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JONATHAN W. BERNARD

## VOICE LEADING AS A SPATIAL FUNCTION IN THE MUSIC OF LIGETI

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### *The Problem of Contrapuntal Hearing*

Technically speaking I have always approached musical texture through part-writing. Both *Atmosphères* and *Lontano* have a dense canonic structure. But you cannot actually hear the polyphony, the canon. You hear a kind of impenetrable texture, something like a very densely woven cobweb. I have retained melodic lines in the process of composition, they are governed by rules as strict as Palestrina's or those of the Flemish school, but the rules of this polyphony are worked out by me. The polyphonic structure does not come through, you cannot hear it; it remains hidden in a microscopic, underwater world, to us inaudible. I call it micropolyphony (such a beautiful word!).<sup>1</sup>

Ligeti's description of the workings of his 'micropolyphony' suggests that the music characterised by it has two, essentially antithetical aspects: 1) the outer, audible one, which results from 2) the internal one, inaudible because it is really no more than a rule, working secretly, 'behind the scenes', as it were. Yet this dichotomy, useful though it may be as a point of departure for investigation of Ligeti's contrapuntal technique, is too simple. What does it mean, exactly, to hear (or not hear) the micropolyphony? Like most questions in which perception plays a pivotal role, this is not easy to answer; but one may begin to answer it, at least, by considering what one could *expect* to hear in this kind of counterpoint, and what precedents there might be in Western music for the demands it makes upon the listener.

Ligeti has mentioned on several occasions his abiding love for older music, especially the great exemplars of contrapuntal practice extending as far back as Machaut, and he evidently feels that his study of this music has significantly influenced his own course as a composer. It would be foolish to conclude, on the basis of this evidence, that Ligeti's own mature music should be heard 'tonally' or 'modally' – but not foolish at all to imagine

that the conditions and limitations governing contrapuntal contexts in older music, specifically those of imitative counterpoint, might have some general bearing upon the way in which Ligeti's own micropolyphonic music is conceived and the way it is meant to be heard.

Within the framework of imitative counterpoint in tonal or modal music, it is of course the entrances of the various parts that announce the fact of imitation in the first place. Whether the imitation is confined to the incipit or 'head-motive' or is more thoroughgoing depends on the type of piece. In the fugues of *The Well-Tempered Clavier*, for example, the former is universally the rule (we need not distinguish for present purposes between those employing the real answer and those employing the tonal); in the *Cantiones duarum vocum* of Lassus or in Telemann's Canonic Sonatas, the latter (to different degrees) holds. In either case, however, the onset of imitation is inescapable aurally and may even be charged with a certain dramatic significance which becomes part of the listener's experience of the piece.

Events beyond the entrances in the *WTC* fugues – that is, once all three, four or five parts have presented the subject in their customary serial and temporally non-overlapping fashion – involve imitation as well, though not in the continuous fashion of a canon; often the subject is treated in stretto, for example. In the Lassus *Cantiones*, on the other hand, imitation frequently persists unbroken for some distance, dissolving only as a cadence approaches; and the Telemann sonatas, true to their 'canonic' designation, maintain imitation strictly throughout, with adjustments made solely to allow the two parts to end together. Does one hear the canonic feature of these pieces? Arguably, yes: in fact, experienced musicians are not likely to contest the assertion that one can keep track of the progress of both the *dux* and the *comes* in a two-part canon without undue strain. In this kind of hearing, which might be called *direct*, the imitative relationship between the parts is more or less explicitly and continuously registered.

Is this also the case with canonic or near-canonic textures in more than two parts? It is more difficult, though certainly not impossible, to hear in the same direct way the canons of the *Goldberg Variations*, for instance, in which two canonic parts are supplemented by a 'free' bass. Beyond that, however – in canons of three, four or even more parts – direct hearing of these specific contrapuntal devices becomes increasingly difficult; the same can also be said, perhaps even to a greater degree, of canons constructed according to devices such as inversion, retrograde, diminution and augmentation. In Ockeghem's *Missa prolationum*, that well-known masterpiece of elaborate contrapuntal practice, the two-part canons not only are of the 'prolation' type (the parts proceeding in diminution or augmentation owing to the fact that they have different mensural signatures) but also occur often in pairs – that is, as two different canons unfolded simultaneously. In such a work, direct hearing of the canonic features is probably beyond the abilities of even the most adept listener.

Pieces exhibiting this degree of intricacy, of course, are relatively rare. Yet the issues of comprehension that their very existence raises go far beyond the tiny portion of the musical literature that they represent. It would seem that pieces the study of which clearly reveals construction according to a specific, well-defined contrapuntal device (or 'rule') do not necessarily come across, aurally speaking, directly through the workings of that device.

This discrepancy has not escaped the attention of Western music theorists. For tonal music, at least, sophisticated theories have been formulated to explain how one can move beyond the 'facts' of imitative counterpoint to an understanding of voice leading in a more general, all-encompassing sense. Schenkerian theory in particular makes a useful distinction between *voice* and *part*. The latter is the familiar element of polyphonic or homophonic textures; the former, despite its frequent use in informal analytical parlance as a synonym for *part*, is at once more abstract and more comprehensive in meaning. Under this stricter, more exact definition, at a given moment a single part may project two or more real voices, or two or more parts may contribute to a single voice. This distinction lends a fluidity to analytical interpretation which enables the analyst to reveal the operation of contrapuntal principles governing musical coherence on many levels, not simply that of note to note. In this sense, then, the contrapuntal nature of textures constructed according to intricate imitative devices is still audible – for one may well gather an impression that the different parts are related *in some way*, if not specifically what the device relating them may be, even as one hears the more general and comprehensive voice-leading structure to which these parts contribute. Such contrapuntal hearing could be called *indirect*.

### *Ligeti and Counterpoint in a Spatial Context*

Since Schenkerian principles are designed to work only for analysis of the particular and well-circumscribed repertoire of tonal music, they will have little, if any, relevance to analysis of Ligeti's work. Nonetheless, the voice/part distinction and the concept of structural levels *in general* could conceivably have some application here – the more so since the contrapuntal situation offers, in some ways, even more challenges to hearing than many of the most intricate of older works. Ligeti has often written canonic textures in four, or eight, or even more parts. In other respects, as well, the reigning conditions differ considerably from those of older music. First, any drama that might arise from a series of clearly identifiable entrances is mitigated, if not entirely effaced, by the composer's explicit direction that the performers make their entrances as imperceptibly as possible. Second, rhythm does not operate to preserve a distinctive aural profile for the imitative part. In fact Ligeti's usual practice in the rhythmic domain is to compose no two individual parts exactly alike.

On the other hand, however, the parts are not made different in striking or 'characteristic' ways, and thus are not readily distinguishable aurally on that basis.

The special conditions of contrapuntal application in Ligeti's music become apparent under analysis. Two especially revealing cases are the openings of *Lux aeterna* (1966) and *Lontano* (1967) – both rigorously canonic in the domain of pitch, and both based on the same canonic strand of thirty-one pitches (to within transposition).<sup>2</sup> That the two *resoluciones* differ in some fairly fundamental ways conforms to the expectations raised by Ligeti's statement that the resultant of the micropolyphony is what one is meant to hear. Nevertheless, it is also true that the openings of the two pieces – 'sister works', as Ligeti has called them<sup>3</sup> – maintain a certain similarity of overall shape. Thus the canon itself can be said to govern, in global terms, the result of its working out.

This matter of *shape* is more significant than it might at first seem to be, for in Ligeti's musical universe the word must be taken in a physical, almost literal sense. In articles and interviews, Ligeti has made abundantly clear the extent to which the visible is transferred to the audible – and vice versa – in his musical thinking, even going so far as to describe a composition as existing *in toto* at a single instant, so that its surfaces and interstices might be traversed like those of a physical object. Such a conception does not, of course, deny the essential temporality of music, or render that aspect of its presentation trivial; it simply interprets the temporal aspect in spatial terms. Thus the key to understanding the reciprocal nature of the relationship between canon and resultant is the role of spatial principles in the formation of the latter.

