ALLEN FORTE'S SET THEORY, NEUTRAL LEVEL ANALYSIS AND POIETICS

JEAN-JACQUES NATTIEZ

Abstract. *Through an evaluation of Set Theory based on the distinction between the delimitation and the definition of musical units, the author shows how this theoretical model supplies a description of the components of an atonal work which is the equivalent of Roman-numeral harmonic analysis, while at the same time contesting the way in which these units are described and segmented.*

Using the paradigmatic method, he subjects Forte's analysis of the first eleven measures of Schoenberg's Opus 11, no. 1 to a critical reassessment which calls into question the basic vocabulary which Forte proposes for this piece. He then goes on to examine the validity of Forte's claims about the poietic relevance of his analysis, which he ultimately contests from a historical as well as a cognitive point of view.

This talk concludes with a concrete proposal which aims at reconciling the elaborate nomenclature of Forte with a rigorous method of musical segmentation.

The goal of this study is to propose a critical evaluation, as synthetic as possible, of set theory as it is theorized and applied by Allen Forte. I consider set theory to be one of the most important theories in the history of music analysis in the Twentieth Century: it offers an analytical model of a particular musical style, namely atonal music, for which traditional models, as well as those developed for the analysis of serial music, are not adequate. The importance of this model can also be seen in the considerable number of applications that have been made of it, as testified by the abundant bibliographies which accompany the "Analysis" entry in both editions of the New Grove, written by Ian Bent, revised by Drabkin for its publication in book form (Bent, 1987) and published in French by Éditions Main d'œuvre (Bent, 1998). Its importance also lies in the fact that this model can be qualified without hesitation as a scientific one, because its explicitness allows any other musicologist, given a particular analysis, to follow the steps taken, and if necessary contest the results and suggest new solutions. We recognize then that it satisfies Popper's fundamental criterion: an analysis is scientific only if, paradoxically, it can be shown to be false.

I will not situate this discussion from the point of view of the uses which it is possible to make of this model as a *compositional tool*, which would pose a completely different set of problems, in my opinion, to those which Forte originally conceived: the *analysis* of atonal works. Neither is it my objective, in this context, to go into all of the problems raised by this model. In particular, I will leave aside the attempts to adapt it to the music of historical periods for which it was not originally conceived, that is those which

arise out of what Deliège calls music of enlarged tonality, modal music or weakly tonal music (1989, p. 64), or even to Liszt, Wagner or the serial works by Messiaen. Nor will I discuss the important methodological extension with which Forte supplemented the model laid out in 1973 in *The Structure of Atonal Music* by adding a linear dimension, inspired, as he himself makes clear (1987), by a Schenkerian perspective on which he is incidentally an admirable specialist. I have no qualms about concentrating, as it will become clear, on the problem of the relationship between the segmentation of units identified and arguments concerning compositional strategies, because in Forte's fascinating application of the linear perspective to Schoenberg's *Buch der hängenden Gärten*, op. 15 (Forte, 1992), he *begins* with an inventory of basic tetrachords which he identifies in the work. My observations today then logically precede an examination of the linear perspective which would have to be undertaken in and of itself, and deal exclusively with the problems of the basic initial segmentation on which all later elaborations depend.

My critical observations will be based on two broad fields of knowledge:

- on the one hand, the epistemology of musical analysis;
- on the other, the semiotic theory of tripartition (Molino, 1975; Nattiez, 1987, 1997), which will lead me to evaluate if and how set theory is relevant with respect to two of the three poles of tripartite theory: the neutral level, that is the immanent structures which constitute the piece, and the poietic dimension, that is the compositional strategies from which the piece originates.

1. Set theory from an epistemological point of view

From the point of view of the epistemology of musical analysis, I believe that a model can be evaluated according to the status which it accords, *from the beginning*, to the following constituents:

- Which musical units are considered by the model? Put another way, how are these units *delimited*?
- How are the units considered as relevant *defined*?

It is probably the latter aspect which has been the source of set theory's success, and I will simply restate what Célestin Deliège said at the first European Congress on Musical Analysis, in Colmar, France, in 1989, which expresses an opinion which I also share wholeheartedly: for having elaborated the table of pitch-class sets in his seminal work of 1973, *The Structure of Atonal Music*, Forte deserves the Nobel prize for Music Analysis, if there were one. In effect, the problem of the analysis of atonal music lies in the fact that, unlike tonal music, there is no taxonomy analogous to the denominations and descriptions of chords which were elaborated and theorized over the course of more than two centuries. The great merit of Forte is to have invented for atonal music a taxonomy which is not a simple grafting of harmonic categories, but one that rather seeks their equivalent.

Ian Bent emphasized in his article "analysis" that, as is the case for tonal music, Forte's model is based on the idea that the identity of an entity is not affected by octave differences, by its different occurrences, by the inversion of its component parts or by transpositions. In the same way that an arpeggio or an Alberti bass can both be associated with one and the same chord, or that a chord in first or second inversion

can be reduced to its root position and to the same function (tonic, dominant, etc.), it was possible for Forte to reduce the diversity and the multitude of all possible atonal sonic manifestations to a number of basic entities, 208 of them to be exact. Whence his painstaking examination of the procedures of transposition, inversion, inclusion, intersection and complementarity, and the essential role which he allots to the intervallic content of the pc-sets.

