Pierre Boulez's *Structures 1a for Two Pianos*

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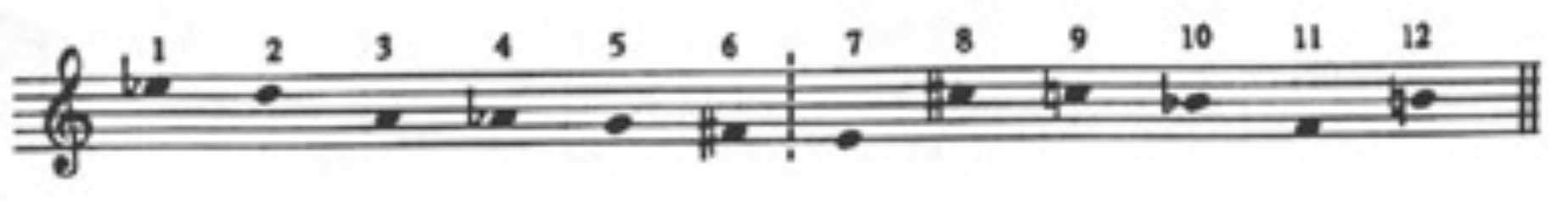
Introduction

Boulez wrote two books of "Structures" for two pianos. Structures I consists of three parts and Structures II of two parts. (We will be discussing Structures Ia)

Structures Ia was written in 1952. As almost every aspect of the piece was predetermined, Structures was without a doubt written in the style of integral (total) serialism. In fact, it was Boulez's intention to make Structures a textbook piece for integral serialism in the same way *The Art of The Fugue* was for fugal writing.

The Tone Row

The tone row Boulez used for *Structures* was based upon a twelve-note series derived from Division 1 of Messiaen's *Mode de valeurs et d'intensités.*

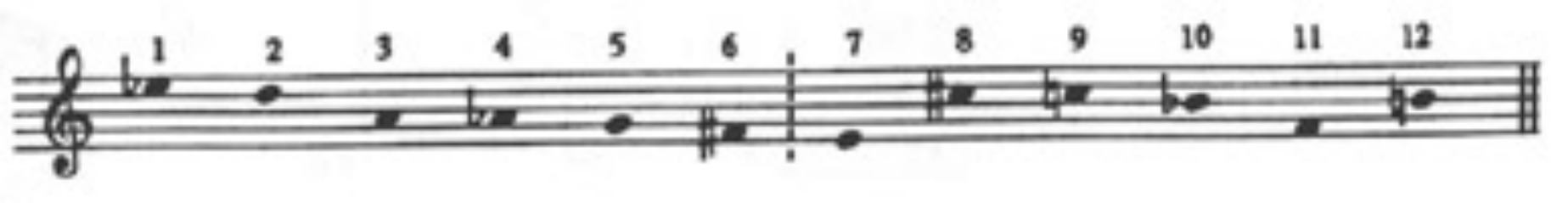


All twelve transpositions of the tone row plus the twelve transpositions of each of the derived forms (inversion, retrograde and inverted retrograde) were used once each throughout *Structures 1a*. Thus, a total of 48 rows appear in the piece, each Piano part containing 24 rows.

The Matrices

Using the tone row, Boulez created two matrices: the Original Matrix, and the Inversion Matrix.

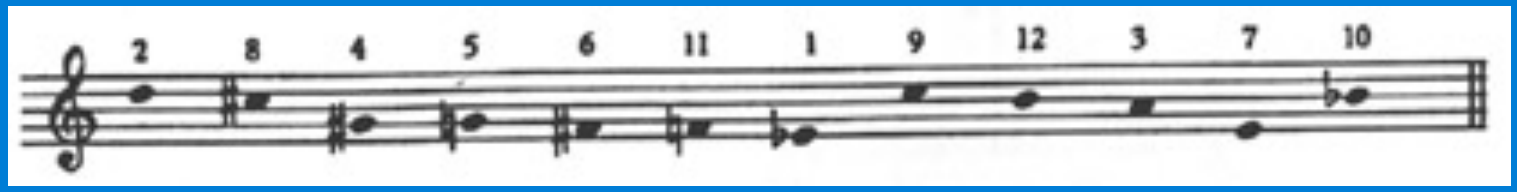
-To create the matrices, Boulez first assigned each of the notes in the tone row a number.



