

ORGANIZATION AND ANALYSIS OF ENTHOMUSICOLOGICAL MATERIALS

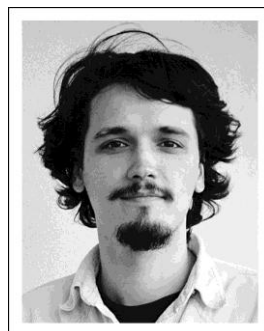
Reconsideration of Comparison, Classification and Evolution as Methods and Purposes of Research in the Context of Electronic Ethnomusicological Corpora (II)

(Continuation from the previous issue)

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(Continuation from the previous issue)

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ABSTRACT

The present study aims to discuss the utility of the corpus as an instrument of knowledge, particularly in ethnomusicology, where it serves as a new form of knowledge organization. The study also undertakes to analyse three of the main points of focus of ethnomusicological research: comparison, classification and evolution. The analysis includes both the conceptual foundations of these lines of research (historical origin, the various meanings or uses they have had over time), and their use in Romanian ethnomusicology, to finally mention some of the most promising approaches of comparison, classification and evolution in the international context of the use of electronic musical corpora.

Keywords: electronic corpus, automated analysis, comparison, classification, evolution.

3. Classification

In order to talk about classification, we will take a step back in time to Aristotle's *Categories*. One of Aristotle's most intensely discussed and commented upon works (especially in Antiquity and the Middle Ages, both in the East and West and in the Arab world), the *Categories* fall into ten "classes of reality"¹: substance, quantity, quality, relation, time, place, position, action and passion, possession. Here, Aristotle does not conceive the world as a unified whole, a unique genus (existence) that brings together all the individual substances, but rather lists the genera that the external reality has conformed to by using the human language. Thus, starting from our discourse on experience, the philosopher classifies all the types of utterances that people are able to make to verbalize the interactions with the external environment.² Assuming that any proposition is reducible to the form "S is P", in which the predicate P is connected to the subject S via the copula "is", Aristotle refers to the various semantic patterns whereby the verb *to be* can unite a predicate to a subject as categories or figures of predication. These typologies will allow a classification of the predicates that can be stated of a subject, thus forming the supreme categories, or genera.³ All the objects of the external world will be deducible, according to Aristotle, from the ten categories, by dividing genera into species, with the help of definition. However, this method of division, represented ever since Late Antiquity as a tree structure, is treated with much caution by the Stagirite in his biological and medical texts (*On the Parts of Animals*). Here, he seems ready to make concessions to the immobility of the trees, seeming willing to draw different trees according to the problem faced, even when defining the same species.⁴

However, philosophers were not the only ones to take an interest in classifications. For biologists and chemists, classifications ranked foremost among their concerns. We will focus for the moment solely on biology, as the correct ordering and arrangement of the specimens in this field are related both to Aristotle's system described above, and to the ethnomusicological classifications. Research in the field of natural sciences generally involves two stages: the creation of an inventory of the entities studied, which necessarily involves their naming and classification, and then theorization. However, upon a retrospective view of the

¹ This is the term used by Constantin Noica in his commentary "Pentru o interpretare a *Categoriilor* lui Aristotel", in Aristotel, *Categoriile*, Editura Humanitas, Bucharest, 1994, p. 66.

² Pierre Aubenque, *Aristotel*, addendum in Aristotel, *Categoriile*, Editura Humanitas, Bucharest, 1994, p. 142.

³ *Ibidem*, p. 143.

⁴ Umberto Eco, *Dall'albero al labirinto: studi storici sul segno e l'interpretazione*, Milano, Bompiani, 2007. Translation by Ștefania Mincu, *De la arbore spre labirint. Studii istorice despre semn și interpretare*, Iași, Editura Polirom, 2009, p. 9.

history of biology, these two stages cannot be separated in time, but rather the elaboration of a classification requires an underlying theory.¹ Until the modern era, classifications were made according to artificial criteria. So were those made by Pliny the Elder or Dioscoride in Antiquity, whose forms of organizations served mainly a utilitarian purpose. Until the 15th century, scholars were content to resume and comment on such works. The idea of natural classification emerged as a result of the numerous similarities between living organisms, which could not be attributed to chance (as opposed to the artificial criteria of classification, used to research the differences). Carolus Linnaeus made an important contribution in this direction, creating a descending hierarchy from class, to order, genus and species, similar to the model proposed by Porphyry's tree. Towards the end of the 18th century, the natural classification, once established, gave birth to a fixist vision of the living world, reflecting the divine order of creation. It was only Darwin with his theory that gave this organization also a temporal dimension, making the development of a classification synonymous with the recovery of the history of the living world (and thus biology becomes a historical science).²

Biology with its classifications as we know them today is a product of the 18th and 19th centuries. According to Michel Foucault, natural history, as this science was called at the time, succeeded by detaching the living being from the words to which until then it had been closely linked and directly conditioned through a complex system of analogies. "The words that had been interwoven in the very being of the beast have been unraveled and removed: and the living being, in its anatomy, its form, its habits, its birth and death, appears as though stripped naked".³ Natural history would now regain its purpose in the observing gaze fixed closely on things so as to describe and analyze them, and whose discourse may now raise pretensions to scientificity. "Natural history is nothing more than the nomination of the visible."⁴ The entire body of research and debates that took place during the 18th century in connection with the existence of genera and species was based on the axiom of a *mathesis*, understood by Foucault as a universal science of measure and order, by which the relationship between living beings can be thought of in terms of order and measure. Any type of knowledge, including that of nature, through its relationship with mathesis, can establish an orderly sequence between things, be they even non-measurable.⁵ Thus, living

¹ Hervé Le Guyader, the article "Clasificare", in Dominique Lecourt (coord.), *Dicționar de istoria și filosofia științelor*, Editura Polirom, Iași, 2009, p. 286.

² *Ibidem*, pp. 296-290.

³ Michel Foucault, *Les Mots et les Choses*, Paris, Gallimard, 1966. Translation by Bogdan Ghiu and Mircea Vasilescu, *Cuvintele și lucrurile*, Bucharest, Editura Rao, 2006, p. 200.

⁴ *Ibidem*, p. 203.

