they moved through their changes, with such assurance and such a developed and constant onward dynamic. Never had I heard chromatic harmonies of such perceptible

distinction and logic. Only Messiaen's harmonies ever had a comparable effect on me, when I first heard them nearly thirty years ago (and I now see his modes within the framework of the tone clock as well). It was this that really set me to work. Thus I would encourage those interested to try to hear some of Schat's later work (and to focus particularly on the harmonic aspect).

For readers of a less technical bent, the latter part of the book (from Chapter 9 on) may hold more charms. Here Schat holds forth—for the most part very seriously, but sometimes outrageously and hilariously—upon music in general and twentieth-century music in particular, upon art, literature, architecture, acoustics, religion, aesthetics and arts policies, and the occasional more earthy topic. His views are always robustly unacademic, stimulating, original and outspoken, never 'politely intellectual'; this is above all a composer, wholly engaged, rich in ideas of many kinds, speaking to us in a very personal vein. His account of the extraordinary 'Stopera' affair—the 'Battle of Waterlooplein'—will surely go down in history as an example to public officials everywhere of how *not* to go about building a national arts-centre. History will have to wait, on the other hand, to enjoy one now missing chapter (on a well-known contemporary figure) which proved so memorably devastating that for the present it has been prudently withdrawn—to be restored, no doubt, at an appropriate later date. He regales us with a number of closely observed 'musical travel' experiences, and constantly relates his musical understanding to his awareness of society, politics and life. In all this, his love of language never deserts him. It is eminently perceptive, humane, refreshing fare, with some unexpectedly poetic moments, even an occasional touch of the oracular. With the passage of time, moreover, we see how his views become deeper, clearer, more tempered and balanced, building up in the last few chapters to a broad vision, at its best, of rare quality and common sense.

I must at this point gratefully acknowledge the sterling contribution of my co-translator, the American composer Jeff Hamburg, who translated Chapter 13 and the final five chapters. We are both much indebted to Peter Schat, whose literary flair and whose unstinting assistance in the finer points of the translation made our task a pleasure. Allowing for adapted word order and figures of speech, a precisely literal translation seemed almost invariably the best solution, so that what is here is very close to the Dutch original.

Also acknowledged for their generous financial support in the Netherlands are the Dutch Ministries of Foreign Affairs and of Welfare, Health and Culture; and the Prins Bernhard Foundation; and in New Zealand the Queen Elizabeth II Arts Council. Further thanks are due to the United States Information Agency and the Louisville Orchestra, Kentucky, under whose kind auspices

Schat and I first met; to my good friends Marinus de Raadt, who loaned me his Dutch dictionary for more than a year; and particularly to Laurens Van Krevelen of Meulenhoff/Landshoff, who eventually supplied a superb dictionary and undertook much behind-the-scenes organisation and paper work.

The Tone Clock is an English translation of a broad selection of Schat's writings, which are mostly articles written for the leading Dutch daily newspaper *NRC Handelsblad* in Rotterdam. These articles formed the basis for his two books *De Toonklok* and *De Wereld Chromatisch* (Meulenhoff/Landshoff, Amsterdam, 1984 and 1988), which are both included here, with some revisions and cuts, and a number of interviews excluded, at the author's request. Also included is the text of the 1988 Huizinga lecture *Adem, een vergelijking* (Bert Bakker, 1988). A few of the present chapters have already appeared in earlier English translations in the Dutch composers' journal *Key Notes* (Donemus); the rest is a new English translation and includes further unpublished material written specifically for this English version.

Jenny McLeod

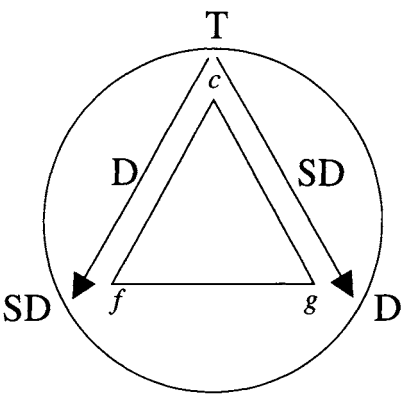
1

CIRCULAR FRAGMENT OF A THEORY

... to speculate on what is still possible, in the domain of tonality.

