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**DETERMINISM, ALEATORISM AND TRADITION:  
THE RELATIONSHIP BETWEEN THE ANALYSIS AND  
COMPOSITIONAL TECHNIQUE OF SELECTED MUSIC FROM 1954-64**

**A Thesis in Two Volumes**

**by**

**JOHN McLACHLAN**

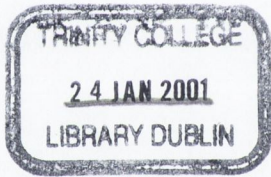
**A THESIS SUBMITTED IN CANDIDACY FOR THE DEGREE OF  
DOCTOR IN PHILOSOPHY**

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The image displays a musical score for the piece *Bourreaux*, consisting of four systems of two staves each (treble and bass clef). The score is annotated with various segments and phrases:

- System 1:** Labeled "Bar 1" at the start. A dashed box labeled "Segment 1" covers bars 2-5. Another dashed box labeled "seg. 2" covers the final portion of the system.
- System 2:** Labeled "bars 6-7" at the start. A dashed box labeled "seg. 3" covers bars 8-12. A dashed box labeled "seg. 4" covers the final portion of the system.
- System 3:** Labeled "bars 13-20" at the start. A dashed box labeled "phrase 3" covers bars 21-2. A dashed box labeled "phrase 4" covers bar 23. A dashed box labeled "phrase 5" covers the final portion of the system.
- System 4:** Labeled "bars 25-7" at the start. A dashed box labeled "subphrase 6a" covers bars 28-31. A dashed box labeled "subp 6b" covers the final portion of the system.

Fig. B. 2. All of the pitches in *Bourreaux* and their phrase aggregates

The image displays a musical score for Figure B.2, continued from the previous page. It consists of five systems of two staves each (treble and bass clef). The score is annotated with various labels and arrows:

- System 1:** Labeled "subp. 6i" (bars 61-7) and "bars 61-7".
- System 2:** Labeled "subp. 6j" (bars 68-74), "bars 68-74", "subp. 6k" (bars 75-8), and "bars 75-8". An arrow points to a note in the upper staff.
- System 3:** Labeled "phrase 7" (bars 79-80), "bars 79-80", "phrase 8a", and "phrase 7". An arrow points to a note in the upper staff.
- System 4:** Labeled "bars 81-4", "phrase 8b", "bs 85-6", "ph. 9a", and "bars 81-4". An arrow points to a note in the upper staff.
- System 5:** Labeled "bars 87-90", "phrase 9b", "bars 91-4", "ph. 10a", "b. 94", "ph. 10b", and "bars 87-90". An arrow points to a note in the upper staff.

Fig. B. 2. continued



The image displays a musical score for Figure B.2, continued from the previous page. It consists of four systems of two staves each (treble and bass clef). The notation includes notes, rests, and various musical symbols such as accidentals and dynamic markings. The score is annotated with several labels and arrows:

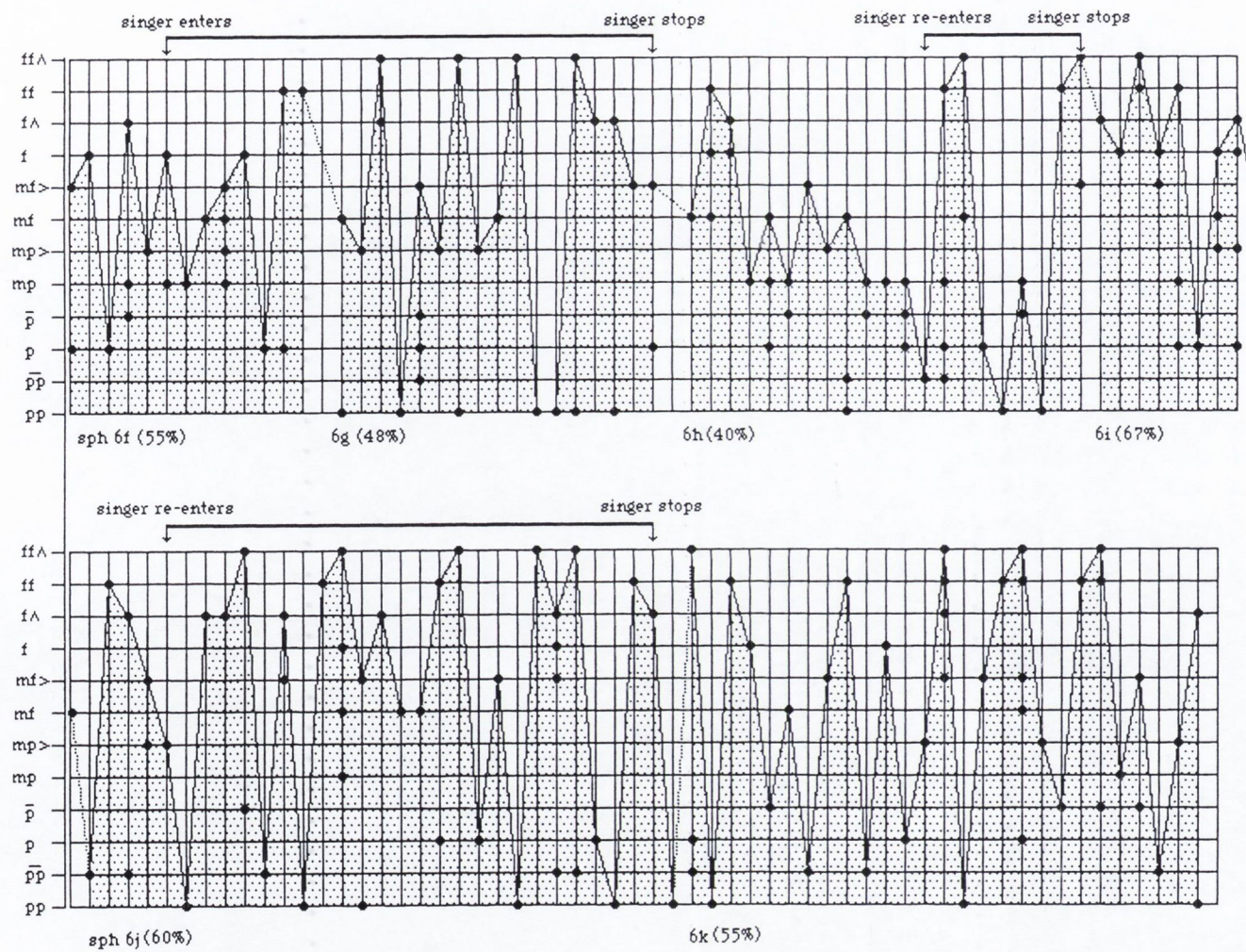
- System 1:** Labeled "subp. 6i" and "bars 61-7".
- System 2:** Labeled "subp. 6j" and "bars 68-74" on the left, and "subp. 6k" and "bars 75-8" on the right. An arrow points to a note in bar 72.
- System 3:** Labeled "phrase 7" and "bars 79-80" in the middle, and "phrase 8a" on the right. An arrow points to a note in bar 79.
- System 4:** Labeled "bars 81-4" on the left, "phrase 8b" in the middle, "bs. 85-6" (likely bar 85-6) on the right, and "ph. 9a" on the far right. An arrow points to a note in bar 85.
- System 5:** Labeled "bars 87-90" on the left, "phrase 9b" and "bars 91-4" in the middle, "ph. 10a" and "b. 94" (likely bar 94) on the right, and "ph. 10b" on the far right. An arrow points to a note in bar 91.

