MUCT 6170

Dr. Engebretsen

Inversions in Douze Notations, No. 6, by Pierre Boulez

Jonathan de Oliveira

Overview

Douze Notations is a piece for piano solo written by Pierre Boulez (1925-2016) in 1945 for Serge Nigg. At the time he was a student under Messiaen and had come into contact with dodecaphonic technique. True to its name, this piece consists of twelve movements, each of which contains twelve measures. For this paper I chose to analyze the sixth movement, *Rapide*. The score for this movement is set as A-B, from the beginning to measure "m," and from there to the end. Although the rhythm consists of a constant sequence of 16th notes, there is some variation, albeit limited, in the dynamics. Boulez gives the performer the option of either starting the piece at *pp* reaching *ff* at measure "m" and then reducing the dynamics back to *pp* towards the end of the piece or of doing the opposite, starting at *ff* reaching *pp* at "m" and ending at *ff*.

I first encountered this piece when I was preparing for my DMA auditions in 2016. Out of all the movements, VI was the one that I had the most difficulty learning. The reason is that the organization can be quite deceptive. The right hand starts the piece and the left hand imitates it in canon, two notes behind and two octaves below it. This strict imitation is maintained until measure "m," at which point the left hand ceases to imitate the pitches of the right hand although it continues to imitate the intervals, now inverted. The real trouble begins after measure "m." The reason I found this section troublesome was that, although I understood that the left hand was an inversion of the right, it took me quite some time to notice that the way in which Boulez inverted

the left hand made it so that the two hands functioned as mirror images of each other. In other words, Boulez takes advantage of the symmetry of the keyboard, so that, whenever the right hand played an F#, the left hand played a Bb, its “mirror image.” Whenever it played a C, the left hand responded with an E. Although the imitation is less strict on the score, it is stricter than ever for the hands of the performer. In this sense, the structure of the piece could also be viewed as an A-B-C. Part A would then be from the beginning of the movement to measure “m,” part Be would be measure “m,” and part C would be the final section, where keyboard symmetry is present.

Digging deeper

For Twelve Notations Boulez uses twelve-tone rows. For movement VI the row is a P4: <405176e8t329>. It is derived from the original tone row used in movement I. The row in that movement is a P8: <8t329405176e>. However, this is done in a roundabout manner, as the P4 of movement VI is not found as a Pn on the matrix of movement 1. In fact, the two movements have different matrices. To find the row of movement VI in the matrix of movement I, one must think creatively. One must start at the sixth pitch of the originating P8: 4. From then it is easy to trace the 12 pitches of P4 to the end of P8 and then starting (or rather ending) again at the beginning of P8, as seen on Figure 1. This overlapping motion will be important further in the analysis as we look at how Boulez develops the P4 tone row in movement VI.

	I_0	I_2	I_7	I_6	I_1	I_8	I_4	I_9	I_5	I_{11}	I_{10}	I_3	
P_0	0	2	7	6	1	8	4	9	5	e	t	3	R_0
P_{10}	t	0	5	4	e	6	2	7	3	9	8	1	R_{10}
P_5	5	7	0	e	6	1	9	2	t	4	3	8	R_5
P_6	6	8	1	0	7	2	t	3	e	5	4	9	R_6
P_{11}	e	1	6	5	0	7	3	8	4	t	9	2	R_{11}
P_4	4	6	e	t	5	0	8	1	9	3	2	7	R_4
P_8	8	t	3	2	9	4	0	5	1	7	6	e	R_8
P_3	3	5	t	9	4	e	7	0	8	2	1	6	R_3
P_7	7	9	2	1	8	3	e	4	0	6	5	t	R_7
P_1	1	3	8	7	2	9	5	t	6	0	e	4	R_1
P_2	2	4	9	8	3	t	6	e	7	1	0	5	R_2
P_9	9	e	4	3	t	5	1	6	2	8	7	0	R_9
	RI_0	RI_2	RI_7	RI_6	RI_1	RI_8	RI_4	RI_9	RI_5	RI_{11}	RI_{10}	RI_3	

Figure 1. P8 Matrix from movement 1.