In any spatially conceived musical context, the whole question of what voice leading can possibly be is a crucial one. One of the more radical solutions developed in this century to the problem of achieving coherence in a spatial context is to do away with voice leading entirely. In Varèse's music, to mention a well-known instance, counterpoint, in the traditional sense of simultaneously projected lines that form a continuous and unified structure while maintaining at the same time a certain independence, is replaced – to use the composer's terminology – by 'volumes', 'masses', and 'planes'. For example, the sound masses referred to by Varèse can be taken as 'seemingly unrelated' (in his words) to exactly the same extent that contrapuntal lines in older music are seemingly independent. Others in this century have followed Varèse's lead in this regard, notable among them Xenakis. Nevertheless, it must be recognised that there is no *necessary* opposition between spatiality and voice leading, only that certain basic operating conditions of voice leading are forced to change in a spatial context. Principal among such changes is the dominant role assumed by *absolute* sizes of intervals, to the point where pitch-class connections not reinforced by literal, registral proximity are relegated to highly dubious status.<sup>4</sup> This means, inevitably, that octave and inversive equivalence

play a more restricted role in voice leading than is generally ascribed to them in older kinds of music, even in much early twentieth-century music. Inversional equivalence, in fact, has practically no place in a spatial context, perhaps for obvious reasons, though some approximate equivalence – for example, of perfect fourths and fifths, or of major sevenths and minor ninths, since they are relatively close in absolute size – is possible.<sup>5</sup> Instances of such equivalence, however, are likely to be special cases without significant impact on structure in general, simply because they are by definition imprecise in nature. Octave equivalence is another matter: it can function where *literal* octaves are stated. This inherent property of octaves – their ability to expand or collapse spaces in use – may in fact explain why they are avoided except for specific articulative functions in post-1945 music such as Ligeti's, rather than for the reason they are avoided in serial music – that octaves interfere with twelve-note continuity or confuse the identities of different simultaneous statements of the row.<sup>6</sup>

The associative power of registral proximity in a spatial context has some obvious common ground with the 'normative' stepwise criteria of voice leading; for this reason it is not surprising to find the canonic strand, in pieces such as *Lux aeterna* and *Lontano*, itself proceeding largely by tones and semitones and, where it does not so proceed, taking on the characteristics of a kind of 'compound melody', as in the opening section of *Lux aeterna* (see Ex. 1). The edges of occupied space creep outward here even though the tone and semitone progressions are not always direct successions. Here one could draw an analogy with the tonal phenomenon in which one part articulates two voices. But there are also some important differences between older and newer practice, among them the fact that Ligeti's compound melody, though beginning its life as a horizontal event, quickly becomes, by virtue of the close stretto of the canon, a vertical one as well, an effect reinforced by the literal imitation in each following part – which in turn is *not* heard as a separate, identifiable entrance, partly because of the performance directions mentioned earlier but also (and more significantly) because the notes in question are already present in the texture. This convergence, even to the point of equivalence, of horizontal and vertical is a hallmark of twentieth-century music, and as such is nothing new; but the implementation of what are, after all, traditional devices to achieve ends that are decidedly untraditional is a startling innovation indeed.<sup>7</sup>

Another difference between Ligeti's and older usage is that perception of these voices depends for all practical purposes entirely on their spatial positions – that is, on their literal functions as upper and lower boundaries of occupied pitch space. Granted, this feature bears a certain resemblance to the importance of outer voices in tonal music. But Ligeti's application of this principle leads to results that are quite different from those of tonality, for whatever is inside such a dense texture is far less likely to be heard

Ex. 1 *Lux aeterna*, Canon 1, pitches 8-19

distinctly *as a linear event* than is an inner voice in tonal music, where the (vertical) packing tends to be sparser. (In tonal music the phenomenon known to Schenkerians as overlapping, in particular, in which the status of upper voice is taken over by a newly entering note or series of notes, does not efface the former upper voice immediately – it continues to be heard for a while in its new, submerged role – but in a Ligeti texture such a voice, overtaken, would instantly vanish. For similar reasons, unfolding or exchange between an outer and inner voice would be difficult if not impossible to manage under the spatial conditions imposed by Ligeti's music.)

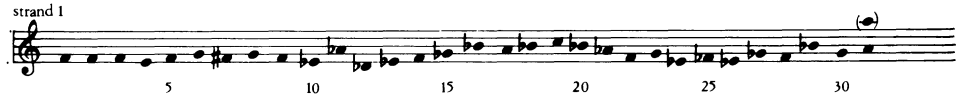
The preponderance of motion by intervals of [1] and [2] in the canonic strands themselves is revealed by the 'statistical' analysis displayed in Table 1.<sup>8</sup> Here, the four canonic strands of *Lux aeterna*, written out in full in Ex. 2, are subjected to an 'imbricated' trichordal segmentation, so that the smallest of temporal contexts beyond the single interval can be examined.<sup>9</sup> And, inevitably, this weighting of [1] and [2] in the horizontal dimension affects the resultant vertical structures.

Table 1 *Lux aeterna*: trichordal imbrications of canonic strands (statistical summary)

| <i>Canon 1</i> | <i>Canon 2</i> |
|----------------|----------------|
| [1] [1]: 2     | [1] [1]: 5     |
| [1] [2]: 7     | [1] [2]: 9     |
| [2] [2]: 4     | [1] [3]: 1     |
| [2] [3]: 3     | [1] [4]: 3     |
| [1] [3]: 2     | [1] [5]: 1     |
| [1] [4]: 2     | [2] [2]: 3     |
| [2] [5]: 2     | [2] [3]: 3     |
|                | [2] [5]: 1     |
| <i>Canon 3</i> | <i>Canon 4</i> |
| [1] [1]: 1     | [1] [2]: 11    |
| [1] [2]: 2     | [2] [2]: 4     |
| [2] [2]: 1     | [1] [3]: 2     |
| [1] [3]: 1     | [1] [4]: 1     |
| [1] [4]: 2     | [2] [3]: 2     |

Ex. 2 *Lux aeterna*

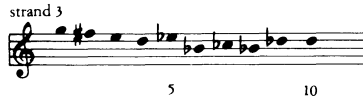
## a) Canon 1 (bs 1-37)



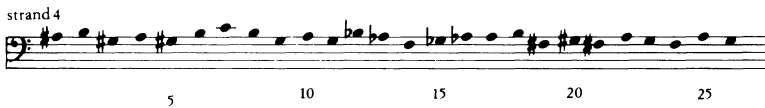
## b) Canon 2 (bs 39-88)



## c) Canon 3 (bs 61-79)



## d) Canon 4 (bs 90-119)



Just how this happens is best shown through analysis of the entire piece. In order to accomplish this task, it will be necessary to recapitulate my previously published treatment of the opening (bs 1-37, Canon 1), though with some added remarks which address more particularly the relationship between the canon and its resultant.<sup>10</sup>

*Analysis of Lux aeterna*

The initial sequence of pitches, F4-F4-F4-E4-F4-G4-F#4, projects a pair of symmetrically related trichords, F4-E4-G4 and E4-G4-F#4 (here labelled *a* and *b*), which in composite fill an initially restricted space to maximum semitonal density. (Because of the dominance of [1] and [2], the trichords [1][1], [1][2] or its equivalent [2][1], and [2][2] are almost constantly present, a fact which is of no particular significance in itself but which, in the implementation of certain patterns of these trichords to be discussed, has important structural implications.) The thinning evident shortly thereafter in the '[2]-striation'<sup>11</sup> of G4-F4-Eb4-D#4 is a direct result



of the compound melodic feature of the canon identified above (Ex. 1). Notice, however, that the [1][2] trichords remain part of the texture (here they are identified as *f* and *h*); like the initial pair, these two are symmetrically (inversionally) related and are succeeded by yet another similarly related pair (linked circles at *k*). One of these, A4-B $\flat$ 4-C5, is a literal segment of the canonic strand; the other is not, its existence a by-product of the F $\sharp$ 4 and A $\flat$ 4 being sustained long enough for them to come into contact with the A4. This A4 disappears relatively soon after its initial appearance, leaving the [2]-striated texture visible on the graph between *k* and *l* (b.14). This formation, C5-B $\flat$ 4-A $\flat$ 4-F $\sharp$ 4, seems clearly to be a mirror image of G4-F4-E $\flat$ 4-D $\flat$ 4, the more so since C5-B $\flat$ 4-A $\flat$ 4, a literal segment of the canon, occurs in descending pitch order, while the earlier D $\flat$ 4-E $\flat$ 4-F4, also a literal segment, occurs ascending. The two segments, it should be noted, serve as upper and lower boundaries of occupied space to this point. By the time the upper [2]-striation becomes audible, of course, the lower has effectively disintegrated, but its missing components are restored by subsequent activity of the canon in such a way that for one brief instant (*l*) the two structures coincide, forming a composite, simultaneously stated symmetry.

The immediately ensuing (and permanent) disappearance of D $\flat$ 4 from the structure of this section of the piece leaves a field of operation bounded by E $\flat$ 4 and C5; new relations form under these changed conditions. For instance, the eventual abandonment of F $\sharp$ 4 (end of b.18) and the resumption of A4 (b.16) effect a shift from the formation at *m* to one mirror-related, at *n*. Then, beginning at b.20, the canonic strand becomes tortuously chromatic again, restoring a characteristic which had effectively been given up around b.7. The effect of this series of pitches – E $\flat$ 4-F $\flat$ 4-E $\flat$ 4-G $\flat$ 4-F4-B $\flat$ 4-G4 – is to fill the texture more densely again; the temporal spacing of canonically related voices results in the ‘staircase’ pattern at *o*, echoed (imperfectly) at *p*.

The dramatic entrance of A5 (b.25, *q*), at first hearing perhaps strikingly discontinuous with preceding events, is actually an affirmation of the power of spatial structure. This highest pitch is obviously an ‘octave doubling’ of A4, but it is also a doubling in another sense: its entrance [9] above C5, the highest pitch in the texture at that point and the highest pitch so far in the piece, increases by exactly twofold the registral space in use. Its entrance, coming together with A4 at the end of the canonic strand, sets the stage for an attenuation of the region bounded by E $\flat$ 4 and C5. The graph depicts the manner in which this happens, with spaces opening up within the region so that [1][2] and [2][2] stacks are revealed again (see *t* and *w*), and with the upper boundary dropping from C5 through B $\flat$ 4 to A4, also projecting an instance of [1][2] (shown at *v*). The sequence of the last notes in the canonic strand leaves a pattern of exits E $\flat$ 4-F4-G4 which, together with the A4 left sounding in b.35, projects a kind of negative image of [2]-striation.

