

## **The Link between Julio Estrada's Theory of Continuum with Different Theories and Musical Currents from Ancient Greece to the 21st Century**

**Abstract.** Studying the origins of Julio Estrada's theory of continuum is a task that must begin by identifying its scientific and aesthetic sources. Elements of this theory can be found in various treatises, since throughout the history of music theory, many researchers have dealt with the aforementioned topic. It was described in treatises devoted to both musical composition, music theory and the humanities. Presenting the history of the idea that Julio Estrada made the subject of his research and presented in his 1994 dissertation, I will recall its first descriptions from ancient Greece and modern research using modern scientific theories that inspired Julio Estrada in order to develop his own theory of continuum. I will include in the discussion the studies of Aristoxenus of Tarentum (354–300 BC), Dennis Gabor (1900–1979), Ernst Levy (1895–1981), Henry Dixon Cowell (1897–1965), György Ligeti (1923–2006), the influence of the Hopi culture along with lectures with Kwan-Faré-Tzé in relation to the continuum in the imagination and in nature. Along with the theoretical assumptions of Julio Estrada, these theories can explain the function of the continuum and its essence in different eras and cultural environments. The sum of all these theories makes it possible to evaluate the importance of this acoustic phenomenon in a global musical context. Adopting a historical and cultural perspective will thus reveal the foundations of the theory developed during Estrada's philosophical, and theoretical-musical reflections.

**Keywords:** discontinuum–continuum, Aristoxenus of Tarentum, Granular Synthesis, Iannis Xenakis, micropolyphony, Theory of Harmony, Hopi, Julio Estrada.

### **Introduction**

Julio Estrada's musical output as well as his theory of composition are influenced by the European schools of the second half of the 20th century and the ancestral cultures of Mexico.<sup>1</sup> He presented the theoretical, philosophical and aesthetic postulates of musical creativity for the first time in his doctoral thesis *Théorie de la composition: discontinuum-continuum* [Theory of composition: discontinuum-continuum] (1994). The foundations of this composer's theory are as follows:

The possibility of structuring the components of a musical work, such as sound, rhythm and space ... depend both on the nature of a given piece and on the limits of auditory perception. This allows its musical matter to be recognized in two large areas—as a discontinuum, which refers to scale orders ... and a continuum, where perception ceases to distinguish a given [sound] point from its neighboring ones, for example, in *glissandi*. (Estrada 2011, 113)

As the composer's quoted statement shows, the subject of its description covers two great spheres of the musical universe—discontinuum, i.e., the spatial organization of musical matter, and continuum, i.e., musical matter perceived in time. This theory, proposing a new perspective on explaining pre-composition processes leading to the creation of a musical work based on new compositional principles, refers to the mechanisms of auditory perception, as well as to selected mathematical theories and research on the physical nature of sound.

Taking into account the principles of functioning of our auditory perception, the way in which musical material is perceived by our consciousness and subconsciousness, explains, among others, the specificity of its organization in each of the above mentioned spheres. Taking these two areas of analysis as a starting point, it is possible to find theoretical references in different cultural environments which can be directly linked to the postulates of Estrada's theory of continuum. The proposal presented here includes philosophers, mathematicians, physicists, shamans, musicians, poets, and theorists who differ in their nationalities, eras, and cultural contexts, however it can be considered that all their observations regarding the continuum in music link them with the current issues of musical composition at a global level. The group of theories exploring the essence of psychoacoustic perception is represented by the works of: Aristoxenus of Tarentum, Ernst Levy, Henry Cowell,

<sup>1</sup> Julio Estrada (born in 1943), is one of the most prominent composers of the last decades. He was educated in Mexico City under the guidance of Julian Orbon; then, he continued education with famous teachers such as Olivier Messiaen, Nadia Boulanger, and Iannis Xenakis in France and György Ligeti and Karlheinz Stockhausen in Germany. His original concept of musical masterpiece was created when he worked at the Centre d'Études de Mathématique et Automatique Musicales in Paris (1980–1986); then, this theory was used when he formed the structure of his compositions (Domínguez Salas 2017, 112).

Conlon Nancarrow, György Ligeti, and Kwan-Faré-Tzé, while the representatives of theories based on mathematical calculations are Dennis Gabor, Iannis Xenakis, Curtis Roads, and Barry Traux. Their method begins the study of the continuum and discontinuum from two perspectives simultaneously, preventing one element from dominating the other. It is intuitive, flexible and at the same time systematic. Interestingly, both groups of theories begin the study of the continuum phenomenon by asking oppositely oriented questions—taking as a starting point either the continuum, the knowledge of which will allow us to understand the discontinuum, or, on the contrary, the discontinuum thanks to which we can reach the sound continuum.