In comparing the P8 from the first movement and the P4 from the sixth movement, I tried to discern if there were any invariances between the two. If P8 is divided into three distinct tetrachords, it is possible to find a certain symmetry to the row. <8t329405176e> divided is <8t32>, <9405>, and <176e>. In normal form, they read [8t23], [9045], and [67e1]. The prime forms for each of these sets are (0157), (0158), and (0157). As we can see, the structure of the P8 row from movement 1 is symmetrical in the sense that the sets on each end of the row belong to set class (0157). I naturally expected to find the same kind of symmetry in analyzing P4 from movement six or at least to find some correlation between P8 and P4. However, I could find no such associations. P4 is <405176e8t329>. Divided into its distinct tetrachords, it reads <4051>, <76e8>, and <t329>. Normal form for the sets is [0145], [678e], and [239t]. These are members of the set classes (0145), (0125), and (0156). As can be seen, there is no relationship between the distinct tetrachords of P8 and P4. However, there are some interesting aspects to take note of when comparing the two. In the first place, the first note of P4 is the sixth note of P8. Rather than

start the tone row for the sixth movement on the sixth note of P8, thus dividing it into two distinct hexachords, Boulez overlaps P8 with P4. I will show at a later point in this paper the importance of this overlapping of rows. For now, it is enough to note that the last note of one hexachord overlaps with the first note of another. The second interesting aspect of a comparison of P8 and P4 lies in the fact that, though there is no direct relationship between the sets of the two rows, an (015) subset relationship is implied in the tetrachords of both rows.

After looking briefly at the structure of P4 and comparing it to P8, I now turn to how the P4 tone row is developed in the piece. An attempt at doing a sequential twelve-count of the piece came to a sudden halt after counting the first row. The first pitch after the P4 is pitch 5. Naturally I assumed that the next row would be P5. I was wrong. A comparison of the pitches of the would-be P5 with the P5 in the matrix derived from P4 revealed that the "P5" in the score and the P5 on the matrix were completely different. I then proceeded to try and locate a snippet of the supposed P5 sequence and found that it was to be found on the matrix not in P5, but in P9. I then concluded that in organizing the tone rows derived from P4, Boulez overlapped the last note of the first row with the first one of the second one, the last of the second one with the first of the third one, and so on, and so forth. However, rather than follow this pattern in a straightforward fashion, Boulez eliminates one pitch from each row as he goes along. As a result, P4, with 12 pitches, is followed by P9 with 11, P7 with 10, P6 with 9, P0 with 8, P4 with 7, P11 with 6, P1 with five, and P4 with 4 pitches. This last P4 row is two notes away from measure "m," the central point of the piece. At this point, Boulez inserted pitch 9. This is unusual, because pitch 9 is not the next pitch in the P4 row. The next pitch ought to have been 7. However, if this pitch is ignored for a moment and the twelve count is resumed, we find that Boulez restarts at P4 with 4 pitches and proceeds not to remove pitches, but to add them back in as he goes. Thus, P4 with 4

pitches is followed by P1 with 5 pitches, P4 with 6, P6 with 7, P1 with 8, P5 with 9, P11 with 10, P10 with 11, P8 with 12, and P1 also with 12 pitches, as shown in Figure 2. Let us now remember the “out of place” pitch 9. The relevance of the number 9 lies in the fact that, from the beginning of the piece until pitch 9, nine tone rows are used. In similar fashion, from pitch 9 to the end of the piece, nine rows are used, if the last complete 12-tone row is ignored. This generates a formal symmetry, which was perhaps hinted at in the symmetry of the tetrachords from P8 mentioned earlier in this paper. Regarding the relevance or the number 9 in this movement and its relationship to symmetry, it is also interesting to take note of how it relates to the number of pitches in each hand for this piece. Each hand plays a total of 140 pitches. This puts the middle of the piece at 4 pitches into measure “m.” So far there is nothing particularly interesting in terms of structural symmetry. However, if the “extra” twelve-tone row at the piece is disregarded, the piece will contain 128 pitches in each hand. If this is divided by two, the result is 64.5. That is exactly the last pitch in Part A, plus one half of a pitch. By this reckoning, the pitch 9 where Boulez starts using inversions for the left hand lies precisely in the middle of the piece.

