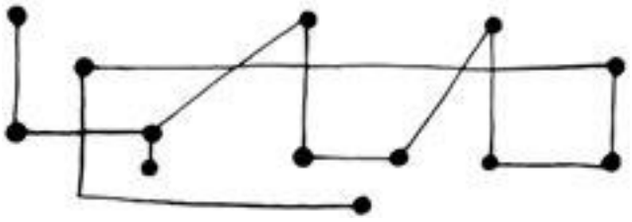
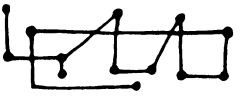


Interval and Form in Ligeti's *Continuum* and *Coulée*



Michael Hicks

Continuum for harpsichord (1968) and *Coulée* for organ (1969) represent a distinct category in György Ligeti's work, one in which patterns of pitch and interval evolve gradually and smoothly beneath an articulative surface that behaves, as he says, "like a precision mechanism."[1] Ligeti produces this fluid, mechanistic music by deploying an extremely fast, even succession of notes primarily in tremolandi and scalar figures which, at the end, abruptly cease "as though torn off." Some of his larger works of the same period contain similar music: the Second String Quartet (1968), *Ramifications* (1969), and the Chamber Concerto (1970). But, for their brevity and uniformity, *Continuum* and *Coulée* provide the purest, most concentrated models for his *meccanico* style.

Most commentators dwell on these works' most superficial aspect, the complex superimposing of diverse right- and left-hand note groupings.[2] Ligeti himself also emphasizes that aspect, in which, as he says, "what you perceive as rhythm is not rhythm coming from the succession of notes your fingers play. The actual rhythm of the piece is a pulsation that emerges from the distribution of the notes, from the frequency of their repetitions."[3] The composer also characterizes his *meccanico* music in terms which are—typically for him—visual: *Continuum* creates a "stroboscopic" musical state, or one in which "*the music is seen* as if through a number of superimposed lattices."[4] What is behind the lattices, suggests Josef Häusler, is nothing less than a "Kafkaesque and machine-like traumatic vision" of "the anxiety of mechanical operations breaking down."[5]

But surprisingly little has been said about the intervallic and formal design of *Continuum* and *Coulée*, even though, for their relative simplicity, these pieces seem like excellent starting places for a study of Ligeti's techniques in those areas. The reticence of scholars concerning interval and form in these works typifies most discussions of Ligeti's work. His cross-rhythms, micropolyphony, "sound mass," and so forth are so striking that they easily preoccupy analysts; the composer himself refers to the bulk of his work as "surface music."[6] And since Ligeti uses pitch idiosyncratically, his music does not easily lend itself to conventional methods of analysis. The composer, however, has suggested certain principles for understanding interval and form in his work, principles which we can use to see just what is the "music" that is "seen" through the rhythmic lattices of Ligeti's *meccanico* style, as exemplified in *Continuum* and *Coulée*.

Ligeti has remarked that "composition consists principally of injecting a system of links into naïve musical ideas" in order to create a "musically consistent and linked network."[7] The first task of an analysis, then, might be to identify both the "naïve musical ideas" in his music and the "system of links" that binds them together. Examples of the former appear in what Ligeti calls "interval signals," which began to emerge in his work during the mid 1960s. These signals, he says, "were neither tonal nor atonal yet somehow, with their purity and clarity, they constituted points of rest."[8] Consisting of single dyads or trichords, signals appear blatantly in the music, undiluted by extraneous pitches; they constitute stable points between areas of flux that are perceived as moving away from the last signal or toward the next. The dyads and trichords used as signals, the composer says, often contain octaves, perfect fifths or fourths, tritones, or major seconds, but rarely major thirds in connection with perfect fifths, because of the composer's wish to avoid triadic sounds; he describes a "typical Ligeti signal" as "a fourth made up of a

minor third and a major second or the other way around."[9] In describing the intervallic content of his signals (and his music generally) Ligeti generally seems to refer to the actual dimensions of simple pitch intervals (hereafter shown as pi's, followed by the number of constituent half steps); in some cases, however, he may also refer to compound pitch intervals (hereafter cpi's)—the simple intervals with one or more octaves added.

To understand the "system of links" in the works at hand, we must first take note of Ligeti's observation that, when constructing a musical form during this part of his career, he replaced tension vs. resolution, dissonance vs. consonance, and other "pairs of opposition in traditional tonal music" with a concern for textural density. Again using a visual metaphor for the processes in his music, Ligeti says, "I . . . contrast 'mistiness' with passages of 'clearing up.'" The intervals that make up the signals

> are divided by blurred areas, so that you hear an interval [or signal] that gets gradually blurred and in the ensuing mist another interval appears, it becomes clearer and clearer until the surrounding mist completely clears and you hear the new interval [or signal] all by itself. . . . 'Mistiness' usually means a contrapuntal texture, a micropolyphonic cobweb technique; the perfect interval appears in the texture first as a hint and then gradually becomes the dominant feature.[10]