The generator of centuries of music, the holy trinity: tonic, dominant, subdominant (T, D, SD), and their extraordinarily clear functions with respect to each other; a constellation which becomes ever more mysterious, the more transparent the mutual relationship of the three poles is:

Figure 1.1



A closed circular form resting in itself, more essential than the genius that bowed to it, for it came first. A hierarchy of tones which could have ensured that the community of sounds which it controlled should be immutable once and for all. And yet one man, Schoenberg, around the time of the first world war, seemed able definitively to destroy this élite of tonal functions.

Fifty years earlier, the first bars of *Tristan und Isolde* had already evoked a disturbing picture: they made concrete the possibility of the non-existence of the fundament of the tonal order, namely the tonic *itself*. A few bars with only subdominant and dominant functions, and no tonic! At best a virtual presence, but in every case a real absence of the tonic.

So, during the conjunction of Nietzsche and Wagner - Schoenberg's subdominant and dominant, respectively - round about

and perhaps linked with the death of God, the light of the tonic began to be extinguished.

What is our situation since then, and to what extent was Schoenberg's concept of the series really a breakthrough from the closed symmetrical world of the tonal hierarchy? Now, a century after *Tristan*, in a fog of total confusion, the contours of a different musical thought begin to emerge, and the suspicion arises that the original idea of the series was in fact a transformation of the tonal thinking-in-closed-forms, in which, when the loss of the tonic has really penetrated it, post-tonal music must eventually run aground.

To open up the way for this alternative musical thinking, it is necessary to take a speculative look at the dialectic of tonality and atonality.

Perhaps simply through its non-existence in our musical situation, the tonic is a constant presence, and its former historical existence remains fascinating. What is going on with that centre of gravity, that fundament of the tonal order, which for us now is just a hole into which all the notes threaten to sink, expressionless, whilst earlier they derived their expression from it?

It is striking that only the tonic (which the Chinese call 'the King') has extra functions in the hierarchical system, the others (SD and D) do not. The tonic is, after all, in addition to 'itself', the dominant of the subdominant, and the subdominant of the dominant. The three poles of the system in its totality are thus mirrored in the *three* functions of its central point, of the tonic.

Which of the three following formulae expresses an absolute truth?

T = T
T = d of SD
T = sd of D

Without doubt only T = T, or indeed A = A; otherwise expressed: 'I am that I am', or: '*Befehl ist Befehl*' (An order is an order).

But when a 'given' in a particular coherent system can be something other than itself, its absolute value becomes relative. In that sense the tonic is less absolute (and thus more vulnerable) than the dominant or the subdominant, which can only be 'themselves'. It is this vulnerability, this possibility, unexpected but implied in its nature, of poly- and finally pan-interpretability, to which the tonic

succumbed. The moment everything can be demonstrated with the tonic, the arguments turn against it: nothing is yet proven.

At this moment, now that the serial postulates are staggering in their turn, one can imagine Schoenberg's position, how he felt himself sinking away into the maelstrom where the tonic had sunk. The horror that he felt, he describes in his letters. We also know his answer, the buoy, as it were, with which he kept himself afloat: a new 'hierarchy of twelve notes, related only to one another'.

From this principle – analagous to the tonal formula – how can we construct a summarised picture?

A condition herein is that this yet-to-be-discovered note-constellation should contain a maximum of information in the most concentrated symbolic form. It must be, as it were, the generator, the microstructure from which all the macrostructures arise organically.

Tonal law can be seen as a series with a fixed centre. In Schoenberg's conception of post-tonal music, this centre moves over the twelve possible notes of our tempered system, according to the laws of a series which the composer himself sets up. This series then becomes combined with its mirror-forms (inversion, retrograde, retrograde inversion).

The summarised model of these principles must be a series with these mirror-forms built into it: in other words, the series must be anacyclic. Moreover, this series should also contain, in addition to all twelve notes, all the possible intervals between them – eleven, in all. The result is a so-called 'all-interval row' (see Fig. 1.2).

With the series, the following observations:

The sum of the intervals from 1 up to and including 11 is 66. It follows from this that the interval between the first and last notes of an 'all-interval row' is always a tritone (6): $66 - 5 \times 12 = 6$.

