ABDUCTIVE REASONING AS A MODEL FOR MUSICAL CREATION IN JULIO ESTRADA'S MUSICAL WORKS

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Abstract

The paper deals with two philosophical postulates that although at first sight both do not have a direct link, it is my hypothesis that there may be a connection between them since in each one imagination plays an important role in the process of scientific discovery. On the one hand, it deals with the abductive reasoning by Charles Sanders Pierce (1839–1914), focusing on the problem related with abduction and scientific imagination, *graphicacy* or the ability to represent ideas through images, *beelddenken* or "pictorial thinking" as a form of communicating ideas without the use of any verbal form, and *synthetic* topology responsible for studying the qualitative relations of any 3-D geometrical structure. On the other hand, the author presents the philosophical postulates of the *Theory of Composition: discontinuum-continuum* by Julio Estrada (*1941), where reality and imagination play an important role in the process of musical creation, presenting a two-fold methodology of creation, (1) the *macro timbre* where the homogenization of the components of the rhythm-sound takes place, and (2) the chronography, a graphic representation of the rhythm-sound in movement. The latter is exemplified in this paper with the three examples of Estrada's musical compositions, (1) the graphical score of *eua'on* UPIC (1980), (2) graphical recording for the series *yuunohui'* (1983–2020), and (3) the topological variations included in the *ishini'ioni* String Quartet (1984–1990).

Keywords: *abductive reasoning, scientific discovery, macro timbre, chronography*.

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Abduction

In Charles S. Peirce's pragmatic philosophy, abductive thinking is essential because it serves to explain the process by which the mind leads to the formulation of a new theory. Peirce generally described this type of reasoning as follows: *Abduction is about examining a mass of facts and allowing the facts to suggest a theory* [CP 4, 4875, 1903]. In Peirce's theory, the concept of imagination is semantically close to the concept of intuition, which is why he emphasized the need to study both spheres of brain activity: imagination and rational thinking, arguing it as follows:

> *Pragmatism is the doctrine that every conception is a conception of conceivable practical effects, it makes conception reach far beyond the practical. It allows any flight of imagination, provided this imagination ultimately alights upon a possible practical effect; and this many hypotheses may seem at first glance to be excluded by the pragmatical maxim that are not really so excluded* [CP 5, 3798, 1903].

In the fifty years that Peirce has devoted to analyzing this philosophical archetype, he has not formulated a single general definition of abductive reasoning, but has offered various interpretations of it. In the philosopher's essays, we find several analytical definitions and terms used to define this type of inference, as mentioned by C. A. Pechlivandinis in the article "What is Behind the Logic of Scientific Discovery? Aristotle and Charles S. Peirce on Imagination": *Abduction, retroduction, hypothesis, hypothetic inference, presumption are the terms used by Peirce for abduction* [Pechlivanidis 2017].

Charles S. Peirce studied the phenomenon of abductive reasoning not only in terms of philosophy. He noticed its usefulness in pedagogy, he used this form of reasoning to explain the processes taking place in chemical compounds and physical, also to solve math problems by experimenting with diagrams, which he classified as an exercise of the imagination to access abductive reasoning. Graphical experiments carried out with this method turned out to be very useful in school teaching at the primary level of education. Seymour Simmons III in the article "C. S. Pierce and the Teaching of Drawing" emphasized this issue by distinguishing between two spheres of influence of Peirce's pedagogy: *First, Peirce's own use of drawing remind us that drawing is a cognitive matter, involving the full range of thinking skills while integrating thought with perception and feeling – in short, a whole brain, holistic experience with applications across the full range of disciplines. Second, Peirce's experimentation with perception and interpretation urges teacher to focus students; attention on the way drawings are read and the mechanism in which they are accurately, inaccurately, and diversely understood* [Simmons III 2017]. The author claims that the implications for Teaching drawing Under Peirce's approach into abductive reasoning could lead *to*

re-establish its role, as an essential aspect of graphicacy, in general education [Simmons 2017]. In this last envelope the author highlights the term ***Graphicacy***, which refers to (..) *the ability to convey or interpret spatial information not easily communicated in words or numbers* [Simmons III 2017]. Peirce's considerations on the functioning of the imagination, vision and instinct as elements of the reasoning process, which are included in his notes kept since 1890, are, according to Pechlivanidis, characterized by greater maturity in explaining the essence of abductive reasoning. The American philosopher defines in them the imagination, intuition, and experimentation as tools of reason used to formulate new theories. It also explains the differences between abductive reasoning and deductive and inductive reasoning. In his notes Peirce claimed that: *Abduction is the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea; for induction does nothing but determine a value, and deduction merely evolves the necessary consequences of a pure hypothesis* [CP 5.171, 1903].

Abduction and scientific imagination

Peirce focuses on abductive reasoning as part of his scientific discoveries in his notes entitled "The nature of inference" (1888). In them, he distinguishes between two methods of reasoning that justify the use of imagination, vision and intuition. *Leading principles are of two classes: those whose pretension it is to lead always to the truth unless from the false, and never astray; and those which only profess to lead toward the truth in the long run. This distinction separates two great branches of reasoning, the one bringing to light the dark things of the hidden recesses of the soul, the other those hidden in nature. We may, for the present, call them Imaginative and Experiential reasoning; or reasoning by diagrams and reasoning by experiments* [CP 4.74, 1893].