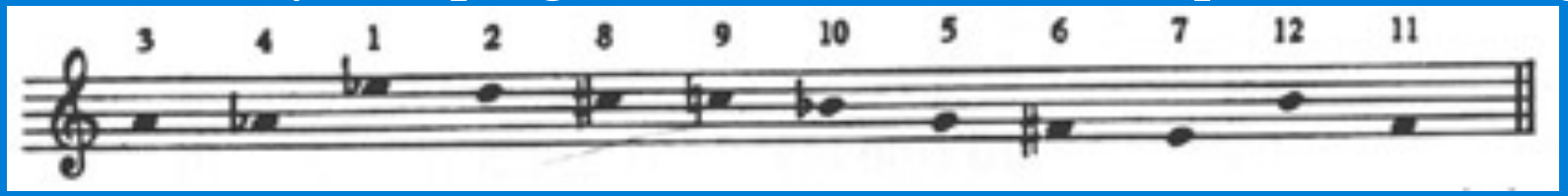
So E-flat became 1, D 2, A 3, A-flat 4, G 5, etc.

The Matrices

The original matrix was then filled in by transposing the original row, beginning on each note in turn. For example, the second note of the series was D, so the second row of the matrix was formed by keeping the interval relationships and starting on a D.



The second row of the matrix thus reads 2 8 4 5 6 11 1 9 12 3 7 10.
The third note of the series was A, so the third row of the matrix was formed by keeping the interval relationships and starting on A.



The third row of the matrix thus reads 3 4 1 2 8 9 10 5 6 7 12 11

The Matrices

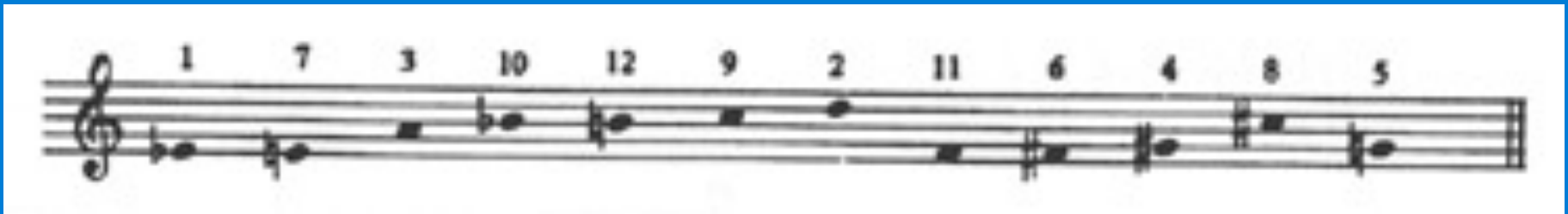
Once all twelve transpositions are determined, they are filled into the matrix. Reading from left to right gives the original row and its transpositions, and reading from right to left gives the retrograde rows.

'O' matrix

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

The Matrices

The second matrix is created by determining the inversion of the original row and its transpositions.



Thus, the first row of the Inversion Matrix reads:
1 7 3 10 12 9 2 11 6 4 8 5

The Matrices

The inversion transpositions are determined in the same way as the for the Original Matrix. They are then filled into the Inversion Matrix. Reading from left to right gives the inversion rows, and reading from right to left gives the retrograde inversion rows.

'I' matrix

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

The Matrices

These two matrices were used to determine all note durations, dynamics, and modes of attack. They also determined the order in which the rows were used and formed a plan for note durations.

'O' matrix

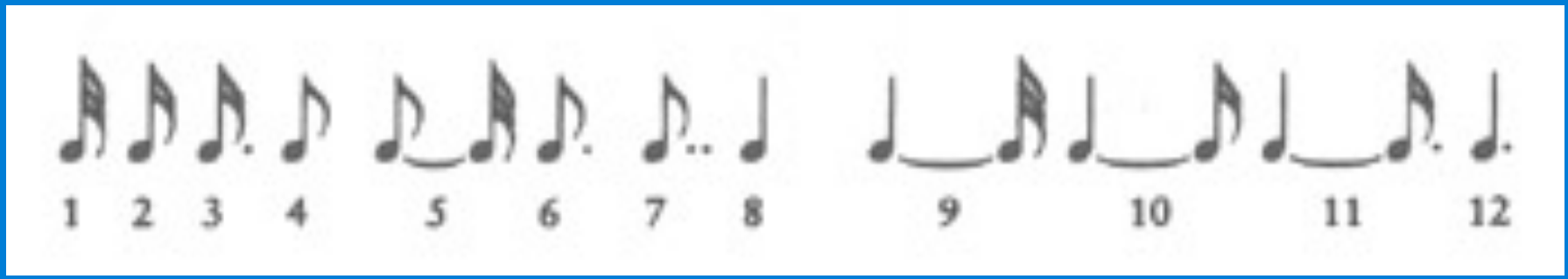
1	2	3	4	5	6	7	8	9	10	11	12
2	8	4	5	6	11	1	9	12	3	7	10
3	4	1	2	8	9	10	5	6	7	12	11
4	5	2	8	9	12	3	6	11	1	10	7
5	6	8	9	12	10	4	11	7	2	3	1
6	11	9	12	10	3	5	7	1	8	4	2
7	1	10	3	4	5	11	2	8	12	6	9
8	9	5	6	11	7	2	12	10	4	1	3
9	12	6	11	7	1	8	10	3	5	2	4
10	3	7	1	2	8	12	4	5	11	9	6
11	7	12	10	3	4	6	1	2	9	5	8
12	10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

