Table XVI-A

Order No.	1	2	3	4	5	6	7	8	9	10	11	12
Pitch	E♭	D	A	A♭	G	F♯	E	C♯	C	B♭	F	B
Duration												
Attack												
Dynamic	*pppp*	*ppp*	*pp*	*p*	quasi *p*	*mp*	*mf*	quasi *f*	*f*	*ff*	*fff*	*ffff*

(The absence of an attack at the fifth order number indicates "normal.")

4. *Pierre Boulez: Conversations with Célestin Deliège* (London, 1975), pp. 41–42.

Table XVI-B

Order No.	7	1	10	3	4	5	11	2	8	12	6	9
Pitch	E	E♭	B♭	A	A♭	G	F	D	C♯	B	F♯	C
Duration												
Attack												
Dynamic	*mf*	*pppp*	*ff*	*pp*	*p*	quasi *p*	*fff*	*ppp*	quasi *f*	*fffff*	*mp*	*f*

PIERRE BOULEZ

GYÖRGY LIGETI

DECISION AND AUTOMATISM IN STRUCTURE Ia

If one is to demonstrate the way constructional principles were used in the early stages of serial music, Structure Ia[1] is a particularly suitable example. Since this composition is very perspicuously worked out, its anatomy is revealed of its own accord, so it can be analysed as a 'textbook example'. Alongside the very ramified complexity of the *Marteau*, it stands in crystal-clear sobriety.

At this level of serial technique the compositional process can be reduced to three working stages: *Decision I – Automatism – Decision II.*

Decision I

A. Selection of elements.

B. Choice of an arrangement for these elements.

C. Choice of the further operations to be carried out with these arrangements ('arrangements of arrangements') and mutual relationships of the individual arrangements to each other.

Automatism

Elements and operations, once selected, are, as it were, fed into a machine, to be woven into structures automatically, on the basis of the relationships chosen.

Decision II

The automatically derived structure is to some extent crude, and one must work on it further, taking decisions in dimensions that are not employed mechanically. If, for example, the parameter 'dynamics' or 'register' has not been passed into the machine, then one can work over the crude structure by directing these left-over parameters. This can be done aleatorically, or with definite formal aims, such as to form or avoid particular connections within the given crude structure.

But the above-mentioned division into three results only if, in analysing, one is inclined to simplify. It could easily tempt one to regard the serial mode of working as a dialectic between freedom and mechanical compulsion. That would be wrong, for in this case decision is not to be confused with freedom, nor automatism with compulsion. You stand before a row of automata, and are free to choose which one to throw into; but at the same time you are compelled to choose one of them; you build your own prison as you please, and once safely inside you are again free to do as you please. Not wholly free, then, but also not totally compelled. Thus automatism does not function as the

[1] Musical examples can for the most part be dispensed with here, since a printed edition of the *Structures* is available. Figures in the text refer to bar-numbers in the UE edition, 12267.

counterpole to decision; choice and mechanism are united in the p[illegible] of choosing one's mechanism.[2]

Let us investigate how the process of composition, as outlined, is realised in this piece by Boulez.

Selection and arrangement of note-qualities[3]

Tied down by the given, fixed temperament of the instruments chosen, and also by the traditional twelve-tone method, Boulez employs all twelve available note-qualities. In homage to his teacher he arranges these notes to form the same series as Division 1 of the note-succession from Messiaen's *Mode de valeurs et d'intensités.*

Example 1
Intervals measured in rising minor seconds

The marked homogeneity of this series is striking – the frequent occurrence of the interval 11 (five times), and the lack of 8 and all intervals below 6. The intervals present, apart from 11, are fairly evenly represented: 10 and 7 twice each, 9 and 6 once each. Very characteristically, 6 is used as the final interval of the series (this will later be intensively exploited in the piece); and the symmetrical position of the two 7s (second and penultimate intervals) is also characteristic.

This apparent poverty of the series becomes an advantage, however, since the inversion of the series

Example 2

consists only of intervals *below* 7, and thus, apart from 6, has no intervals in common with the basic form; this makes it easier to draw a clear distinction between the individual series, which function like threads in a web. Through this arrangement, the tritone 6 (common to the two series) becomes the axis of the basic series and inversions, while the regions of the remaining intervals function separately, in the one case as intervals above 6 (basic series and inverted cancrizan), in the other below 6 (inversion and cancrizan of the basic series). This separation is made all the more clearly manifest because the two triple successions of the same interval (11 and 1 respectively) act as characteristic vectors and thus produce a very marked contrast between the prevailing movement of the two different serial regions. 11 and 1 also produce a pronounced chromatic connection within the series; however, in the network of variously-combined serial threads these connections and prevailing movements are to a greater or lesser degree destroyed, because between the intervals of one series there are inserted notes from other series, which distract our attention from the connections mentioned, making us concentrate on other relationships. Thus as the overall structure

[2] For further discussion of this question the reader is referred to Herbert Eimert's article 'The Composer's Freedom of Choice', *Die Reihe III*, Universal Edition (London) and Theodore Presser Company, 1959.

