

## Dinu Ciocan – A Unique Case in Romanian Musicology

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*Abstract:* Dinu Ciocan's theoretical contribution spans over several decades. Applying a linguistic and mathematical rendering, his contribution is inscribed in the direction of investigations on musical language, closely linked with a semiotic conception of music. Mathematics, in this singular and original theoretic construction, at least for Romanian musicology, is a mean of systematically analyzing the musical structure, which necessarily sparks observations regarding the specificity of the musical message.

*Key-Words:* Linguistic-mathematical Rendering, Generative Grammar, Theory of Formal Language

### 1 General information

In the diverse landscape of recent Romanian musicology, the theoretical direction developed by Professor Dinu Ciocan has a unique character. Crystallized in the '70s, it continues to exert a powerful influence over the most modern methods of musical analysis. The moment when it appeared was favourable. In the second half of the previous century, a scientific current established the milestones of discourse on musical language, being almost exclusively supported by Romanian composers. The impulse came primarily from the necessities of composing creation and the most edifying examples include Aurel Stroe, Anatol Vieru, Georg Wilhelm Berger, Ștefan Niculescu, Octavian Nemescu, Nicolae Brânduș, Lucian Mețianu, Corneliu Cezar, musicians preoccupied with the possibilities of working with computers and applying mathematical concepts and methods in analysis, but especially in musical composition.

Upon completing his university studies of both piano and composition, Dinu Ciocan will join in his research the aforementioned group, channelling his efforts in both analysis and performance. His preoccupations concerned the field of mathematics and the results of new research in the field of linguistics, closely linked with the discipline of semiotics, on the rise at that time. This meant a larger, more encompassing synthesis of musical language, from the perspective of composing language per se, but also of musical performance. This is what gives consistency to the complex activity pursued by Professor Ciocan: systematic theory in the service of musical creation itself.

This analytical, interdisciplinary method was initiated and jointly supervised by Professor Dinu Ciocan and professors from the Faculty of Mathematics, University of Bucharest - Solomon Marcus, Dragoș Vaida – through dissertations focused on a general theme such as “Mathematic Methods in Musicology” ('70s-'80s). It continued and was finalized in the National University of Music Bucharest through a collective project of fundamental musicological research, in which participated professors belonging to the general theme, under the leadership of Professor Dinu Ciocan - Dan Dediu, Valentina Sandu-Dediu, Antigona Rădulescu -, as well as students at that time - Cipriana Smărăndescu and Adina Teodorescu -, a project that had as theme “Problems of Computer-Assisted Musical Linguistics and Stylistics” (1992-1995). [1] At the same time, in order to verify and profit both theoretically and musically from these preoccupations, Professor Ciocan published, for instance, an “Introduction to Set Theory for Musicians” (1976), but also an “Introduction to the Theory of Formal Language and Automata for Musicians” (1980-1984) [2], both works benefiting from the demanding guidance of Professor Virgil Emil Căzănescu, PhD, from the Faculty of Mathematics, as well as “A Semiotic Theory of Musical Interpretation” (vol. I in 2006, vol. II soon to be published).

In this case, a semio-linguistic and mathematical rendering of musical language is proposed and the justness of this perspective was and still is permanently validated in musical practice through a fruitful collaboration with remarkable performers on a national and international scale, such as violinist

Irina Mureșan, pianist Dana Ciocârlie, with other musicians such as composer Dan Dediu or musicologist Valentina Sandu-Dediu that also perform as pianists.

## 2 Directions of Research

### 2.1 Connections with other theories

The concord with other theories, developed especially by researchers-composers generated a first direction of Dinu Ciocan's theoretical activity on an inter- and trans-disciplinary terrain. Implementing in his university lectures, gathered under the name of *Modern Methods of Analysis*, the notions expounded by Anatol Vieru in *The Book of Modes* and the action of logical-mathematical rendering carried out as an instrument for the explanation and organisation of the modal sonic world, is such an example. The utilized notions, valid for both Vieru and Ciocan's theory, are musical notions which, from a mathematical perspective, essentially renew the more or less traditional musical meta-language, at a high level of abstractization and generalization of its sonic coordinates. Pitches or the intervals of the tempered system respectively can be perceived as belonging to the set of residue classes modulo 12 that has, as we know, the property of being an algebraic ring. Thus, the unison corresponds to the neutral element, while adding the intervals in a direct or reversed state corresponds to addition and transposition to multiplication.