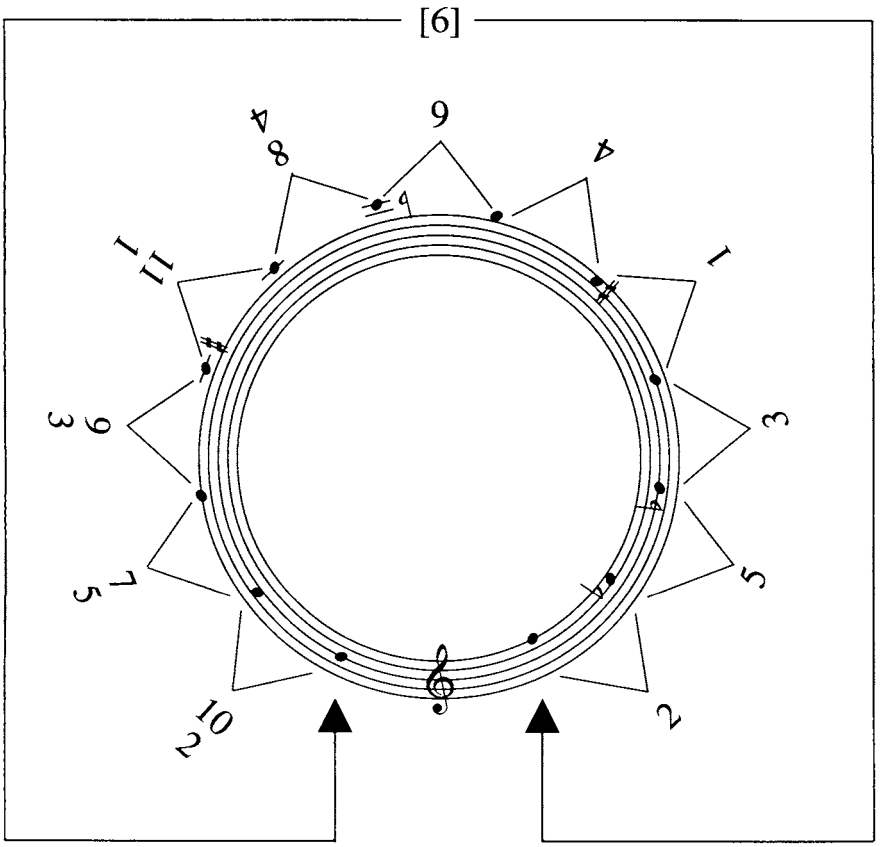
The point of symmetry in the series must then also always be the interval 6, whilst the mirror-point in each half-series is 3: ($\frac{1}{2} \times 6$).

This interval 6 is at the same time the symmetry-point of the octave ($\frac{1}{2} \times 12 = 6$), from which it follows that the absolute value of every possible interval in the twelve-note sphere can be expressed in the form of a number equal to or smaller than 6. This interval-value is the constant in every symmetrical all-interval row.

(Example: the series 7 4 9 2 11 -6- 1 10 3 8 5 can be written as: 5 4 3 2 1 -6- 1 2 3 4 5, I must simply indicate the direction of each interval: 5↑ 4↓ 3↑ 2↓ 1↑ -6- 1↓ 2↑ 3↓ 4↑ 5↓)

Back to the first series. The symmetry therein is indeed total:

Figure 1.2



1. The halves of the series mirror each other.
2. All the intervals smaller than 6 are to the left, the intervals greater than 6 to the right; in other words: the directions in which the intervals are measured mirror one another.
3. Both halves of the row are interchangeable: the series 4 1 3 5 2 -6- 2 5 3 1 4 also works.
4. The series halves can each in themselves be mirrored around the interval 3, from which the series 1 4 3 2 5 -6- 5 2 3 4 1 results. Also, the two halves of this derived series are interchangeable: 5 2 3 4 1 -6- 1 4 3 2 5.