Right Hand begins.												
P_4	4	0	5	1	7	6	E	8	T	3	2	9
P_9	9	5	T	6	0	E	4	1	3	8	7	
P_7	7	3	8	4	T	9	2	E	1	6		
P_6	6	2	7	3	9	8	1	T	0			
P_0	0	8	1	9	3	2	7	4				
P_4	4	0	5	1	7	6	E					
P_{11}	E	7	0	8	2	1						
P_1	1	9	2	T	4							
P_4	4	0	5	1								
Pitch 9	Strict imitation ends											
P_4	4	0	5	1								
P_1	1	9	2	T	4							
P_4	4	0	5	1	7	6						
P_6	6	2	7	3	9	8	1					
Keyboard Symmetry begins						8	1					
P_1	1	9	2	T	4	3	8	5				
P_5	5	1	6	2	8	7	0	9	E			
P_{11}	E	7	0	8	2	1	6	3	5	T		
P_{10}	T	6	E	7	1	0	5	2	4	9	8	
P_8	8	4	9	5	E	T	3	0	2	7	6	1
P_1	1	9	2	T	4	3	8	5	7	0	E	6

Left Hands follows in strict imitation two notes behind and two octaves below												
P_4	4	0	5	1	7	6	E	8	T	3	2	9
P_9	9	5	T	6	0	E	4	1	3	8	7	
P_7	7	3	8	4	T	9	2	E	1	6		
P_6	6	2	7	3	9	8	1	T	0			
P_0	0	8	1	9	3	2	7	4				
P_4	4	0	5	1	7	6	E					
P_{11}	E	7	0	8	2	1						
P_1	1	9	2	T	4							
P_4	4	0	5	1								
Pitch 9	Strict imitation ends											
I_4	4	8	3	7								
I_7	7	E	6	T	4							
I_4	4	8	3	7	1	2						
I_2	2	6	1	5	E	(0)	(7)					
Keyboard Symmetry begins						(8)	(3)					
I_3	3	7	2	6	0	1	8	E				
I_{11}	E	3	T	2	8	9	4	7	5			
I_5	5	9	4	8	2	3	T	1	E	6		
I_6	6	T	5	9	3	4	E	2	0	7	8	
I_8	8	0	7	E	5	6	1	4	2	9	T	3
I_3	3	7	2	6	0	1	8	E	9	4	5	T

Figure 2. Tone rows derived from P4, displaying symmetric reduction and growth of row size

Once the form of the piece has been established from a twelve-count point of view, it is time to look into the relationship between the two hands. Up to this point, I have made mention solely of the goings on of the right hand. Before turning to the left hand, it is important to point out some interesting aspects of what Boulez does with the right hand in terms of structure. He starts the piece with P4, reaches measure “m” also with P4. It is interesting to note that this last occurrence of P4 contains only 4 pitches. He then restarts at P4, with 4 pitches, and ends at P8 (once again, I am ignoring for now the actual last row, P1, which I consider a “restatement” of sorts used to “round off” the structure). There is an obvious preponderance of the number 4 in this description, and the number 8 is in an obvious position of importance. This is especially true when we consider that 8 is the integer which names the tone row used in the first movement. What then is the significance of the numbers 4 and 8 at this point of this analysis?

The importance of the integers 4 and 8 lies in how Boulez structures the left hand. As mentioned above, the left hand follows the right in strict imitative canon up to measure “m.” I conducted a twelve-count of the pitches of the left hand and found that, at measure “m,” Boulez started using inversions of the rows used in the right hand. For all of measure “m,” the rows of the rows used for the left hand are inversions of those of the right hand, generated by the operation I8 (thus the significance of the number 8). Thus, while the right hand starts the measure at P4, the left hand starts at I4. Notice that the use of I8 created an invariance between the hands at least for the first row of the measure, so that both right and left hand have “4” for the “n” values of their rows. Boulez develops the left hand as he does the right, adding a pitch to each row and overlapping the first pitch of the next row with the last pitch of the previous one. This happens until the end of measure “m,” at which point Boulez again makes a change to the “natural” sequence of events. The I2 row that finalizes measure “m” with 6 pitches is modified

