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Time and Rhythm in 20th Century Music
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Temporal structures and time perception in the music of Gérard Grisey: some similarities and differences to Karlheinz Stockhausen's ideas.

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Introduction

"L'Itinéraire" is the name of an ensemble and musicians' collective in Paris. The general outlook is that the composers in "L'Itinéraire" are all working with music from an acoustic point of view, noticeable above all in their way of treating harmony. However, sweeping statements may always be dangerous and, like any other grouping, "L'Itinéraire" consists of individual composers with different music.

Gérard Grisey, born on 17 June 1946, is one of the founder-members of "L'Itinéraire". His many seminars around Europe on personal ideas and works have triggered great interest in a younger generation of composers and musicians.[1] The key word for his musical ideas are perception. After a period in music history, when carrying through the structural context of a work has been more important than the listener's reactions to the work, it is of no surprise that a younger generation is taking great interest in ideas dealing with the *experience* of musical structure.

Grisey studied with several well-known European composers, such as O. Messiaen, H. Dutilleux, K. Stockhausen, I. Xenakis and G. Ligeti. In an article in "Darmstädter Beiträge zur neuen Musik" he generously gives us a list of composers (~~that~~ who) have had influence on his music ("...that have helped me to become a musician..."[2]): O. Messiaen, G. Scelsi, K. Stockhausen, F. Cerha, E. Varèse, I. Strawinsky. B. Bartók, A. Webern, G. Mahler, C. Debussy, R. Wagner, L. v. Beethoven, W. A. Mozart, L. Couperin, J. S. Bach, C. Monteverdi,

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1 For Scandinavians there were two opportunities to attend his seminars recently; in the fall of 1992 he was the main guest at the UNM-festival ("Young Nordic Music") in Reykjavik on Iceland and in the spring of 1994 he was in Malmö in the south of Sweden for some days, giving seminars and concerts devoted to his music.

2 [Es sei mir gestattet, an dieser Stelle all jenen öffentlich zu danken, die mir dazu verholfen haben, der Musiker zu sein, der ich heute bin, all jenen, die mich durch das Beispiel ihrer Musik dazu gezwungen haben, ausreichend neidisch zu werden, um ihnen nacheifern zu wollen.] Grisey, Gerard. "Zur Entstehung des Klanges..." in *Darmstädter Beiträge zur neuen Musik*, vol.17 (1978): 76.

G. Frescobaldi, J. Ockeghem, G. de Machault. In this essay I will show that, in Grisey's theories, Stockhausen has a prominent role.

Besides music Grisey studied acoustics at *Faculté des Sciences* in Paris. His approach, like Stockhausen's, to the musical material is very much like a scientist investigating the nature of sound and its unfolding in time. Even if Grisey's ideas are strongly influenced by Stockhausen's thinking and organizing of musical material, his resulting conclusion is different from Stockhausen's. Even at a brief comparison between the two composers' works it is clear that they realize their musical ideas in very different ways. In my analysis of *Modulations* I will further on illustrate how Grisey puts his ideas into practice.

Les Espaces acoustiques

The cycle *Les Espaces acoustiques* is a gigantic composition-project that Grisey started to compose 1974, and the last movement was finished 1985. The basic idea for the orchestration is to enlarge the orchestra for every part. The different movements are *Prologue* (solo viola), *Periodes* (7 instruments), *Partiels* (16 or 18 musicians), *Modulations* (33 musicians), *Transitoires* (84 musicians) and *Epilogue* (large orchestra). The harmonic base for each movement is the overtone spectrum of E (41,2 Hz), most often distorted in different ways, using the same acoustic thinking as in the electronic music studio. Grisey uses the word "instrumental synthesis" for his way of dealing with harmony, and to understand the quality of this part of his music it is better to think of simultaneous pitch as timbre instead of harmony in a traditional way. However interesting this area may be, this essay will not deal with pitch in the first place, and therefore I will not discuss this subject here.

Tempus ex machina

In Grisey's main thesis, "Tempus ex Machina: réflexions sur le temps musical"[3], he discusses time and duration, and how a musical context can affect our way of perceiving time passing. Our everyday experience that time on some occasions seems to be "endless" (for instance when we are bored) or on other occasions passes very quickly (when we are too busy and do not have "enough time") is familiar to every human being. One of Grisey's main concerns is to control the speed of this perceptual time, and to use it as an important structural element in his own music.

Grisey distinguishes three layers in music that interpret time. He calls them "The skeleton of time", "The flesh of time" and "The skin of time". "The skeleton of time" is the foundation for the structure of a piece. It is the temporal divisions for the sounds (or any other musical event), but not the sounds themselves. Grisey does not develop the nature of this layer very much in his article. He is, as many other 20th-century composers, more concerned about how to organize it (he points out himself that many 20th-century composers have taken great interest in organizing this infrastructure), and how this affects our time-perception. However, other authors have discussed more strictly what this structure really is. Jonathan Kramer discusses meter and rhythm in chapter four in his book *The Time of Music*. Meter is surely one kind of "skeleton of time", however not the only one. Kramer describes meter as a succession of time points. "But what is a time point? Whereas a timespan is a specific duration (whether of a note, chord, silence, motive, or whatever), a timepoint really has no duration."[4] It is interesting to see that we always think about time as unfolding in space, talking about time-*lines* and time-*points*. The philosopher Henri Bergson discusses this. His

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3 This thesis was written 1980 for the summer courses in Darmstadt. It is available in an English translation in *Contemporary Music Review*, vol.2 (1987) vol.2 pp. 239-275.

4 Kramer, Jonathan. *The Time of Music: New Meanings, New Temporalities, New Listening Strategies*. New York: Schirmer Books (1988): 82.

conclusion is that we are unable to measure time without converting it into space.

> "We saw above how inner duration exteriorizes itself as spatialized time and how the latter, space rather than time, is measurable. It is henceforth through the intermediary of space that we shall measure every interval of time."[5]

Real time, for Bergson the *experienced* time and not chronometric time, is impossible to measure in itself: the first time span does not longer exist when the other appears. I think this is very true, and one of the main reasons that an interesting structure on paper (i.e. converted to space) is not always satisfying for our perception.

Since the time points in "The skeleton of time" have no duration it is obvious that we can not hear them in an acoustic sense. To be perceived they have to be expressed in the sounds enveloping them. If the musical context does not care about the bar lines and the hierarchy of the metric accents, we will of course not perceive any metric music, and the same can be said about other kinds of temporal division. This brings us to "The flesh of time" – the sound material itself. Our perception of the length of a time span depends on the events within it. In *Feeling and Form* Susan Langer also writes about this:

> "But the experience of time is anything but simple. It involves more properties than 'length', or interval between selected moments; for its passages have also what I can only call, metaphorically, *volume*. [...] it is filled with its own characteristic forms, as space is filled with material forms, otherwise it could not be observed and appreciated at all. The phenomena that fill time are *tensions* – physical, emotional, or intellectual. [...] for perception they give *quality* rather than form to the passage of time..."[6]

Grisey, just as Langer, calls this layer the qualitative approach to time, compared to the quantitative aspect in "The skeleton of time".

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5 Bergson, Henri: *Duration and Simultaneity with reference to Einstein's theory*, translated by Leon Jacobsson. Indianapolis: Bobbs-Merrill (1965): 57. Orginally published in 1922.