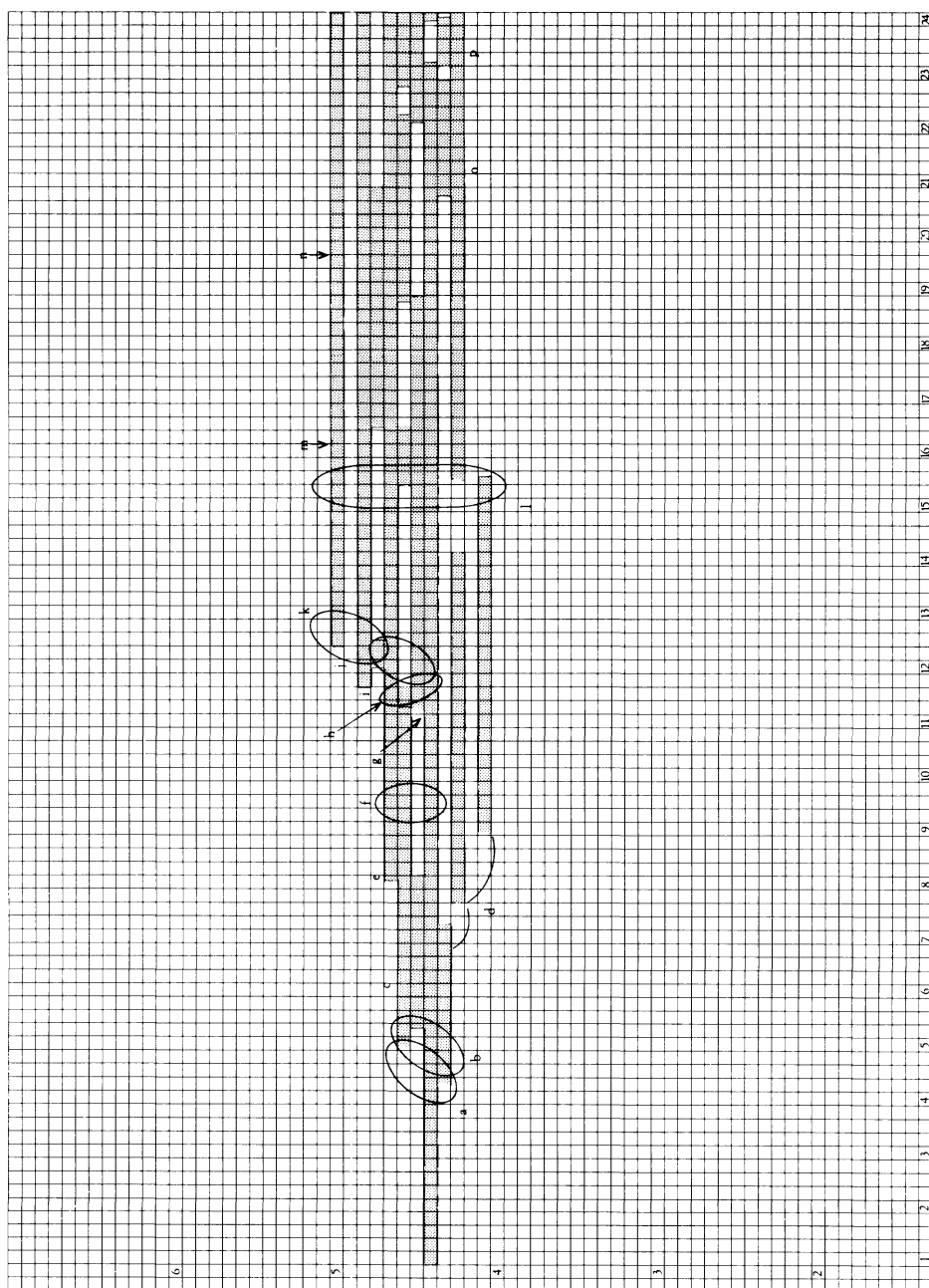
The 'aerating' effect of the A5 – the empty space it opens up and the emulation it seems to provoke in the lower, previously densely occupied region – seems also to lead to the sonority given by basses *falsetti* beginning in b.37 (*x*). This [2][3] chord has been identified by the composer as a 'typical Ligeti signal' in either of its two possible vertical orders of adjacent intervals, and indeed it is found elsewhere in the piece; but what is it doing here? The reader, looking back over the graph of the piece to this point, will notice that [2][3] has appeared once before – bs 29-31, E4-G4-A4 – as a direct outgrowth of the attenuating process. One might also attach some importance to the fact that it is an *unfolding* of [1][2].<sup>12</sup>

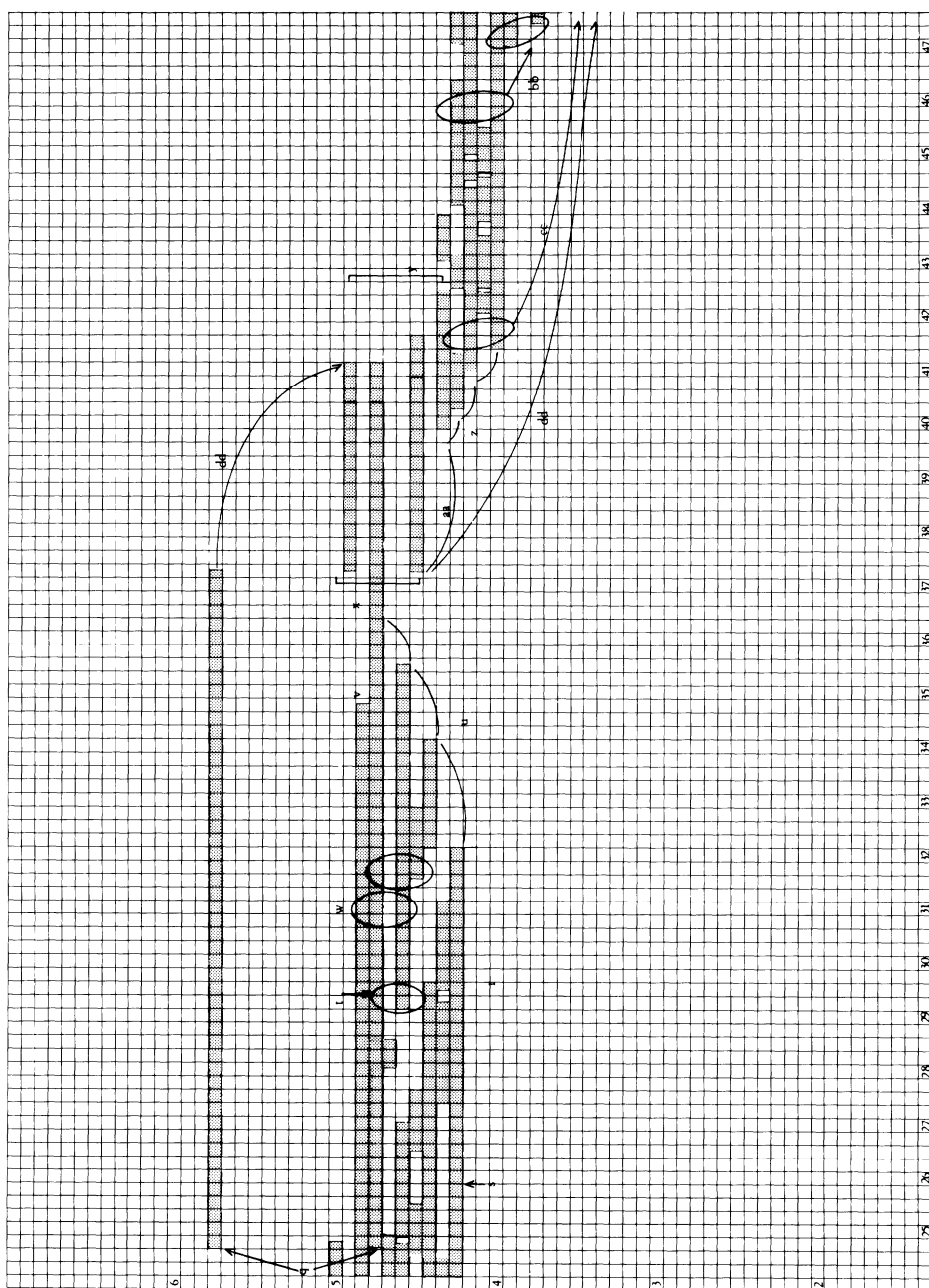
As for the function of this chord as a 'signal', it becomes clear immediately afterwards (bs 40ff.) that its wider spacing does not presage a shift to textures that are less dense from here on; rather, it seems to function as a signal in the sense that each new canon, including Canon 2 beginning in b.40, is demarcated and introduced by some form of [2][3].