so that, rather than end with pitch 0 as would be expected, it ends with pitch 8. In comparing both hands at this point I noticed that, by changing pitch 0 in the left hand to pitch 8, Boulez made it so that both hands “start” part C of the piece at pitch 8. From this point in the piece to the end, the inversion operation used for the left hand is I4 (therein lies the significance of the preponderance of the number 4 in this piece). The importance of the use of I4 operations for the remainder of the piece is that this type of inversion yields keyboard symmetry. Keyboard symmetry can be thought of simply as the left hand “mirroring” the right hand not in pitches played, but in the layout of the keyboard. From this perspective, Eb on the right hand is mirrored onto the left as Db. In similar fashion F in the right hand would be mirrored onto the left as B. Herein lies the reason why Boulez changed pitch 0 into pitch 8 in the left hand at the start of part C. Starting both hands at pitch 8 allows Boulez to use this keyboard symmetry throughout the rest of the piece. Thus, the sequence of pitches <8192> in the right hand becomes <8372> in the left. Notice in Figure 3 that, because the right hand is inverted onto the left at I4, the pitches played by each hand are mirror images of each other as far as the pattern of black and white keys on the keyboard is concerned. It is important to make note here of the fact that, when inverted at I4, both pitch 8 and pitch 2 are mapped onto themselves. It is interesting that, at the same time that the number of pitches in the rows used creates a structural mirror image, Boulez applies this mirror-image relationship between the two hands.

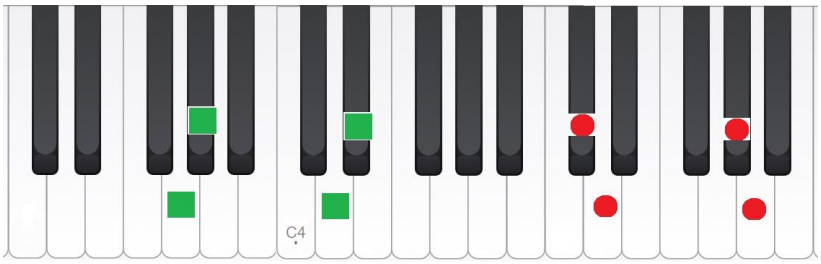

Figure 3. pitches <8192> in the r.h. becomes <8372> in the l.h. at I4 inversion.

Besides looking at the twelve-count, I also looked at the intervals contained within the rows. As I show in Figure 4, there is not much of a pattern visible when analyzing ordered pitch intervals, past the frequent presence of intervals 8 and 4. However, as the view is broadened to ordered and unordered pitch class intervals, a pattern reveals itself. Figure 5 shows that the most common pitch class interval used in the piece is interval class 4. Once again, the integer 4 occupies a position of importance within this movement of the piece.

Ordered Pitch Intervals												
P_4 r	+8	+5	+8	+6	+11	+5	-15	-10	-7	+11	+7	
l	+8	+5	+8	+6	+11	+5	-15	-10	-7	+11	+7	
P_9	+8	+5	+8	+6	-13	-7	-3	-10	-7	-13		
	+8	+5	+8	+6	-13	-7	-3	-10	-7	-13		
P_7	-4	+5	+8	+6	+11	+5	+9	-10	-7			
	-4	+5	+8	+6	+11	+5	+9	-10	-7			
P_6	-4	-7	-4	-6	+11	+5	+9	+2				
	-4	-7	-4	-6	+11	+5	+9	+2				
P_0	+8	-7	-4	-6	-1	-7	-3					
	+8	-7	-4	-6	-1	-7	-3					
P_4	+8	+5	+8	+6	-13	-7						
	+8	+5	+8	+6	-13	-7						
P_{11}	-4	+5	+8	+6	-13							
	-4	+5	+8	+6	-13							
P_1	-4	+5	+8	-6								
	-4	+5	+8	-6								
P_4	-4	+5	-4	+8								
	-4	+5	-4	+8								
Pitch 9	Strict imitation ends											
P_4	-5	-4	+5	-4								
I_4	-5	+4	-5	+4								
P_1	-4	+5	+8	+6								
I_7	+4	-5	-8	-6								
P_4	-4	-7	-4	-6	-1							
I_4	+4	+7	+4	+6	+1							
P_6	+8	+5	+8	+6	-13	-7						
I_2	-8	-5	-8	-6	+9	+7						
Keyboard Symmetry begins					9 | 8	8 | 1						
P_1	-4	-7	-4	+6	+11	+5	+9					
I_3	+4	+7	+4	-6	-11	-5	-9					
P_5	+8	-7	-4	-6	-13	-7	-3	+14				
I_{11}	-8	+7	+4	+6	+13	+7	+15	-26				
P_{11}	+8	+5	+8	+6	-13	-7	-3	-10	-5			
I_5	-8	-5	-8	-6	+50	-29	+3	+10	+7			
P_{10}	-4	+5	+8	+6	+11	+5	+9	+2	+5	-13		
I_6	+4	-3	-10	-3	-11	-5	-9	-2	+7	+1		
P_8	-4	-7	-4	-6	-1	-7	-3	+2	+5	+11	+7	
I_8	+4	+7	+4	+6	+1	+7	+3	-2	-5	+1	-7	
P_1	+8	+5	+8	-6	-13	-7	-3	-10	-7	+11	-17	
I_3	-8	-5	-8	+6	+13	+7	+3	+10	+7	-11	+17	

