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# Correlations between Developing Variation and Genetic Processes in the Analysis of Brahms' Violin Sonata Op. 78

## ABSTRACT

This paper is part of a research project intended to systematically study musical variation. Two complementary principles elaborated by Schoenberg form the theoretical basis of the research: *Grundgestalt* and developing variation. *Grundgestalt* can be essentially defined as a basic group of musical elements from which most of the substance of an organically-constructed piece may be deduced. Developing variation techniques (henceforward, DV) correspond to the means employed for producing this derived material and for structuring it. DV provides progressive, organic, and economic growth, consequently being intimately associated with the concepts of coherence and variety, whose balanced interaction is of central importance for musical composition. The main focus of this study addresses correlations between DV and biological/genetic processes. Three original concepts are introduced: Axe of Global Invariance (AGI); Transmitted Heritage (TH) and Residual Variance (RV). AGI represents a group of musical elements which is maintained along transformations of a given musical idea. TH, the very core of this proposal, corresponds to the material that is effectively and progressively modified (through DV). RV is the material that has no further consequences during the process. These elements integrate an original analytical model employed for the exam of organically-constructed music. The final section of the paper presents a practical application of the analysis model on eight thematic ideas in the first movement of Brahms' Violin Sonata Op. 78. The results obtained demonstrate the efficacy of the methodology for a systematical and precise analysis of thematic structures built by developing variation processes.

## 1. INTRODUCTION

This paper integrates an ongoing Doctorate research which is itself part of a broader research project intended to systematically study musical variation under analytical and compositional perspectives, based on organic constructive procedures. The research consists essentially of a comparative analysis of two almost contemporary violin sonatas (Brahms' Op. 78 and Op. 14 by the Brazilian romantic composer Leopoldo Miguéz), considering their thematic structures, based on organic, economic construction.

The aims of the present article are: a) to evidence associations between musical and biological variations; b) to present an original theoretical proposal for systematizing the analysis of developing variation procedures; c) to demonstrate the analytical suitability of this proposal through a practical application, considering some selected excerpts of Brahms' Op. 78. However, before initiating the discussion, it is necessary to present some important contextual antecedents and theoretical elements.

## 2. ORGANICISM, DEVELOPING VARIATION AND *GRUNDGESTALT*

The organicism is associated with the idea that the artistic creation — literature, painting, sculpture, architecture, music — must be accomplished through a gradual and progressive development from basic elements, therefore *organically*, like the growth of a living being. Its philosophical origins can be traced back to Classical Greece, present in writings by Plato and Aristotle (Freitas 2012, 65–6; Grimes, 2012, 128). According to Leonard Meyer (1989, 164), in the 19th century the organicist thinking was intensely resumed as the main extra-musical influence on some Romantic German composers, being especially attributed to studies by Goethe and Darwin on biological and evolutionary phenomena.

Grimes (2012, 128) considers that E. T. A. Hoffmann is the main responsible for the use of 'the notion of organicism as a model for musical structure'. She considers to Hoffmann's review of Beethoven's Fifth Symphony (published in 1810) as the most important document in this sense. In Hoffmann's text, the 'organic unity' of the work is especially evidenced, a perspective that would influence further analytical Beethoven's studies. Grimes also comments on the works of three of Brahms' contemporaries, Hermann Deiters, Selmar Bagge and Adolf Schubring, German musical critics, who praised in their texts published between 1860 and 1870 the extraordinary mastery of Brahms in organic construction.[1] Some decades later, Schoenberg also acknowledged this compositional capacity as an authentic Brahmsian hallmark, as it can be read in the seminal essay 'Brahms the progressive' (Schoenberg 1984, 398–441). As a matter of fact, Brahms' influence can be easily detected in Schoenberg's own music, marked by an intense and sophisticated use of variation techniques, economy and organic development.[2] The principles of *Grundgestalt* and developing variation — maybe the most important Schoenbergian contribution for the study of analysis and composition — can be considered as theoretical fruits from a perfect combination of his refined intuition, personal experience, as well as this long organicist heritage.

*Grundgestalt* (generally translated as 'basic shape') can be essentially defined as a primordial group of musical elements (intervallic and rhythmic sequences, harmonic relations,

[1] For comments and analyses by these three authors see Grimes (2012, 133–56).