I would also add a characteristic which seems to me to be common to the harmonic taxinomy of tonal music and the taxonomy of pitch-class sets: in the same way that the classification of chords make comparisons and stylistic analyses possible, the classification of pitch classes allows us to characterize what I like to call "the atonal style", and to make comparisons and to call attention to similarities from one work to the next of a composer, or between two different composers. Without this taxonomy, it would not have been possible for Forte to publish, in his "Composers of the 20th Century" series at Yale University Press, a collection of books by his disciples devoted to Bartók, Berg, Debussy, Hindemith, Ives, Prokofiev, Scriabine, Stravinsky and Varèse. Without it, Forte could not have treated as a whole the 15 melodies of the *Buch der hängenden Gärten* as he does in the first part of his detailed analysis of Schoenberg's op. 15 (1992, pp. 288-351) or all of Webern's atonal music (1999). Set theory supplies a metalanguage which allows for the 'seriation'of individual works which are constitutive of stylistic ensembles, which does not, obviously, eliminate the problems inherent to this method which I will now discuss.

2. Set theory and criteria for the demarcation of basic units

However, the description of units is not the only component of an analytical model. It must also be the case that these entities be isolated and delineated on the basis of precise criteria of segmentation. It is precisely the question of the demarcation of units singled out by the analysis which seems to me to be the main problem with this model. I am not the first to make this fundamental objection to Forte (cf. Benjamin, 1974; Browne, 1974; Bent, 1987, p. 108; Lerdahl, 1989, p. 104; Deliège, 1989, p. 68 and sgg.). I will cite the critical observation of Nicholas Cook, which strikes me as being the most incisive and the most precise: "Apart from final details of interpretation, everything in the analysis depends on the [initial] segmentation [of the music] because it is here that all the *musical* decisions are made." He then adds, "No set-theoretical analysis can be more objective, or more well-founded musically, than its initial segmentation." (Cook, 1987, p. 146). My specific topic will be to confront an empirical analysis of Forte with a segmentation founded on criteria more rigorous than the ones which he proposes, that is, ones which are explicitly made clear through the paradigmatic technique, and to then examine the links between these segmentations and poietics.

Forte is well aware of the importance which segmentation plays in the choice of basic units in any analytical model, because he devotes an entire section of *The Structure of Atonal Music*, pages 83-92, to such criteria: "It is necessary to give attention to a fundamental and more immediate analytical process, the process of *segmentation*. By segmentation is meant the procedure of determining which musical units of a composition are to be regarded as analytical objects" (p. 83).

Forte identifies first of all what he calls "primary segments", that is, configurations which result from conventional techniques such as a "rhythmically distinct melodic figure", isolated by a rest or by a beam group (p. 83), a vertical harmonic grouping or by an *ostinato* pattern. In the concrete examples which he gives in the rest of the section, one notes that other criteria are added, such as those of repetition or of context (p. 91). He also attempts to justify the segmentation of a unit by its return in other parts of the work (p. 87) or in other works (p. 92), or by taking into account what we already know about the particular way in which such and such a composer composes (p. 92). After the "primary segments", Forte goes on to speak of what he calls "imbrication" (p. 83-84), that is the identification, within a single initial segment, of two or three overlapping pc-sets, and which he calls ìsubsegments of a primary segment". Thirdly, he distinguishes the "composite segments" (p.84), that is the combination of more than one "primary segment" or subsegment which are either contiguous or related to each other. The beginning and the end of these composite segments are usually marked, according to him, by an instrumental attack, or by a rest.

There are principally four methodological problems here:

- Forte seems to take for granted that thanks to a certain number of clues, the segmentation of the "primary" or the "composite segments" is a given that, so to speak, goes without saying. The problem which is posed here is in fact that of the analysis of the neutral level. Deliège (1989, p. 70-73, p. 76) has already made several precise and invaluable remarks along similar lines, but I am not sure that the three points which Forte addressed him in response are convincing (1989, p. 81). He refers first of all to the linear analyses which he grafted onto his initial segmentations; but linear analysis as such cannot be the solution to the problem of segmentation because linear analysis itself depends on segmentation. In response to Lerdahl, whom Deliège opposes to Forte, Forte comes out in defense of flexibility in segmentation, but it is precisely this laxness which needs to be avoided, and the reason for the necessity of explicit rules of segmentation. Finally, Forte refers to an article by Hasty (1984) devoted to phrase analyses of post-tonal music. This study deserves close scrutiny. We will simply note that Hasty was not able, at the time he wrote that article, to take into account Lerdahl and Jackendorff's book of 1983 which would have supplied him with the rules necessary for determining the frontiers between the end of one event and the beginning of a second, as he himself correctly notes (Hasty, 1983, p. 169). Moreover, even if he adopts a point of view which is essentially perceptive, the author proceeds to 'discover' sets in the first of Webern's *Bagatelles*, which are in fact taken *a priori* from Forte's model. This is one of the serious problems which he uncovers.

- As for the "subsegments", their identification is effectively of another order altogether, because they depend on recognizing, within a "primary segment", identified beforehand, or in the "composite segments", entities recognizable from the list of 208 pc-sets. In principle, the definition of units according to pitch-class sets occurs, for Forte, *after* their segmentation. But in truth, it is very tempting to identify a sub-segment because it corresponds to an entity given *a priori* in the table, and we will see that this is often the case. A unit is then defined because it corresponds to an entity present in the model. In that case, the reasoning is in danger of becoming circular.

- By putting on the same footing the criteria of, on the one hand, repetition within a work and on the other, between different works of the same composer, and granted that Forte's model allows for the construction of a theory of style, because it is based on the principle of seriation, the procedure for segmentation nevertheless goes wrong when it compares units which belong to different levels of stylistic relevance, from the single work, to a group of works within a composer's output, and all the way to the entire corpus of works by the same composer. This is a problem because in reality, the determination of these different stylistic levels requires distinct operations of seriation.