[3] In our case it is more exact to talk of twelve note-qualities per octave, rather than pitches (which, after all, signify wholly exact frequencies), since the individual notes of the series can be transposed to different octave registers.

unfo[illegible]ere is continually a dialectic – chosen conditions within the series, versus the tendencies (moving in a different direction) of automatic serial combination.

Boulez uses the chosen note-quality series and its inversion, cancrizan and cancrizan inversion[4] in all twelve transpositions. In arranging the individual transpositions he refers to the following tables.[5]

S

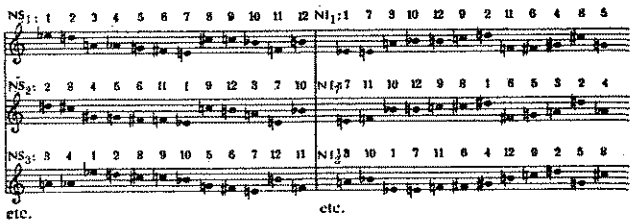
1	2	3	4	5	6	7	8	9	10	11	12
2	8	4	5	6	11	1	9	12	3	7	10
3	4	1	2	8	9	10	5	6	7	12	11
4	5	2	8	9	12	3	6	11	1	10	7
5	6	8	9	12	10	4	11	7	2	3	1
6	11	9	12	10	3	5	7	1	8	4	2
7	1	10	3	4	5	11	2	8	12	6	9
8	9	5	6	11	7	2	12	10	4	1	3
9	12	6	11	7	1	8	10	3	5	2	4
10	3	7	1	2	8	12	4	5	11	9	6
11	7	12	10	3	4	6	1	2	9	5	8
12	10	11	7	1	2	9	3	4	6	8	5

I

1	7	3	10	12	9	2	11	6	4	8	5
7	11	10	12	9	8	1	6	5	3	2	4
3	10	1	7	11	6	4	12	9	2	5	8
10	12	7	11	6	5	3	9	8	1	4	2
12	9	11	6	5	4	10	8	2	7	3	1
9	8	6	5	4	3	12	2	1	11	10	7
2	1	4	3	10	12	8	7	11	5	9	6
11	6	12	9	8	2	7	5	4	10	1	3
6	5	9	8	2	1	11	4	3	12	7	10
4	3	2	1	7	11	5	10	12	8	6	9
8	2	5	4	3	10	9	1	7	6	12	11
5	4	8	2	1	7	6	3	10	9	11	12

Example 3

These tables result from lining up the original series and inversions according to the note-order of NS_1 and NI_1, thus:



Example 4

No further tables are necessary for cancrizan and cancrizan inversion, since these result without more ado if we read the series of numbers from right to left: e.g., NI_4 becomes 7, 10, 1 . . . 4, or NIC_{10} 2, 4, 1, . . . 10.

[4] To distinguish between the note-quality series and duration series we use the following abbreviations
NS Original forms of the note-quality series.
NI Inversions " " " " "
NC Cancrizans " " " " "
NIC Inverted cancrizans " " "
DS Original forms of the duration series
DI Inversions " " " "
DC Cancrizans " " " "
DIC Inverted cancrizans " "

[5] Cf. Feldman, Boulez, Cage, Wolff: '4 Musicians at work', *Trans/formation*, 1/3, New York 1952, p.169.

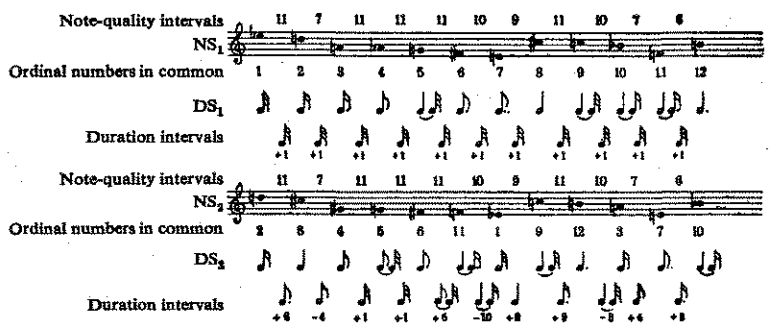
Selection and arrangement of the (relative) time-durations

The chosen basic unit (demisemiquaver) is multiplied by from 1 [illegible], and arran[illegible] in an increasing arithmetical series (again as in the above-mentioned piano piece Messiaen).