[2] For some derivative analysis of Schoenberg's works, see Neff (1984), Frisch (1993), Collison (1994), Haimo (1997), and Almada (2016b), among others.

metrical configurations, etc.) from which, at least in an idealized case, all the substance of an organically-constructed piece can be extracted. Developing variation techniques (henceforward, DV) are the means employed for producing this derived material and for structuring it. DV can also be viewed as intense and dynamic derivative processes basically involving variations over variations. The use of DV, a distinctive characteristic of the music of Brahms (Schoenberg 1984; Frisch 1984; Burts 2004; Auerbach, 2005; Ng 2005; Embry 2007) and Schoenberg himself (Rufer 1954; Frisch 1993; Haimo 1997; Taruskin 2010), provides progressive, organic, and economic growth, consequently being intimately associated with the complementary parameters of coherence and variety, whose balanced interplay is paramount for musical composition.

Figure 1 models the interaction of both principles. The *Grundgestalt* (Gr.) can be considered as a basic musical cell, from which, through transformation (of countless kinds), derived forms can be obtained, which in turn become the basis for further derivation, and so on.

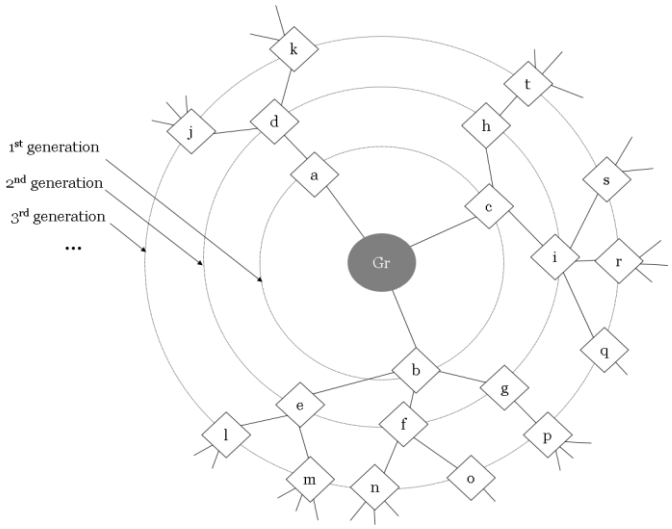


**Fig. 1. Graphic representation of developing variation from a hypothetical *Grundgestalt.***

In a sense, this model replicates biological growth, through a combination of, on one hand, progressive transformation and gradual divergence, and on the other, maintenance of characteristic features and economy of material. At a broader perspective, the scheme can also be viewed as a genealogical or evolutionary representation.[3]

## 3. A THEORETICAL PROPOSAL

These interesting correlations, associated with modern notions about biological evolution and genetics (like DNA and RNA structures, genome, phenotypes, mutations, etc.)[4] motivated us to elaborate the present theoretical proposal, aiming to contribute to a systematization of the analysis of developing variation.

Firstly, it is necessary to mention two central points that represent an intersection of musical and biological variation: 1) a (not necessarily equal) balance between similarity (or coherence) and contrast (or variety); 2) a teleological perspective, i.e., the (almost always not explicit) existence of an objective or goal orienting these processes. While the former aspect can be easily understood, the latter deserves a closer examination. In Darwinian terms, teleological trajectories can be viewed as resulting from the action of evolutionary pressures that affect the living species along a given span of time. In natural selection, these evolutionary 'paths' depend on random mutations and environmental conditions and are normally measured in geological time scales. On the other hand, in artificial selection (i.e., made under human supervision, aiming at animal or agricultural improvements) the evolutionary teleological process is more evident,[5] which makes it more adequate for our comparison with music. Ethan Haimo considers the presence of a planned goal as a distinguished aspect of developing variation, which is defined as:

> a special category of variation technique, one that implies a teleological process. As a result, later events — even markedly contrasting ones — can be understood as originate from, or grow out of, changes that were made in the repetitions of early musical unities. Therefore, true developing variation can be distinguished from purely local varied repetitions that have no developmental consequences. Developing variation offers the possibility of forwards motion, permitting the creation of new or contrasting (but still related) ideas, while local variation affects only the passage in question. (Haimo 1997, 351.)