⁵ *Ibidem*, pp. 116-117.

beings were organized in the form of a table in which the continuity (the continuum, as Foucault calls it) – a prerequisite for the ordering of the general categories – between specimens, species and genera was based on a system of identities and differences.

3.1. Classification in Romanian ethnomusicology

Just as in biology, ethnomusicological classification is an equally important point of debate, especially as the folk musical material, by its typical polymorphism, largely resembles the living world. The thoroughness and care with which Bartók devoted himself to the investigation of musical folklore justifies the assertion that “he collected, notated and catalogued the elements of folk music like a naturalist.”¹ In the classification he made to his collection of Hungarian folk music, Bartók divided the melodies into three categories, based on the archaism or modernism of the items. However, for the collection of Romanian vocal folk songs (the 2nd volume of *Romanian Folk Music*), Bartók used a different method of systematization. Here, the musical material is classified according to the major genres it falls under. Thus, we have the non-ceremonial songs, funeral songs, wedding ritual songs, harvest songs, rain invoking songs and carols. In addition to this functional aspect noticed by Bartók, the material is divided into ten classes, the first six of which represent the divisions of the non-ceremonial songs group. The criteria used in delineating these classes are related to the metro-rhythmic structure of the songs (parlando rubato, giusto, dance songs, dotted rhythm, or long song). To make the classification more specific, Bartók later introduced further criteria, such as the distinction between isometric and heterometric melodies, the number of lines in the song and the place of the main caesura.² In biological terms, we could say that here we have a mixed type of classification, as Bartók applies both natural criteria of organization (the structuring of melodies based on genres, where the functionality they were endowed with is an endogenous manifestation of folklore; on the other hand, we should mention the phenomenon of migration of certain melodic patterns to several genres, which made Speranța Rădulescu assert that “genres are still not fully established, due to an inhomogeneous complex of functional and structural features”³), and artificial criteria (where the metro-

¹ Pál Richter, “Colecția completă de cântece populare maghiare a lui Béla Bartók”, in Laurent Aubert, *Memorie activă. Omagiu lui Constantin Brăiloiu*, translation by Speranța Rădulescu, Editura Martor, Bucharest, 2011, p. 226.

² Béla Bartók, *Romanian Folk Music*, vol. II, Vocal Melodies, Benjamin Suchoff (ed.), Martinus Nijhoff, The Hague, 1967, pp. 7-9.

³ Speranța Rădulescu, *Cântecul-tipologie muzicală. Transilvania meridională*, Editura Muzicală, Bucharest, 1990, p. 115.

rhythmic criteria, or the isometric/heterometric distinction are concepts projected by the researcher upon the folkloric material, following the analysis). Another aspect worth mentioning in Bartók's classification is that his approach starts from the most general characteristics (the genres of the songs) to gradually decrease, through various criteria, to smaller and smaller details of the tunes, whereby we can conclude that the order envisaged here is a descending one in the form of a tree structure, which, however, is no longer a binary tree, as with the ancient philosophers.

From Bartók to this day, the question of classification could hardly be avoided by any ethnomusicologist, so that the methods of classification were more or less different from one initiative to another. To complete the picture of the classifications made by the researchers in the field, we will briefly describe the process conducted by Ileana Szenik in the systematization of the songs (more exactly of the non-ceremonial songs preserved in the archives of the "Gheorghe Dima" Academy of Music of Cluj-Napoca.¹ In this case, the material is classified in ascending order, starting from the characteristics of the individual melodies, to finally reach the main typological categories, i.e. the most comprehensive units. The essential characteristics of the songs were previously entered on analytical cards, separately for each individual tune, using the melodic contour as their ordering criterion. To obtain a higher degree of objectivity, a table was devised showing the main aspects that a melodic contour can display, and resulting in four main types: arched contour and descending contour, and their reversals, concave contour and ascending contour. After this first phase of classification based on analytical cards, the process continued by comparing and grouping the variants, which ultimately generated cards containing the most important variant types (cards containing the most representative variants for a certain typology, basic variations, inventory data and the first line). Aspects such as the melodic contour, the range, the presence of the recitative, cadence variability or different changes in form were graphically represented using different symbols consisting of numbers and/or letters. Finally, this type of notation was used to prepare the summarizing cards (replacing the variant cards written with notes), which included the cadence system, the modal relations, the profile of variants in symbolic notation, the inventory number and the area with the widest distribution. All these cards were then summed up to eventually create the typological catalogue file of the archive. At the end of the process, two broad categories of non-ceremonial songs were identified: the first one containing melodies unfolding between the low and middle register and whose opening lines do not linger in the upper register, and the

¹ Ileana Szenik, "Preliminarii la întocmirea catalogului tipologic al melodiilor din arhiva de folclor a Conservatorului de muzică "G. Dima", *Lucrări de muzicologie*, No. 17-18, 1985, Cluj-Napoca.

second one, containing melodies that initially linger in the upper, or upper middle register, or whose opening lines move abruptly towards the upper part of the register. Based on their melodic line, each of these two categories is divided into four groups, which, in turn, are divided into two subgroups.

As we can see at least in the two classification examples presented above, ethnomusicology, unlike modern biology, uses almost exclusively artificial criteria. The only groups that can be regarded as natural are the ones based on genre (though even here there are some reservations) and on the individual separation of each melody, or, in other words, music itself enables us to make either the most general delimitations or the most specific ones (in Aristotelian language, only the most general genera and the individual substances). In order to penetrate the nature of the music under study, the researcher intervenes with his own classification criteria precisely between these two extremes. We can therefore say that this operation is based rather on the criteria of the classifier, than on the internal criteria of the material to be classified.¹ Consequently, we find ourselves having to reopen the old medieval controversy between realism and nominalism and revisit two questions that were posed on other occasions: “Is folk music a continuum?” and “Do genres really exist, or are they mere conceptions of the mind?”² To overcome this status of a mere tool facilitating the ethnomusicologist's orientation in the material, and to be able to describe the internal coherence of such music, the researcher can turn to areas such as linguistics and cognitive sciences, which provide valuable tools for evaluating the grammaticality of a discourse. The relevant literature in the field includes a number of research studies of this type, with noteworthy results. A brief summary of some of these initiatives will bring our discussion of classification to a close.

