Conclusion and More:

As previously mentioned, pitch has been the primary element in the creation of form for many centuries. "*It was not until the 1930s that composers began to use sonic attributes as a form bearing element in a musical composition."*[51] Replacing pitch with timbre contributes to sonorities. It also requires a different set of rules and regulations about what can contribute to form in the absence of pitch. The structural process of a musical composition might transform into a new procedure if pitch is not the primary element of form. As a result, new sets of rules will help the piece communicate a musical meaning to the audience.

What type of structural procedure might contribute to conceiving a musical composition in which pitch is suppressed?

Crama, by Panayiotis Kokoras, (b. 1974), is a perfect example of a sound-based composition. This study discovered that the structural procedure in Crama is transformational variation, in which a motive, texture, or a block of sound undergoes a process of transformation to obtain the resultant. In this way, arriving at the transformation via a series of transformational variations might be considered an essential tool. Achieving form and coherence in a musical composition, however, should not have priority over form. The process and form are equally essential to arrive at a musical composition that is intrinsic and extrinsic.

What are some of the ingredients for structuring a sound-based composition?

There are many instances in which the repetition of similar timbres creates a parallelism between different instruments. As a result, repetition contributes to the continuity of sound and structuring

[51] Panayiotis Kokoras, *Morphopoiesis: An Analytical Model for Electronic Music,* 2005.

phrases and sub-sections. It also contributes to transitions and supports transformation from one section to another. Repetition of the same timbre, as well as the gradual appearance of a new timbre, contributes to the growth of a new section as the older timbral state decays. Repetition of the same timbral values supports the forward motion of a particular section. As a result, it becomes an essential tool in a sound-based composition.

Furthermore, I discovered that repetition of the identical timbral values contributes to the contrast between different sections. Contrast is a valuable tool that contributes to the growth of form in many sections. This is evident in sections in which the main form is ABA'. As repetition contributes to the creation of contrast, repetition and contrast are among the primary tools which contribute to transformational variation. Subsequently, repetition and contrast, along with transformation, count among the tools which can contribute in conceiving a modest-length form.

Transformation:

The ABA' structure was discovered in many Figures in Crama. The structure of ABA' can be interpreted as timbral state A, transformed to timbral state B, transformed to timbral state A'. There are also other types of transformation, such as AB, a binary transformation, or ABCBA, which is an arc transformation. Transformational variation is the most practical tool to achieve form in a sound-based composition because it contributes to growth and decay of different phrases or sections in and outside of each other. This type of growth and transformation structures a sound-based composition in the absence of cadence. As a result, transformation has replaced the function of cadence. Variation, repetition, and imitation between similar and virtually similar timbres of similar or different instruments are the main components of the

transformational variation. All these aspects contribute to the continuity of sound and forward motion of sound and, thus, to the form.

When pitch is not the primary element of the form in a musical composition, how would a listener be engaged in such a post-pitch world?

The presence of pitch dominates the form in a musical composition. In other words, pitch engages the listener with form, and it is the primary element in processing form in a pitch-based composition. However, in a sound-based composition, the structural procedure of transformational variation is the primary element of form. As a result, the listener must be engaged with the process of transformations in a sound-based composition, since pitch ceases to exist. Aspects such as variation, repetition, and imitation between similar and virtually similar timbres of different instruments are the main components of the transformational variation. All of the following aspects contribute to form in the absence of pitch. The listener may follow the guidelines below to engage with a sound-based composition.

Timbre as the Primary Element of the Phrase:

The interrelation between different contributing elements of sound contributes to the complexity of timbre and phrase. Timbre, as the primary element of the phrase, contributes to the structure of section, which thus creates an interrelation between phrase and section. As a result, timbre contributes to the structure of phrase, section, and, ultimately, the overall form.

There are instances in which the progression of timbre changes from one bar to another or stays static, as in instances of parallelism. More importantly, however, there is always a reoccurrence

of the same value a few bars later, which contributes to the construction of phrase in Crama. For the most part, a sense of start, process, and return brings coherency to the structure of the phrase, sub-section, section, and form in Crama.

Timbral Space:

The comparison between different instruments creates minimum and maximum values. There were cases in which the absolute value differences between minimum and maximum values were small, such as nine in Figure 133, and case in which this difference was much more significant. The absolute value difference between the minimum and maximum values indicates the timbral space. Thus, timbral space can be considered a tool to create contrast within a phrase in order to shape the phrase. Imagine a phrase that begins with smaller timbral space and then suddenly grows to larger timbral space. This can also create contrast between different sections, as in the way section B, with a timbral value of 10, contrasts with section A, which has a timbral space value of 45.

Density and Textures in a Sound-Based Composition:

Granularity of Textures:

Another contributing element in timbre is the granularity of texture which derives from the dissonant rhythmic relationship between modules stacked on top of one another. As was mentioned in attempt two, Crama's forward motion arrives via modules and their repetitive nature. For example, the density in bar 12, the clarinet with repeated 32nd notes and piano with 16th notes sextuplets, is generated as a result of the dissonant relationship between the above

rhythmic modules. The subdivision of 6 against 8 in the above modules does not line up, which results in conflicting rhythm and its contribution to the density of texture in bar 12. The subdivision of 6 against eight is orchestrated between other instruments in bar 12, to support the density of texture and its arrival from conflicting rhythms.