Unordered Pitch Intervals												
P_4 r	8	5	8	6	11	5	15	10	7	11	7	
l	8	5	8	6	11	5	15	10	7	11	7	
P_9	8	5	8	6	13	7	3	10	7	13		
	8	5	8	6	13	7	3	10	7	13		
P_7	4	5	8	6	11	5	9	10	7			
	4	5	8	6	11	5	9	10	7			
P_6	4	7	4	6	11	5	9	2				
	4	7	4	6	11	5	9	2				
P_0	8	7	4	6	1	7	3					
	8	7	4	6	1	7	3					
P_4	8	5	8	6	13	7						
	8	5	8	6	13	7						
P_{11}	4	5	8	6	13							
	4	5	8	6	13							
P_1	4	5	8	6								
	4	5	8	6								
P_4	4	5	4	8								
	4	5	4	8								
Pitch 9	Strict imitation ends											
P_4	5	4	5	4								
I_4	5	4	5	4								
P_1	4	5	8	6								
I_7	4	5	8	6								
P_4	4	7	4	6	1							
I_4	4	7	4	6	1							
P_6	8	5	8	6	13	7						
I_2	8	5	8	6	9	7						
Keyboard Symmetry begins					9 | 8	8 | 1						
P_1	4	7	4	6	11	5	9					
I_3	4	7	4	6	11	5	9					
P_5	8	7	4	6	13	7	3	14				
I_{11}	8	7	4	6	13	7	15	26				
P_{11}	8	5	8	6	13	7	3	10	5			
I_5	8	5	8	6	50	29	3	10	7			
P_{10}	4	5	8	6	11	5	9	2	5	13		
I_6	4	3	10	3	11	5	9	2	7	1		
P_8	4	7	4	6	1	7	3	2	5	11	7	
I_8	4	7	4	6	1	7	3	2	5	1	7	
P_1	8	5	8	6	13	7	3	10	7	11	17	
I_3	8	5	8	6	13	7	3	10	7	11	17	