In fact, like a farmer who intends to obtain, say, bigger corn cobs at any breeding, a composer can project specific lineages of musical ideas, recurrently applying variation techniques and selecting those forms more promising for further transformation, according to his/her creative intentions.[6] In spite of being a difficult (in some cases even impossible) task, the search for these intentions in an analysis corresponds precisely to the determination of the goal — or *telos* — of a given derivative process. Normally, only retroactively — through careful observation — an analyst can reconstruct a transformational path linking an elaborated variant to its predecessors.

Schematically, we can consider musical variation as resulting from a dynamic system formed by two opposed tendencies: 1) *centripetal*, associated with the need of keeping coherence; and 2) *centrifugal*, associated with the impulse for variety. If we plot both tendencies as orthogonal vectors (CP × CF) we obtain a resulting component vector (R) and, consequently, the angles α and β (Figure 2a). In order to expose our point, let's assume that the modules of CP and CF are proportionally related to the 'amounts' of *variety* and *coherence* in a given musical piece.

[3] See especially a well-known tree-diagram drawn by Darwin in his *The Origins of Species* in the chapter dedicated to biological variation. For a reproduction of this figure in the web, see: <http://bertie.ccsu.edu/naturesci/Evolution/Unit12OriginSpecies/DarwinOrigin.html>, accessed 26/06/2023.

[4] For some information about these concepts, see, among others possible references, Dawkins 2000 and 2006.

[5] Which is favored by the relatively short period considered, normally 'only' decades or hundred of years.

[6] For compositional experiments in this approach, see Almada (2015 and 2016a).

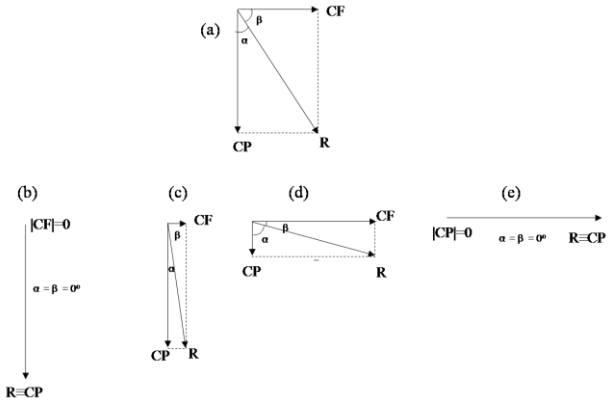


**Fig. 2. Correlations between similarity and variety represented as a dynamic system.**

If there is no variety in the system (|CF| = 0 and R ≡ CP, Figure 2b) we have total coherence and, therefore, monotony (as in continuously literal repetitions of a unique motive). On the other hand, no coherence (|CP| = 0 and R ≡ CF, Figure 2e) results in absolute variety (absence of any 'parenthood' links between a given statement and its response) which, if prolonged, implies in unintelligibility. Both extreme cases are hardly desirable in musical contexts — except, of course, in 'small doses'. Variation (represented by R) will occur when the modules of the two forces are not null. The angles α (formed between R and CP) and β (formed between R and CF) will represent basically the *quality degree* of the derivative process. Broadly speaking, the greater is α (and smaller is β), more new material is inserted in a piece in a determined span of time; this implies high variety and low coherence (Figure 2c). Conversely, the greater is β (and smaller is α), the 'velocity' of derivative process tends to decrease, providing little variety in a context of high coherence (Figure 2d). Developing variation (notably in Brahms' music) can be viewed as a special case of this dynamic system, in which α and β are roughly similar (not necessarily in exact proportions).

From these basic considerations, three new concepts were elaborated:

1. Axe of global invariance **(**AGI): is represented by those musical elements which are literally kept constant along transformations of a referential musical idea. In the dynamic system of Figure 2 it can be associated with the vector CP;
2. Residual variance (RV): is the material that has no further consequences or motivic implications during the process, being associated with the vector CF;
3. Transmitted heritage (TH): corresponds to a material clearly related to the original reference, but that presents some degree of modification. This is related to the very core of this proposal and can be compared to the combined transmission of genetic information from two progenitors to their descendants (this concept is represented in Figure 2 by the vector R).