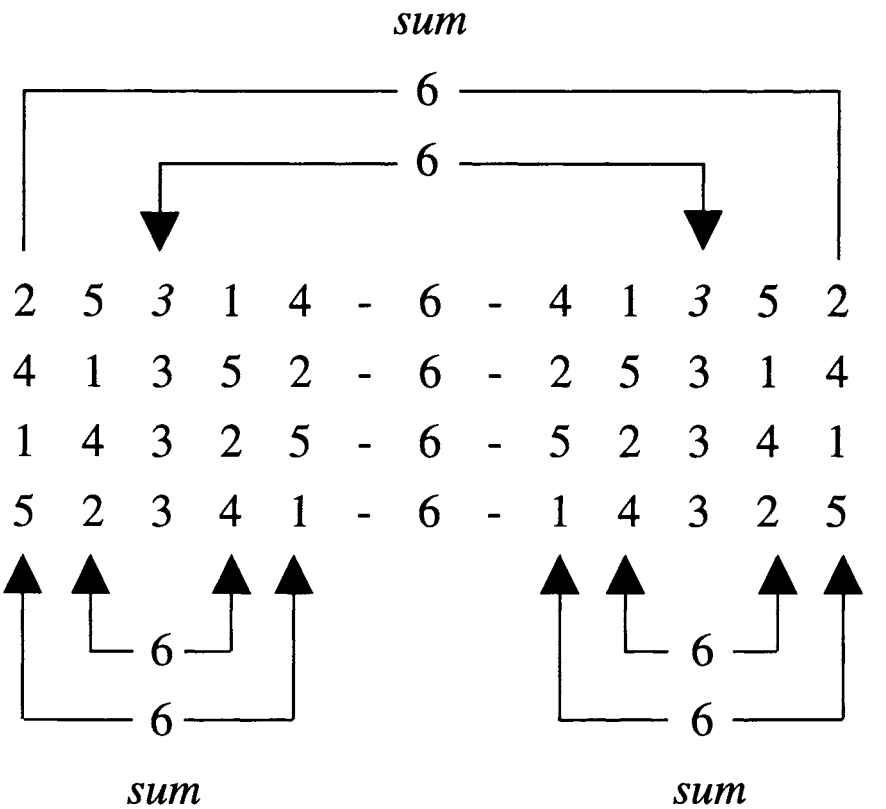
With these series there are thus, in total, as many related variations possible, through internal mirroring, as are obtained

through the customary external mirroring (inversion, retrograde, retrograde inversion).

5. Starting from the mirror-points 3, the sum of the intervals is constant, namely 6.
6. Other permutations of the intervals 1 to 5 (included) do not meet the conditions.

The schema below gives a summary of all this:

Figure 1.3

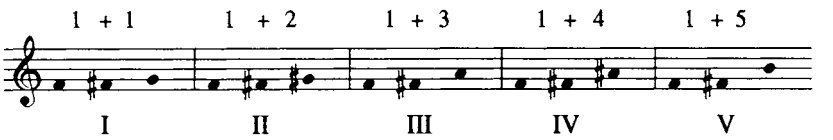


The practical musical value of this note-constellation, in which a maximum of Schoenberg's structural principles is compressed, is inversely proportional to its theoretical value in serving as a model for symmetrical serial thinking.

That the above series is unattractive as a compositional departure-point can be explained by the fact that it does not fulfil the

'anti-tonal' functions which play a great role in atonal music. What it comes down to is that, in order to neutralise tonalising centripetal effects, in ensembles of three notes at least one basic interval (the semitone) should emerge. In our tempered system, there are in total no more than five anti-tonal functions conceivable:

Figure 1.4



Measured against these functions, the series discovered earlier consists chiefly of tonalising note-groups, which lack all centrifugal effect. Thus, a series which, no matter how optimally informative for symmetrical serial thinking, is inadequate for the purpose: giving form to atonal music. Naturally this does not mean that no symmetrical row can be found (or used: Webern!) which actually meets the criterion of anti-tonality. Nonetheless, I have come across no series which can be mirrored from all sides like the one I have described above.

It would be absurd to conclude, from the discrepancy between the theoretical and the practical value of this series, that serial thinking is fundamentally a mistake: one cannot simply write off with a theoretical find the musical history of the first half of this century, which after all was determined by the obvious power of the serial principle. Nor is it for me to do this. Rather, I have described the models of both tonal and serial musical thought, in order to show how closely linked their dialectic is, how they mirror one another. So illustrated, the insight may arise that tonality cannot be resolved by serial thinking. It was for me to prove that both are hierarchic, deterministic approaches to sound, to the problem of musical form.