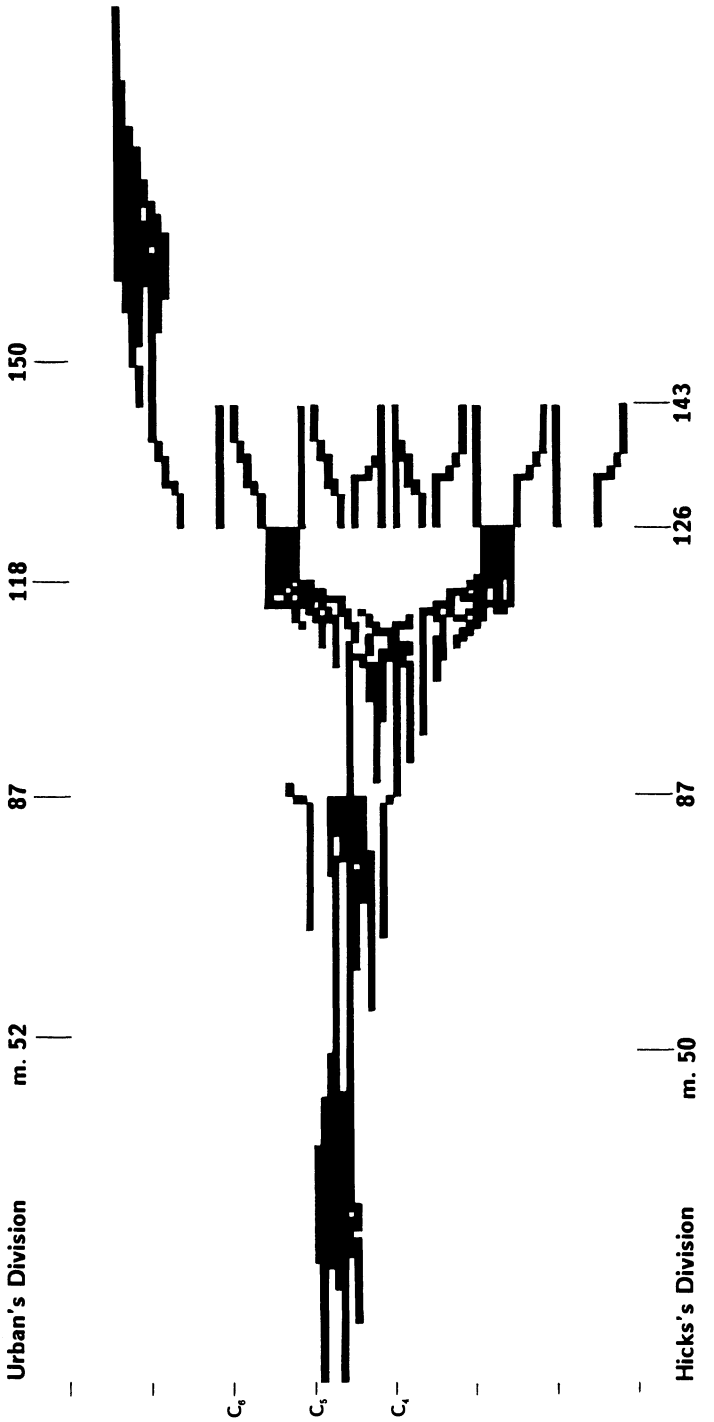
The nature of this blurring, however, may vary. Signals—the "perfect intervals" of which he speaks—may be blurred by ***filling***, a process wherein new pitches are inserted into existing intervals; by ***accretion***, in which new pitches are attached to the outside of existing intervals; or by ***shifting***, in which one or more of their elements ascend or descend. These three fundamental blurring techniques, of course, may occur in various combinations within a single episode of "mistiness." For example, a signal might be blurred by accretion first, then filling, then shifting of the collection up, down, or both.

Intervals, then, seem to play at least four roles in the construction and blurring of signals. Those roles are listed here more or less in descending order of their importance to the overall structure of a piece.[11] First, are ***boundary intervals***, which define spaces to be filled or partitioned. Second are ***partition intervals***, which delineate smaller-scale boundaries ***within*** larger boundary intervals. Third are ***projection intervals***, which are the intervals of transposition from one occurrence of an idea to another.[12] Fourth are ***blur intervals***, which arise during the processes of filling, accretion, and shifting; these seem to play no role in defining the

boundaries or internal structure of signals or other stable structures based on signals—"cadential" sonorities, for example, about which we shall say more below. In the repertory of intervallic functions, most intervals in a work play multiple roles, yet no role is played by all. In this way Ligeti is able to achieve the sort of "network" he desires, a web of functions in which every strand touches others but no strand touches all.