Figure 4. Ordered and Unordered pitch intervals

Ordered Pitch Class Intervals												
P_4 r	+8	+5	+8	+6	+11	+5	-3	-10	-7	+11	+7	
I	+8	+5	+8	+6	+11	+5	-3	-10	-7	+11	+7	
P_9	+8	+5	+8	+6	-1	-7	-3	-10	-7	-1		
	+8	+5	+8	+6	-1	-7	-3	-10	-7	-1		
P_7	-4	+5	+8	+6	+11	+5	+9	-10	-7			
	-4	+5	+8	+6	+11	+5	+9	-10	-7			
P_6	-4	-7	-4	-6	+11	+5	+9	+2				
	-4	-7	-4	-6	+11	+5	+9	+2				
P_0	+8	-7	-4	-6	-1	-7	-3					
	+8	-7	-4	-6	-1	-7	-3					
P_4	+8	+5	+8	+6	-1	-7						
	+8	+5	+8	+6	-1	-7						
P_{11}	-4	+5	+8	+6	-1							
	-4	+5	+8	+6	-1							
P_1	-4	+5	+8	-6								
	-4	+5	+8	-6								
P_4	-4	+5	-4	+8								
	-4	+5	-4	+8								
Pitch 9	Strict imitation ends											
P_4	-5	-4	+5	-4								
I_4	-5	+4	-5	+4								
P_1	-4	+5	+8	+6								
I_7	+4	-5	-8	-6								
P_4	-4	-7	-4	-6	-1							
I_4	+4	+7	+4	+6	+1							
P_6	+8	+5	+8	+6	-1	-7						
I_2	-8	-5	-8	-6	-9	+7						
Keyboard Symmetry begins					9 | 8	8 | 1						
P_1	-4	-7	-4	+6	+11	+5	+9					
I_3	+4	+7	+4	-6	-11	-5	-9					
P_5	+8	-7	-4	-6	-1	-7	-3	+2				
I_{11}	-8	+7	+4	+6	+1	+7	+3	-2				
P_{11}	+8	+5	+8	+6	-1	-7	-3	-10	-5			
I_5	-8	-5	-8	-6	+1	-5	+3	+10	+7			
P_{10}	-4	+5	+8	+6	+11	+5	+9	+2	+5	-1		
I_6	+4	-3	-10	-3	-11	-5	-9	-2	+7	+1		
P_8	-4	-7	-4	-6	-1	-7	-3	+2	+5	+11	+7	
I_8	+4	+7	+4	+6	+1	+7	+3	-2	-5	+1	-7	
P_1	+8	+5	+8	-6	-1	-7	-3	-10	-7	+11	-5	
I_3	-8	-5	-8	+6	+1	+7	+3	+10	+7	-11	+5	

Unordered Pitch Class Intervals												
P_4 r	4	5	4	6	1	5	3	2	5	1	5	
I	4	5	4	6	1	5	3	2	5	1	5	
P_9	4	5	4	6	1	5	3	2	5	1		
	4	5	4	6	1	5	3	2	5	1		
P_7	4	5	4	6	1	5	3	2	5			
	4	5	4	6	1	5	3	2	5			
P_6	4	5	4	6	1	5	3	2				
	4	5	4	6	1	5	3	2				
P_0	4	5	4	6	1	5	3					
	4	5	4	6	1	5	3					
P_4	4	5	4	6	1	5						
	4	5	4	6	1	5						
P_{11}	4	5	4	6	1							
	4	5	4	6	1							
P_1	4	5	4	6								
	4	5	4	6								
P_4	4	5	4	4								
	4	5	4	4								
Pitch 9	Strict imitation ends											
P_4	5	4	5	4								
I_4	5	4	5	4								
P_1	4	5	4	6								
I_7	4	5	4	6								
P_4	4	5	4	6	1							
I_4	4	5	4	6	1							
P_6	4	5	4	6	1	5						
I_2	4	5	4	6	3	5						
Keyboard Symmetry begins					9 | 8	8 | 1						
P_1	4	5	4	6	1	5	3					
I_3	4	5	4	6	1	5	3					
P_5	4	5	4	6	1	5	3	2				
I_{11}	4	5	4	6	1	5	3	2				
P_{11}	4	5	4	6	1	5	3	2	5			
I_5	4	5	4	6	1	5	3	2	5			
P_{10}	4	5	4	6	1	5	3	2	5	1		
I_6	4	3	2	3	1	5	3	2	5	1		
P_8	4	5	4	6	1	5	3	2	5	1	5	
I_8	4	5	4	6	1	5	3	2	5	1	5	
P_1	4	5	4	6	1	5	3	2	5	1	5	
I_3	4	5	4	6	1	5	3	2	5	1	5	

Figure 5. Ordered and Unordered Pitch Class Intervals

It is also interesting to look at how Boulez subdivides the rhythm within the measures. However, my initial attempts at this were thwarted. There seems to be no correlation between the number of pitches and rhythmic subdivisions within the measures except for a repetition of the grouping of six pitches followed by the grouping of seven pitches in the first measure, four and five pitches in the second, followed by six and seven in the third, and four and seven in the next. No pattern seems to be apparent. Once I tried to link the repeated patterns though, I found a measure of symmetry. As I show in Figure 6, there is some invariance in how Boulez divides the rhythms in the second, third, and fourth measures of the first half of the piece and the same measures in the second half of the piece. In each half of the piece, these measures are subdivided according to the following pattern: │4-5│6-7│4-7│. In analyzing the rhythmic groupings in each measure,

there is also a symmetrical pattern in what measures of each half of the piece are repeated. While in the first half of the piece the rhythmic pattern of measure one is repeated in the third measure and the pattern of the second measure is repeated in the last, an inversion of this pattern occurs in the second half of the piece. The rhythmic pattern of the last measure of the second half of the piece is repeated in the antepenultimate measure. In similar fashion, the rhythmic pattern of the first measure of the second half of the piece is repeated in the penultimate measure. In this sense the pattern of repetition of measures with equal rhythmic patterns is symmetrical between the two halves of the piece.