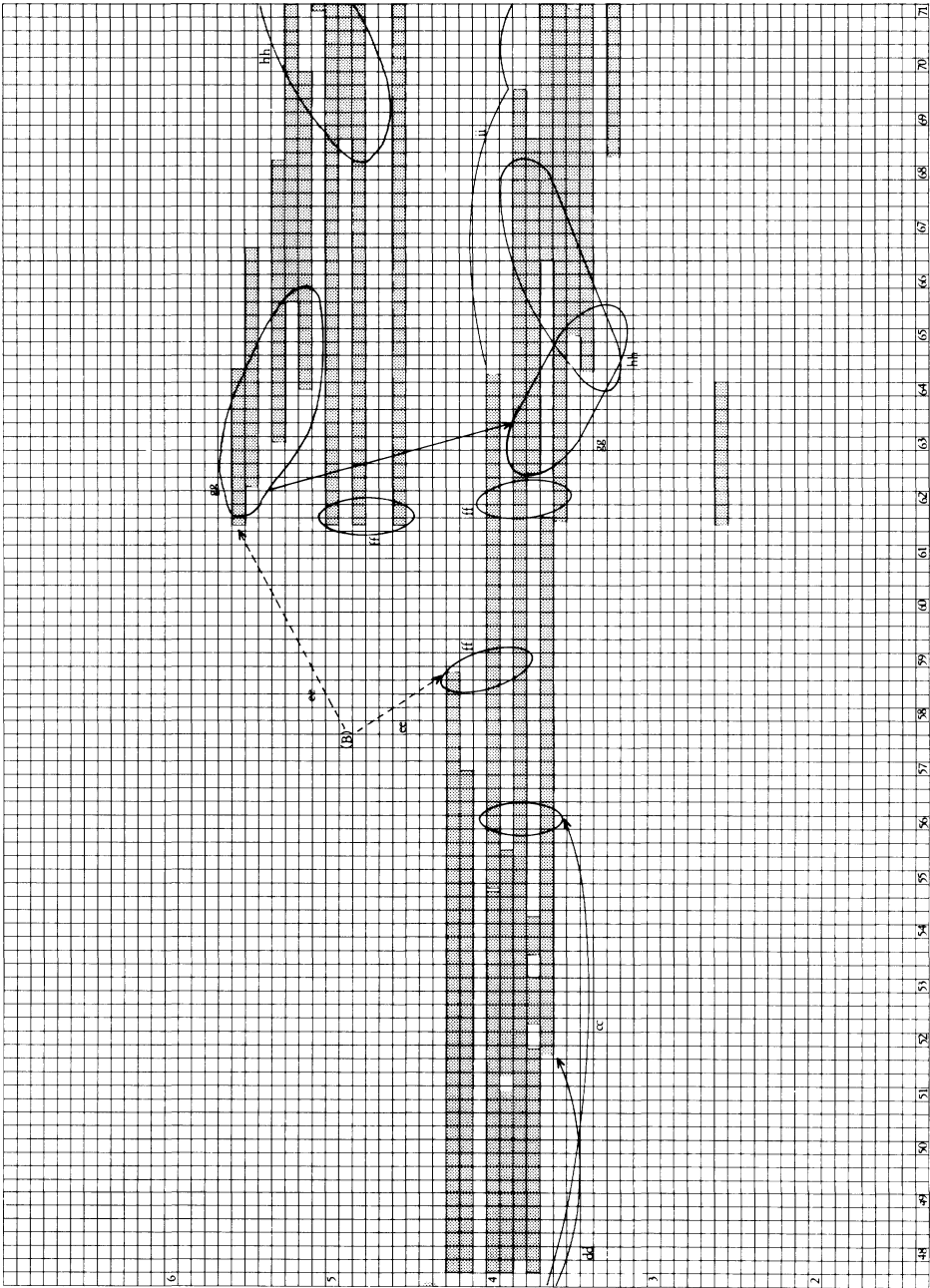
The onset of Canon 2, in fact, confirms the spatial significance of the signal chord. The new canonic strand begins on E4, which adds [2] below the sustained [2][3] in symmetrical fashion (*y*). From this point, space is occupied downwards, through D $\sharp$ 4 and D4 to C4. This motion has two significant aspects: one (*z*) is that the descent E4-D $\sharp$ 4-D4-C4 is reminiscent of the descending arm of the opening, F4-E4-E $\flat$ 4-D $\flat$ 4 (see bs 4-8); the other (*aa*), more local, connects its outline E4-D4-C4 to the F $\sharp$ 4 of the sustained chord and shows that it reverses the series of exits that closes Canon 1, E $\flat$ 4-F4-G4-A4 (*u*). (The resemblance becomes clearer after D $\sharp$ 4 exits in b.41.) The [2]-striation E4-D4-C4 must now be held in mind, for it has another role to play later on.

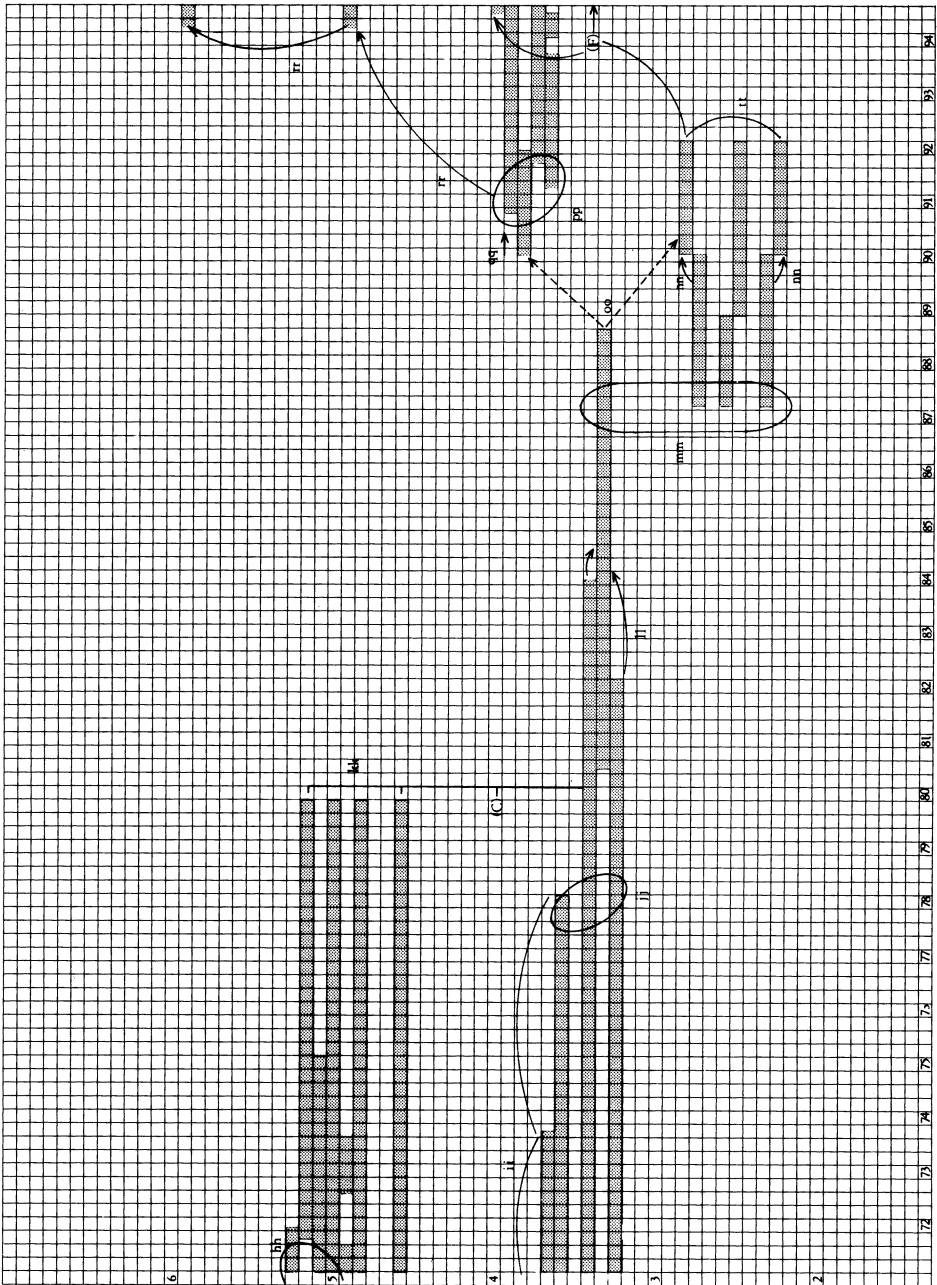
Meanwhile, just before the downbeat of b.44, the upper boundary falls to E $\flat$ 4; the resultant space C4-E $\flat$ 4 is essentially filled chromatically, but the textural 'iridescence' produced by the different voices making their way along the canon at various stages causes a few little gaps, or windows, to appear in the filling, which eventually give way to another [1][2] vertical formation as C $\sharp$ 4 exits (b.45). Soon thereafter, occupied space expands downwards to A3, in the process articulating another [1][2], C4-B3-A3 (*bb*), subsequently chromatically filled (by b.47) and thus effectively (though only approximately) reversing the process involving C4-E $\flat$ 4 just previously. Further evidence of reversal, in temporally symmetrical form and on an ever larger scale, comes with the entrance of A $\flat$ 3 (b.51). Just as A3 stands in analogy to E $\flat$ 4 – being as far below C4 as E $\flat$ 4 is above it – so A $\flat$ 3 is brought into a position analogous to that of E4. The analogy is strengthened subsequently by the thinning that begins immediately after the A $\flat$ 3 entrance in b.51 and eventually yields a [2]-striation A $\flat$ 3-B $\flat$ 3-C4 (*cc*), the counterpart to C4-D4-E4 above. Finally in this section, which is demarcated by the entrance of Canon 3 in b.61, A $\flat$ 3 represents the lowest point in pitch space attained since the beginning of Canon 2 and completes a symmetry about the chord F $\sharp$ 4-A4-B4, in that A $\flat$ 3 is exactly the same

