Transformations of BACH in Webern's Op. 16, No. 4

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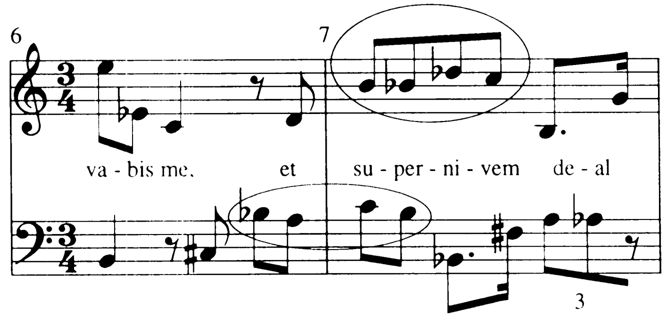
Several features of Webern's canon op. 16, no. 4 for soprano and bass clarinet provide pattern and structure for the listener, yet are not obviously related to one another. However, each of these features can be related in some way to the BACH motive, the familiar motive Webern and many other composers have used as a tribute to J. S. Bach's musical genius and contrapuntal mastery. In this canon, Webern uses the BACH motive not only as a source for melodic motivic ideas, but also as a source for structural ideas. As shown in Example 1, the BACH motive is heard just once in each line near the middle of the canon during mm. 6–7, as B♭–A–C–B in the clarinet imitated by B–B♭–D♭–C in the voice.[1] As a surface melodic gesture, the BACH motive is not particularly noteworthy, yet structural features derived from the BACH motive permeate the canon, allowing relationships among disparate musical patterns to be understood.

Example 1. BACH motive in mm. 6–7 of Webern's canon op. 16, no. 4.



[1]The bass clarinet sounds as written in Webern's score and on all examples in this paper.

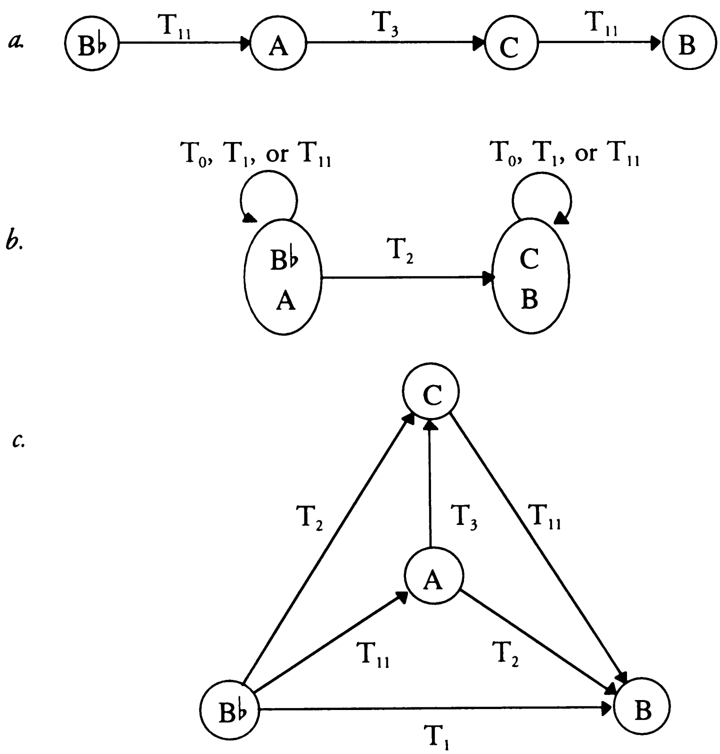
The BACH motive can be represented by five related transformation networks, as shown in Figures 1 and 2.[2] Each of the five interpretations of the BACH motive highlights different structural properties of the motive: Figure 1a displays the motive as a succession of three melodic intervals, Figure 1b divides the motive into two similar dyads, focusing attention on the intervallic relationship between the two dyads, and Figure 1c provides a more complete picture of the motive, combining features of both Figures 1a and 1b. Figure 2a models the BACH motive with a more streamlined structure extracted from Figure 1c, a "product network" involving T_{11} in one dimension and T_2 in the other.[3] Figure 2b shows the BACH motive as a product network involving T_1 rather than T_{11} in one dimension by using the arrows to model going up in register rather than forward in time. The network of Figure 2b is paradigmatic for the canonic structure of the piece. Specifically, any two successive notes in the clarinet, together with the two answering notes in the voice, must project a similar graph—that is, a four-node product graph in which one of the operands is T_1. Figure 3 shows the generic product network involving T_1 in one dimension and T_n in the other, where n is the interval between successive notes in each part. Structures modeled by Figure 3 occur over and over, as dictated by the canonic rule. In addition, Webern emphasizes similar networks in other ways throughout the piece.