6 Langer, Susan. *Feeling and Form*. New York: Charles Scribner's Sons (1953): 112.

Also Stockhausen talks about the connection between the events and our perception of time. I will return to this later.

The last layer, "The skin of time", is the most abstract and the hardest to analyze. Here psychological and sociological aspects in the music, or rather in the listener, come into the foreground. To use Grisey's own words, it is the "place of communication between musical time and the listener's time..."[7]

The infrastructure

A central subject in Grisey's thesis mentioned above is his "Scale of complexity". This scale shows the degree of regular repetition in the succession of time points in a piece, or in other words the degree of predictability in the basic time structure for the piece. The most regular repetition in Grisey's scale is periodicity, and the least is when the length of the temporal divisions is determined at random, which he calls "white noise of durations". His aim is to "construct a *continuum that can be found in the classification of intervals (by their degree of dissonance) and of timbres (by the extent to which they are non-harmonic).*"[8] It is not a new wish to deal with disparate musical parameters in a similar way. In serial music composers have tried to control every different parameter by the same system of number-rows. The basis for Stockhausen's thesis ".....how time passes....." is to look at pitch and duration in exactly the same way. The only difference is that the length of the durations is more or less than 1/16 sec, the threshold for perceiving pitch.[9] Stockhausen does not work out a scale between regular and irregular repetition

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7 Grisey, Gerard. "Tempus ex Machina: A composer's reflections on musical time." in *Contemporary Music Review*, vol.2 (1987): 272.

8 Grisey. (1987): 244.

9 There have been several attempts to make a continuum between duration and pitch. We will probably find most of them in electro-acoustic music. A classical example is the enormous glissando in Stockhausen's Kontakte, starting in the pitch area and ending in the duration area where every pulse in the sound becomes a new pitch event (the sound-waves are synthesized with pulse generators). At the second measure after rehearsal number 22 in Grisey's Modulations we find another example. We can think of the rhythm in the bass drum as a very low pitch (2.1 Hz!) which gets higher, first within the percussion-group, and then, when the 2nd double-bass and contrabass clarinet start playing, it exceeds the threshold for our ears to perceive pitch.

like Grisey, but it is interesting to read the following passage from Stockhausen's thesis:

> "In order to compare one group of phases [= time-intervals] with another, we make a distinction between 'periodic' and 'aperiodic' phase-groups, and, between these extremes, we distinguish a greater or smaller number of transitional stages (as deviations from either periodicity or aperiodicity, depending on which predominates)."[10]

a)	**Periodic**	maximum predictability	**ORDER**
			↓
b)	**Continuous-dynamic**	average predictability	↓
			↓
c)	**Discontinuous-dynamic**	slight predictability	↓
			↓
d)	**Statistical**	zero predictability	**DISORDER**

Fig.1 The scale of complexity

In "Zur Entstehung des Klanges..." in *Darmstädter Beiträge zur neuen Musik* Grisey mentions the importance of periodicity. He says that our perception needs "a kind of exceedingly simple cues that can be perceived and remembered. We hold on to two kinds: the rhythmical periodicity and the harmonic spectrum (another kind of periodicity)."[11] However, periodicity can be too perfect. Mechanical periodicity tires the listener. Fig. 2 shows a periodic succession of events, where the horizontal axis is the time, and the vertical is the events (numbered from the beginning of the sequence, starting with zero). I will come back to how Grisey uses periodicity as a musical expression further on in my essay.

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10 Stockhausen, Karlheinz. "....HOW TIME PASSES....." in *Die Reihe* vol.3 (1959): 10.

11 [...eine Art überaus einfacher Orientierungspunkte, die jeder wahrnehmen und behalten können sollte. Wir werden zwei davon festhalten: die rhytmische Periodizität und das harmonische Spektrum (andere Form der Periodizität).] Grisey. (1978): 74.

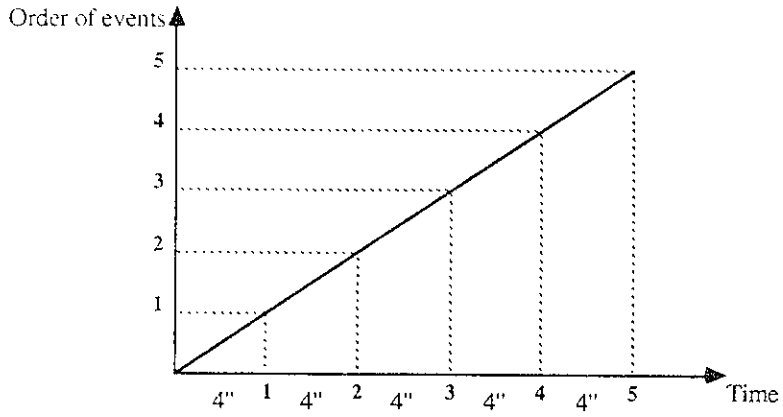

Fig.2 A periodic succession of events.

The next step on the scale, "Continuous-dynamic", can be either a continuous acceleration or a continuous deceleration. Grisey points out that there are two ways of achieving an accelerando or a ritardando. We could either add/subtract a constant duration to the preceding duration, or we could multiply/divide the preceding duration with a constant. Fig. 3 shows an accelerando where every duration has the duration of the preceding one minus 2 seconds. Fig. 4 shows a sequence where every duration has the duration of the preceding one divided with two. All the graphs are as they appear in Grisey's thesis "Tempus ex Machina".

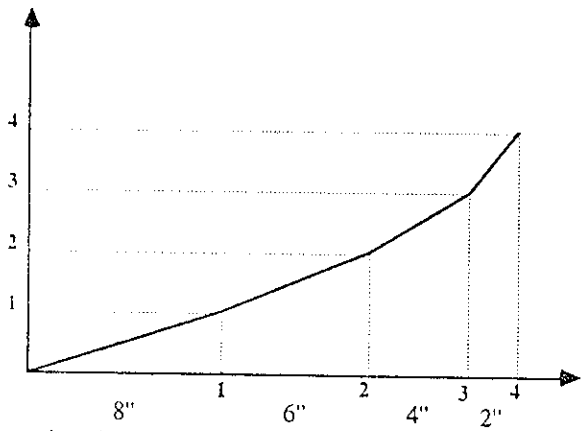

Fig.3 Continuous acceleration where every duration has the length of the preceding one minus 2.

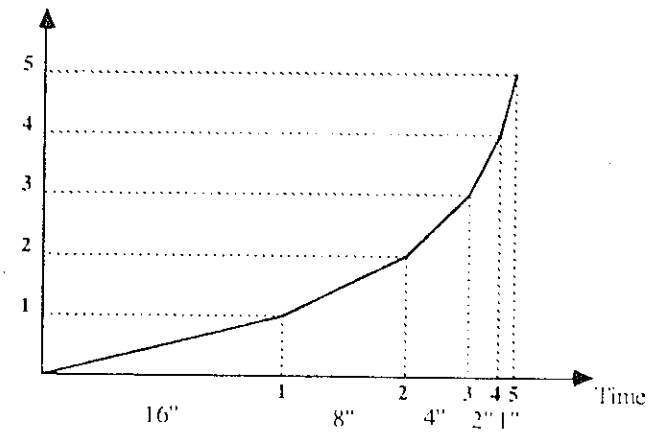

Fig.4 Continuous acceleration where every duration has the length of the preceding one divided with 2.