Dinu Ciocan is the one who facilitated, within the university, the access of young musicians to the theory of Aurel Stroe collected in the study *Compositions and Classes of Musical Compositions*. Facing prejudice, compensating gaps in information, his effort build the bridge towards algebraic thinking combined with a determinist-probabilistic thinking which stood at the basis of the programme realized by Aurel Stroe. A perfectly legitimate effort, since "using mathematical methods (especially modern mathematical methods) in the service of concrete research in a particular field is justified and becomes necessary only as long as these methods bring a (substantial) contribution to a deeper, more precise knowledge of that field, of the laws that govern it". [3]

He will manifest the same description for other methods of analysis. Promoting in the Romanian musicology field Heinrich Schenker's theory, along with its European version belonging to Célestin Deliège, implementing the fundamental principles of Fred Lerdahl and Ray Jackendoff's generative

theory on tonal music, adapting concepts used by Heinrich Plett in music analytic method, propagating Jean-Jacques Nattiez's theory started with the famous volume *Les fondements d'une sémiologie de la musique* and more recently, Eero Tarasti's research directions, representative authors on a global scale of musical semiotics, represent a variety of perspectives for reflection on music in modernity, which Dinu Ciocan ambitiously introduced in the academic environment of the National University of Music Bucharest.

### 2.2 A Multidisciplinary Theory

The complex structure of Dinu Ciocan's theoretical thinking stems from a few considerations that set the frame and establish the place and role of theory in general musical activity. The relation between theory and musical work or the living phenomenon of creation can be easily portrayed in pairs of terms such as concrete-abstract, sensible-reasonable, subjective-objective, incommunicable-communicable, creation-craftsmanship, theory-practice. In this relation and not in the narcissistic individuality of theory lies the essence of Dinu Ciocan's position – a theory generated by concrete musical facts, by the realities of the musical language, creation and interpretation; theory as a mirror of the specificity of a process representing knowledge, meaning that reason must be an adequate means of understanding and adapting to the musical ineffable. "Bringing theory into contemporaneity, Dinu Ciocan states, placing it in accordance with practice, constituting their natural unity, is an objective necessity, representing the only truly possible solution in solving the contradiction emerged between the two fundamental aspects of musical knowledge." [4]

Through the linguistic-mathematic rendering of music, Dinu Ciocan takes into account several objectives: increasing the objectivity of musical analysis, perfecting the methods of musical teaching, accepting the idea that music is a language, differentiating aspects of musical structure from semantic elements and the pragmatics of composing and performing.

Insisting on the necessity of re-thinking traditional music theory in structural terms, Ciocan uses the mathematical data and computer resources to mediate the data provided by the structural and informatic linguistics. The study called *Contributions to the Structural Analysis of Rhythm in Traditional Musical Language* [5], or in *Some Observations Regarding the Structure of Measures in Traditional Musical Language* [6]. The analysis

of melodic, rhythmical, dynamic and timbre structures, taking into account the data resulted from the study of musical works is put in relation to both traditional and modern programmatic teaching methods, through which, Dinu Ciocan claims, “a system of practical exercises of successive, simultaneous and composed rhythms can be organised, whose main characteristics should be formulated probabilistically, depending on the structural characteristics of researched works” [7].

The same issues arise from the effort of the musicological research project-group of the National University of Music Bucharest, a project mentioned in the introduction of point 1 [8].