Other arguments showing the advantages of abduction reasoning are considered in the notes entitled "Abduction" (CP 7.218). Peirce describes the exercises of the imagination in them and intellect as mediators used in scientific research. When used in the tests, they allow the researcher to choose the most satisfactory result. This way, a hypothesis is formulated that provides an explanation of the phenomenon under study. Another situation in which the two mentioned mediators show their usefulness is a method of questioning everything that you want to create. It forces your imagination and intuition to be active. By means of an imagination, non-conventionally based reasoning, a human being is able to perceive all possibilities that may relate to an event that has taken place. *I have already pointed out that it is a primary hypothesis underlying all abduction that the human mind is akin to the truth in the sense that in a finite number of guesses it will light upon the correct hypothesis*. [CP 4, 4544, 1903] *Now the only way to discover the principles upon which anything*

ought to be constructed is to consider what is to be done with the constructed thing after it is constructed [CP 4, 4543, 1903].

All the previously mentioned aspects of abductive reasoning focus on exercising imagination, intuition and creativity as determinants of the ability to formulate logical, factual questions. Peirce's arguments regarding the advantages of abductive reasoning therefore relate to exercising the imagination, while always focusing on the situations observed in reality. The absence of either of these two components of reasoning prevents us from achieving objective results.

Julio Estrada's philosophy of musical creation

In Estrada's doctoral dissertation: *Theory of Composition: discontinuum-continuum* [1994], Julio Estrada presented his philosophical postulates concerning musical creation taking as one of the main fundaments the relation between reality and imagination in the process of creation. Imagination manifests everything that appears to the creator, is a product of his individuality, it manifests itself through dreams, fantasies, memories, memory, etc., acts and states. In musical creation, it is rather a mnemic process. Estrada explains that in order to experience a musical imagination, you need certain conditions that are only available in space and in solitude, similar to those we find in sleep. At the same time, the material that appears in the state of imagination will not always be identical to the material that appears in musical reality: (..) *the inner experience of the imaginary occurs in states of solitude* (..) *Objects of the imagination are in some cases not identical to how they are concrete, because they often disappear from the control of those who perceive them* [Estrada 1994].

Musical irrationality and rationality

Estrada emphasizes the importance of a dialogue between two factors: musical irrationality, the source of which is imagination and auditory perception, and musical rationality – its source is the acoustic reality. Musical creativity becomes more authentic when the following areas are combined in the act of creation: imagination and musical reality. The study of these processes makes it possible to base a new musical language on the relationships that develop between auditory perception and empirical reasoning, which is why Estrada proposes the subject of the study to make three components: **(1)** Mental atmosphere – it defines this aspect of the imagination with the help of the human instinct recognizing phonetic structures with different levels of expression and the associated sense of the height of a musical object. **(2)** Perceptual tendencies – Music is created by combining imaginary musical content with the process of rational organization of musical material. Given that each composer makes use of the above possibilities in different ways, the results are endless. **(3)** Movement – *The impressions related to the perception of movement coming*

from the musical imagination allow us to obtain a bit more objective descriptions [of these processes] *thanks to the similarity with reality* [Estrada in print].

Julio Estrada treats the philosophy of the *Theory of Composition: discontinuum-continuum* as a starting point for interpreting the products of his imagination. Searching for the philosophical foundations of his theory, he notices that the process of creation is characterized by an intrinsically united dualism; it takes into account: on the one hand, the analysis of real phenomena and abstract structures involved in the mathematical and physical organization of musical material, and on the other hand, the need to understand everything that is represented in the imagination (what the composer calls a figment of the imagination). For as he wrote: *The process we are going to follow will have to meet two conditions necessary to interpret the products of our imagination: one will take into account the physics and mathematics approach to the phenomena of reality or to abstract structures, the other – to include methods for understanding the mechanisms of internal representation* [Estrada 1994]. Thus, Estrada distinguishes two views that require consideration in the philosophical foundations of his theory. The first is aimed at examining all musical material that can be organized and structured based on empirical reasoning (involving deductive and inductive reasoning). The second – it examines everything that is a figment of the imagination and that can be explained by abduction. The combination of these two types of reasoning forms the basis on which he establishes his philosophy of *Theory of Composition: discontinuum-continuum*.

Dynamic interaction

Estrada's philosophy challenges the existing methods of teaching composition and existing in musicology theories of a musical work, the principles of counterpoint, harmony and others. His proposal includes a three-sided view of the process of creating music, taking into account theory, system and style. He argues this as follows: *My work will not be limited to researching the technique or system of teaching composition, understood as a set of methods of organizing and recording musical works,* [*methods*] *aimed at materializing previous ideas. I will also depart from purely theoretical approaches to musicology and will not be interested in their usefulness in creating compositions, nor with the idea of composition as an exclusive field of work. My approach requires considering a slightly broader understanding of the theory of composition, proposing to study the objective and subjective aspects of musical creativity. In the theory of composition, I propose to distinguish three different areas of problems:* **(1)** *Theory – that is, the study of the physical or abstract organization of musical structures.* **(2)** *System – as an area of application of theory to develop models based on selectively selected individual or collective trends.* **(3)** *Style – the subject of creativity and individual approach to perception and imagination is characteristic for each system* [Estrada 1994].