- And Forte adds, *in fine*, another criterion, this time of a poietic nature: "It should be said that knowledge of a particular composer's way of composing [...] provides guides for segment determination." (p. 92) A little earlier, he underscored the poietic pertinence of another analytical observation: by noting the analogy between a pc-set particular to Schoenberg's op. 23, no. 4, and the way in which the composer marked it in the manuscript (p. 18), Forte seems to want to legitimize, albeit furtively, his immanent analysis from the point of view of what I name "external poietics", that is, the recourse to information exterior to the work itself, in this case, the manuscript. He does not elaborate on this point, but he nevertheless introduces a criterion of poietic relevance to the identification of units defined by his analysis. He goes further into this aspect in his important article of 1981 which I will examine shortly. I will attempt to show the difficulties which plague the recourse to poietics, though I hasten to add that this recourse is necessary, despite the difficulties.

3. Set theory and the analysis of the neutral level

The inventory of these four families of problems leads me to an examination of set theory from the point of view of the relations between immanent segmentation of the pieces and the observations relating to compositional strategies. In order to do this, I must first examine how Forte defines the basic units of a piece being analyzed.

What is initially at stake in the definition of basic units? Forte recognizes the need to begin the job with what the model which I employ calls, following proposals by Jean Molino, the 'analysis of the neutral level'. I do not believe that we can trust a few graphic signs and our musical intuition alone in the determination of basic segments; also, the practice of defining units *a priori* because they correspond to a pc-set recognized by set theory must be avoided at all costs. The reason that there is a need for such prudence is that the initial step is decisive: it is as a function of the extension of these segments, which are then categorized under the label of pitch-class sets, that the validity of comparisons between pc-sets stands or falls. Moreover, if we intend on attributing poietic pertinence to an immanent analysis, we first have to ensure that the initial segmentation is acceptable.

I would like to give an example here of the difficulties which arise from proceeding with an analysis without first undertaking a systematic segmentation, one which is based on explicit and reproducible criteria. To this end, I will examine the important analysis which Forte devotes to Schoenberg's op. 11, no. 1, under the title "The Magical Kaleido-

scope" (Forte, 1981) about which Ian Bent, in his aforementioned study, writes that "this analysis might well be taken as a model for the method as a whole" (1987, p. 108). I will examine the approach adopted by Forte by concentrating on the first thirteen measures of this piece.

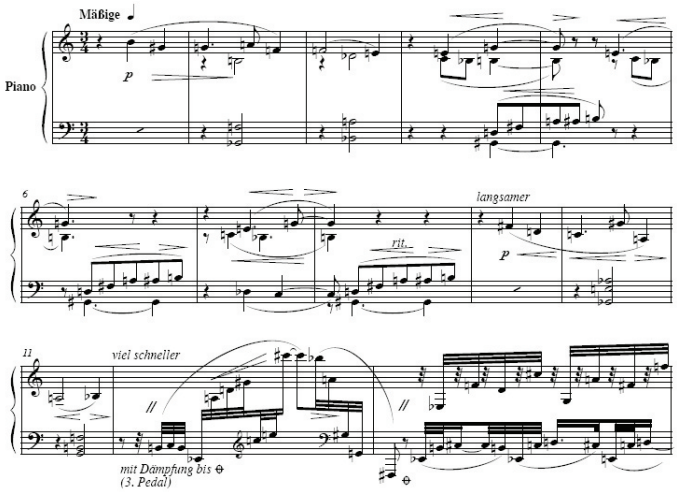

Figure 1. First 13 measures of Schoenberg's op. 11, no. 1

To begin with, here is a paradigmatic segmentation of the first eleven measures of the piece, in which I am following Deliège's lead, who has given several examples of this approach in a remarkable critical essay (1989, p. 70 et sq.).

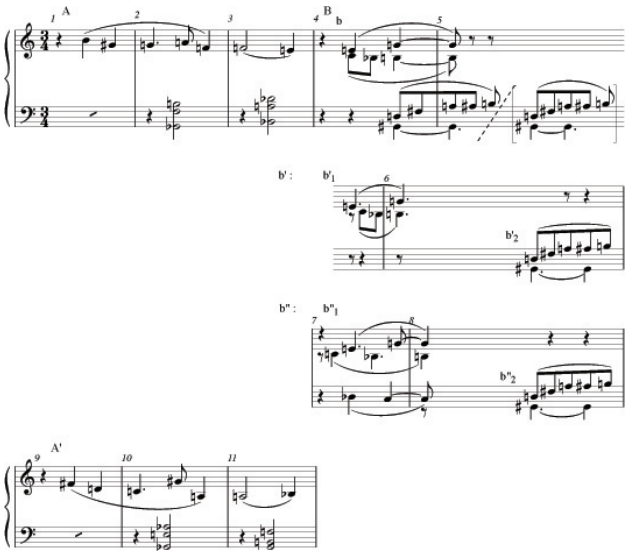

Figure 2. Paradigm of the first eleven measures of Schoenberg's op. 11, no. 1. (Nattiez)

I will not rehearse here the principles of the paradigmatic method, which are by now well known (Ruwet, 1972, chap. IV), but, and this adheres to the instructions of the main proponent of this method, I will explicitly state the criteria which are at work in the segmentation proposed here:

- A and A' are included in the same paradigmatic class

- because of the identical phrasing of mm. 1-2 and m. 3 on the one hand, and mm. 9-10 and 11 on the other;
- the rhythm of the melody in mm. 1-4 and 9-11 is literally identical;
- the chords are both based on tritones and have the same durations in both measures 2-3 and 10-11;
- new musical material begins at measure 4 and 12.

- The unit B, on the other hand, results from what is left over from the segmentation of A and A', and is itself divided into three sub-units, b, b' and b".

- A small rhythmic transformation can be observed of the initial E^b, between b on the one hand, and b' and b" on the other.
- The melodic figures are identical, but there is an addition of D^b-C in bî.
- The figure D-F-A-A♯-B, in b' and b", stands out from the polyphonic context in which it is located in b. This is why, at line 2, I rewrote it in parentheses in order to make clear the paradigmatic transformation which takes place in b' and b". This transformation leads me to identify two sub-units for b' and b": b'1 and b'2 for the former, b"1 and b"2 for the latter.