Aiming at analytical purposes, the interaction of the three concepts can be graphically modeled in a genealogical tree format (Figure 3).

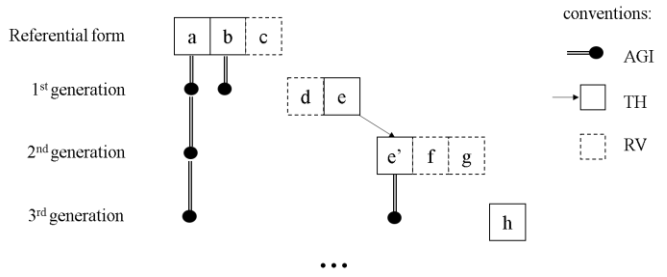


**Fig. 3. Graphic representation of the interaction of the concepts AGI, TH, and RV.**

Let's consider a hypothetical musical idea formed by three components, *a*, *b* and *c* — for example, special intervallic and/or rhythmic motives. Assuming that *a* and *b* are strictly maintained at a first transformational generation, but not *c*, a characteristic eliminated from the 'genetic pool' (being retroactively labeled as a RV), two new elements are then introduced, *d* and *e*. In the second generation only the lineage AGI.a continues (AGI.b is interrupted). Characteristic *d* is eliminated but *e* is variedly transmitted (*e'*), illustrating an instance of TH. In the third generation, *e'* is literally kept (initiating another AGI), and so on — the process can accordingly proceed indefinitely. In short, we propose that developing variation can be described in terms of the interaction of these three concepts.

An important point to consider in this approach is that the musical characteristics that are subject to the analysis must be isolated in such a manner that their derivative behavior may be properly determined. Maintaining our biological analogy, these elements are to be viewed as *genetic* components of the whole idea. In the example of Figure 3, characteristics a–d could be referred, say, to melodic patterns, while characteristics e-h to rhythmic configurations. The exam of derivative relations considering abstract, isolated musical elements is precisely one of the most distinctive aspects of an analytical model that is employed in the present study. The essential features of this model are concisely described in the next section.

## 4. DERIVATIVE ANALYSIS

The model for derivative analysis (MDA) is part of a research project initiated in 2011 intended to study systematically musical variation. Its main premise is that the derivative process in an organically-constructed musical composition can be observed according to two operative levels: concrete (or phenotypical) and abstract (or genotypical). While the former corresponds to what is considered as a 'conventional' analytical approach (i.e., the exam of the musical material considering it as an inseparable unity), in the abstract level the structurally-meaningful elements of a motive (intervals, rhythm, implicit harmony, metrical relations, etc.) are isolated and separately analyzed as autonomous entities. Figure 4 presents the abstraction of structural elements from a given musical idea (considering in this case just its intervallic and rhythmic dimensions) and some of their further derivations.

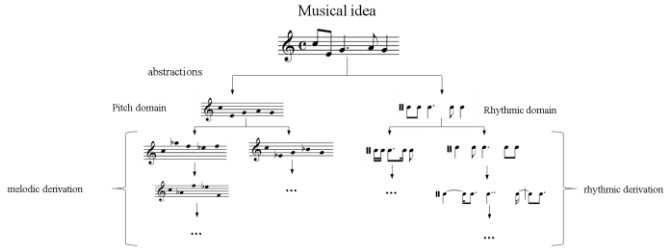


**Fig. 4. Pitch and rhythmic abstractions from a hypothetical musical idea.**

The conventions adopted for the analysis in the abstract level are presented in Figure 5, exemplified by a simple musical idea (M). There are four structural dimensions subject to abstraction, grouped two by two in a *pitch-space* (depicted above the score) and in *a rhythm-space* (below the score). The pitch dimensions are: 1) the intervallic ambit (labeled as '*/M'), i.e., the number of semitones between the first and the last note (the signals '+' and '-' indicate the intervallic direction); and 2) the intervallic sequence (i/M). The rhythmic dimensions are: 3) the durational sequence (r/M), considering the sixteenth-note as the temporal unity; and (4) the metrical configuration (m/M), associated with the *metrical profile* of the motive in question.[7]