Two gestures from Webern's canon are striking in that they are similar in many ways, yet not identical. Example 2 shows both the first gesture, the opening four-note motive in the bass clarinet with its answer in the vocal line, and the second gesture, heard in

[2]Transformation graphs and networks are defined by David Lewin in chapters 7–10 of *Generalized Musical Intervals and Transformations* (New Haven, CT: Yale University Press, 1987).

[3]Lewin uses the concept of a "product network" to model similar structures in *Generalized Musical Intervals and Transformations*, pp. 204–206 and 235. Richard Cohn provides an extensive discussion of the related transpositional combination property in "Inversional Symmetry and Transpositional Combination," *Music Theory Spectrum* 10 (1988): 19–42. George Perle discusses symmetric tetrachords in *Serial Composition and Atonality* (Berkeley and Los Angeles, CA: University of California Press, 1991), pp. xi–xiii, 16–18.

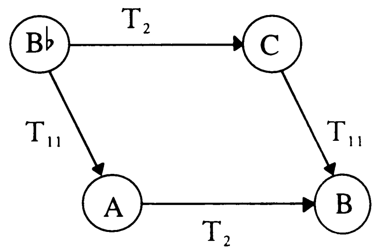
Figure 1. Transformation graphs modeling the BACH motive.



mm. 5–6. Both gestures share the same rhythmic and metric structure, set parallel phrases of the Latin text, and have the same dynamic contour. These surface features of the music make it easy to relate the gestures. Yet other less obvious aspects of the musical structure, also derived from the BACH motive, provide even stronger links between these two gestures as well as among many others heard throughout the short canon.

Figure 2. Product networks modeling the BACH motive.

a.



b.

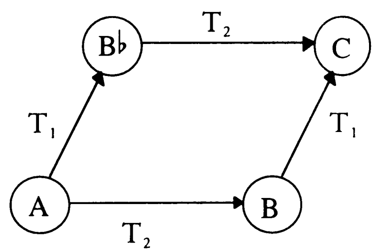
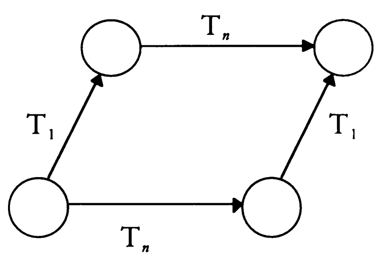
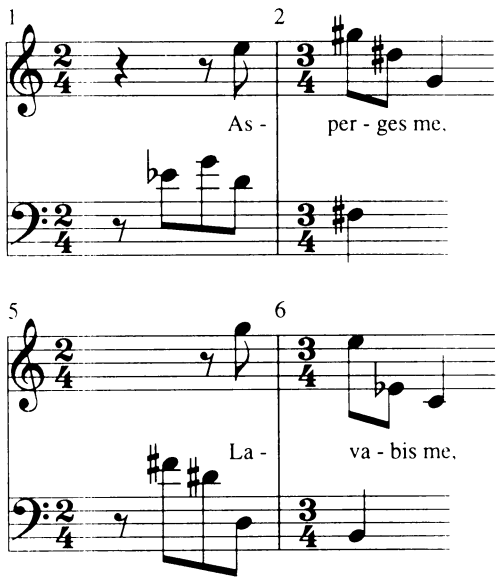


Figure 3. Product network modeling the canonic structure.