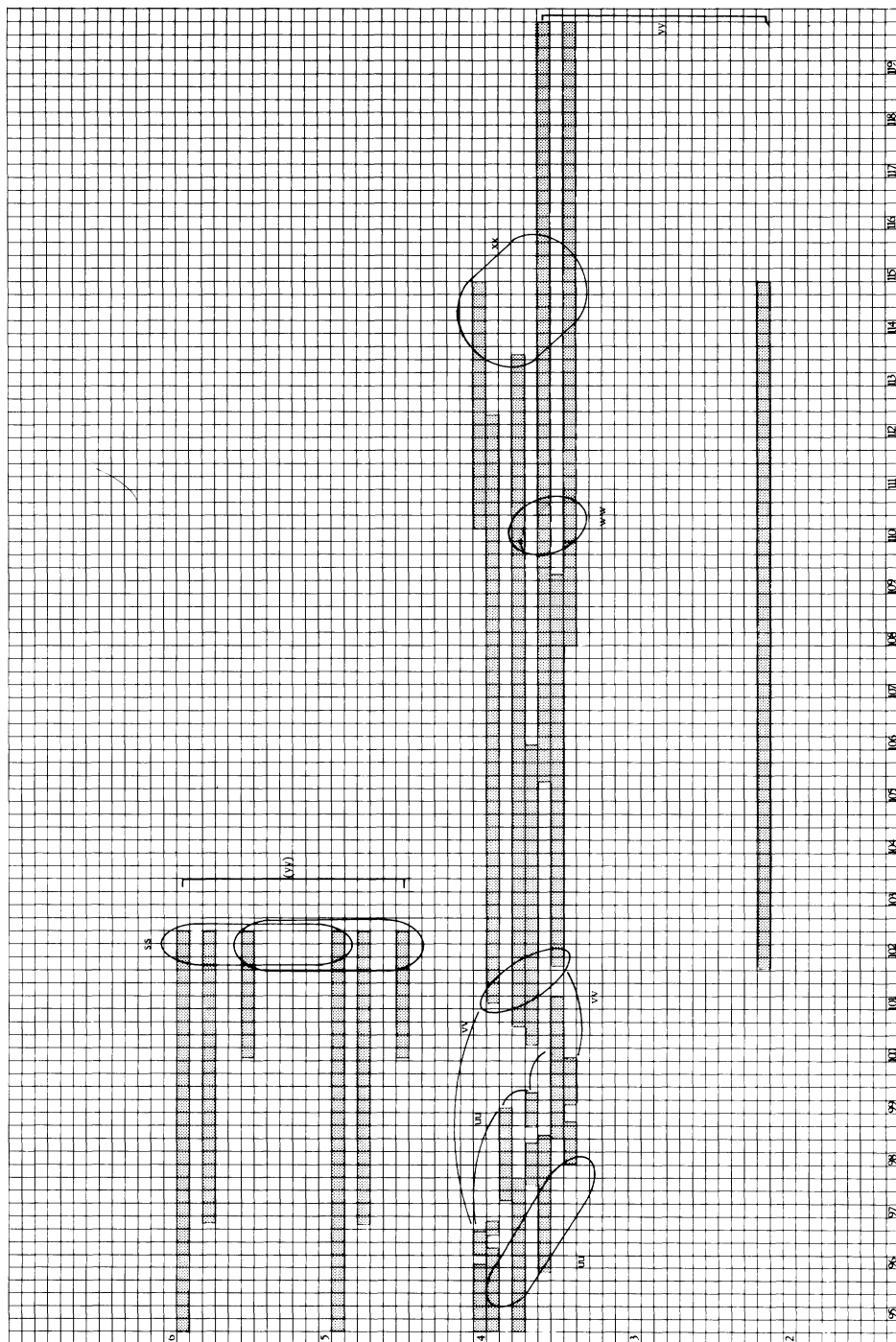
Ex. 3 *Lux aeterna*, graph











vertical distance below F $\sharp$ 4, [10], as A5 is above B4 (*dd*).<sup>13</sup>

The falling upper boundary of bs 41-61 has some structural significance as well; it becomes crucial to the onset of Canon 3, in two respects. First, the drop from B4 to E $\flat$ 4 is immediately 'doubled', in a symmetrical fashion already familiar from the doubling of E $\flat$ 4-C5 at C5-A5 in Canon 1, at G5, the highest and first note of Canon 3 (*ee*). Second, the further drop from E $\flat$ 4 to C4 (b.58) exposes in a particularly prominent way the vertical adjacency B $\flat$ 3-C4-E $\flat$ 4, that [2][3] signal formation which marked the opening of Canon 2 and now does the same for Canon 3, in octave doubling (*ff*). The stack G3-B $\flat$ 3-C4 in b.61 can in fact be regarded as a mirror image of B $\flat$ 3-C4-E $\flat$ 4, reflected about B $\flat$ 3. Bracketing this doubling and spatially symmetrical to G3 and G4 in b.61 are G2 and G5.

The next passage (bs 61-79), which takes in the entire duration of Canon 3, is unique in *Lux aeterna*: the only place at which two different canons unfold simultaneously. The listener should have no great difficulty grasping the fact that the two are different, owing to the registral separation (the dramatically sudden entrance of material in relatively distant registral positions at once combines and intensifies the effects of bs 24 and 37); what may take longer to hear is the carefully calculated relationship between the two canons, a relationship which links different aspects of the two in a constantly changing web of events. The graph reveals a distinct similarity of contour within the duration of bs 61-79. This can be particularised, first of all, in the way in which the opening successive notes of Canon 3, G5-F $\sharp$ 5-E5-D5-E $\flat$ 5, find their analogue in close temporal overlap in G3-A3-B $\flat$ 3-F3-G $\flat$ 3, notes 24-28 of Canon 2 – the same series as the group in Canon 3, transposed and with the order of the first three notes reversed (*gg*). As spatial resultants, of course, the two groups make quite similar effects. Secondly, notes 4-9 in Canon 3, D5-E $\flat$ 5-B $\flat$ 4-C $\flat$ 5-B $\flat$ 4-D $\flat$ 5, correspond exactly in order and within transposition to notes 25-30 in Canon 2, A3-B $\flat$ 3-F3-G $\flat$ 3-F3-A $\flat$ 3. The visible effects of this correspondence in the graph are the 'staircases' labelled *hh*. These groups give way to [2]-striations in contrary motion, with Canon 2 falling from A $\flat$ 3 to G3-E $\flat$ 3-F3 and Canon 3 rising to D5, which joins with the already sustained B $\flat$ 4 and C5 of the chord begun in b.61.

At this point, another general similarity of contour between the two canons becomes apparent: in both cases, the upper boundary has fallen [5] from the opening of the section in b.61 (G5 to D5 and C4 to G3; see *ii*). Canon 3 ends with the sustained [3][2][2], G4-B $\flat$ 4-C5-D5, creating a correspondence between its use here and the use of [2][3] as initiator (bs 37 and 61). Notice also that [2][2][3] figures in the events immediately preceding the entrance of Canon 3 (see A $\flat$ 3-B $\flat$ 3-C4-E $\flat$ 4, bs 57-8), suggesting a possible balancing and terminating role for this verticality *vis-à-vis* [2][3].

The descent of the upper boundary of Canon 2 to F3 (b.78, *jj*), together with the coming to stasis of Canon 3, completes a large-scale



symmetry involving the interval [7], outlined by D5, G4, C4, and F3 (*kk*). The symmetrical contraction of the remaining [2] to a single pitch, E3 (*ll*), is reminiscent of the attenuation to A at the end of Canon 1; here, however, the octave doubling is absent until the entrance of the [2][3] chord, E2-G2-A2, in b.87 (*mm*). But this interesting twist on the events of b.37 does more than recall the transition from Canon 1 to Canon 2; it also duplicates the spatial arrangement of G3-B $\flat$ 3-C4-G4 or G4-B $\flat$ 4-C5-G5, [3][2][7]. The symmetrical expansion that now follows, to E $\flat$ 2-F $\sharp$ 2-B $\flat$ 2 in b.90 (*nn*), seems to reverse the contraction of bs 80-4; it also moves the upper boundary of the basses' chord to within [6] of the E3 that ends Canon 3. As at earlier points in the piece, though with a different interval each time, this [6] is now doubled to reach B $\flat$ 3, the opening note of Canon 4 (*oo*). We note in passing that the pitch series opening this final canon duplicates in mirror image the opening *resultant* (not pitch series) of Canon 1 (*pp*). Accompanying these intimations of reversal, in both the spatial and the temporal sense, is the opening doubling of the B $\flat$ 3 by B $\flat$ 2 – the only note in Canon 4 doubled at point of attack – which seems to act as a counterpart to A4, the *last* note of Canon 1 and the only one so treated there.