The basic signal of *Continuum* is rather clear, despite some conflicting comments by the composer. In one instance Ligeti refers to the minor third alone as the "simple model" for the piece, an interval which is "slowly blurred by the appearance of other intervals."[13] This explanation certainly seems to be confirmed by the work's beginning: the dyad G_4–$B\flat_4$ sounds alone for the first nine measures, after which other pitches gradually appear; and only the G_4 and $B\flat_4$ are consistently played by both hands throughout the section. The range of the piece is cpi3: $C\sharp_1$ is the lowest note (measures 137–43), $F\flat_7$ the highest (measures 163 to the end). These registral boundaries not only suggest a "minor third" between themselves, but they also form a "tritonal" relationship (cpi6) to the opening pitches; together, the opening pitches and the registral boundaries suggest, in pitch-class terms, a cycle of "minor thirds" (0369).[14] Nevertheless, as Ligeti remarks with respect to the opening of one of his pieces, "the point is not using one specific interval"—crucial intervallic elements may be introduced gradually.[15] This certainly appears to be the case in *Continuum*'s opening measures, which suggest the "typical Ligeti signal" (025), articulated in two parts, with the opening G_4–$B\flat_4$ serving only as a portion of a basic signal that is completed by the addition of the F_4 (measures 10–14).[16] Further support for this interpretation will come later.

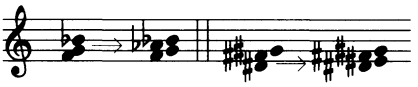
A diagram (Example 1) gives a clearer picture of how blurring and refocusing occur in *Continuum*.[17] The diagram also suggests that the piece consists of five sections, each with a different shape. Uve Urban divides the piece as shown at the top of the diagram, justifying his divisions by the very approximate mirror symmetry produced among the lengths of the sections (52, 33, 30, 31, and 55 measures, respectively). But if, as Ligeti has said, each signal constitutes a "juncture of form," the division shown at the bottom of the diagram seems more plausible—and some important correspondences among sections emerge. The outer sections, I and V, contain blurring followed by gradual refocusing. (In the case of Section I, an elision results, as its ending dovetails with the signal that begins Section II.) Sections II and III both contain accretions and fillings that cadence in inversionally symmetrical chords, which suddenly give way to new signals. Section IV is unique, the shortest in duration yet broadest in registral span (which it achieves only by octave doublings



EXAMPLE 1

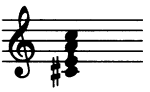
of a few pitch classes). Moreover, its blurring and refocusing takes place only by shifting. This section's structural uniqueness, not to mention its sense of climax, may correspond to its position in the overall form: it begins at measure 126, the golden mean of the piece.[18]

Sections I and II serve together as a kind of double exposition. Both construct the basic signal one interval at a time; Section I opens with a pi3, below which a pi2 is added; Section II (measures 50–61) opens with a pi2 below which a pi3 is added. (The upper boundaries of the two signals are pi2 apart.) In each case the next pitch introduced after the construction of the signal suggests an alternate partitioning of the boundary-interval of pi5. Thus, $A\flat_4$ is added to F_4–G_4–$B\flat_4$, and an $E\sharp_4$ to the $D\sharp_4$–$F\sharp_4$–$G\sharp_4$, creating the same isometric harmony in both cases (Example 2).



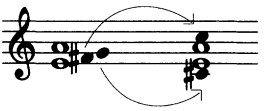
EXAMPLE 2

Thereafter, however, the sections blur their signals differently. In Section I the signal is gradually filled and a $C\flat_5$ added, after which pitches gradually drop out until only $F\sharp_4$ and $G\sharp_4$ remain (the beginning of the signal for Section II). In Section II, the blurring is more complicated, consisting primarily of alternating accretion and filling. This blurring leads to a cadence on a chromatically filled pi5 (E_4–A_4), with an open pi3 on either side (Example 3: measures 81–85).



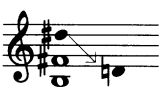
EXAMPLE 3

With this chord Ligeti creates a point of arrival derived from *Continuum*'s basic signal through an extension of the process Jonathan Bernard refers to as "unfolding":[19] taking the two possible forms of the "typical Ligeti signal" as a starting point (i.e., pi 2+3 or 3+2), the partition-interval pi3 is "folded" out of the boundary-interval pi5 on both sides, and the pi5 filled (Example 4).

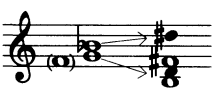


EXAMPLE 4

In the wake of this chord, following a single "transitional" measure (86), a new signal abruptly appears: the oscillating B_3–$F\sharp_4$ in the right hand and a sustained $D\sharp_5$ in the left hand. After two measures, the $D\sharp_5$ is replaced by D_4, which sounds for three measures, then gives way to blurring (Example 5). Griffiths regards the appearance of these chords—a B-major and a B-minor triad—as evidence that "Ligeti is now sufficiently confident in his chord-change technique to include frankly tonal harmonies."[20] This, however, appears to be overstated. Ligeti insisted in 1978 that "at junctures of form you would rarely find a major third or a fifth, since—and you may call that dogmatic—I do shun major triads."[21] The structural import of these chords becomes clear only by referring them to the basic signal. The pi7 in the right hand expands (or complements) the pi5 that defined the basic signal; the fifth's lower boundary is B_3 (a projection pi6 down from the lower boundary of the basic signal). Meanwhile, the $D\sharp_5$ is pi5 above the piece's opening $B\flat_4$, and the D_4 is pi5 below the piece's opening G_4. Thus the opening dyad of the piece (a pi3 that represents a partitioning of a pi5) now provides the center for an isometric projection of pi5 intervals (Example 6). (Coincidentally, if the $D\sharp$ appeared in the same octave as the D, we would have two versions of a vertically expanded "typical Ligeti signal"—pi7 divided both into pi4+3 and 3+4.)