(1966)

2

THE DREAM OF REASON

Daedalus, son of Metion of Athens, murderer of his worthier cousin Talos, favourite and later captive of King Minos of Crete, tragic-brilliant architect of the Labyrinth of Knossus, lair of the child-devouring Moloch, the Minotaur (half man, half bull), father of Icarus (with whom he was incarcerated in his own labyrinth), chiefly responsible for the first air disaster in history (in which he lost his son, and cursed his art – the story is familiar enough), fugitive, rash builder of a temple to Aphrodite on Mount Eryx in Sicily, and finally victim of a snakebite – this *ingénieur maudit* is the mythological progenitor of art-engineers, mood-engineers, builders of music-boxes and synthesizers from Pythagoras to Meyer-Eppler and Moog.

At the exhibition 'From Music-Box to Music Computer,' I met recently a very distant second cousin of this Daedalus, leaping about wildly before a vast fantasticon, with a panel wired a million-fold, the size of a barrel-organ, a machine which could be deemed responsible for the current merry uproar of an outsized parrot-cage, amplified in turn by an extended system of suspended, ascending loudspeakers. The apparatus sounded just as 'New-Babylonian' as it looked: impossible to disentangle, incomprehensible, but not uncheerful.

The leaping engineer was likewise all optimism, and he asked me, as a guinea-pig from the little group of bystanders, to join him in an improvised 'voice-spiel' before one of three microphones he had just set up. From this, the operation of the music-computer would become clear to everyone. If one said something, no matter what, or snapped one's fingers, the computer would then react, probably with something surprising.

We, 'mutually not knowing who we were', began fairly randomly to say things into the microphone, until suddenly the engineer snapped his fingers before it, and indeed –'high in the hall of the building, a loudspeaker went 'plok'. Not disagreeable, also not uncheerful, but not exactly in harmony with the size of the apparatus. All the more so because, during a tour around the antique automated instruments, everyone had just stood admiring an old music-box the size of a violin-case, which sang magnificently. But before the general

disappointment could register itself too deeply on the bystanders, the engineer had already bounded to the knobs. Invoking the machine's countless promising possibilities, he now produced an avalanche of sinusoidal, sawtooth, square-wave, voltage-controlled and ring-modulated generator-sounds. '*Can you sing? Can you make a melody?*' I yelled into the microphone. No, the machine couldn't sing.

Before I go any further, I want emphatically to distance myself from the sort of shallow review which is unwilling to take its time, and which, leaping across the ice-floes of all sorts of misgivings, manages to make the next morning paper. It is easy enough to mock things, you can squash the seed of a tree between thumb and forefinger. To fell a fullgrown beech is another matter altogether.

But does what I call in summary the 'music-computer' concern a seed, a new idea? Is it not rather more concerned with an old affair, a technological dream from the Cold War period, a musical Concorde project from the Darmstadt school?

Quite soon after the war, there arose, amidst the ruins of Europe, the idea of a 'total' compositional technique. It was meant to 'settle accounts' in the coming centuries with the 'tonal' technique. This was to become possible through an anti-romantic 'scientific' approach to the 'phenomenon' music, through analysing sound-properties into 'parameters', and making these thereafter the unhappy object of a totalitarian compositional technique (for example, *Structures* for two pianos, by Boulez). Science had the last word, for, since the Industrial Revolution, science had walked off with great social successes, 'scientific thought' had overtaken all the other intellectual disciplines, and laid claim to the highest social honour, immortality, which the arts above all had made off with prior to that. Artists, already inclined to bow by virtue of their profession, bowed their heads before the scientists, and a whole generation of composers took over catchwords from the engineers' jargon: 'permutation', 'interpolation', 'superposition', 'phase', 'structure', 'montage', and what not.

Iannis Daedalus Xenakis let computers read off the construction plans for a new composition, and lo: a prestige pavilion for Philips!