3.2. Classification in contemporary ethnomusicological research

As a continuation of the manual classification of songs performed by folklorists with a common training, automatic classification emerged as an alternative ever since the mid-1950s³. Currently, the approaches that follow this direction envisage two types of classification: the automatic classification of the melodic variants falling in the same pattern and that of the various musical pieces of the same genre. There is a real need today for effective methods of automatic

¹ Ioan Haplea, *Despre clasificare*, introductory study to Doina Haplea, Ioan Haplea, Ion H. Ciubotaru, *Folclor muzical din ținutul Neamțului*, Editura Arpeggione, Cluj-Napoca, 2008, p. XXIV.

² *Ibidem*, p. XXVII.

³ one of the first examples being Freeman L. C., Merriam A. P., “Statistical Classification in Anthropology: An Application to Ethnomusicology”, *American Anthropologist*, nr. 58/1956, pp. 464-472.

classification of melodies, due to the existence of several musical corpora in which manual classification would be a difficult process to imagine.

Regarding the classification of the different melodic variants, Ciril Bohak and Matija Marolt¹ describe a software specially created to perform this type of classification automatically. To this end they statistically derived a number of melodic features that served as standards in calculating the similarity between variants.

A similar approach was taken by Peter van Kranenburg², who undertook the automatic classification of variants around the concept of “tune family”. In establishing the criteria for the determination of variants, he started from the manual classification performed by a group of three ethnomusicologists, whereby 26 such tune families are identified. The criteria used by the experts – melodic contour, rhythmic structure, recurring melodic motifs – were not all of equal importance in establishing the tune families, being involved in this process to variable degrees. These criteria were then integrated into a program of automatic classification of the variants, which was applied to the Dutch Song Database corpus. In testing this model, the most promising results were obtained in the classification based on the frequency of occurrence of the melodic motifs.

Another type of classification is based on the musical genres. The automation of this process can prove its advantages in rendering the handling of large corpora more effective. In this respect, a research study conducted by Ruben Hillewaere, Bernard Manderick and Darrell Conklin³ evaluated three different models for achieving this type of classification. All these models started from the symbolic representation of tunes in the form of strings and were tested against a corpus of 2198 dance songs, for the task of grouping them according to the 9 genres existing in the corpus. The three models evaluated in this task were: the determination of the similarity between two strings of symbols by estimating the minimum number of steps to be taken to turn one into the other through operations such as substitution, insertion or deletion; the statistical estimation, by using n -gram models (one such model assumes that the probability of occurrence of a symbol in an input sequence depends only on the $n-1$ previous symbols⁴) of the probabilities of succession of the symbols for each genre separately, with the

¹ In “Calculating Similarity of Folk Song Variants with Melody-Based Features”, International Society for Music Information Retrieval, 2009.

² Peter van Kranenburg, *A Computational Approach to Content-Based Retrieval of Folk Song Melodies*, Ph.D. thesis, University of Utrecht, 2010.

³ Ruben Hillewaere, Bernard Manderick and Darrell Conklin, “String Methods for Folk Tune Genre Classification”, 13th International Society for Music Information Retrieval Conference, 2012.

⁴ Doina Tătar, *Inteligență artificială. Aplicații în prelucrare limbajului natural*, Editura Alabastră, Cluj-Napoca, 2003, p. 24.

classification being then made based on these probabilities; the selection of a number of global features derived from tunes and note durations, which were represented as multidimensional vectors characterizing the 9 types of dances. The most effective method for classifying tunes by genre proved to be the one based on the n -gram models. Given that these are dance types of tunes, the rhythmic aspect was most important in assigning the tunes to certain genres.

4. Evolution

The term evolution comes from the Latin *evolutio*, derived from the verb *evolvere*, meaning “to unfold”, “to cause something to roll out from somewhere”, “to explain”, i.e. to unwrap something that is wrapped up.¹ Although it was only in the 17th century that the term as such started to gain a certain degree of currency in science and philosophy, its conceptual roots, i.e. the idea of evolution itself, derives from the Stoic philosophy, whose seminal reasons later influenced St. Augustine and can be traced up to the modern era, when Malebranche used the terms “evolution” and “development” to advocate the theory of pre-existence of the embryo, positing that the embryo contained in essence all the information that would define the future adult, and that all it had to do was evolve. The term became established, at least on a philosophical level, only in the 19th century, when Herbert Spencer defined evolution as a universal law of progress. In the German philosopher's view, evolution applies to the genesis of the Universe and to the history of the Earth and life, as well as to the psychological development of man and of the human societies.² Spencer's influence was extremely important and continued into the early half of the 20th century (echoes of his work can be found, for example, in the philosophical works of Lucian Blaga). However, the biological meaning of evolution gained advantage over the philosophical one, so that the French philosopher Henri Bergson, in his book *Creative Evolution*, framed his arguments around the themes of evolutionary biology. For Bergson, the knowledge of the living is based on the interval of duration, on the irreducibility and irreversibility of a history.³

Like any human artifact, music is also subject to change. Music history, or at least the manner in which it is taught in schools and universities, presents this

¹ Jean Gayon, *Evoluționism*, in Dominique Lecourt (coord.), *Dicționar de istoria și filosofia științelor*, Ed. Polirom, Iași, 2009, p. 574.

² *Ibidem*, pp. 575-577.

³ Henri Bergson, *L'Évolution créatrice*, Paris, F. Alcan, 1908. Translation and preface by Vasile Sporic, *Evoluția creatoare*, Iași, Editura Institutul European, 1998, pp. 42-43.

change as an evolutionary process that started millennia ago from the most rudimentary sound effects, to develop gradually until it reached its maturity in the 19th century, when the Western musical canon was fully established. Although since then this canon was constantly expanded either by including composers of the Baroque and Renaissance period, or by accepting a few names of the 20th century modernism, the impression left by this narrativization of music history, of its gradual evolution, is that of a teleological process: the gradual improvement of the musical techniques and practices aimed at achieving their highest perfection, which happened in the 19th century. From this teleological perspective, evolution is synonymous with progress, and ideas like the qualitative change from one stylistic period to another, or the culmination attained by Classicism and Romanticism have axiomatic values.