Forte considers that the harmonic vocabulary of the piece is derived from six hexachords and four of their complements. I will naturally assume familiarity here with the complex but precise procedure by which Forte designates pc-classes and establishes their intervallic content and their complementarity relations. Here is his list of units comprising the basic vocabulary of op. 11, no. 1.

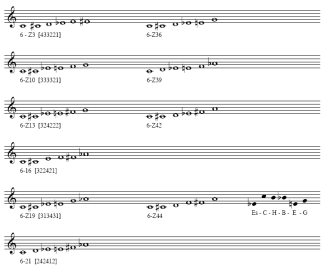

Figure 3. The Harmonic Vocabulary of Op. 11, no. 1. The Six Hexachords and Their Complements (Forte, 1981, p. 132)

What is important, from the point of view of the critical examination proposed here, is the *correspondence* between the basic units of the piece, grouped as a function of the inventory of basic sets (Figure 3) and the musical units explicitly segmented by the paradigmatic analysis on the basis of explicit criteria (Figure 2). Here, first of all, is the table proposed by Forte of these ten 'thematic' units.

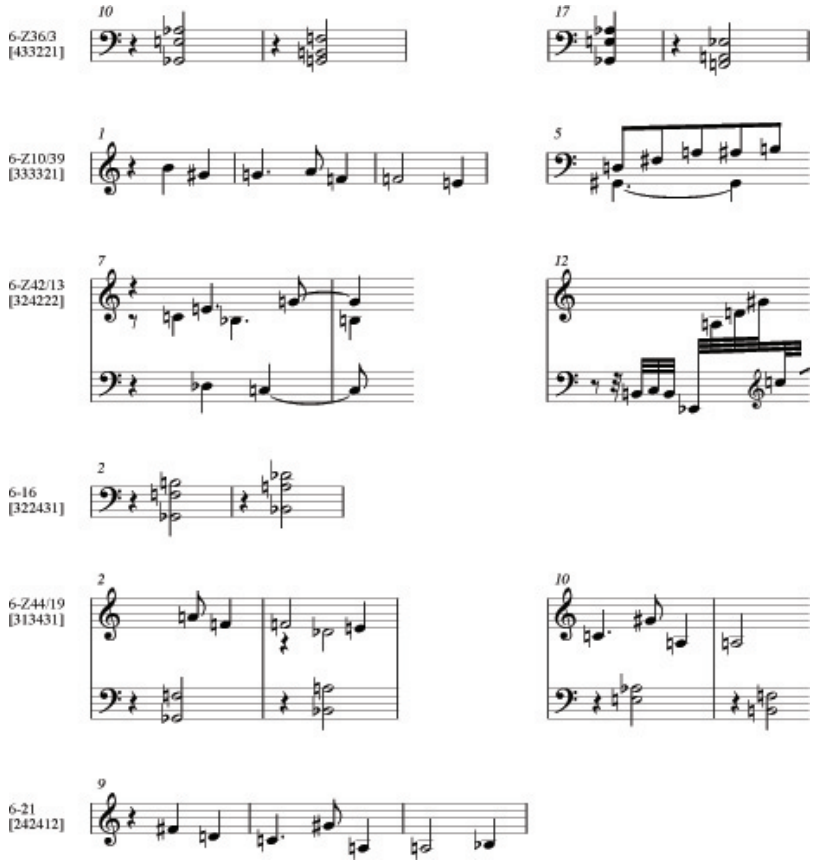

Figure 4. The Six Hexachords and Their Complements. Initial Thematic Statements (Forte, 1981, p. 132)

The units selected by Forte at mm. 10-11, 17-18, 1-3, 5, 7-8, 2-3 and 9-11 correspond to those delineated by the paradigmatic analysis. For the sake of certainty, we will mark on the paradigmatic chart of the 11 first bars, 6 of the 7 pc-sets (6-Z3 appears at mm. 17-18, but it corresponds to a unit whose segmentation is acceptable).

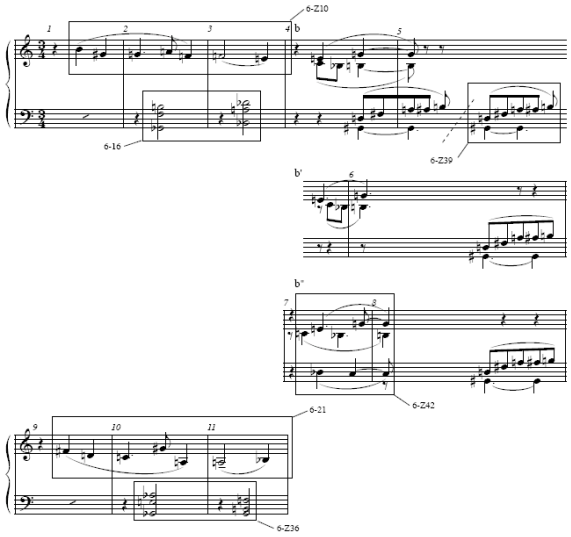

Figure 5. Pc-sets added to the paradigm of the first eleven measures (Nattiez)

On the other hand, the same is not true of the units of mm. 2-3, 10-11 and 12-13.