The essential instrument of this uncommonly optimistic method was an all-embracing administration, a 'census' of the tones. Schoenberg had started it: he numbered the notes, from 1 to 12. All sorts of mechanical tone-production methods could now be quickly applied: inversion, retrograde, retrograde inversion, concatenation,

compression, structural filtering - the whole catalogue. Deaf to Schoenberg's warning that his method would wreak havoc in music in the second half of the century (which is now really happening), the post-war composers set deafly to work. What the epigones of Le Corbusier had in store for our cities was what those of Schoenberg would do with our music. Whilst the drawing-board directors of Public Works were busy manipulating whole groups of inhabitants out of their districts and into dormitory suburbs, the Cold War composers struck no half-measures either: there arose thousands and thousands of 'calculation' scores, whose inhabitants, the notes, were dumped in this, that or the other 'graphic' corner, with the help of serial data-banks. Scores in which the individual tones (and thus their mutual relationships) perished pathetically in glissandi, noise and technological speculations. Scores that were full of dead voices - for what each individual player was given to play could no longer possibly be called pleasant. And from such a mountain, such a 'montage' of roughly a hundred and forty dead bodies, the living flame should then shine forth.

The result of this bureaucratic seizure of power from the Muse was that she withdrew, and left behind the celebrated Chasm - that between music-lovers and new music. To bridge that gap, the experts, just as progressive as the Labour Party spelling reformers*, constructed a new man, a sort of Six Million Dollar Man, with 'new ears' (all the better to hear modern music with), and 'new eyes' (all the better to see audio-visually), and a bigger mouth (all the better to consume with, and to have one's say). In short, they invented a wolf, a monster, such as Goya had already portrayed in *Los Caprichos*: 'The Dream of Reason Brings Forth Monsters!'

The nineteen-seventies were characterised by a mass defection from the optimistic belief in the 'Triumph of Technique'. The victory of the Vietnamese peasants over the American super-technology, the energy crisis, the destruction of the environment, or of the Nieuwmarkt**, were one and all events that shook this clearcut faith.

But then what, indeed? Should we simply abandon (electronic) technology in music? Drop out, back to nature, back to the

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*The Dutch Labour Party in the early nineteen-seventies unsuccessfully attempted to institute a simple-minded spelling reform.

**In 1975, the inhabitants of the Nieuwmarkt, an area in the inner city of Amsterdam, were to be moved out to the suburbs against their will. Mass protest eventually prevented this.

tonic, whether or not decked out in the new clothes of the emperors of American minimal-mood music? Or head towards that other fashionable 'moronising' of musical communication, towards the mystical music of Karlheinz "Karma" Stockhausen?

Of course not.

Rather, we must apply a homeopathic principle, confront the disease with its cause, defeat technocracy with technique. A made-to-measure, human, anarchistic technique, a technique that responds, instead of amazing us.

But to begin with, we must pay attention once again to Schoenberg's inescapable idea of the 'twelve notes related only to one another', concerning ourselves not so much with the administration, with the 'twelve', nor with the 'notes' (c, c-sharp, d, etc.), but with the essentially anarchistic principle of the 'related *only* to one another', with the intervening space, the interval.

It is my conviction that the new harmony that Schoenberg invoked on his death-bed can only arise from listening in a non-discriminatory, cherishing way to the special tensions, the love-relationships between the notes, which, amid the Tyranny of Technique, fortunately still dwell in our well-tempered solar system.

(1976)

3

THE REASON OF A DREAM

I'm looking over
A four-leafed clover
That I overlooked before.

A

Now, what does this solar system look like? What forces therein control the movements of the tones?

A first attempt to measure this was undertaken in 1691 by Andreas Werckmeister, however still not very precisely: his *Musikalische Temperatur* describes in fact an *un*equal tempering. Not until 1724 did Johann Georg Neidhardt give a theoretical basis for the twelve equal semitones in the octave, in his *Sectio canonis harmonici.**

But as always in art, the dream-vision of a universal tone-order materialised not in a theory, but in a work of art. In 1722 (the same year Rameau's *Traité de l'harmonie* appeared), Bach wrote the first book of the *Well-tempered Clavier.*

When one tries to reconstruct what was at stake, this seems an event of almost Keplerian magnitude. It concerned showing empirically that the twelve-note universe really exists, not as a dream of reason, but as music. Writing this music, Bach must have felt like the first astronauts: every page of this miraculous work quivers with wonder at the beauty, the harmony, the order of this new tone-universe.