Fig. B. 2. *continued*

The image displays a musical score for guitar, organized into three distinct sections. Each section is presented on a grand staff consisting of a treble clef (G-clef) and a bass clef (F-clef) on a five-line staff. The notation includes various rhythmic values such as quarter, eighth, and sixteenth notes, as well as rests and accidentals. The first section, labeled 'Section 1', spans the first two staves. The second section, labeled '(section 2)', spans the third staff. The third section, which is divided into two parts, is labeled 'section 2' and 'section 3' and spans the fourth and fifth staves. The music is written in a key signature of one sharp (F#) and a common time signature (C).

Fig. B. 3. The aggregates

Fig. B. 8. Dynamics in the last six subphrases of  $S_2$ : bars 43-74



Handwritten musical score for Figure B.11, showing first derived series for various instruments. The score is divided into six systems, each with two staves. The instruments are: 1st system (f4, g4), 2nd system (f#4, a4), 3rd system (c#4), 4th system (g#4, eb4), 5th system (b4), and 6th system (d4, e4, b4). The notation includes notes, rests, and dynamic markings such as f, ff, mf, mp, pp, and p.

Fig. B. 11. First derived series

ga

$(0,1,3)$   $(0,1,4)$   $(0,1,5)i$   $(0,1,3)$

f#

$(0,1,3)$   $(0,1,3)$   $(0,1,4)$   $(0,1,5)i$

fa

$(0,1,2)$   $(0,1,2)$   $(0,1,2)$   $(0,1,2)$

c#

$(0,1,4)$   $(0,1,4)i$   $(0,1,4)i$   $(0,1,4)$

eb

$(0,1,3)$   $(0,1,3)i$   $(0,1,3)$   $(0,1,3)i$

Fig. B. 13. Isometries in first derived series



Handwritten musical score for 18 staves, organized into six systems of three staves each. The score is annotated with dynamic markings and structural labels.

- Staff 1 (d4):** Labeled "series by direction" on the left and "series by structure" on the right. Includes "Bars 1-2" and dynamic markings: *pp*, *mp*, *f*, *pp*, *mf*, *p*, *mf*, *f*, *pp*, *mf*.
- Staff 2 (g#):** Labeled "2-4" and includes dynamic markings: *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*.
- Staff 3 (b):** Labeled "3-5" and includes dynamic markings: *mp*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*.
- Staff 4 (c#):** Labeled "6-8" and includes dynamic markings: *mp*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*.
- Staff 5 (a4):** Labeled "8-10" and includes dynamic markings: *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*.
- Staff 6 (e4):** Labeled "10-14" and includes dynamic markings: *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*.
- Staff 7 (b4):** Labeled "13-17, 21-24 (voice)" and includes dynamic markings: *p*, *pp*, *f*, *mp*, *mf*, *mp*, *mf*, *pp*, *f*, *pp*.
- Staff 8 (eb):** Labeled "17-20" and includes dynamic markings: *mp*, *pp*, *p*, *mf*, *mf*, *mf*, *f*, *pp*, *mf*.
- Staff 9 (f#):** Labeled "18-24" and includes dynamic markings: *f*, *pp*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*, *f*, *pp*, *mf*.
- Staff 10 (f4):** Labeled "25-31" and includes dynamic markings: *p*, *pp*, *mf*, *pp*, *p*, *mf*, *p*, *f*, *pp*, *f*, *pp*, *f*, *pp*, *f*.
- Staff 11 (g4):** Labeled "26-33" and includes dynamic markings: *pp*, *p*, *f*, *pp*, *f*, *pp*, *f*, *pp*, *f*, *pp*, *f*, *pp*, *f*, *pp*, *f*.