According to Estrada, composing a musical work without critically addressing each of these areas leads to the failure to realize the intention taken from his imagination. Without questioning the first or the second distinguished element of the process of creating music, the artist – according to Estrada – cannot make a real contribution to the work being created. In this case, it is possible only in the third phase of its formation, during which you can shape the sound, organize it, but without realizing that the organization system is based on the *a priori* adopted theory. Such a model is insufficient for Estrada himself, because it keeps him unaware of the ongoing process of concretizing his musical vision and forces him to write down musical ideas in accordance with a set of instructions, contradicting his own creative impulses, it does not allow to establish a personal relationship between objective and subjective aspects of his musical creativity. That is why Julio Estrada's philosophy proposes a dynamic interaction between three separate areas of the creative process, during which the real (objective) and what is imaginary (subjective) are integrated in musical creativity. As Estrada declares: *My philosophy of composition proposes a dynamic interaction in which all the motor functions of musical thought are effectively involved. Their synthetic manifestation will allow us to observe the pluralism of connections to which our interactive model aspires. Thanks to this, it is possible to balance the objective and subjective factors participating in the three-area division proposed by us* [Estrada 1994]: • **reality**: composed of two basic elements of musical matter, rhythm and sound; • **theory**: the study of the basic phsyco-acoustic, mathematical or other organization of musical matter; • **system**: designing representative models of individual or collective choices from a theoretical base; • **style**: characteristics determined by individual creativity in the use of each system; • **imagination**: it marks the field of intuition, fantasies, perceptions, memories or the construction of a creative and phenomenal universe of music. **See Figure 1. *Dynamic interaction*.**

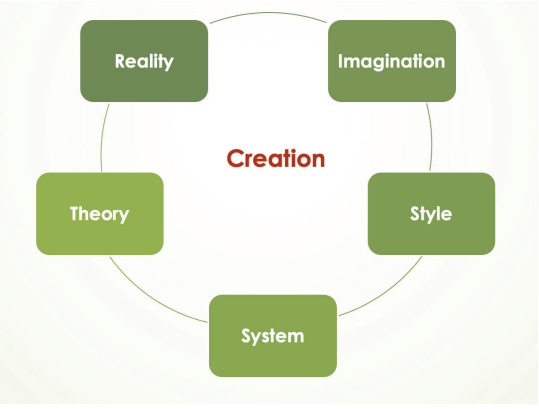

Figure 1. Dynamic interaction.

Based on this dynamic interaction Estrada developed a two-fold methodology which integrates imagination and reality. (1) The first one referring to reality, the so-called ***macro timbre***, (2) the second one referring to the imaginary corresponds to a **chrono-graphical** methodology base on drawing the movements of the sound.

Chronoacoustic – *macro timbre*

The article *Escuela del continuo en México* writing by the pianist and musicologist Velia Nieto presents the relation of Estrada to chrono-acoustics as follows: *Estrada generalizes the physical-acoustic concept of the continuum and proposes the perceptual concept of macro timbre, a synthesis of rhythm and sound that leads to a chrono-acoustic fusion of musical matter* [Nieto 2002]. The chrono-acoustic synthesis of all the components of rhythm and sound creates a physical-acoustic unit which is the rhythm-sound. Its components are sound, rhythm and sound generated by frequency, amplitude and harmonic content. They define quite a complex musical matter, the acoustic spectrum of which is defined by the composer with the term *macro timbre*. He suggests that the sound (vocal or instrumental) is the result of the homogenization of three main generators: frequency, amplitude, and harmonic content, among which six components can be distinguished – three corresponding to the rhythm and three sounds. They are constituted by the following factors: • in terms of **frequency** – by the rhythm, its duration, and by the sound itself, its pitch; • in terms of **amplitude** – by the rhythm, its global intensity (in which the attack is the most important) and by the global intensity of the sound itself (envelope); • in terms of the **harmonic content** – by the rhythm, the microstructure of the duration (*vibrato*) and by the timbre of the sound (in the sense of the tonal color).

Chrono-graphical transcription

Drawing as a graphic form of what has been generated by creative fantasy is one of the main pillars of the representation of the continuum of rhythm-sound. The composer declares the need to draw these original musical ideas as follows: *Everything I hear must first be drawn and then transformed into a musical notation* [Estrada and Domínguez Salas 2020]. This key moment – the act of drawing revolutionized the whole approach to musical creation in the continuum. It allowed for a spontaneous and less rigorous consolidation of the movement of rhythm-sound-noise components in a *macro timbre*. This procedure helped him to obtain more sophisticated data of the musical material, as the composer explains: *The practice of graphically recording three-dimensional trajectories requires a highly developed ear in order to capture the immense amount of data inherent in musical materials. A multi-dimensional chrono-acoustic graphical trajectory can allow one to obtain a variety of inflections simultaneously occurring on several layers* [Estrada 2002]. The method of

conversion is explained in four steps as follows: *I. A chrono-graphical recording – an accurate copy – of any musical material. II. The assigning of a series of reference scales to chosen parameters in order to obtain the conversion of chrono-graphical data. III. A series of alternatives for transcribing data into a multidimensional musical score. IV. A musical performance that is a new version of the original material (I) based on the resulting score* [Estrada 2002]. **See Figure 2. *Cronographical transcription.***