### 1. Hopi Culture and Lectures by Kwan-Faré-Tzé: Imagination and Continuum in Nature

Estrada's research on the continuum, especially in the area of aesthetics, began to gain great momentum at the end of the 1970s. It was influenced by learning about the Hopi culture and their understanding of the continuum phenomenon in music. The composer decided to include it in his musical work because it emphasizes the important role of expression in musical creativity, which—according to Estrada—European modernism and postmodernism do not take into account to such an extent. This aesthetic evolution of Estrada is illustrated by the following statement:

... the pre-Columbian roots. I get from those a different angle to understand the musical matter: a frequent sense of continuity in the rhythmic pulse, a non necessarily scalar sense of melody, an open door to noise as a part of the natural continuum, and the admission of synesthesia or something similar to the idea of perceiving all sensorial messages, as a rich resource for artistic perception. (as quoted in McHard 2015, 55)

In 1987 at San Juan Pueblo, Arizona, Estrada attended eight sessions with Kwan-Faré-Tzé<sup>2</sup> with the intention of exploring the aesthetic and philosophical significance of Hopi musical works.<sup>3</sup> Until now, the only existing bibliographic source that allows us to learn more about the direct influence of Kwan-Faré-Tzé's opinions on Estrada's aesthetic thought and music is found in the book *Julio Estrada. Memories and shadows in the imaginary. A biography* (2015) written by the musicologist and composer James McHard (1942–2015), who managed to establish close contact with Julio Estrada. In this text McHard summarizes eight questions raised in the subsequent sessions that Julio Estrada had with Kwan-Faré-Tzé (McHard 2015, 124–130):

- In the first session, he focused on the symbolism of dances and music, their connection with the changes of seasons and relationships with animals, as illustrated by genres such as: hunter dance, yellow corn dance, green mast dance, etc.
- The second session focused on the relationship between music and dance and how music serves as an acoustic medium to accentuate the dancer's movements.
- The third session talked about song lyrics, phrasing and its relationship with rhythm, melody pitches, and pulsation.
- The fourth session explained the natural nature of each dance and their assignment to specific categories that are considered sacred and indisputable.
- The fifth session focused on the relationship between dance and the pulse of music.
- The sixth session talked about the importance of melody, its structure, which is not related to language, but inspired by the free flow of movements of dancers and musicians.
- The seventh session talked about the importance of singing and its relationship with language and changes in rhythm. Regarding the tone of voice, Estrada stated that it was not related to the spoken language.

<sup>2</sup> Also known as Peter García, is the master of ceremonies for the Twea Indian Reservation in San Juan Pueblo, Arizona (McHard 2015, 312).

<sup>3</sup> The bibliographic records left by Estrada on the aesthetic and philosophical lectures delivered by Kwan-Faré-Tzé are sparse. In existing publications, some mentions on this topic are marked in a subtle way that leaves the reader with the impression that they are difficult to identify with elements of other composition theories developed in the tradition of European music (see: Estrada 1988, 2002, 2004, 2008). In fact, if these texts are expected to provide detailed information about the knowledge transmitted by the teachings of Kwan-Faré-Tzé, the result obtained is perhaps unsatisfactory, since there is no direct signal of reference to Hopi culture. However, you can find several fragments that indicate a pre-Columbian origin. Three key passages selected from this article illustrate the above influence: "(1) Through this enlarged perspective a chrono-acoustic field requires an equally large amount of information in order for a macro timbre to capture the richness of nature and of the imaginary ...; (2) A multi-dimensional chrono-graphical trajectory can allow one to obtain a variety of inflections simultaneously occurring on several layers. This is important when musical ideas are understood as a living material ...; (3) In case of an imaginary listening experience, musical ideas tend to be constantly modified by different types of influences: rational thinking, sensorial stimuli or the freedom of action in the imaginary itself" (Estrada 2002, 74, 79, 82).

- The eighth and final session focused on the philosophy of Hopi singing, based on the movements of nature, the rhythm of objects and their specific sounds, the concept of sound combining the sounds of the earth with the sounds made by living things (people, animals, plants).

All knowledge acquired from Kwan-Faré-Tzé was based mainly on integrating human existence with the environment and observing and perceiving the movement of nature in a free and continuous manner. Within a total of eight sessions, Estrada managed to acquire almost all of the necessary knowledge stored by the Hopi,<sup>4</sup> which he uses even today to organize musical material into a continuum. It is worth highlighting at this point the convergence that exists between the beginning of the writing of Estrada's theory of composition (1990–1994) with the beginning of the composition of the emblematic musical work *Murmulllos del páramo* (1992–2006), where elements of the continuum are combined from the European tradition with the pre-Columbian ancestral notions already explained above.