'I' matrix

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

Note Durations

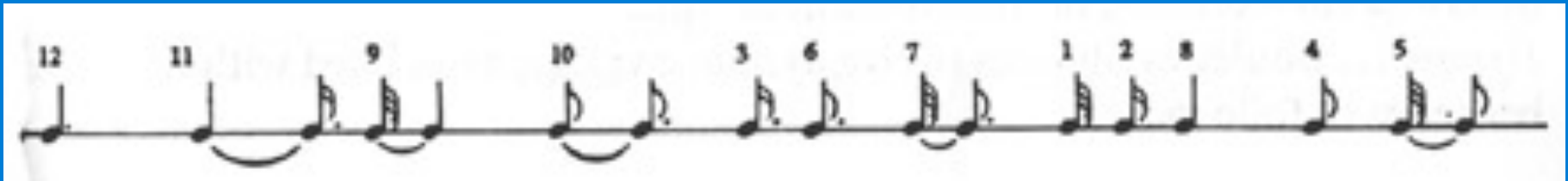
In *Structures 1a*, Boulez uses the thirty-second note as the basic time unit. To determine note durations throughout the work, the thirty-second note is multiplied by the numbers in each of the row of the matrices. For example, a note duration series based on the original row would look like this:



A 32nd note x 1= a 32nd, a 32nd x 2 = a 16th, a 32nd x 3= a dotted 16th, etc.

Note Durations

In Piano I, the piece begins by playing note durations of the RI^5 row (12 11 9 10 3 6 7 1 2 8 4 5). This results in the following rhythm:



Piano II plays note durations of the R^{12} row (5 8 6 4 3 9 2 1 7 11 10 12). This multiplication concept is applied to all 48 of the rows, each resulting duration series being used once during the piece.

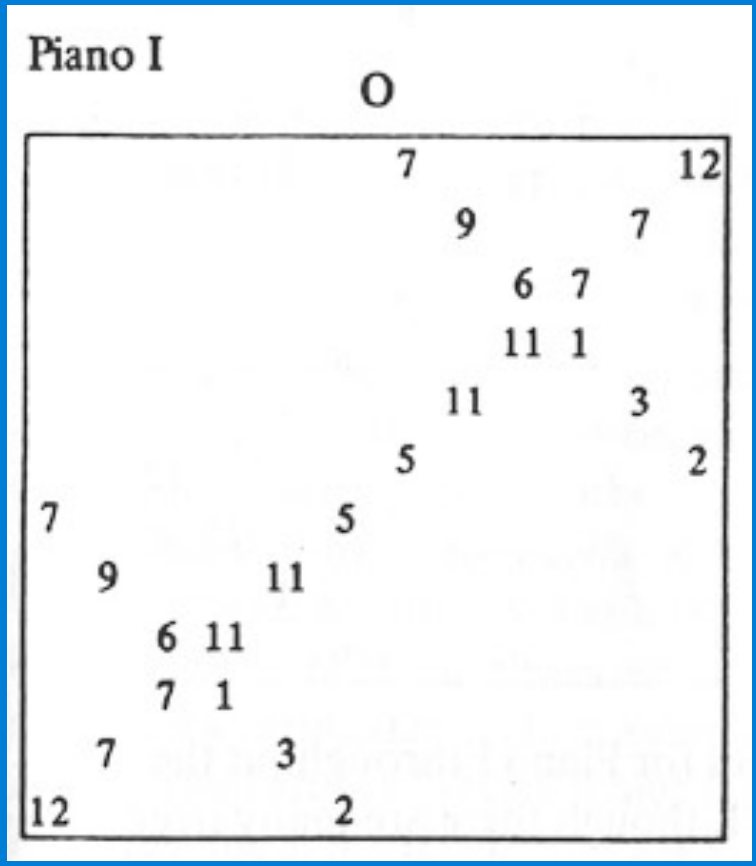
Dynamics

To determine dynamics, Boulez chose twelve different dynamic values and assigned each one a different number.