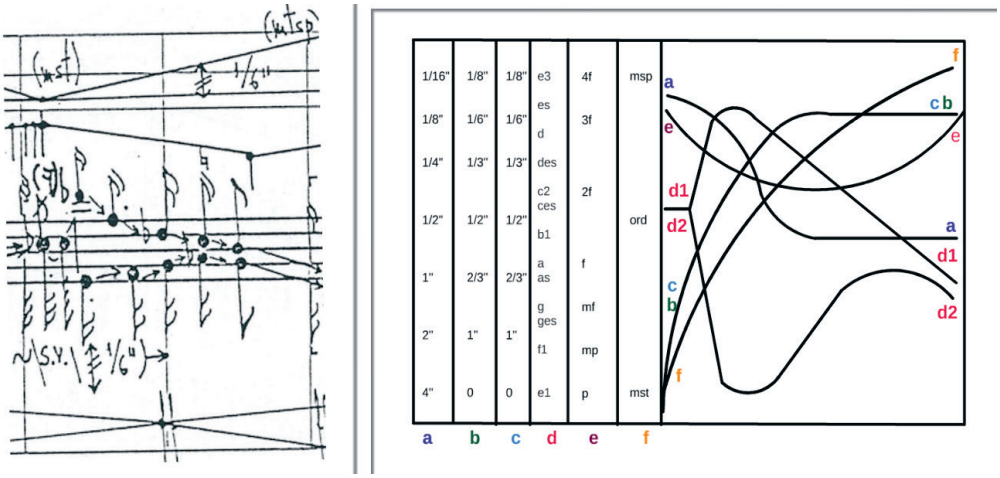

Figure 2. Cronographical transcription.

Visual thinking

I do not think I ever reflect in words: I employ visual diagrams, firstly, because this way of thinking is my natural language of self-communication, and secondly, because I am convinced that it is the best system for the purpose [R 619, 1909]. For Peirce, visual thinking was perhaps one of the most basic and clear ways to represent ideas, since the philosopher assumes that the reasoning process in the mind is not *composed of distinct parts corresponding to the argument of the logical representation of it, each requiring a distinct effort of thought* since thought *is continuous and begins at percepts, which cannot be fully represented in words. Language cannot represent the movements of thought* [CP 2.27, 1902]. As for what concerns musical creation the way of representing sounds in a traditional score obliges the composer to involve some form of musical writing, which is based on a limited code of symbols that hinder the immediate representation of the fantasy (musical idea). Following Peirce's ideas in a musical context, it can be assumed that traditional musical notation cannot represent the movements of sound in the imaginary due to the fact that the notation process needs to rely on the literalness of the language with stereotyped verbal indications, *as can be observed in much of the traditional European music – espressivo, con fuoco, molto*

cantabile, lamentoso, or others [Estrada in print]. On the contrary, by applying visual thinking with a graphical methodology of notation the musical creator can be able to achieve a higher resolution of the movement of sound in the imaginary and with the help of an analog representation, in this case with graphicacy, it reveals textures and shapes which express deeper understanding of the emotional intensity in the composition as well as the need to create a more personal method of converting the sound material represented in the graphic design into the final musical score. This idea can be exemplified with Estrada's following statement: *Processes of an analogical order, such as executing, recording, narrating or drawing musical fantasies, give immediate access to their objective register and open up a new space for the methods of musical creation. These processes question the idea of direct writing as an appropriate formula to represent the imaginary and place it among the concrete methods derived from transcription – or from the conversion of a type of writing* [Estrada in print]. The practice of drawing directly influenced the process of creating music, activating both auditory perception as well as visual. Creating a draw can be compared with the creation of a graphic representation of music created in the composer's imagination. This peculiar fact directly indicates the need to use drawing as one of the fundamental ontological figures of a musical work, indispensable in Estrada's musical practice. It is worth noting that this problem is addressed by the philosopher Kathleen A. Hull in the article entitled "The Iconic Peirce", in which she writes that a group of scientists from the Netherlands calls this phenomenon *beelddenken* [*pictorial thinking*]. Hull explains them as follows: (..) *researcher Maria J. Krabbe notices that people who think in images do not use language and* ***see*** *answers to* [*given*] *problems in an intuitive way* [Hull 2017]. In case of Estrada's drawing practice, it must be stated, however, that it has no connection with the linguistic cognitive problems presented by Krabe and Hull. In Estrada's process of creation, thinking with pictures is related with the musical *language*, in which the sounds preserved graphically are the product of the relationship between the imagined and the visualized sound, they are a derivative of cognitive activities that work simultaneously without the need to use any verbal expressions. The composer explains it as follows: *Drawing allows me to stimulate my musical creativity through the intuition of the rhythmic-sound movement in the continuum without involving any verbal form* [Estrada and Domínguez Salas 2020]. As was explained above, Peirce's observations regarding visual thinking do not concern sound as a form of visualizing a structure in a 3-D space. However, as Kathleen A. Hull explains [Peirce] *came to understand, appreciate, and, finally, to exploit the riches of visual perceptions as used in geometry for the sake of a deeper understanding of all human reasoning* (..) [Hull 2017]. Considering Peirce hypothesis for what visual thinking and imagination concerns, is possible to seek a connection between visual thinking within sound thinking applying topological variations. Here abductive

reasoning involves simultaneously an imaginary 3-D image of a sound structure and a graphical structure of the sound in movement.