Unlike the history of Western art music, whose writing in the 19th century was influenced by the philosophy of history, resulting in this intertwining of meanings between evolution and progress, folk musics received a relatively different treatment. Their discovery often meant (particularly in the case of primitive civilizations, far removed from the European world) the discovery of the primary stage of music, the zero point of what was (or had) to become, after a long progress, the Western art music. Things, however, did not stop here; the music of primitive peoples remained the farthest point in the history of music, but also an inert one, doomed to immobility. The progressive perspective is not applied to these musics, and not because the philosophy of history, which had influenced the entire Western thought, was no longer in vogue in the early 20th century, when ethnomusicology became a standalone field of study, but because these primitive civilizations were not considered as part of History, i.e. of that entity whose specific laws European philosophers and historians believed to have discovered. In his *Lectures on the Philosophy of History*, Hegel states that “the only consistent and worthy method which philosophical investigation can adopt is to take up History where Rationality begins to manifest itself in the actual conduct of the World’s affairs and not where it is merely an undeveloped potentiality.”¹ It is useless to add that rationality was not considered to be specific to the primitive societies. As *outsiders* of History, the primitive peoples do not participate in the progressive development of the Western culture, and therefore their music cannot exceed the boundaries within which they are already framed.

Thus, without being caught in this logic of progress, traditional music, from wherever it may come, undoubtedly undergoes, in turn, a certain type of

¹ G. W. F. Hegel, *Vorlesungen über die Philosophie der Weltgeschichte*, 1837. Translation by Petru Drăghici and Radu Stoichiță, preface by Adrian Paul Iliescu, *Prelegeri de filosofie a istoriei*, Pitești, Editura Paralela 45, 2006, p. 86.

evolution, whether in a positive direction, or in a negative one (an involution that can be observed when traditional societies embark decisively on the path of modernization). Although no audio recordings are available from before the first decade of the last century, and transcriptions were extremely rare until the 19th century, Romanian ethnomusicology has already established the manner in which the local folklore modified some of its features during the last century. Whether we are speaking of modal or morphological structures, performing techniques, rhythmic systems, or functional implications, Romanian traditional music underwent configuration changes that led to the identification of several stages of development within it, with traces of the first archaic stage being still preserved when B. Bartók or C. Brăiloiu, among others, conducted their folklore collection campaigns. In Maramureș, Bartók had already found two musical styles that co-existed in the musical practice of the region, the oldest of which was characterized by the *parlando-rubato* style of performance, a rich ornamentation and a specific manner of vocal performance (*hore cu noduri* - 'song with knots'). A new stage is that which ethnomusicologists call modern style, already observed in the early 20th century, born through the contact with the urban and entertainment musics and characterized by a moderate ornamentation, a *giusto* style of performance and a more precise articulation of form. A last stage would be the contemporary one, of the new song (or *de viață nouă* – the 'new-life song'), theorized during the communist period out of obvious ideological reasons, but whose post-revolutionary reconsideration we are not aware of.

4.1. Evolution – the biological perspective

To determine more accurately the meanings that the concept of evolution can acquire in an ethnomusicological analysis, we should first dwell a little on the science credited with having initially established this concept, i.e. biology. In 1859, the publication of Darwin's book, *On the Origin of Species*, caused a true revolution, not only in the biology of that time, but also in the entire Western culture. Until the publication of this work, the world was considered to have reached its final form, as natural philosophy – concerned with the study of nature at that time – was still under the influence of the Biblical creationist theory. Thus, the species were considered to be fixed and unchanged since the time of creation, and the world, frozen in this original form, was heading for the last judgment as its final destination. The first ideas of evolution emerged as a result of the discoveries made during the 17th and 18th centuries. Then, anything existing on Earth, from inorganic matter to animals and humans, was ordered from simple to complex forms, in a unique, linear and continuous chain (the great chain of being, in Arthur

Lovejoy's words, or *scala naturae*, as it was called at the time). The idea that this exhaustive chain could actually embody a process of evolution from simple to complex, from lower to higher, was first formulated by the French naturalist Lamarck.¹

Darwin's research thus managed to demonstrate the inadequacy of the essentialist way of thinking about nature, according to which classes are constant (like the Aristotelian categories), and proposed instead the alternative of the populational view. Each species is composed of several local populations, within which each individual is uniquely different from all others. According to Darwin's theory, the population is at the same time the basic unit of evolution, the most important level where evolution occurs.² "Evolution is best understood as the genetic turnover of the individuals of every population from generation to generation".³ The determining factor that ensures the evolution of a given population is therefore precisely its inexhaustible variability. This genetic variability provides the necessary material for the generation of new chromosomal rearrangements. The French biologist François Jacob described the mode of operation of evolution as *bricolage* ('tinkering'), i.e. as the constant reuse of the old to make something new, or the use of the same elements to finally obtain new and more complex systems. The same author compares this activity to that of an engineer, who starts working only after procuring all the raw materials and tools that he needs.⁴ The entire process of evolution of the living world could be represented in the form of a phylogenetic tree. In each node of this tree, the trajectory of evolution could take a different direction, and once a choice was made, the process becomes irreversible. The phylogenetic tree is therefore a probabilistic tree.⁵ According to the French biologist Jacques Monod, the direction in time implied by the irreversibility of evolution is the same as the direction enjoined by the law of increasing entropy (the second law of thermodynamics), as the two processes are based on identical statistical grounds.⁶

4.1.1. *Development, progress, complexity*

¹ Ernst Mayr, *What Evolution Is*. New York, Basic Books, 2001. Translation by Marcela Elena Badea and Ileana Popovici, *De la bacterii la om. Evoluția lumii vii*, Humanitas, Bucharest, 2008, p. 26.

² *Ibidem*, pp. 97-99.

³ *Ibidem*, p. 99.

⁴ Mircea Flonta, *Darwin și după Darwin. Studii de filosofie a biologiei*, Ed. Humanitas, Bucharest, 2010, p. 298.

⁵ *Ibidem*, pp. 300-301.

⁶ Jacques Monod, *Le hasard et la nécessité. Essai sur la philosophie naturelle de la biologie moderne*, Paris, Éditions du Seuil, 1970. Translation by Sergiu Săraru, *Hazard și necesitate. Eseu despre filosofia naturală a biologiei moderne*, Ed. Bucharest, Humanitas, 1991, p. 109.