Fig. B. 16. Third derived series, as they appear in bars 1-33

Figure C.5 illustrates the register in a theme, showing ten phrases (ph. 1 to ph. 10) across two staves (piano and bass). The phrases are annotated with register information:

- ph. 1: (E3-within this range)
- ph. 2: (E3-within this range)
- ph. 3: (E3-within this range)
- ph. 4: (E3 goes above)
- ph. 5: (E3 above)
- ph. 6: (E3 above)
- ph. 7: (E3 above)
- ph. 8: (E3 above)
- ph. 9: (E3 above)
- ph. 10: (E3 above & below)

The score shows the piano part in the upper staff and the bass part in the lower staff. The register annotations indicate the relationship between the piano and bass parts for each phrase, specifically focusing on the E3 note.

Fig. C. 5. Register in Theme



ph. 1

ph. 2

ph. 3

ph. 4

ph. 5

ph. 6

ph. 7

ph. 8

ph. 9

ph. 10

ph. 11

Var. 1

Detailed description: The figure displays 11 phases of a musical register in E3. Each phase is represented by a pair of staves (treble and bass clef). Phase 1 shows a simple chordal structure. Phases 2 through 10 show increasingly complex melodic and harmonic developments with various accidentals (sharps, flats, naturals) and note values. Phase 11 includes a variation labeled 'Var. 1' with arrows indicating a change in the melodic line.

Fig. C. 8. Register in E3

(♩ = 96)  
 (N)

(♩ = 64)  
 (C)

(♩ = 144, ♩ = 72)  
 (C) *sempre* (R.H.) (C) *sempre* (R.H.)  
*poco a poco cresc.* (L.H.) (C) *only!*

(♩ = 108)  
 (C) *sempre* (L.H. only)

(♩ = 162)  
 (N) (both hands)

Dynamics: *p*, *mf*, *f*, *ff*  
 Performance instructions: *trill*, *poco a poco cresc.*, *sempre*, *only!*

Fig. C. 18. Canaries, illustrating metric modulation

top line contours

The first system, titled "top line contours", consists of two columns of staves. The left column contains six staves: ph 1 trpt, ph 2 trpt, ph 2 trpt, ph 3 hn, ph 3 hn, and ph 4 trpt. The right column contains five staves: ph 2 hn, ph 3 hn, ph 3 trpt, ph 4 hn, and ph 4 hn. Each staff contains a sequence of notes representing a melodic contour.

Lower part contours

The second system, titled "Lower part contours", consists of five staves: ph 1 trpt, ph 2 trmb, ph 2 trmb, ph 3 hn, and ph 4 trpt. Each staff contains a sequence of notes representing a melodic contour.

Fig. C. 20. Isomorphisms in E3/mosaic texture

Bar 76

Vertical 3      5 3 5 5

047 036   015 037   025 025 026   025 025 027   025

047      2 5 3 5 3 5 4      2 2 4 5 2 1 4 4 2 1 5

Detailed description: The image shows two systems of musical notation for piano. The first system is labeled 'Bar 76'. It consists of two staves. The right staff has a treble clef and a key signature of one sharp (F#). The left staff has a bass clef. Both staves contain complex rhythmic patterns with many sixteenth and thirty-second notes. Fingerings are indicated by numbers 1-5 above or below notes. A bracket labeled '6' spans a group of notes in both staves. Below the staves, there are vertical numbers: 'Vertical 3' and '5 3 5 5'. A series of numbers '047 036 015 037 025 025 026 025 025 027 025' is aligned with the notes. The second system continues the music, also with two staves and similar notation. It includes fingerings and a bracket labeled '5' above the first few notes. Below the staves, there are vertical numbers '2 5 3 5 3 5 4' and '2 2 4 5 2 1 4 4 2 1 5'. The number '047' is written below the first measure of the second system.

Fig. C. 21. Sonorities in E3, bars 76-8



50

Musical notation for exercise 50, consisting of three staves. The top staff contains a melody with quarter and half notes. The middle staff contains a bass line with eighth notes. The bottom staff contains a piano accompaniment with sixteenth-note patterns.

60

Musical notation for exercise 60, consisting of three staves. The top staff contains a melody with quarter and half notes. The middle staff contains a bass line with eighth notes. The bottom staff contains a piano accompaniment with sixteenth-note patterns.

70

Musical notation for exercise 70, consisting of three staves. The top staff contains a melody with quarter and half notes. The middle staff contains a bass line with eighth notes. The bottom staff contains a piano accompaniment with sixteenth-note patterns.

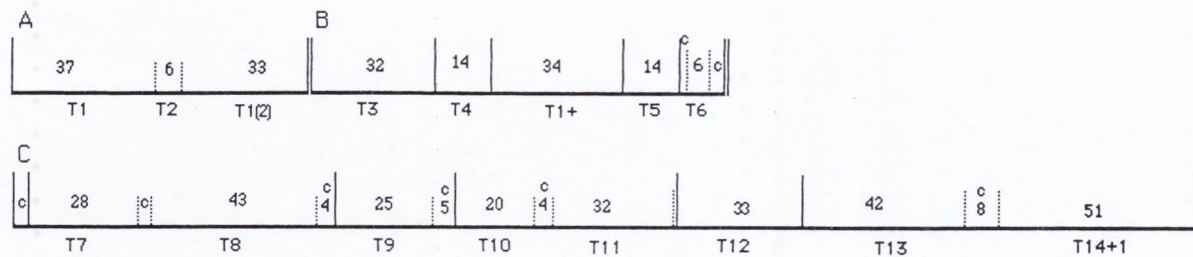
Musical notation for exercise 80, consisting of three staves. The top staff contains a melody with quarter and half notes. The middle staff contains a bass line with eighth notes. The bottom staff contains a piano accompaniment with sixteenth-note patterns.