It initially consisted of establishing the necessary and sufficient conditions to form monodies or homophonies, respectively, on the basis of rules established by the theoretical, pre-compositional disciplines, i.e., Palestrinian harmony and polyphony envisaged by Knud Jeppesen. Once transformed into computational programs, the machine could realize the totality of melodies in Palestrinian style to samples in 4 voices in pre-established conditions (conditions imposed not only by the rules of successions and simultaneities in accordance with the type of modal language and Renaissance style, but also by the limitations in regard to dimension – number of pitches or attacks -, sound/interval/initial and final tunes). A second program, called MELO (Melodic Experiment with Limited Objects), aimed at creating melodic samples formed out of a different number of microstructures with a different profile in musical evolution, on the basis of transformations such as transposition, inversion and sequencing. The comments that emerge from this labour can be concentrated in a few ideas sustained by Dinu Ciocan’s theory:

- through the rigour imposed by associating musical thinking on sonic elements to mathematical logic, the level of objectivity and generality of harmonic and polyphonic principles engaged in the creation of the program has raised.
- as long as musical rules are clear, explicitly formulated and in a reasonable number, harmony and counterpoint exercises can be solved with the help of the computer.
- the program gathers, on the basis of rules, the totality of musical examples emerging from pre-established conditions.
- the resulted musical examples are grammatically correct.
- their aesthetic value is distinct from the level of correctness of examples and can be established only after computational realization, on the basis of assumed choices after their intonation.
- musical examples can be ordered in different classes on the basis of semantic criteria, thus resulting different semantic fields.

The same need to register new aspects that govern the musical work determined Dinu Ciocan to employ different formal means to obtain this result. Such an example is applying notions of graph theory (in König’s sense) in determining certain characteristics of musical structures. The example of application was offered by examining the fugues in *The Well-Tempered Clavier* by Johann Sebastian Bach. The action entailed realizing the graphs of all the 48 Bachian themes, on the basis of common, similar or properties, at the level of tonal functions expressed in themes and classifying them on the basis of these criteria. The comparative study thus realized is capable of assuring “the writing of a program, on the basis of which a computer would ‘compose’ a music having a similar, identical structure etc., with a group of given themes” [9].

In the same manner, the sonic reality of any musical piece can be synthesized starting from establishing an algorithm for sensible data of the musical sound, moving on to generalizations enabled by the mathematic language. Once the sound is defined in the field of mathematics, as a Cartesian product formed as  $(f, d, i, t) \in F \times D \times I \times T$ , where  $F$  represents the set of pitches,  $D$  represents the set of durations,  $I$  represents the set of intensities and  $T$  the set of timbres of the musical language, generalizations will follow from simple to complex. [8]. Then:

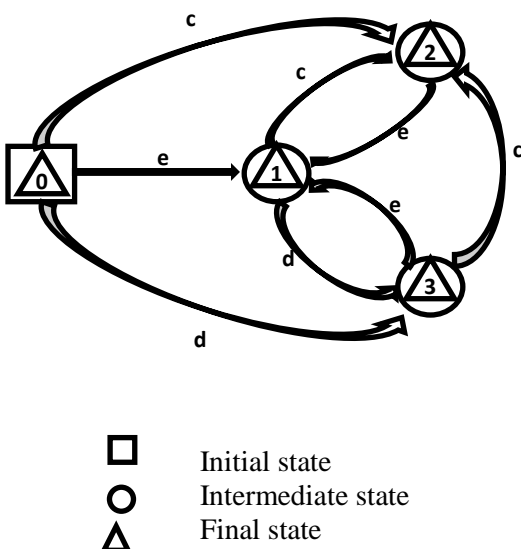
- the set of all musical sounds can be thus expressed through the formula
 
$$S = \{ (f, d, i, t) / f \in F, d \in D, i \in I \text{ și } t \in T$$
- a melody, defined as function, will be expressed through the formula
 
$$f : \{ 1, 2, \dots, n \} \rightarrow F \times D \times I \times T$$
- a musical piece is a sequence of  $n$  elements from the set of finite sequences of  $k$  elements from  $F \times D \times I \times T$  (where  $k$  is the maximum number of voices in the piece and  $D$  is the set of non-cumulative or cumulative durations) and the functions is expressed in the formula
 
$$f: \{1, 2, \dots, n\} \times \{1, 2, \dots, k\} \rightarrow F \times D \times I \times T$$

Dinu Ciocan’s theoretical construction is the result of a synthesis between mathematics,

linguistics, informatics and semiotics. With the help of mathematics, Dinu Ciocan generalizes the theory of formal languages, of grammars that generate them and automata that recognize them. [11]. The starting point is the conception that music is a language: “Music is a specific form of signification and communication, thus a specific form of language, hence a specific form of transmitting information” [12]. This is where many directions stem, true postulates in Dinu Ciocan’s theory [13] [14] [15] [18].