Contrary to the biblical doctrine, Darwinism promotes the idea that the living world is in a state of constant change. In order for this change to occur, an impressive number of factors and contingent correlations must synchronize together. It is precisely this constant production of new structures that led certain biologists to equate evolution with progress. When speaking about progress, contemporary biology makes a clear distinction between three concepts: the *trend*, which describes a pattern, a directional change in a group statistic; *tendency*, which also describes a pattern, but at a lower level, among the species that make up the group; *cause*, which offers explanations for the occurrence of the tendency.¹ Ever since Aristotle, progress was associated with increasing complexity, but Darwinism and its later supporters demonstrated that, at least in biology, simplification may, in turn, also result in progress.² Biology drew heavily upon the research on information theory initiated in the latter half of the last century, according to which complexity is a function of the number of parts of a particular (be it biological) system and the irregularity of their arrangement. According to this definition, order is the opposite of complexity, because an ordered system contains a few different kinds of parts arranged according to certain *patterns* that can be easily specified. However, living organisms are not ordered systems, but rather systems that have an organization. Organization as so understood refers to the degree of structuring of a system for the performance of some function, independent of its complexity or order. In this conceptual separation of complexity (as a structural property) and organization (as a functional property), there is no necessary connection between the two terms. In evolution, however, complexity and organization are connected, because the more complex an organism is, the more refined its organization should be in order for it to survive.³

According to Friedrich Cramer, the degree of complexity of a system is related to its describability, and the more parameters are required for its comprehensive description, the more complex the system is. Relying on the concept of information, complexity can be defined as the logarithm of the number of possibilities of organization of a system.⁴ Analyzing the phenomenon of complexity, the same author speaks of three types of complexity: *subcritical*

¹ Alex Rosenberg and Daniel W. McShea, *Philosophy of Biology. A contemporary introduction*, Routledge, 2008, p. 150.

² Michael Ruse, *Evolution and Progress*, in Hull, David L. and Michael Ruse (ed.), *The Philosophy of Biology*, Oxford University Press, 2008, p. 617.

³ Daniel W. McShea, *Complexity and Evolution: What Everybody Knows*, in Hull, David L. and Michael Ruse (ed.), *The Philosophy of Biology*, Oxford University Press, 2008, p. 627.

⁴ Friedrich Cramer, *Chaos und Ordnung. Die komplexe Struktur des Lebendigen*, Stuttgart, Deutsche Verlags-Anstalt, 1988. Translation by Andrei Apostol and Marius Stan, *Haos și ordine. Structura complexă a viului*, Bucharest, Editura All, 2001, p. 263.

complexity (systems that can be simplified by mathematical laws, resulting in deterministic systems that can be subsumed under some physical regularities analogical to Newton's laws), *critical* complexity (where subsystems emerge within a given system, so that the possibility of prediction, though having no practical limitations, is faced with principal limitations) and *fundamental* complexity (in which the systems, despite the initial deterministic conditions, develop non-deterministic or chaotic solutions). A structure is fundamentally complex (or non-determinable) when the smallest algorithm needed to describe it has a number of bits comparable to the structure itself. The category of fundamentally complex systems includes, according to Cramer, the network system called "life", with all its manifestations, from the functioning of the central nervous system to the organization of human societies (from this perspective, folk music, as a whole, as well as its specific productions, can well be considered as such a system). According to Cramer's theorem, in the spiritual world, in the creation of ideas, in the world of decision, due to the fundamentally complex neurological and physiological properties, there is no simple causality or possibility to make predictions.¹ These epistemological limitations are inevitably reflected in the study of the evolutionary process of folk idioms, and the only way to address this issue is, according to the same author, by reducing the complexity in order to control the fundamental complexity.²

4.1.2. *Biological evolution and rehabilitation of the historical explanations*

Another important aspect of the evolutionary theory is the importance of the historical dimension of the evolution of life on earth. As an opponent of any form of finalism, Darwin introduced the historical perspective in science, in an epistemological landscape dominated by Newtonian mechanics, in which everything in the world is controlled by perfectly quantifiable forces, capable of being translated through equations. For Darwin, however, historical antecedents are of paramount importance in explaining the evolutionary phenomena.³ In this historical perspective, the biology of evolution acquires a special configuration, which clearly distinguishes it, in certain respects, from the exact sciences. Its object of study is the unique and unrepeatable processes (the extinction of dinosaurs, the emergence of eukaryotes, the origin of man etc.), for whose investigation the experiment (essential in the exact sciences) turns out to be an inadequate working method. Unlike other sciences, the biology of evolution makes frequent use of

¹ *Ibidem*, pp. 267-276.

² *Ibidem*, p. 284.

³ Ernst Mayr, *op. cit.*, p. 98.

historical explanations, and its explanations are not given in the light of certain laws, but according to concepts such as reproduction, division, growth, adaptation, individual, population.¹ This reconsideration of the historical explanations paved the way for a scientific approach to the “idea of change” in other areas as well. One must not forget that with the advent of the Cartesian rationalism, history as an object of study fell into obscurity, being deemed unworthy of the new reasoning requirements based on clear and distinct ideas; even the philosophy of history, mentioned earlier for its profound influence on the European thought of the 18th and 20th centuries, is not a rehabilitation of history in itself, but rather a transformation thereof into a mechanistic type of instrument enabling future predictions based on the knowledge of the past. Anthropology or economics, for example, relying on the theory of natural selection, resorted to a method of formalization of a contingent historical process. Just as Newton's gravitational mechanics served as a model in articulating different anthropological speculations, the theory of natural selection is used today in developing models that explain the human dimension.²

Throughout the entire history of his species, man has undergone two types of evolution: a biological, exclusively vertical evolution (parents-children descendancy) due to the heredity of his genetic code, and a cultural evolution, both vertical and horizontal, of transmission of information through various media. Biologist Francisco Ayala calls these two types of heredity organic and superorganic, or endosomatic and exosomatic. Unlike other animals, humans can transmit the acquired knowledge from one generation to another, thus creating a “social memory” through which accumulated experiences can be passed on to the new generations. This mode of operation is actually a Lamarckian model of evolution (given that the Darwinian theory vigorously, albeit rightly, rejected the Lamarckian theory according to which, in the entire living world, the acquired knowledge can be passed on by way of heredity). Cultural inheritance made cultural evolution possible, as a new form of adaptation to the environment, available only to humans.³ But this problem of cultural evolution leads us to another aspect. As Friedrich Cramer showed, humanity produces annually 10^{18} bits of non-genetic information, i.e. a billion times more information that is passed on to future generations than would be possible through hereditary devices over a

¹ Mircea Flonta, *op. cit.*, p. 289.