1= pppp	5= quasi p	9= f
2= ppp	6= mp	10= ff
3= pp	7= mf	11= fff
4= p	8= quasi f	12= ffff

Dynamics

The order in which the dynamics were used was determined from the diagonals of the two matrices. The Original Matrix determined the order of dynamics for Piano I.



Dynamics

The diagonals from the Original Matrix resulted in the following ordering of dynamics:

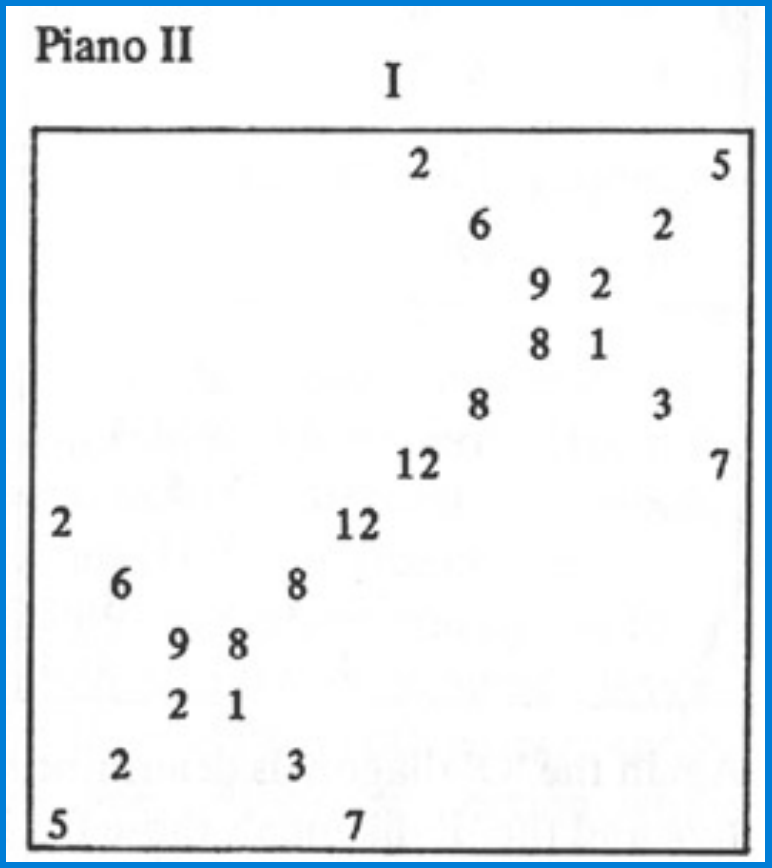
12 ffff	7 mf	7 mf	11 fff	11 fff	5 q-p	5 q-p	11 fff	11 fff	7 mf	7 mf	12 ffff

2 ppp	3 pp	1 pppp	6 mp	9 f	7 mf	7 mf	9 f	6 mp	1 pppp	3 pp	2 ppp

Each of the 24 dynamics were applied in this order to the 24 rows that made up the part of Piano I. (The first row used was ffff, the second series was mf, the third was mf, etc.)

Dynamics

The Inversion Matrix determined the dynamics for Piano II.



Dynamics

The diagonals from the Inversion Matrix resulted in the following ordering of dynamics:

5 q-p	2 ppp	2 ppp	8 q-f	8 q-f	12 ffff	12 ffff	8 q-f	8 q-f	2 ppp	2 ppp	5 q-p

7 mf	3 pp	1 pppp	9 f	6 mp	2 ppp	2 ppp	6 mp	9 f	1 pppp	3 pp	7 mf

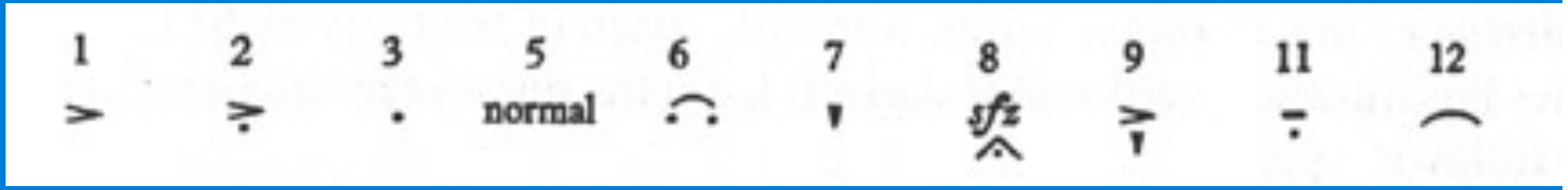
Each of the 24 dynamics were applied in this order to the 24 row that made up the part of Piano II.

Dynamics

Note that in Piano I, the numbers 4, 8 and 10 do not occur in the Original Matrix diagonal number series, and therefore the dynamics *p, quasi f* and *ff* do not occur in the part of Piano I. Similarly, the dynamics *p, ff* and *fff* do not occur in part of Piano II. However, these discrepancies caused Boulez to make a few unimportant deviations from his scheme

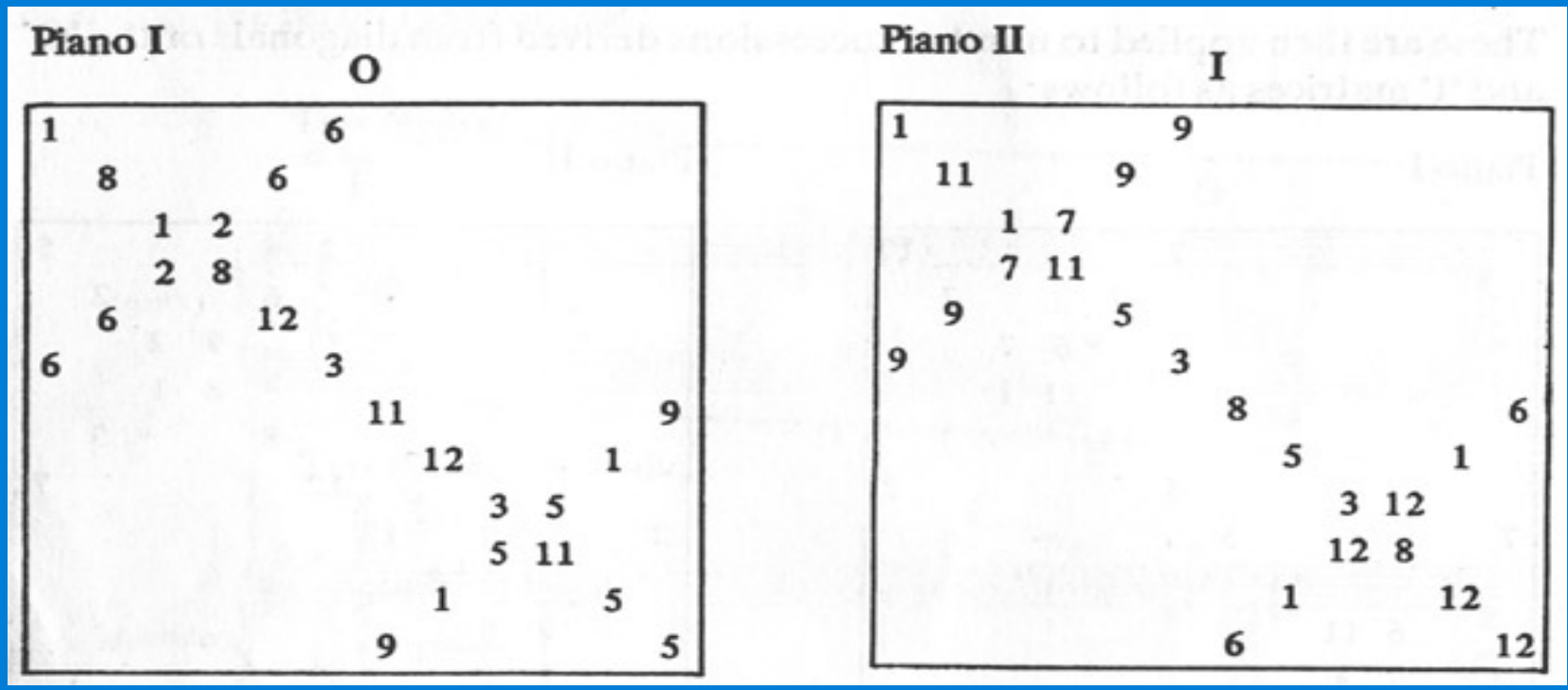
Modes of Attack

Boulez assigned modes of attack (articulation) in much the same fashion as he assigned dynamics. He assigned a different mode of attack to each of the following numbers: 1 2 3 5 6 7 8 9 11 12. (Since neither 4 nor 10 appear in the diagonals of either matrix, he did not assign those numbers a mode of attack.



