CHAPTER 4

AN ANALYSIS OF ECUATORIAL

PART I: INSTRUMENTAL EXPOSITION

mm. 1-20

Measures 1-20 are dominated almost exclusively by the cluster/6 set 4-5 and its subsets. In addition to places where SC 4-5 is heard as a complete set in a single context, it is also articulated over wider spans by temporal separation of its component subsets. Some subsets of SC 4-5, however, assert an independence of their own.

The parsings of SC 4-5 which are characteristic throughout Ecuatorial can be found in the trumpet lines of mm. 3-4, pitches E5-(A#-A)4-(G#-Cx)5: SC 3-5 in {A94}, SC 3-1 in {89A}, ic(1) in {89}, and i(6) in {4A} and {28}. The following is an account of how these subsets interact in the opening measures.

SC 3-1 is, of course, the opening figure of the work; another SC 3-1, also in piano, follows in mm. 6-8. Both of these 3-1s are each dependent upon another note to form a complete SC 4-5 and in both cases the completion note is a prominant sustained note in an ensuing measure: the sustained {5} in trumpet, mm. 4-7 completes SC 4-5 with

the first SC 3-1, and the reiterated note {8} in mm. 8-15 completes SC 4-5 with the second SC 3-1.

A frequent partition of SC 4-5 throughout Ecuatorial is by the two dyad subsets ic(1) and ic(6). An example is the vertical SC 4-5 which appears in m. 8, beat three. There are many Tn/TnI configurations[1] of this dyad pair that produce a SC 4-5: four distinct SC 4-5s share a common tritone, and two distinct SC 4-5s share a common ic(1). SC 4-5 of course, is the primary representative of the cluster/6 family of sets in Ecuatorial; remarkably, the only other cardinality four set class which forms by a pairing of ic(1) and ic(6) is SC 4-12, the primary representative of the cycle/1 family of sets. Consequently, the same operations on a SC 4-5 that will keep tritones or ic(1)s invariant produce the same results on SC 4-12.[2]

This relationship between SC 4-5 and SC 4-6 is no more clearly seen than in the "falling tritones" passages (m. 12). The only vertical tetrachords which can be

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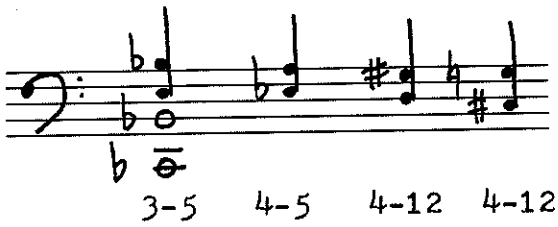
[1]The term "configuration" stands for the relative transposition levels of any two sets A and B. This term is used by Eric Regener in "On Allen Forte's Theory of Chords," Perspectives of New Music 13/1 (1974): 191-212.

[2]If we represent any SC 4-5 or 4-12 by {abcd}, where {ad}= ic(6) and {bc} = ic(1), then the operators T6, T(a+d)I and T(a+d+6)I will keep the tritone invariant, and operator T(b+c)I will keep the ic(1) invariant (while maintaining a tritone as the interval of {ad}).

produced as the falling tritones interact with the stationary ic(1) are SCs 4-5 and 4-12, as shown in example 13. Because the contrast between cluster/6 and cycle/1 sets is a prominant feature of Ecuatorial, in a sense this passage epitomizes the underlying formal principle of the work.

Example 13 Measure 12, organ, trombones



(octaves changed)

This passage also interacts with its environment to produce other interesting relationships. Of the first four descending tritones, the first two are stated by the trombones, and then are continued by the organ. These first two tritones complete SC 4-5s by timbral association with ic(1)s heard earlier in other brass instruments: the {56} sustained through mm. 5-7 in trumpets 1 and 2 combine with the first tritone to make {456A}, and the {78} sustained through mm. 9-10 in trumpet 2 form {9873} when combined with the second tritone. It is interesting to notice that both of these ic(1)s are articulated by i(13) and that each include the "prominant sustained note" which had combined earlier with other temporally remote subsets of SC 4-5.

A horizontal view of the tritones in m. 12 shows two linear chromatic tetrachords, {A987} and {4321}. Each of these tetrachords contains a SC 3-1, the first three pcs of each, which duplicates SC 3-1s heard earlier: the {A98} of the trumpets in mm. 6-9, and the {342} of the piano in m. 6. The remaining pcs of the two tetrachords, {7} and {1}, have a purely vertical role in m. 13, where all sounding pitches form cluster/6 set 4-6.

The event in mm. 14-15, consisting of pitches G#4-(G#-A-Bb)5-(F-B)6, is a passage which also recurs several times, pitch-transposed to various levels. The set-class formed by this event is cluster/6 set 5-5; it can be further dissected into SC 4-5 subsets SC 3-1 and SC 3-5, which are formed by pitches (G#-A-Bb)5 and Bb5-(F-B)6. SC 4-5 is then filtered out from this set and remains sounding in mm. 16-19. Once again, the dyadic partition of this SC 4-5 is an ic(1)/i(6) pair.

Before continuing on to mm. 19-20, two minor features of mm. 4-5 need to be illuminated. First, there is the first appearance of a cyclic/1 set in this section: SC 4-12, formed by pitches (G#-D)5-E#4-D#5. Secondly, a SC 3-2 is formed by E#4-(D#-F#)5. This set may seem

coincidental in the present context, since all the other trichords have been SC 4-5 subsets; however, the spatial form of this set, [3][10], is important, as it reappears from time to time throughout the work.

SC 3-2 appears again in m. 19, in the organ ({653}). Although this does not have the form [3][10], it is associated with the SC 3-2 at m. 5 by common Tn/TnI level, and by their temporal unfolding in the order {5, 3, 6}. A SC 3-1, also in the organ, recalls the opening of the work, and the trichord sounding on beat two (m. 19) is SC 3-5. Falling tritones appear once again in m. 20, yet the first dyad is an i(5) rather than a tritone. A rather provocative possible explanation for this is that its pcs, {6B}, form the registral extremes of this whole section (mm. 1-20): F#0 in organ, m. 12 is the lowest pitch, and B6 in onde I, mm. 15-19 is the highest pitch. Another possible explanation for this anomaly is that the misplaced pc {6}---that is, F#2 "should be" F2---is a completion pc for the SC 4-5 subset [012] in the previous measure (organ).[3]

Measures 21-29

Measures 21-29 sharply contrast with the first 20 measures by switching the focus from cluster/6 sets to

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[3]Appendix 2 of this study deals with the issues of score accuracy in Ecuatorial; according to the sources, the F#2 is correct.

cycle/1 sets. Here the cyclic properties of this set-type are prominantly displayed. Three SC 4-6s (270/1) contained in the brass event (m. 21) show their cycle(5) components very clearly: $\{492/3\}^4$ in trumpet 1; 5A3/4 in trombones, beat 1; and $\{381/2\}$ formed by trumpet 4 plus Eb4 of trombone 1. A SC 4-19, (480/1) is clearly seen in the $\{B37/8\}$ formed by trombone 1 in union with the G#4 of trumpet 4, as well as the $\{480/1\}$ formed by trumpet 3. The pitches Bb2-(D-F#)3-C#4 in trombones 2 and 3 may also be accounted for as a (480/1).

Two cluster/6 sets occur within the brass event as well. The trombone 3 part forms SC 4-5, while the final verticality of this event (downbeat, m. 22) is a SC 6-5. The form [3][10] appears as the top trichord of this verticality.

Measure 22 continues with a clearly stated SC 4-18 (741/0) in ondes and organ, beats three and four: {BA7/4}. The remainder of this measure and m. 23 are a "shadow" of the various components of m. 21. As shown in example 5 of chapter two of the present study, Bernard observes a trichordal rotation between the m. 22 chord (downbeat) and a portion of m. 23. Here it is shown that the

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[4]For the remainder of the paper, the convention for indicating cycle/1 sets (e.g., (480/1), (0236)) will be applied to the pc representations of specific sets, as shown above.

relationship between the materials of the two measures are all by half-step transformations (T_1, T_1I, T_{11}, $T_{11}I$). The F3-(Gb-Cb)4 in organ, m. 22, is a registral transposition by T^p_{-1} of the last three pitches in trombones 1, 2, and 3 in m. 21. The Bb1-Db2-Cb3 in organ, m. 23, is a T_1I of the top three notes of m. 22, downbeat, while both share the form [3][10]. Eb1-E0 in organ, m. 23, is a T^p_{-37} (compound $T^p_{-1}I$) transposition of F3-E4 in trombone 3, m. 21. Additionally, half-step transpositions appear to control activity <u>within</u> mm. 21 and 23. In m. 21, all of the (270/1)s identified are in neighboring half-step relationships; and in m. 23, the (Bb-Db)1-(Cb-F)3 is transformed in the same measure by T^1_I to (C-Eb)2-(D-G#)3.[5]

A very quick melodic statement of SC 4-5 is played by organ in m. 24, and comes to rest on a {2}, sounding above the {4} in the pedals. When the {2} moves to {5} in the following measure, the three pcs {542} have formed (registrally) a [3][10]. Once again the temporal introduction of [3][10]'s members are the same as they were in m. 5 (see p. 45).

In m. 23 the brass play a figure in rhythmic unison, the first ensemble passage of its type in <u>Ecuatorial</u>. The set formed by the figure is cyclic/1 set 5-31 ({6309/8}).

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[5]The set class of the latter two collections is 4-15/29, one of the other primary sets of <u>Ecuatorial</u>.

This is followed in m. 26, beat three by a SC 4-5 in piano, organ, and trombone 4 ({B015}), which is once again in the ic(1)/ic(6) formation.

A SC 4-5 subset not yet heard in Ecuatorial, SC 3-4, appears twice in m. 27, in trombones, organ and piano, beats one and two: pitches G#1-(E-A)2 and (Eb-G)3-D4. Another SC 4-5 subset, SC 3-1, is held through mm. 28-29, bearing a similarity (by its length) to the SC 4-5 held through mm. 16-17. Cycle/1 sets 4-6 and 4-19 appear in trumpets, m. 27 ({05A/B}), and onde I, mm. 27-28 ({519/8}), respectively. Finally, the i(11) played by organ in m. 27, {45}, is related to the earlier i(11)s, most notably the {45} of trombone 3, m. 21.

Measures 30-48

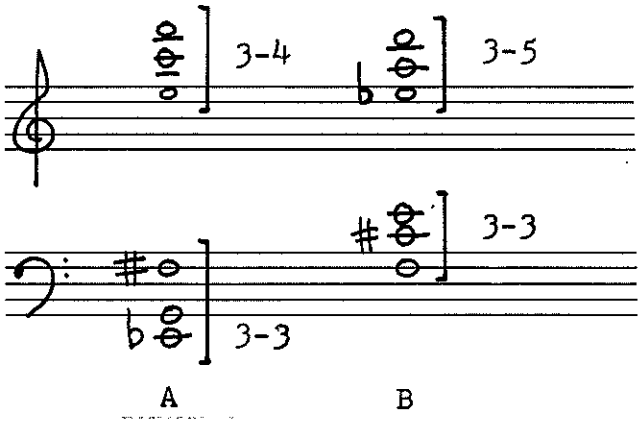
Cycle/1 sets continue to control mm. 30-33 and 37-38, and half-step transformations of earlier material continue to be present. Cluster/6 sets return at mm. 35-36 and then dominate the music from mm. 40-48.

Transformations by the half-step determine the two quick trichords of the piano part in the piano/timpani duet in mm. 30-33. The first trichord, {126}, is a T^{p}_{-1} of the pitches (Eb-G)3-D4 in m. 27, while the {54B} trichord is related by T^{p}_{-25} to the F3-(C-Gb)4 in m. 22, organ. The timpani part is a cycle/1 set, as was shown in example 8

of chapter 2. The function of the strongly emphasized {3} in trombones, m. 31 and piano m. 34, and its relationship to {8} was discussed it the Preliminary Analysis (see p. 40).

Measure 35 contains some interesting set-theoretic interchanges which require a somewhat detailed explanation. Example 14 below shows a segmentation of this measure into two vertical hexachords A and B, which are cluster/6 sets 6-36/3 and 6-37/4, respectively. The further division into four trichords (whose segmentation by timbre is evident in the score) is also shown in the example.

Example 14 Measure 35, piano, brass, organ

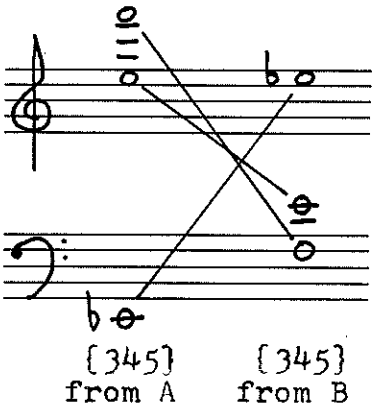


(all pitches sounding one octave ~~lower~~ higher)

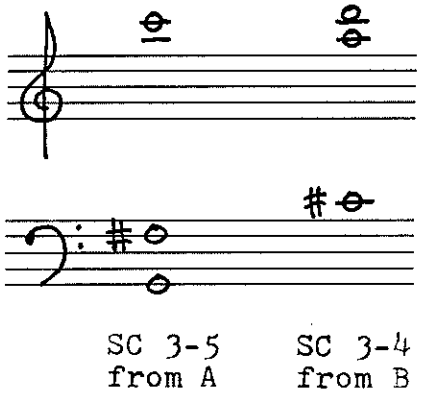
Chords A and B are not pitch-class exclusive. Their shared pcs, {345}, are shown in example 15a; the diagonal lines show that their registral orderings of {345} are in reverse image of each other. When these common pcs are removed from chords A and B, the chords shown in example

15b result, revealing an interesting interchange: the embedded SC 3-5 in A (ex. 15b) is the same set as the top trichord in B (ex. 14), while the embedded SC 3-4 in B is the same set as the top trichord in A. This interchange explains the presence of the two non-SC 4-5 subsets 3-3: although they appear prominent by their spatial isolation, they are in fact an incidental product of the SC 4-5 subsets 3-1, 3-4, and 3-5 which are embedded in this passage.

Example 15a



Example 15b



(all pitches sounding one octave higher)

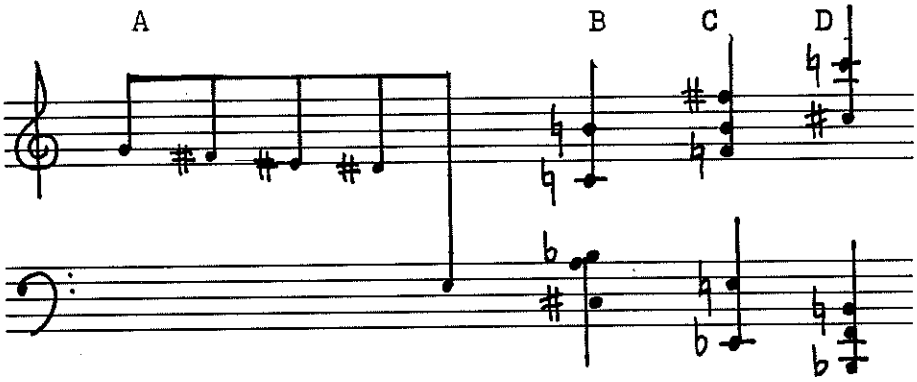
The i(5) cyclic series in m. 37 is the longest one yet encountered. It consists of G#2-(C#-F#-B)3-(E-A)4-D5; with the (Eb)6,7 in m. 38 (organ, piano) as an ic(1) appendage, it forms cycle/1 set 8-23.

A relationship between the pitches (F-G#)2-(C-C#-F#)3 of m. 37 and the timpani part of mm. 30-33 was already illustrated in chapter 1; see example 2. The figure in the piano in m. 38, {31B/A}, is cyclic/1 set 4-11; this figure will appear again in m. 58 at T^{p}_{-7} (transposition of the lower octave of the figure). Beneath this figure,

cluster/6 set 5-5 sounds in brass and organ ({789A2}). As each pc of the piano figure interacts with the SC 5-5 below, it produces a cluster/6 set: 6-38/6, 6-5, 6-36/3, and 5-5.

Measures 40-41 contains several "classic" atonal procedures which are rather striking by their appearance in so brief a passage. Example 16 shows a segmentation of these measures into pitch collections A, B, C, and D. Collections A and B are SC 5-1s, and C and D are SC 5-5s.

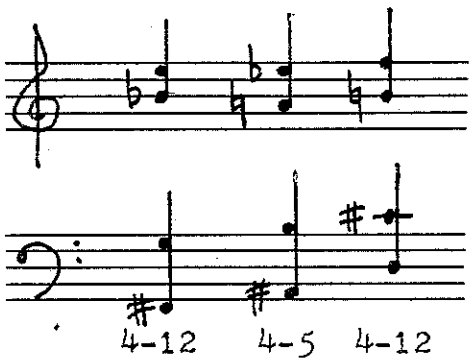
Example 16 Measures 40-41, brass and piano



The remarkable feature of this passage is that the equivalent pairs A and B are related under the same operator as are the equivalent pairs C and D: T_4I. Additionally, when we examine complementation and intersection relationships among the two pairs, ic(6) becomes apparent as a structural feature: $\overline{A \cup B} = \{28\}$, and $C \cap D = \{5B\}$. SC 4-6 plays a role as well, for $\overline{C \cup D} = \{7892\}$; this Tn/TnI level of SC 4-6 is a significant one, for {7892} are the pcs of trumpet 1 in mm. 77-78 (the repeat of the brass event from m. 21).

The trumpet parts in m. 43 articulate two SC 3-1s a tritone apart, while underneath them, trombones 2 and 4 have three ic(1)s in a row ({67}, {AB}, and {12}).[6] It will be recalled that ic(1) and ic(6) pairing can produce only two possible cardinality four set classes, SCs 4-5 and 4-12; thus, although the surface hardly shows it, this is in fact a falling tritones passage, as a comparison of example 17 with example 13 will show.

Example 17 Measure 43, brass



The piano/timpani duet is very quickly recalled as well, in m. 44. The timpani pitches here are a transposition by T_1^P of the same part at mm. 30-33, although m.44 lacks a Gb3 needed to make an exact duplication. The correspondence between piano, trombones, and organ here and the same instruments in m.30 is less direct, but quite interesting. Although the piano has only one

[6] The {349} of trombone 3 which is being excluded from this analysis may be regarded as an independent SC 3-5, or, in combination with the {5} that follows it in m. 44, a SC 4-5.

trichord in m. 44, {540}, it summarizes the <u>two</u> trichords of the earlier passage: as a set-class (3-4) it resembles the (D-F#)3-C#4 of m. 30, but its registral location and spatial configuration resemble the (E-B)2-F1 of m. 30. The presence of {3} in both passages (trombones in m. 31, and trombone 1, piano in m. 44) articulates a relationship between the two SC 3-4s of mm. 30 and 44: the union of {3} with each of the SC 3-4s produce the same set class, 4-4.[7]

Measures 45-47 contains one of <u>Ecuatorial</u>'s more complex passages, which was titled "explosion" in the Preliminary Analysis. Because the passage appears in varied form in four other locations (mm. 82-83, 102-105, 200-203, and 211-215) the approach taken here will be to examine the similarities among all of them first and proceed to contextual individualities as each passage occurs. The features common to all appearances, shown in example 18, are: an overlapping SC 4-15/29 and SC 4-5, and a SC 4-9 (except for mm. 82-83), hereafter called A, B, and C, respectively. In each case the Tn/TnI configurations of the three sets is the same (except for mm. 200-203); likewise, the spatial and registral distribution of A and B are also the same at each instance, while C has a varying makeup in

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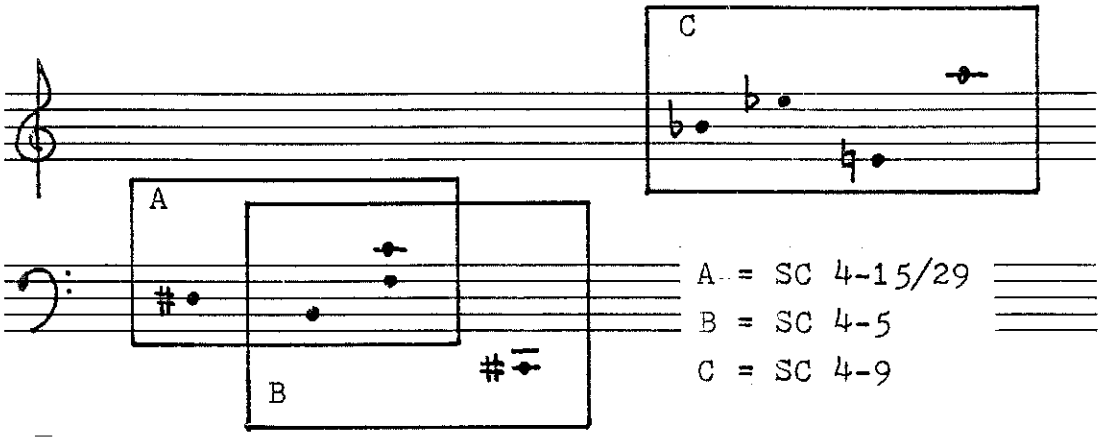
[7]That is, {126}∪{3}≡{540}∪{3}=SC 4-4. The set-class itself is not considered a structurally important set here.

this regard. Example 18 shows this basic form; the Tn level chosen here is that of its first appearance.

Example 18 "Explosion," basic form

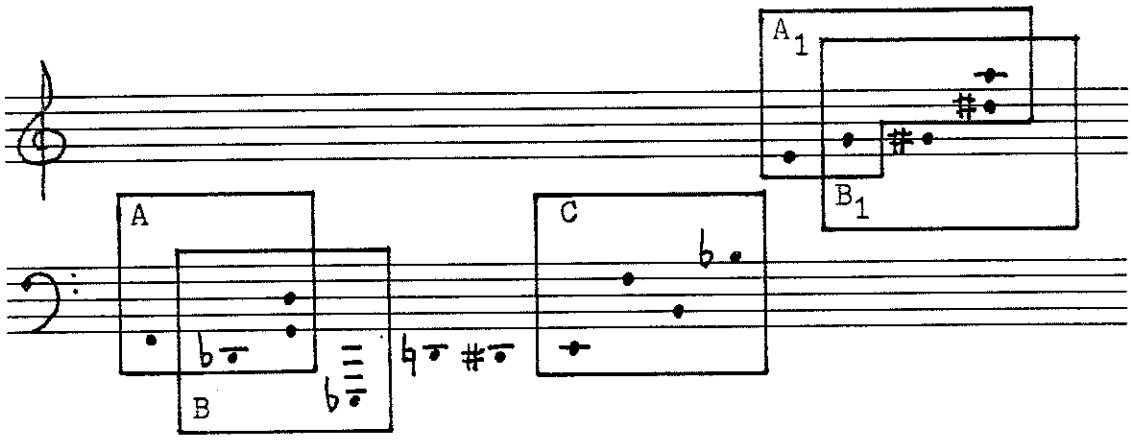


The five pitches comprising A and B are divided into two collections because the pitch collection B is sustained as a chord, while pitch collection A is a more transient, but nonetheless distinct, entity. In each case where B and C are both present their union is a SC 8-5; thus, SC 4-5 embeds into its complement. In the "explosions" of mm. 45, 103, and 202 this union is especially prominant, as the SC 8-5 appears as a distinct verticality: the downbeats of mm. 46 and 104, and m. 203, beat two.

The "explosion" of m. 202 presents a remarable demonstration of equivalence under inversion, and will be discussed presently; the components A, B, and C are shown in example 19. While A and B here are a T_2 of the original (m. 45) version, the pitches in C are not the "right" ones; i.e., for A, B, and C to be in the correct

Tn/TnI configuration, C must be {56B0}. However, C is in the correct configuration with the A_1 and B_1 which follow. These three are a T_8I of the basic form, resulting in a vertical SC 8-5 on beat two of m. 203 which is an inversion of the other SC 8-5s. It is interesting to note that not only has inversion occured in the pitch-class domain (i.e., the T_8I transformation) but in the spatial domain as well, because C usually appears after A and B and above them (registrally).

Example 19 "Explosion," m. 202



We now return to the present passage (m. 45) to discuss its individual features. Three chords occur in the remainder of m. 46 (triplets), which are cycle/1 set 5-19 (not counting the chord sustained by trombones and trumpet 4 into beat three), a whole-tone set (5-33) and cycle/1 set 5-16. Starting in m. 47 the sets are segmented by timbre rather than pure verticalities: the brass play cycle/1 set 5-19 on beats one and two, while the organ has cluster/6 set 6-37/4 throughout the whole

measure. The falling tritones appear once again starting on beat three of m. 47: piano and trombones contain the tritones, while the organ has the stationary ic(1), {45}. As the tritone {28} is sustained into m. 48 by trombones 3 and 4, the ic(1) in organ moves to a new level, {01}.

Measure 47-53

The first of four extended duets for ondes martenot soli follows in mm. 47-53. This passage and the similar passages at mm. 222-224, 242-245, and 251-256 make up the most concentrated areas of melodic activity in Ecuatorial. Each passage contains the following features: a) a highly active onde I part of eight to nine pcs articulated by many ic(1) motions and occupying up to $3\frac{1}{2}$ octaves of registral space; b) a more static onde II part of only three to four pcs, occupying no more than $1\frac{1}{2}$ octaves of registral space (the first duet is the exception to this rule: both onde parts are equally active); and c) an emphasis on SC 3-1 at the beginning of each duet by the two ondes in combination.

A computer-assisted study was made on these passages in order to determine the importance of all possible melodic segments and harmonic combinations. Two general observations may be made as a result:

1. 25% of all possible combinations are cluster/6 sets. The reader will recall that this is the

same ratio of cluster/6 vertical "slices" and melodic segments to non-cluster/6 vertical "slices" and melodic segments.

2. Although many of the segments found are of the same set-classes as segments found throughout the other portions of Ecuatorial, they are relatively unrelated to each other as intervallic successions and other measures of melodic similarity.

The first duet is especially rich with cluster/6 sets and their complements, both within single lines and within combinations of both lines. Example 20 (all examples for this passage are contained on pages 60-63) shows a significant articulation of SC 6-37/4. This particular set has only one ic(6) element (i.e., {28} of {012348}); the two Tn/TnI levels of the SC 6-37/4s in this passage are such that they share the same ic(6) element, {28}. In both 6-37/4s, each {28} appears as an adjacency in its respective onde line, and they are situated in relative positions to one another with respect to their parent SC 6-37/4. Additionally, in between the two {28}s lie {01}, which in union produce SC 4-5; hence, the same ic(6) element shared between the two instruments forms the sole ic(6) member of another cluster/6 set, SC 4-5.

The first and and last three pcs of the Onde I line in example 20 are both SC 3-2s, and they flank the appearance of SC 6-37/4 in that line. Pairing the SC

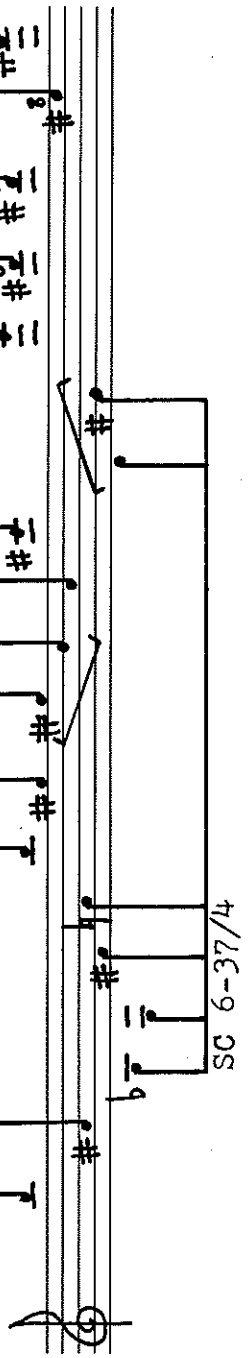
6-37/4 with one of its adjacent SC 3-2s produces the same set class in both cases, SC 8-2 (a non-property set). But a more remarkable feature is shown in example 21, where each of these SC 3-2s is embedded in its complement in symmetrical arrangements with respect to each other.

Other interpretations which examine both single melodic lines and the two melodic lines together produce interesting matrices of cluster/6 sets and their complements. In example 22 we have a single SC 4-5 embedded in two different SC 8-5s (one of which comprises the entire onde II line) which are themselves interconnected.

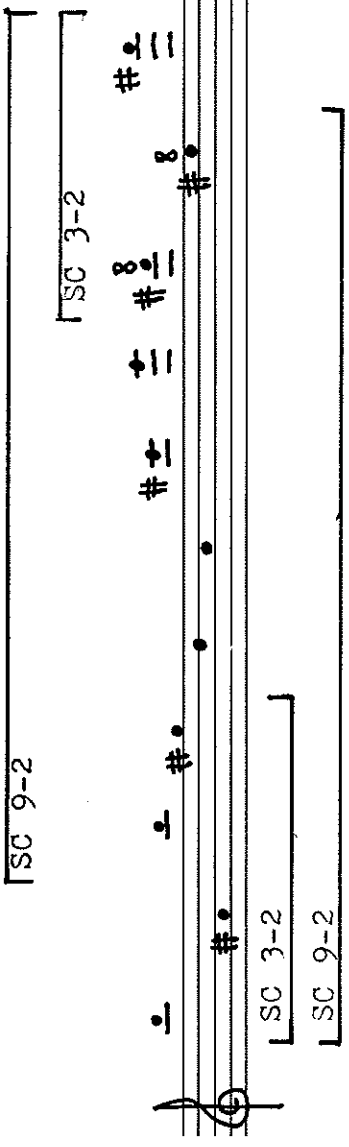
Example 23 shows the two SC 6-3/36s and their complement 6-36/3 combined together in another way. The SC 6-3/36 on the left and the 6-36/3, interestingly, are literal complements; also, the 6-3/36 taken from onde I is partitioned into three ic(1)s, one of which is shared by the 6-3/36 on the left, another which is shared by the 6-36/3, and another which is a part of neither.

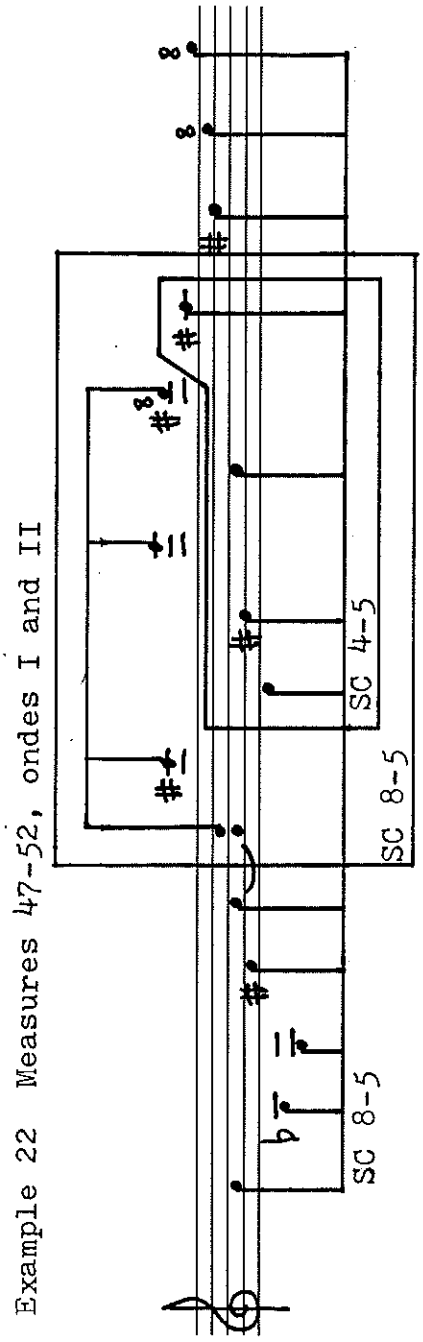
SC 5-7 is involved in a similar trio of sets: example 24 shows how two SC 5-7s and a SC 7-7 occur in the combined ondes parts. At the same temporal moment, this same trio appears within the onde II part, as shown in example 25. Still more confluences of cluster/6 sets are shown in example 26.

Example 20 Measures 48-52, ondes I and II

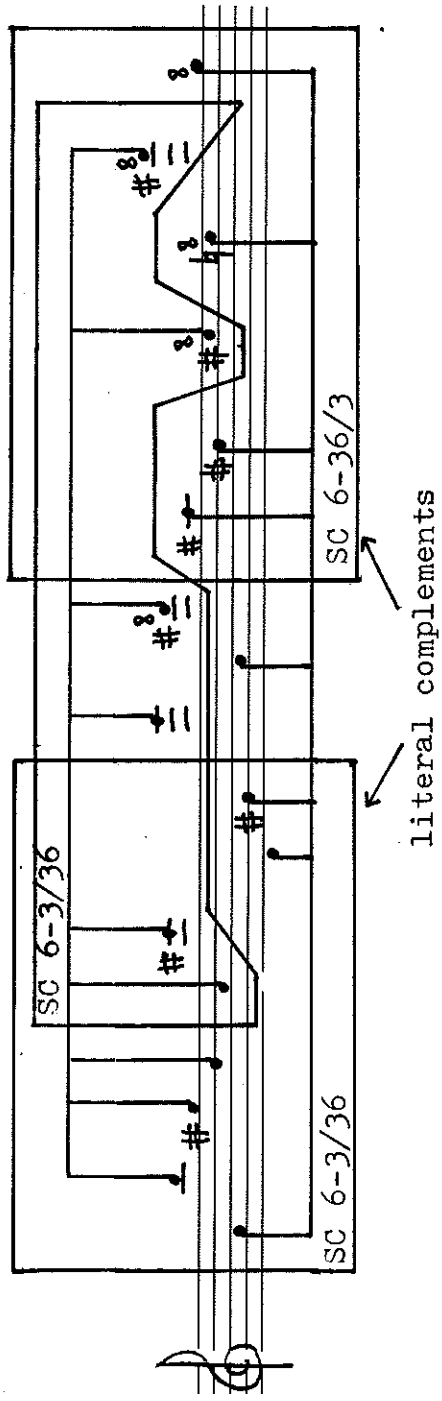


Example 21 Measures 48-52, onde I



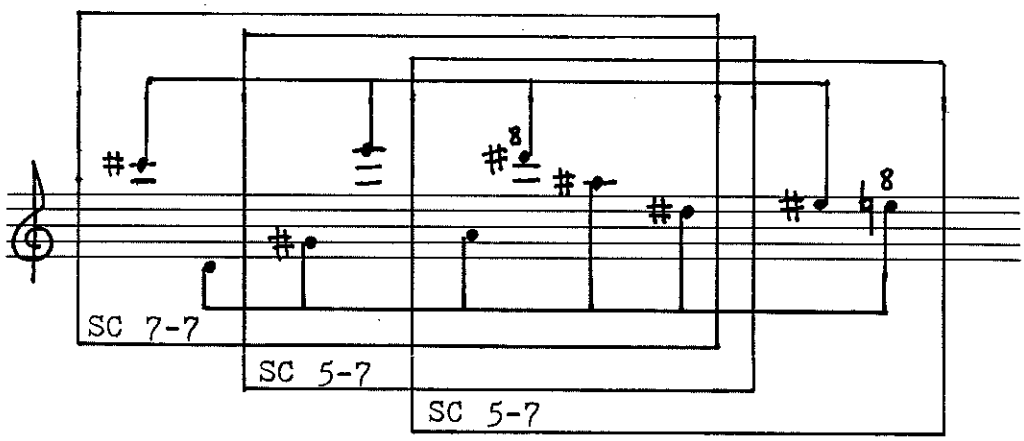


Example 22 Measures 47-52, ondes I and II

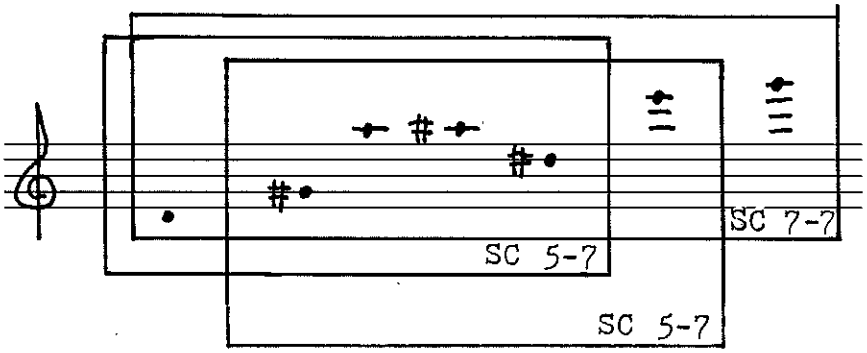


Example 23 Measures 47-52, ondes I and II

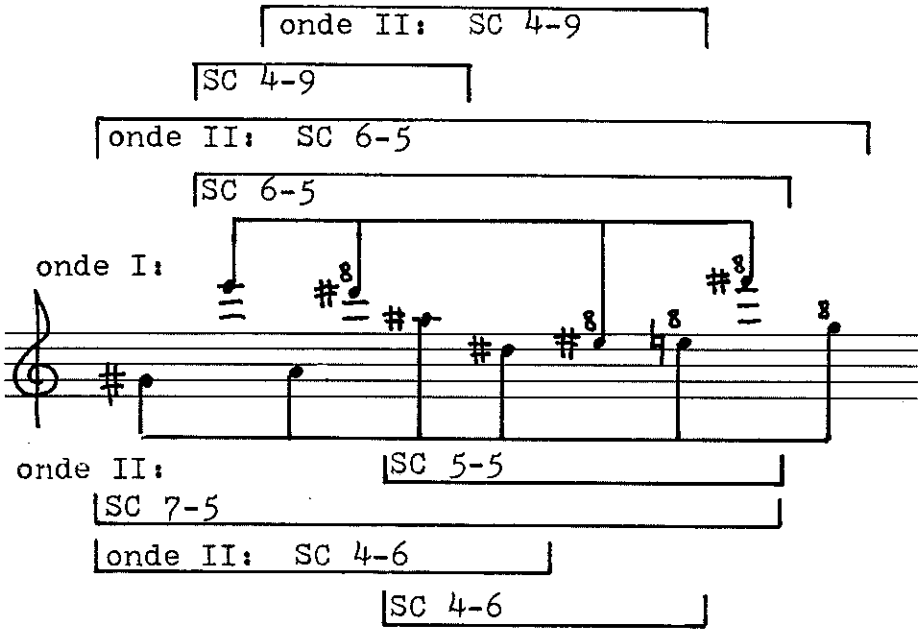
Example 24 Measure 52, ondes I and II



Example 25 Measure 52, onde II



Example 26 Measure 52, ondes I and II



Measures 53-58

The end of the ondes duet is followed by a very rapid figure in the organ, consisting of a SC 6-43/17 partitioned into two SC 3-5s an i(4) apart. The pairing of two SC 3-5s is a frequent trichord partitioning of six pc sets in Ecuatorial, as will be shown later. The remainder of the organ part in m. 53 consists of cluster/6 set 6-7 ({23489A}), which contains cycle/1 set 4-16 as a melodically articulated subset ({34̂8A}).

The highly complex passage for brass, piano and organ in mm. 53½-54 is one of the more analytically resistant moments (in terms of the present approach) in

Ecuatorial. The melodic sets in trumpet 3 (4-22), trumpet 4 (4-26) and trombone 2 (4-2) are members of neither properties, and cause the passage to appear rather anomalous. Other portions, however, are more familiar. Trumpet 1, and the (F#-Bb)5-(E-F)6 in the right hand of the organ are both SC 4-5s. Cycle/1 sets appear in the left hand of the organ (SC 5-31) and trombone 4 (SC 4-16). Other sets here are: SC 3-8 in the right hand of the organ, pitches (C-G#)-D7; SC 4-15/29 in trombone 1; and a cycle(3) set in trumpet 2.

Two i(13)s occuring in mm. 55-56 ({B07}, followed by {567}) bind together to form SC 4-9. In the brass, a cycle(3) set, {147}, also combines with the latter i(13) to form cluster/6 set 5-4. This 5-4, {76541}, has zero intersected pcs with the brass parts at mm. 56½-57, which form cluster/6 set 6-2, {89AB03}. The note missing from the aggregate, {2}, is supplied at the moment of the vocal entry with the pcs {27}. Melodically, the climbing half-steps of trombone 3 in m. 57, (G#-A-A#-B)3 (an echo of the (Db-D-Eb)5 in trumpet 1, mm. 53-54) create a sense of anticipation for the vocal entry to come in m. 59.

As the pitch B3 is sustained through m. 57, two trichords sound in the organ: SC 3-8 in the left hand, and SC 3-2 in the right hand. While the set produced by their union is cycle/1 set 6-24/46, in addition each

each combines individually with the sustained {B} to form SC 4-15/29 and cycle/1 set 4-11, respectively.

At the moment before the voice entry, trumpet 2 has cycle/1 set 4-11 in the same melodic shape as the 4-11 in m. 38, piano.[8] The other pitches in m. 58 are SC 4-5 subsets whose completion pcs are the {27} in m. 59: {860} is completed by {7}, and {89A} is completed by {2}.

PART II: VOCAL EXPOSITION

Measures 59-79

With the entrance of the voice, the texture of the piece thins out considerably. Fewer instruments play at once, sets of smaller cardinalities dominate, and the rate of change is slower. The features which are important to the whole of the passage are prominently displayed in the voice part: SCs 3-5 and 3-3, and the chromatic space-filling motions. The two property sets are present but play a minor role throughout this section.

The repeated 8s in the trumpet 2 part of m. 58 highlight a linear connection to the {7} in the following measure. In union with the first three measures of the

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[8]This trumpet 2 part raises some issues of score accuracy. The present author reads the part as (Ab-Gb-Fb-Eb)5 although some sources indicate otherwise; this matter is dealt with in appendix 2.

voice part, {670}, this half-step produces another SC 4-5. The voice's SC 3-5 is followed by the addition of {1} in m. 62, making SC 4-9 the total set of the first vocal phrase. SC 4-9 is a significant set for the voice's first statement, because this set is saturated with SC 3-5s, which is a frequent set for the voice throughout Ecuatorial.[9]

Two SC 3-3s appear in the next few measures: {541} in onde II, mm. 62-63 and {32B} in mm. 64-65, voice. The first of these have the spatial form [3][8], a form of 3-3 which will appear several times in the work. The union of the two produce cluster/6 set 6-2. This pair is in turn followed by a pair of space-filling sets in piano, mm. 65-66 ({9AB01}) and voice, m. 66 ({789AB}). A specific type of space-filling set, the vocal wedge, follows in mm. 67-71, with {345678}. The union of the three chromatic sets heard so far lacks only a {2} to complete the aggregate, which is immediately supplied in the first note of the next voice entry in m. 72.

Trombones 3 and 4 accompany the vocal wedges in mm. 67-71 with cycle/1 set 4-18, {096/5}.[10] Also accompaning the voice is an "explosion;" although it contains few

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[9]There are four distinct SC 3-5s contained in SC 4-9.

[10]As was mentioned earlier, cycle/1 sets are often used as contrapuntal accompaniments to voice parts.

of the outward features of m. 45, both the "A" and "C" sets occur here (refer to example 7) in the "correct" Tn/TnI configuration, and interestingly, at the same Tn/TnI level as m. 45: A is represented by trombones, downbeat of m. 69, and C in trumpet 1 (omitting pc {0}).

The passage that follows is the "declamatory voice with piano chords," as identified in the Preliminary Analysis. The first piano chord here is a SC 4-1 ({4567}), a literal subset of the previous vocal wedge; the grace-note chord, {B9742} combines with the {67} still sounding in piano and organ to form cycle/1 set 6-32 ({294B6/7}). The key feature of the voice part is the new appearance of SC 3-3, {AB2}, although it is actually a subset of the complete voice part, {9AB2}. The falling tritones appear here in trombones 1 and 2 in m. 75, against the ic(1) still sounding in organ and piano, {67}.

A large space-filling motion by the ondes and the return of the brass event from m. 21 articulate closure of this section at mm. 75-79. The space-filling occurs in two stages. Up to the Bb5 in onde I, the space filled is {6789A}. This space expands to {0123456789A} with the addition of ondes I and II pitches in mm. 77-79. Once again, the necessary pc for aggregate completion, in this case a {B}, is to be found in the next voice entry, in m. 80. The function of this and the aggregate completions at mm. 59 and 72 appear to be as indicators of beginnings rather than endings, as the completion pc always arrives

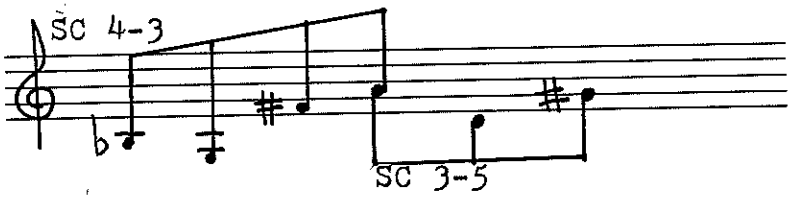
at the initiation of a new vocal phrase.

There are several interesting features about the voice part in mm. 76-77; these will be discussed starting with its smallest subsets and proceeding to the entire line. 1) The repetition of the pcs {B0} foreshadows the appearance of the passages "voice {B0} with repeated piano chords," which will be seen at m. 106, 149, 208, and 239. 2) SC 3-5 dominates most of the phrase's duration until the entrance of {0134} in m. 77 beat 2, and engages in a complement relation with the ondes lines above (by way of a different segmentation from the one previously chosen): starting on beat 3 of m. 75 until the end of m. 78, ondes I and II articulate SC 9-5, the non-literal complement of the voice SC 3-5. 3) The entire vocal line at mm. 76-77 is SC 6-4/37. While this is not a property set, a direct connection exists between this set and a melodic segment from the ondes duet in mm. 47-53. In example 20, the 6-37/4 in onde II is the literal complement of the present set, and in addition, both lines are partitioned into an overlapping SC 4-3 and SC 3-5, as shown in example 27.

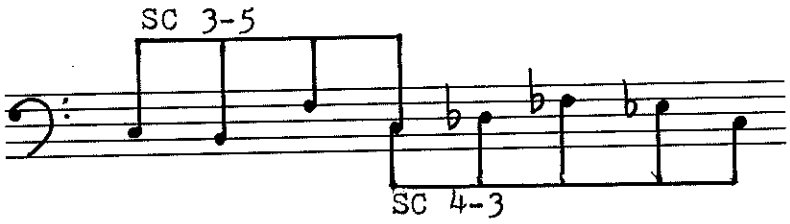
There are also two interesting features in the organ part in this passage. The right hand part doubles the voice here, but only as far as the Db3, which creates a SC 4-5 segmentation of the voice part ({B015}). Additionally, the SC 3-8 in the left hand is a SC 4-5 subset whose completion pc appears at the registral

Example 27 Complementation of 6-37/4 and 6-4/37

Onde II, mm. 50-52



Voice, mm. 75-77



climax of the onde I line (mm. 75-78), Eb7.

The repeat of the brass event in m. 78 has minor changes from the original version at m. 21, but for the most part the transposition is by T^{P}_{-7}. There is only one pitch-class change: E2 occurs in trombone 4 where Eb2 is expected.[11] The SC 4-18 which followed the m. 21 version in ondes and organ (m. 22) also follows here in m. 79, ondes. The transpositon level changes: mm. 79 is a T_6 of m. 22.

Measures 79-90

This section introduces the "Que Tranquilas" theme and the set pair associated with it, Z-related SCs

[11] It is possible that this is a misprint, since a solitary change seems unlikely. See appendix 2.

4-29/15. The lyrical character of this "theme" contrasts sharply with the nature of the material preceding it; as a result it creates the impression of being a "second theme." The set pair which controls this section is an element of contrast itself because of their interval content. Since they are the two "all-interval tetrachords," they are the perfect antithesis of the two property sets: cluster/6 and cycle/1 sets maximize some intervals and minimize others, whereas SCs 4-15/29 have an even distribution of interval content.

SC 3-2 in the form [3][10], absent since m. 25, reappears in organ and trombones in m. 80 ({457}). Upon the entrance of {B} in the voice this set becomes 4-29/15, a set which is immediately followed by its Z-pair (4-15/29) in the pcs of the voice line itself, {596B}. A sequence on the contour of the "Que Tranquilas" theme organizes the vocal phrases of the passage, rising from pitch level B2 to C#3 to E3 (mm. 80, 85, and 88, respectively). The second one is only an intermediary version, however, not a statement of what we call the "Que Tranquilas" theme.

The "explosion" at m. 82 contains the "A" and "B" components of the basic form transposed at T^{P}_{-2} from the original version. Where the "C" component is expected, a SC 4-19 appears instead, in the pitches (D-Ab)4-(Db-F#)5. The {6} of this set need only be replaced by {7} to make the "C" at the requisite Tn/TnI level; this change is

indeed provided in the onde I part in its succession F#5-G6.

The chord which appears in all instruments in m. 83 is curiously one pc short of completing the expected SC 8-5; the pc missing is {3}. However, this missing pc is provided in the climactic Eb4 which the voice arrives at in m. 91.

The chord in piano, m. 84, is a SC 5-13,[12] a chord which belongs to neither property. The appearance of a non-property set in so prominant a position is in keeping with the contrasting nature of this section, as described above. SC 5-13 is in fact closely related to SC 4-29/15, for it is a superset of this set.

The voice in mm. 85-87 (doubled by trombone 3) consists of a SC 3-5, and is accompanied by cycle/1 set 4-11 in trombones 2 and 4 ({357/8}). Together, voice and trombones produce cycle/1 set 6-26 ({$\hat{0}$13578$\hat{}$}).

The "Que Tranquilas" theme at mm. 88-90 consists of only SC 3-5 in the voice, rather than the complete SC 4-15/29. Remarkably, however, its complement does appear, in the vertical dimension: piano, trumpets, and organ form a SC 8-15/29 throughout this passage. The voice line is accompanied by a counterpoint in trombone 4 (pcs {04}), which in union with the voice SC 3-5

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[12]Here again is a spot where different editions conflict (see appendix 2). The present author reads the right hands piano part as (C#-D-G)4-C#5).

produces SC 4-5. The SC 4-6 which climaxes the voice part in this section, on the words "—cia que nos días" is a T_0 version of the trumpet line of the first brass event, m. 21, as mentioned in the Preliminary Analysis. The set of the entire vocal line here, non-property set 6-6/38, will be seen in related passages; it too is a superset of SC 4-15/29.

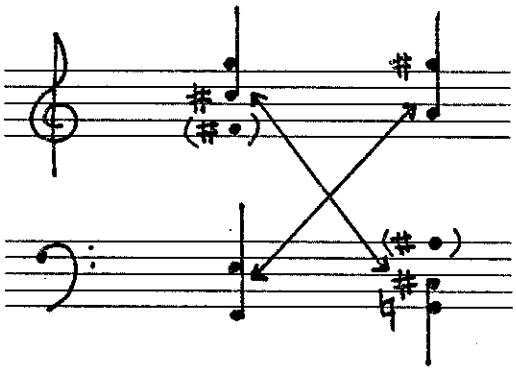
Measures 91-124

A sudden abundance of cluster/6 sets contrast this section sharply with the two which preceded it. Dramatic features, such as the intense polyphony of cluster/6 sets at m. 99, an explosion, and a high Eb in the voice direct the emotional bearing of the Vocal Exposition towards the voice "re-entry" (m. 111) as its major climax. A transitional section which follows (mm. 115-124) includes a "Que Tranquilas" passage, asserting SC 4-15/29 once again before the close of the Vocal Exposition.

The same rapid SC 6-43/17 which initiated the final section of the Instrumental Exposition (m. 53) likewise initiates this final section of the Vocal Exposition. It appears in the organ and piano here, in m. 91, transposed by T_6 from its m. 53 version. This is followed on beat four of m. 91 by cycle/1 set 5-10, {B0235}, in organ and ondes.

Three vertical cluster/6 sets appear in mm. 92-93: a SC 5-5 on beat four of m. 92 ({67891}), a SC 5-4 on the following beat ({76541}) and another SC 5-4 on beat three of m. 93 ({789A1}). An interchange of the outer dyads of these two chords (a Stimmentauch of sets) seems to "prolong" SC 5-4, as shown below.

Example 28 Measures 92-93



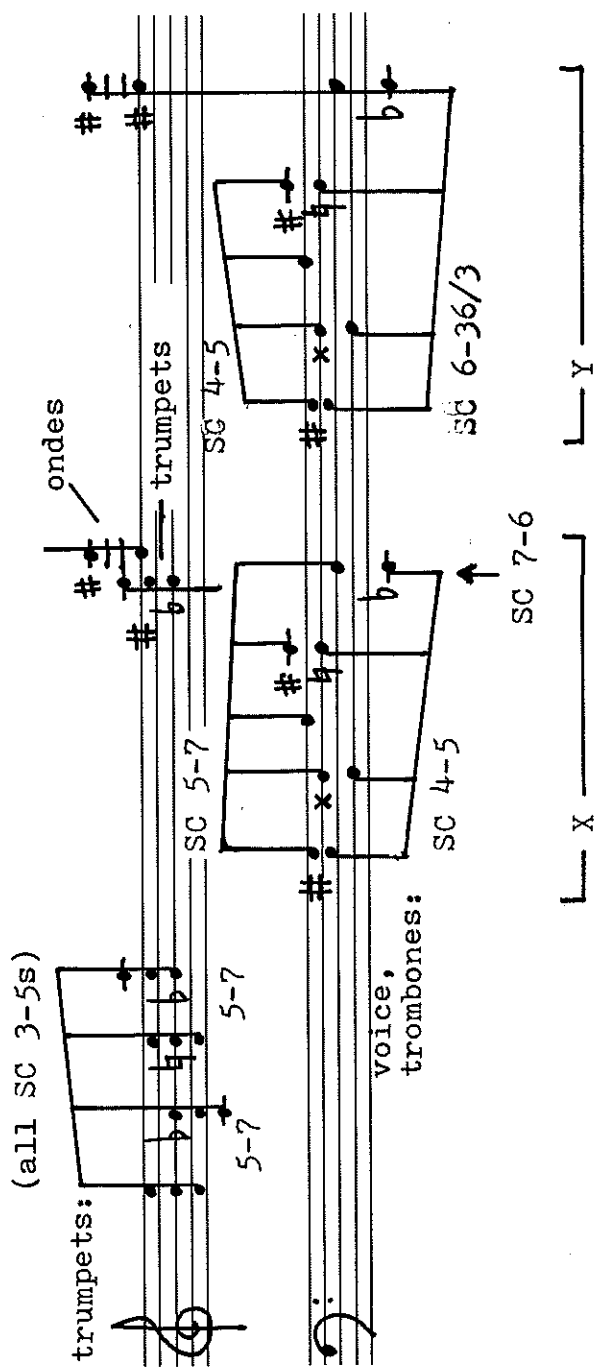
A brief duet for the ondes in mm. 94-96 fills the chromatic space {123456}. In mm. 96-98 two SC 3-5s appear, {650} in voice, and {A94} in timpani, a Tn/TnI configuration which is identical to that of the rapid organ figures at m. 53 and m. 91. The timpani SC 3-5 is part of a piano/timpani duet in this passage; the timpani here corresponds directly to the earlier version at mm. 30-33 (T_0^p, with the absence of pitches (D-F)3), but the piano part does not; here it has a SC 4-5, {2348}. The articulation of this SC 4-5 is identical to the SC 4-5 in piano, m. 26, beat three:

the present passage is a T^p_3 of the earlier SC 4-5. Finally, organ and trombones play cluster/6 set 5-4 on beats four and five of m. 98.

Example 29 illustrates the remarkable confluence of cluster/6 sets which occurs in mm. 99-101. The example shows two possible segmentations of the voice, trombone, and onde parts in this passage, indicated by letters x and y. Segmentation x divides up the pitches according to instruments and accounts for the {56} in ondes as part of cluster/6 set 7-6 occuring in beats one of both mm. 100 and 101. Segmentation y uses other forms of association: in the voice (and trombone 1) the D3 is seperated by register from the other pitches of the voice part, leaving a SC 4-5 ({7891}); and D3 associates with Eb2 to form an i(11), which in turn associates with the i(11) in ondes, forming cluster/6 set 6-36/3 with the remaining notes of trombone 2 ({65432B}).

The explosion in mm. 102-105 is a T^p_{-1} transposition of the m. 45 explosion, with almost no variants. The voice participates here, however, by singing a SC 3-3 in the form [3][8], last seen in onde II, m. 62. The half-step transposition is featured again: the m. 102 [3][8] is transposed by T^p_{-13} from the m. 62 [3][8].

The passage "voice {B0} with piano chords" appears in mm. 106-109. The piano chord, {3459A}, is cluster/6 set 5-7, which embeds into its complement when in union



Example 29 Measures 99-101, all instruments

with the {B0} of the voice. SC 5-7 is not the piano chord of all the appearances of this passage in Ecuatorial, but on the other hand, each of these passages contain {45} in the right hand, and some Tn of spatial form [6][7] in the left hand.

Measures 109-110 resemble m. 58 in outward features, but there are significant differences. Trumpet 1 still has the linear half-step motion into m. 111 (A5 to G#5), but the set in which it appears is not a SC 4-11 in this case (here it is a SC 3-7); however, in union with the D# in the following measure it forms a SC 4-15/29. Also, the trombones here have an i(11) rather than the i(6) of m. 58. Each note of the trumpet line interacts with the notes below it to form important sets, as before; here these sets are three of the most important sets in the work, SCs 4-15/29, 4-5, and 4-6. The voice re-entry in m. 111 is T_1^p of the entry at m. 59, another half-step transposition. The opening line of the voice is SC 3-5 once again; the linear succession {98} can be associated (as before) with this to form SC 4-5.

The transition at mm. 115-124 begins with a prominent non-property set in the piano, SC 5-3, and a [3][10] in the trombones. A long voice wedge occurs in the next four measure, inscribing a SC 9-1.

The "Que Tranquilas" passage at mm. 121-124 is a near-exact T_{-4}^p repetition of mm. 88-90, the exception being

that the voice here has a "complete" SC 4-15/29, and that it does not end with the SC 4-6 which ended the prior one. The piano chords beginning at m. 119 (SC 5-13 followed by SC 5-11) are likewise a T^{p}_{-4} repeat of the chords which preceded the m. 88 passage.

III. VOCAL CHANT WITH OBSCURED RECALL OF OPENING

Measures 125-154

Forward motion in the work comes to a near standstill in most of this section. Like the Vocal Exposition, instrumental activity and rate of change decreases from the section which precedes it, but here the degree is more extreme. Sparse, fragmentary brass chords, static vocal phrases, and disembodied ondes repetitions of material from the opening of the work punctuate the silent background of the section, evoking a variety of evocative or conceptual states of mind (e.g., dreams, deja vu experiences, barren deserts, blank canvases, etc.). Set-class activity is governed mostly by the returning material, which originates in a section where SC 4-5 was dominant. Chromatic sets in the fragmentary brass, piano and organ chords, and in vocal space-filling motions, also appear throughout the section.

The approach to this section will be by category rather than temporal succession. We begin with the

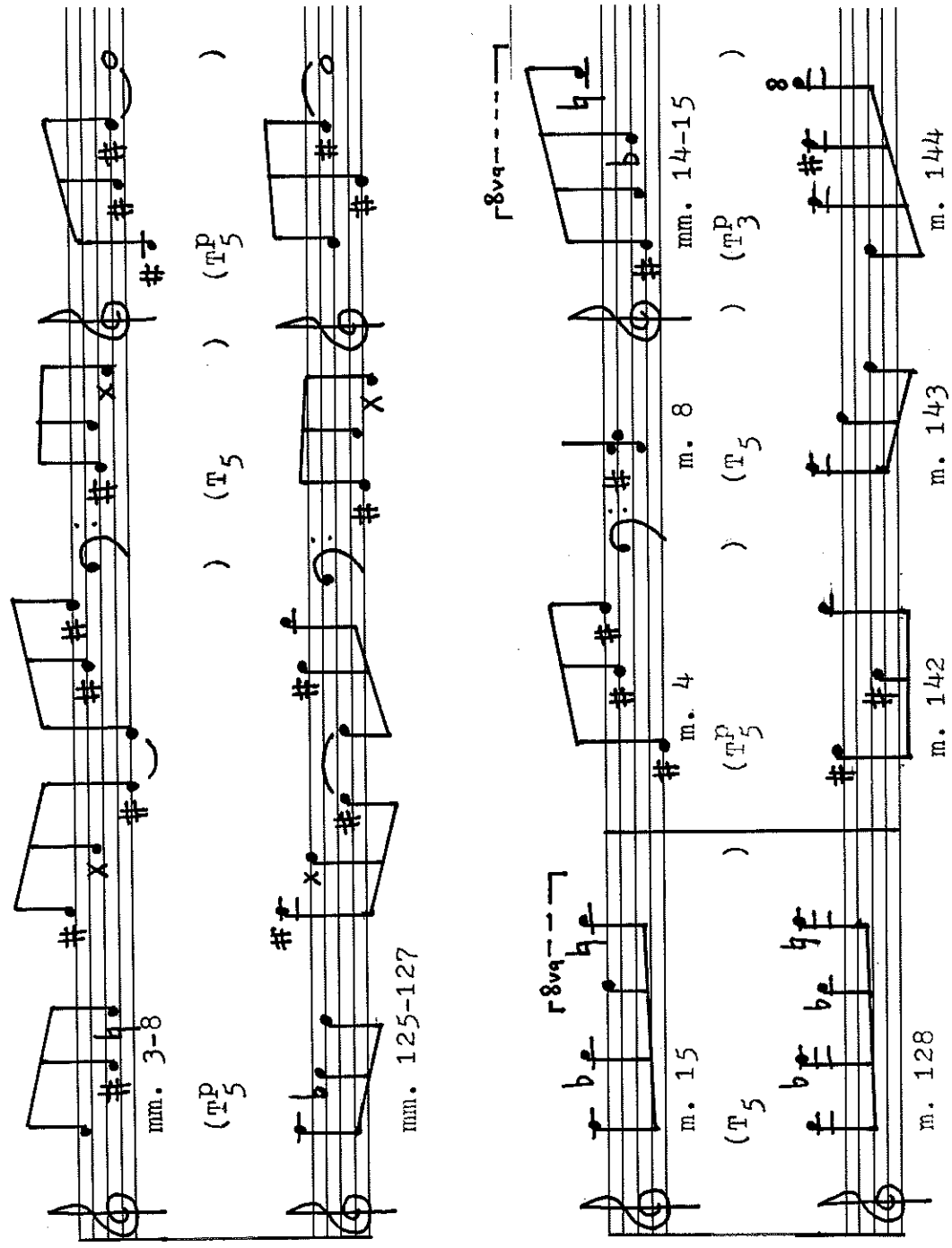
elements which return from the opening, followed by: the brass, piano and organ fragments; the vocal parts; and the ondes duet at mm. 135-137.

Elements repeated from the opening recur at two places in this section: mm. 125-131, and mm. 142-147. For convenience, these passages are shown in entirety in example 30; no further explanation is needed. Each repetition is aligned with the original version of the passage immediately above it, with the operator of transposition indicating the transformation of the original to the present version.

Although the detail and length of these repetitions might lead one to regard this section as a sort of structural return to the beginning, in the sense of recapitulation, we have avoided this notion by use of the phrase "obscured recall of opening." The suspended sense of time, the lack of emotional focus or dramatic direction, the presence of a voice reciting a text (i.e. in contrast to the opening, where there is no voice), and the thinness of timbre in the ondes all produce distinct contextual differences between this passage and the opening, preventing the listener from perceiving it as a "return." The passage is a reference to early events, or to use Bernard's words, a "reminic[sp]ence or recollection."

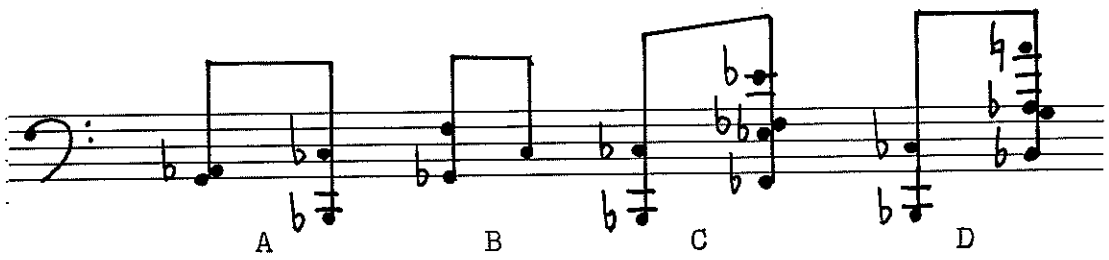
We now turn to the fragments played by brass, piano and organ in this section. The small repertoire of

Example 30 Recall of material from mm. 3-15



elements which appear in this section are shown in the example below.

Example 31 Brass, piano and organ fragments, mm. 134-147



Fragments B and D (SCs 3-5 and 5-1, respectively) are the only fragments which are significant in and of themselves; the others interact with each other or with other elements in the music to produce significant sets. In mm. 139 and 147 the {78} of A interacts with C to produce SC 5-5. The C#6-D7 sounding through mm. 144-147 in ondes interact with portions of the fragments also: with {78} of A it produces SC 4-9; with {789A} of D it produces SC 6-5; and with {34} of C it produces SC 4-1. Additionally, A participates in the recall of elements from the opening, as shown in example 32.

The voice parts in this section consist of "Half sung-Half spoken"[13] passages, and sung passages containing quarter tones. Since Varèse writes "pitch must be observed"[14]

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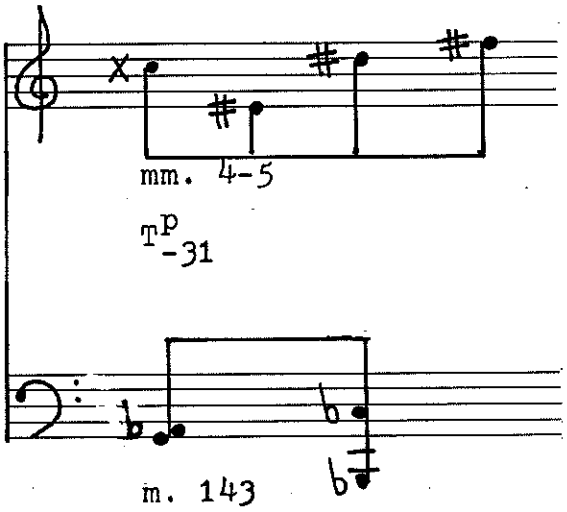
[13]Score to Ecuatorial, p. 32.

[14]Ibid.

Example 32



it seems appropriate to include the first of these two into the pitch structure analysis. All of these passages are space-filling motions: SC 4-1s in mm. 129 and 135, SC 3-1 at m. 142.

The quarter-tone passages may be interpreted using the same set theoretic procedures used so far, with the replacement of the 12-pc aggregate and mod-12 aritmetic by a 24-pc aggregate and mod-24 arithmetic; that is, C = 0, C♯ = 1, C# = 2, D4 = 3 . . . B♯ = 23. Using Forte's method of reducing sets to normal form, we produce the following:

	pcs	prime form
mm. 133-34	{2,7,13,19}	(0,5,11,17)
m. 141	{4,10,15,23}	(0,5,11,16)
mm. 148-149	{2,8,19,16,14,17}	(0,2,3,5,11,17)

By abstract inclusion, we see that the first passage is contained in the last, and that all three contain a common subset of (0,5,11).

The two ondes parts at mm. 135-137 cannot be accounted for as material returning from mm. 3-15. Onde II forms SC 6-43/17, a set familiar to us as the rapid organ figure of mm. 53 and 91. Once again, the partitioning here is two SC 3-5s at the distance of an ic(4). The onde I part forms cycle/1 set 4-13 ({6$\hat{5}$30}).

IV. RETURN AND CONCLUDING MOTION

Measures 154-188

Elements from both the Instrumental and Vocal Expositions return in this section, and in this case can be heard as a structural return, since the contexts associated with the returning elements are present. The organ ostinato clearly heralds the return of SC 4-5, and a relatively long instrumental interlude (clearly functioning as a condensed Instrumental Exposition, as the voice remains tacit for the first time since its entry at m. 59) features several other property sets which were absent during the Vocal Chant... section. Upon the entry of the voice (m. 172), SC 4-15/29 is asserted once again, followed by space-filling passages.

The organ ostinato in mm. 154-159 contains two different statements of SC 4-5. Linearally, the passage outlines 1237 with the pitches (G-D-Eb-C#)3.[15] The other SC 4-5 is produced by pitches F#1-C2 and Ab2-D3, the familiar ic(1)/i(6) combination.

The directed linear chromatic motion in mm. 159-160 ({789AB0}) not only recalls the opening (this was discussed in the Preliminary Analysis), but appears to be connected to the space-filling passage at m. 94 ({123456}) as well by two important associations: they are literal complements, and both occur at the only two places where the score indicates ♩ = 100.

The reiterated note and the passage from mm. 14-15 appear at T_5^p in mm. 161-162, although it lacks a C#5 needed to make the passage a literal repetition of mm. 14-15. Another element from the opening, the cycle/1 set 4-18 of m. 22 (ondes and organ), appears in the same instruments in mm. 164-165, transposed at T_7 from the original.

A SC 4-5 appears as all sounding pitches in the first beat of m. 163 ({432A}). The brass continue to unfold in the same measure to form a SC 8-9 (i.e., all brass pitches on the downbeat of m. 164). A brief duet for the ondes in mm. 166-168 consists of cyclic/1 sets 4-12

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[15] The (F)2,3 in m. 154 appears to be purely ornamental, since upon the return of this passage in m. 246 does not recur.

in onde I ({8$\hat{6}$52}) and 4-19 in onde II ({408/7}).

The chords in piano at mm. 169-171 resemble the "voice {B0} ..." passages; they include {45}, and have form [6][7], in the left hand, as all such passages have had. Although the voice is not present, the trombones supply a {B}, which functions as an abbreviated {B0}. The complete pc collection of the trombones in mm. 168-170 is cycle/1 set 4-13 ({5$\hat{4}$2B}). At m. 171, both piano and trombones change to different chords; in union, they form cycle/1 set 4-16 ({8$\hat{9}$13}).

The duet played by trumpets 1 and 2 in mm. 169-171 consists of SC 5-3 and SC 5-1, respectively. The "odd set" 5-3 was seen earlier, in the piano chord at m. 115.

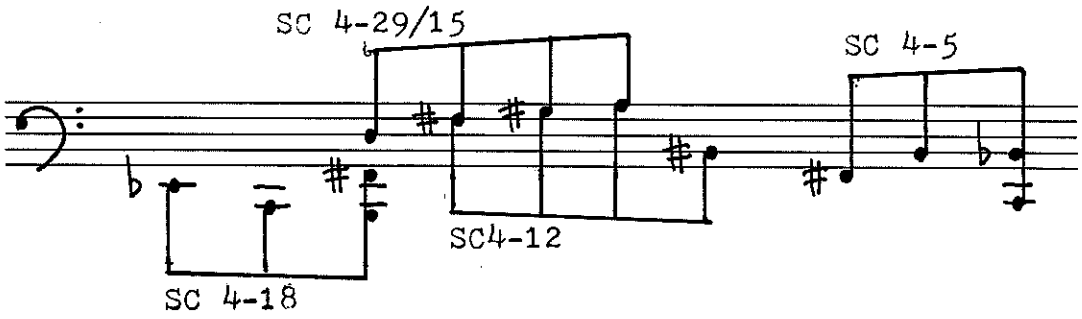
The "Que Tranquilas" passage at mm. 172-175 is a reduced version of the same passage at mm. 88-90, transposed by T^{p}_{-6} (although the voice here has a complete SC 4-15/29). The Bb4-(F-Bb)5-F6 which appears briefly in m. 174 corresponds to the B4-(E-B)5 of the earlier passage. The complete voice part up to m. 175, although no SC 4-6 appears here, is the same set as that of the complete voice part at mm. 88-91 (SC 6-6/38).

Two overlapping SC 5-4s occur in the voice, between the {34569} of mm. 175-176 ("—tenes de vuestros nu—") and the {76541} of mm. 176-177 ("de vuestros nutridores"). The latter is doubled by trombone 3 and accompanied by trombone 4 with cycle/1 set 4-18 ({8B2/3}).

The "declamatory voice" passage in mm. 178-182 is generally a T_2 transposition of mm. 72-75. The present version expands the earlier one by increasing the size of its sets by one pc. The SC 5-1 in piano, downbeat of m. 178, is the T_2 of the SC 4-1 in m. 72 (piano) with the addition of a {5}. Likewise, the SC 5-5 of the voice in the present passage is the T_2 of the voice in mm. 72-75 with the addition of a {9}.[16]

A vocal wedge passage follows in mm. 182-187. It is divided into two phrases, "espiritus del cielo" and "espiritus de la tierra," which form SC 6-1 in toto. The organ doubles the voice and adds contrapuntal lines of its own, as shown in example 22.

Example 33 Measure 182-187, organ



[16]The grace-note chords in m. 179 present difficulties. One possible (albeit awkward) segmentation is: right hand {863} ∪ G#0-A2 (left hand, beat two) = cycle/1 set 4-13, and left hand {9A1} ∪ {B0} (m. 180) = SC 5-1.

Measures 188-215

Space-filling motions appear throughout this section, giving rise to a motivic figure called the "SC 4-1 motive." This motive consists of a SC 4-1 in any of the following melodic successions: ⟨+2,-2,-1,+2⟩, ⟨+1,-2,+3⟩, or ⟨-2,-1,+2⟩.[17] The aural effect of this new motive here creates a "closing theme" effect (hence the phrase "concluding motion" in the title of this part), much as "Que Tranquilas" created the effect of "second theme" in the Vocal Exposition. SC 4-5 is given considerable attention as well here.

The organ in mm. 188-189 produces SC 6-1 with pcs {345678}, the literal complement of the voice wedge passage which immediately precedes it. The right hand part of the organ is a doubling of the voice, whose part contains the SC 4-1 motive in its last four notes ({5746}). The left hand part in m. 190 contains melodic lines which are anomalous; another segmentation of this part, however, G#1-(E-G-Bb)2 and (Eb-B)2-D3, produce SC 4-12 ({A874}) and SC 3-3 in the form [3][8], respectively.

The SC 3-5 ({0B6}) in voice, m. 191 is followed in quick succession by three chords in brass, piano, and

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[17] Earlier appearances of this motive exist as well: trumpet 1 of mm. 46-47 and 104-105, and voice in mm. 117-119 (starting with the G#2).

organ (mm. 192-193, cycle/1 set 5-25, cluster/6 set 7-7, and cycle/1 set 5-19), a [3][8] in the trombones (m. 194) and a large space-filling set in the piano (SC 9-1, mm. 194-195). This is followed by a literal repeat of mm. 189-190, and a second statement of the SC 3-5 in the voice. The {A} sustained into m. 198 by trumpet 1 combines with the SC 3-5 to form SC 4-5.

The "explosion" in mm. 200-203 was already discussed, at the time of the m. 45 "explosion". One additional feature which is relevant to the present context is the space-filling set 5-1, {12345}, in organ, trombone 4, and piano (mm. 200-201).

Trumpets 1 and 2 outline three different SC 4-5s in mm. 204-206: {6780} in trumpet 1, {9AB3} in trumpet 2 (mm. 204-205), and {8762} formed by (F#-G-G#)5 of trumpet 1 and D5 of trumpet 2.

A cycle/1 set 4-19 is formed by organ and onde I in mm. 204-205 ({7B3/4}) while trombones and piano have space-filling set 4-1. A SC 3-5 is articulated by the piano timpani duet in m. 206, followed by SC 4-1 motive {9A8B} in piano, organ and trombone 3 in m. 207. A voice {B0} passage then appears in mm. 208-210, without the piano chords; this is the last appearance of this passage in the work.

The "explosion" in mm. 211-212 is a general T^{p}_{-3} transposition of the m.45 explosion. Two SC 4-1 motives

appear here: in organ, trumpet 1 and piano, m. 212 ({6435}) and in organ, m. 213 ({1203}). This "explosion," the last to occur in the work, is closed by the final falling tritones passage of Ecuatorial. The reader will recall that the first "explosion" of the work also closed with a falling tritones passage; hence the association "explosion/falling tritones" forms a large-level spanning element. Because the Coda immediately follows, this spanning element articulates the division between this "afterthought" section and the main body of the composition which precedes it.

V. CODA Measures 216-256

Material from the two Expositions continues to return in the Coda. Several complete passages from disparate sections of the two Expositions return (pitch-transposed from the original) in direct succession in this section. Both property sets and SC 4-15/29 dominate the Coda; a variety of different cycle/1 sets appear, but cluster/1 sets are mostly limited to those which have dominated throughout Ecuatorial: SCs 3-5, 4-5 and 5-7.

Two SC 3-8s appear in the sextuplet figures of trombones, organ and piano;[13] their union produces cluster/6

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[18]The E3 in the piano here is most likely an error; F3 is the more probable note. See appendix 2.

set 6-5. The two trombones then fill the space {345678} in the remainder of the measure, coming to rest on {38} in m. 217. Upon the entrance of the reiterated {9} in trumpet 3, these three instruments for SC 3-5 ({983}).

Two segmentations of mm. 217-220 are available, as shown in example 34. The first approach (top two staves) is fairly self-explantory; of special interest here is the two z-pair sets in close succession.[19] The second segmentation shows how pairs of SC 4-1s and SC 4-2s form an "invertible counterpoint" of sets: the position of the set pairing in the trumpets is inverted when it appears in the trombones.

The ondes duet in mm. 221-224 contains mostly cycle/1 sets, the most obvious of which is the SC 4-19 that makes up the onde II line ({951/0}). Two prominent cluster/6 set 4-5s occur as well, by combination of the two parts: both the first and last four sounding pcs of the duet,

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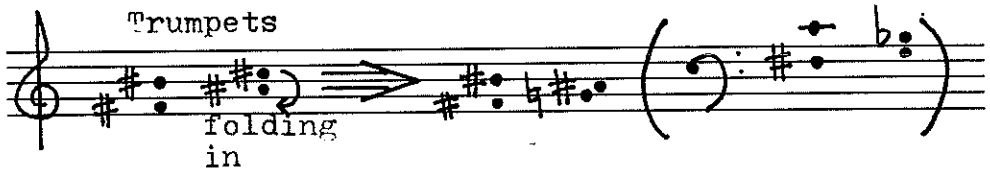
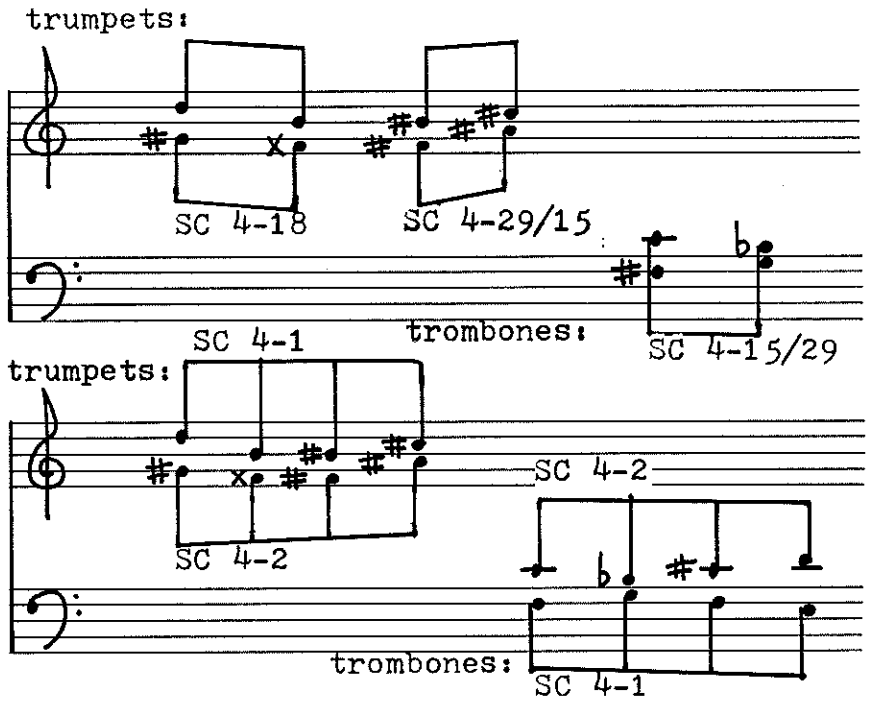
[19]The pc intersection among this Z-pair (they share {0A6}) reveals an interesting fact which merits further investigation: SCs 4-15/29 and 4-29/15 transform into one another under Bernard's "folding in" operation. In this instance, the folding in of the C#5 about the axis of A#4 produces G4, as shown below:



Example 34 Measures 217-220, brass



(F-F#)5-(Db-G)6 and Db6-(C-F-B)7 are SC 4-5s.

Quarter-tones appear once again in the bass voice in mm. 222-223. Using the same approach as before, these pcs reduce to a normal form of (0,5,17), a trichord which is included in the previous quarter-tone passages at mm. 133 and 148 (i.e., by abstract inclusion).

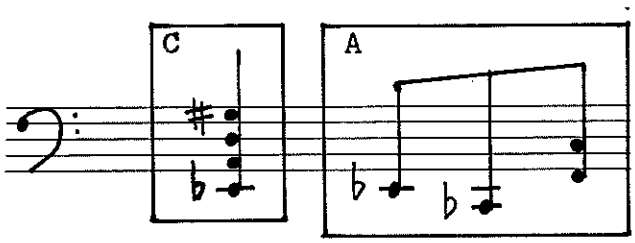
In mm. 224-226 the voice forms SC 4-15/29. The trumpet 1 and 3 parts are in rhythmic unison with the voice, and form two SC 3-5s; in union they produce cycle/1 set 6-29/50 ({$\hat{0}$B964$\hat{3}$3}). Although the timpani is tacit in m. 225, this part played by the piano is a "piano/ timpani duet" passage. The set here is SC 4-27, but the extreme rarity of this set in Ecuatorial leads us

to believe that the notated F1 is a copyists error; the intended note may have been D1, thus making the piano part a SC 4-5 subset SC 3-8.

Another SC 3-5 pair, in right and left hands of the organ in m. 227, also forms a property set by their union: cluster/6 set 6-41/12. A SC 4-5 subset appears in the left hand as well, {012}; its completion pc is the G#2 in m. 228. A SC 4-1 motive appears in the voice in m. 227 ({6547}), as a part of a larger SC 5-1 (mm. 227-228).

The descending major third in the organ part of m. 228 is reminicient of the "explosion" passages. Indeed, both "A" and "C" of the basic form appear (see example 35), although they are not in the Tn/TnI configuration which is characteristic of the passage.

Example 35 Measure 228, organ



Measures 229-230 are divided by register into two components: (E-A)2-(D#-G#)3-D4 and (F-F#)4-(C#-G)5. The former is cluster/6 set 5-7, and the latter is a

T^{p}_{-16} transposition of the passage from m. 14-15, here in the form [1][7][6]. The whole of the vocal line in these measures is cluster/6 set 7-4.

The "Que Tranquilas" in mm. 231-234 is the last appearance of this passage in Ecuatorial; it is a T^{p}_{-2} version of the mm. 121-124 passage.[20] A piano/timpani duet in mm. 235-236 produces a SC 3-5, which combines with the {5} still sounding in the voice to form a SC 4-15/29. The complement of this set, of course, has just appeared as a verticality in the preceding "Que Tranquilas" passage. Still another SC 4-15/29 is seen in the first four pitches of the next voice entry ({0B86}).

This SC 3-5 (piano/timpani duet) combines as well with another SC 3-5, the first three pcs of the voice entry in m. 237 to form cluster/6 set 6-38/6. This same set is also the chord formed by all the pitches at m. 239, beat one. The contour of the voice line here resembles the "Que Tranquilas" theme, and the last four pitches here are especially reminiscent of the ending of mm. 88-91 (notably the Eb4 as high point in both passages). These "Que Tranquilas" associations make the twofold appearance of the SC 6-38/6 in this passage all the more

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[20] The "forearm cluster" in the piano in m. 231 is best regarded as a timbral event in association with the gong sounding with it in the percussion section; it does not relate to the aggregate-filling procedures which have operated elsewhere in the work.

interesting because, as the reader will recall, it is the Z-complement of this set, 6-6/38, which make up the voice parts in mm. 88-91 and 172-175.

The six chords played by brass and organ in mm. 240-241 may be segmented in two different ways. As verticalities, chords one through three and chord five are: cycle/1 sets 5-10, 6-18, 5-19, and cluster/6 set 5-7, respectively.[21] SC 5-7 is also the chord in the piano here, which is a T_0^p version of the chord at mm. 106-108. An alternative approach to the passage is to segment according to timbre: all the trumpet pitches in mm. 240-241 form cluster/6 set 6-41/12, and all the right hand organ pitches in m. 240 form cluster/6 set 6-5.

The ondes duet in mm. 242-245 is a near literal repeat at T_{-3}^p of the duet at mm. 221-225. The organ ostinato which follows is also a repeat of the earlier statement of this passage (mm. 155-159), at T_{-4}^p.

A final duet for the ondes in mm. 252-256 closes Ecuatorial. In the two measures preceding this, trumpet 1, organ and ondes once again reproduce to passage from mm. 14-15, at T_1^p (although A5 is needed for an exact repeat). In the duet itself, two of the most important sets of the work are strongly emphasized, SCs 4-5 and 4-15/29. The entire onde I line is a SC 8-5, in which two SC

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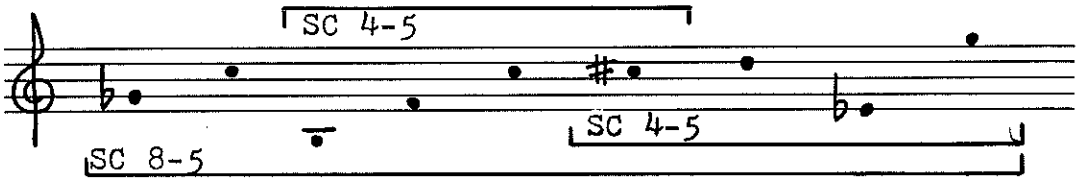
[21] Chords four and six are the same as one and three.

4-5s are melodically embedded; and the two ondes in combination produce two overlapping SC 4-15/29s at the end of the duet (both are illustrated below).

Example 36 Measures 251-256, onde I



Example 37 Measures 254-256, ondes I and II