## 2. Ancient Greece: Aristoxenus of Tarentum

Another source of inspiration for Estrada's continuum theory dates back to Ancient Greece. This theory was first formulated by the philosopher, mathematician and music theorist Aristoxenus of Tarentum (354–300 BC), a student of Aristotle and Theophrastus. In his treatise *Elementa Harmonica* consisting of three books, Aristoxenus analyzed the issues that were of greatest importance in explaining musical phenomena important in his time.

The first book describes issues of melody, being a continuation of the philosopher's earlier work *Elementa Rhythmica*, which focused on the temporal and metric relations of the poetic text.

In the first volume of *Elementa Harmonica*, Aristoxenus details several types of sound movement, illustrating their essence by referring to the functioning of the human voice: continuum as the sound of speech and continuum–continuum as the sound of singing. The first type of movement (continuum) is characterized by constant, smooth movement of sound, which can be associated with others occurring in its immediate vicinity. However, speech cannot be clearly stopped at one specific sound, and thus the detection of a specific tone becomes impossible. However, in the second type of movement, there are clear transitions through specific tones that can be registered auditorily—intervals between at least two sounds create a discontinuous harmonic state of the sound. In his treatise Aristoxenus describes the continuity and discontinuity of sound as follows:

We describe the motion of the voice as continuous when it moves in such a way as to seem to the ear ..., when the voice seems to the ear first to come to a standstill on a point of pitch, then to leap over a certain space, and, having done so, to come to a standstill on a second point, and to repeat this alternating process continuously—the motion of the voice under these circumstances we describe as motion by intervals. (Aristoxenus 1902, 171)

The Greek philosopher explains the characteristic aspects of this theory, taking into account the way in which these two types of movement—speech or singing—affect human auditory perception. The type of movement corresponding to the sound of speech is called continuous, while the second type, the sound present in a musical piece, Aristoxenus defines as continuum–continuum, because its essence is repetitions of continuity with the intervention of a pause during the movement of sound (Aristoxenus 1902, 171–172).

Aristoxenus, perceiving the movements of sounds in a natural, sensual way, confirms two types of their presence. It should be noted that by stopping sounds at specific points, we can distinguish the distances between them, and the intervals thus created are understood as discontinuities. The continuous movement of the voice functions differently, as it does not stop the sound's trajectory but begins the sound with a specific tone and ends it in silence.

It should be remembered that Aristoxenus created the first definition of the physical and psycho-acoustic causes of the continuum by observing the dynamic changes that occur in the voice. He believed that the continuum utilized energy that manifested in two forms, each of which was perceived by human perception. Both can be detected in sound when an increase or decrease in pressure generates changes in pitch. Consequently, Aristoxenus defined the upward movement as the application of tension and the downward movement as relaxation. Two physical interferences—tension and relaxation—cause an increase in the pitch or depth of the

<sup>4</sup> McHard points out in his book that “Tzé would not discuss the religious (sacred) ‘secrets’ of the cultural aspect of the Hopi musical traditions. This always has troubled Estrada” (McHard 2015, 129).

tone. The philosopher defined this idea as follows: “Tension is the continuous transition of the voice from a lower position to a higher, relaxation that from a higher to a lower. Height of the pitch is the result of tension, depth the result of relaxation” (Aristoxenus 1902, 172).

In addition to his two-perspective analysis of sound movements, Aristoxenus also established the first theoretical definition of continuous and discontinuous sound phenomena. It is used in the transformation of a parameter corresponding to frequency, but this knowledge was not put into practice until the 20th century, and only in the last century did glissando begin to be used as an important textural device.

Aristoxenus’s treatise, transcending its time, laid the foundations for the development of other musical theories, of which we can mention Estrada’s Theory of Composition which, analogically with the Greek philosopher, highlights the importance of the study of the human voice in the sphere of continuum and discontinuum (see Estrada 1994, 2004).