- Music is a specific artistic language, objectively accepted within the cultures in which it was crystallized.
- Since it is a language, it accepts a vocabulary and grammar on the basis of which communication is possible. The well-known mathematical definition of the general structure of Chomskian grammar is  $G = (V_T, V_N, A, \mathfrak{R})$ , where  $V_T$  is the terminal vocabulary (the smallest significant-musical units of the piece in their sonic aspect),  $V_N$  represents the non-terminal vocabulary (the grammatical-musical categories, such as cell, motive, phrase, period etc.),  $A$  is the axiom, and  $\mathfrak{R}$  the rules that ensure the correctness of musical sentences. Therefore, the task of modern musicology is to research not only the aspects regarding musical syntax, but also the essential issues of musical vocabulary. See in this sense the finite automata proposed by Dinu Ciocan [16] in order to recognize the minimal rhythmical syntagmas that form a rational language on the set  $\{c, d, e\}$ , where  $c$ ,  $d$  and  $e$  signify the ascending, descending or equal rhythmical intervals.

The graphic representation of this automata:



The accepted language of automaton  $A$  (calculated with Kleene’s theorem) is:

$$L(A) = (\{1\} \cup \{1,e\} \{ce,de,dce\}^* \{d\}) \cup \{1,e\} \{ce\}^* \{1,c\}, \text{ where } 1 \text{ signifies the word void.}$$

One can observe that, in this conception, the sequence of non-pause durations type  $c/d$  signifies a rhythmical cadence in which the rhythmical interval “ $c$ ” belongs and closes the previous rhythmical sequence, while “ $d$ ” belongs and starts the next rhythmical sequence. (For the integration of the extent of non-pause durations in the extent of the non-pause duration that proceeds them, see the quoted text.)

- New vocabulary concepts are introduced, such as “elementary homogenous/heterogeneous sentences properly/improperly extended”, “melodic, rhythmic, metric, harmonic, timbral, motivic generative vocabularies  $V_0$ ”, “primary vocabularies of the lexemes” / “elementary motives properly or improperly extended” etc.
- As important as defining the grammatical dimension of musical language is defining the semantic dimension in its aspects of musical psychology, morality, wisdom and sacrality.
- Organizing the structure of a musical piece derives from the stratification on levels of musical signification on different lengths, from the musical piece in its entirety to the level of the smallest, zero degree signifying units that cannot be divided from a signifying point of view.
- Through the musical significance of a musical piece is understood:
  - the relation mediated by a musical culture between that piece and its referent;
  - by referent, we understand the set of psycho-physiological states specific to music which a culture is interested in, at a particular time of its existence.
- Taking into account the coordinates of the system of organizing musical language – the syntagmatic and paradigmatic axis, the musical work will have to be understood and analyzed not only through the musical events that succeed each other in time, but also as a succession of classes of events

(classes of motives, classes of phrases etc.) existing *in praesentia* in the piece and *in absentia* in the language of the piece.

- A two-step model of analysis of a musical piece is proposed:
  - consistently establishing grammatical characteristics (lexical and syntactical) of the signifying units of different levels, components of the musical piece, emphasizing lexemes as elementary sentences (zero degree) that form the terminal vocabulary  $V_T$  on which it is finally defined the piece, along with the other synthetically composed sentences of a superior order to the maximum level of the piece in its entirety; establishing it is compulsory according to the definition of generative grammar previously expounded.
  - consistently establishing the signified character of all grammatical structures of different levels and orders of the previously described piece, through the systematic evaluation of their semantic value in the framework of a fuzzy logic, whose terms must belong to psychology, morality, wisdom or sacrality of music.
- Since musical language is a poetic language (in the general sense of the term) [17], its ambiguity is necessarily found at all levels of creation for a piece of certain musical aesthetic value. What is important to notice is that this ambiguity is relevant only in relation with a corresponding non-ambiguity, also existing at the same levels, with the natural prevalence of ambiguity over non-ambiguity, priority that gradually assures the varied poeticity of that particular piece. Consequently, the analysis of a piece culturally, musically and objectively supports more possible versions (but not equally probable and not arbitrarily infinite).