Grisey's distinction above owes very much to Stockhausen's "scale of durations" in ".....how time passes.....". Fig. 3 above has the same idea of proportions as Stockhausen's "subharmonic series of proportions". Here the rule is also to add a constant note value to the preceding duration. As mentioned above, Stockhausen does not make

any difference between pitch and rhythm, and the term subharmonic means that (transposed to the pitch area) the durations in the scale forms a subharmonic spectrum (an inversed harmonic spectrum). An example of such a scale can be seen in fig. 5.

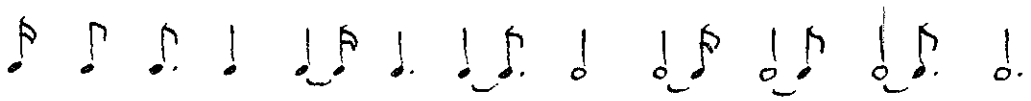

Fig.5 "Subharmonic" duration-scale. Each duration in the scale is a sixteenth-note longer than the preceding one.

It is obvious that it is easier to hear the difference between the first two note-values than the last two in the scale in fig. 5. The difference between the last two might even be smaller than the degree to which the performers could vary their durations for musical reasons. Stockhausen's viewpoint in his thesis is from the serial music, and he makes a very interesting reflection: pieces that use this type of duration-scale for serial purpose have an overweight of long note values.[12] There is one duration we perceive as short in the scale, then the next one is already twice as long and the difference is great. On the other hand there are several note values at the end of the scale that we will perceive as almost the same duration. It may now be obvious that we do not experience the difference between durations in a linear but in a logarithmic way. To achieve a perfect smooth accelerando it would be better to use the method in fig. 4 (which also Grisey points out). Stockhausen calls this a harmonic series of proportions (equal to the overtone series).

Fig.6 "Harmonic" duration-scale. Each duration in the scale has the length of the preceding one divided with two.

12 Stockhausen. (1959): 13.

Stockhausen goes much further with his ideas of duration-scales and creates a chromatic scale for durations. Grisey, as we shall see, develops his ideas in another direction.

"Discontinuous-dynamic" is the next step in the scale of complexity, and is less predictable than the previous step. Grisey shows two ways of making the sequence of events more unpredictable. The first method is to cut out parts of a continuous-dynamic sequence, for example when an accelerando has reached a certain speed, we could make a sudden jump to a more rapid event-frequency and then continue our accelerando from there. The other method is to follow the continuous-dynamic sequence with some deviations. The outline for the curve is maintained, but the actual sequence is always a bit too fast or a bit too slow. The deviations could be controlled by adding or subtracting (depending on if the actual sequence is too slow or fast compared to the underlying curve) small random-durations. Grisey calls this "statistical acceleration or deceleration". See fig. 7.

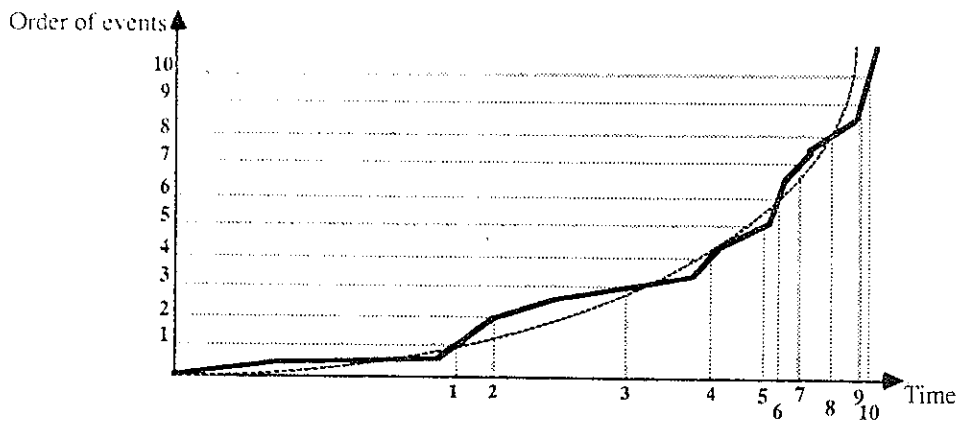

Fig.7 A statistical acceleration

The last step in the scale is called "Statistical" and has no predictability at all. This is when there is no logical succession for the durations, "like a veritable white noise of durations..."[13] We can find the idea of "noise of durations" already in Stockhausen's thinking. In discussing the possibility of organizing duration in a spectrum-like manner in his thesis discussed above, he says that if

13 Grisey. (1987): 256.

one omits or ties duration in the different layers in the "duration-spectra" to a too great extent, one runs the risk to "do away with periodicity, and thus with the 'harmonic' effect of the whole formant-spectrum; one composes the time counterpart of 'noise'."[14]

To this scale Grisey adds what he calls "Smooth" as a last possibility. This may fall outside his scale of complexity. He describes it as "seamlessness":

> "This 'seamlessness', this absence of durations can either be entirely perceptible, the rhythms being only operative, or can be perceptible *and* conceptual, a rare case of the total absence of any event, single sound or rhythmic silence."[15]

Analytic interlude

After having gone through Grisey's "Scale of complexity" I will now show how he realizes his theories in his music. When it comes to "real music" some composers tend to allow themselves many exceptions from their compositional rules, since their musical intention goes beyond their theoretical system. Others seem to take the consequences given by their system, which may be of great importance for the understanding of their pieces. How does Grisey's music relate to his "Scale of complexity"?

I have looked in more detail at *Modulations* for 33 musicians, the fourth movement in *Les Espaces acoustiques*. The piece was composed in 1976-77 and was commissioned by the Ensemble InterContemporain in Paris. In the program note Grisey divides the piece into five parts. The first part consists exclusively of homophonic music, and develops from "tension" to "détente".

At the first page in the score (see page 26) he divides the orchestra into two groups, the wind instruments and the first percussionist being the first, the strings, the hammond organ and the second percussionist the second group. The rhythmic structure is in

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14 Stockhausen. (1959): 29.
15 Grisey. (1987): 256-257.

one way very simple. Every new event is easy to hear. There are not numerous layers blurring the total impression of clearly pronounced chords, or rather timbres. In another way the structure is extremely complex. The time-intervals between two events are entirely irregular. The shortest time-interval on the page is less than a 32nd-note, and the longest is longer than a half note. We can also see a tendency to put the shortest time-intervals at the beginning of the page. In fig. 8 I have made a graph of the time-intervals between the events from the beginning of the piece to one measure before rehearsal number 3. The very fast repetitions of exactly the same chord that occur in the strings are treated as one event. The graph can be compared with fig. 2, 3, 4 and 7 above. The dualistic idea, where every two events should be played by the strings, and the others by the winds, suggest that the events are in such a state of disorder in the first measure, that some come in "the wrong order" (and that causes the ripple on the curve). A straight line should illustrate the most predictable sequence, periodicity. Here the condition is the opposite. The lengths of the time-intervals are unpredictable; the music is an example of "white noise of durations" (maybe "colored