Looking back during the second half of the XX century, Iannis Xenakis (1922–2001) proposed perhaps the first and most innovative method for electro-acoustic musical creation using drawing as a form of immediate representation of continuous musical fantasies: the UPIC system. From a pedagogical perspective, UPIC allows not only professional musicians but anyone who wishes to experience the spontaneous creation of a musical structure simply by freely drawing any design that arises from their intuition. Consistent with Peirce's assumptions regarding drawing as part of abductive reasoning, Xenakis's approach to musical creation provides similar results when he discovered (..) *that not only architecture, but also music can emerge from precisely recorded designs: lines on the drawing surface as pictures of sustained or moving tones in the tonal space* [Frisus 2020]. In this way abductive reasoning is activated through drawing, making possible to connect intuition with musical creativity, and as a result the musical structures which emerged from this specific type of creation would be impossible to obtain if taken in consideration only from a traditional graphic representation methodology (strictly musical writing). In the following statement Xenakis provides a clear explanation for what concerns graphicacy in musical creation and how by this method a new way of communication can be approached: *If you draw lines on a blackboard, you can* (..) *create sounds and music* (..). *Not just sounds, but also developments of rather complex sounds, that is to say, of music.* (..) *And drawing is an ability of every human with a hand and a brain; the hand is the organ closest to the brain.* (..) *Giving everyone the opportunity to compose music leads to a double result: on the one hand, you make the creative activity available to everyone, and on the other hand, there is no longer this abyss between any avant-garde (there are always avant-gardes) and the rest of the audience. Rather, it's about building bridges and being able to think music, meaning creating music with everything that comes with it.* (..) *For everyone. From the age when the child can hold a pencil and listen, to adulthood and until death* [Frisus 2020]. Xenakis's methodology confirms – without this being the foundation of his thesis – that abductive reasoning in the process of musical composition can be increased through drawing resulting in a new form of communication between the creator and the receptor of any musical work.

Back in the year 1980 Julio Estrada got in contact with the UPIC System. Estrada's intention to approach and compose his first and only electroacoustic musical work *euo-on* (1980), was entirely an experimental form using drawing as the medium for spontaneously linking the musical reasoning within the imagination. In his own words he describes his experience as follows: *My intention was to observe the link between the dynamic and psychic potentials through the inflections given to the*

drawing within the continuous medium and to create, with massive transformations, a texture that evokes the mental environment of the imaginary. **See Figure 3. *eua'on* UPIC (1980).**

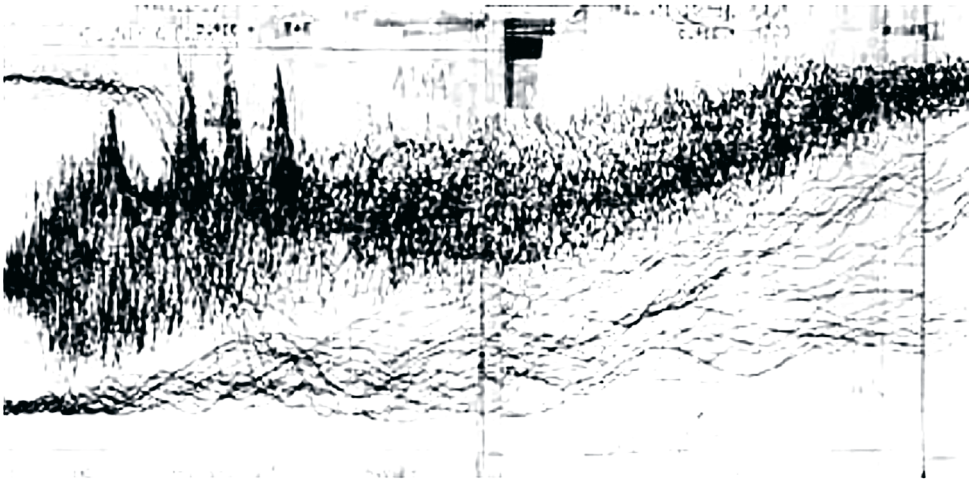

Figure 3. *eua'on* UPIC (1980).