Example 5

Whereas the twelve elements of the note-quality series are predetermined by the customary temperament, the choice of durations, though in itself logical (as an arithmetical series), is all the same arbitrary. The number of duration elements (12) is meant to equal the number of note-qualities present, but the duration series, because of its additive structure, behaves heterogeneously as compared with the note-quality series, whose organisation is proportioned.[6]

It would, however, be unjust to pass a negative judgment on this dimensional difference, since such disagreements, artistically used, can lead to exciting combinations. It is not such a bad idea of Boulez', to link a linear scale (as duration series) to a note-quality series that is formed quite differently and is not (or only partly) scalar. One might object more to the unorganic way the durations are permutated. Boulez proceeds as follows: since a duration series DS_1: 1, 2, . . . 12 corresponds to the note-quality series NS_1: 1, 2 . . . 12, a permutation DS_2: 2, 8, 4, 5 . . . 10, for instance, must correspond to the transposition NS_2: 2, 8, 4, 5 . . . 10. Let us compare the resulting duration intervals with the note-quality intervals:



Example 6

Since in a series the decisive thing is the relationship between each element and the next, the contrast between the two procedures is obvious; whereas with the (organic) transposition of the note-quality series, the individual note-qualities are permutated but the interval-relationships always remain the same, the permutations of durations (which are in fact not transpositions at all) occur mechanically, according to tables, and have constantly different internal proportions. It is therefore by no means clear why just *these* permutations have been chosen out of all the possible ones. What is unorganic is this pointless transplantation of a system; note-qualities labelled with numbers, the

[6] Stockhausen has discussed this in detail in '. . . how time passes . . .', *Die Reihe III*.

unfolds, there is continually a dialectic – chosen conditions within the series, versus the tendencies (moving in a different direction) of automatic serial combination.

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S

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4	5	2	8	9	12	3	6	11	1	10	7
5	6	8	9	12	10	4	11	7	2	3	1
6	11	9	12	10	3	5	7	1	8	4	2
7	1	10	3	4	5	11	2	8	12	6	9
8	9	5	6	11	7	2	12	10	4	1	3
9	12	6	11	7	1	8	10	3	5	2	4
10	3	7	1	2	8	12	4	5	11	9	6
11	7	12	10	3	4	6	1	2	9	5	8
12	10	11	7	1	2	9	3	4	6	8	5

I

1	7	3	10	12	9	2	11	6	4	8	5
7	11	10	12	9	8	1	6	5	3	2	4
3	10	1	7	11	6	4	12	9	2	5	8
10	12	7	11	6	5	3	9	8	1	4	2
12	9	11	6	5	4	10	8	2	7	3	1
9	8	6	5	4	3	12	2	1	11	10	7
2	1	4	3	10	12	8	7	11	5	9	6
11	6	12	9	8	2	7	5	4	10	1	3
6	5	9	8	2	1	11	4	3	12	7	10
4	3	2	1	7	11	5	10	12	8	6	9
8	2	5	4	3	10	9	1	7	6	12	11
5	4	8	2	1	7	6	3	10	9	11	12

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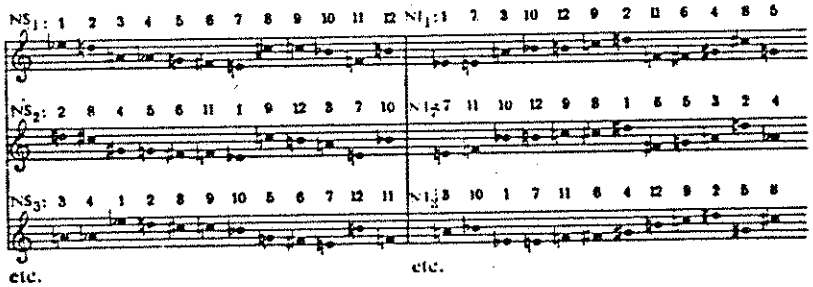

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NI	Inversions	„	„	„	„
NC	Cancrizans	„	„	„	„
NIC	Inverted cancrizans	„	„	„	„
DS	Original forms of the duration series				
DI	Inversions	„	„	„	„
DC	Cancrizans	„	„	„	„
DIC	Inverted cancrizans	„	„		

[5] Cf. Feldman, Boulez, Cage, Wolff: '4 Musicians at work', *Trans/formation*, 1/3, New York 1952, p.169.