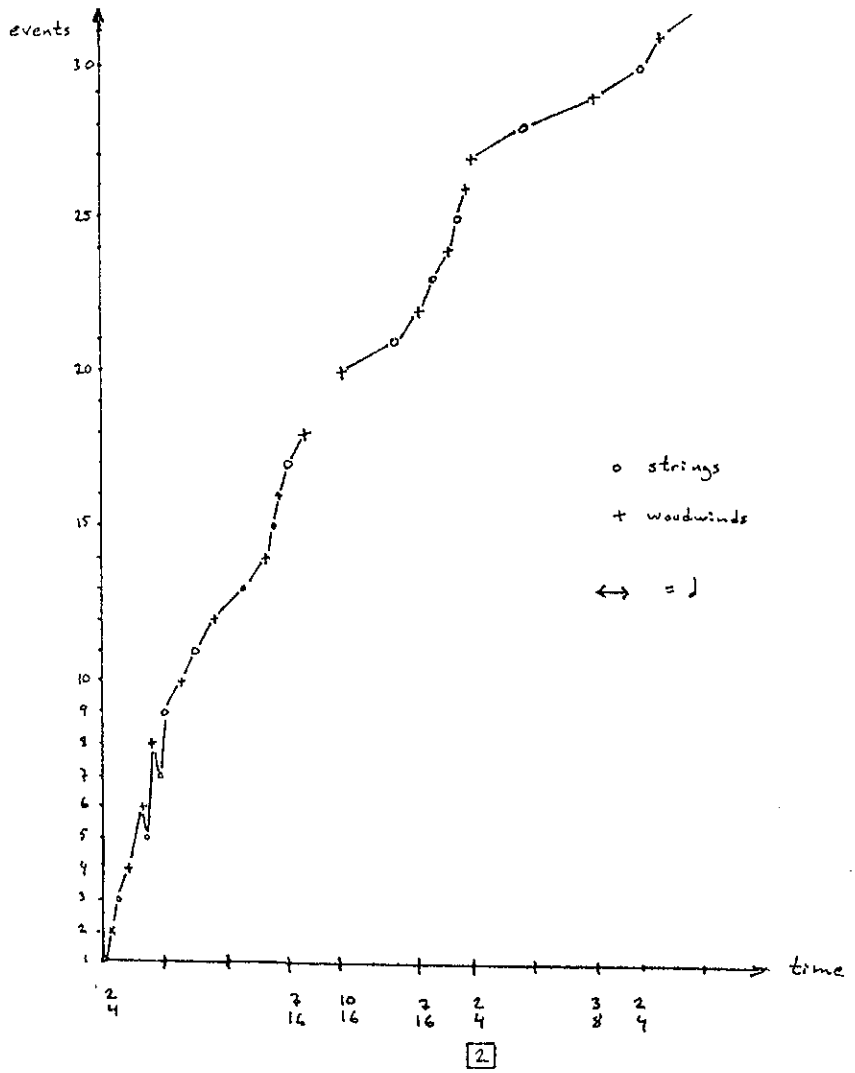

Fig. 8 Modulations: from rehearsal number 1.

noise" would be closer to the truth, since we have already noticed the tendency of changing the event-frequency in the passage).

At rehearsal number 4 the music has lasted for about half a minute (see page 27 and 28). Fig. 9 shows the time-intervals for the events from rehearsal number 4 to 6. The chords (no. 44 - 64 from the beginning of the piece) are here spaced much more regularly. The curve is almost a straight line, but there are important (and indeed perceptual) deviations. The events sometimes come "too early," and sometimes "too late" to form the absolute straight line. This is what Grisey calls discontinuous-dynamic, and even if this short passage does not clearly illustrate a deceleration, the overall process is a long ritardando. We could therefore call this a statistical deceleration.

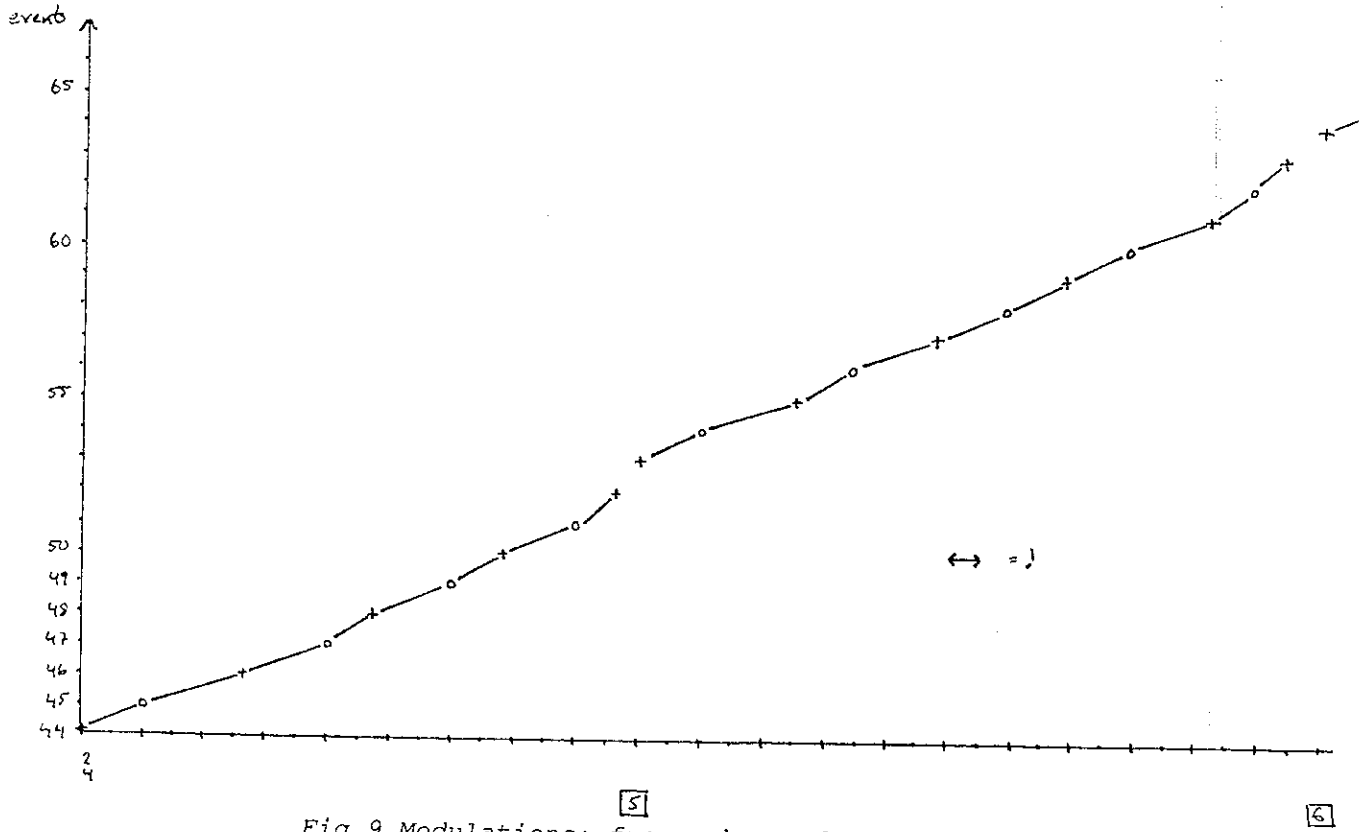

Fig.9 Modulations: from rehearsal number 4.

Finally we look from rehearsal number 12. As we see in the graph in fig. 10, we have come to a point where we can talk about periodicity in the music. Every event happens on the downbeat in each measure (starting in piano and then doing a crescendo to mezzo forte and back again), and the only exception from the perfect periodicity is when he

changes the time-signature from 2/4 in certain measures. The orchestration of the two groups has changed. The instrument-families are mixed in both groups.