The gestures shown in Example 2, "*Asperges me*" and "*lavabis me*," are represented by the transformation graphs in Figures 4 and 5. Figure 4a shows the "*Asperges me*" gesture in the clarinet line alone with a NODE/ARROW system similar to that of Figure 1b. Figure 4b models the "*Asperges me*" gesture in the clarinet line alone with a product network similar to that of Figure 3. The variable T_n of Figure 3 equals T_4 in Figure 4b. Figures 4c and 4d show the "*Asperges me*" gesture as presented by the clarinet and voice together with a NODE/ARROW system and product network similar to those of Figures 1c and 3 respectively.

Example 2. Similar gestures in mm. 1–2 and mm. 5–6 in Webern's canon op. 16, no. 4.



The "*Asperges me*" gesture in Figure 4a could be displayed with NODE/ARROW systems similar to Figures 1a or 1c as well. However, displaying Figure 4a with a network related to Fibure 1b shows further connections. The relation illustrates how the clarinet gesture, when combined with the vocal imitation, becomes part of a larger NODE/ARROW system, shown as Figure 4c, which is similar to the NODE/ARROW system of Figure 1c. Likewise, the product network of Figure 4b is embedded within the product network of Figure 4d. In fact, two such systems or networks, one in the clarinet, and one in the voice, are embedded within the NODE/ARROW system of Figure 4c or product network of Figure 4d. In short, each NODE in Figure 1c contains a single pitch, while each node in Figure 4c contains a dyad. The product network of Figure 4d would be best represented by a three-dimensional structure, with T_4 in one dimension, T_1 in the second dimension, and T_1 in the third dimension.[4]

Figure 4c highlights several audible aspects of the "*Asperges me*" gesture. The first two pitch classes in the clarinet are repeated as the final two pitch classes of the soprano line, as shown by the T_0 arrow on the transformation graph. The parallel "major seconds" heard between the last two pitches of the clarinet line and the first two pitches of the soprano are represented by the T_2 arrow in the middle of the transformation graph.

The similarity between the NODE/ARROW systems of the BACH motive (Figure 1c) and the "*Asperges me*" gesture (Figure 4c) provides one way to articulate the elusive relationship between these two elements of the canon. The structural similarity between the product network of Figure 3 and the product networks of Figures 4b and 4d articulates the same relationship in a slightly different way.

Similarly, the BACH motive and the "*lavabis me*" gesture are related. The relationship is revealed by comparing the NODE/ARROW systems shown in Figures 1 and 2 with those of Figure 5. It is interesting to note that the product network that models the "*lavabis me*" gesture in the clarinet line alone, Figure 5b, does not involve T_1 or T_{11} in either dimension. The relationship between this gesture and the BACH motive is articulated by their shared product network structure alone. The three-dimensional product network structure for the "*lavabis me*" gesture, shown in Figure 5d, does involve T_1 as the canonic interval.

[4]Cohn defines this as the recursive property of transpositional combination in "Inversional Symmetry and Transpositional Combination," *Music Theory Spectrum* 10 (1988): 29–30.

Figure 4. Transformation graphs of the "Asperges me" gesture.

a.

b.

c.

d.