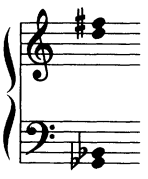


EXAMPLE 5



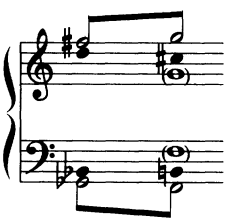
EXAMPLE 6

The "B-minor triad" (i.e., pi7, divided into pi3+4) is blurred first by accretion in the left hand (measures 92–97) and by filling in the right hand (measures 98–104). At measure 105 both hands begin a dramatic contrary motion passage that combines shifting and filling to culminate in the cadential chord of Section III (measures 119–25), an inversionally symmetrical structure that spans exactly three octaves (Example 7). This chord complements the cadential chord of Section II. Whereas the earlier chord (measures 82–86) filled the middle and left open the intervals above and below, this chord now fills the outer intervals ($G\flat_2$–$B\flat_2$ and D_5–$F\sharp_5$, both pi4) and leaves the middle interval open ($B\flat_2$–D_5, cpi4).



EXAMPLE 7

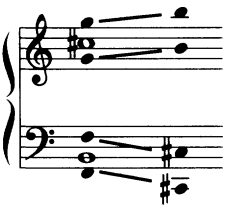
After this chord sounds for six measures, the piece takes a new step—partitioning the octave (pi12, the sum of earlier boundary-intervals pi5 and pi7) into two equal parts. Preparatory to doing so, the $G\flat_2$ and the $F\sharp_5$ continue the contrary motion of the preceding section by pushing outward to F_2 and G_5, respectively (measure 126). These pitch classes not only recall the F and G of the work's opening signal, but also generate octaves that are symmetrically divided by the pushing inward of the inner voices (Example 8).



EXAMPLE 8

Ligeti emphasizes the octave's importance to this signal (and to this moment in the form) by directing that the 4′ and 16′ stops of the instrument be opened, sending out octave doublings in both directions. Once

this new signal has been established, the pitch classes of the boundary-intervals (F and G) gradually shift outward in contrary motion until each arrives at the other's partitioning pitch class (Example 9).

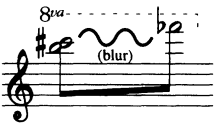


EXAMPLE 9

Although the final section (measures 143–205) seems like a simple coda, it actually carries greater structural weight, transforming and resolving previous ideas. On one level, Section V mediates between the gradual and abrupt types of focusing featured earlier: the pitch classes B and C♯ from the end of Section IV linger, providing a smooth transition, while the removal of the 8′ and 16′ stops articulates a sudden change in both register and density. And the pi2 is blurred initially not by filling or accretion—which always began the blurring process of earlier sections—but with a delicate shift, in which $C♯_7$ moves up to D_7, forming a pi3 with the continuing B_6. This shift elegantly transforms the initial signal of the piece: instead of a pi5 being built from pi2 and pi3, here pi2 *becomes* pi3.

Accretion and filling[22] then proceed until the span from A_6–$F♭_7$ (pi7) is completely filled (measures 163–69). Here, though, pitches begin to drop out from the bottom up until only the $F♭_7$ remains for the last twelve measures. (As in other works of Ligeti's, the intervallic material has resolved into octaves and finally a unison "as though ironed flat," to use the composer's phrase.)[23] The $F♭_7$ completes what turns out to be another transformation of the opening signal of the piece. In the first two sections of the piece, the partitioned pi5 appeared twice, with a blurring between the two appearances; in both cases the signals appeared one interval at a time. In this last section a projection of the basic signal appears, with a blurring coming between its opening dyad (B_6–$C♯_7$) and the final pitch ($F♭_7$) (Example 10).

Continuum achieves balance through both symmetry and compensation. Symmetry appears in Section III's initial isometric projections ($D♯_5$, D_4) from the work's opening G_4–$B♭_4$, in the inversionally symmetrical cadential chords that end Sections II and III, and in the