Immediately, the prelude that opens the work contains a tonal law, a hidden foundation, which will be revealed in the following analysis.

One has only to quote the first bar (Fig.3.1) to recall to memory this prelude in its entirety.

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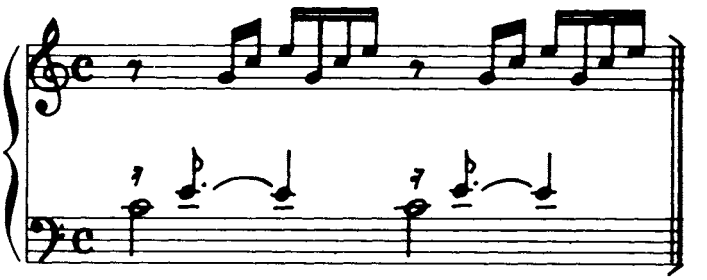
*The precise mathematics of the system were calculated in China, around 1580, by the scholar Chu Tsai-Yü (Joseph Needham, *Science and Civilisation in China,* 1962).

Figure 3.1



With this simplest of all musical vehicles (speaking of minimal music) the composer will now carry himself and his listeners, in the most unassertive and self-evident manner, into this new tone-universe. In one continuous movement, all the intervals that are possible between two notes in this system are very carefully investigated by ear, thus not intellectually-theoretically, but musically-intuitively, resulting in a form of startling clarity. This dream has structure, ratio.

Measured in terms of the smallest unit of this tone-system (the semitone = 1), the above bar, from note to note, contains the following intervals:

	4		3		5		4	
c′		e′		g′		c″		e″

When we summarise this in a harmonic scheme, we arrive at Figure 3.2. When we arrange the intervals used in a graph, marking the appearance of each new interval, the picture shown in Figure 3.3. arises.

Clear as day, this analysis yields us the following insights:

1. *All* the twelve intervals possible within the 'well-tempered' octave appear. The piece waits, as it were, for the appearance of the last, the 'ultimate' interval, the major seventh (11) in bar 34, before it can come to a close.

   (In the theme of the closing piece of this book, the Fugue in B minor, all the twelve possible *notes* are used, as we know. We travel with Bach from one remote corner of this universe to the other, from the twelve intervals to the twelve tones - a remarkable fact to which we shall return.)