² Jean Gayon, *op.cit.*, pp. 584-585.

³ Francisco J. Ayala, *Human Evolution. The Three Grand Challenges of Human Biology*, in David L. Hull and Michael Ruse (ed.), *The Philosophy of Biology*, Oxford University Press, 2008, p. 250.

period of 30 years. In Cramer's view, this means that the genetic evolution of the human species has reached its final station.¹

4.2. Evolution – an anthropological perspective

The evolutionary paradigm had a major impact on humanities too, which allows us to speak of an anthropological evolutionism developed in the second half of the 19th century. The main challenge that the European culture at the dawn of modernity had to face was, in this respect, the contact with the exotic civilizations of the Far East and, especially, with the primitive societies, be they Asian, African or American. The savage, the primitive, offered the European culture the opportunity to reconsider itself and, at the same time, to project its own image onto the rest of the world. The primitive is thus regarded to be at the origin of modern man, the starting point of a road that was to be followed to the end only by the inhabitants of the old continent. The Enlightenment, through some of its representatives such as Rousseau, offered a different approach to the primitive, viewing him in an idealized light, as an example of wisdom and tolerance, the myth of the “good savage” being thus used in the criticism of the political and religious realities of the Europe of that time.

Primitivism, as a concept underlying the study of non-European civilizations, managed to integrate those once considered as “savages” into a unified view of the world, but in which they became our ancestors, standing at the bottom of the evolutionary ladder. What was considered to be different between Us and Them was not chronology, the passage of time, which, in their case, seemed to have stood still, but the quality of this time. For the West, the time taken by this culture to make its rise was considered to be of a high quality, while for the primitive, the passage of time seemed to have had no notable result. By treating the differences between the societies of the world as “ages of mankind”, this evolutionary-historicist perspective, or, as Vintilă Mihăilescu calls it, this “primitivist ideology” managed to affirm the unity of mankind (with no more “savages” or non-humans) and the common ideal of “growth” as being intrinsic to this humanity (progress thus became a natural law that sooner or later applied to all civilizations).² For a long time, the evidence to prove the infallibility of this progress was obtained by observing different primitive cultures, regarded as a kind of “living fossils”, representatives of a way of life that characterized the entire humanity at a given time, and by whose temporal distribution man's entire evolutionary path could be retraced.

¹ Friedrich Cramer, *op. cit.*, p. 278.

² Vintilă Mihăilescu, *Antropologie. Cinci introduceri*, Ed. Polirom, Iași, 2007, pp. 265-266.

Today, the idea of progress applied to anthropology has lost this momentum, and other models of understanding are used to explain the differences between different cultures. Claude Lévi-Strauss, for example, compares the archaic societies with some mechanical machines, and the modern ones with some thermodynamic machines. The former, i.e. the mechanical ones, are “cold” societies, which produce extremely little disorder (entropy) and which tend to preserve themselves in their initial state. The latter, on the other hand, are “hot” societies that create and maintain imbalances within them, produced by much more order (the industrial society), but also by more entropy in human relationships. The reason why primitive societies were long considered without a history and incapable of progress is because, despite lacking a culture comparable to ours, they have a high level of social homogeneity, they are egalitarian societies, of a mechanical nature, governed by the rule of unanimity, which ensures their cohesion and, at the same time, protects them from potential radical changes.¹

Contemporary anthropological evolutionism gave up the hierarchical ordering of the cultures that are contemporary with us, based on their alleged distance from an arbitrarily chosen origin. Nowadays, evolution is viewed from a Darwinian perspective, in which the time of evolution is no longer a finalistic one, endowed with a direction and a clear target. Such an approach is no longer limited to highlighting the aspects related to development and progress, but takes into account, in equal measure, the dissolution, decline or stagnation of a society, defining evolution strictly as a sum of qualitative changes in the historical order.²

4.3. The subject of evolution as treated in Romanian ethnomusicology

To determine the direction of musical evolution in the human societies, the musical folklore of different populations was taken into consideration. Thus, the simpler the music was, or the farther removed from our level of civilization those singing it were, the older it was considered. However, all these deductions were never enough to form a complete picture, or even a satisfactory one. If we accept that music too evolves, like living beings, it means that it too had a continuous evolution, without leaps, and it is therefore hard to believe that gathering all the information needed for the reconstruction of its entire evolutionary path will ever be possible. On the other hand, if we consider folk music as a fundamentally complex system, as Cramer defined it, then, even if we manage at some point to

¹ Claude Lévi-Strauss, *L'Anthropologie face aux problèmes du monde moderne*, Paris, Seuil, 2011. Translation by Giuliano Sfichi, preface by Maurice Olender, *Antropologia și problemele lumii moderne*, Iași, Ed. Polirom, 2011, pp. 117-122.

² Vintilă Mihăilescu, *op. cit.*, p. 278.

figure out its synchronic configuration, it will still be impossible to make accurate descriptions of its previous states. The limits of knowledge of such systems will be reflected both in their future development and in their previous course.

If we stay in the realm of analogies, we should mention that the evolution of traditional music is the result of the competition between tradition and innovation, between the force with which tradition is kept alive in the memory of the actors and their willingness to make concessions to innovation and its force of persuasion. This mode of operation is similar to that of the genetic mechanism, whose structures are characterized by the property of invariance, but which still allows retention of certain perturbations due to mutations.¹ However, this acceptance is conditioned by the compatibility between the “novelty” occurred and an already fully developed system that controls the execution of the organism's project.² This mechanism of acceptance of the novelty, of its compliance with the already existing structures, is also found in the controversy between tradition and innovation, where novelty is never absolute novelty, but, if it is accepted, it is precisely because it can bend to the traditional frames. On the other hand, if in genetics, novelty arises from mutations, i.e. from events with a probabilistic determination and subject to chance, cultural (and therefore musical) innovation can be determined with greater accuracy (albeit never completely), precisely due to the constraints, of the selection pressure it is subjected to by the cultural customs in use at a given time.

The parallels that can be drawn between musical folklore and genetic evolutionism have already been noticed for a good while, as is evident from the highly explicit definition of folk music proposed in 1955 at the International Folk Music Council³:

Folk music is the product of a musical tradition that has been evolved through the process of oral transmission. The factors that shape the tradition are: (i) continuity which links the present with the past; (ii) variation which springs from the creative impulse of the individual or the group; and (iii) selection by the community, which determines the form or forms in which the music survives.

The evolutionary dimension of folklore is mentioned in the very first sentence of this definition, and the agent of this evolution is the process of oral transmission. The three factors that shape tradition – continuity, variation and selection – may be associated with the genetic mechanisms of transmission of information (called here continuity) and with variation and selection.

¹ Jacques Monod, *op. cit.*, p. 30.

² *Ibidem*, p. 106.

³ Patrick E. Savage and Steven Brown, “Toward a New Comparative Musicology”, *Analytical Approaches To World Music*, 2.2, 2013, p. 166.

In Romanian ethnomusicology, the problem of evolution has rarely been addressed, and often only tangentially. In his article "*Despre factorii care înlesnesc evoluția muzicii populare*" [Factors Facilitating the Evolution of Folk Music], Gheorghe Ciobanu names five such factors, without establishing any hierarchy: the contact with the music of other peoples; the contact with art music; the interpenetration of different regional styles; variation and contamination. Of these factors, the ethnomusicologist calls the first three as external, and the last two as internal.¹ For the rest of the study, the author's attention focuses on certain particular cases that illustrate the five factors above.

Other considerations on the evolution of Romanian folk music are found in Ghizela Sulițeanu's book, *Psihologia folclorului muzical* [The Psychology of Musical Folklore]. Here, the occurrence of novelty is explained by processing the already established elements (similar to François Jacob's description of biological evolution).² The author regards each folk category as a system, hence the existence of specific systems for carols, lamentations, ballads, lullabies etc. The development of these systems involves five distinct and consecutive stages: an early stage, in which certain already established elements dominate completely all musical manifestations; a stage in which new elements occur, but only sporadically and apparently incidentally; a stage in which novelty claims a main functionality of its own; a subsequent stage in which the new element has the same importance as the central element, and a final stage in which the system thus created reaches an apparent stagnation.³ Regarding the emergence and development of sonorous systems, the author believes that we are dealing with an organic process, in which the incipient, fundamental cells gave birth to the pre-modal systems, which, in turn, led to the formation of the modal systems consisting of six or seven tones.⁴ The mechanisms by which this process unfolds are the relative mutation of the musical motif and the substitution of the musical sound; they represent in fact the forms of manifestation of variation.

Another survey on the evolution of Romanian traditional music, conducted by Emilia Comișel and Mariana Rodan-Kahane and entitled *Pe urmele lui Béla Bartók în Hunedoara* [In the Footsteps of Béla Bartók in Hunedoara], presents the results of a field research carried out in a region visited by Bartók 40 years earlier. The authors of this survey started from Bartók's articles on the music of this region, entitled "The Musical Dialect of the Romanian People of

¹ Gheorghe Ciobanu, "Despre factorii care înlesnesc evoluția muzicii populare", in *Studii de etnomuzicologie și bizantinologie*, vol. II, Editura Muzicală, Bucharest, 1979, pp. 27-28.

² Ghizela Sulițeanu, *Psihologia folclorului muzical. Contribuția psihologiei la studierea limbajului muzicii populare*, Editura Academiei R.S.R., Bucharest, 1980, p. 101.

³ *Ibidem*, p. 159.

⁴ *Ibidem*, p. 160.

Hunedoara” and “Romanian Folk Music”. The authors compared the conclusions reached by the Hungarian musician four decades earlier, with the results obtained from the material collected by the researchers from the Folklore Institute. In terms of melodic scales, Bartók found that the dominant mode in the songs of the Hunedoara region was the Aeolian mode (with or without the sixth scale degree), with the final on G and the leading tone F (the seventh scale degree); in the final cadence, in most of the songs collected by Bartók, the second degree is lowered by a semitone, resulting in a Phrygian cadence (in fact, the Hungarian musician used to call the music of this region a dialect of the Phrygian cadence). The same melodic scale is prevalent in the material collected by the Romanian researchers, except that now there is a tendency of expansion of the upper register. Another difference that occurred over time is related to the final cadence formula. Although the Phrygian cadence is still prominent, it gradually begins to give way to downward cadences and especially to leading tone cadences. The last category were also present in Bartók's collection, though in a much smaller number, but over time they came to represent a strong evolutionary tendency of the musical material of that region.¹ In terms of structure, if in Bartók's time the three-lined melodies prevailed, in the 1950s they were replaced by four-lined tunes. As a matter of fact, several three-lined tunes from Bartók's collection were later found in their four-line variants, formed by a repetition of the second melodic line.² The melodic formulae were also analyzed based on the criterion of the place they occupy in the economy of the song. Thus it was found that there are places where the melody is much more susceptible to change (the opening formula and the point immediately after the main caesura, both showing a particular tendency towards melodic expansion) and passages with a more static character (best illustrated by the cadence formulae).³

As a general conclusion, the survey conducted by Emilia Comișel and Mariana Kahane highlights the fact that more than half of the material collected by Bartók could be reconstructed when the research took place. But this percentage has an uneven distribution, because most songs have a limited area of circulation, surviving only in the repertoire of older people or in isolated geographical areas. Thus, if some of the songs collected by Bartók could be faithfully reproduced, others have considerably altered, while others have completely disappeared. According to the authors of the survey, this is due both to the performer's memory and his emotional attitude towards that song, and to the position the song

¹ Emilia Comișel, Mariana Rodan-Kahane, “Pe urmele lui Béla Bartók în Hunedoara”, in *Muzica*, No. 9, 1955, pp. 12-13.

² *Ibidem*, p. 14.

³ *Ibidem*, p. 17.

occupied in the general repertoire of the village.¹ Also worth mentioning is the rich ornamentation developed in the Pădureni folk song within the decades following Bartók's visit, which the Hungarian musician had briefly characterized as having an "ornamentation not very rich". According to the authors of the survey, this was due to the influence of the music of Banat on that of Hunedoara, also noticed by Bartók, which since then has grown so strong that the songs of Banat were eventually assimilated almost beyond recognition in the local style.²

Another field collection campaign, though smaller in size, was conducted in the same region by a team from Cluj, one hundred years after Bartók's visit in Hunedoara. One of the materials collected on this occasion was a song from the ritual repertoire entitled *Cântecul bradului* [The Song of the Pine Tree] from the village of Feregi, where Bartók had also found it one century earlier under the name of *A bradului* [Of the Pine Tree]. The comparison of the two variants, so distant in time, revealed the minimal changes that occurred during this period of time: except for some slight changes in the melodic contour, the main difference in the current variant of the song is the melodic progression towards the final cadence which is achieved by leading tone progression and not by stepwise downward progression, which, paradoxically, gives the current variant an amplified archaic look:

¹ *Ibidem*, p. 20.

² *Ibidem*, p. 22.

Example 3: Bartók's variant of the Song of the Pine Tree

639d.

1. Ăi Șe-ci - nă d'e bra - du Șe-ci nă d'e bra - du

8

Șe țî'ai d'o - bli - și - tu Șe țî'ai d'o - bli - și - tu

2. Din co - dru'i por - ni - tu Din co - dru'i por - ni - tu

7

Eu n'am cei por - ni - tu Eu n'am cei por - ni - tu

Example 4: the current version of the Song of the Pine Tree, collected by Ioan Haplea

m Ce-ti - nă de bra - du e Ce-ti - nă de bra - du m

4

Ce te'ai d'o - bli - ci - tu De'n co - tro'i por - ni - tu

The main question raised by the authors of the study is how it was possible for such a song to be preserved, with minor changes, for a period of four generations and in a cultural environment in which the musical products were not passed on in writing or through a declared adhesion of the community members. The answer is that such musical pieces follow a minimally tensioned archetypal pattern, achieved through the convergence of the grammaticality levels that make up any musical discourse.¹

¹ Ioan Haplea, Doina Haplea, "Convergent și divergent în gândirea anonimă românească. Gânduri pe un traseu bartókian în Hunedoara și Bihor", *Miorița – Revistă de Etnografie și Folclor*, No. 16-17, 2012, pp. 5-7.

4.4. Evolution in contemporary ethnomusicological research

Nowadays, the mechanisms of evolution rely on evolutionary computing, which was initially used in the study of DNA sequences, but which eventually found applications in other fields as well, including music. Perhaps one of the most interesting applications of evolutionary computing in the evolution of music is for the study of the circumstances and mechanisms by which musical cultures might originate and evolve in artificially created worlds, inhabited by virtual communities of software agents. In these cases, music is studied as a complex adaptive system in which its origins and evolution are studied in the context of the cultural conventions that may emerge under a number of psychological, physiological and ecological constraints.¹ Although musicology has its own answers to and methods of investigation of these issues, the computer simulation of such systems can be useful for developing and demonstrating specific musical theories, which find their theoretical validation through computer modeling.

The contemporary literature on the computational study of musical evolution offers a broad spectrum of approaches and results. Eduardo Miranda, Simon Kirby and Peter Todd (in "On Computational Models of the Evolution of Music: From the Origins of Musical Taste to the Emergence of Grammars", in *Contemporary Music Review*, 2003, Vol. 22, No. 3 91-111) review a number of initiatives in the field: the study of the origins of musical taste based on a reasoning inspired from the mating of birds, in which the "males" songs evolve as a result of the selection made by the "females" acting as critics and basing their judgment on the surprise produced by a certain combination of sounds, calculated based on their expectation of the probability of one pitch following another; the development, in an artificial environment, of a musical repertoire common to a number of subjects, based on the social relations that can develop between them; the simulation of the teacher/learner learning process based on a model involving the two actors, a signal space (a limited set of notes) and a semantic space (a set of emotions, each associated with a combination of two or three sounds, which can be combined to form a melody), as a result of which the melodies created in response to the stimulus of certain emotions should evolve towards greater complexity, as the grammars underlying the hierarchical structuring of emotions become simpler and more flexible.

¹ Eduardo Reck Miranda, Simon Kirby, Peter M. Todd, "On Computational Models of the Evolution of Music: From the Origins of Musical Taste to the Emergence of Grammars", *Contemporary Music Review*, 2003, Vol. 22, No. 3, 91-111, p. 91.

More recent studies¹ start from the same computational simulation of the evolution of music, which is now under the selective pressure imposed by the human subjects participating in the study. For this purpose, the authors created a population of tree-like digital genomes, each of which encodes a computer program. Every time such a program is executed, a short melodic sequence is produced, in which the order of notes and instrumentation are fixed, while tempo and meter are unspecified. These short melodic sequences can replicate, to produce new melodic sequences through recombination and mutations. Mutations are then evaluated by the human subjects and the positively perceived fragments will continue to “multiply”, while the less pleasing ones will be eliminated. Thus, starting from a set of random melodic combinations, after a number of 2500 generations in which approximately 50,000 such melodic fragments were produced, the result was the detection of a number of pleasing musical structures.

The evolution of music is also dealt with in the study of the evolution of the Western musical styles². The research was conducted on the Peachnote corpus, consisting of all the scores housed by the Petrucci virtual library, and aimed at determining the frequency of occurrence of each melodic interval in the library scores, between 1730 and 1930. The results provided evidence for each year's conditional probability distribution of melodic intervals, establishing the specific intervallic combinations for each of the Baroque, Classical and Romantic stylistic periods. These results were then correlated with cognitive theories of music expectation of the listeners of a particular musical style.

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¹ Robert MacCallum et al, “Evolution of Music by Public Choice”, *PNAS*, Vol. 109, No. 30, 12081-12086, 2012.

² Pablo Zivic, Favio Shifres, Guillermo Cecchi, “Perceptual Basis of Evolving Western Musical Styles”, *PNAS*, Vol. 110, No. 24, 1034-1038, 2013.

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