Let's examine first of all the analysis suggested by Forte of mm. 12-13, on top of which I will superimpose my own segmentation, with a vertical line (JJN):

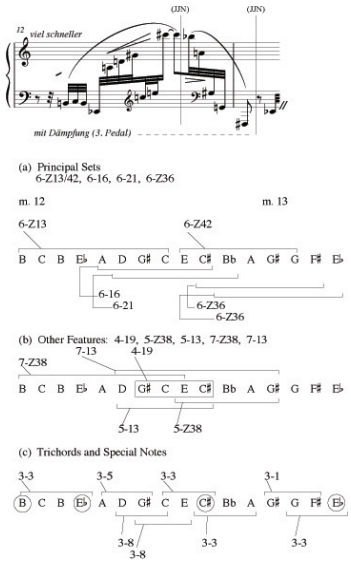

Figure 6. Measures 12-13 according to Forte (1981, p. 144), *with Nattiez's segmentation superimposed*

In this analysis, underneath measures 12 and 13, the author gives the list of all the sets and subsets that he identifies in these two measures. What strikes me as problematic is the set 6-Z13.

If we look once again at the table of ex. 4, we note that, in order to construct it, Forte only considers the first eight notes of bar 12.

If we go back to measures 12 and 13, we can compare the units obtained through the paradigmatic technique (Ex. 7, first system) and those demarcated by Forte (Ex. 7, second system).

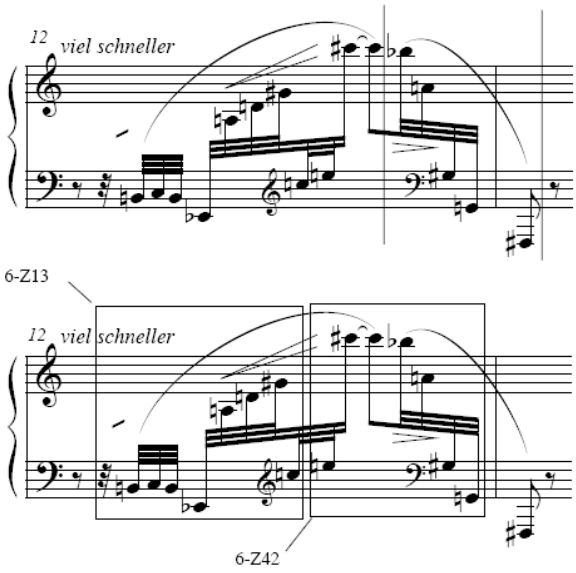

Figure 7. Units from measures 12 and 13 according to paradigmatic segmentation and according to Forte

It can be seen that in measure 12 the basic unit, which ought to have been defined before the definitions of the sets was given, necessarily includes the E and the C♯ , which it is impossible to separate from the eight preceding notes: This is because of the ascending motion, the slur and the *crescendo*; after the B^b, another unit of five notes begins, this time descending and with another slur. Neither does the pc-set 6-Z 42 identified at measure 12 in order to have the preceding 6-Z13 as a complement, correspond to an acceptable segmentation into basic units: it includes the E and the C♯ from the preceding unit, and excludes the low F♯ which necessarily comes at the end of the second unit.

For these reasons, it does not seem to me that the set 6-Z13 should be included as part of the basic vocabulary of this work. Moreover, if I set out to find this 6-Z13 in the rest of the piece, which, allow me to emphasize, is possible thanks to the complete

inventory which Forte has supplied, I only find it a single time, at measures 45 and 46, but only if we allow for a segmentation which, once again, is not one that we would be led to adopt from a systematic segmentation of the piece. Are two occurrences of two units arbitrarily segmented in the sound continuum sufficient to be considered one of the six basic hexachords of this piece?

If we look again at the demarcations of sets proposed in example 6 (Forte, p. 144) for the sets 6-Z44 and 6-Z19, i.e., those which are identified in measures 2-3 on the one hand, and measures 10-11 on the other, we find, once again, that they do not correspond to units suggested by the paradigmatic segmentation.

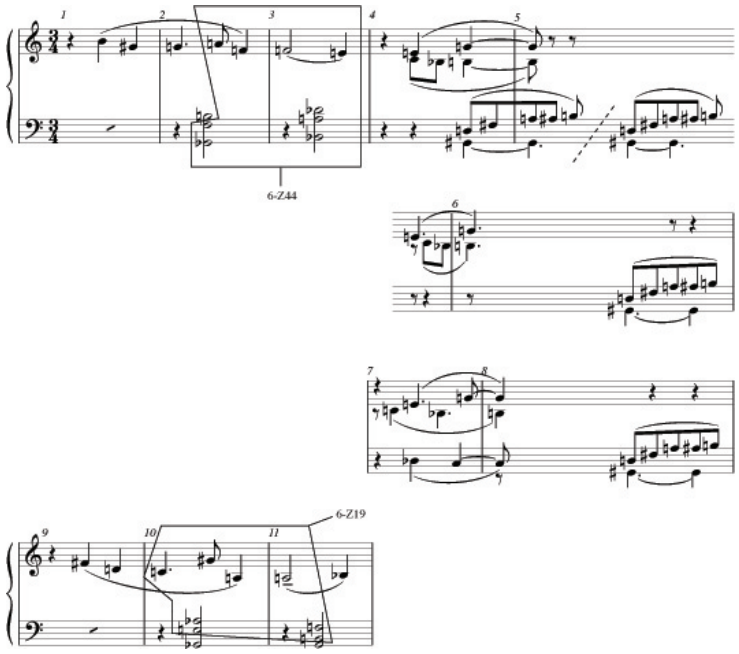

Figure 8. Projection of the sets 6-Z44 and 6-Z19 onto the Paradigmatic chart (Nattiez)

These two sets are only identifiable at the cost of a selection of pitches which an explicit segmentation is not able to justify. They therefore do not seem to me to belong to the list of the six basic hexachords and their complements.

Going back to example 5, it is certainly surprising that at mm. 7-8 the unit which I have called b" is defined according to the set 6-Z42 as one of the fundamental hexachords of the piece, whereas the set which uses the pitch content of unit b, at measures 4 and 5, which is the basis for the development of measures 5 to 8, i.e. precisely of b' and b", is not even included in Forte's list of fundamental sets.