The expansion by octaves achieved by the joining of E2 to E3 and by the joining of B $\flat$ 3 to B $\flat$ 2 now continues in a particularly intense form; just as A2 rises to B $\flat$ 2 and is doubled one octave above (b.90), so B $\flat$ 3 rises to B3 (*qq*) and becomes doubled *one and two* octaves above (b.94, *rr*). These new doublings, at B4 and B5, initiate non-canonic material which obviously resembles other material, standing outside the canons, that has previously been heard in the piece: the sudden seizing of a higher register recalls the A5 at b.24, while the doubling of a note in the canonic strand in more than one octave and its subsequent sustention recalls bs 61ff. In bs 94-102, the gradual presentation of a doubled [2][3] structure, B5-A5-F $\sharp$ 5-B4-A4-F $\sharp$ 4 (*ss*), constitutes a new twist upon this by now familiar intervallic pattern; in a way, it constitutes a working out of the implications of A4-A5 followed by F $\sharp$ 4-A4-B4 in bs 24-41, in that in the earlier passage the octave-doubled A is followed by a [2][3] structure which makes use of only the lower A, while in the later passage the octave doubling and the [2][3] occur as part of a single structure, with the successive aspect of bs 24-41 now passing to the presentation of [2][3] itself. There is the unmistakable suggestion here that the features of the work represented by the canons, the octave doubling and the [2][3] structure have come, at this relatively late point in *Lux aeterna*, to exert mutual influence.

Meanwhile, Canon 4 progresses within a spatial range which turns out to be the most restricted of the four: eventually it fills F3-C4, recalling, together with the arrangement of the lower parts, the symmetry of [7]'s noted earlier (compare *tt* with *kk*). The graph also shows that Canon 4 has overall the sparsest density of the four canons of *Lux*, a feature which seems to prepare effectively for the 'combing out' (*ww*) of the final bars. At

*uu*, notice the overlapping [2]-striations that emerge from the choppiness of the texture. The span F3-C4 contracts symmetrically to F#3-B3 in b.101, producing a vertical structure which is itself symmetrical, [2][1][2] (*vv*).

The final events of the piece establish notable relations with previous ones. The last four sounding notes of the canon, F3-G3-A3-C4 (*xx*), duplicate the formation embedded in the presentation of Canon 2 just before the entrance of Canon 3 (see A $\flat$ 3-B $\flat$ 3-C4-E $\flat$ 4, bs 57-9). The last two sounding notes of Canon 4, F3-G3, taken together with the D2 of bs 101-14, present an octave-expanded form of [2][3] – [2][15] – which clearly owes its coherence to the developments that produced octave doublings of [2][3], first at b.61 and then over the span of bs 94-102 (*yy*). The latter is of more direct relevance here: notice that the span of [17] filled by the structure *ss* ending at b.102 has as its upper boundary the highest note of the entire piece, while structure *yy* has as its lower boundary the lowest note of the entire piece. This final structure is itself a kind of ‘combed-out’ sonority in comparison with *ss*, and in this way helps to bring the thinning process to a logical and satisfying conclusion.<sup>14</sup>

In *Lux aeterna*, as in works of Ligeti constructed according to similar principles, the unfolding of canonic structures affects spatial developments in a wide variety of ways – not only in that the unfolding canons form vertical resultants in and of themselves, but also in that their dimensions have consequences for the articulation of structure on a larger scale. For instance, the activity of bs 15-24 is of significance both in terms of the resultant shifts in internal structure and in the resultant external span of [9], which motivates the entrance of A5 in b.24. Could such structural relationships be formed *without* recourse to canon? Or would other principles inevitably have to take over in its absence? A non-canonic excerpt from a piece written not long after *Lux aeterna*, the Second String Quartet (1968), serves as an apt test case, one which also suggests some more general conditions of voice leading in Ligeti’s music.

### *Analysis of Second String Quartet, Third Movement*

The opening of this movement (bs 1-30) is a passage of the type designated by Ligeti as ‘meccanico’, employing a kind of rhythmic treatment which is often, though not always, associated with canonic structures (here not). The most complicated part of this passage is the first twelve bars – or, more accurately, bs 3-12, since the first two bars are empty of sound. These bars are diagrammed in detail in Ex. 4. Here, as in *Lux aeterna* and other canonic pieces, the texture changes gradually, one note at a time, and musical progression is best followed through examination of the successive vertical resultants in combination with the horizontal movement of parts – though, as will be seen, from rather a

different point of view than in *Lux aeterna*.

The initial dyad, A5-B5 (Stage 1), is doubled in Stage 2 to yield a symmetrical partitioning of space into [2]s. Next (Stage 3), D6 enters the texture, adding a [3] above the uppermost [2]. Already, this sequence of events might be taken to suggest a motion to successively larger intervals – an impression which is confirmed in Stage 4, where A5 is dropped in favour of F#5, opening up G5-B5, [4], explicitly as an interval. This move has the further consequence of providing a counterpart to the [2][3] of Stages 2-3, A5-B5-D6, in the [2] *within* [3] of Stages 3-4, F#5-G5-A5. Obviously this is not an exactly symmetrical counterpart, but it has a symmetrical aspect in that the cello's move from A5 to F#5 articulates [3] below the lower note of the original dyad of the movement just as D6 articulated a [3] above the upper note of that dyad. The relationship of [2] without [3] to [2] within [3] is suggestive of a spatial condensation of motions below relative to what is happening above – an impression which is borne out by the shape of bs 3-12 as a whole (a brief glance at the graph in Ex. 5 shows that the upper boundary is expanded three times as far as is the lower).

Stage 5 (b.10), where E6 enters, is also marked by the sudden intrusion of a *forte* dynamic, an event which tends to separate bs 3-9, for certain purposes, from what follows (to be discussed later). On other levels, however, progress continues uninterrupted: B5-D6-E6 of Stages 4-5 forms a further [2][3], and there is a new symmetry of [5]s formed about B5 (see dotted lines in Ex. 4), which would seem both to bear a relation to the symmetrical [2]s of Stage 2 and accurately to represent, in both the larger span of the symmetrical intervals and their collectively higher range, the asymmetry of the overall fanning-out motion of the passage. Also evident in Stage 5 are the adjacent formations [4][5], G5-B5-E6, and [1][4], F#5-G5-B5, otherwise construed as [4] inside [5]; this pairing, like the earlier one between [2][3] and its infolded form, is representative of a tendency towards condensation in the lower region, towards aeration in the upper.

Stage 6 intensifies motion upwards through its suppression of G5 in favour of C#6. The steady pulling away of upper region from lower is evident in the adjacent [2][5], F#5-B5-C#6, which can be interpreted as an unfolding of [2][3]. Obliquely present, really only as a kind of potential form, is [1][6], F#5-G5-C#6 (Ex. 4a). Stage 7 flips the first [4][5] around the interval B5-E6 to reach G#6 (Ex. 4b) and, at the same time, brings forth another dual-interval symmetry, this one of [7]s: F#5-C#6-G#6. Finally, Stage 8 brings the attenuation of this passage towards the higher register to its peak, with the abandonment of F#5. The chord C6-C#6-E6-G#6 is nearly the same as that of Stage 4 – the [3] and the [4] are reversed in their relative positions – and as such agrees with the partitioning of the passage as a whole with respect to dynamics. The external and internal aspects of these chords that are congruent can be expressed as [1][7], or [7] within [8], a characteristic with consequences for future developments.

Also present, more explicitly than in the connection between Stages 5 and 6, is [1][6], F $\sharp$ 5-C6-C $\sharp$ 6.

The sudden interjection of the cello's Bartók pizz. on B $\flat$ 2 in b.12 ends this phase of development. Its spatial placement with respect to ensuing events, as shown in the graph of the entire excerpt (Ex. 5), is quite important: the initial lowest note of the new material beginning in b.12, D4, falls exactly halfway between the lowest pitch of bs 1-12, F $\sharp$ 5, and the Bartók pizz. Other reasons for the relative positions of these materials become clearer as the new passage progresses.

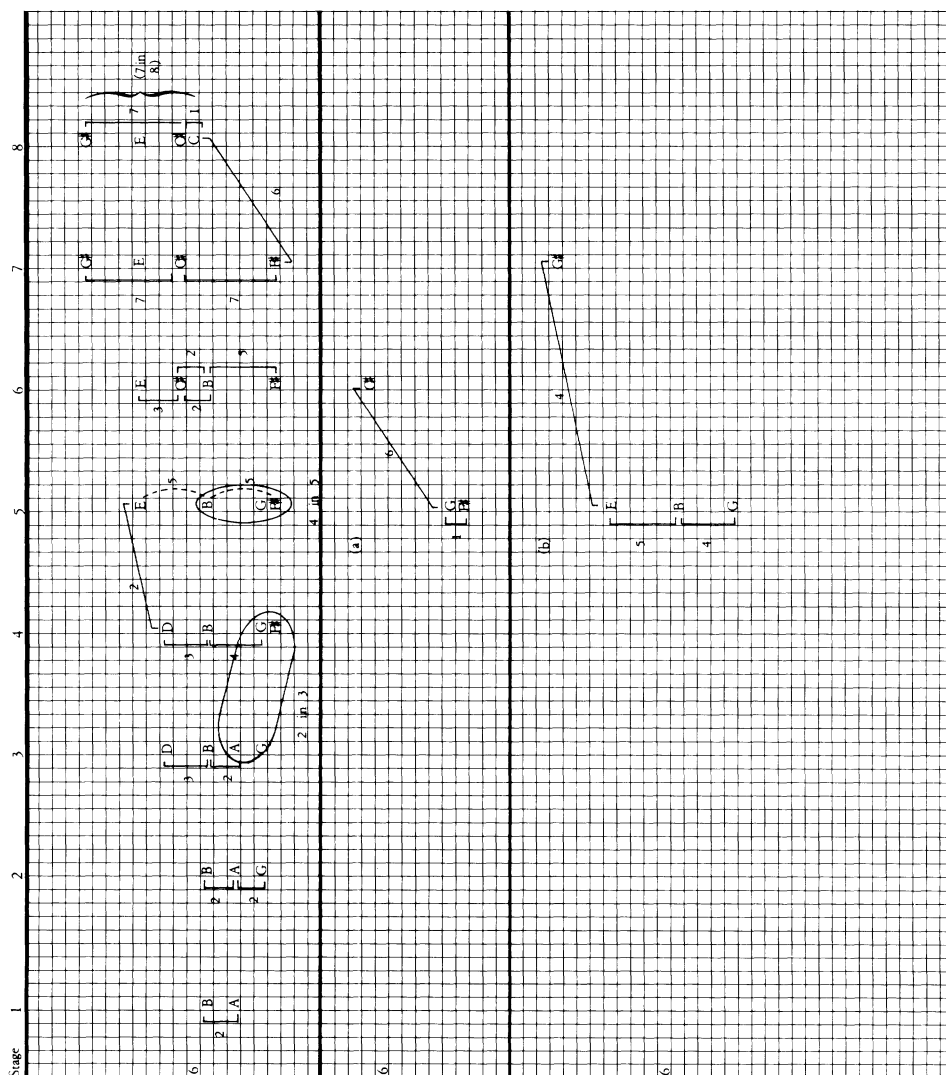
From the onset of D4-E $\flat$ 4-F4-F $\sharp$ 4 in b.12, in fact, it is clear that this new material forms a beginning analogous to that of b.3, though with some significant differences: already, as the instruments re-enter, there are four different pitches present, as though the original [2] had swelled by [1] on either side; also already present is the rhythmic differentiation which only gradually enters the texture in the first passage. Very early on in the second passage, microtonal shifts begin, in almost exactly symmetrical fashion (spatially and temporally speaking), to pull the initial configuration apart.<sup>15</sup> Example 5 shows that the discrepancy of [1] between upper and lower shifting in the first phase of this expansion is compensated in the second phase, so that by b.18 the upper boundary has risen exactly as far as the lower has fallen, [9]. The fact that each of these motions of [9] is subdivided [4][5] seems significant in the light of the ascent by [9], also divided [4][5], of the upper boundary in bs 1-12.

Further relationships to the first passage of the movement are apparent in the mirror-symmetrical chord at b.18, which has an adjacent intervallic structure of [7][8][7], or interlocking [7][8]s. These can be interpreted as unfolded forms of the articulative [1][7]s in bs 1-12 (see above). The symmetrical chord thus obtained now expands along the lines of a new, independent symmetry (see Ex. 6): the two violins, which have the upper two notes of the chord, each add a note as a double stop [9] below, while viola and cello on the lower two notes each add a double stop [8] below. This operation, complete by b.19, produces an expanded chord not in itself symmetrical which incorporates forms of [1][6] and [1][7] in its internal structure. These forms also provide a connection with bs 1-12 (see remarks above).

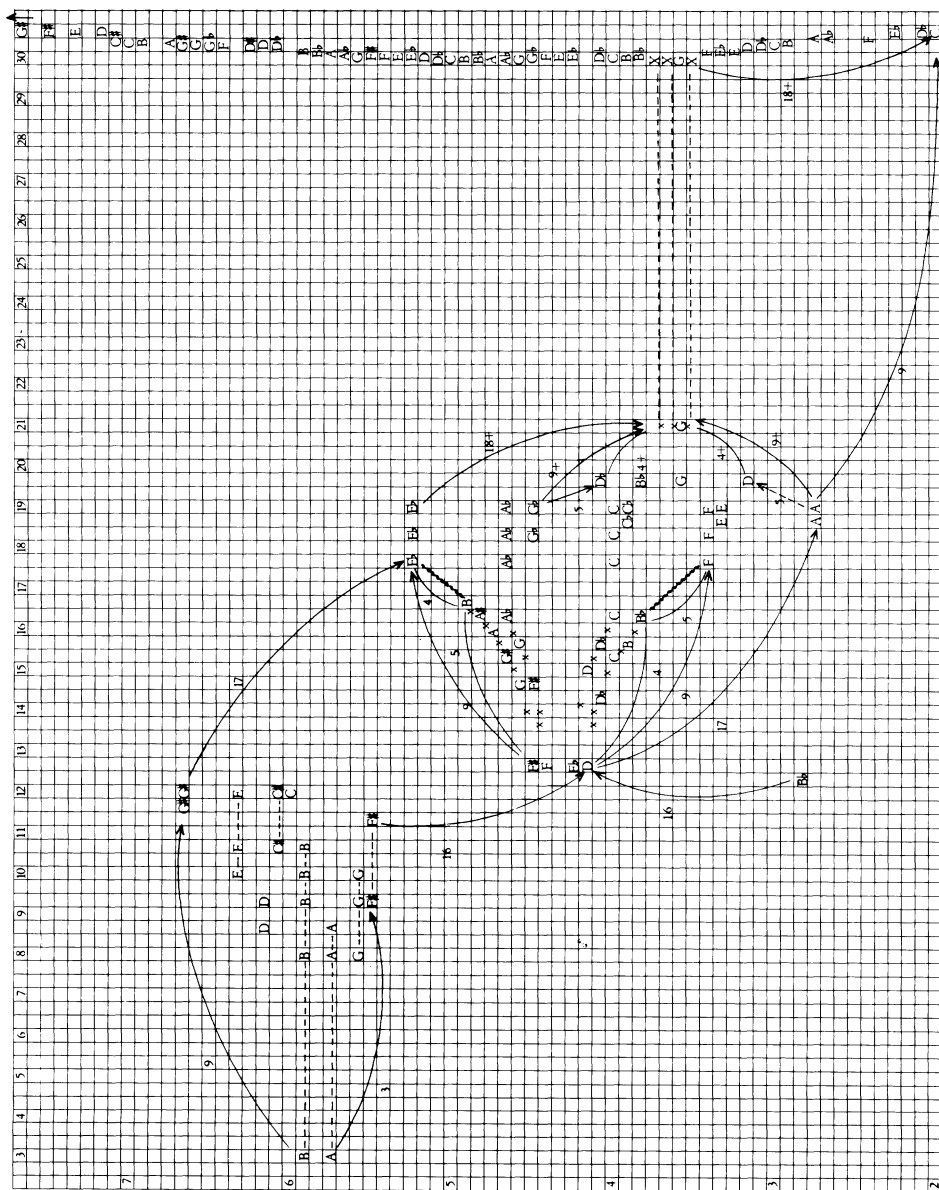
Another result of the addition of double stops is to drop the lower boundary by another [8], for a total descent of [17] since the passage began with a lower boundary D4 at b.12. As Ex. 5 shows, this [17] is also found above, between the final upper boundary of the first passage (G $\sharp$ 6) and the final upper boundary of the present passage (E $\flat$ 5). The congruence between these two spans signifies that the space defined by the entire first passage plus the abrupt descent to the beginning of the second (excluding the Bartók pizz.) is equivalent to that of the expanded mirror-symmetrical chord at b.19.

The radical and sudden shrinkage of occupied space that occurs at the

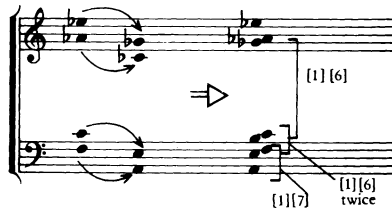
Ex. 4 String Quartet No. 2, third movement, bs 3-12: stages of intervallic development



Ex. 5 String Quartet No. 2, third movement, bs 1-30: graph



## Ex. 6 String Quartet No. 2, third movement, bs. 17-19 (reduction)



end of b.19 seems to result from a symmetrical contraction of just part of the previous sonority, as shown by the converging dotted lines in the graph. Further contraction comes soon thereafter (b.20), yielding a net reduction of [9+] on either end. This [9+] signifies that microtones have been deployed; it seems quite in the spirit of Ligeti's use of these that we take this distance to mean 'approximately [9]', to that extent bearing a relationship to previous spans of [9].<sup>16</sup> Notice also that this contraction reverses – this time completely in mirror fashion – the expansion by [4][5] at either end of bs 12-18.

At this point, the span  $F\sharp\uparrow 3-A\downarrow 3$  is maintained, with subtle dynamic and timbral evolution, for some ten bars. In its spatial size, it approximates to that of the opening event of the movement; in its temporal size relative to the previous duration of the second passage, it also approximates to the proportion that the opening A5-B5 bears to the remaining duration of the first passage. In other respects bs 21-30 represent a radical transformation of bs 1-8; their more highly agitated rhythmic character, together perhaps with the tension implicit in their microtonal pitch definition, leads plausibly to the 'explosion' in b.30 and the subsequent presentation of very different material. But the spatial and temporal symmetry of this prolongation of  $F\sharp\uparrow 3-A\downarrow 3$  to the opening of the movement acts as a kind of reversal of that opening, framing the expansion of bs 1-12 and 12-17 and the contraction of bs 19-21. Further, the explosion of b.30 completes another long-range symmetry, this one extending back to b.12: the rise of [9] from  $F\sharp 4$  to  $E\flat 5$ , followed by the fall of [18+] to  $A\downarrow 3$ , is now counterpointed by the rise of [9+] from A2 in b.19 to  $F\sharp\uparrow 3$  in b.21 and the fall of [18+] in b.30 to C2. Again, see Ex. 5, from which it is evident that these motions actually imply an exact mirror symmetry between the two groups of three points each.