Rhythmic and Intervallic Dissonance:

Rhythmic dissonance is not the only element creating the density of textures in Crama. Other aspects, such as register activity and intervallic dissonance, also contribute to the density of textures. A closer look at bar 23 reveals the rhythmic dissonance of piano, between the left hand and right hand, as it is marked in the score "two tremolos not in sync." This also contributes to the rhythmic dissonance relationship, in a textural context, with the clarinet. This rhythmic-dissonance relationship between the piano and clarinet contributes to the density of the texture. The rhythmic dissonance is paired with intervallic dissonance as part of the density of texture in this bar. Note the interval of m2, in C8 register between violin and piano, left hand, which can be partially heard as part of the foreground and contributes as a dissonance to the density of texture in bar 23.

Aural Perception:

According to Boulez, *"an investigation into aural perception reveals that humans have a perceptual threshold whereby separate sound events occurring at intervals faster than about 20 per second (periodicity of about 0.05") will inevitably fuse into a single sound."*[52] According to Bergman, the general region of events happening at a rate faster than ten times per second (periodicity of <0.10") has traditionally been reserved in music for trills, tremolo, ornamentation,

[52] Pierre Boulez, "Timbre and Composition-Timbre and Language," *Contemporary Music Review* 2 (1987): 161–71.

arpeggiation, etc."[53]

Boulez's sensory perception resonates with the definition of saturated textures. These textures can be defined when an event reaches a point of textural saturation and the ear can no longer discern individual components. In these cases, the human ear is compelled to experience the event primarily through timbre. In other words, in an orchestral passage including fast tremolos in strings, aural perception fuses all the tremolo to one texture, which also interprets it as a saturated texture.

Density and Periodicity:

The density of textures is defined by the periodicity of different events or layers, such as pitch, dynamics, and rhythm. Thus, there is a direct relationship between periodicity and the density of a saturated texture. This suggests a depth in musical texture that changes according to the number of events or layers which occur during a specific interval of time.

There are a few instances in which such saturations occur in Crama. For example, a closer look at the downbeat of bar 12 reveals that the appearance of 29 events, tremolos or the repetition of the same note, occur in almost every second, since quarter note equals 60-72. Also, there are 20 events, repetition or tremolo, which occur in the downbeat of bar 13. Density is achieved this way, via the periodicity of the same event, in many other cases, such as the downbeat of bar 34.

[53] Albert S Bregman, *Auditory Scene Analysis: The Perceptual Organization of Sound*, Cambridge, MA: MIT Press, 1990.

Density and Saturation:

It seems the construction of density via saturated textures plays a vital role in Crama. Kokoras is almost always assured to arrive at density by the saturation of textures. Among many other events, the importance of density justifies a few samples which are mentioned in the discourse of Crama. The composer shows a particular and specific concern toward the production of saturated textures. He refers to sound as texture and too-saturated textures as holophony. Kokoras mentions:

"Holophonic musical texture is best perceived as the synthesis of simultaneous sound streams into a coherent whole with internal components and focal points. Holophonic music is the music whose texture is formed by the fusion of several sound entities which lose their identity and independence in order to contribute to the synthesis of a whole. The word Holophony is derived from the Greek word holos, which means 'whole/ entire,' and the word phone, which means 'sound/ voice.' In other words, each independent phone (sound) contributes to the synthesis of the holos (whole)."[54]

Kokoras implies specific details regarding the construction of holophonic textures. There are articulate details such as "simultaneous sound streams into a coherent whole," which contribute to the holophonic texture. This definition gives a clear direction for the construction of a particular type of density in which coherency is achieved via the functional relationship between internal components, sound blocks or modules, which results in the construction of a holophonic texture. As a result, the functional relationship between sound units creates a new sound and

[54] Panayiotis Kokoras, *Auditory Fusion and Holophonic Musical Texture in Xenakis's Pithoprakta,* International Computer Music Association, 2014, 2.

contributes to the concept of holophonic texture. These precise directions result in generating the intrinsic relationship between sound units and the extrinsic relationship with the listener.

Forward Motion:

Among many other characteristics of a holophonic texture, forward motion is the essential feature which contributes to the continuity of a holophonic texture. This type of character is evident in bar 7, in violin and cello, as it is expressed via repetition and dynamics. The forward motion is conceived usually via the progression of modules, which are expressed by dynamic gestures. In bar 11, in flute, clarinet, and cello, in beat 2, the continued motion of these modules is paired with a crescendo that contributes to the forward motion of holophonic texture in bar 11 of Crama. Hence, forward motion in holophonic texture derives from a combination of repetition of modules along with dynamics, which can be understood as a gesture. Thus, gestures are one of the forming principles of holophonic texture.