Once his experience with the UPIC system was concluded, in 1983 Estrada began to elaborate his own chrono-graphical recording methodology – the chrono-graphical transcription based on his own theory of chrono-acoustics – *macro timbre* – already mentioned above. The conjunction of both methodologies proposes to establish a new technique for transcribing the rhythm-sound components by means of drawings. The musical material perceived intuitively by the composer is presented in a graphic design, made by hand or using a computerized transcription system, the so-called *euao'oolin* system (from Nahuatl: *eua* – flying; *oolin* – movement) created by Estrada himself at The Instituto de Matemáticas, UNAM, México. The first design created by the mentioned system is entitled the *yuunohui'* cycle (from the Zapotec language: *yuunohui* – fresh clay), which currently consists of eight series of compositions for solo instruments and two series for chamber music, all based on the same graphical composition. The total set of ten *yuunohui* series composed for solo instruments or chamber ensemble and vocal parts is as follows: • *yuunohui'yei* (1983) for solo cello, • *yuunohui' nahui* (1985) for double bass solo, *yuunohui'ome* (1989) for solo viola, • *yuunohui'se* (1990) for solo violin, • *yuunohui'se'ome'yei'nahui* (1994) for string quartet, • *yuunohui'tlapoa* (1999) for any keyboard instrument, e. g. piano, organ, harpsichord, • *yuunohui'wah* (2008) for noisemaker, • *yuunohui'ehecatl* (2010–2012) for solo or ensemble of any woodwind or brass instruments, • *yuunohui'sa* (2017–2020) for solo voice, and • *yuunohui concertante*, integrates each of the series

created in the years 1983–2020. This last series can function as a chamber orchestra piece with any number of performers without requiring a conductor, as the piece is arranged so that each instrumentalist function as a soloist. **See Figure 4. *yuunohui'* (1983) original chrono-graphical notation.**

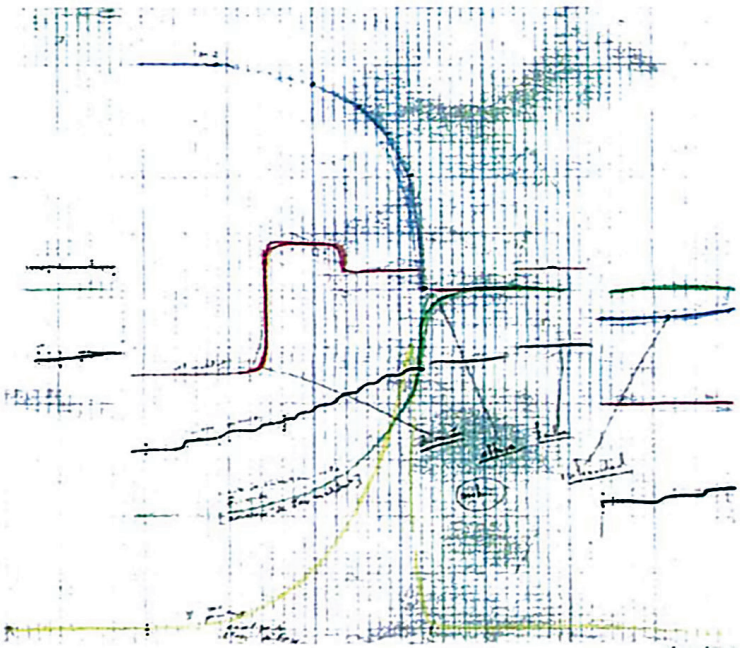

Figure 4. *yuunohui'* (1983) original chrono-graphical notation.

Topological variations

In Peircean terms topological variations are most studied in the field of mathematics. Kathleen A. Hull explains that Peirce's classification of topology is understood (..) *as the foundation of all geometry* (..) *topology may be described as the study of properties of geometric objects that do not change when continuous stretching and bending of the object into a new space is performed* [Hull 2017]. *In modern synthetic topology is characterized by studying the geometry shapes in a continuous transformation regardless of the distances and measurements between the points that correspond to the structure of those objects. For that reason topological geometry does not study the forms of each object, but the transformation that are obtained through the topological variations. In order to understand the estradian topology, the dynamic identities must be treated in the same way as in the topological geometry, the content of the dynamic identities – pitch and rhythm – are not circumstantial elements that define the aesthetics value of the variation* [Domínguez Salas 2018].

Topological exploration

Estrada's topological variations are accomplished by the imaginative representation of an acoustical-visual structure which provides a full range of information in reference with the internal relation of the components of the rhythm-sound. Kathleen A. Hull refers to this process as *topological exploration* where (..) *the visual method engages the geometer's assumption of true continuity, using imagery, and treats of* ***qualitative*** *spatial relations, rather than precise numerical values or* ***quantitative*** *relations* [Hull 2017]. Topological exploration serves as a point of reference to determine the value in Estrada's topological variations, where analogically to Hull's definition, the visual method provides precise information of true continuum of the musical material treating the components of rhythm-sound according to their *qualitative* relations rather than precise interval relationship or *quantitative* relations. Topology, then, is marked by its *synthetic* method: the study of flexible objects moving in 3-D sound-space involving bodily interaction with sound imagination.

ishini'ioni string quartet (1984–1990)