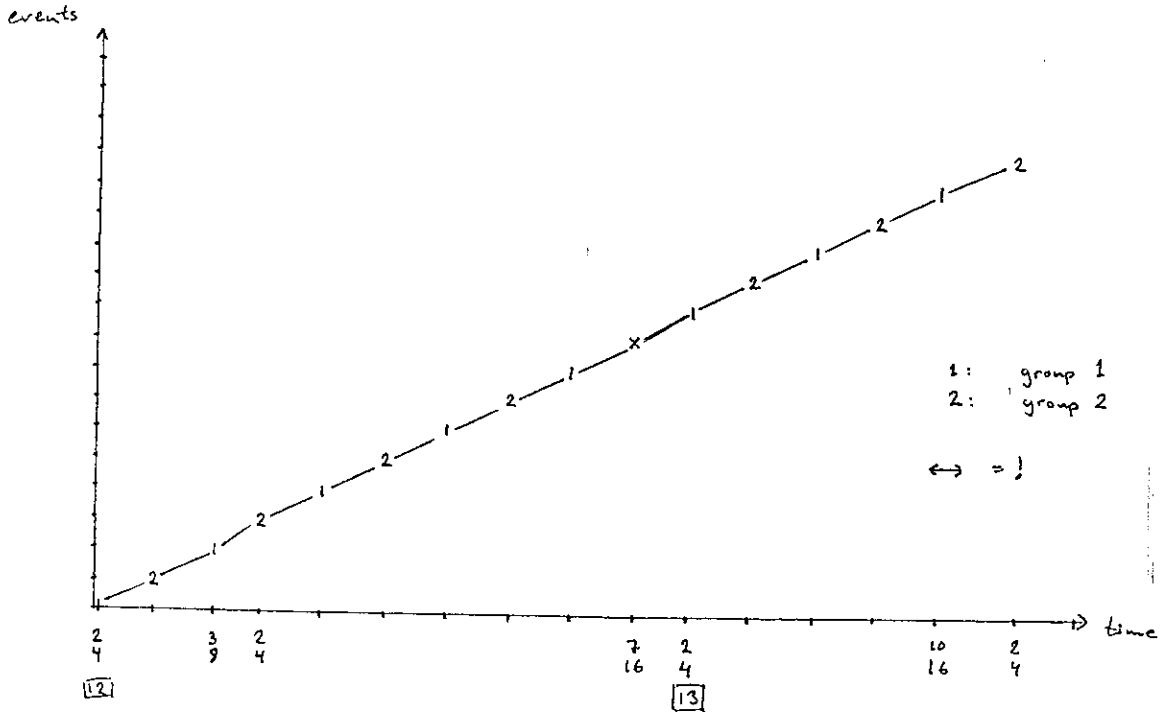

Fig.10 Modulaions: from rehearsal number 12.

To summarize the course of the music so far: The piece began in a state of disturbance and the events came irregularly. The music was in maximum disorder and at the last step, the "statistical", on Grisey's "Scale of complexity". Then we gradually moved over the scale from this unpredictable state until we reached the most predictable condition, periodicity. This kind of process from a tense to a more relaxed structure is of course a very common progress for music. But in fact the way Grisey achieves this it also affects our time-perception. Surely we experience that time unfolds at a different speed at the beginning of the piece than at rehearsal number 12. Periodicity and aperiodicity are here used as important musical expressions.

> "Periodicity is irreplaceable; it allows a pause in the music's unfolding, the suspension of time and, sometimes, a redundancy helpful to our powers of comprehension. When the musical structure demands it, we use it for its intrinsic qualities, avoiding both rejection and obsession."[16]

Of course there are other parameters that are important for our experience of the music than just the time spans between events. One is the harmony/timbre. Without analyzing pitch in detail we can easily hear that there are very complex chords/timbres at the beginning of the piece, and when the music gets more periodic, the chords/timbres get closer to the harmonic spectra.

It should be said that the quality of the process discussed above can not be seen in the score or in the graphs. To understand the change of time-speed one has to listen to the music.

A process of alteration

The infrastructure of the music, the temporal divisions of events, is not the only thing that affects our perception of time. The same "Skeleton of time" can be perceived differently depending on the characteristics of the events within it. Musical time and sound have a complex relationship to each other. Inspired by information theory Stockhausen has explored this problem in his texts. To experience time we need at least two events, the first where the time span begins and the second where it ends. The two events may be identical (very rare) or more or less altered. The following passage is from Stockhausen's article "Structure and experiential time" in *Die Reihe* no. 2 (1958) where he analyzes A. Webern's String quartet op. 28.

> "We experience the passage of time in the intervals between alterations: when nothing alters at all, we lose our orientation of time. Thus even the repetition of an event is an alteration: something happens - then nothing happens - then again something happens. Even within a single process we experience alterations; it begins, it ends."[17]

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16 Grisey. (1987): 247.

17 Stockhausen, Karlheinz. "Structure and experiential time" in *Die Reihe* vol.2 (1958): 64.

Stockhausen discusses some concepts linked to "processes of alteration". When the "degree of alteration" between every event is great, the "density of alteration" gets thick and we get surprised at every new, different event. However, if the alterations are always the same, we start to expect this alteration as a rule, and the following events are no longer unexpected for us. The more surprising events there are in the sequence, the more quickly our experienced time passes, and vice versa.

> "An apparent paradox is immediately explained: the greater the temporal density of unexpected alterations - the information content - the more time we need to grasp events, and the less time we have for reflection, the quicker time passes; the lower the *effective* density of alteration (not reduced by recollection or the fact that the alterations coincide with our expectations), the less time the senses need to react, so that greater intervals of experiential time lie between the processes, and the slower time passes."[18]

Grisey's ideas about the relation between time perception and the musical events, "The flesh of time", are almost identical with Stockhausen's discussed above. To those ideas he adds the function of our memory. When we are occupied with much information (high density of alteration) time passes quickly, but afterwards we remember the time-span as much greater. The opposite happens when the degree of alteration is small (for example if one, unchanged, chord repeats in an endless, periodic sequence), we quickly get bored and time seems to pass very slowly. In our memory this seems to be a much shorter time-span (maybe because there is nothing of interest to remember).[19]

Grisey has a great interest in the nature of sounds. As mentioned above his harmony is more based on timbre and acoustic science than traditional chord structures. For *Modulations* the timbre from brass instruments using different mutes were analyzed with the help of

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18 Stockhausen. (1958): 64.

19 [...our perception of time is sometimes the opposite of how we remember it: in a busy day time can seem to pass quickly as we experience it, but on recalling the day we say 'what an interminable day!' Similarly, to a quiet day corresponds the perception of time passing slowly and the memory of a day soon over.] Grisey. (1987): 272-273.

sonograms, and then "reconstructed" (or distorted) in the "chords" of the piece. To let the listener focus on the timbreal qualities of the music, there has to be time for him to grasp the details in the chord-structure. In a passage with too much information (too high density of information) this is impossible. When experienced time passes at a high speed we can only grasp the overall structure. The possibility to focus on either the macro structure or the micro structure, which Grisey calls the "depth in music", interests him. To control the "play with the zoom lens back and forth" he creates a tool for this, a "Scale of sound proximity". He does not tell us what this scale consists of, but he refers to a part of *Modulations* as an example. Let us take a detailed look at the passage.