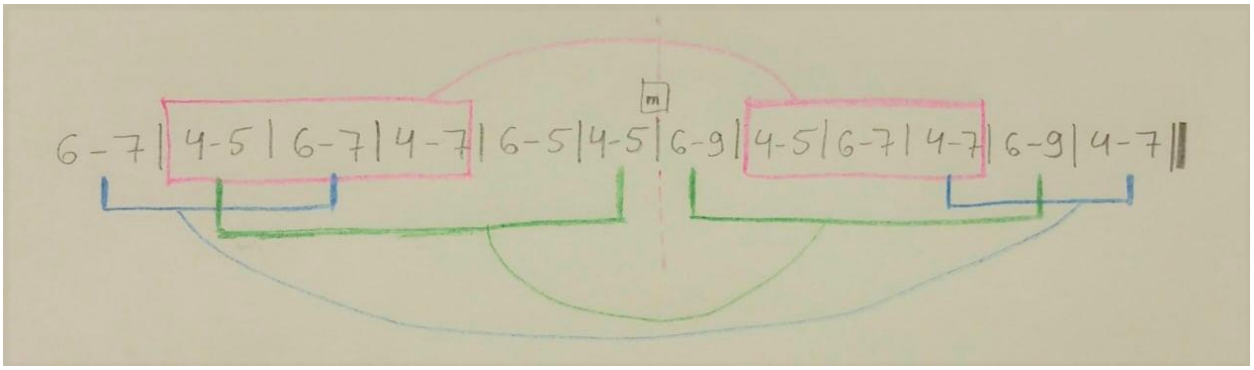

Figure 6. Rhythmic grouping symmetry

The final analysis aspect I looked at for this paper was the contour. Figure 7 shows a graph on which was sketched the lowest and highest notes of each hand. A comparison of the contour of the two hands shows that for the first part of the piece, the contours for both hands are identical. At measure “m,” or rather pitch 9 right before it, the relationship becomes more obscure, due to how Boulez arranges the high and low notes of each hand. Some adjustment was attempted on the graph to better portray the I4 relationship between the hands when Part C begins. We can see that when the I4 operation is begun, the contour lines show that the high and low points of each hand are at opposite ends of the piano. It is also interesting to notice that

Boulez used some degree of symmetry through the conversion of the contour towards pitch 9 when dealing with the contour. The piece begins with high and low notes of each hand being almost two octaves away from each other. As the piece nears measure “m,” the distances between the extremes of the contour of each hand become closer and closer together, so that by the time measure “m” is reached, the high and low notes for each hand are within a single octave. Once the second half of the piece begins, the extremities of each hand become farther and farther apart, until, at the end of the piece, they are over four octaves apart in the right hand.