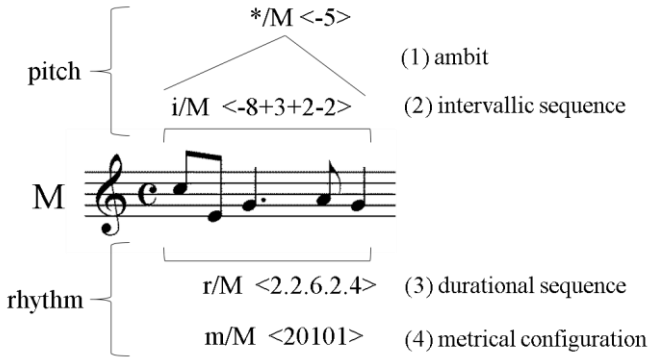


**Fig. 5. Conventions for abstracted analysis of a given musical idea M with basic domains: *pitch-space* (above M); *rhythm-space* (bellow M). Specific dimensions: (1) */M = intervallic ambit; (2) i/M = intervallic sequence; (3) r/M = durational sequence; (4) m/M = metrical configuration.**

The next section presents an analytical application of our theoretical proposal, considering only two of the abstracted dimensions: the intervallic ambit and the rhythmic sequence.

## 5. A PRACTICAL APPLICATION

To demonstrate the applicability of the DV analysis incorporating the group of the three concepts previously introduced (AGI, TH and RV) we examine here eight progressive transformations of a brief motivic fragment in the first movement of Brahms' Violin Sonata Op. 78. The piece's *Grundgestalt* is formed by four components (labelled as G.A, G.B, G.C, and G.D), being presented by the violin's melodic line in the first four bars (Figure 6).

[7] Basically, the metrical profile functions according to the following principle: the bigger the number associated with a given event, the higher is its hierarchical importance. Thus, in the case of Figure 5, the first event (score 2) is the most deeply anchored in the metrical configuration, followed by events 5 and 6 (score 1). For more information about these concepts, see Mayr and Almada (2017).

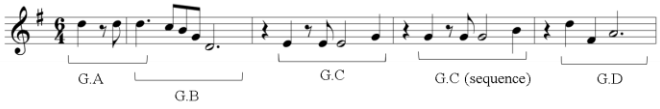


**Fig. 6. Brahms' Op. 78 (bb. 1–4): *Grundgestalt.***

Basically, the *Grundgestalt*'s components have a 'germinative' property, becoming potential references for elaborations and transformations of all sorts. We can succinctly and broadly describe them as: a repeated-note pattern in a characteristic dotted rhythm (G.A), a descending arpeggio encompassing one octave (G.B), an upwards third based on the rhythm of G.A (G.C) and a broken chord in a new, contrasting rhythmic configuration.

The musical idea we selected for analysis is associated with these basic components in different manners, as it will be evident. Eight manifestations of it are distributed along four themes present in the expositional section of the movement: $P^{1.2}$, $S^{1.1}$, $C^{1.1}$, and $C^{1.2}$ (Figure 7).[8] For the sake of analytical clearness, we consider the first fragment as the motivic reference in the whole the process, labeling it as 'M'.