Modes of Attack

Once again he used the Original Matrix to determine Piano I and the Inversion Matrix to determine Piano II. (the opposite diagonals were used, however.)



Generally one mode of attack is used per 12-note series, though there are many irregularities.

Ordering of the Note Series

The two matrices determine the order in which the different rows are heard during the piece. Each individual row is heard once, so there are a total of 48 rows sounded. Each piano plays 24 of these rows. *Structures 1a* is divided into two main parts, A and B, in which twelve rows are used by each piano. The following chart shows how the rows are divided between the two pianos:

Ordering of the Note Series

	Part A	Part B
Piano I	All “O” series in order. I^1	All “RI” series in order. RI^1
Piano II	All “I” series in order. O^1	All “R” series in order. R^1

Ordering of the Duration Series

A similar chart is also used for the duration series.

	Part A	Part B
Piano I	All "RI" series in order. RI^1	All "I" series in order. R^1
Piano II	All "R" series in order. R^1	All "O" series in order. RI^1

Overall Form

Structures 1a can be broken into two main divisions, called A and B. Each of these sections can be further broken down into smaller sections. There are a total of eleven sections in all, which are determined by tempo. A has 5 sections and B has 6. There are three tempos which occur throughout the piece: lent (slow),modéré, presque vif (medium), and très modéré (fast). The order of tempos is:

(section)	1	2	3	4	5	6	7	8	9	10	11
(part A)	M	F	S	F	M						
(part B)						S	F	M	F	S	M

Overall Form

This can be rearranged as two partly overlapping symmetrical cycles centered around section 5 (section 5 in fact being a crucial moment of the piece).

1	2	3	4	5	6	7	8	9	10	11
M	F	S	F	M						
				M	S	F	M	S	F	M

However, it is important to remember that the overall formal structure is really a *free* conception.

Overall Form

Section	Bars	Tempo	Length
1	1-7	Très modéré	10 sec
2	8-31	Modéré, presque vif	30 sec.
3	32-39	Lent	20
4	40-56	Modéré, presque vif	20
5	57-64	Très modéré	10
6	65-72	Lent	40
7	73-81	Modéré, presque vif	10
8	82-89	Très modéré	10
9	90-97	Modéré, presque vif	15
10	98-105	Lent	25
11	106-115	Très modéré	15