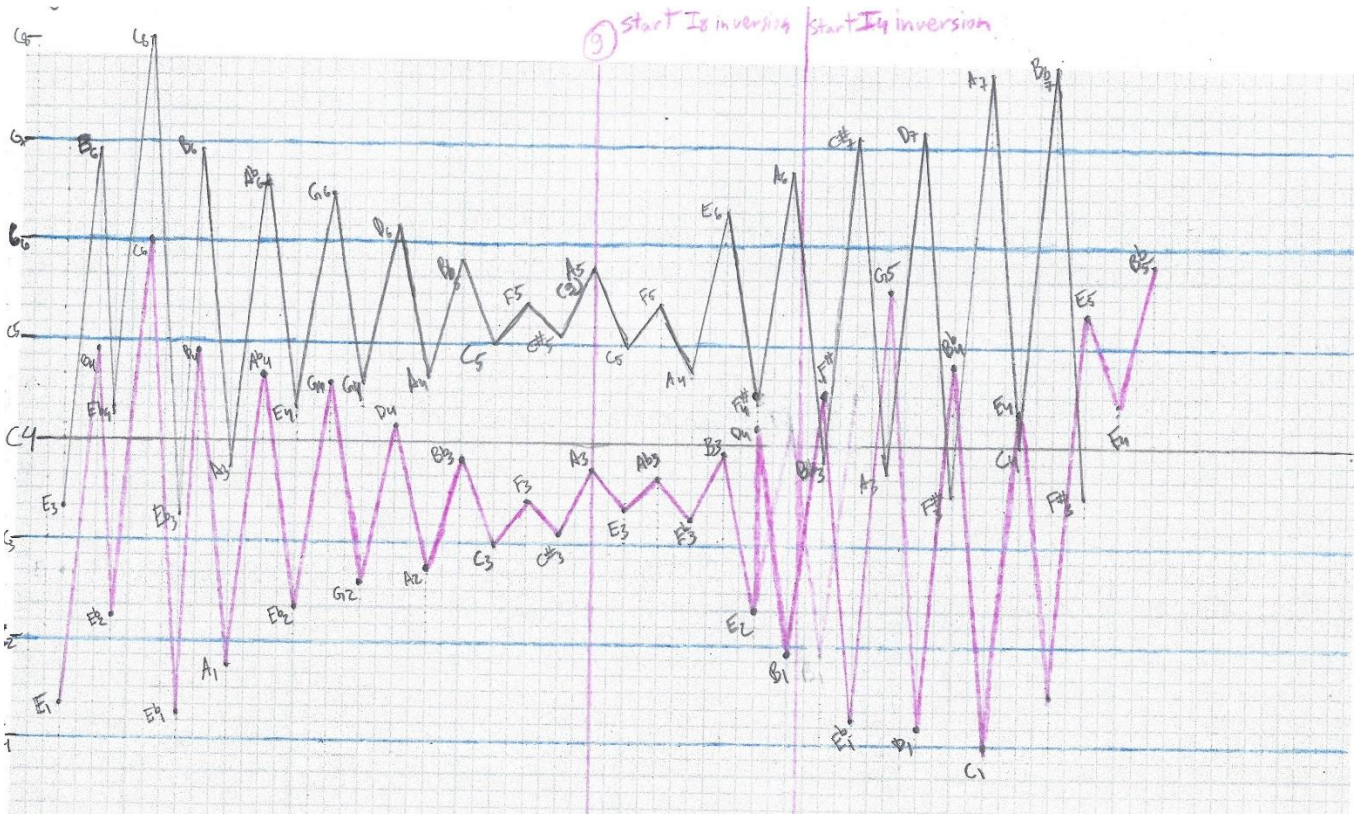

Figure 7. Contour of right and left hands (highest and lowest notes).

Conclusion

In this paper I showed how Boulez applied the concept of symmetry to the structure, dynamics, pitch content of the tone rows, the rhythmic grouping, and the contour of the piece. I

also showed that the numbers 4 and 8 have important roles in the piece. They are the P numbers of the tone rows used in the sixth piece, and the first piece. They also help provide the symmetry to the piece. For example, the movement starts with a P4 row, reaches the middle at P4 again containing 4 pitches. Then it the hands are inverted by I8 then I4. Not to mention the fact that in terms of unordered pitch class, the pitch 8 symmetrically becomes pitch class 4. It is fascinating the level to which Boulez implemented the concept of 4 as well as symmetry in every aspect of the piece.

The knowledge and understanding of how Boulez works with the I4 inversion to attain keyboard symmetry holds more than intellectual value. Understanding this concept makes it easier to learn the piece. Once one understands that the left hand is simply a mirror image of the right in the second half of the piece, one need not worry about the pitches played with the left hand, only about mirroring the fingering and keys played by the right. It also makes it easier to identify instants in which keyboard symmetry appears in other pieces, such as Rautavaara's Piano Concerto Op. 45, more specifically measure 89. Rautavaara also uses keyboard symmetry, or I4 inversion to form arpeggios in measure 55 of the first movement of Lost Landscapes. In short, understanding keyboard symmetry has helped my performance practice much like scales have: once I know what to look for and how to recognize it, it becomes much more simple to know how to deal with it.