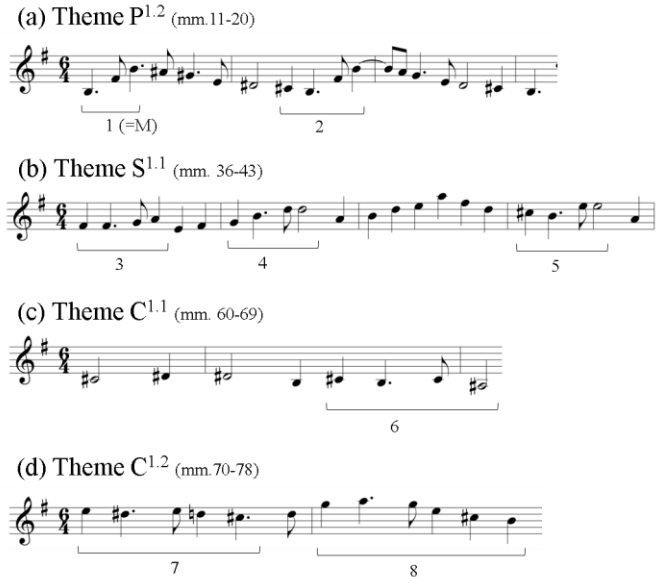


**Fig. 7. Brahms' Op. 78: transformations of idea M along four themes.**

It is our main intention to map the seven transformations of M along the four themes, aiming to demonstrate that there is a progressive process of developing variation in action that results in new, but correlated musical ideas through an organic and economic way. For the sake of simplification, variables are employed for substituting some analytical designations which have derivative implications, thus avoiding unnecessarily complicated labels. For this, we use the initial letters of the alphabet, lowercased and italicized (*a*, *b*, …), for designating the most relevant rhythmic information (i.e., 'r/…'). Conversely, the final alphabetic letters, in reverse order (also lowercased and italicized: *z*, *y*, *x*, …), are employed for substituting ambit information ('*/…'). In their initial apparitions, the variables are inserted in gray circles. References from the *Grundgestalt*'s components are indicated between curly

[8] For the thematic nomenclature, we adopt the terminology proposed by Hepokosky and Darcy (2006).

brackets. Figure 8 presents the first two manifestations of the motive, both inside theme $P^{1.2}$. As it can be observed, the rhythmic configuration of M is derived from G.A (and substituted by variable *a*) with its ambit related to G.B (see Figure 6), in this case, transformed by inversion. A derived form ($M._1$) is obtained through the addition of a quarter note (C♯), forming an elided 'prefix' *b*. The intervallic ambit of *b* (a descending major second) is renamed as variable *z*. The resulting rhythmic structure (an expansion of *a*) becomes a stable element (as will be evidenced ahead), being identified with the label $a._1$.

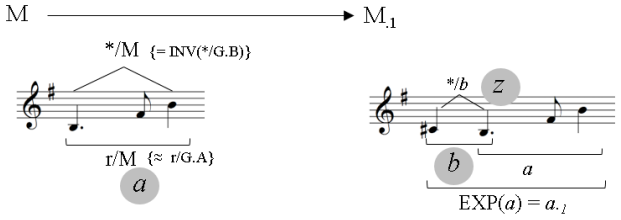


**Fig. 8. Theme $P^{1.2}$: analysis of fragments 1 (M) and 2 ($M._1$).**

Three variants are present in theme $S^{1.1}$ (Figure 9), all of them keeping constant the rhythmic configuration of their predecessor ($M._1$), but differing in respect to particular elaborations in the melodic ambit. The first one ($M._{1.1}$) combines intervallic characteristics of two *Grundgestalt*'s components (see Figure 6): the ascending minor-third ambit of G.C (labeled as *y*) and the repeated notes of G.A (*x*). A variant of it ($M._{1.1.1}$) is obtained through dislocation of *x* from the beginning to the end of the fragment. The third idea can be considered as deriving from three possible origins: 1) directly, from $M._{1.1.1}$ (evidenced by the 'genetic' link *x*), 2) indirectly, from $M._{1.1}$ (*y*), and remotely, from $M._1$ (*z*). Withstanding the temporal separation between 'parent' and 'child', we consider the last derivation the most plausible and strong, since the very original pitches of the reference's prefix (C♯–B) are resumed in the variant, which justifies its label, $M._{1.2}$.

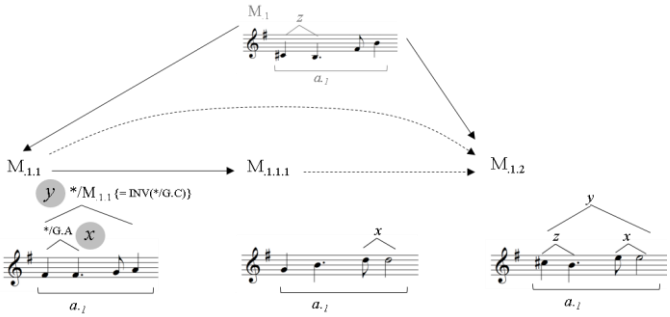


**Fig. 9. Theme $S^{1.1}$: analysis of fragments 3 ($M._{1.1}$), 4 ($M._{1.1.1}$) and 5 ($M._{1.2}$).**

The sixth fragment ($M._{1.2.1}$) occurs in theme $C^{1.1}$ as a closer variant from its predecessor (Figure 10), keeping its rhythmic structure and the prefixal block *z*. Its ambit, however, appears inverted as a descending minor-third ($y._1$).