Figure 3.2

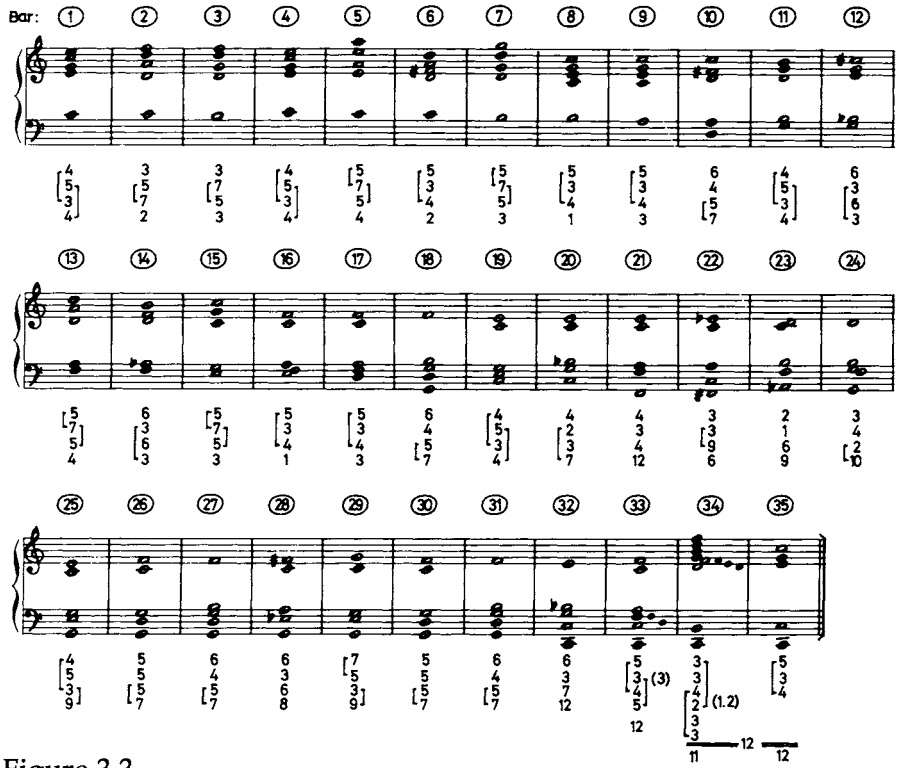
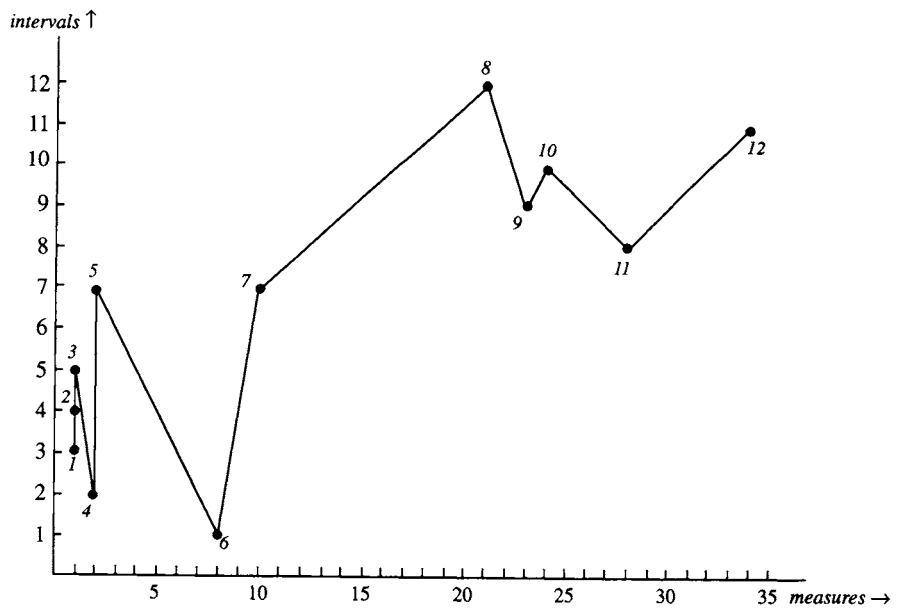


Figure 3.3



2. The seven smaller intervals form the building-stones of the first twenty bars of this piece; after that, it is the turn of the five larger intervals. Through this compositional technique, the piece opens up like a fan.
3. The smaller intervals, once exposed, are first carefully compared with one another (by changing places, permutation) before a new interval has its turn. The basic interval, the minor second, is an exception; it is used (in bars 8, 16, 23 and 34) as a sort of 'inter-punctuation' of the total form – just as a whole bridgeway can rest on the smallest imagineable supports. This whole process of interchanging a limited number of units proceeds in a totally non-mechanical, continually self-renewing manner.
4. The intervals are grouped so that they yield a maximum number of octave (= 12)-relations (the brackets in Figure 3.2). The intervals 3, 4 and 5 (together 12) make up then almost 70% of all the intervallic material. The octave, which does not appear until bar 21, majestically deep on the sub-dominant, is until that moment 'sub-conscious', handled as a secondary interval. Working with this golden rule ensures the emergence of classical, 'tonal' harmony. (One of Schoenberg's most brilliant intuitions, then, was likewise the octave-taboo; we shall return to this also.)
5. When the intervallic structure of this prelude is represented in a coloured schema, an image of universal harmony arises, a communal pattern of tones, a city in heaven, as shown in colour plate (Fig 3.4).
6. The state of affairs described here has gone unnoticed for two and a half centuries – 'something that we overlooked before'.

B

There is no greater terror for a composer than the collapse of the tone-system. It is as if the tones plunged like stars into the Black Hole of meaninglessness – not a single tone can be trusted any longer, no compositional decision can be justified (for the poet: as if words had suddenly lost all meaning). Barbarism breaks loose everywhere, the Great Void, the Eternal Silence sucks up everything.

No composer went through this agony as Schoenberg did. In his creative life, there is a gap of no less than nine years. It is as if he