Analysis of Webern op. 5/2 using Lewinian Transformations

1. Summarize his analysis of op.5/II: write out his network, identifying the T_n and I_n labels.

Lewin is interested in seeing how particular sets of pitch-classes change into other pitch-class sets through the course of this piece, calling that process "transformation". The main motive used by Lewin is culled from the opening notes of the viola line and includes the pitches {G,B,C#}. Lewin calls this pitch-class set "X". In order to track the progress of this X motive through the piece (or rather the first four bars of the piece), Lewin begins to identify and label all of the transpositional and inversional functions that conceivably happen to the motive. By doing this, he is ostensibly showing the reader how Webern moves a single idea smoothly forward in the music, permeating all of the voices. The transpositional procedures discussed by Lewin are summarized in Table 1 below; I have converted his slightly confusing and inconsistent inversional transformational labels (such as I(X), J(X), and K(X)) into more standard T_n/I_n labels. I should also mention that I have adopted the label <V> to represent pitch-class {B} in mod-12 notation, as I feel the use of letters that have parallels in the musical scale (such as A, B, E) opens the possibility for unnecessary confusion; therefore, my ordered mod-12 aggregate is represented by <0123456789TV>.

***Table 1**: Summary of Lewin's transpositional procedures for Webern op.5/II*

Unord'd PCs	Ordered PCs	T_n-class	set-class	Lewin's label	T_n/I_n label
{G,B,C#}	<17V>	P_7[046]	I_1[026]	T_0(X)	T_0(X)
{E*b*,G,A}	<379>	P_3[046]	I_9[026]	T_8(X)	T_8(X)
{A,F,E*b*}	<359>	P_3[026]	T_3[026]	I(X)	I_4(X)
{F,C#,B}	<15V>	P_{11}[026]	T_{11}[026]	J(X)	I_0(X)
{B,G,F}	<57V>	P_5[026]	T_5[026]	K(X)	I_6(X)
{C#,F,G}	<157>	P_1[046]	I_7[026]	T_6(X)	T_6(X)
{A,C#,E*b*}	<139>	P_9[046]	I_3[026]	T_2(X)	T_2(X)
{F,A,B}	<59V>	P_5[046]	I_{11}[026]	T_{10}(X)	T_{10}(X)

Many of Lewin's transformations are easily seen on the surface of the piece, but others are a little more deeply buried. For example, by including the second violin and cello notes from bar 2 into one trichord, which he recognizes as T_8(X), Lewin is obviously making a simple distinction as to how the accompaniment has been formed out of an earlier melodic motive. Other related trichords, though, may not be so obvious. In bar 3, Lewin points out how the {C#} in the viola line combines with the {A} in the second violin line and {E*b*} in the cello dyad to create a T_2(X) transformation. Thus, Lewin is creating transformational sets not just from notes that sound at any given moment during the piece, but also from potential linear instances of the motive and appearances of the motive in a general area of the music.

Once Lewin has captured all of the transformations undergone by this motive in the first four bars of music, he creates a graph to show how these transformations have morphed the motive through the music. I have recreated Lewin's graph in my Example 1, substituting the more common T_n/I_n labels for his own and filling in the specific PCs where he only gives transformational equivalents. Lewin's graph forms a closed network (or full-cadence?) in that the opening X motive, through transformational twists and turns of various routes, eventually reverts back to its initial state by the end of bar 3. Lewin is also able to show the persistence of each form of the motive by changing the size of the bubbles (or "nodes") that contain the PC representatives. Thus, <379>, which is prolonged through bars 2 and 3 by the cello and second violin chords, exists in a longer container ("node") in his graph to help give durational information to the transformations shown, thereby also giving information as to the relative importance of each transformation on the surface of the music.