### 3. Theory of Granular Synthesis in the 20th Century: Iannis Xenakis, Curtis Roads, and Barry Truax

In the 20th century, aesthetic and technological changes began to take place at an extraordinary speed, and were coupled with scientific transformations. Thanks to advances in computer science and digital optics and the search for infinity in the context of the micro-macro universe, matter could be analyzed using strict measurement methods. In the case of sound, the most significant discoveries were made by observing the sound spectrum using computer programs, which facilitated the study of its matter and movement. The observation of sound material in the continuum, conducted by Aristoxenus, was preceded—as noted—by the first analyses of the discontinuum phenomenon made by two philosophers from the end of the 5th century BC—Leucippus and Democritus. They believed that all matter consisted of small, separate elements located in empty space, invisible to the naked eye. Speculating on this topic, they determined the possibility of dividing matter into smaller parts, until an indivisible end point was reached—the effect of this division, i.e., the smallest particle, they called an atom (Taylor 2005). This concept was modernized by Albert Einstein when in 1907 he predicted the presence of photons and tried to prove their existence using ultrasonic vibrations. However, Einstein’s photons could not be detected by examining only the physical properties of sound through audible experiments. This task was passed on to one of his students, the Hungarian physicist Dennis Gabor (1900–1979). In 1940, Gabor began to develop a model of sound perception based on the same thesis. He called his model the sound grain and described it in the 1947 article “Acoustical Quanta and the Theory of Hearing”. There he presented his theory along with acoustic experiments related to quantum physics. Curtis Roads revealed in the book *Microsounds* that one of Gabor’s most important proposals was the assumption that “...all sound could be decomposed into a family of functions obtained by time and frequency shifts of a single Gaussian particle” (Roads 2001, 54–55). Gabor built a sound granulator that used a film projector to create optical recordings that helped understand the duration of sound and expand it without affecting its pitch.

This theory was used in music by three composers: Iannis Xenakis, Curtis Roads, and Barry Truax. Without a doubt, Xenakis was the first to use some elements of Gabor grain synthesis to generate new sound frequencies. The 1960 article “Elements of Stochastic Music”, is the first formal description of this synthesis. In this text, the composer reveals his concept of grain synthesis, which explains the main features of so-called sonic grains. In his doctoral thesis, Xenakis defines issues related to granular synthesis as follows: “All sound is an integration of grains, of elementary sonic particles, of sonic quanta. Each of these elementary grains has a threefold nature: duration, frequency and intensity. All sound, even all continuous sonic variation, is conceived as an assemblage of a large number of elementary grains adequately disposed in time” (Xenakis 1971, 43).

As an illustration reflecting the assumptions contained in *Musiques Formelles* from 1960, we can cite the Xenakis’s Graphical Synthesis Screen (see Figure 1). An experiment takes place here—cuts and splices are created from the production of granular sounds, which are recorded on the tape that constitutes the material of the composition. The granular synthesis functions in the form of a screen where the visible frequency is divided into partial graphic graphs. Each of them represents a granule with an intensity greater than or equal to zero, and six form a series from which the composition is built.