The form of topological variations in the *ishini'ioni* string quartet indicates that they constitute another step in the development of the polyparametric counterpoint technique as well as the dynamic identity of the continuum. Characteristics of the functions entrusted to the polyparametric counterpoint and topological variations in the micropolyphonic texture can be summarized as follows: **(1)** The movement of the rhythm-sound components determines the quality of the micropolyphonic texture in the macro timbre. As in microorganisms, movement enables cells to transform their internal structure and prepares a new stage for the formation of the biological body, so entities of dynamic identities maintain a state of constant change of the sound spectrum in macro timbre. **(2)** The structural independence of the components in a given dynamic identity is manifested in the fact that each of them is independent. This makes it possible to distinguish in the auditory perception the color of sound manifested simultaneously in different areas: through upward and downward movement, trajectory acceleration-delay. **(3)** The rhythm-sound density is produced by the different combinatorial levels of the rhythm-sound components. The Chronograph charts corresponding to segment H of the *ishini'ioni* string quartet, where *the flexibility with which variations are rotated in space-time in different instrumental combinations. Each one is different, and the flexibility of the continuum movement ensures that they are not identical to the one that leads them, while emphasizing the continuous evolution of time. To highlight the trajectories of each voice form the original score, colors have been assigned to each instrument: first violin – red; second violin – green; viola – blue; and cello – purple* [Domínguez Salas 2018]. **See Figure 5. *Topological variations,* and Figure 6. Facsimile *ishini'ioni* String Quartet, bars 363–375.**

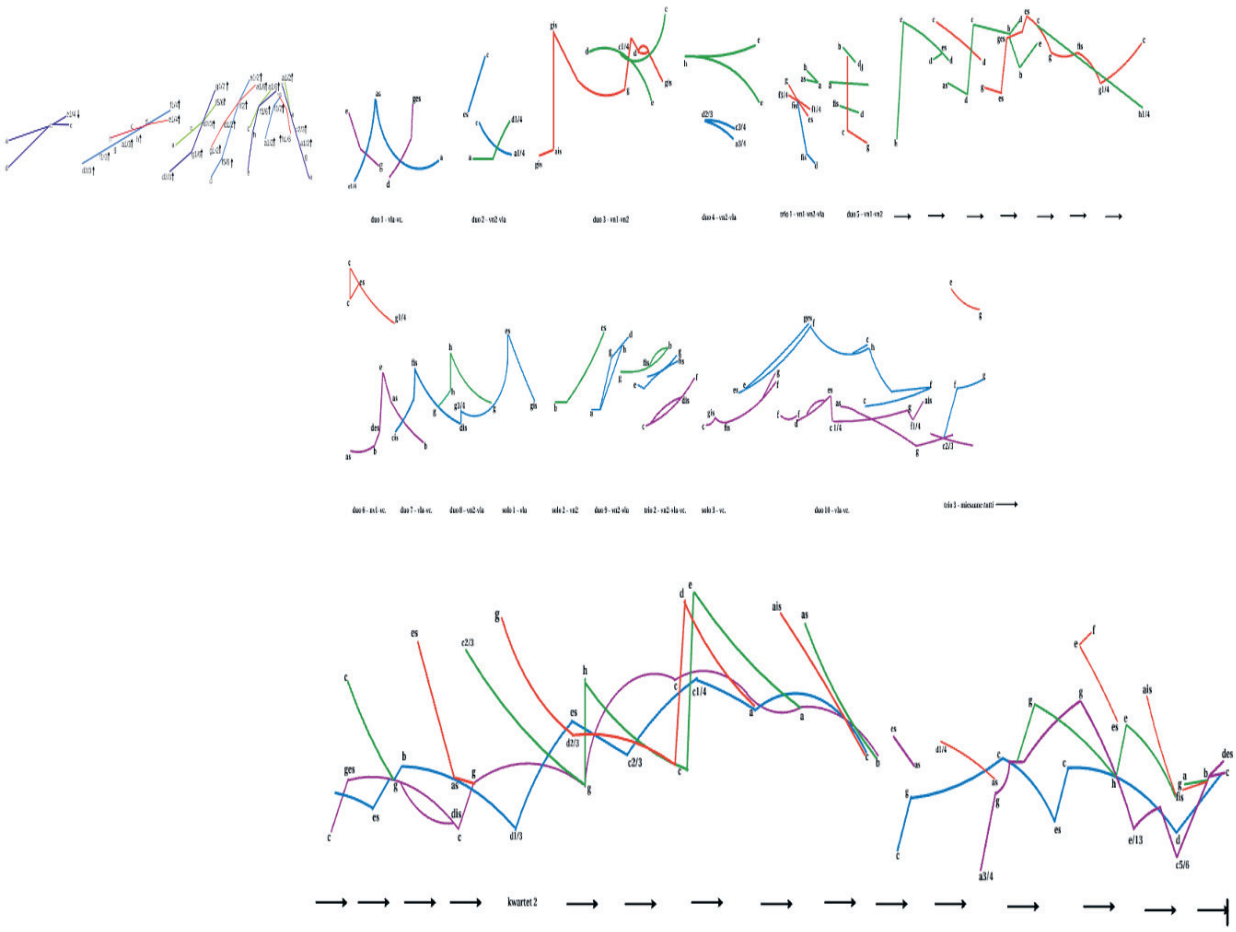

Figure 5. Topological variations [Domínguez Salas 2021].