2. Define a transformation graph and transformation network and how they are used

A transformation graph depicts a chain of processes (or functions) to which a musical object can be subjected. These musical objects can be single notes, sets of notes, or transformational processes themselves. The transformation graph includes nodes and arrow-relationships, the former akin to subway stops and the latter like the underground subway lines between them (to use a Headlam metaphor). The musical objects exist and live in the nodes, whereas transpositional and inversional methods create the arrow-relationships by taking the information in one node and "transforming" into the information in the corresponding node. Lewin's Figure 9 shows a very simple example of a transformation graph, with Figure 8 showing the graph for the Webern piece. It should also be mentioned that Lewin is careful to point out that the arrow-relationships never go from right to left, as they are meant to indicate musical processes occurring over the course of a work (unfolding in a forward direction in time).

A transformation network is simply a populated transformation graph, in which the nodes are filled with musical objects (notes, transformations, etc.). Lewin's Figures 6 and 9 are thus networks in that they include examples of musical objects undergoing the transformations depicted in the graphs. The power of a transformation graph is that it can become a variety of different networks. For instance, Lewin also shows how another motive he calls Y, consisting of PCs {G,B,C,C#}, can also be used to instantiate the basic Figure 8 graph for the opening bars of Webern op. 5/II. Therefore, Lewin seems to imply that for a transformation graph to be valid for a piece of music, it should withstand multiple network iterations.

*One thing on which I would like to briefly comment, something that Lewin does not discuss since it may be too remedial, is the method for calculating multiple nested transformations. Because transformations can act on other transformations as well as musical notes, an easy way to confirm the results of nested transformations would be useful. Nested transformations are at the heart of a transformation graph, since following any number of arrow-relationships greater than one inherently implies multiple (i.e. nested) transformations. Calculating $I_6(T_8(I_2(T_4(X))))$ can be a time-consuming activity, especially if X is a large set of notes.

Thus, it would seem best to define $T_n(X)$ as a function in mod-12 space, such that:

$$T_n(X) = X + n$$

Similarly, we could define $I_n(X)$ as a function in mod-12 space, such that:

$$I_n(X) = -X + n$$

With these two definitions, we can easily calculate a long string of transformations:

Problem: $I_6(T_8(I_2(T_4(X)))) =$

Solution: $T_4(X) = X + 4$

$$I_2(X + 4) = -(X + 4) + 2 = -X - 4 + 2 = -X - 2$$

$$T_8(-X - 2) = (-X - 2) + 8 = -X - 2 + 8 = -X + 6$$

$$I_6(-X + 6) = -(-X + 6) + 6 = X - 6 + 6 = X$$

Therefore, $I_6(T_8(I_2(T_4(X)))) = T_0(X)$. If the result had been $(-X + 2)$, then it would have equaled $I_2(X)$. By mod-12, if the result had been $(X + 14)$, then it would have equaled $T_2(X)$, and similarly, (-X - 4) would equal $I_8(X)$. Some simple algebra can thus simply and easily connect far-estranged nodes on a transformation graph.

3. Summarize the approaches to op. 19/VI of Schoenberg

In his approach to Schoenberg's op. 19/VI piece for piano (specifically *not* an analysis according to him), Lewin is concerned not by literal transpositions and inversions, but rather by those transpositions and inversions that approximate the transformational process seen in the course of the music. For example, the first two trichords in the piece, {A,F#,B} in the right hand and {G,C,F} in the left hand, are unrelated by any direct T_n/I_n operation. However, Lewin notices how the first trichord includes an interval-class 2 between {A,B} as well as an interval-class 5 between {F#,B}; similarly, the second trichord includes an interval-class 2 between {G,F} and an interval-class 5 between {G,C} and {C,F}. Thus, despite the two trichords belonging to separate set-classes, the trichords share similar intervallic content, an attribute that Lewin seeks to express somehow.