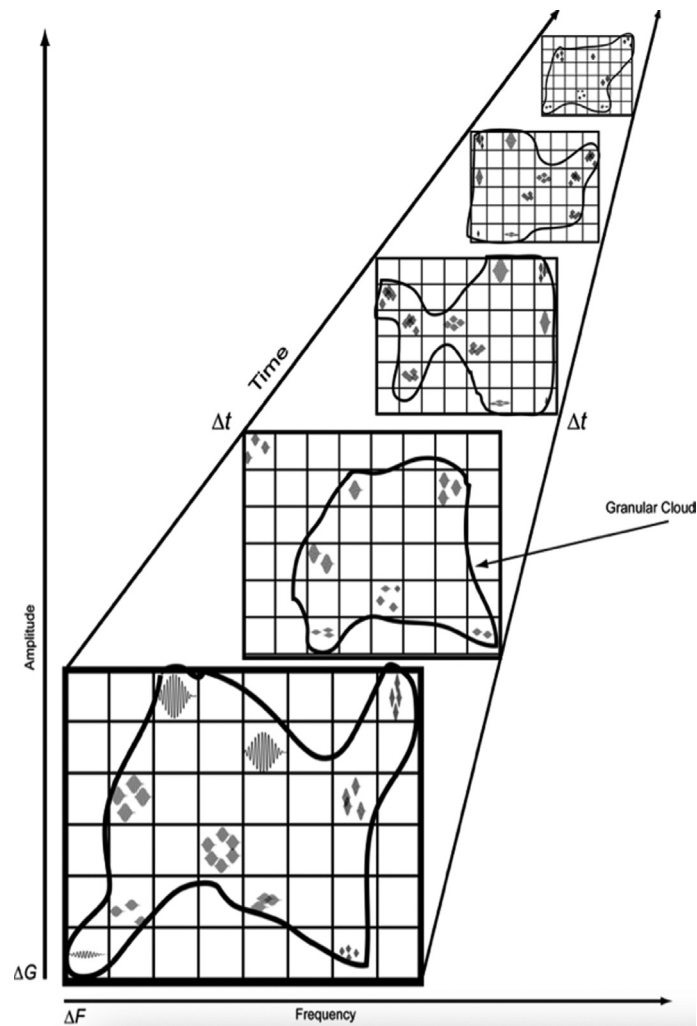


Figure 1. Iannis Xenakis. Granular Synthesis Screen

Composer and electroacoustic theorist Curtis Roads became interested in grain synthesis in 1974. Using the first computer program designed for granular synthesis that was available at the University of California, San Diego, he finally completed his research at the Massachusetts Institute of Technology in 1981. He created a granular synthesis algorithm that allowed him to compose several electroacoustic pieces. The most important achievements that Roads contributed to the development of granular synthesis are described in his publications presenting experiments examining the discontinuity and continuity of the granular system.<sup>5</sup>

Another composer who reinterpreted this method was Barry Truax, who also used it to create electroacoustic music. Truax defined the granular synthesis system at the micro-macro level as a paradox between the parameters of frequency and duration: “Granular synthesis is in a unique position to mediate between the micro and macro time worlds .... Paradoxically, linking frequency and time at the level of the grain, one makes them independently controlled variables at the macro level” (Truax 1990, 130).

The achievements of Xenakis, Roads, and Truax in this field are very close to the quantum theory of sound physics by Dennis Gabor. Xenakis, drawing inspiration from the continuum theory, dealt with the architectural sphere of musical composition, using Gabor’s research showing that it is possible to build large blocks of audible mass from sound grains. Thus, the study of the discontinuum in its relationship to the continuum in the area of the sound spectrum, initiated by the physicist Gabor, led to the development of the theory of granular synthesis, which is a synthesis of the continuum and the discontinuum. In Julio Estrada’s theory,

<sup>5</sup> “The Evolution of Granular Synthesis: An Overview of Current Research” (2006); “A Comparison of Molecular Approaches for generating Spares and Structured Multiresolution Representation of Audio and Musical Signals” (2008); “Grains, Form and Formalization” (2012); *Microsound* (2001).



this synthesis is understood under the notion of *macro timbre* (Domínguez Salas 2017, 108), which is the chronoacoustic synthesis of all rhythm and sound components that create a physical-acoustic unit: rhythm-sound. This synthesis can be analyzed from three different levels: 1. continuum: including maximum resolution in all components; 2. discontinuum: in which there is a minimum degree of resolution in all components; 3. discontinuum-continuum: containing a combination of the first two types of macro timbre in different components.

#### 4. Ernst Levy's Theory of Harmony

In 1985, the American theorist, composer, and pianist Ernst Levy published his treatise *A Theory of Harmony*, in which he proposes the study of harmony from the perspective of tone polarization, and discusses theoretical approaches related to the psychoacoustic perception of the “absolute conception”. In the sixth chapter of his book, Levy focuses on the issue of tempered tones and their impact on musical analysis. The proposed approach to the issue allows us to observe similarities with the theory of Aristoxenus. Levy's theory, approaching the continuum-discontinuum phenomenon from two perspectives, unlike the Greek philosopher's concept, does not analyze models of vocal movements. The author focuses exclusively on explaining frequency changes that may affect the psychoacoustic perception of the continuum and the distribution of sounds in the octave. According to Levy, all audible phenomena surrounding us in nature manifest themselves on a continuum—without divisions, segregation, or syntheses. However, the human psyche is conditioned to organize and classify each detected sound in our natural environment, so it strives to capture it in a specific structure:

Pitch change may first be considered as a continuum . . . , the human mind is so structured that it apprehends the continuum by starting from discrete quantities, and not vice versa. The development of mathematics offers a case in point. We see it starting from units (integers) and slowly making its way towards the continuum (calculus). (Levy 1985, 53)

Levy refers to procedures used in mathematics, establishing a clear distinction between differences in the quality and quantity of physical and sound matter. Focusing on observing the transition from continuum to discontinuum, he analyzes the divisions of the octave covering an infinite number of sounds in a finite space. The study of harmony, he argues, commits us to synthesizing the audible chaos of the continuum into discrete amounts of different audible signs derived from the various interval relations between individual sounds. From Levy's perspective, a transition from continuum to discontinuum occurs: “Quantity has been replaced by quality—an entirely new element. Quantity judgments will now be replaced by quality judgments” (Levy 1985, 53).