Statistical and pointillistic textures

The passage starts at rehearsal number 37 in the score, and continues until rehearsal number 44. In this part of the piece Grisey divides the orchestra into four groups (named A, B, C and D). Each group consists of five voices, and the instrumentation of them changes. The score is organized according to those groups, and thus the vertical order for the instruments is unusual.

The notation of duration on the first page in the passage is different from the one on the last page. The last page uses traditional note values. The notheads are followed by a thick, horizontal line to give us a visual impression of their length. The music is homophonic and all rhythms on the page should be performed simultaneously in all parts.

At rehearsal number 37 the situation is more complex. Here the notation does not give us the exact duration for every note. The only thing the score shows is when a phrase starts, which pitches the phrase consists of, and when the phrase should end. Look at the first phrase in the upper voice of group A (viola 2) fig. 11. The phrase starts here at the second eighth note of the third beat in the second measure of the page. It consists of seven pitches and the performance must be done exactly at the second sixteenth note of the fourth beat

in the same measure. The notation does not tell us how long each note within the phrase should be, and it is up to the performer to distribute the notes within the given limits. It is the duration of the pauses between phrases that is exactly notated, not the length of the individual notes!

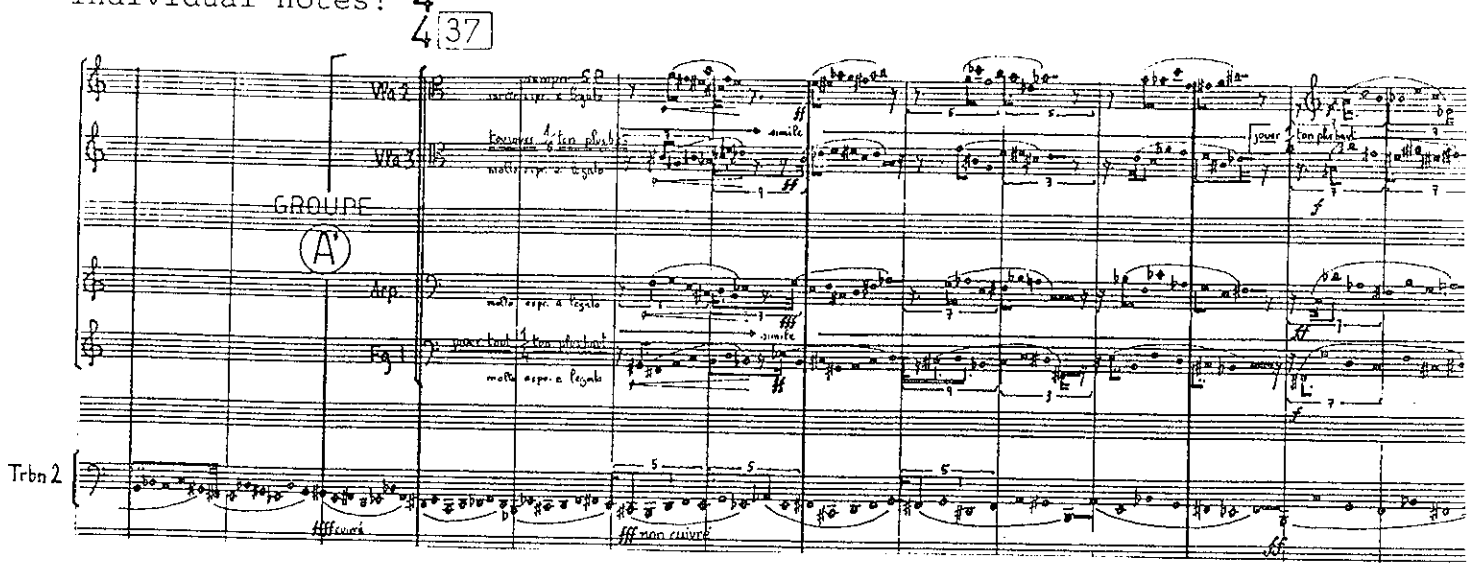

Fig.11 Modulations: group A on page 41 in the score.

In Stockhausen's article ".....how time passes.....", he writes about the relation between notated rhythm and the resulting, actual performed rhythm. The more complicated the notation gets, the less precision in the performance we can expect. Instead of giving the whole responsibility for solving this problem to the performer, he shows other, more flexible systems for notation of duration. (He points out that John Cage has already experimented with this. Stockhausen's article was written in the fall of 1956.) A more flexible system should allow the performer to play a note within certain limits, and not force him to start and end the note at exact time-points. For this he uses the term time-fields. Thus there are two ways of notating duration, a "pointillistic" (exact duration) and a "statistical" (duration within time-fields). The latter can be very useful in complex passages where we can only perceive the macro-structure. The details in such a passage disappear in the background, in "the depth" of the music.

> "Such a switch, from 'pointillist' to 'statistical' perception of time has become a further occasion for the *statistical composition of fields*. But this means that the elements themselves are no

> longer presented as discrete degrees of some scale or other [...] Rather, a field-size, in the sense described above, is substituted for each discrete value..."[20]

Stockhausen develops his ideas further later on in his text.

> "A particular number of single field-sizes gives a *group-field*. Here the size of the group-fields depends on the number and size of the single fields. Similarly, it is possible to start from group-fields of various sizes, and from these to arrive at the magnitude-proportions of the single fields."[21]

As we have already seen, this is exactly what Grisey does. In fig. 11 he fixes the length of the first group-field in the upper voice to exactly a dotted eighth note, and from this the single durations are determined. May be that Stockhausen does not necessarily fix the length of the group-fields, but the similarity of their ideas remains. When discussing how to compose with time-fields in a meaningful way Stockhausen says that "...if a series of field-sizes served to present a time-structure in which the composed fields mediated between the pointillist and statistical extremes (A), then we should really be dealing with a new musical time-continuum: time as a discontinuum - and time as a continuum would then merge in a supra-ordered concept of serial *field-time*."[22] We shall have this quotation in mind when we now resume our analysis of Grisey's *Modulations* and scale of sound proximity.

The zoom lens

We could think of each group from rehearsal number 37 in the score as based on its lowest voice. Group A should then be based on the 2nd trombone, group B on the 1st trombone, group C on the two french horns and group D on the tuba. In my analysis I will use group A as an example, but the technique is the same for every group.

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20 Stockhausen. (1959): 32.
21 Stockhausen. (1959): 35.
22 Stockhausen. (1959): 34.

The music in the 2nd trombone is divided into "phrases" indicated by slurs, and each phrase consists so far of seven notes. In the four upper voices in the group there are also slurs indicating seven-notes-long phrases, but here pauses separate the phrases. The higher voice, the longer pauses. If we compare all voices in the group vertically, we see that all phrases in the upper voices fit within in the phrases in the 2nd trombone. Thus, since the pauses between the phrases are longest in the first voice, these phrases will be played most rapidly. Fig. 12 illustrates the phrases' duration graphically. This picture could as well be an illustration for an envelope-generator in electro-acoustic music. It is also a common behavior for natural sounds that the higher harmonics attack last and decay first.

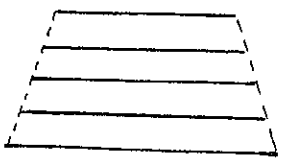

Fig.12 Graphic illustration of the five voices in a phrase.