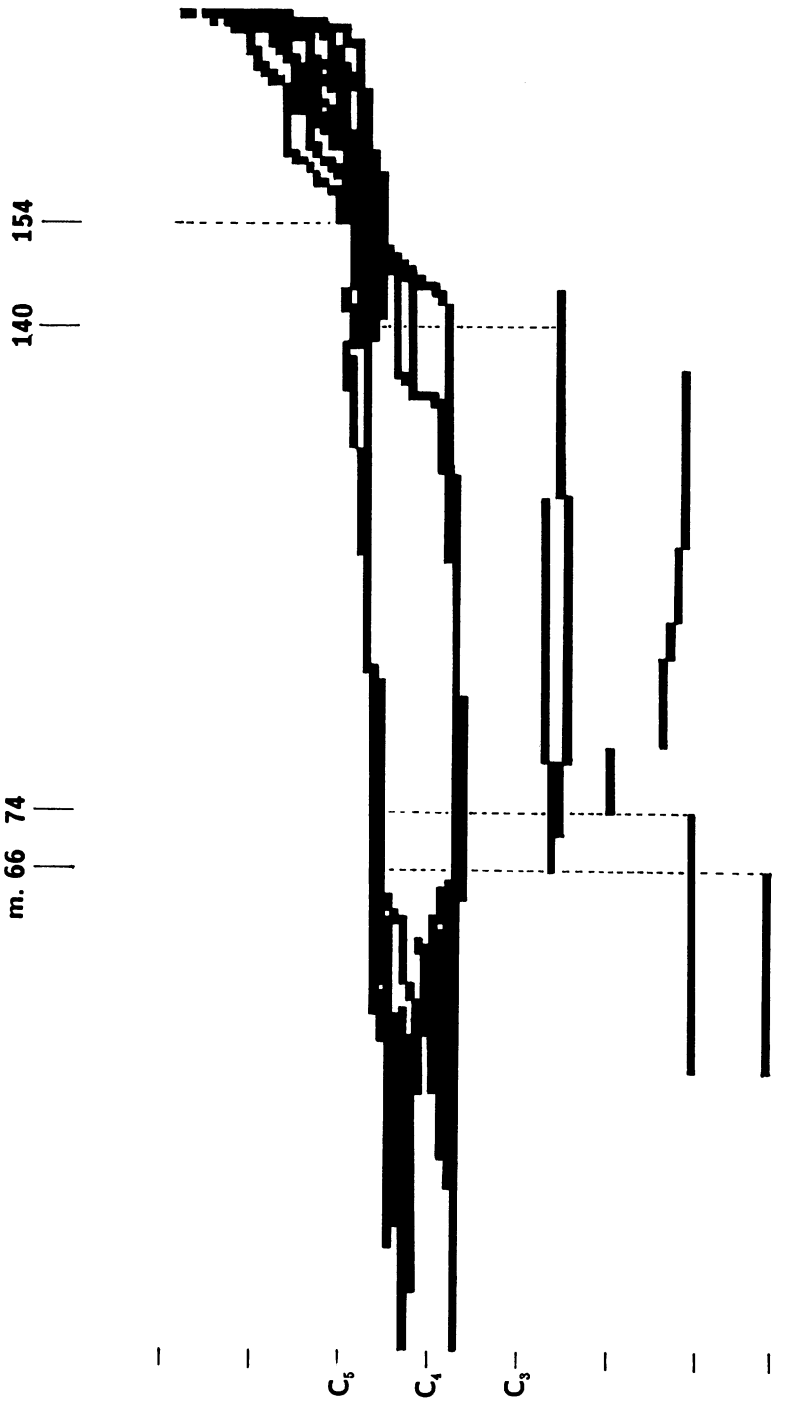


EXAMPLE 10

symmetrical partitionings of pi12 at the opening of Section IV. Compensation appears in the double exposition (with its reversals of partitioning of pi5), and, more importantly, in the overall progression of register. As the diagram of *Continuum* shows, the registral center of the piece descends steadily during the first four sections. The high register of the ending dramatically answers this descent, counterbalancing it in unequivocal terms.

If *Coulée* shares many of *Continuum*'s underlying principles, it also differs considerably at both the local and global levels. Like its predecessor, *Coulée* begins with a single oscillating interval, here a pi7. But *Coulée*'s opening interval turns out not to be a partition-interval (as in *Continuum*) but a boundary-interval, which is then partitioned.[24] The resulting trichordal signal, a perfect fifth divided into a tritone and a minor second (017, pi7 divided into 6+1), has two principal ramifications. First, the roles of intervals are clouded. By excluding pi1 from its signal, *Continuum* was able to reserve that interval for blurring; in *Coulée* blur-intervals and partition-intervals intermingle. Second, *Coulée*'s basic signal forms the least balanced partitioning of pi7 (6+1 rather than 5+2 or 4+3), instead of *Continuum*'s more balanced partitioning of pi5 (2+3 rather than 1+4). As we will see, that microcosmic imbalance seems to echo in the work's macrocosmic structure.

A comparison of Example 1 with a diagram of *Coulée* (Example 11) shows the formal correspondences and contrasts between the two works. Both open with single intervals, both have the obvious features of "mistiness" and "clearing up" (especially in their opening sections), both have moments of inversional symmetry (see especially the middle area of *Coulée*), and both reach their highest pitch at the end, following an openly spaced broad registral span. Yet, while *Continuum* has a strong sense of progression, connected with its forking expansion of range, *Coulée* seems convoluted, as though it were a dismantled and reassembled version of its predecessor. The one clearly drives toward cadences and evident formal thresholds, while the other suggests near continuous elision. *Coulée* seems more stable in its slow evolution of pitch-class content: the pitch classes of *Continuum*'s basic signal, for example, disappear early on



EXAMPLE 11

(though they recur later), while *Coulée*'s opening pitch class $A_\flat$ maintains a constant presence until the shifting of the final twelve measures.[25] In the first work the octave doublings (through changes in registration) have clear structural purpose, while in the second much of the registration is left indeterminate. (In the performance notes to *Coulée* Ligeti himself gives as acceptable registrations for the manuals various combinations of 2′, 4′, 8′, and even 16′ settings—reorienting the counterpoint of registers from one performance to another.)[26] Finally, the end of *Continuum* achieves a real equilibrium in its final high unison, which compensates for the lowering registral center of the rest of the piece; *Coulée* ends precipitously, amidst a dramatic, increasingly rapid ascent.