Très modéré:
8th note=120

Modéré, Presque Vif:
8th note=144

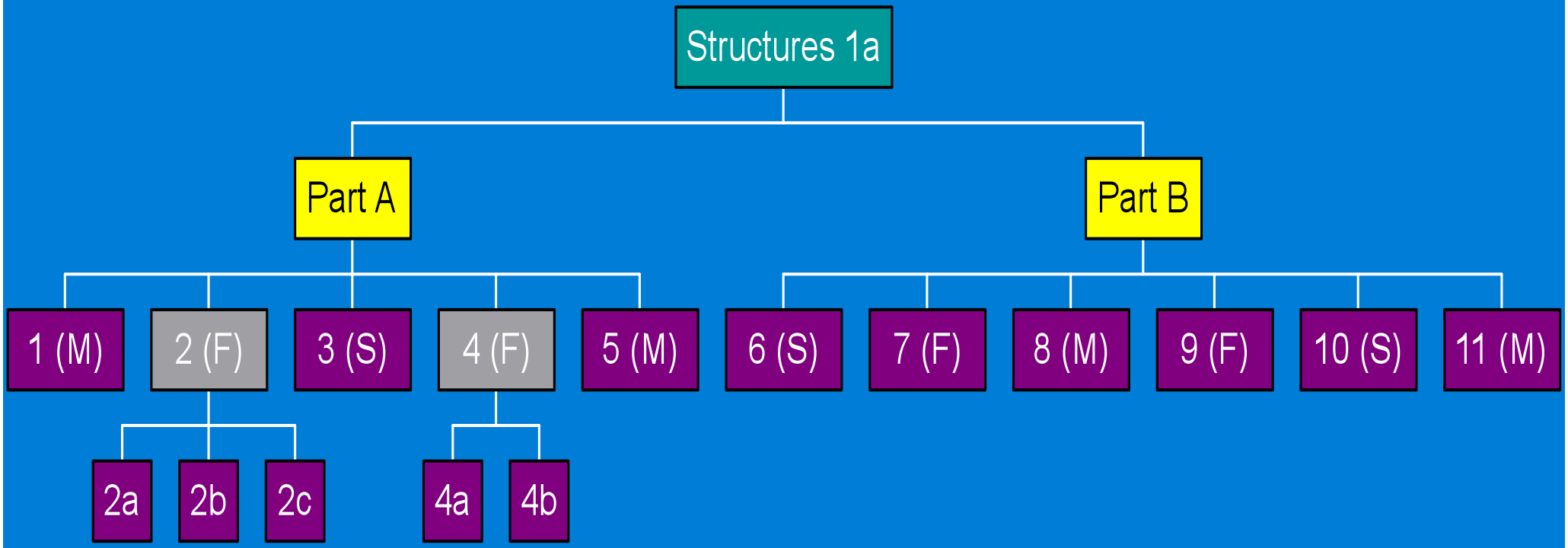
Lent:
16th note=120

Overall Form

While *Structures 1a* can be divided into two main parts, A and B, and then further divided into eleven sections which are determined by tempo, some of these sections can be further divided into subsections. Subsections are determined by length. Each subsection is 78 thirty-second notes long → the length of one duration series. For example, the tempo for section 1 is *très modéré* and it is 78 thirty-second notes long; therefore it cannot be broken into any further subsections. The tempo for section 2, however, is *modéré, presque vif* and it is a total of 234 thirty-second notes long. Therefore section 2 is broken into three subsections; 2a, 2b and 2c. Both sections 2 and 4 can be broken into subsections.

Overall Form

Key
M=*très modéré*
F=*modéré, presque vif*
S=*lent*
purple=78 thirty-second notes long



Density

Because the piano is capable of playing several different musical lines at once, it is possible for one section or one subsection to contain more than one version of the tone row. As an arbitrary example, the piano player could play the original tone row in the right hand and a transposition of the original row in the left. Or the piano player could play both the original row and the inversion with the right hand, and the retrograde row and retrograde-inversion with the left. Since *Structures 1a* is written for two pianos, there are many different possibilities for **density** (the number of rows which are played in one section or subsection).