Fig. C. 22. Rhythm of the elements

All existing tetrachords			(R) Set based on I.V. similarity to a.i.t.	(S) Subgroup [...2...] of (R)	(3) All [...2 <sup>+</sup> ...] chords
4-1	0,1,2,3	[321000]			
4-2	0,1,2,4	[221100]			
4-3	0,1,3,4	[212100]			•
4-4	0,1,2,5	[211110]	•		
4-5	0,1,2,6	[210111]	•		
4-6(12)	0,1,2,7	[210021]			
4-7(12)	0,1,4,5	[201210]			
4-8(12)	0,1,5,6	[200121]			
4-9(6)	0,1,6,7	[200022]			
4-10(12)	0,2,3,5	[122010]			•
4-11	0,1,3,5	[121110]	•		
4-12	0,2,3,6	[112101]	•	•	•
4-13	0,1,3,6	[112011]	•	•	•
4-14	0,2,3,7	[111120]	•		
4-Z15	0,1,4,6	[111111]	•		
4-16	0,1,5,7	[110121]	•		
4-17(12)	0,3,4,7	[102210]			•
4-18	0,1,4,7	[102111]	•	•	•
4-19	0,1,4,8	[101310]			
4-20(12)	0,1,5,8	[101220]			
4-21(12)	0,2,4,6	[030201]			
4-22	0,2,4,7	[021120]			
4-23(12)	0,2,5,7	[021030]			
4-24(12)	0,2,4,8	[020301]			
4-25(6)	0,2,6,8	[020202]			
4-26(12)	0,3,5,8	[012120]			•
4-27	0,2,5,8	[012111]	•	•	•
4-28(3)	0,3,6,9	[004002]			•
4-Z29	0,1,3,7	[111111]	•		

**Fig. C. 27.** Related tetrachords

### Introductory Movement



### Main Movement

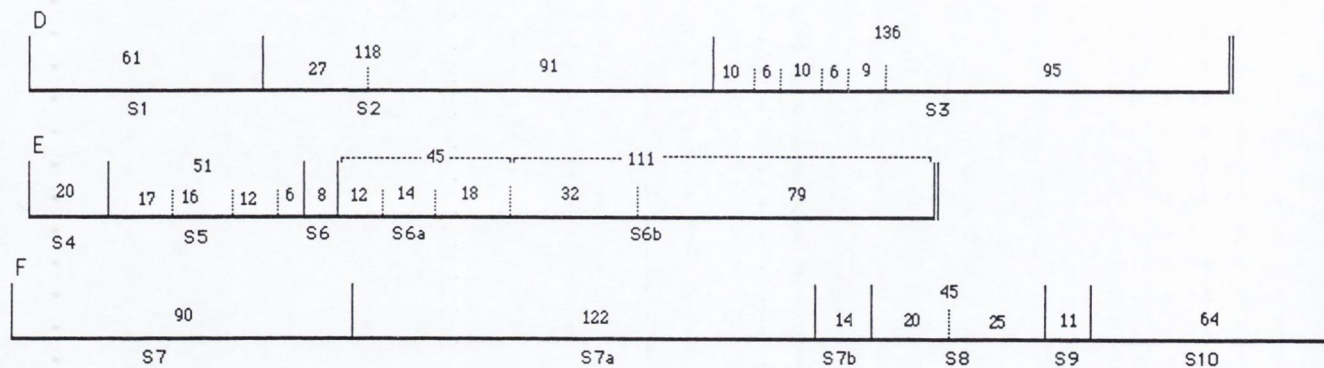
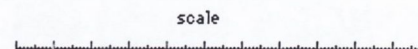


Fig. L. 1. String quartet, overview of sections





	No. of pitches		No. of motifs			Registral gesture		No. of insts				Harmonic type					
	fixed few	free many	1	2	3 more	undirection falling	mixed rising	1	2	3	4	$\frac{1}{4}$ tone	$\frac{1}{2}$ tone	tone	3rdsp.	5th	tritone
T1		X	X				X	X					X				X
T2		X	X				X	X					X				
T3	X		X			X			X			X	X				X
T4	X		X				X	X					X				X
T5	X		X				X		X				X	X	X		
T6	X		X			X			X				X				
T7		X	X				X		X				X	X	X	X	
T8	X					X	X		X				X	X			X
T9		X		X			X		X			X	X	X	X		
T10	X		X				X		X				X	X			
T11	X		X				X	X	X			X	X	X			
T12		X	X			X			X				X	X	X		
T13		X	X				X		X				X	X	X	X	
T14	X		X						X				X		X		

Fig. L. 2. Gestural weighting in the Introductory movement

Handwritten musical score for strings, consisting of two systems. The first system includes staves for vn II, va, vc, and RR. The second system includes staves for vn II, va, vc, and RR. The notation is handwritten and includes various musical symbols such as notes, rests, and accidentals. The first system is more densely notated than the second.

Fig. L. 3. Idealised version of T<sub>3</sub>

phase 1      phase 2      ♯

phase 3

etc

0, 1/2 0, 1 0, 1/2, 1 0, 1/2, 4 0, 1/2, 3 0, 3, 5, 1/2 0, 2, 7 0, 1, 2 0, 2, 5 0, 2, 7 0, 1, 4, 5 0, 3, 7

Fig. L. 4. Typical derived vertical harmonies in T<sub>3</sub>

\* These occur in fig L.3 - idealised version

Fig. L. 4a. The 18 possible chords in T<sub>3</sub>

The musical score is written on five staves. The top staff is for Violin I (V1), the second for Violin II (V2), the third for Viola (Va), and the bottom two for Right Hand parts (RR). The notation includes notes, rests, and dynamic markings such as *ff*, *f*, *mf*, and *pp*. There are numerous handwritten annotations, including circled numbers (e.g., (1), (2), (3), (4), (5), (6), (7), (8), (9), (10), (11), (12), (13), (14), (15), (16), (17), (18), (19), (20), (21), (22), (23), (24), (25), (26), (27), (28), (29), (30), (31), (32), (33), (34), (35), (36), (37), (38), (39), (40), (41), (42), (43), (44), (45), (46), (47), (48), (49), (50), (51), (52), (53), (54), (55), (56), (57), (58), (59), (60), (61), (62), (63), (64), (65), (66), (67), (68), (69), (70), (71), (72), (73), (74), (75), (76), (77), (78), (79), (80), (81), (82), (83), (84), (85), (86), (87), (88), (89), (90), (91), (92), (93), (94), (95), (96), (97), (98), (99), (100)) and letters (e.g., R, h, a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z). Specific performance instructions include "Sua loco" and "Example of repeat". The score is densely annotated with these markings throughout.

Fig. L. 5. Idealised version of T<sub>1+</sub> and T<sub>5</sub>



Musical score for strings (vno I, vno II, vla, vc) with measures 13-17. The score includes dynamics like *pp* and fingering numbers (0,1,5,7) and (0,1,2,3).

Musical score for strings (vno I, vno II, vla, vc) with "T° I" marking and "arco" and "quasif" markings.

Fig. L. 6. continued

Handwritten musical notation for 18 bars. The notation is organized into two systems of two staves each (treble and bass clef).  
 System 1 (bars 1-10):  
 - bar 1: Treble: D, G, C, F; Bass: D, G, C, F. Marked with \*.  
 - bar 2: Treble: E, A, D, G; Bass: E, A, D, G. Marked with \*.  
 - bar 3: Treble: F, B, E, A; Bass: F, B, E, A.  
 - bar 4: Treble: G, C, F, B; Bass: G, C, F, B.  
 - bar 5: Treble: A, D, G, C; Bass: A, D, G, C.  
 - bar 6: Treble: B, E, A, D; Bass: B, E, A, D.  
 - bar 7: Treble: C, F, B, E; Bass: C, F, B, E. Marked with \*.  
 - bar 8-9: Treble: D, G, C, F; Bass: D, G, C, F. Marked with \*.  
 - bar 10: Treble: E, A, D, G; Bass: E, A, D, G. Marked with \*.  
 System 2 (bars 11-15):  
 - bar 11: Treble: F, B, E, A; Bass: F, B, E, A. Marked with \*.  
 - bar 12: Treble: G, C, F, B; Bass: G, C, F, B. Marked with \*.  
 - bar 13: Treble: A, D, G, C; Bass: A, D, G, C. Marked with \*.  
 - bar 14: Treble: B, E, A, D; Bass: B, E, A, D. Marked with \*.  
 - bar 15: Treble: C, F, B, E; Bass: C, F, B, E. Marked with \*.  
 - bar 16-18: Indicated by an arrow pointing to a complex set of notes in the treble staff.

The grids marked \* are eleven-note sets, C is the absent pitch.

Fig. L. 7. Apparent grids in T<sub>7</sub>

A series of ten empty musical staves, each consisting of a treble and bass clef staff, arranged vertically.

VI  
V2  
Va  
0,1,6    0,1,6 0,1,4 0,1,6    0,1,6 0,1,4 0,2,4    0,1,6    0,1,6 0,1,5 0,1,6    0,1,5 0,3,7 0,1,2    0,1,6 0,1,2    0,1,6

oba (0,1,2,5,6)    (0,1,2,4,6)    (0,1,5,6)    (0,1,2,3,6,9,8)    (0,1,2,6)    (0,1,6,7)

Fig. L. 8. Idealised version of T<sub>8</sub>

Fig. L. 9. Idealised version of T<sub>9</sub>

pp    sost    acc.    precipit.    sost. acc.    sost. acc.    (0,1,4) (0,2,6) (0,3,7) (0,3,4) (0,2,6,9) P (0,1,4,9,8) P (0,3,6) pp (0,1,4,8) (0,1,5) (0,2,5,8) (0,1,4,8)

pp    pizz    mf    rit    precipit.    rit    (0,1,4) (0,2,6) (0,3,7) (0,3,4) (0,2,6,9) P (0,1,4,9,8) P (0,3,6) pp (0,1,4,8) (0,1,5) (0,2,5,8) (0,1,4,8)

mf    pp    arco    etc    quasi

3    4



Fig. L. 10. Superchords in T<sub>9</sub>

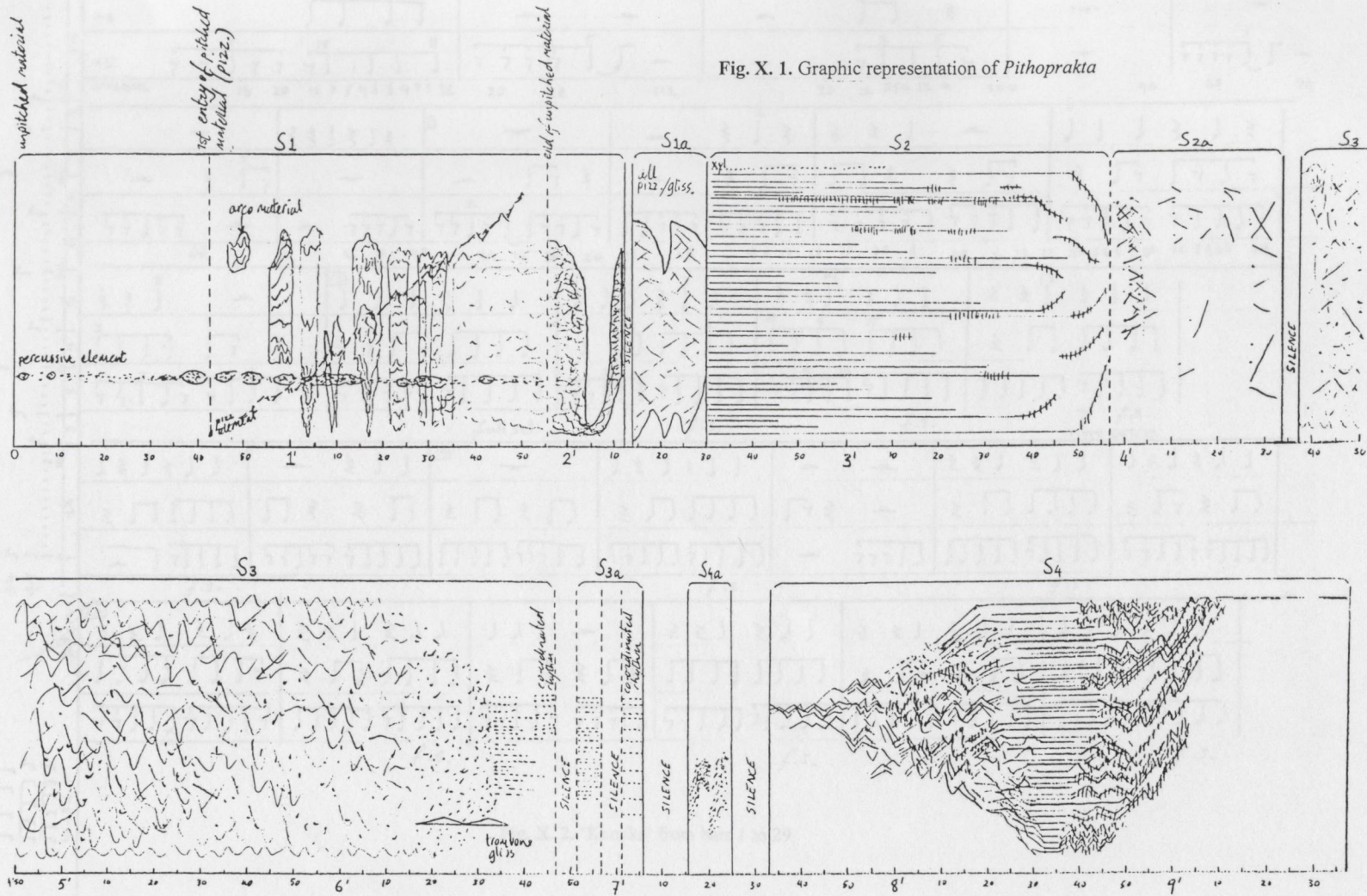
The musical score is handwritten and spans measures 14 to 23. It is organized into two systems. The first system contains measures 14 through 19, and the second system contains measures 20 through 23. Each measure is labeled with 'r.m.' (right measure) and a number. The score is written for four string parts: Violin I (V1), Violin II (V2), Viola (Va), and Violoncello (Vc).  
- Measure 14: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12)gr1, (12)gr2, (8)gr3, (5)gr4.  
- Measure 15: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
- Measure 16: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
- Measure 17: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
- Measure 18: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
- Measure 19: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
- Measure 20: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
- Measure 21: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
- Measure 22: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
- Measure 23: V1 has a whole note chord with notes #2, #4, #6, #7. V2 and Va have chords with notes #2, #4, #6, #7. Vc has a whole note chord with notes (12).  
Performance instructions include '3x3x3x3 pass vertical (81)' written below the Vc staff in measure 14. Fingering and bowing marks are present throughout the score.

Fig. L. 13. Partitioned sets in  $S_2$

The image displays a handwritten musical score for 'Proportional HRC, S2'. It consists of several systems of musical notation and data rows. The top system features four staves of music with complex rhythmic and melodic patterns, including many accidentals and dynamic markings. Below this system is a row of HRC data: 90, 12, 15, 13, 14, 9, 12, 1, 9, 9, 1, 9, 1, 1, 1, 1, 1, 23, 1, 54, 42, 18, 16, 30, 12, 6, 44, 22, 14, 12, 9, 6, 11, 33, 36, 10, 1, 6, 45, 9, 15, 14, 28, 45, 76, 22, 11, 10, 23, 24, 37, 52, 20, 24, 36, 83, 22, 24, 64, 55, 57, 36, 25, 10. The second system includes the label 'Registrul outer limits' and features musical notation with arrows and the word 'static' written above and below the staves. The third system consists of four staves of music with rhythmic patterns. Below it is another HRC data row: 62, 31, 18, 24, 9, 18, 9, 7, 14, 32, 9, 7, 14, 9, 16, 7, 14, 9, 16, 7, 14, 14. The final system shows musical notation with arrows and the label 'static (cyclic)' written below the staves.

Fig. L. 19. Proportional HRC, S<sub>2</sub>

Fig. X. 1. Graphic representation of Pithoprakta



Superposition of 3/4+5

Interval numbers: 16, 20, 12, 2, 5, 4, 6, 6, 4, 9, 3, 12, 20, 28, 112, 20, 12, 35, 4, 12, 4, 100, 40, 48, 96

Interval numbers: 66, 70, 40, 16, 48, 24, 12, 36, 24, 12, 68, 10, 6, 12, 12, 15, 25, 8, 42, 6, 12, 12, 20, 4, 6, 6, 4, 20, 12, 8, 4, 6, 6, 24

Interval numbers: 2, 2, 3, 14, 13

Interval numbers: 3, 2, 4, 6, 15, 14, 13

Interval numbers: 3, 4, 5, 10, 12

Interval numbers: 3, 4, 5

Interval numbers: 3, 4, 5

Interval numbers: 3, 4, 5

Annotations: full set, f.s., PITCH ENTERS

Fig. X. 2. 'Knocks' from bars 1 to 29

Handwritten musical score for bars 16-25. The score is written on five staves. The top staff is labeled '16' and has a '-3-' marking. The second staff has a '-4-' marking. The third staff has a '-5-' marking. The bottom staff is labeled 'Pizz.' and has a '-5-' marking. The music is in 2/4 time and features complex rhythmic patterns, including triplets and quintuplets, and various accidentals.

Handwritten musical score for bars 26-46. The score is written on five staves. The top staff is labeled '26' and has a '-3-' marking. The second staff has a '3' marking. The third staff has a '4' marking. The fourth staff has a '5' marking. The bottom staff has a '-5-' marking. The music is in 2/4 time and features complex rhythmic patterns, including triplets and quintuplets, and various accidentals.

Fig. X. 3. Score reduction of bars 16-46

Fig. X. 3. continued

36

3

4

5

Pizz.

43

3

4

5

Articulation/Timbre	Section							
	1 1-51	1a 52-59	2 60-104	2a 105-119	3 122-186	3a 189-195	4a 200-204	4 208-268
knocking on the body of the instrument	1-43				139-167			
woodblock ( <i>ff</i> )	7 24 46-8		70 72		130 171	191		209 231 256
<i>pizz.</i> ( <i>ff</i> )	15-41				130-3 146-8			
<i>arco</i> —all downbows 'au talon' ( <i>f</i> )	16-51							
<i>arco</i> —all upbows ( <i>f</i> )	23(Vc)-51							
<i>gliss.</i> + <i>pizz.</i> ( <i>fff</i> )		52-59						
long held notes <i>arco</i> ( <i>mf</i> )			60-104					231-242
xyl, even pulse, repeated note ( <i>mf</i> )			60-104					
repeated pitch <i>pizz.</i> ( <i>fff/fff</i> )			68-101		180-186	189-191		
<i>gliss.</i> + repeating <i>pizz.</i> ( <i>fff</i> )			97-104					210-218
<i>pizz.</i> + <i>arco gliss.</i> ( <i>ff</i> , 2 insts share)				105-120				
col legno frappé ( <i>ff</i> , <i>staccatiss.</i> )					122-171			
col legno frotté + <i>gliss.</i> ( <i>pp</i> )					122-171			
<i>arco</i> ( <i>pp</i> )					122-171			
<i>pizz.</i> ( <i>p</i> )					122-171			
<i>arco brevis</i> ( <i>ff</i> )					125-7 143-5			
					and 162			
<i>gliss. arco norm</i> ( <i>fff</i> )					154 158-62			
					and 164-6			
trombones <i>gliss.*</i> ( <i>ppp</i> )					172-183			
col legno frappé ( <i>fff</i> )					172-179			
repeated pitch col leg. frappé ( <i>fff</i> )					180-182	193-195		
unidirectional <i>pizz.</i> group ( <i>fff</i> )							200-201	
unidirectional col legno frappé group ( <i>fff</i> )							202-204	
<i>gliss. arco con sord.</i> ( <i>p</i> )								208-237
<i>arco tremolo sul pont</i> + <i>gliss.</i> ( <i>p</i> )								212-230
" " " " " "								239-250
col legno frappé + trem. <i>gliss.</i> ( <i>ff</i> )								218-230
long held notes <i>arco</i> ( <i>fff</i> , <i>con sord</i> )								231-242
harmonic, held note ( <i>fff</i> )								250-267
harmonic, tremolo on single pitch ( <i>fff</i> )								251-268

\*the trombones are creating a special effect of tuning beats, which change frequency as trombone 1 glissandos very slowly away from trombone 2's held pitch, and back again.

Fig. X. 6. Articulation/Timbre in *Pithoprakta*



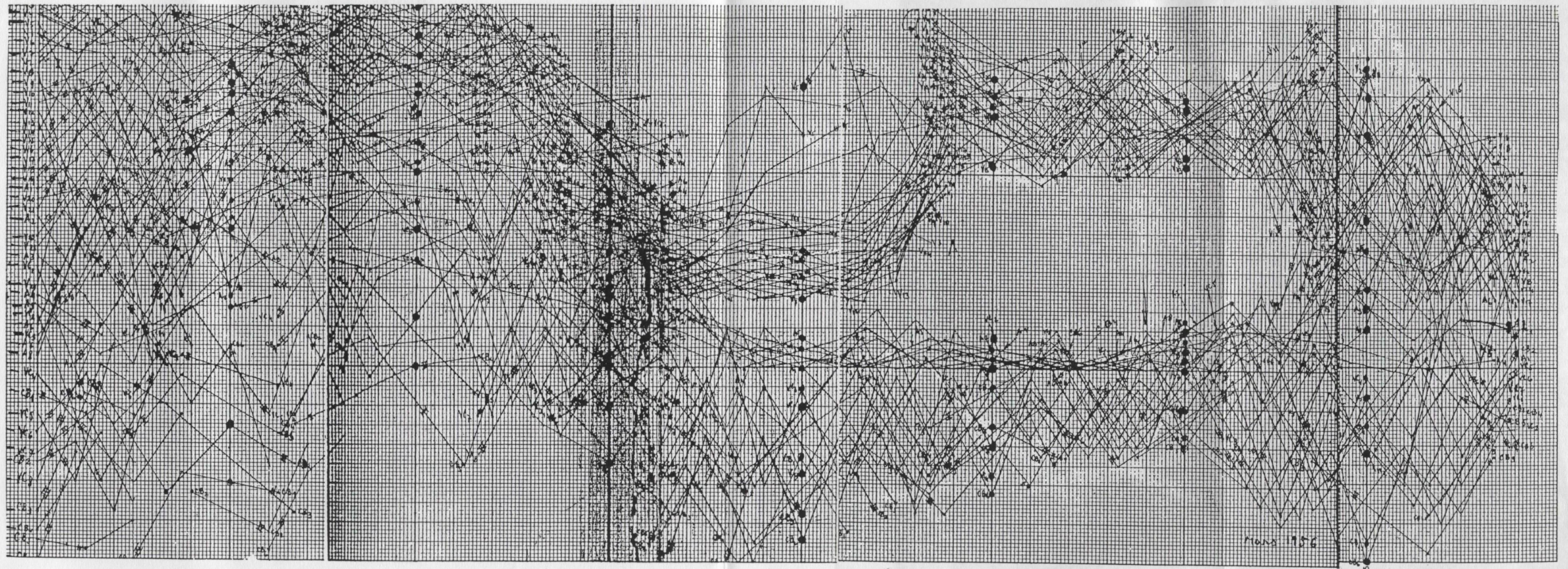


Fig. X. 9. Graph of  $S_{1a}$

Vn I/4

Vn I/9

Va 2

Fig. X. 12. Typical lines from bars 122-4

The image displays a musical score for a string quartet and woodwinds, spanning bars 200 to 201. The score is organized into four systems. The first system (bars 5-12) features five staves (5-12) with a 'pizz.' (pizzicato) instruction and a 'fff' (fortissimo) dynamic. A bracket labeled 'All (0,1,2,3,4)' spans the first five staves, with a sub-bracket '(0,1,2)' under the first three. The second system (bars 1-6) features five staves (1-6) with 'pizz.' and 'fff' markings. A bracket labeled 'All (0,1,2,3,4)' spans the first five staves. The third system (bars 1-8) features five staves (1-6) with 'pizz.' and 'fff' markings. A bracket labeled 'All (0,1,2,3,4)' spans the first five staves. The fourth system (bars 1-6) features five staves (1-6) with 'pizz.' and 'fff' markings. A bracket labeled 'All (0,1,2,3,4)' spans the first five staves. The score includes various performance instructions such as 'Col legno frappe' and 'Sourd.' (Sordid). The notation includes rhythmic patterns, dynamic markings, and articulation marks.

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Fig. X. 13. Vertical pitch structures, bar 200-201

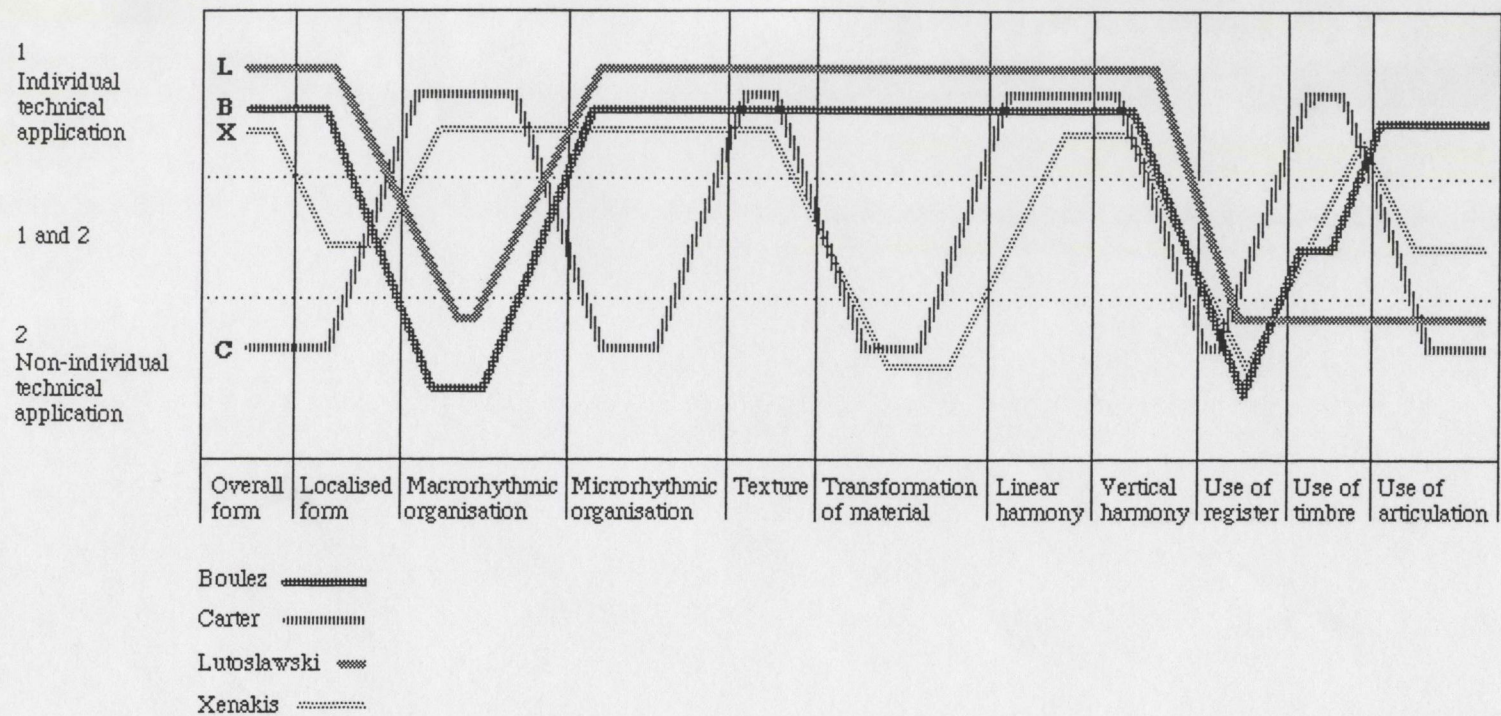


Fig. Cn. 1. Overview of technical applications