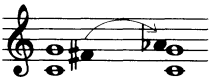
Coulée divides into three large sections and two brief passages at the junctures between them—"seams," as I will refer to them. The first two sections are broad and slow in their progression of events. Each of the two seams (marked by dotted lines on the diagram) provides some sort of elision of materials and a lifting of the bottom registral boundary up from the section that immediately precedes it. The third section, unlike the previous two, is short and progresses rapidly.

This parsing of the piece depends somewhat on the changing relationship between the organ manuals and the pedals. Throughout, the pedals contrast with the *meccanico* surface of the manuals by presenting only sustained tones. They double and blend with pitches played in the manuals until measure 39; they then break away to form a distinct lower layer in the texture, although Ligeti requires that they should still briefly "stay in the background." At the end of Section I Ligeti adds the notation that, "from this point on, the pedal registration is almost equal in volume to the manual registration, that is, it is no longer in the background." Throughout most of Section II the pedals take on a more active role, subsiding somewhat near the section's end. They fade altogether by measure 145 (the beginning of Seam II) and do not reappear for the remaining thirty-nine measures of the piece—the same distance from the end as their sudden appearance was from the beginning.

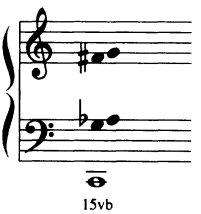
Section I (measures 1–65) functions as an exposition of both the basic intervallic materials of the piece and of the interdependent activity of the manuals and pedals. The basic signal is presented in the manuals (measures 1–14), then blurred through accretion and filling (measures 15–38). When all pitches between $A_{\flat 3}$ and F_4 are sounding except one (C_4), the pedals provide the equivalent pitch class by sounding C_0–C_1 (measure 39); the lower pitch of this octave is the furthest distance possible below the manuals' blurring and is indeed the lowest pitch in the piece. The appearance of this new layer establishes a distinct sense of registral imbalance: the upper portion of the texture now appears as a tight band

above a broad, open space below—a configuration resembling that of the basic signal itself.

After an expansion of the pitch compass (by accretion) and a "clearing up" (by gradually omitting pitches), the manuals finally stabilize on the pitches G_3–$A\flat_3$ and $F\sharp_4$–G_4, which, when set against the pedals, may denote two forms of the basic signal: the $F\sharp_4$–G_4 combines with the C_0 to form cpi6+pi1, while the G_3–$A\flat_3$ combines with the C_0 to form a cpi7+pi1—a kind of "unfolding" of the 6+1 idea (Example 12).[27] The resulting chord (Example 13) closes Section I.



EXAMPLE 12



EXAMPLE 13

At Seam I (measures 66–73), the 32′ stop (i.e., C_0) is removed. But the pedals begin to assert their place in the texture by presenting a projection of the basic signal, retaining the C_1, then adding G_2 and $F\sharp_2$.

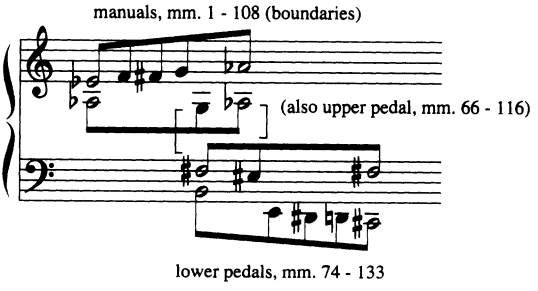
At the opening of Section II (measure 74), B_1 supersedes C_1 in the pedals, creating a new unfolding of the signal (B_1–$F\sharp_2$–G_2). The upper notes then shift outward isometrically by half-steps at measure 81 (Example 14).

EXAMPLE 14

The pedal motion of F♯$_2$ to E♯$_2$ against the sustained B$_1$ (measure 80) suggests a linear reference to the 017 structure of the basic signal (B$_1$–E♯$_2$, with respect to F♯$_2$, to which that voice in fact returns at measure 117). Meanwhile, the upper pitch of this shift (G♯$_2$) transforms that pedal voice into an octave doubling of the A♭$_3$ that has persisted in the manuals from the first measure; at measure 92, the center of the piece, A♭$_4$ appears as well. The resultant chain of open octaves in the upper part of the texture (measures 93–107) displays an expansion of the basic signal's boundary-interval from pi7 to pi12 (similar to what happens in Sections III and IV of *Continuum*).