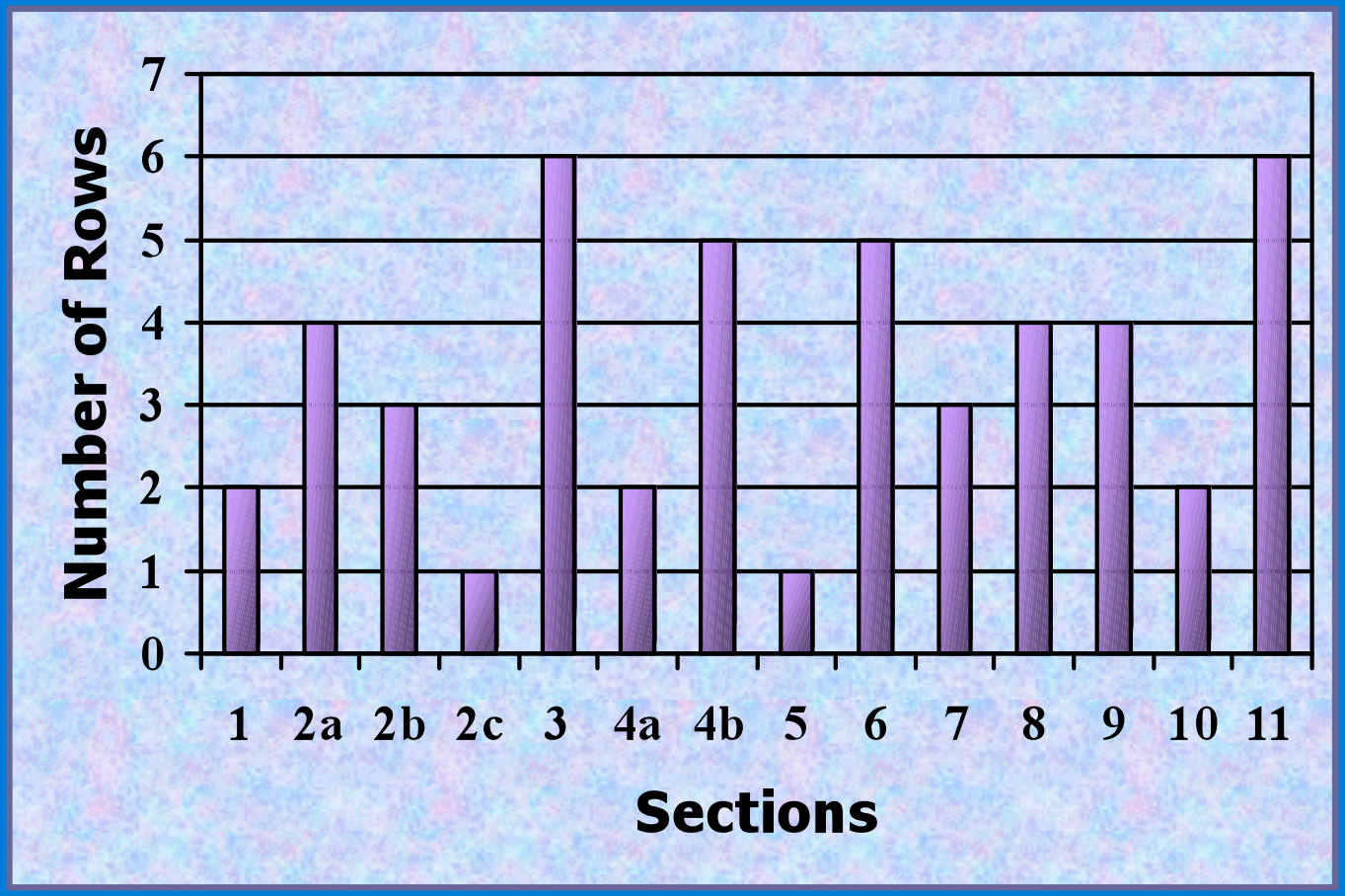
Density

In *Structures 1a*, each piano contributes a total of 12 rows in both Parts A & B, meaning that each part contains an overall total of 24 rows. Each piano sounds either one, two or three rows per section or subsection, and remains silent in once. The following chart shows the density of *Structures 1a*.

	Part A								Part B					
Section	1	2a	2b	2c	3	4a	4b	5	6	7	8	9	10	11
# of Rows														
Piano 1	1	2	2		3	1	2	1	3	1	2	2	1	3
Piano 2	1	2	1	1	3	1	3		2	2	2	2	1	3
Total # of Rows	2	4	3	1	6	2	5	1	5	3	4	4	2	6
									24					**24**

Density

The density of *Structures 1a* can also be represented in the form of a graph.



Non-Predetermined Elements

Several elements of *Structures 1a* were not predetermined. They are: 1) octave register; 2) rests; and 3) metre.

Octaves: Boulez did not assign any particular octave register to any particular note, row, dynamic, etc. Thus, the octave registers used were determined as the piece was being composed. However, two principles can be observed: 1) for each part, successions of notes are generally spread over a wide register; and 2) whenever the same note occurs simultaneously in two rows, it is played in unison, therefore avoiding octaves.

Non-Predetermined Elements

Rests: In staccato passages, frequently the notes will be indicated by either a thirty-second or a sixteenth-note, with the remainder of its duration filled out by rests, as opposed to using the staccato symbol. This also occurs in passages with these symbols: 

Otherwise, rest signs usually aren't used, unless they clarify the part writing.

Metre: The metre changes frequently in *Structures 1a*, but its only purpose is to aid the performer. When listening to the piece there does not seem to be a sense of metre at all.

Conclusion

Structures 1a was organized with extreme care, leaving few elements to chance. However, listening to the piece, it sounds like total randomness. Donald Mitchell says "Never was music so over-determined, and never so difficult to *hear* as an expression of order in terms of sound. Boulez' *Structures*, one assumes (because one has not succeeded in experiencing their organization as *sound*), are 'about' nothing other than their structures. But even the most open and admiring ear (one recognizes the brilliance of Boulez' musical personality) is baffled in performance by the absence of audible sequence or logic." (p.128)

Conclusion

Boulez himself realized that *Structures* was pushing the technique of integral serialism to its absolute limit. He inscribed a provisional title on the first page of Book I which he took from a Paul Klee painting: "A là limite du fertile pays" (Meaning, "At the limit of fertile ground."

Bibliography

This presentation was mainly based upon:

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