It is true that, for 6-Z44 et 6-Z19, Forte notes that it is a "somewhat concealed subcomponent of a thematic statement" (p. 136). And he emphasizes the fact that "the real

internal form is determined by the pitch structures that organize the music" (p. 130). In fact, one gets a very clear sense that, given the table of 208 pc-sets, it could always be possible to find any one of them at the price of an arbitrary segmentation of the units, and to establish meaningful relationships of inversion, inclusion, intersection and complementarity. This is true when we follow closely, from the beginning, the presence of sets considered to be constitutive of the basic vocabulary. In the next example [ex. 9], we see how right is the first system, Forte finds three occurrences of the pc-set 6-21 from measures 9-11.

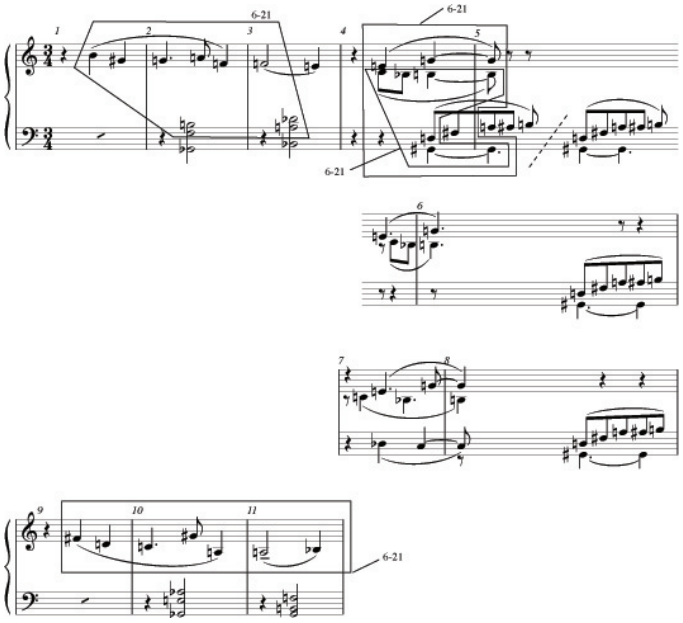

Figure 9. Occurrences of the set 6-21 in mm. 1-5 according to Forte

And he doesn't stop there. In ex. 10, we see that Forte finds the set in measures 10 and 11, and he discovers its complement 6-Z44 in measures 2 and 3. The rest of the analysis is conducted according to the same principles...

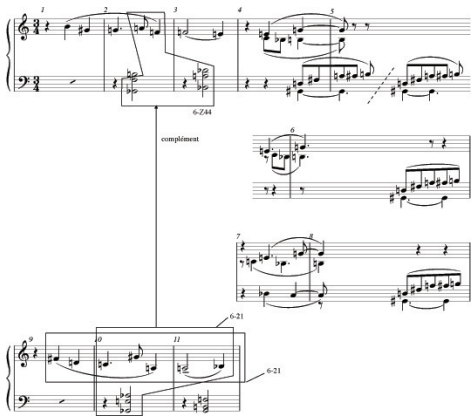

Figure 10. The set 6-21 identified in mm. 10-11 and its complement in mm. 2 and 3 according to Forte

The problem of set theory is analogous to that which faces Chomskian generative grammar, which incidentally appeared on the American scientific horizon around the same time, and which also took a rather aloof approach to the criteria of segmentation of the units considered: the proposed analytical algorithm is so strong that it enables justifying almost any relationship.

4. Set theory and poietic relevance

We must then ask ourselves what motivates Allen Forte to proceed in this manner. I believe that we can find the key to his method in his conception of poietics and in the way in which he treats it.

One might be surprised that I refer to the poietic dimension when, besides the two brief allusions to poietic concerns which I cited earlier, *The Structure of Atonal Music* can be considered, 99.9% of the time, to be a work of Structuralist persuasion. In truth, Forte's interest in the poietic is not new to him: one of his first writings deals with the *Compositional Matrix* (1961) and in 1978 he devoted a paper to the creative evolution of Schoenberg in his path towards atonality.

For my part, I believe that at some point in every analysis, it is necessary to confront the poietic dimension. In the above examination of the tonal harmonic taxonomy that I discern in Forte's model, I have not yet discussed one of the most important points.

Since the denomination of chords concerns what is generally called the "common practice" era, roughly from Bach to Wagner, and because it is used in music education and consigned to treatises and textbooks, the denomination of chords has a certain poietic relevance. Of course, for each particular composer, we need to specify what the compositional strategies consist of on the harmonic level; we would have to take into account the evolution of tonal harmony over the course of years and to qualify the impression of stability which it appears to have enjoyed over a period of more than two centuries. It remains nevertheless that these entities, defined by various harmonic taxonomies desig-

nate the basic tools that were taught and from which tonal works were elaborated.

Forte's entire paper on op. 11, no. 1 is predicated on the poietic hypothesis that, by opposition to the point of view of three of his predecessors (Leichtentritt, Brinkmann and Von der Nüll) for whom the piece still owes much to tonality. For Forte, beginning in 1909, Schoenberg invented a radically new way of composing. For him, the important point is that the relationship between sets, "the dynamic and kaleidoscopic transformations", bring into view a second level, situated underneath the conventional musical surface of the piece, made up of themes and motifs ("beneath what appears to be a conventional musical surface composed of themes and motives", p. 137). While admitting that Schoenberg never discussed this manner of composing, he affirms that the essays collected in *Style and Idea* show that "at the time he composed Op. 11/1, he was not interested in producing tonal music, especially in some kind of contorted tonal idiom" (p. 138), but he does not specify in which texts Schoenberg implied this, the only exception being the 1946 article "New Music, Outmoded Music, Style and Idea" in which Schoenberg inscribes the formula "Because : Arts means New Arts" as its epigraph. Looking back at this text, one does not get the sense that the desire to write in a new way goes all the way back to 1903 for Schoenberg, as Forte asserts. On the contrary, in this text, the composer speaks of the period which follows the First World War (1984, p. 114) and the allusion is to twelve-tone composition (l984, p. 99).