The next step is to look at the pitches in each voice. All voices use the same mode in a phrase, but transposed to different levels. In the first phrase (I start counting phrases from the third beat in the second measure on the page) the mode in the 2nd trombone is b, c sharp, d, e flat, e, f and g. In the next voice, the 1st bassoon, the same mode is transposed to a quarter tone high f sharp (note the instruction "jouer tout 1/4ton plus haut"). In the harp the starting tone for the mode is b (as in the 2nd trombone), in the 3rd viola it is the sixths of tone low a, and in the 2nd viola it is the d sharp. The 1st bassoon plays the pitches in the same order as the 2nd trombone. In the other voices the order for the pitches are free. From the third phrase the harp joins the 1st bassoon and 2nd trombone, and from here on the three lower voices all play the pitches in the mode in the same order. In the fifth phrase the second violin goes the same way, and from the second phrase on the next page in the score all voices in group A play the same, transposed pitch-row.

At one measure before rehearsal number 38, the next change in the structure takes place. From here on the 1st bassoon and 2nd trombone should play not just parallel in pitch, but also parallel in time. There is an ambiguousness in the notation here. Grisey does still use the field-size notation, so the actual result can not be exact simultaneity in duration. This must yet have been carefully calculated. The indication in the score is "quasi synchrone avec trbn 2", and the meaning of this is clear. It is not meant to be as precise as with traditional, "pointillistic" notation.

In the phrase one measure after 38 the harp starts to play "quasi synchronous" with the two lower voices, and in the third phrase on the next page the 3rd viola joins them. Finally, at the upbeat to one measure after 39 all five voices in group A play parallel in pitch and "quasi" parallel in time. In the next phrase Grisey starts to use traditional note values, and thus the precision increases.

The graphic illustration in fig. 13 shows the beginning of the process described in the text. The brackets to the left indicate where the groups are. I use two ways to indicate that an instrument is playing. The thin line indicates that just this voice is playing. The pitches are here in the same mode (but transposed) as the bottom voice in the group, but the order of them is free. When the line becomes outlined (like a rectangle) the pitches even come in the same order as in the bottom voice. The vertical lines that connect voices within a group at the end of the illustration show that the voices play "quasi synchrone". The graph starts at rehearsal number 37 and ends at three measures after 39. We can now see the process clearly. The texture is at the beginning considerably complex. The similarity in mode between the voices within a phrase in a group is not perceptible, and the impression is that 20 instruments are playing a chaotic texture. As the music unfolds the voices in each group come more and more together. The phrases in the upper voices are gradually lengthend until they are of equal length to those in the bottom voice in the group, and this causes them to play "quasi" parallel. In the beginning of the example there is a polyphony of 20 parts. At the

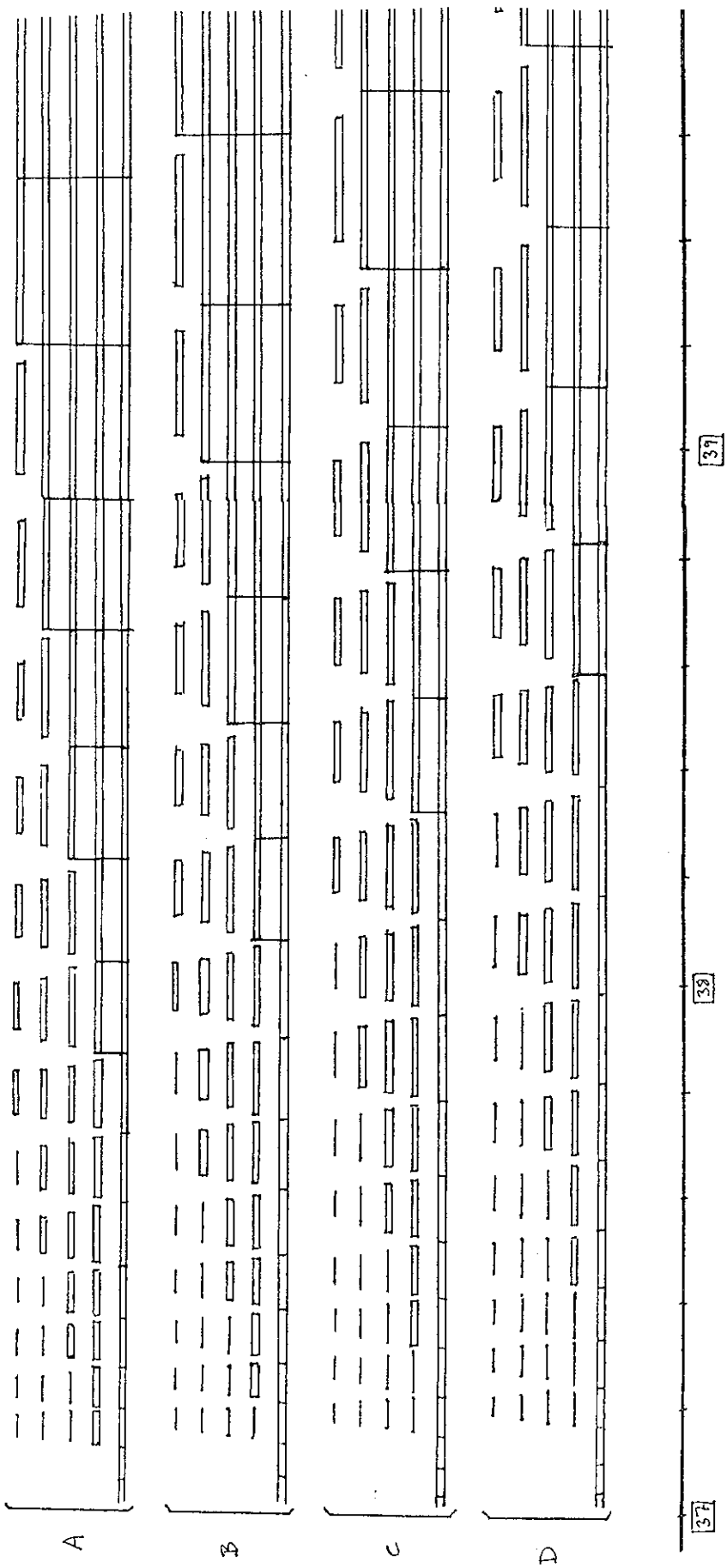

Fig.13 Modulations: from rehearsal number 37.

end of fig. 13 we are reaching a polyphony of four groups. At two measures after rehearsal number 43 in the score the music has reached the point where all groups play together in a homophonic texture.

From fig. 13 we can get an idea of what Grisey's "Scale of sound proximity" is. The more the music reaches a homophonic texture, the easier we perceive the details in the texture. Grisey's "zoom lens" is a good illustration of what happens to our perception. At 37 in the score we are only able to grasp the outline of the texture. Our ears focus on the macro structure. Gradually the music zooms in on the details of the texture, and the timbre and micro structure of the sounds become increasingly apparent for our hearing. This is also stressed by the long deceleration in the section. The slowing down of time has the effect that we "arrive at the very heart of sound".