Here, however, the "clearing up" of the upper layer into open octaves takes place against a separate gesture in the lower layer, a gesture enacted by the two lower pedal voices within the registral gap formed at the end of Section I. Following the isometric shift mentioned above (measure 80), the lowest voice in the pedals leaps down pi7 (B$_1$ to E$_1$, measure 83) and descends chromatically until, at measure 110, it arrives at C♯$_1$, whereupon the E♯$_2$ ascends back to F♯$_2$ (and the G♯$_2$ disappears, measure 117). A cpi5 remains (C♯$_1$–F♯$_2$); its lower boundary has been projected down cpi7 from the manuals' persistent A♭$_3$.[28]

The activity of the lower voices in the pedals in Section II corresponds somewhat to the motion of the pitch *boundaries* in the manuals during the piece's first half (measures 1–93). The manuals begin the piece on a pi7 and gradually raise the upper boundary until pi12 is reached (except for a brief, embellishing half-step drop in the *lower* boundary); in Section II the pedals begin on pi7, then expand the lower boundary until cpi5 is reached (except for a brief embellishing half-step drop in the *upper* boundary). Example 15 illustrates this in a skeletal form.



EXAMPLE 15

By the time the pedals stabilize on C♯1–F♯2, the manuals have already reactivated (displaying again the contrapuntal independence of

Coulée's two layers—one activates as the other relaxes). The manuals present an interlocked octave $A\flat_3$–A_3/$A\flat_4$–A_4 (measures 108–18), which is blurred through slight filling, accretion, and then shifting. Then, just as the pedals begin to fade, the manuals begin Seam II, the transition toward Section III. This transition (measures 140–53) aggressively lifts the lower boundary (cf. *Continuum*, Section V) and compresses the texture until a filled pi4 is reached ($F\sharp_4$–$B\flat_4$—cf. *Continuum*, the end of Section III).

At the beginning of Section III, the filled pi4 suddenly expands to a filled pi6 ($F\sharp_4$–C_5, measure 154). Thereafter (measure 159), the manuals begin the dramatic ascent to the highest notes of the piece, each hand playing primarily in disjunct tetrachords voiced as interlocked pi5s, pi6s, and pi7s. In the final three measures the harmonic rhythm accelerates prodigiously and the music rockets up in register—only to stop short "as though torn off." This final section compensates the previous section in at least two ways. First, it returns the texture to a dense single layer, refuting Section II's open-spaced dual layers. Second, it answers the descent of the pedals in the middle of the piece. But, by the inordinate haste of its ending, Section III actually seems to *overcompensate*, leaving the piece ultimately imbalanced, truly "torn off" in some way. That lingering sense of imbalance, of course, corresponds to the shape of *Coulée*'s basic signal as *Continuum*'s sense of balance did to its.

Nevertheless, despite its greater sense of balance, *Continuum* seems to generate more momentum than *Coulée*. As its diagram suggests, the former piece is continually weighted to the right, its textures carefully accumulating into cadential chords and climaxing at the golden section. The decidedly more layered and opaque *Coulée*, despite its greater sense of disequilibrium, offers little sense of direction via clear thresholds of form and points of arrival; rather than climax it offers horizontal symmetry in both the centered activity of the pedals and the transparency of a stack of octaves deployed at the piece's center.

What one should understand from the comparison of these two small works is that Ligeti's fundamental techniques of signalling, blurring, and so forth, are both consistent enough to create a comprehensible musical language and flexible enough to allow for a variety of plausible compositional designs. The consistency with which he uses certain methods accounts for the unmistakability of Ligeti's style. The inherent flexibility of the methods themselves accounts for the breadth of expression to be found beneath the articulative surface. By taking a correspondingly consistent yet flexible approach to his music—perhaps using terms and methods similar to those we have used here—we might continue to part some of the mist that surrounds Ligeti's music, discerning more clearly some of the constancies of process embedded in its attractive but variegated textures, and ultimately understanding his work less as a collection

of categories distinguished by surfaces and effects than as a vast "system of links among naïve musical ideas." It may be that the sum of his music will form a musically consistent network of the sort found in each piece, a sturdy, supple web of webs.

Notes

The author thanks Steven Johnson for his advice on earlier drafts of this article.

1. *György Ligeti in Conversation with Péter Várnai, Josef Häusler, Claude Samuel and Himself* (London: Eulenberg, 1983), 135. Ligeti discusses the origins of his fascination with *meccanico* technique in ibid., 17. *Coulée* is the second of Ligeti's Two Etudes for Organ; *Continuum* is an independent piece.
2. Of the two pieces, *Continuum* has received virtually all of the attention: see Paul Griffiths, *György Ligeti* (London: Robson, 1983), 63–65; and Franco Pulcini, "*Continuum*," in Enzo Restagno, ed., *Ligeti* (Turin: E.D.T./Musica, 1985), 145–48. Two other articles attempt to deal with pitch structures and musical allusions in *Continuum*: Uve Urban, "Serielle Technik und Barocker Geist in Ligetis Cembalo-Stück '*Continuum*': Untersuchung zur Kompositionstechnik," *Musik und Bildung* 5, no. 2 (1973): 63–70; and Hubert Wißkirchen, "Klausurbeispiel der Aufgabenart 'Analyse und Interpretation' (Ligeti: *Continuum*)," *Musik und Bildung* 16 (March 1984): 180–87. Other than brief comments in reviews of early performances, *Coulée* has gone quite unnoticed; it is treated very briefly in Griffiths, *Ligeti*, 64–65, and in Glenda Collins, "Avant-Garde Techniques in the Organ Works of György Ligeti," *Diapason* 73 (January 1982): 11. The notes to recordings of both works are useful primarily for their metaphorical descriptions—see especially the notes by Ove Nordwall and Hans-Christian von Dadelsen, Wergo CD 60161-50, and Josef Häusler, "Trompe-l'Orielle, Allusion, Illusion—Concerning Some Works by György Ligeti," trans. John Patrick Thomas, booklet in Wergo CD 60100-50, 11–13.