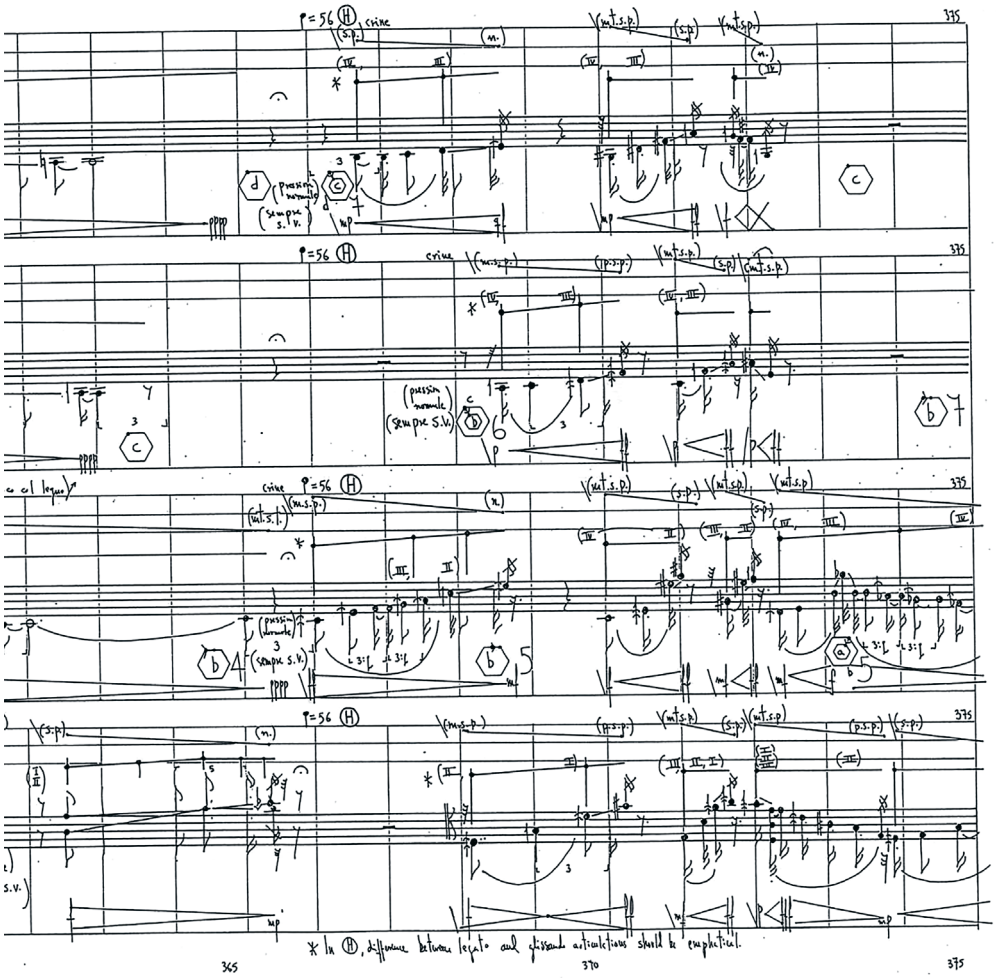

Figure 6. Facsimile *ishini'ioni* String Quartet, bars 363–375.

Conclusion

The type of reasoning presented in Estrada's musical works shows connections with abductive reasoning, the essence of which was explained in Charles S. Peirce's writings. Although the Mexican composer was unfamiliar with the American philosopher's theory, he used the same type of reasoning. In his statements, he emphasized the importance of the creative role of the mind as an important element of creativity, which can be stimulated by both subjective (inspiration) and objective (influence) factors. My thesis related to the philosophical foundations of the Theory of Composition: discontinuum-continuum in the method of reasoning called abductive requires additional support. One of them concerns

the achieved results. As you know, the purpose of abductive reasoning is to search for explanations for surprising information. In relation to the process of creating music, Estrada tries to find arguments and logical connections between what takes place in the act of creating music and the final result, i. e., a musical work. Regarding graphicacy and visual thinking, the examples presented above show that this type of reasoning began to be applied in musical creation from the second half of the 20th century, starting with Iannis Xenakis and continuing (not only) with Julio Estrada, who included the notion of the *macro timbre*. The result of this valuable conjunction of methodologies allows to enrich the scientific discovery regarding musical creation in the 21st century. Although Peirce has never used the abduction procedure to explain the complex and hardly empirically verifiable processes of creating music, the arguments presented above confirm the value of the philosophical presuppositions of Estrada's composition theory, highlighting the importance of visual thinking in conjunction with the creation of drawings in order to access a more creative world where imagination and the reality of sound merge in the act of music creation. In the words of Julio Estrada himself, the intention and resonance of the creation a musical work under the introspection of imagination and reality, two essential components of the creative process are expressed as follows: *Located halfway between the ear and the rational, musical perception requires an adjustment to understand the data provided by physical reality based on the awareness of the limits of human hearing.* (..) *The high resolution of the continuous medium leads to the greatest clarification of the phantasies. By fixing the spatio-temporal evolution of all data to the maximum, matter achieves an appearance as fortuitous and, at the same time, as precise as that of reality...* [Estrada in print].

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