Ernst Levy focuses on the difference between the quantity and quality of sounds, their opposing properties, present in the natural state of sounds, i.e., in the continuum. The second state: discontinuum, is achieved using points and intervals that give each sound different characteristics. Chords are the synthesis of harmonic sound compounds. According to Levy, we can represent the continuum as an image of quantum chaos, manifested in the movements of tones, in undulations passing through a countless number of harmonics, which makes it impossible to assign them any specific pitch. However, operating within the framework of the organization of tones, which Levy examined in his treatise by analyzing the sequence of thirds, we recognize the quality of sound revealed through the quantity of sounds. Levy summarizes this idea with the following statement: “The two kinds of judgments are incommensurable; yet they will be symbolically united in the number which thus acquires a twofold meaning, a quantitative one (frequency, wavelength), and a qualitative one (musical)” (Levy 1985, 53).

In his theory, Levy assumes the existence of wave frequencies responsible for manifesting sound via a vibratory continuum. However, quality determines the harmonic characteristics that manifest themselves through the discontinuum in the vertical organization of sound, resulting in music. The same direction of research was undertaken by Estrada, when he analyzed the vibrations of sound frequencies within the concept of continuum. His research was based on the theories of Ezra Pound, Henry Cowell, Conlon Nancarrow, and György Ligeti.

### 5. Rhythm-sound in Continuum: Ezra Pound, Henry Cowell, and Conlon Nancarrow

In the first half of the 20th century, on the European and American continent, there were two theories that referred on the rhythm-sound aspect of the continuum that directly influenced Estrada's approach to this matter. The first one is the so-called absolute rhythm and Great Base theory from 1910 by Ezra Pound, a poet, critic and musician belonging to "The Lost Generation".<sup>6</sup> He introduced the concept of absolute rhythm, defining it as a sense of rhythmic freedom and liberation from the metric proper to poetry. The regained freedom facilitates the expression of various shades of emotions in poetry using this type of rhythm. In his commentaries and critical sketches on music, Pound explains the nature of absolute rhythm as follows:

Rhythm is perhaps the most primal of all things known to us ... , music is, by further analysis, pure rhythm; rhythm and nothing else, for the variation of pitch is the variation in rhythms of the individual notes, and harmony the blending of these varied rhythms. When we know more of overtones we will see that the tempo of every masterpiece is absolute, and is exactly set by some further law of rhythmic accord. (Pound 2008, 469)

In Pound's theory we find a justification for the connection of harmonic tones with rhythm as a form of vibratory energy translated into sound frequencies. It is important to emphasize the fact that these observations come from aesthetic reflection, applied jointly to poetry and music. Pound predicts that harmonic frequencies are the product of rhythmic laws. This situation leads us to the second source of research on this phenomenon present in the works of the American theorist and composer Henry Cowell. In the book *New Musical Resources* (1930), he introduces the study of rhythm according to musical elements; time and metric are related to the principles of harmony and counterpoint based on sound vibrations. Cowell develops his theory based on his own compositional experiences, thus addressing those aspects of composition that were necessary to define rhythm and sound as a unified essence of harmonic proportions. In the second chapter of the book, Cowell defines the functions of rhythm, identifying them with the phenomenon of sound in music: "sound and rhythm being considered as the two primary elements of music. Subdivisions of rhythm will be considered to be time, or duration of tones; meter, or stress, which has to do with the ascending of tones; and tempo, which has to do with the rate of speed at which tones move" (Cowell 1996, 45). This view was finally given the status of a theory determining the creation of sound in the first half of the 20th century. Cowell's theory changed the concept of rhythm as a source of sound.

Paradoxically, Cowell's musical works did not prove to be music capable of presenting all the discoveries regarding the continuum. The most emblematic musical examples that confirmed his theory were the works of the Mexican-American composer, Conlon Nancarrow. They can be found in a large part of his etudes for mechanical piano. From 1940 until his death in 1997, Nancarrow focused his musical work on poly-tempi experiments. *Etude No. 21 Canon X* demonstrates the transformation of discontinuum into continuum using rhythmic-vibratory condensation. According to the analysis of musicologist Kyle Gann, the meeting point of the two layers is identified in the score on the 32nd staff, where the level of sound condensation makes it impossible to aurally identify two separate planes because the number of sounds in seconds exceeds the amount that human auditory perception can recognize (Gann 2008, 178). The physical-sound result reflected in psychoacoustic perception is explained by the mass of the sound product obtained by rhythm condensation. Pound and Cowell's hypotheses were therefore finally proven in Nancarrow's musical output.