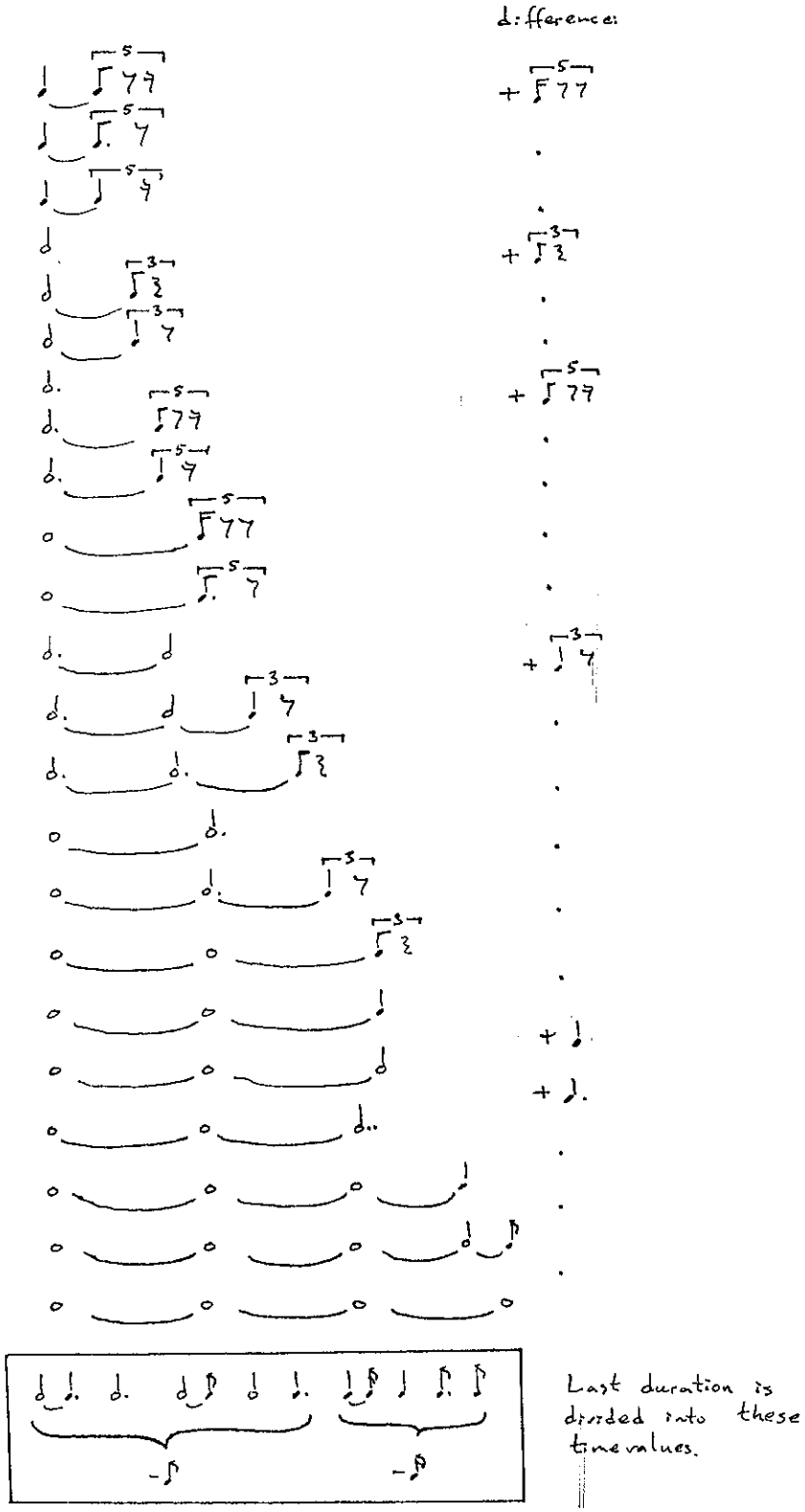

Fig. 14 Modulations: length of the phrases from rehearsal number 37 in group A.

Finally, how is the deceleration constructed? Does it relate to his ideas in

the continuous-dynamic step in his "Scale of Complexity"? In fig. 14 we can see the length of each phrase in group A from 37 to 44 in the score. The differences between two adjacent phrases are shown in the right column. The sequence seems to be very carefully calculated. The first four phrases increase all with a sixteenth note within a quintuplet. Then the differences grow in steps, and at the end of the section the differences among the five last phrases are a dotted quarter note. An interesting observation is that the last phrase consists of nine notes making an acceleration - an acceleration within the deceleration! We will however probably not perceive the overall deceleration at this point. The speed at which time passes is slower, and we have arrived at a point where the micro structure is in focus. Grisey explains the effect in this way: "What remains of the dynamism of global structures when, with our ears riveted to the *internal* dynamism of sounds like the eye to a microscope, we become deaf to every *macrophonic* event..."[23]

Summary

Modulations was written 1976/77, twenty years after Stockhausen's article ".....how time passes....." Many composers have used proportional notation in those twenty years (among others Lutoslawski, Penderecki and Berio). Still it is striking how close to Stockhausen's ideas Grisey is. The following passage is from Stockhausen's article:

> "If a composer experiences musical time as multi-dimensional time, his composition has itself become multi-dimensional; for him measured and perceived proportions, time-fields and -quantities, systematic and 'chance' determinations, are extremes, between which there are many stages."[24]

In our analysis of Grisey's "Scale of sound proximity" we have discovered several stages between time-fields and time-quantities. Time has many dimensions in his music. There are close connections

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23 Grisey. (1987): 259
24 Stockhausen. (1959): 38.

between the speed of time's unfolding and the way the composer structures the music. In one way Grisey's music is very traditional: it is goal-directed and has basically a linear structure of time - the texture develops through processes. His mastery over experienced time speed, and his way of focusing on different levels in the structure is however unique. We can not find this in Stockhausen's music. Stockhausen's pieces connected to his text above are *Zeitmasse*, *Gruppen für drei Orchester* and *Klavierstück XI*, and the differences are greater than the similarities to Grisey's *Modulations*. Grisey's main concern is the listeners' perception of his musical structures. Problems always arise when we try to apply theories to real compositions. Grisey's criticism of some earlier examples is crushing. There has to be a connection between the composer's ideas and what the listener experiences. "*They* [the ideas] *became ridiculous when our elders ended up confusing the map with the lie of the land.*"[25] He uses Gruppen as an example: "...the tempi have a great structural importance. Who perceives them?".

The last word is always left to the listener. The perception of time takes place within the listener. Factors such as the listener's cultural and social background are beyond the composers control, but are not trivial. His capability to memorize does also affect his experience of music. In Grisey's article in *Darmstädter Beiträge zur neuen Musik* he writes:

> "Faced with a work of music we are not, as when faced with a room, passive spectators on an immovable point. On the contrary, the point from which we perceive is always in motion, since it concerns the present. I suspect that we experience the time of a work of music from the point of view of another time, which is the rhythm of our lives."[26]

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25 Grisey. (1987): 240.

26 [Einem Musikwerk gegenüber sind wir nämlich nicht, wie etwa einem Raum gegenüber, passiver Beobachter auf einem unbeweglichen Punkt. Der Standpunkt der Wahrnehmung ist im Gegenteil seinerseits ständig in Bewegung, da es sich ja um die Gegenwart handelt. Ich vermute im übringen, daß wir die Zeit eines Musikwerkes von einer anderen Zeit aus erfahren, die der Rhythmus unseres Leben ist.] Grisey. (1978): 78.

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Örjan Sandred, Montréal Dec.94