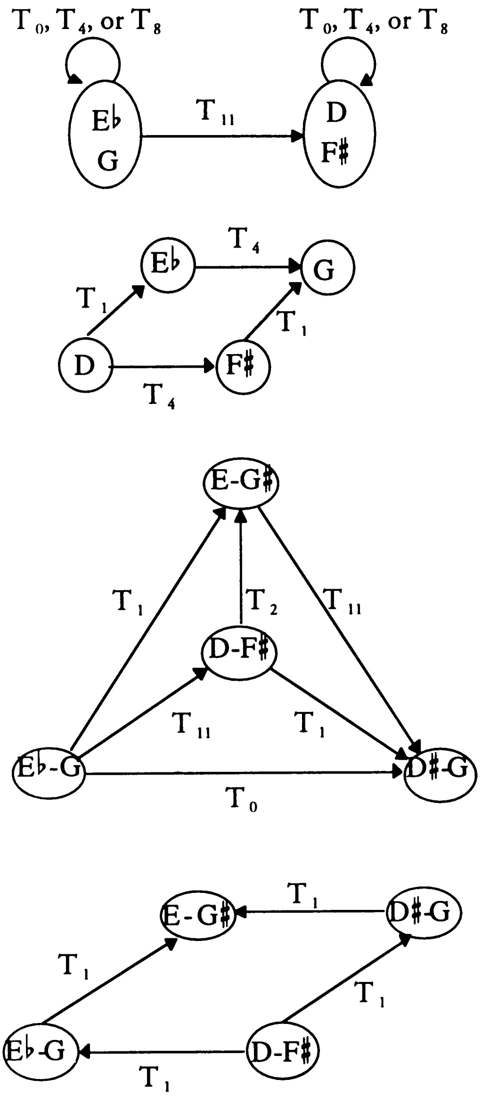
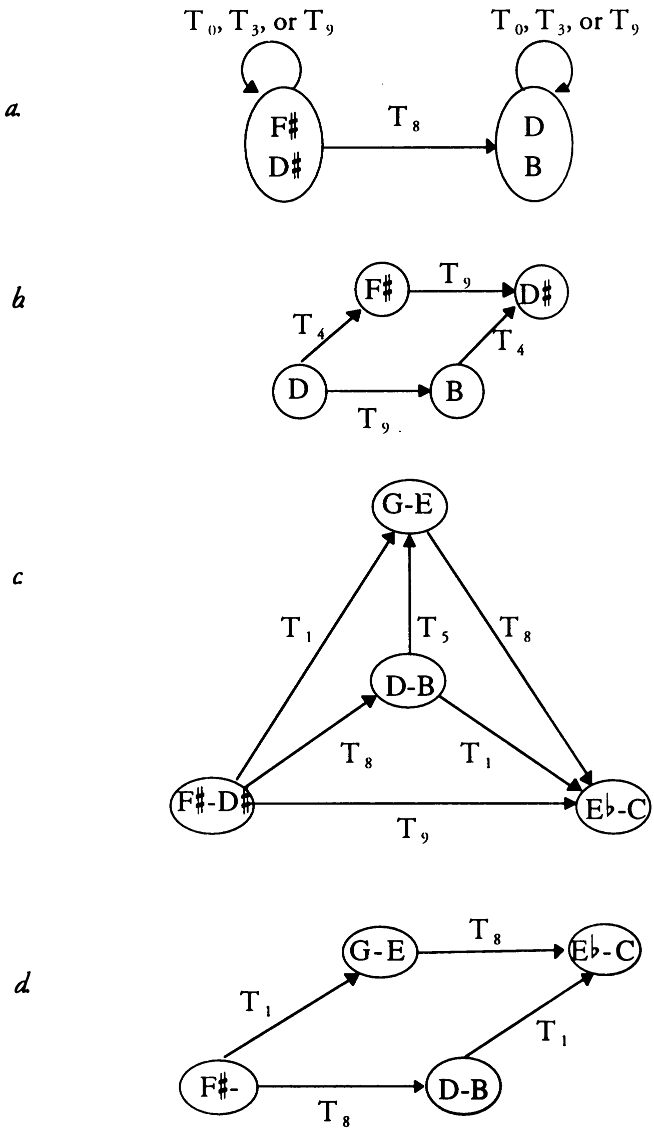


Figure 5. Transformation graphs of the "lavabis me" gesture.



The NODE/ARROW systems for the "*Asperges me*" and "*lavabis me*" gestures are also similar, although the first and last dyads of the "*lavabis me*" gesture are not invariant as they were in the "*Asperges me*" gesture. Still, the center of the gesture exhibits parallel motion between the clarinet and voice, in this case at pitch-class interval 5, or parallel fourths. Again, as in the "*Asperges me*" gesture, this parallelism is an audible feature of the musical surface.

Equivalent structures are heard throughout the piece whenever a four-note gesture in one line displays a symmetric pattern of melodic intervals. Figure 6 shows the melodic intervallic structure of the soprano line for the entire canon. The soprano's text is shown on the figure to assist the reader in locating each symmetric gesture in the music. Each four-note motive that displays a symmetric pattern of melodic intervals is marked on the figure. The canonic structure dictates that for each of these four-note gestures in the clarinet and its imitation in the soprano, transformation graphs and product networks can be drawn that are modeled in Figures 1, 2, and 3, which represent the BACH motive. None of these gestures, however, is highlighted musically as clearly as are the "*Asperges me*" and "*lavabis me*" gestures.