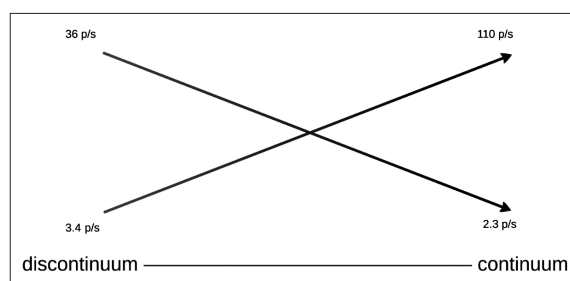


Figure 2. Domínguez Salas. Graphic representation of the transition from discontinuum to continuum in *Canon X* by Conlon Nancarrow

<sup>6</sup> "The 'Lost Generation' refers to a group of writers and poets who were men and women of this period [first World War]. All were American, but several members emigrated to Europe" (O'Connor 2012).

## 6. György Ligeti's Influence on Julio Estrada's Approach to Continuum

Searching for a musical language adequate to his own sonic ideas, Julio Estrada began to shape his theory by recording and examining acoustic material that came from his imagination. Describing the process of transforming an idea into a real musical work, in the piece *Memorias* for keyboard–piano, harpsichord or organ (1971), which was created based on this idea, he described the influence that György Ligeti had on him: “*Memorias* ... is a continuum form inspired by Ligeti” (Estrada 2020). This information forces us to examine Ligeti's work, which Estrada refers to and the contribution to the problem of the continuum.

In the 1950s, ideas for new music began to emerge in Ligeti's output, stimulated by explorations in the field of electroacoustics in an electronic music studio in Cologne. Ligeti then developed a technique that he initially called: *Bewegungsfarbe* (timbre of motion), which later took the form of micropolyphony. It is characterized by the interweaving of sequentially ordered voices, which results in a combination of these vertically unsynchronized melodic modules (Okonsar 1997, 12).<sup>7</sup>

The methods of transforming musical material allowed him to create two types of transformation known as: 1) destabilization of static structures and 2) micropolyphony. Both methodologies can be identified in *Atmosphères* (1961) for orchestra, which were later developed in *Continuum* (1968), for clavichord. In this piece, the instrument synthesizes and enhances the micro-polyphonic technique thanks to two technical advantages offered by its mechanics: 1) the ease of obtaining continuous movement when pressing a key, which allows it to achieve very fast speeds; and 2) a characteristic timbre extracted from the harpsichord strings, generating a mass of sounds that approaches a continuum.

Referring specifically to Estrada's *Memorias* for keyboard (1971), the technique of organizing the musical material consists of non-identical repetition of the sound. As the composer explains: “In *Memorias* for keyboard–piano, harpsichord or organ (1971), the melodic patterns created by the performer must go through repetitive processes whose central objective is to avoid identical repetition.” (Estrada 1971, 3)

In this way, Estrada creates a paradoxical situation for the performers – they transform the musical material into a continuum using repetition; however, it cannot be identical, but must contain different techniques of repetition of musical material. In this way, the composer obtains different forms of texture of the same sound object. This technique will later be developed into topological variations. For Estrada, the sound object is the melodic module, the importance of which he explains in the piece as follows: “Melodic modules are the initial matter from which constant transformations must result. For this purpose, they must be easy to imagine, execute and remember” (Estrada 1971, 3). Changes in the melodic structure can be achieved by the speed of the reproduced sound objects and by placing them in different layers of melodic lines that are not synchronized in time. In this way, the temporal sensation becomes continuous.



Figure 3. Estrada. *Memorias para teclado*, legend

<sup>7</sup> This makes it difficult to recognize the melodic structures that create a mass of sounds. The most representative compositions based on this technique are two pieces for orchestra and one solo piece: the orchestral *Apparitions* (1958–59) and *Atmosphères* (1961) and *Continuum* for harpsichord (1968).



## 7. Aesthetic Reflections on the Continuum in a Global Musical Context

Considering the essence of musical creativity from the perspective of a continuum creates the risk of treating this theory only as a tool in the composition process. If the goal is to create musical matter as close as possible to musical phantasy, then in the act of creation it is necessary to eliminate any theoretical “filter” beyond the experience itself. Only then does the musical material allow the creator to identify the continuum and create a relationship between the reality perceived by the sense of hearing and the imagination. This leads to the exploration of the external universe—its sounds, colors, aromas, and textures, in order to express through them the inner world of the creator, with his phantasies, memories, and emotions, in order to present the *in vitro* state of musical matter as accurately as possible in the continuum. As a summary, I propose to illustrate the above-mentioned process between the pure state of imagination and musical reality through a triadic relationship:

### 1. Asynchronicity – timelessness:

The space-time relations of musical matter in the *in vitro* state are characterized by an asynchrony of events. The movement of musical matter in the imaginary state is based on timelessness, and its transformation into sound reality must take into account the same level of timelessness. The timelessness of musical matter in physical reality is therefore based on the constant fluctuation of rhythm-sound-noise components in the continuum.