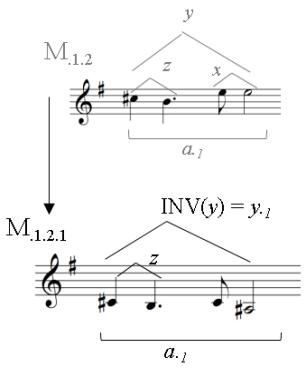


**Fig. 10. Theme $C^{1.1}$: analysis of fragment 6 ($M._{1.2.1}$).**

Figure 11 presents the last two fragments of the analysis, both in theme $C^{1.2}$. Finally, we observe a mutation in the rhythmic configuration, with $a._1$ being expanded by subdivision of the half-note into two quarters. In the intervallic domain, in spite of the maintenance of the global ambit ($y._1$), the prefix is contracted to become a minor second ($z._1$) which is replicated and inserted at the end of the fragment as a suffix. The rhythmic structure of the last variant ($M._{1.2.1.1.1}$) is formed by another expansion ($a._{1.1.1}$), resulting from the insertion of a quarter before the suffixed element, which resumes the ambit *z* (with the original pitches C♯–B). The prefix, however, is depicted in inverted direction ($z._2$).

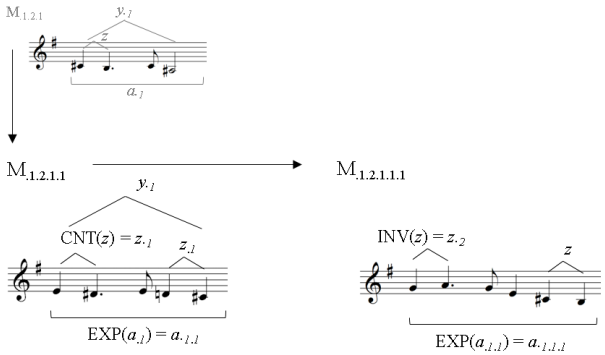


**Fig. 11. Theme $C^{1.2}$: analysis of fragments 7 ($M._{1.2.1.1}$) and 8 ($M._{1.2.1..1.1}$).**

The genealogical-tree model provides an evolutionary perspective on the whole developing-variation process considering M and its descendants.

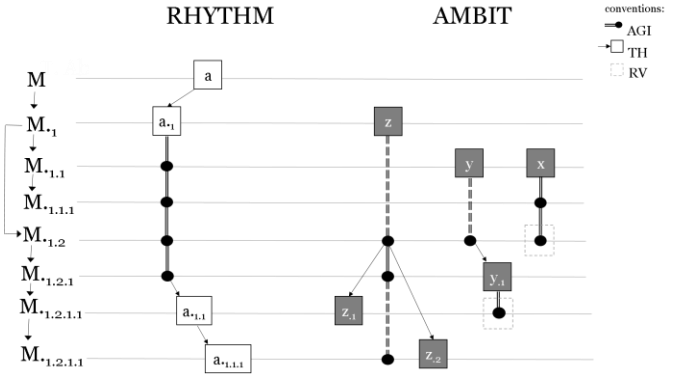


**Fig. 12. Graphic representation of evolutionary derivation of motive M considering the rhythmic structure and intervallic ambit.**

## 6. CONCLUSION

This study aimed to discuss the correlations between biological and musical variations, introducing new concepts destined to improve an analytical methodology considering specially the systematization of the process. We think that these correlations are considerably strong and consistent, which opens up an interesting dimension of thinking developing variation according to an evolutionary perspective. This view is basically supported by two forces: the balance between coherence and variety and the teleological component that seems clearly to direct some compositional decisions. In the next stages of the research, it is intended to make adaptations and improvements of this methodology in order to extend its application to the analysis of the complete thematic structure of both Brahms's and Miguéz's violin sonatas.

## KEYWORDS

*Grundgestalt*, Developing Variation, Relations of Similarity and Contrast, Biological/Genetic Variation.

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