As shown in Figure 6, two passages during the canon, the final gesture "*misericordiam tuam*" and the passage in mm. 7–9 setting the text "*dealbabor. Miserere*," do not contain a four-note pattern of symmetric melodic intervals. Still, slightly more complicated structures related to the BACH motive are present during these passages. The final gesture, ending with one of just three melodic tritones heard in the canon, seems to evaporate into silence. The clarinet line from the final gesture, shown in Example 3, contains two pairs of related trichords, set-classes [016] and [014], which are shown on the example with beams above and below the pitches. Similarly, the same trichords, transposed up one half-step, are heard in the vocal line. The transformation graphs shown in Figure 7 are both similar to the transformation graph of Figure 1c. However, each node contains a trichord in Figure 7 (set-class [016] in Figure 7a and set-class [014] in Figure 7b), not a single

Figure 6. Melodic intervallic structure of the soprano line (pitch classes), with symmetric patterns underlined.

text: As- per- ges me Do- mi- ne, hys- so- — po, et mun- da- bor: la- va- bis me, et [su-]
soprano: 4 8 3 7 2 10 1 0 6 5 2 10 0 9 8 7 4 3 0 2 11
intervals: *4 7 4 7 8 3 11 6 11 9 8 2 9 11 11 9 11 9 2 9*

- -

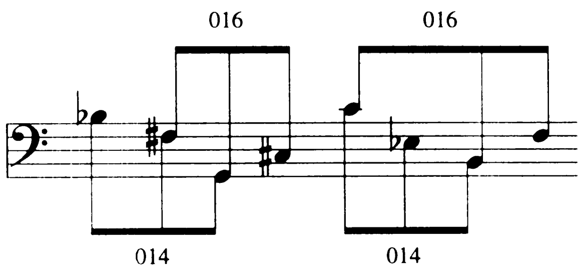
text: su- per ni- vem de- al- ba- bor. Mi- se- re- re me- i, De- us, se- [cun]
soprano: 11 10 1 0 11 7 10 9 5 0 3 2 10 9 8 7 6 1
intervals: *11 3 11 11 8 3 11 8 7 3 11 8 11 11 11 11 7*

- -

text: cun- dum mag- nam mi- se- ri- cor- di- am tu- am.
soprano: 1 4 0 3 11 7 8 2 1 4 0 6
intervals: *3 8 3 8 8 1 6 11 3 8*

pitch as in Figure 1c or a dyad as in Figures 4c and 5c. The transformation graph of Figure 7a is unique among the graphs studied so far in that it includes inversional operations.

Example 3. Final gesture (found in mm. 11–12) with [016] and [014] trichords beamed.



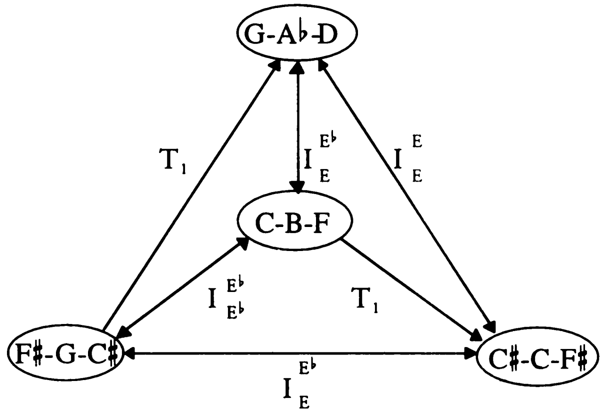
Four pitches are omitted on Figure 7a, which includes just the four [016] trichords. Of the four pitch classes from the final gesture omitted to produce Figure 7a—E♭, E, B♭, and B—all but one (the B♮) are part of the axis of inversion for one of the inversions used on the transformation graph.