### 2. Imperfection of musical matter:

The search for a perfect understanding of musical phantasies is hindered by access to the universe of imagination in which musical phantasies reside. In order to preserve the original, “imperfect” form of the musical material, one should avoid the need to adjust this imperfection to a pre-established form models and/or compositional techniques that are alien to the concept of continuum. In the imaginary soundscape we do not find perfection within a systemic framework, but only “imperfect” forms of musical matter.

### 3. Uniqueness and non-staticity:

The movement of sound imagination manifests itself in the imagination. Just as a living organism evolves, this musical phantasy constantly evolves and transforms over time. No form, element or object is static, on the contrary, the very nature of imagination subtly forces it to constantly transformation. Therefore, the evolution of rhythm-sound-noise components in musical reality is unique and independent of anything else. The structure of musical matter is never stable, and the composition of the density of changes in rhythm-sound-noise components is continuous.

## Conclusion

To sum up the process of shaping a new theory of composition in Julio Estrada’s work, it should be emphasized that from the very beginning the phenomenon of continuity was described and discontinuities in music have been studied from various points of view. We can illustrate the wide range of his theoretical proposals with a spiral in which we find the starting point in Ancient Greece with Aristoxenus, later on by the influence of the Hopi culture and the culmination of the trajectory in the last three decades of the 20th century and the current 21st century. What distinguishes artists from how the continuum is integrated into their works can be assessed only by their intentionality—aesthetical, philosophical, cultural, and musical—which in turn will be decisive in valuing the singularity or collectivity of their musical output in the current global context of musical art in the 21st century. As far as the collectivity in Estrada’s case is concerned, the process of emancipation from the continuum in his musical work has been ongoing since the composer adapted compositional techniques used by artists from the circle of the second European avant-garde. Among those that can be mentioned with the greatest influence on his music from the late 1970s to the mid 1980s we find Xenakis and Ligeti. The singularity can be identified from the 1980s when Estrada began to become independent from this influence (European), and start to internalize the Hopi teachings, their aesthetics and the perspective of the continuum in nature and in the imagination. The conjugation of both sources guided him to form his own independent musical language. In this context, the approach to the phenomenon of continuum in Estrada’s music is the result of searching for about 30 years for methods of creating music that were most adequate to what he imagined, i.e., what appeared in his “musical imagination”.

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### Julio Estrada's kontinuumo teorijos ryšys su įvairiomis teorijomis ir muzikinėmis srovėmis nuo senovės Graikijos iki XXI amžiaus

#### Santrauka

Julio Estrada's kontinuumo teorijos ištakas reikėtų pradėti tirti nuo jos mokslinių ir estetinių šaltinių identifikavimo. Teorijos elementų galima aptikti įvairiuose traktatuose, kadangi per visą muzikos teorijos istoriją šią temą gvildeno daugybė tyrinėtojų, – ji buvo aprašoma tiek muzikos kompozicijai, tiek muzikos teorijai, tiek humanitariniams mokslams skirtuose veikaluose. Pristatydamas šios idėjos, kurią Estrada padarė savo tyrimo objektu ir pateikė 1994 m. disertacijoje, istoriją, šio straipsnio autorius mini pirmuosius jos aprašymus senovės Graikijos šaltiniuose, taip pat šiuolaikinius tyrimus, atliktus pasitelkiant naujausias mokslo teorijas. Visa tai įkvėpė Julio Estrada'ą sukurti savąją kontinuumo teoriją. Straipsnyje nagrinėjami Aristokseno iš Tarento (354–300 m. pr. Kr.), Deniso Gaboro (1900–1979), Ernesto Levy (1895–1981), Henry Dixono Cowello (1897–1965), György'io Ligeti (1923–2006) tyrimai, taip pat aptariama Hopi kultūros ir Kwan-Faré-Tzé paskaitų apie kontinuumą vaizduotėje ir gamtoje įtaka kompozitoriui. Įvardytos teorijos kartu su Estrada's išvalgomis gali paaikškinti kontinuumo funkciją, jo esmę skirtingose epochose ir kultūrinėse aplinkose, o teorijų visuma leidžia įvertinti šio akustinio reiškinio svarbą pasauliniame muzikos kontekste. Taigi istorinės ir kultūrinės perspektyvos taikymas padeda atskleisti Estrada's teorijos, sukurtos apmąstant filosofinius ir teorinius-muzikinius aspektus, pagrindus.