Through the original theoretical directions formulated by Dinu Ciocan, Romanian musicology is situated on a high scientific and musical plane. If in its relation with mathematics, music seems to be unable to count (as Leibniz once thought), the science about music can consciously choose

mathematics to order its principles and objectify its analysis instruments.

*Translated by Simina Neagu.*

*References:*

- [1] See the results of the project synthesized in “Quelques aspects de la modelisation sémiotique et computationnelle du langage musical”. *Muzica*, no. 3, 1995.
- [2] Solomon Marcus, *Artă și Știință* (Bucharest: Editura Eminescu, 1986), p. 76.
- [3] Dinu Ciocan, “Aplicații ale matematicii în cercetarea muzicologică”. *Studii de muzicologie*, vol. IX (Bucharest: Editura Muzicală a Uniunii Compozitorilor, 1973), p. 138.
- [4] Dinu Ciocan, “Despre rolul teoriei în procesul cunoașterii muzicale. Unele aspecte ale conceptului de relație sonoră în limbajul muzical tradițional”. *Cercetări de muzicologie* (București: Conservatorul „Ciprian Porumbescu”), vol. 2, p. 279.
- [5] Dinu Ciocan, in *Cercetări de muzicologie* (Bucharest: Conservatorul „Ciprian Porumbescu”) vol. 3.
- [6] Dinu, Ciocan, in *Cercetări de muzicologie* (Bucharest: Conservatorul „Ciprian Porumbescu”), vol. 4.
- [7] Dinu Ciocan, “Contribuții la analiza structurală a ritmului în limbajul muzical tradițional”. *Cercetări de muzicologie* (Bucharest: Conservatorul „Ciprian Porumbescu”), vol. 3, p. 354.
- [8] See the results of the project synthesized in “Quelques aspects de la modelisation sémiotique et computationnelle du langage musical”. *Muzica*, no. 3, 1995.
- [9] Dinu Ciocan, *Aplicații ale matematicii în cercetarea muzicologică*, p. 137.
- [10] See chapter II from the article mentioned in reference [7], “Un model analitic al operei muzicale”, p. 141.
- [11] *Introducere în teoria limbajelor formale și a automatelor pentru muzicieni* (Bucharest: Litografie Conservatorul de Muzică „Ciprian Porumbescu”), vol. 3, 1984.
- [12] “Quelques aspects de la modelisation sémiotique et computationnelle du langage musical”. *Muzica* no. 3/1995, p. 55.
- [13] Dinu Ciocan, *Introducere în teoria limbajelor formale și a automatelor pentru muzicieni*.

- [14] Dinu Ciocan, Antígona Rădulescu, “Probleme de semiotică muzicală”. *Studii de Muzicologie* (Bucharest: Editura Muzicală vol.XXI, 1989).
- [15] Dinu Ciocan, *O teorie semiotică a interpretării muzicale*. (Bucharest: Editura Universității Naționale de Muzică, 2005).
- [16] “Quelques aspects de la modelisation sémiotique et computationnelle du langage musical”. *Muzica* no.3/1995, p. 60.
- [17] See Solomon Marcus, *Artă și Știință*, chapter III.
- [18] Synthesis written with the direct support of Professor Ciocan.

In the diverse landscape of recent Romanian musicology, the theoretical direction developed by Professor Dinu Ciocan has a unique character. Crystallized in the 1970s, it continues to exert a powerful influence over the most modern methods of musical analysis. The moment when it appeared was favourable. In the second half of the previous century, a scientific current established the milestones of discourse on musical language, being almost exclusively supported by Romanian composers. The impulse came primarily from the Master's degree in Musicology gives you an opportunity to acquire specialised knowledge about the many forms and practices of music. The Master's degree programme in Musicology has two tracks: In Music, Sound and Communication you study music as an historical, cultural and/or aesthetic phenomenon and acquire increased understanding of the sound dimension of modern life by analysing and producing intelligent and aesthetic sound spaces and surroundings.