Forte's poietic characterization amounts to what I call *inductive poietics* (Nattiez, 1987, p. 177; Eng. trans., 1990, p. 140). This process consists in justifying compositional relevance by observing the systematic recurrence of a structural phenomenon. In Forte, it is based on a reasoning which I could reconstruct as follows: These sets and their transformations turn up in the piece too often for it not to be the result of Schoenberg's conscious compositional work; and I quote: "Since there are no sketches for Opus 11, and, in general, precompositional sketches for the atonal works are extremely scarce, we do not know how systematically Schoenberg explored the properties of the hexachords. However, from the *analytical evidence* [my emphasis], it is clear that the intricate manipulations of these hexachordal materials was completely natural to him." (p. 133). "Evidently Schoenberg selected hexachords of considerable diversity as well as similarity with respect to interval content." (p. 135)

Once we admit that the "analytical evidence", that is the recurrence of sets inventoried by analysis, proves that we are indeed in the presence of a hidden compositional strategy, Forte can appeal to an argument which uses the approach of *external poietics*, i.e., based on information relevant to compositional strategies, but external to the work (Nattiez, 1987, p. 177; Eng. trans., 1990, p. 141) ñ and which would apparently confirm the recurrences which he believes to have found: "Given Schoenberg's numerological bent, the selection of exactly six hexachords of Op. 11/1 is more than fortuitous" (p. 133). That is to say, the selection of these basic six elements is apparently deliberate and is poietically relevant. But in order to speak of "analytical evidence", it would first be necessary, at the neutral level, for the basic units to be determined in a convincing manner. We saw earlier that this is not the case for one of them and that we are left wondering about the absence of measures 4 and 5.

Forte's empirical observations are not what justifies the poietic relevance of his analysis. It is in fact his preconceived notions *a priori* about Schoenberg's poietics which lead him to legitimate his analytical procedure. Why does he select, against all evidence, the set 6-Z13? Because its complement is 6-Z42 which does in fact correspond to a structural unit and because he affirms, on p. 133, that both are fundamental in *Die Jakobsleiter*. By admitting that it is legitimate, here, to retain a set which does not correspond to a unit identified on the basis of acceptable criteria, it would be necessary to verify whether in *Die Jakobsleiter*, they were properly segmented. Why does he retain 6-Z19 and 6-Z44, which, as we have seen, are also just as arbitrarily segmented? Because they correspond to Schoenberg's musical signature: Es-C-H-B-E-G. (p. 133).

Even if Forte doesn't say so explicitly, one senses that, in order to understand the poietics of Schoenberg, he is appealing in fact to a very strong hypothesis according to which Schoenberg applied, in 1909, a compositional strategy which he never defined explicitly, but which roughly corresponds to the formal operations described by set theory. As I have indicated elsewhere (Nattiez, 1997, p. 17), a poietic interpretation of structures revealed by the analysis of the neutral level presupposes that we have an acceptable *theory of the poietic*. I am afraid that I am not able to accept the poietic theory which I discern in the article that I am examining here. I have three reasons for this.

The first is of a methodological nature, and I will not return to it: the units selected and characterized do not all correspond to units grouped as a function of explicit and acceptable criteria — musical criteria, as Nicholas Cook would say — of segmentation; their other occurrences are not determined as a function of the initial segmentation but from the *a priori* definitions supplied by the table of sets.

The second reason is of a historical nature. It seems to me that there is no reason to reject the idea that Schoenberg elaborated poietically his atonal style by systematically turning on its head to the tonal organization of pitch and tonal harmony with which he was so well acquainted. The fact that the rhythmic, metrical and phrase structure of this piece are those of a tonal piece ñ not to mention the form, as Forte demonstrates so well himself in the rest of his paper, based on a play of contrasts, so common to Romanticism, and characterizes this piece from beginning to end — all of these things lead me to think that it is in the *gap* between the tonal norm and what Schoenberg actually does that we must pursue our research if we wish to know and understand the compositional processes which he put into practice during that period. And as a result, starting from the proposed paradigmatic analysis, I can make observations whose poietic relevance seem to me difficult to contest and which, since they are situated at the surface of the piece, have good chances of being quite close to conscious poietics: the introduction presents first of all a thematic unit of three measures; then new material (mm. 4-5) allows for the construction of a new unit, made up once again of three elements. The return of the three initial measures transformed (mm. 9-11) reveals a ternary construction. If there is a magic number to find in the piece, which is as a matter of fact organised at the macroscopic level according to a ternary plan, it would be with no doubt number 3 and not number 6. If this is so, this piece could be "relatively easy to understand today" (Forte, p. 127), as Schoenberg said himself in a quotation the author placed at the top of his article, but which the rest of the text tries to refute. For me, the logic of the poietic

elaboration of op. 11, no. 1 still owes much to the Romantic era.

The third is of a cognitive nature. Let's recall that in order to discern pitch-class sets and the relationships among them in any musical succession, three conditions must be obtained:

1. The ordered set of pitches must be reduced to a non-ordered set, namely the "prime form", presented in compact form;

2. The interval vector constitutive of the set must be calculated by reducing to one and the same class (defined not from the given succession of notes but from the 'prime form') an interval, its inversion and its compound, and similarly the enharmonic intervals which correspond to them;

3. The relationships of transposition, inversion, retrogradation, retrogradation- inversion, inclusion and intersection must be identified once the sets are established.