The transformation graph of Figure 7b fills each node with an unordered version of set-class [014], again omitting four pitches from the music on the figure. The segmentation of the final gesture that isolates set-class [014] follows the contour of the line, beginning each segment with one of the two highest pitches in the line. Here each of the four pitches omitted from the texture lies a tritone from the final pitch of the preceding trichord. Figure 8 is an attempt to show this feature on a modified transformation graph. Each trichord is listed within its node in normal order, and the T_6 relation is shown with a dotted arrow from the pitch class in the trichord which is heard last in Webern's presentation of the trichord. The dotted arrows shown in Figure 8 are not part of a rigorous node/arrow system as defined by Lewin. The dotted arrow—representing transposition by a tritone—is not fixed to the same element within each node. Therefore, following the T_5 arrow from the leftmost node in

Figure 8 (F♯, G, B♭) to the central node on the figure (B, C, E♭) does not imply that C♯, the T_6 transformation of G from the leftmost node, is transformed by T_5 into F, the T_6 transformation of B from the central node. A well-defined node/arrow system would not allow such an inconsistency.

Figure 7. Transformation graphs of the final gesture.

a.



b.

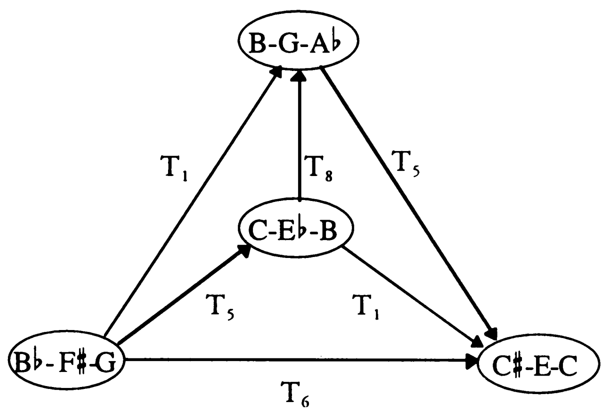
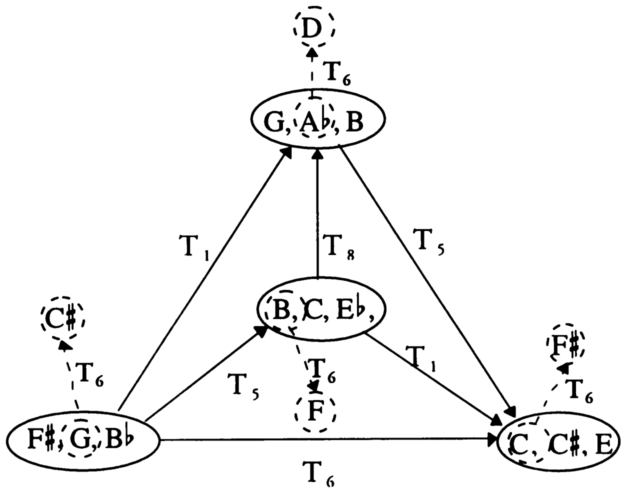
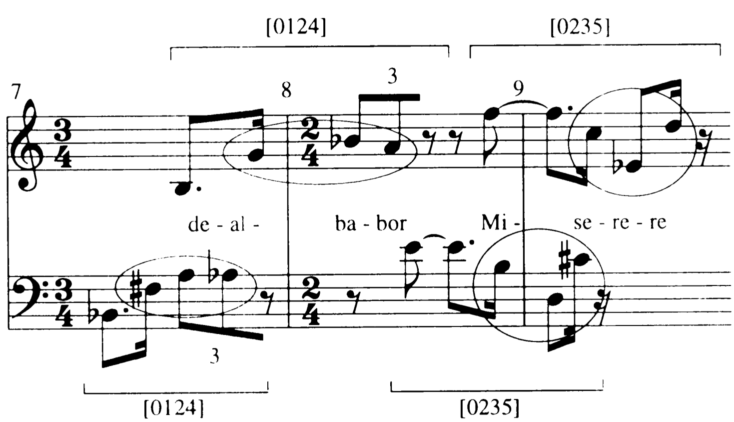


Figure 8. Diagram of final gesture, including T_6 transformations.



The passage in mm. 7–9, setting the text "*dealbabor. Miserere*" and shown in Example 4, can be segmented into [013] trichords, each of which is embedded in either a [0124] or a [0235]

Example 4. [013] trichords in mm. 7-9.



tetrachord. If the B♭ in the clarinet line were instead B♮, then both tetrachords would represent set-class [0235]. If the E♮ in the clarinet line were instead an E♭, then both tetrachords would represent set-class [0124]. Figure 9a places the four [013] trichords as ordered sets into the nodes of a transformation graph similar to Figure 1c. Figure 9b places the four [013] trichords into the nodes of a product network similar to Figure 3. If one of the pitches in each line were altered, as outlined above, the nodes on both Figures 9a and 9b could be filled with ordered tetrachords instead of trichords.

Figure 9. Transformation graphs for mm. 7-9.

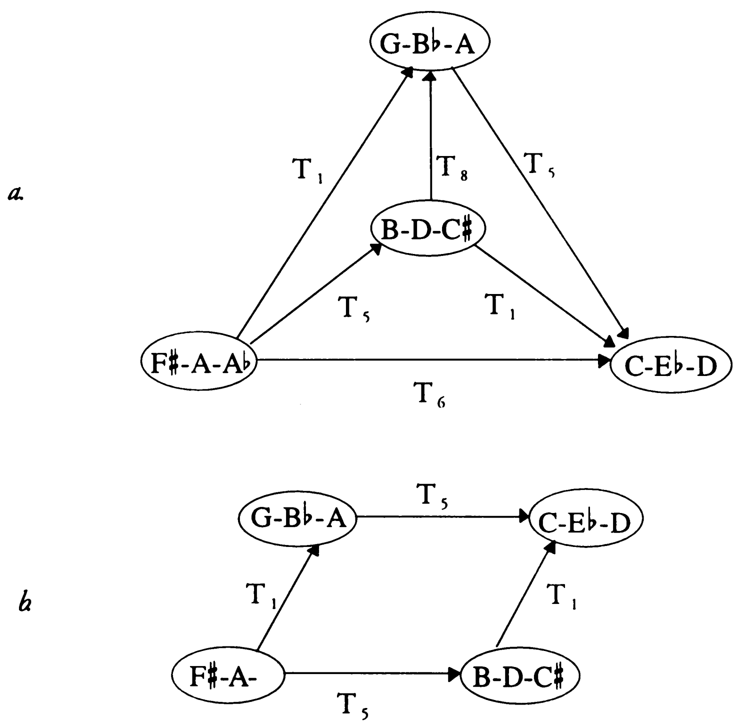


Figure 10. Contiguous and noncontiguous melodic intervals, $(i_1,1)$ and $(i_1,2)$.

text:			As-	per-	ges	me	Do-	mi-	ne,	hys-	so-	—	po,	et	mun-	da-	bor:
soprano:			E	G♯	**D♯**	G	**D**	B♭	**D♭**	**C**	F♯	**F**	D	B♭	C	**A**	**G♯**
clarinet:	E♭	G	D	F♯	C♯	A	C	B	F	E	C♯	A	B	G♯	G	F♯	D♯
$(i_1,1)$:	*4*	*7*	*4*	*7*	*8*	*3*	*11*	*6*	*11*	*9*	*8*	*2*	*9*	*11*	*11*	*9*	*11*
$(i_1,2)$:	*11*	*11*	*11*	*3*	*11*	*2*	*5*	*5*	*8*	*5*	*10*	*11*	*8*	*10*	*8*	*8*	*8*

text:	la-	va-	bis	me	et	su-	per	ni-	vem	de-	al-	ba-	bor.	Mi-	se-	re-	re
soprano:	**G**	E	**E♭**	C	**D**	**B**	**B♭**	D♭	**C**	**B**	G	**B♭**	**A**	F	C	E♭	**D**
clarinet:	D	B	C♯	B♭	A	C	B	B♭	F♯	A	A♭	E	B	D	C♯	A	G♯
$(i_1,1)$:	*9*	*2*	*9*	*11*	*3*	*11*	*11*	*8*	*3*	*11*	*8*	*7*	*3*	*11*	*8*	*11*	*11*
$(i_1,2)$:	*11*	*11*	*8*	*2*	*2*	*10*	*7*	*11*	*2*	*7*	*3*	*10*	*2*	*7*	*7*	*10*	*10*

text:	me-	i	De-	us	se-	cun-	dum	mag-	nam	mi-	se-	ri-	cor-	di-	am	tu-	am.
soprano:	B♭	**A**	**G♯**	**G**	**F♯**	C♯	E	**C**	**E♭**	**B**	G	A♭	**D**	**C♯**	E	**C**	F♯
clarinet:	G	F♯	F	C	E♭	B	D	B♭	F♯	G	C♯	C	E♭	B	F		
$(i_1,1)$:	*11*	*11*	*7*	*3*	*8*	*3*	*8*	*8*	*1*	*6*	*11*	*3*	*8*	*6*			
$(i_1,2)$:	*10*	*6*	*10*	*11*	*11*	*11*	*4*	*9*	*7*	*5*	*2*	*11*	*2*				

Another easily perceived feature of the music is the preponderance of descending chromatic motion between contiguous and non-contiguous pitches in each individual line, leading to an intriguing pattern of common tones heard between voices in this canon. Descending chromatic motion can be easily derived from the BACH motive and is represented by pitch-class interval 11 in Figure 10. Figure 10 shows the intervals between contiguous pitches in the row labeled $(i_1,1)$ and intervals between pitches separated by one other pitch in row $(i_1,2)$. These intervals evoke the concept of a direct product Generalized Interval System, as formally defined by Lewin.[5] In this specific case, each interval takes a compound form and is represented by a dyad (i_1, i_2) in which i_1 measures the distance between pitch classes in the line as ordered intervals from 0 to 11, and i_2 measures the distance between attack points. There are 49 attacks in each line of the canon, restricting i_2 to a theoretical range of 0 to 49. As shown in Example 2, the canon begins with the melodic gesture E♭, G, D. The compound interval between E♭ and G, (4, 1), and the compound interval between E♭ and D, (11, 2) are shown in the column below the E♭ of the clarinet line in Figure 10. Compound intervals where i_2 is larger than 2 are not included in Figure 10, since they are not relevant to this discussion. Figure 10 demonstrates that there is indeed a preponderance of descending chromatic motion between contiguous and almost contiguous pitch classes in each line of the canon.

Descending chromatic motion within each individual line, combined with the canonic imitation at the minor 9th, or 13 half-steps, leads to an intriguing pattern of common tones between voices. This is most obvious in the first two measures, shown in Example 2, where the E♭–G dyad of the clarinet at the beginning of the first four-note motive is answered by D♯–G in the voice at the end of the "*Asperges me*" gesture. Example 5 shows the entire piece with each pair of common tones connected. More than half of the pitch classes in each voice are involved in what is essentially a second canon, a canon of pitch classes at pitch-class interval 0, subsumed within the original canonic imitation of

[5]Lewin, *Generalized Musical Intervals and Transformations*, pp. 37–45.

Example 5. Canonic pattern of pitch classes in Webern's canon op. 16, no. 4.

pitches in register.[6] This second canon is the direct result of the descending chromatic motion that dominates the melodic structure of each line. Descending chromatic motion can be derived from the descending half-steps in the BACH motive.

The BACH motive itself is not a prominent surface or melodic feature in this canon. In fact, it is heard only once, insignificantly in the middle of the work. The structure of the BACH motive, however, can be seen to contribute to the structure of the melodic and contrapuntal organization of the canon is several different ways. The symmetric structure of the BACH motive, which can be modeled by a product network, is reflected in the preponderance of symmetric gestures heard in the canon. At the simplest level this symmetry involves four-note gestures within the individual lines. The same four-note gestures, when combined with their canonic imitations, result in a symmetric patterns of dyads. At a level furthest removed from the simple BACH motive, similar symmetric patterns of trichords are also heard involving both contrapuntal voices. In addition, the intervallic content of the BACH motive, which includes two descending half-steps, is reflected in the melodic structure of the individual lines in the canon, leading to a second canon of pitch classes hidden within the obvious pitch canon.

[6]This illustration contradicts Perle's statement, "No general vertical consideration seems to influence the progress of the individual voices in these works except that of avoiding doublings," *Serial Composition and Atonality*, p. 31.