In order to express this relationship, Lewin lists those transpositions and inversions that map the most members of the first trichord to the second. In each case, two notes from the first can be mapped to the second. He finds six total transformations that can affect this close mapping, three of which are transpositions (T_1, T_6, T_8) and three of which are their inversionary complements (I_{11}, I_6, I_4 respectively), although Lewin does not explicitly mention this complementary relationship for some reason. In fact, Lewin relies on the strange labels I(X), J(X), K(X) here, too, like the Webern analysis, although the letters now denote different inversion functions than they did previously in the article.

Since each transposition and inversion process can only map two of the three notes of the trichord to the second, Lewin posits a ghost note for both the first and second trichord of each transformation that could have allowed a literal transformation to/from each trichord from/to the other. These supplemental notes, according to Lewin, display "lusts" and "urges" that create musical tensions and potentials realized only later in the piece. Thus, the {D#} and {E} notes in bar 3 supposedly arise from the implicit members of transformations between the first two chords that should have existed were these transformations literal. Whether or not missing members of implied transformations are audible musical entities (or were an original compositional resource) seems tenuous, but this little piece does appear to cleanly support Lewin's assertion.

Lewin goes on to distinguish "external, progressive, kinetic" transformations from "internal, dynamic, static" transformations, the former occurring between musical objects with the latter occurring within a musical object. Thus far in his discussion of the piece, Lewin has been concerned with the external type of transformation. However, he sets up a transformation network involving the ways in which the notes of the second trichord ({F,C,G}) can map onto one another in Figure 22, and then shows how the original external transformations (such as T_1, T_6, T_8) can exist within this internal transformation network. Therefore, Lewin argues that the isography of the implicit transformations between the first two trichords as well as the isography internal to the second trichord are the same. In a sense then, the structure of the second trichord can be seen as "thematically prolonged" by the external transformations.

4. Go back and find/summarize group structures.

On page 326 of his article, Lewin states: "The graph of Figure 8 is 'connected'...[which] enables us to infer the operand-content of all nodes....In this connection, we are implicitly invoking the fact that the family of operations at issue forms a mathematical 'group'." It seems, then, that Lewin is stating the transformations of his graph form a group, yet particular members of his graph in Figure 8 do not include inverse transformations anywhere on the graph. For example, T_4 and T_{10}, both preceding the final node, should have as complementary inversions I_8 and I_2 respectively, but these inversions do not appear in his transformation graph. Therefore, I would surmise that his operations are members of a larger group. The smallest collection of transpositions and inversions that form a valid group structure to which all of Lewin's transformations belong would be the D6 group, expanded below in Table 2:

Table 2: *Group structure for D6 group*

$T_0(X)$	**$T_2(X)$**	**$T_4(X)$**	**$T_6(X)$**	**$T_8(X)$**	**$T_{10}(X)$**	**$I_0(X)$**	**$I_2(X)$**	**$I_4(X)$**	**$I_6(X)$**	**$I_8(X)$**	**$I_{10}(X)$**
$T_2(X)$	$T_4(X)$	$T_6(X)$	$T_8(X)$	$T_{10}(X)$	$T_0(X)$	$I_{10}(X)$	$I_0(X)$	$I_2(X)$	$I_4(X)$	$I_6(X)$	$I_8(X)$
$T_4(X)$	$T_6(X)$	$T_8(X)$	$T_{10}(X)$	$T_0(X)$	$T_2(X)$	$I_8(X)$	$I_{10}(X)$	$I_0(X)$	$I_2(X)$	$I_4(X)$	$I_6(X)$
$T_6(X)$	$T_8(X)$	$T_{10}(X)$	$T_0(X)$	$T_2(X)$	$T_4(X)$	$I_6(X)$	$I_8(X)$	$I_{10}(X)$	$I_0(X)$	$I_2(X)$	$I_4(X)$
$T_8(X)$	$T_{10}(X)$	$T_0(X)$	$T_2(X)$	$T_4(X)$	$T_6(X)$	$I_4(X)$	$I_6(X)$	$I_8(X)$	$I_{10}(X)$	$I_0(X)$	$I_2(X)$
$T_{10}(X)$	$T_0(X)$	$T_2(X)$	$T_4(X)$	$T_6(X)$	$T_8(X)$	$I_2(X)$	$I_4(X)$	$I_6(X)$	$I_8(X)$	$I_{10}(X)$	$I_0(X)$
$I_0(X)$	$I_2(X)$	$I_4(X)$	$I_6(X)$	$I_8(X)$	$I_{10}(X)$	$T_0(X)$	$T_2(X)$	$T_4(X)$	$T_6(X)$	$T_8(X)$	$T_{10}(X)$
$I_2(X)$	$I_4(X)$	$I_6(X)$	$I_8(X)$	$I_{10}(X)$	$I_0(X)$	$T_{10}(X)$	$T_0(X)$	$T_2(X)$	$T_4(X)$	$T_6(X)$	$T_8(X)$
$I_4(X)$	$I_6(X)$	$I_8(X)$	$I_{10}(X)$	$I_0(X)$	$I_2(X)$	$T_8(X)$	$T_{10}(X)$	$T_0(X)$	$T_2(X)$	$T_4(X)$	$T_6(X)$
$I_6(X)$	$I_8(X)$	$I_{10}(X)$	$I_0(X)$	$I_2(X)$	$I_4(X)$	$T_6(X)$	$T_8(X)$	$T_{10}(X)$	$T_0(X)$	$T_2(X)$	$T_4(X)$
$I_8(X)$	$I_{10}(X)$	$I_0(X)$	$I_2(X)$	$I_4(X)$	$I_6(X)$	$T_4(X)$	$T_6(X)$	$T_8(X)$	$T_{10}(X)$	$T_0(X)$	$T_2(X)$
$I_{10}(X)$	$I_0(X)$	$I_2(X)$	$I_4(X)$	$I_6(X)$	$I_8(X)$	$T_2(X)$	$T_4(X)$	$T_6(X)$	$T_8(X)$	$T_{10}(X)$	$T_0(X)$

Other sub-groups exist within this larger D6 group, all of whose members are included in Lewin's transformation graph of the first four bars. For instance, one could create a group structure around T_4 and T_8 if one assumes $T_0(X)$ is implicitly stated; therefore, the C3 group structure exists in the beginning of the piece. As well, T_0 and T_6 combine to make a C2 subgroup. One can also pull a D2 subgroup out of Lewin's transformation graph using T_0, T_6,I_0, and I_6 as its members. Finally, the C1 and D1 groups are self-evident. The complete list of explicit groups in Lewin's transformation graph is thus comprised of C1, C2, C3, D1, and D2, with each being a subgroup of the implied D6 group.

Finish Lewin's analysis of Webern's op.5/2–is 026 pervasive throughout, or does another set-class (like [025]) come to the fore? What's the big picture of the piece? Add your own analysis of the piece.

Looking at Lewin's Figure 6 from page 320 of his article, one is confronted by a fairly complex web of arrows, nodes, and transformation functions. What may not be obvious at first glance is that all the transpositions and inversions in this network are *even*-order transformations. Moreover, the motive "X" upon which these transformations are acting is a set-class including only *even*-order members ([026]). Thus, this entire network is merely showing relationships among six pitch-classes, all of which are members of a single whole-tone scale starting on {C#}. Conversely, Figure 6 does not include any pitch-classes from the first four bars that are not members of the C#-whole-tone scale, i.e. the excluded pitch-classes all belong to the whole-tone scale beginning on {C}. It would seem to me, therefore, that Lewin has implied a compositional tension in the Webern piece between one whole-tone scale and its complement. In fact, since a complete whole-tone scale can be created from just two [026] sets (the first at T_0 and the second at I_{10}), Webern can easily interlock [026] sets to create whole-tone scales as well as other hexachords, some of which become important later in the piece.

To better allow a visual representation of these opposing whole-tone scales, I have sectioned off notes from the piece in my Example 2 into distinct blocks of whole-tone material. Certainly at the beginning of the work, the dominance of the C#-whole-tone (C#-wt) scale can be easily seen. Lewin develops ways to explain those notes belonging to the C-wt scale that will not conform to his transformation graph theory, citing them as centers of inversion, but perhaps Webern's techniques are a bit simpler. As Lewin has already shown, [026] plays an important role in these first few bars. Is it by coincidence, then, that those notes outside the predominant C#-wt scale in these measures neatly fall into their own [026] sets as well? For example, the {A*b*,D,E} pitch-classes, which are the first members of the C-wt scale that appear in the piece, create [026]; similarly, the{C,A*b*,F#} pitch-classes from the C-wt scale that follow in the viola line also create [026]. Therefore, if one is committed to viewing [026] as a germinal set-class here, one also has to admit how Webern surrounds those sets from the C#-wt scale with similar sets from the C-wt scale. The final chord in bar four {F#,B,G,B*b*} might even be seen as harkening back to the opening, where outer voices belonged to the C-wt scale and inner voices to the C#-wt scale.

As my Example 2 also shows, though, the relative dominance of the C#-wt scale does not persist much past bar 4. At this point, the conflict between the two opposing whole-tone scales becomes more prominent. In fact, bars 5-13 arguably form a complete musical section that balances the first four bars of the piece. This division is supported by the tempo markings that Webern uses, as both mm. 4 and 12-13 include ritards that signal the end of the sections. The pitch-class content of the piece also supports this division, though. Lewin has already proven how in bar 4, Webern returns to his original set-class from the beginning of the work. In my Example 3, I show how bar 5 begins with the same [013467] set-class as the hexachord that ends the piece.

This new section in bar 5 shows relatively equal stature given to each whole-tone collection. The [013467] bookending hexachord itself in bar 5 arises from the [026] sets of both whole-tone scales being intertwined (notice how [013467] includes both <046> and <137>). In a sense, this interleaving effect mimics the way that two [026] sets can be interleaved to create the whole-tone scale itself. In the phrase between bars 5 and 6, we can also see in Example 3 how two nearly complete whole-tone scales are put in conflict with one another, as a [02468] set-class appears in the second-violin (also derived from two interlocked [026] sets) above complementary [02468] material in the viola and cello parts.

Looking forward to the [013467] hexachord at the end of the piece, the conflict between the two whole-tone scales seems to have morphed into something different. In bars 12-13, the second violin line is composed of an [025] set-class while the viola and cello form [037]. Webern has thus taken the [013467] hexachord that arose out of whole-tone material and reinterpreted it as pentatonic [025] material against triadic [037] material. In other words, something old has become something new.

But how does Webern affect this shift from a primarily whole-tone based palette to a reinterpretation of [013467]? Measures 7-9 are the key. In this area, Webern plays with the differences and similarities between the [026] set-class that underpinned the previous bars of the piece and the [025] trichord that ends the work. Interval-class 2 is the common element, and this interval-class acts as a sort of glue to form the second violin's ostinato through these transitional bars. Interval-class 4 (deriving from [026]) and interval-class 3 (deriving from [025]) consequently dance between the first violin, viola, and cello parts as little motivic figures in bars 8-10. Notice how {A,C#} and {D,F#} in the first violin and viola are answered by {G,E} and {F#,E*b*} in the first violin and cello fragments that follow. In fact, by moving away from interval-classes 2 and 4 to interval-classes 2 and 3, Webern has now extracted himself from the motivic confines of a single whole-tone scale and can fully integrate notes from both whole-tone scales more easily into the string lines. Thus, by the end of the piece, the blocks of whole-tone material that determined pitch content for areas at the beginning of the work are now merged into a sound field permeated by members of both whole-tone collections. In a sense, then, the conflict between the two collections has been resolved through the course of the work.

WORKS CITED

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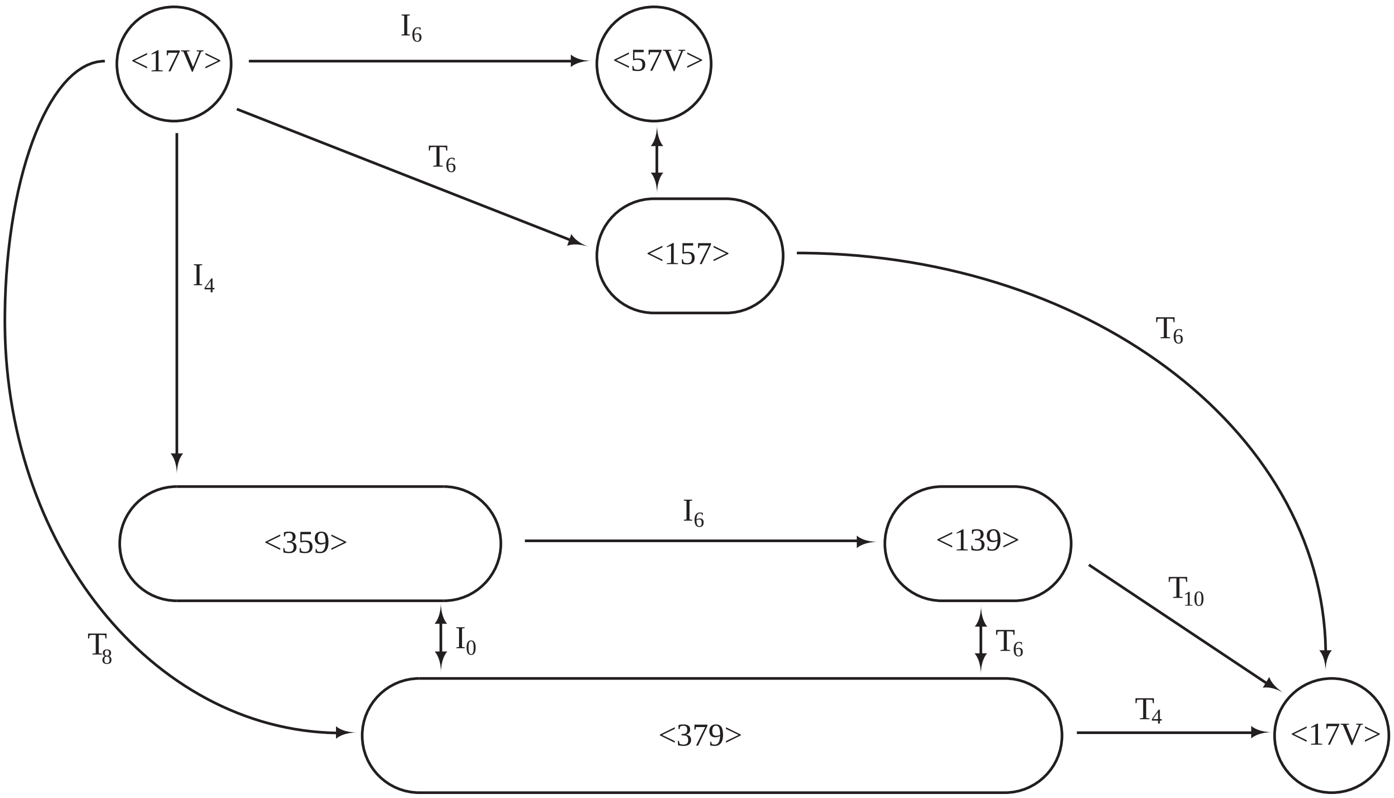
Example 1: Lewin's *Figure 6*, revised to include PC information and more standard transformational notation



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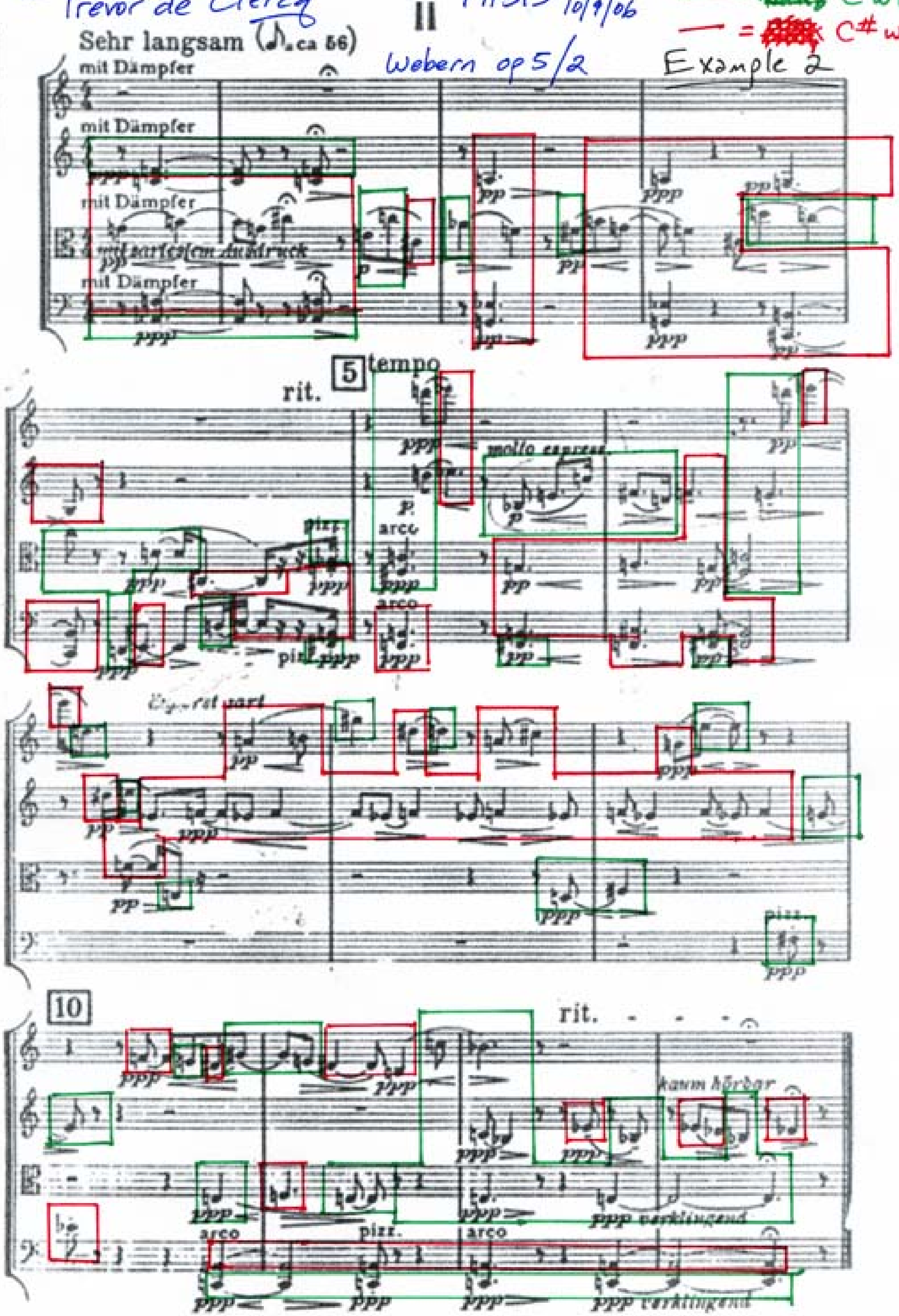
— = C wt

— = C# wt

Webern op 5/2

Example 2



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Webern op5/2

— = [02468]
— = [013467]
— = [014589]

Example 3