Holophonic Texture as Wholeness:

Density is the essential requirement of holophonic texture. Density can be achieved via many solutions that have been previously mentioned. In Crama, however, density appears to be a crucial aspect of bringing a piece to life and helping to create form. On the other hand, the majority of textures are density-driven from saturated textures, meaning that density is a solution for holophonic texture. As Kokoras mentions, "*A holophonic musical texture does not consist of parts and cannot be partitioned. It exists as wholeness."*[55] In Crama, there are many instances of saturated textures that derive from Boulez's investigation into aural perception. Therefore,

[55] Panayiotis Kokoras, "Sound Composition," Panayiotis KOKORAS – Projects, August, 2016, http://www.panayiotiskokoras.com/en/projects.html.

arriving at saturated textures via the periodicity of events which exceed the perceptual threshold can be considered one of the potential channels in creating a holophonic texture.

Background versus Foreground:

The holophonic texture is a fused-oriented texture in which every sound unit fuses with others in order to construct a new texture. Every sound unit contributes equally or unequally to the texture. In other words, in order to arrive at a holophonic texture, each sound unit is essential and as important as every other sound unit, regardless of its activity. A holophonic texture could not occur without participation from all of the sound units. As Kokoras mentions, *"Holophonic Texture is not a background versus foreground,"*[56] which resonates with the 20th-century explanation of texture. According to this explanation, the composer brings texture to the foreground and prioritizes its function, as opposed to the 18th or 19th century in which the composer uses texture as a backdrop for the melody or other aspects of a musical composition.

The Importance of Rhythm:

Pitch or noise are the results of fluctuating regular or irregular soundwaves. The act of fluctuation itself occurs with motion and energy. Faster fluctuations create higher pitches, and slower fluctuations contribute to lower pitches. The tempo, slowness or fastness, of fluctuations resonates with the concept of rhythm. As a result, different pitches blossom by the production of faster or slower rhythm. In this way, rhythm is key to forming pitch and timbre and a contributing element to a holophonic texture. As Kokoras notes, *"In holophonic musical texture*

[56] *Ibid.*

you cannot separate the rhythm from the pitch and the timbre. Therefore, sound-based composition expected to be rhythmical and gestural."[57]

Timbre Fused with Different Registers:

The primary objective of a holophonic texture is to achieve an effective fusion. As mentioned, holophonic textures can be achieved via the saturation of textures and/or the concurrent appearance of extreme timbre in different registers. Holophonic textures are conceived via density and the fluctuation of affairs between sound units which can occur in any register and create new textures. As Kokoras suggests, *"In holophonic texture it's natural to fuse timbres with different registers. The point is to find the right timbres so to create the fusion."*[58] Therefore, registers, or perhaps the contrast between registers, might be considered one of the primary tools to develop holophonic textures, as Rosemary Mountain refers to textures as the *"temporal and registral distribution of notes in any given passage."*[59]

The Importance of Leading Instrument/s and Imitation of Timbres:

In the discourse of this case study, it was discovered that the piano plays a significant contribution to the form of Crama. In bars 1 – 87, the piano is fused with other instruments to support the density of textures. However, in bars 88 – 162, the piano transforms to a leading timbral instrument, in that it leads other instruments to follow its own timbre. Thus, in a sound-based composition, one of the instruments that presents a variety of timbre can become the central leader of other instruments. This type of relationship was also observed in the string

[57] Panayiotis Kokoras, "Sound Composition," Panayiotis KOKORAS – Projects, August, 2016, http://www.panayiotiskokoras.com/en/projects.html.
[58] *Ibid.*
[59] Rosemary Mountain, *Periodicity and Musical Texture,* armchair-researcher.com, http://armchairresearcher.com/Rooms/Research/Rooms/writings/articles/PeriodicityMusical-Texture.pdf.

section, in an imitation of timbres in which the cello was the leader and the violin and the viola were the followers. The leader-follower relationship between different instruments might contribute to the form in a sound-based composition.

Is it possible to convey musical meaning if pitch is the least-prominent element in a composition?

Pitch has been the primary element of form for many centuries. The goal of this study, through the guidelines above, was to recover form in the absence of pitch in a sound-based composition. Since form suggests the intellectual engagement of the listener with structure, in any musical genre, wise use of these guidelines and discoveries can make a case for musical meaning in a sound-base composition. Crama, as a sound-based composition, employs all the guidelines discovered in the course of this dissertation. It creates musical meaning by employing timbre and textural density as the primary elements of form. As a result, in the absence of pitch, the presence of timbre communicates musical meaning.

The End:

This dissertation is not an attempt to disregard the importance of melody, harmony, or other elements of music from the past. My passion as a composer is to create a forward-thinking composition traced from that past. The evolution of music is unavoidable. This dissertation is my attempt to discover new guidelines that function in a sound-based composition. Perhaps these can be linked to the evolution of music, as Crama extracted principles from older music to create a sound-based composition. The primary goal of sound-based composition is not only creating a work of art which avoids pitch, but to make a connection with the listener. Therefore, the

mission of a sound-based composition would not be complete without mesmerizing its audience. In the end, composition is the result of inspiration and intellectual justification. I hope the discoveries and guidelines provided in the discourse of this dissertation can provide new alternatives for whoever has passion and curiosity to create a sound-based composition.

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List of rests for each instrument in Crama: