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Introduction to Post-Tonal Theory
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Patterns and Structure in György Ligeti's *LUX AETERNA*

Ligeti's choral work *Lux Aeterna*, written in 1966, is scored for sixteen singers, four each of sopranos, altos, tenors, and basses, taking as its text the Communion portion of the Catholic Requiem Mass. In a number of respects, it is very much a contemporary work: it lacks a perceptible pulse, is devoid of melody, lacks any individual dynamic levels outside the range from pianississimo to piano, is unconstrained by traditional ideas of consonance and dissonance, and seems not to follow any particular, scale, mode, or serialistic system in its construction, either tonal or atonal. With such articulation directions to the performers as "enter imperceptibly" noted throughout almost the entire piece, the singers blend in such a way that individual voices can rarely be distinguished, making it at first difficult to identify many instances of specific musical events. Additionally, with large gestures often overlapping each other, the overarching structure of the piece is initially somewhat opaque.

But Ligeti has crafted the piece carefully; instead of more traditional materials, he is very much concerned with timbre and texture, often using voices less as individuals than as part of a huge mass of vocal sound. He maintains an inner coherence within the piece by constructing it largely from horizontal elements in the form of canonical vocal lines, allowing each voice to proceed at a different pace such that they drift apart rhythmically, creating a flowing texture of simultaneous consonance and dissonance out of which individual elements occasionally rise to the surface. Additionally, there are several very important instances of vertical pitch focus, i.e. harmony, often

coordinated with rare instances of rhythmic unison, which together contrast wonderfully with the other elements in the context of their placement. Though each individual voice has a reduced dynamic range, large-scale dynamic changes are achieved by additive density or sparsity of voices. The result is an incredibly stunning and unique piece, ethereal and quite powerful in its effect.

To best present an analysis of this piece, it is helpful to begin with a depiction of the entire large-scale structure, discussing the different large-scale gestures involved and their interrelations, then to delve into some of the attributes of each of these gestures and discuss how the individual elements of which they are comprised function together. Thus, for reference throughout the rest of the discussions presented:

LUX AETERNA STRUCTURAL DIAGRAM

	Section 1		Section 2A			Section 2B		Section 3A		Section 3B		
Letter (mm. #s)	Intro (1-24)	A (25-36)	B (37-39)	C (40-46)	D (47-60)	E (61-79)	F (80-86)	G (87-89)	H (90-93)	I (94-100)	J (101-109)	K (110-126)
Sopranos	CF1					CF3				QCF2		QCF3 (end)
Altos	CF1					QCF1			CF4			
Tenors		CF1 (end)		CF2						QCF2		
Basses			RUF1		CF2 (begins in middle)			RUF2			QCF3	

CF = *Canonical Figure* **RUF** = *Rhythmic Unison Figure* **QCF** = *Quasi-Canonical Figure*

Each Figure consists of a gesture that is discernible as a unified behavior generally (but not always precisely) followed by all of the voices within a given group (e.g., all of the altos and sopranos sing the Figure CF1 in Section 1, but in RUF1 and RUF2, only three of the basses sing while the other is tacet; in CF4, altos 3 and 4 do not reach the last two notes of the figure, and so forth). Essentially, every note of the piece can be accounted for within one of these Figures. It should be noted that because gestures of the piece often overlap and/or do not stop or start precisely

at Letter changes, with occasional differences of several measures, the labeled Figures may be slightly longer or shorter than indicated above. (It should also be noted that the word 'Section' in this paper will denote one of the three larger Sections delineated above, and the smaller units of structural division specified within the score itself will be referred to as 'Letter A,' 'Letter B,' etc.)

Each Figure sets a single line or portion of a line of text from the Communion, as follows:

Figure:	**Latin text:**	**English translation:**
CF1	Lux aeterna luceat eis...	May eternal light shine upon them...
RUF1	Domine...	O, Lord...
CF2	Cum sanctis tuis in aeternum quia pius es Do[mine]...	With Thy saints forever, for Thou art merciful, O, Lord...
CF3	Requiem aeternam dona eis...	Grant them eternal rest...
QCF1	Requiem aeternam dona eis...	Grant them eternal rest...
RUF2	Domine...	O, Lord...
CF4	et lux perpetua luceat eis...	And may perpetual light shine upon them...
QCF2	luceat...	Shine upon...
QCF3	lu[ceat]...	Shine upon...

The Latin phrases within each Figure are often repeated, and the last line of the traditional Communion, a refrain of "Cum sanctis tuis in aeternum, quia pius es," is omitted.

DISTINCTIONS BETWEEN FIGURE LABELS

Canonical Figures (CFs): These make up the bulk of musical material of the piece, with four CFs present in total. Each CF consists of a relatively long series of pitch classes presented in a specific order, all (or mostly all) of which are sung in that order by each member of a group of voices, but passed through at different rates; these are often exactly the same pitches (as opposed to pitch classes), though there is some deviation in octave between different voices at different points. These

figures are sometimes begun by individual voices entering one or two at a time, and sometimes with the voices starting in rhythmic unison, but always end with them moving out of phase with each other as some proceed more quickly and others more slowly, with differences both in terms of the starting points and durations of notes. There do not appear to be any strict rules by which the pitch classes used in the CFs are derived, nor how they progress from one pitch to the next, though there are certain apparent trends that unite the CFs as a whole, discussed later. The overlapping lines within CFs often create dense harmonic clusters that include a great deal of both diatonic harmonies and chromaticism. Within individual voices' membership to a CF, there is a certain amount of flexibility, as certain voices or groups of voices occasionally enter CFs *in media res*, certain voices do not finish the entire CF by the time of the gestural endpoint due to starting later or moving slower, and so forth.

Rhythmic Unison Figures (RUFs): There are two of these in the entire piece, each of which is a structural landmark indicating the beginning of a new large-scale Section. In contrast to the longer phrases of the CFs, which move with a general lack of rhythmic unity and are less focused on vertical harmonic alignment, the two RUFs are quite short, featuring only three notes at a time (each voiced by one of the basses), with all of the voices moving in rhythmic unison, thus drawing attention to harmonic relationships. Though both RUFs begin at the end of a prior gesture and are slightly overlapped by an entering gesture, each is largely featured by itself, with no other figures entirely covering it. It is certainly conceptually significant that the text for both of these is only "Domine" (O, Lord), the ultimate singular and infinite entity of unity. Interestingly, though the registers of the two RUFs differ greatly (and RUF1 remains static while RUF2 contains perhaps the only instance of genuine harmonic movement in the entire piece), the set class of each chord presented in the RUFs is always within the pentatonic scale, with 025 especially being a very

prominent set class that is also featured throughout the piece in numerous different ways. The significant harmonic differences between the two RUFs will be discussed later where they occur.

Quasi-Canonical Figures (QCFs): These Figures are somewhat more difficult to categorize, falling somewhere between CFs and RUFs. Additionally, each QCF has distinct features that distinguish it from the others. Their defining characteristics are that each QCF displays canonical attributes, and would potentially tend toward some sort of CF if modified, through extension or otherwise, but for various reasons each cannot be categorized as such; these will be discussed where the Figures occur. Rhythmically, the voices within QCFs sometimes display partial but incomplete rhythmic unity, with some voices within the group remaining static while others move. Each QCF contains only three pitch classes, resulting in a small set class (025 in the case of QCFs 1 and 2, 013 in the case of QCF3). These Figures are placed over other ongoing Figures, adding thickness and harmonic complexity to the existing textures.

THE THREE-SECTION STRUCTURE

Though *Lux Aeterna* is divided in the score by an Introduction and rehearsal Letters A through K, these divisions do not necessarily correspond to the most practical large-scale structural description. Labeling the piece according to a structure consisting of three Sections based on the placement of the CFs, the RUFs, and the QCFs, however, does seem to cleave the piece into fairly logical divisions. Section 1 consists solely of CF1, initiated by the sopranos and altos and picked up by the tenors toward its terminus. After all of the voices in CF1 come together on the pitch class A at the end of the canon, CF1 ends quite cleanly; only a single tenor holds the final A to transition into RUF1, beginning at Letter B, an event notable for its change in register, overall dynamic level,

density, rhythmic interaction, and lyrical content, signaling the beginning of Section 2A.

Section 2A continues into Letter C as the tenors begin CF2 together smoothly over the tail end of RUF1, and the basses pick up CF2 mid-stream, beginning at Letter D. While the tenors and basses continue CF2, at Letter E, the sopranos and altos all enter in rhythmic unison (with CF3 and QCF1, respectively); though the tenors continue CF2 uninterrupted, each voice of the basses actually modifies its canonical rhythm to join them in this rhythmic event before continuing with CF2. It would be tempting to label this coordinated rhythmic entrance the start of a new Section; it is also a notable event for suddenly adding many voices in different registers, and thus also increasing the density and therefore the overall dynamic level of the Section, as well as introducing new Figures and their accompanying text, harmony, consonance and dissonance, and so forth. Letter E is actually the first time in the entire piece that all singers are singing simultaneously.

However, to do so would be complicated by the fact that CF2 has not completed and does not end cleanly here; indeed, CF2 continues in the basses and tenors all the way through Letter E to the end of Letter F. As such, this Section beginning at Letter E is more properly seen as a continuation of Section 2, with enough of a differentiation to warrant the distinction Section 2B. At Letter F, the sopranos' shorter CF3 and altos' QCF1 die out, leaving the basses and tenors to complete CF2, which by now has gradually moved down to a lower register and uses sustained, elongated notes. The basses die out one by one, with the tenors following suit shortly thereafter as the piece reaches Letter G.

Here, the tenors' last pitch class E smoothes the transition into the basses' presentation of the brief RUF2 in a very low register, which begins Section 3A (as the previous RUF1 began Section 2A). As in that earlier Section, another group then begins a new Canonical Figure over the tail end of RUF2: this time, the altos, with a relatively low-register CF4 at Letter H.

At Letter I, while the altos continue CF4, the sopranos and tenors each begin QCF2 in

comparatively higher registers, initially in rhythmic unison, and partially continuing that unison until dying out at the end of the Letter. This entrance of two vocal groups over an extant CF4 at Letter I mirrors the entrance of the two vocal groups in Letter E, at the beginning of Section 2B, lending further credence to the proposed sectional labeling. Thus, Section 3B begins with this entrance at Letter I.

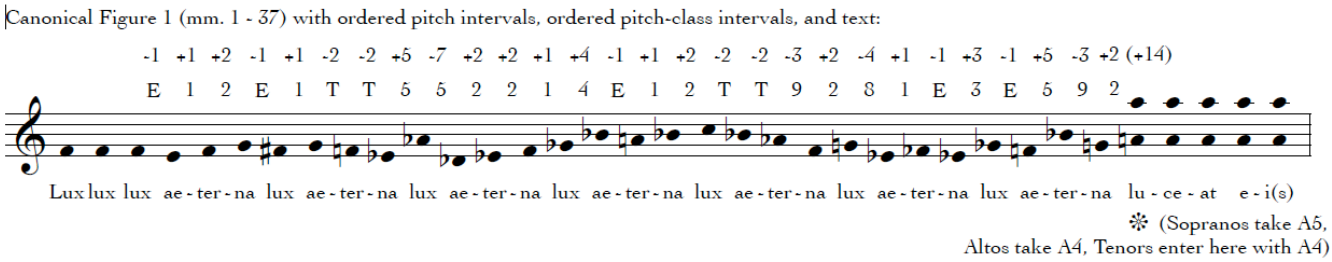
The altos continue CF4 into Letter J as the sopranos' and tenors' QCF2 dies out and the basses begin QCF3 (here atypically splitting the voices, with basses 1 and 2 taking a relatively high B3 and basses 3 and 4 taking a low D2 (the lowest note in the entire piece). The two continue together through Letter K, where the sopranos enter with pitch class C, completing the end of QCF3, joined rhythmically and harmonically by only bass 1 from that group, who also hits a pitch class C. The sopranos and basses die out as the altos hold their last pitches for several more measures before following suit. Seven measures of silence conclude the piece.

Structurally then, to summarize, Section 1 is slightly shorter in length and contains one Canonical Figure, and both Sections 2 and 3 begin with Rhythmic Unison Figures, continue with Canonical Figures, and contain midpoint coordinated entrances of multiple vocal groups that split the Sections into two parts. These delineations make logical sense and allow for relatively even divisions of the piece into an easily discernible structure.

SECTION 1

Beginning to look more closely at portions of the piece, it makes sense to examine the first events, those of CF1, which give quite a few examples of how the piece proceeds as a whole. CF1, diagrammed below, begins in soprano 1 and alto 1, and the canon cascades downward from these lead voices sequentially through voices 2, 3, and 4 of each vocal group; soprano 2 begins on a

sixteenth-note quintuplet of beat 2 in measure 1, alto 2 on a sixteenth note of beat 4 in measure 1, soprano 3 on an eighth note of beat 1 of measure 2, and so forth. Each begins the canon on the exact same pitch with the exact same syllables, as indicated below, with soprano and alto 1 leading, and the others following more or less (much less, as the Section progresses) in tandem.



It is immediately apparent on listening and studying the score that there is no intended perceptible pulse. Though the time signature is notated as 4/4 and the tempo as 56 BPM, Ligeti specifies: "Sing totally without accents: barlines have no rhythmic significance and should not be emphasized." Examining the starting and ending points of notes, it is also apparent that, aside from soprano 1 and alto 1 starting together, *none* of the notes here, or indeed, for the majority of Section 1 and much of the CFs, begin simultaneously; they are carefully staggered to avoid rhythmic unison. Though several notes do end together, this is rare, and never more than two end at the same time. Coupled with the pianissimo dynamic level and Ligeti's further stating, "all entries very gentle," the performance's cumulative effect is of an ethereal mass of growing vocal texture with essentially no focus on individual vocal lines and an obscuring of specific musical events.

The rhythmic scheme, however, is not random: to maintain this general staggering of entrance and exit points for each note, the different voices of each vocal group are given different rhythmic vocabularies that actually remain consistent throughout the entire piece (aside from rare specific instances of rhythmic unity, mentioned earlier and discussed later), as follows:

Soprano:	*Subdivision:*	**Alto:**	*Subdivision:*	**Tenor:**	*Subdivision:*	**Bass**	*Subdivision:*
1	Triplets	1	Quintuplets	1	Eighths	1	Triplets
2	Quintuplets	2	Eighths	2	Triplets	2	Quintuplets
3	Eights	3	Triplets	3	Quintuplets	3	Eighths
4	Triplets	4	Quintuplets	4	Eighths	4	Triplets

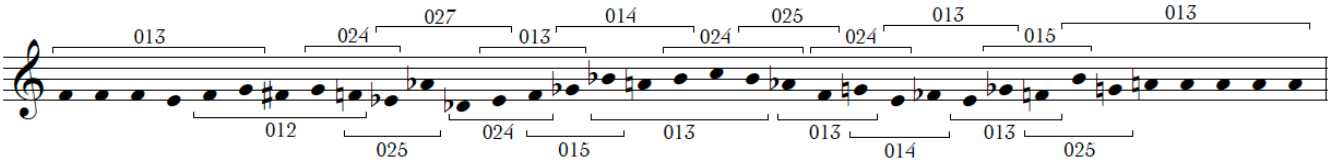
In *Lux Aeterna*'s apparent scheme of rhythmic rules, each of these individual rhythmic vocabularies applies to eighth- and sixteenth-note values (e.g. "quintuplets" means eighth-note quintuplets or sixteenth-note quintuplets), and each occurrence can also be presented as further subdivisions or expansions of that particular rhythmic type: eighth notes can become sixteenths, triplets sextuplets, and quintuplets decaplets, and any of the above can be expanded into quarter, half, or whole notes. In CF1, as in other Figures, though Ligeti has been careful to ensure that different singers' notes do not begin simultaneously, pairs of the vocalists do move in rough synchronization, at least initially; here, soprano 1 and alto 1 begin at the same time, and proceed more or less together, as do soprano 2 and alto 2, and so on. These patterns quickly break down, however, as the section progresses and the voices drift further apart. It should also be noted that though the rhythmic vocabulary essentially remains the same for each voice throughout the piece, it does not seem that any instances of specific rhythmic patterns reappear, either within each Figure or from Section to Section.

Interestingly, after analysis, the pitch classes used in CF1 do not easily reveal any discernible compositional system. Examining the relationships between the series of notes via both ordered pitch intervals and ordered pitch class intervals (ignoring the repeated notes at the beginning and end of the phrase) reveals some trends, such as a significant amount of movement by 1 or 2 semitones up or down, as well as, with less frequency, several larger leaps of 3, 4, 5, and 7 semitones, but nothing resembling a concrete repeating pattern or prescribed system. Clearly, F is a very

important pitch class (and F4 an important pitch) for the beginning of the Figure. A is clearly an even more important pitch class for the end of the Figure; the sopranos jump up significantly higher in register than the mid-range area that they and the altos have been occupying to hit the A5 beginning at Letter A, and the first of the tenors enters in rhythmic unison with an A4 at the same time, picking up the end of CF1. Though stragglers remain until the very end of the Section, more and more of the singers have reached either an A4 or an A5 as it approaches, until finally, approximately a measure before Letter B and the basses' entrance with RUF1, all singers hit pitch class A, even though some do not reach the last repeated notes of the Canonical Figure.

Taking a different approach to the task, it may be helpful to analyze the groupings of notes within CF1. The simplest manner of doing this, diagrammed below, is an examination of the set classes created by adjacent notes: here, every three (with repeated notes within this range of adjacency counted only once):

CF1 with set class analysis of every three adjacent pitch classes:

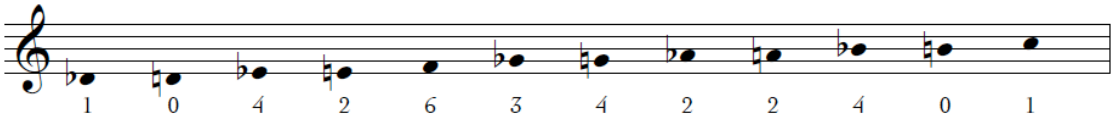


As can be seen, there is a predominance of sets of 013 (seven), a number of 024s (four) and 025s (three) (025 also being an important set class in the RUFs and QCFs), a couple of 014s (two) and 015s (two), and the odd 027 (one) and 012 (one). None of these seem to fall into any readily apparent systematic organization, though they do give something of a summary of the kind of musical language the piece uses.

Given the relative paucity of concrete organizational information about pitch class content elucidated by the respective intervallic and set class analyses, another potentially fruitful tack is to

analyze the frequency with which each pitch class occurs (excluding adjacent repeated notes, like the numerous Fs and As at the beginnings and ends of CF1):

CF1 pitch-class distribution frequency (excluding adjacent repeated notes):



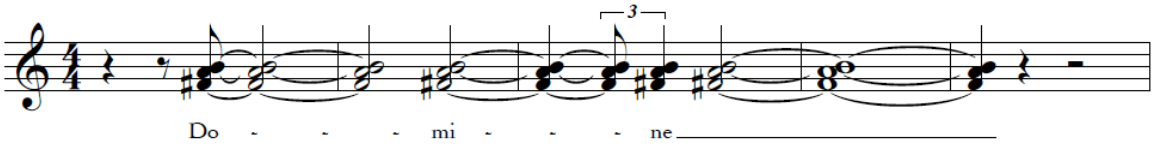
Though this approach also fails to reveal any concrete data, it is interesting to note the symmetrical spacing of the frequency of pitch classes used: both Db and C are used once, and moving inward a semitone from each, D and B are not used at all, Eb and Bb are each used four times, and E and A are each used twice. The pattern breaks down here, though if the six Fs are weighed against the four Gs and two Abs, which together total six, a rough axis of symmetry could be established from somewhere slightly higher in pitch than the central Gb (of which there are three), to the starting point halfway between Db and C on the other side of the 12-tone circle. Though is an interesting idea, examinations of the later CFs yield only tenuously similar results, so this may simply be a coincidence.

Briefly examining a few areas in CF1 that contain sustained notes is potentially revealing, as these moments are audibly distinctive in the often very thick texture. Quickly surveying two such areas in which three or more different long notes are sustained, we find, at m. 13 in altos 2 – 4, Gb, Db, and Eb, an 025 set, and at m. 18, in sopranos 1 – 3 and altos 1 and 2, Eb, F, C, G, Ab, which yields three 037s, two 025s, two 015s, an 013, an 024, and an 027. All of these groupings, save the 037s, were present in the set classes analyzed earlier, so these could be considered things already known, but they do evince a consistency in pitch class vocabulary. But there is still no distinct apparent answer to the question of why Ligeti chose these particular pitches for CF1, save perhaps aesthetic preference.

SECTION 2A

Section 2A, at Letter B, begins with RUF1, voiced in falsetto by basses 1 – 3, putting them in a similar registral range as the tenors and altos at the end of CF1. This is the first instance of what could be considered intentional rhythmic unison in the piece. Additionally, the rhythms are quite simple, in contrast to the complex layered staggering in CF1:

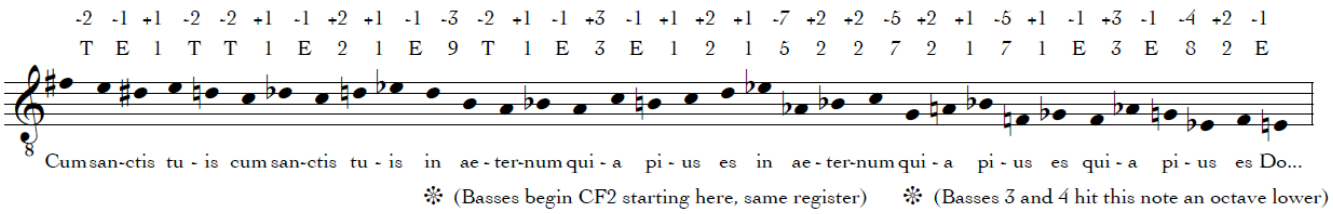
Rhythmic Unison Figure 1 (mm. 37 - 41), set class 025, with text:



The set class of these three pitches, which remain constant for every syllable, is 025. Appearing in this context, not preceded by material setting up any expectation nor followed by any resolution, it feels like part of a pentatonic minor scale, though the two other members of the pentatonic set class are not present. As to why these particular pitch classes were chosen here, it is perhaps worth noting that A is the prominent pitch class at the end of CF1 (the transition smoothed by the lingering of tenor 4 into Letter B), B is one of the pitches not present at all in CF1, and F# is the approximate axis around which the CF1 pitches were distributed. Beyond that, there does not seem to be an immediately forthcoming answer. The change from CF1 into this Figure is, however, quite dramatic, rhythmically, timbrally, dynamically, and harmonically.

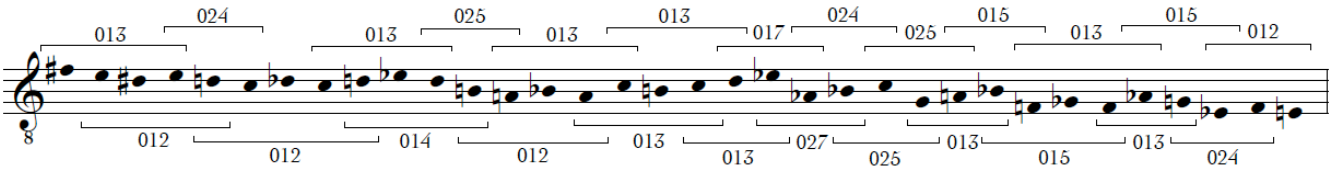
As RUF1 dies away, the tenors enter in rhythmic unison with CF2. This time, the entrances seem to cascade upward from the bottom voice, though as in CF1, this interaction quickly becomes obscured as the voices separate rhythmically and progress through the canon. Rhythmically, CF2 uses a vocabulary similar to that in CF1, though as mentioned before, not identical.

Canonical Figure 2 (mm. 39 - 88) with ordered pitch intervals, ordered pitch-class intervals, and text:



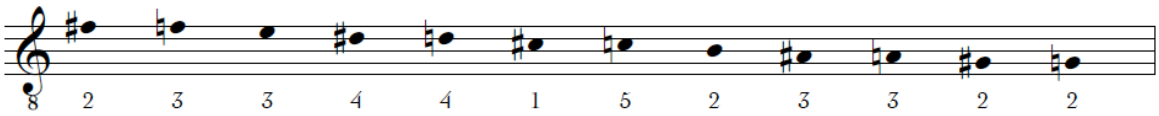
There are numerous similarities apparent when comparing the intervallic motion of CF2 to that of CF1; again, there are a large number of movements up or down by 1 or 2 semitones, and a few scattered leaps of 3, 4, 5, and 7 semitones. Like CF1, CF2 has a relatively similar set class grouping when analyzing adjacent notes in sets of three:

CF2 with set class analysis of every three adjacent pitch classes:



Here, as before, there are relatively similar numbers of 013s (eight), 024s (three), 025s (three), 015s (three), 014s (one), and 027s (one). The biggest different from CF1 with regards to set class frequency is the increased prominence of 012s (four) and a hitherto unseen 017 (one). Examining the pitch class distribution frequency, is can be seen that unlike CF1, CF2 contains every note in the chromatic scale, which helps account for the differences in set classes. Here, a case similar to that made for CF1 could perhaps be made for an apparent axis of symmetry around which pitch class distribution frequency revolves; there are two F#s and two G#s, three each of F and A, and E and A#; the D#s and Ds, together totaling eight, match up with the total of the C#s, Cs, and Bs, such that the axis would run from slightly sharp of C# through to the G on the other side of the 12-tone circle. Again, it requires imposing some amount of symmetry where there may not been intention of any, and as such, the imposition of a pattern seems a bit dubious.

CF2 pitch-class distribution frequency (excluding adjacent repeated notes):



Essentially, CF2 is similarly resistant to easy analysis; intervallic, set class, and distribution frequency analysis all yield no concrete patterns. Additionally, CF2 is not a direct transposition, inversion, retrograde, or retrograde inversion of CF1. There is however, at least one small grouping within CF2 that does relate to CF1; beginning with the note on the fourth syllable in CF2, E, the eight pitch classes in sequence (E, D, C, Db, C, D, Eb, D) form a retrograde inversion at transpositional level *7* of the eight pitch classes beginning with the note on the third syllable in CF1, F (F, E, F, G, F#, G, F, Eb). It is unlikely that this relationship was accidental, but even so, the pattern breaks down on either side of this figure, and it seems an anomaly. There is a tendency of contour in both Figures, embodied in the above example, after hitting a pitch, to move to an adjacent pitch and then return to the first, sometimes several times in sequence, which helps maintain an internal coherence both within the Figures themselves and from Section to Section.

While CF1's contour begins on an F4, moves slightly lower, gradually makes its way up to C5 before heading back down again, and then jumps to an A5, the contour of CF2 is much different. Though CF2 starts in the same register as CF1, with an F#5 in the tenors' higher register, its overall contour gradually moves downward until, by the end of its long course at the end of Letter F, it has become significantly lower. As it is sung by the tenors and basses, in contrast to CF1's sopranos and altos, this provides a successful registral contrast to Section 1.

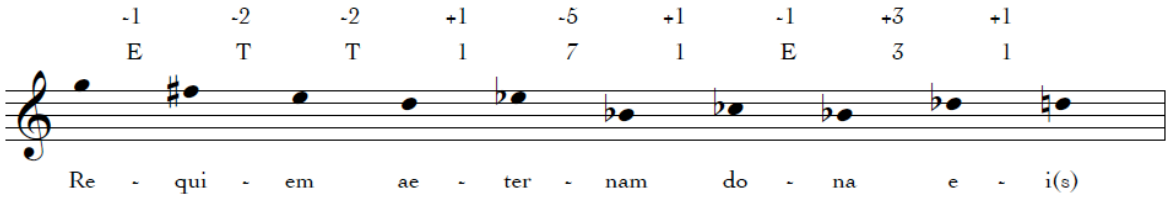
SECTION 2B

Approaching Letter E, the tenor and basses have diminuendoed somewhat, moved to a lower

register, and primarily been singing long, sustained notes. At Letter E, however, Section 2B begins with the simultaneous entrance of the sopranos with CF3, the altos with QCF1, and the interruption of the basses' CF2 to join the rhythmic unison of the higher voices. The effect is quite startling, with the introduction of louder overall dynamics, two groups of voices in higher registers, new Figures with new pitch class content, and a timbral change from the softer low register male voices. Letter E is the densest portion of the piece, and thus also the loudest, and as mentioned, the only portion where all singers are singing. Interestingly, almost all of the singers at Letter E focus on longer notes, particularly toward the end, in contrast to the often rapid passage through syllables and pitches found at the beginning of CF1; this ensures that Letter E, though dissonant, does not become chaotic or cluttered, an effect that would be at odds with the established aesthetic bounds of this piece.

Though significantly shorter, lasting only for the space of Letter E, the sopranos' CF3 figure is similar to CF1 and CF2 in intervallic movement, set class content, and rhythmic vocabulary.

Canonical Figure 3 (mm. 61 - 79) with ordered pitch intervals, ordered pitch-class intervals, and text:

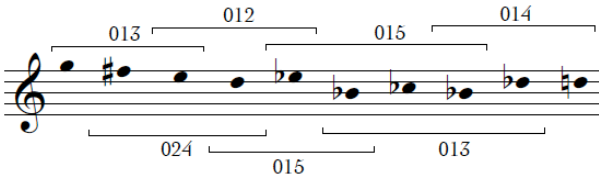


Having given adequate discussion to these sorts of issues as relating to CF1 and CF2, this paper will not delve as deeply into a discussion of CF3. One specific fact about CF3 worth mentioning is its range and register: the former is smaller than the other CFs, extending only from Bb4 to G5, and the latter is generally higher than that of the other CFs.

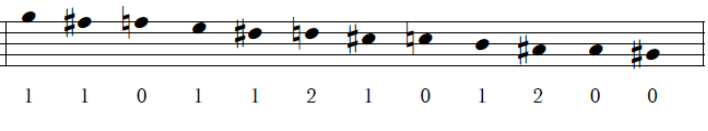
Another interesting difference between CF3 and the other CFs, however, relates to the aforementioned hypothetical axis of symmetry for pitch class distribution frequency. Were one to exclude the unused A and G# from the 12-tone circle, a perfect axis of symmetry for CF3 could be

drawn from C through F.

CF3 with set class analysis of every three adjacent pitch classes:



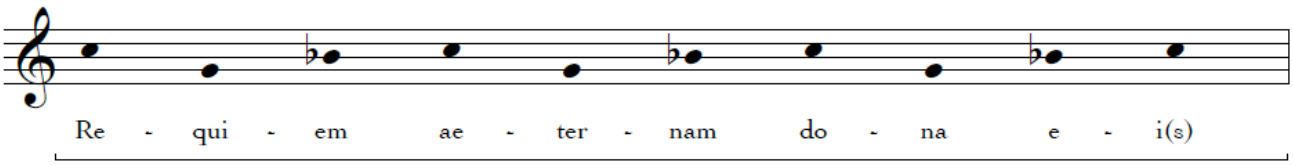
CF3 pitch-class distribution frequency (excluding adjacent repeated notes):



Unfortunately, this hypothesis requires a leap of faith beyond that concerning the last two CFs, as A and G# are indeed in the 12-tone circle, and such haphazard connections, while worth noting, alas, do not allow for a formulation of any consistent theory in this regard.

Entering concurrently with the sopranos at Letter E are the altos, with QCF1:

Quasi-Canonical Figure 1 (mm. 61 - 79), set class 025, with text:



Note that this is the Alto 1 pattern for QCF1; Alto 2 cycles through the same note pattern, but starts "Re-" on Bb, with the rest of the syllablic assignments adjusted accordingly. Alto 3s and 4 start "Re-" on G with the same caveat.

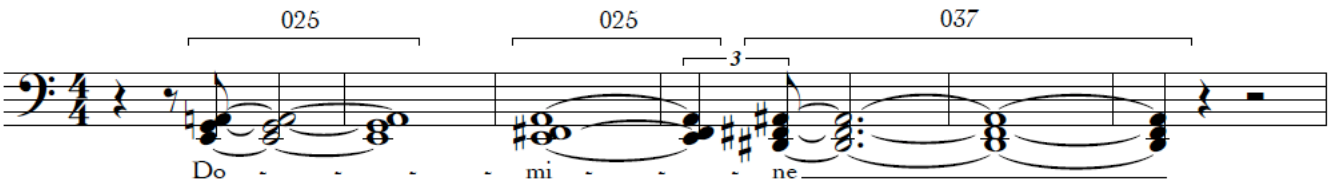
This figure is the first of its kind presented in the piece; it operates almost canonically in the way it proceeds through the rhythmic and text elements like the CFs, with each of the alto voices moving through the same text within the same number of notes. However, instead of a long series of notes, QCF1 uses a repeating pattern of C, G, and Bb (or G, Bb, and C, or Bb, C, and G, depending on where one starts); and while alto 1 starts the first syllable of QCF1 with a C, alto 2 starts it with a Bb, and altos 3 and 4 start it with Gs, each then proceeding with the next notes in the Figure's pattern. As noted in the diagram, the set class for this group of notes is 025, the same set class found in RUF1 and within much of the pitch class content of CF1 and CF2. As with RUF1's F#, A, and B having a common tone with the existing material in the A held by the tenor in Letter A, QCF1's G, Bb, and C have a common tone of G with the sopranos' CF3 and the G being reached by the basses and some of the tenors in the middle of their CF2 figure.

As Letter E ends, from mm. 75 – 79, the sopranos and altos express an aggregate of G, Bb, C, and D, or an 0247 set class, remindful of the pentatonic scale hinted at earlier. Under this, however, the tenors are holding F, Eb, and G, and the basses are solidly holding an F, making an 024 set class. When combined with the pitch classes in the sopranos and altos, this produces a modal sort of scale, perhaps F Dorian (the earlier A having a flatted inflection), though with all of the pitches essentially sounding simultaneously, it is difficult to delineate any one as a pitch center. Eventually, as the sopranos and altos drop out and Letter E merges into Letter F, all that remains is the low register F. This is, however, shortly undercut by the gradual shift from pitch class F to the E a semitone below, first in the basses, cascading up from the lowest voice, and eventually moving through the tenors.

SECTION 3A

As the basses and then the tenors gradually die out from the low E at the end of Letter F, basses 2 – 4 enter with RUF2, another rhythmic unison set to the text, "Domine."

Rhythmic Unison Figure 2 (mm. 87 - 92), with set classes and text:



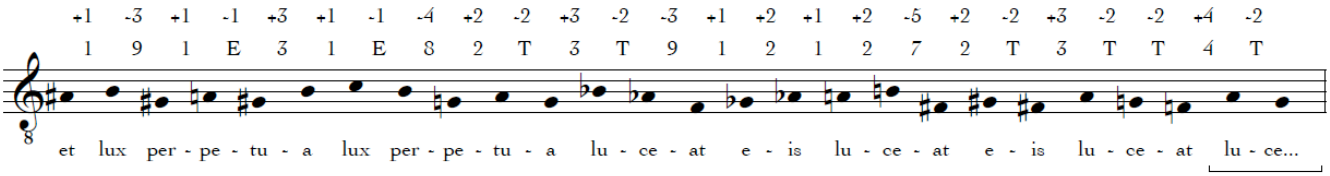
The rhythmic figure is similar, though not identical, to that for RUF1. The register is the lowest in the piece yet, quite a contrast from the basses' falsetto in RUF1. RUF2 begins with E, G, and A, set class 025, smoothed by the tenors and bass 1 holding the E from Letter F. However, unlike RUF1, in which the pitches and 025 set class remain static, each of RUF2's three syllables is set to a different chord, providing what seems to be the only instance of synchronous harmonic motion in

the entire piece, a very unique sound in this context. As the progression begins, due to the residual low E from Letter F, the first chord feels somewhat like an E minor with an added fourth (or perhaps an A7 (no third) in second inversion). As the E and A remain, but the G moves down a semitone to an F#, the second chord (also in the 025 set class) retains the feel of the E minor with the added fourth, but now with a suspended second replacing the minor third (or perhaps an A6 chord (no third) in second inversion). The motion from the first chord to the second is within the vocabulary of the piece thus far, but the movement from the second chord to the third is quite unique, and puts the first and second chords within a different and interesting harmonic context.

The second chord's E then moves down a semitone, the A moves up a semitone, and the F# remains in place, leaving D#, F#, and A#, voiced as a traditional root position D# minor triad. This gesture is unusual here because it suddenly brings tonal and rhythmic elements to a very experimental piece, hitherto governed by its own often arrhythmic structures and incongruous yet oddly intuitive pitch class system, neither fully tonal nor atonal. But this motion also fails to follow typical tonal rules; moving from what is essentially E minor (or A7 (no third)) to D# minor is not frequently done in the tonal world, and to do so by presenting and holding what feels like a suspension that instead ends up remaining and functioning as the minor third of the eventual destination chord is unusual, as is descending by half-step to the new minor chord root. Additionally, set class 037 had been implicitly presented among the conjunctions of canonic voices, but never implicitly as it is here. It is notable as a very intriguing change, both on its own and contextually in the piece.

Concurrent with this shift to the D# minor chord at Letter H, the altos enter in rhythmic unison with CF4, in their low register. This begins on pitch class A#, which is a member of the D# minor triad, but also undermines the triad's root somewhat by emphasizing its fifth, and CF4 moves onward in canonical fashion from there.

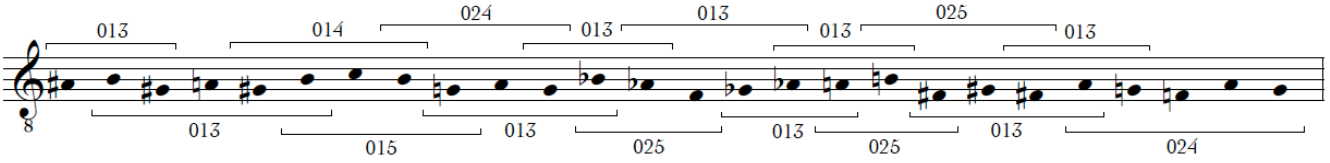
Canonical Figure 4 (mm. 90 - 119) with ordered pitch intervals, ordered pitch-class intervals, and text:



Altos 3 and 4 do not reach these notes, ending with "-at" on the F

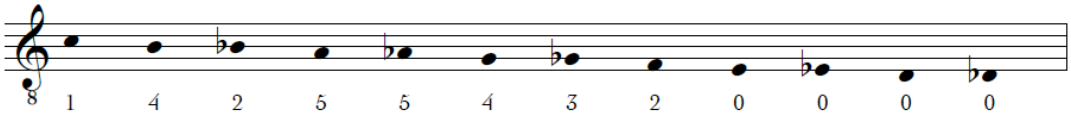
As with CF3, this paper will not delve too deeply into CF4, but it is worth mentioning that it follows the general rhythmic, intervallic movement, and set class trends in CFs 1 – 3. CF4 contains less intervallic movement up or down by 2 semitones, and more by 1 semitone, as well as fewer larger leaps. The last can be attributed to its more limited range, which extends only from F3 to C4. In terms of set classes, CF4 contains sets all found in the other CFs, in relatively similar proportions, though is notably free of 012s and any sets involving intervals that are greater than 5 semitones apart between the furthest pitch classes, also owing to its more limited range.

CF4 with set class analysis of every three adjacent pitch classes:



Examining the pitch class distribution frequency, it would here require an even greater imposition of purported symmetry between non-symmetrical parts were one to attempt to continue with the notably imperfect axis-of-symmetry hypothesis applied to the previous CFs, which this paper will not. It is still useful to note, however, that within the diminished range CF4 makes use of, the two most frequently used notes do occur in the middle, and that generally as pitches approach the range's limits, they are less frequently used.

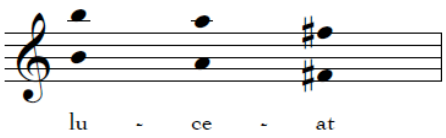
CF4 pitch-class distribution frequency (excluding adjacent repeated notes):



SECTION 3B

As in Section 2B, Section 3B is begun by the sudden simultaneous entrance of two groups of voices, this time at Letter I, with both groups presenting QCF2. As in 2B, this is a notable structural event; over the altos continuing their low-register CF4, the sopranos and tenors enter, each with pitch class B in their higher register. As with many of the sudden entrances in this piece, this entrance is assisted somewhat by three of the alto voices also sustaining or hitting Bs. The fact that the dynamic level of the individual singers now changes to piano (the loudest marking in the piece), coupled with the density of the additional singers and their high register, makes this quite a forceful entrance.

Quasi-Canonical Figure 2 (mm. 94 - 102), set class 025, with text:



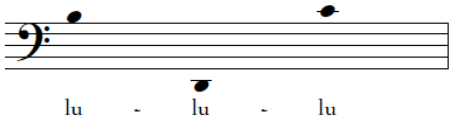
This figure is labeled a Quasi-Canonical Figure because it possesses attributes of both the CFs and the RUFs. Like the CFs, each voice does pass through the same series of syllables (though some voices do not reach the third or even second syllable in the Figure), and it uses the phrase "luceat" as its text, which previously appeared in CF1. But it is quite a short Figure, lasting only until Letter J and consisting of only three notes (which form the set class 025), and also displays partial rhythmic unity, all of which are attributes more typical of the RUFs. By focusing on fewer pitch classes and very long notes here, mostly in the higher registers, Ligeti again draws particular attention to the 025 set class.

It is also significant that the sopranos' B here is the highest note in the piece. In fact, each of the sopranos' three highest notes demarcate important events: A5, the ending of Section 1, G5, the beginning of Section 2B, and B5, here, the beginning of Section 3B. Incidentally, these three notes

together belong to the set class 024, a figure found in the set class analyses of CFs 1 – 4, and a member of the pentatonic scale.

At Letter J, the basses begin QCF3, over the altos' continuing CF4 and the tail end of the sopranos' and tenors' QCF2. Interestingly, QCF3 is the only other Figure in the entire piece, aside from QCF1, in which an individual vocal group's starting notes are not the same. Here, basses 1 and 2 take the higher B3, while basses 3 and 4 take D2, as mentioned, the lowest note of the piece.

Quasi-Canonical Figure 3 (mm. 101 - 119), set class 013, with text:



Dynamic levels for all singers are now effectively back to pianississimo (the altos' piano here is only a way of keeping them at pianississimo, with their low register), and the basses sustain their respective Bs and Ds on through Letter J while the altos move closer to the end of CF4.

QCF3 is actually not completed until the sopranos enter at Letter K, all simultaneously, with their single C4. One factor that ties the sopranos pitch class C to QCF3 is that bass 1 also hits the same pitch C at the same time. Additionally, each shorter Figure throughout the piece presents at least three pitch classes; QCF1's cyclic pattern consists of three pitch classes, and QCF2 has three pitch classes total. RUF1 has three pitch classes in its 025 collection, which it hits three times, once each for every syllable in "Domine." RUF2 presents three different chords for each of these three syllables, each containing three pitch classes. (There is no way to substantiate this, but the number three being so prominent within so many Figures, given the subject matter, may be a reference to the Holy Trinity (or may simply be an aesthetic or conceptual preference of Ligeti's).) With QCF3 consisting of the pitch classes B, C, and D, it belongs to the set class 013, found many times throughout the set class analysis of the CFs. 013 also happens to be the same set class that begins the entire piece, transposed there as E, F, and G, thus creating a sort of circularity.

The piece nears the end as QCF3 dies away in the basses and sopranos, and the altos are left to finish their CF4. All that remains in the altos at the end are long, low, sustained notes on F and G, an interval of 2 semitones apart, which is found all over the piece in intervallic movement, the prominent set classes 025, 013, 024, and more. The piece concludes with the aforementioned seven measures of silence, quite in keeping with *Lux Aeterna*'s meditative and quietly intense nature to allow the listener this period of reflection.

Lux Aeterna eschews so many conventions that its success and incredible beauty are all the more powerful for it. Yet despite the amount of information revealed through this analysis, many of the piece's elemental features seem to skirt easy explanations; in cases like that of the origin of the CF pitch classes, the underlying patterns seem almost to reveal themselves, when a counterexample renders the hypothesis useless. In many senses, this paper only scratches the surface of this work. For example, different analytical methods may reveal more about the inner workings of the CF pitch classes, the interactions between the juxtaposed notes present in the CFs as their canons unfold absolutely bear more discussion, as I am sure that Ligeti was very careful with how he spaced out each canonic member, creating important relationships that were not discussed here, and so forth. Nonetheless, it has been a great pleasure spending time with and studying this singular and remarkably crafted piece of music.