### Conclusion

The apparent changes in Ligeti's methods during the period immediately

after *Lontano* did not, in fact, change the constructive basis of his music. The example from the Second String Quartet, notable for its infrequent recourse to densely filled spaces, compared to most of what Ligeti wrote during the decade following his emigration from Hungary, simply represents further progress in the stylistic evolution that he had been undergoing since 1956. At first, his reaction to European serialism of the 1950s led him to eliminate, as far as was possible, pitch (especially pitch-class) and interval functions, substituting for them, respectively, a simple distinction between high and low and a scale of larger or smaller 'bandwidths' (that is, intervals as vertical spans of absolute size) filled more or less densely. *Line*, in the usual sense, and *rhythm*, in the traditional sense of local articulative and larger-scale phrase functions, were eliminated as well. The next stage can be said to have begun with the *Requiem* (1963-5), where canon came into its own as an organising principle. Previously, in such works as *Apparitions* (1959) and *Atmosphères* (1961), micropolyphony had been an ingredient in the texture, but the imitative passages were of relatively brief duration; in *Apparitions*, for instance, the only such passage in the entire piece occupies but thirteen bars of the second movement. In introducing canons whose resolution required sometimes quite considerable spans of time, Ligeti may have been attempting a kind of structural integration which the techniques he had employed earlier could not easily produce, if at all. He may even have sought to break down the distinctions he had created between 'states', 'events' and 'metamorphoses', phenomena which tended to have a fracturing effect upon temporal continuity.<sup>17</sup> Thus the idea of musical line was reintroduced – but in a concealed way, one which acted to maintain a steady linear flow while preserving itself as far as possible from recognition as an actual line.

In his works from 1968 on, Ligeti has simply taken one further step, returning to *interval* certain freedoms of which it had been previously (mostly) deprived.<sup>18</sup> Like line, however, interval has been restored in a form which places it under the control of the overriding spatial context – in such a way that, even though an interval need not behave any longer simply as a bandwidth, neither can it possibly sound like an element in a universe defined in pitch-class terms. One suspects that Ligeti's even more recent restoration to rhythm of certain of its traditional roles, in such works as the *Horn Trio* (1981) and the *Etudes pour piano*, Book I (1985), has been carried out along similar lines, giving rhythm a function which it could never have fulfilled before the *tabula rasa* of the late 1950s.

Thus, by forcing himself to do for a while without most of what his compositional training had led him to consider the principal elements of composition, Ligeti taught himself again how to use them, one by one – in the process making them fully his own. Moreover, the lessons learned at each stage of this process formed the basis for the next – a statement which might at first seem self-evident but which, upon further reflection, provides a convincing basis for explanation of what happened after *Lontano*. Since



then, canon has never again assumed such immense importance for him, becoming instead one of several techniques that may either be employed or not.<sup>19</sup> The fact that it is no longer an indispensable part of his compositional method suggests that the restoration of interval has crucially altered the definition of voice leading in Ligeti's music. What were called 'intervals' in the analysis of *Lux aeterna* were, for the most part, actually bandwidths of varying density. There were a few exceptions to this, such as the 'signal' chords, which may be taken as anticipations of the restoration to come; but in all other cases vertical spans had to be filled, over time, by stacks of [1] and [2] derived in various ways from the canonic strands themselves in order to acquire structural significance. In the analysis of the excerpt from the Quartet, by contrast, intervals are shown to function more or less directly and immediately, without the intermediary of the canonic procedures and the linear continuity that they guarantee.

The kind of structuring permitted by this expanded power of interval is distinctly reminiscent of the 'mechanics' of sound masses pioneered by Varèse. But while some of the means by which Ligeti manipulates structures in space resemble those of Varèse, they do not bear the same significance. The difference resides in what might be termed the 'structural levels' of Ligeti's music. These are not 'organically' related, in the sense in which those of Schenkerian theory are, for the processes taking place on one level are not essentially the same as those on the others. And they are not those of Varèse's music either, where every structure, small or large, has a primarily vertical meaning from its very inception. Instead, Ligeti's levels are defined by the differences between local, note-to-note structures and large-scale resultant structures. By thus engaging the transformation of horizontal structure over time into vertical, Ligeti ensures that it is not only in the relationship of lines to each other but also in the agglomeration of those lines into an *object* which may in turn establish relations with other, similarly formed objects, that voice leading – and, therefore, counterpoint – consists.

## NOTES

1. Quoted in Várnai 1983: 14–15.
2. See Bernard 1987a, in particular :222–33. My comparison of the two canons in this article identifies a repetition at one point of two pitches in the *Lontano* strand, yielding a total of thirty-three notes instead of the thirty-one counted for *Lux aeterna*. I have since come to the conclusion that these extra two notes really have no independent status, and that the canonic strand in *Lontano* (bs 1–41) is in fact the same as that of *Lux aeterna* (bs 1–37), transposed up a minor third.
3. See Ligeti 1969. Ligeti has also referred to *Lontano* as a parody – in the Renaissance sense – of *Lux aeterna*; see Michel 1985: 161.

4. The importance of literal stepwise motion has been emphasised in several published analyses of Ligeti's music, such as Morrison 1985. Approaches of this sort, however, are limited by their *exclusive* reliance upon stepwise motion to establish structural connections. As will become clear later in this article, a spatial context offers numerous other avenues to continuity, which Ligeti exploits in a manner perfectly consistent with that achieved by stepwise motion and which combine with it in a rich and satisfying manner.
5. Inversional equivalence is invoked in the analysis of *Atmosphères* in Bernard 1987a: 216-20.
6. This criterion of twelve-note coherence is by now obsolete anyway, for composers of serial music in the years since the 1950s have made occasional use of octaves in a manner which is convincing from a twelve-note standpoint. But there can be little doubt that Ligeti did at first avoid octaves entirely in the music he wrote after his emigration to the West in 1956, only after about 1965 reintroducing them for certain limited and specific purposes. See Várnai 1983: 27-9 for an interesting discussion of this issue.
7. Ligeti has described his explicit aim, in employing canonic procedures, of unifying the vertical and horizontal through the process of succession becoming simultaneity. See Michel 1985: 151-2.
8. Numbers in square brackets denote sizes of intervals in semitones.
9. The term 'imbrication' is used here in the sense ascribed to it in Forte 1973: 83-4.
10. The graph in Ex. 3 is of the same type that was employed in Bernard 1987a; it duplicates and extends Ex. 7 from that article. The vertical axis from bottom to top corresponds to pitch from lowest to highest; one square equals one semitone. Numbers in the left margin mark positions of C, designated according to the numbering system recommended by the Acoustical Society of America (C1 is the lowest C on the piano, C8 the highest). The numerical suffix of each C also applies to the eleven pitches above it; this system of reference is used consistently throughout the text. The horizontal axis corresponds to time, which elapses from left to right; one square equals one crotchet beat, at a constant tempo of MM 56. Numbers along the lower margin are bar numbers. The presence or absence of shading indicates the simple presence or absence of a particular pitch at any given moment in the work.

This graph of course exemplifies only one potentially valid representation of structure in Ligeti's music. See Clendinning 1989 for an extensive and enlightening application of other types.

11. The term '[2]-striation' refers to patterns in which at least two pitches [2] apart are maintained for at least a bar or two without the intrusion of semitonal filling between them.
12. For any trichord, or stack of two adjacent (unequal) intervals, there are two possible *unfoldings* and one *infolding*. The first term refers to the spatial operation in which one of the two intervals is taken outside the larger interval that encompasses both the adjacent intervals and attached there as a new

adjacency; the second term denotes the placing of the smaller of the two intervals within the larger in such a way that the two intervals continue to share one pitch. Thus [1][2] can be unfolded either to [2][3] or to [1][3], and can be infolded to [1][1]. For a more comprehensive discussion of this phenomenon in the context of Varèse's music, see Bernard 1987b, Chapter 3.

13. This relationship is mentioned and illustrated in Bernard 1987a, Ex. 8 (p.227).
14. The analogy to thinning with a comb is Ligeti's; see his description of events in *San Francisco Polyphony* (Várnai 1983: 44).
15. As Ligeti has pointed out on a number of occasions, the upward- or downward-pointing arrows attached to notated pitches are meant to signify a 'dirtying' of exact pitch, not actual quarter tones. Thus the position of a given 'x' on the graph should be taken as *somewhere between* the two pitches in question, not necessarily *halfway between* them.
16. Ligeti has implied that intervals retain some aspects of their original identities when subjected to microtonal fluctuation; see Michel 1985: 175.
17. See Ligeti 1967 (1993). This article originally had an additional subtitle, 'Bemerkungen zu meinem Orchesterstück *Apparitions*', in its first publication (*Bilder und Blätter*, 1960).
18. See Ligeti 1983: 126. Ligeti sees the beginnings of this 'abandonment of harmonic neutrality' as early as the last movement of his *Requiem*.
19. See Michel 1985: 151.

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