In order to properly understand Forte's analysis, I made precise tables for myself of all of the analytical steps involved here. The analytical operations at work in this text and proposed for the atonal period seem to be of such a great degree of complexity that I have difficulty following Forte when he writes that "The intricate manipulations of these hexachordal materials was completely natural to him." (p. 133). Also, I hope that Allen Forte will one day respond to the following question: 'Do you really think that the manipulations of the basic material which allow you to construct your taxonomy and which you follow scrupulously throughout the piece, corresponds to any conscious poietic strategy? If we confront the units finally brought out by your analysis, is it conceivable that Schoenberg followed analogous procedures, on the level of pre-compositional elaboration, without recourse to a pencil and paper?'Forte himself notes that no sketch of this nature has been found for the atonal period. However, such sketches abound for serial works for which basic operations — inversion, retrograde or retrograde inversion — are infinitely simpler than what Forte proposes for the atonal period. Also, I cannot help thinking that what I believe to be genuine Schoenbergian poietics cannot under any circumstances justify the analytical approach adopted by Forte.

Once again, this does not invalidate in any way the remarkable taxonomy which he elaborated for the study of atonal music. Let's say it again, it allows us to undertake vast stylistic and comparative analyses, but it is only epistemologically possible on condition that it be based *first of all* on a hierarchical segmentation of works which is at once systematic and coherent. This is at any rate the proposal I would like to make here: it would be fascinating to see what results we would obtain from comparing sets which would describe units previously segmented by a paradigmatic analysis at the neutral level. If we do feel compelled to rely on this preliminary analysis, in effect, the kaleidoscope which the analyst will discover in atonal works will effectively be the fruit of magical operations, not because the composer hid them there, but because the musicologist, through sleight of hand, was acting like a magician!

English translation by Jonathan Goldman.

Bibliography

[1] Benjamin 1974
William Benjamin. "Review of The Structure of Atonal Music by A. Forte." *Perspectives of New Music* 2, 170-211.

[2] Bent and Drabkin 1987
Ian Bent and William Drabkin. *Analysis*. London: Macmillan Press.

[3] Browne 1974
Richmond Browne. "Review of *The Structure of Atonal Music* by A. Forte." *Journal of Music Theory* 18, 390-415.

[4] Cook 1987
Nicholas Cook. *A Guide to Musical Analysis*. London, Melbourne: J.M. Dent and Sons.

[5] Deliège 1989
Célestin Deliège. "La set-theory ou les enjeux du pléonasme," *Analyse musicale*, No. 17, pp. 64-79.

[6] Forte 1961-1974
Allen Forte. *The Compositional Matrix*. Baldwin: Music Teachers National Association; reprinted, New York: Da Capo Press, 1974.

[7] Forte 1973
Allen Forte. *The Structure of Atonal Music*. New Haven - London: Yale University Press.

[8] Forte 1978
Allen Forte. "Schoenberg's Creative Evolution: the Path to Atonality,î *The Musical Quarterly* 49, 133-176.

[9] Forte 1981
Allen Forte. "The Magic Kaleidoscope; Schoenberg's First Atonal Masterwork, Opus 11, Number 1." *Journal of the Arnold Schoenberg Institute* 5, No. 2, 127-169.

[10] Forte 1987
Allen Forte. "Liszt's Experimental Music and Music of the Early Twentieth Century." *19th Century Music* 10, No. 3, 133-176.

[11] Forte 1989
Allen Forte. "La Set-Complex Theory: Élevons les enjeux!." *Analyse musicale* No. 17, 80-86.

[12] Forte 1992
Allen Forte. "Concepts of Linearity in Schoenberg's Atonal Music: a Study of the Opus 15 Song Cycle." *Journal of Music Theory* 36, No. 2, 285-382.

[13] Forte 1999
Allen Forte. *The Music of Anton Webern*. New Haven, London: Yale University Press.

[14] Hasty 1984
Christopher Hasty. "Phrase Formation in Post-Tonal Music." *Journal of Music Theory* 28, No. 2, 167-190.

[15] Lerdahl and Jackendoff 1984
Fred Lerdahl and Ray Jackendoff. *A Generative Theory of Tonal Music*. Boston, Cambridge: MIT Press.

[16] Lerdahl 1989
Fred Lerdahl. “Structure de prolongation dans l’atonalité.” In *La musique et les sciences cognitives*. Edited by Stephen McAdams and Irène Deliège,. Liège, Brussels: Mardaga, 103-135.

[17] Molino 1975
Jean Molino. “Fait musical et sémiologie de la musique.” *Musique en jeu* No. 17, 1975, 37-62; Eng. trans., “Musical Fact and the Semiology of Music.” *Music Analysis* 9, No. 2, 105-6.

[18] Nattiez 1987
Jean-Jacques Nattiez. *Musicologie générale et sémiologie*. Paris: Christian Bourgois éditeur; Eng. trans., *Music and Discourse. Towards a Semiology of Music*. Princeton University Press.

[19] Nattiez 1997
Jean-Jacques Nattiez. “De la sémiologie générale à la sémiologie musicale: l’exemple de la Cathédrale engloutie de Debussy.” *Protée* 25, No. 2, 7-20.

[20] Ruwet 1972-1987
Nicolas Ruwet. “Méthodes d’analyse en musicologie.” In *Langage, musique, poésie*. Paris: éditions du Seuil. pp. 100-134; Eng. Trans. “Methods of Analysis in Musicology.” *Music Analysis* 6, No. 1-2, July, 3-36.

[21] Schoenberg 1984
Arnold Schoenberg. *Style and Idea*. Berkeley ñ Los Angeles: University of California Press (new edition).