3. The quotation is from *Ligeti in Conversation*, 61; see also his similar comments in *Trackings: Composers Speak with Richard Dufallo* (New York and Oxford: Oxford University Press, 1989), 335. Ligeti comments on the parallel between this music and the music of Riley and Reich during the same period in Denys Bouliane, "Geronnene Zeit und Narration: György Ligeti im Gespräch," *Neue Zeitschrift für Musik* 149 (May 1988): 24–25.
4. *Ligeti in Conversation*, 65, 135, emphasis mine.
5. Häusler, "Trompe-l'Oreille," 12.
6. In István Szigeti, "A Budapest Interview with György Ligeti," *New Hungarian Quarterly* 94 (Summer 1984): 209.
7. *Ligeti in Conversation*, 124.
8. *Ligeti in Conversation*, 31.
9. See *Ligeti in Conversation*, 28–29. The "typical Ligeti signal" (with changing partitionings, inversions, and tritonal transpositions) dominates *Lux Aeterna* (1966). There are later incarnations as well: the fourth of his Etudes for Piano (1985), for example, contains a ceaseless eight-note ostinato consisting of the tetrachord 0245 and its transposition at the tritone.
10. *Ligeti in Conversation*, 60.
11. See the different but related list of "phases" through which intervals pass in Ligeti's *Apparitions*, in Jonathan W. Bernard, "Inaudible Structures, Audible Music: Ligeti's Problem, and His Solution," *Music Analysis* 6 (1987): 215.
12. I borrow the term "projection" here (as opposed to "transposition") from Jonathan W. Bernard, *The Music of Edgard Varèse* (New Haven and London: Yale University Press, 1987), 48. The visual implication in the term (itself derived from Varèse) seems to accord with Ligeti's characteristically visual metaphors for describing his music.
13. *Ligeti in Conversation*, 60.
14. Urban diagrams these relations ("Serielle Technik," 65).
15. *Ligeti in Conversation*, 60.
16. For comparable examples of basic signals that I believe are presented in this fashion, consider the third movement of the Second String Quartet, which opens with a pi2 to which another pi2 is attached—cf. Ligeti's reference to a favorite signal as "two major seconds on top of one another" (*Ligeti in Conversation*, 28).

17. The diagram was produced by graphing the occurrence of each pitch (vertical axis) in each measure (horizontal axis), then transferring the resultant shape onto a blank page. Urban ("Serielle Technik," 68–69) provides a similar diagram, but in two halves, with the second half turned sideways. Urban also fills in the held tones of the left hand in measures 143–49. Because I believe that these tones only provide resonance to the right hand pitches, I do not fill them in on the diagram.

18. Cf. Ligeti's admiration for Ernö Lendvai's golden section–oriented analyses of Bartók, in *Ligeti in Conversation*, 43. Ligeti has traced his own musical "genetic code" to Bartók's methods—see *Trackings*, 327–28.

19. Bernard defines "unfolding" in his *Music of Edgard Varèse*, 74. Inversionally symmetrical harmonies appear in Ligeti's works at least as early as the First String Quartet (1954)—see Bernard, "Inaudible Structures, Audible Music," 211–12.

20. Griffiths, *Ligeti*, 64.

21. *Ligeti in Conversation*, 29.

22. The sustained $C\sharp_7$ at measures 153–54 against the B_6–D_7 lacks the rhythmic activity one would expect in blurring. It may denote a partitioning rather than a blurring—thus, an "infolded" version of the original signal (pi2+1).

23. Cf. the end of the third movement of the Second String Quartet, which ends with a repeated unison that ends "as though torn off." Ligeti makes his "ironed flat" statement about his *San Francisco Polyphony* (*Ligeti in Conversation*, 44).

24. Ligeti presents signals in each of these ways in two other meccanico movements. The fifth movement of the Second String Quartet (1968), which opens with an oscillating pi3 ($D\sharp_4$–$F\sharp_4$), divides into 1+2 (by adding E_4), then is blurred by filling, accretion, and shifting, respectively (measures 1–17). Contrastingly, the second movement of the Double Concerto (1972) begins its signal (014) with oscillating pi3, to which is *added* (à la *Continuum*) a pi1.

25. The opening $A\flat_3$ lingers until measure 119; $A\flat_4$ persists throughout measures 92–170.

26. My diagram is based only on the actual pitches and stops specifically designated in the score.

27. I take the liberty here of applying "unfolding" to a structure containing a cpi—not part of Bernard's formulation.

28. Moreover, the $C\sharp_1$ itself may complement the opening C_1–$F\sharp_2$–G_2 by, in effect, suggesting an inverse partitioning of the boundary-interval C_1–G_2—a plausible ending to the pedals' layer of the music?