Chapter 2: Preparation for Case Study

Definition of timbre:

Timbre can be defined as the quality of sound. There are various factors which contribute to the quality of sound. The contribution of different acoustical properties which can define the quality of sound in a particular instrument. The acoustical property of each instrument can be modified according, but not limited, to many factors, as follow:

1) The number of harmonic partials: Usually, regular sound waves contribute to the overall acoustical property of a note, whereas irregular sound waves mostly contribute to generating noise. Therefore, a vast number of partials with regular sound waves results in a rich sound spectrum. Pierre Schaeffer refers to this kind of sound as 'rich sound,' "for a sound that has a significant number of harmonics with significant amplitude."[24] In contrast, a smaller number of regular sound waves or a vast number of partials with irregular sound waves contribute to forming noise or a sound which contains a large portion of noise. Pierre Schaeffer refers to this kind of sound as 'poor sound,' "for a sound made up of only one or a very small number of components of significant amplitude."[25]

2) Thinness or thickness of sound: There is always a direct relationship between register and thinness or thickness of sound. Sounds in the lower register are thicker, whereas sounds in the upper register are thinner. The thick sound is the resultant of sinewaves in the lower register, which fluctuate slower. On the other hand, sinewaves with fast fluctuations form thin sounds in

[24] Pierre Schaeffer, *In search of Concrete Music* (A la recherche d'une musique concrete), 209.
[25] *Ibid*., 208.

the upper register. Furthermore, thinness or thickness of sound can be the resultant of the dissonant relationship between a package of partials which are focused on the lower register or upper register.

3) Range of the strongest partials: The placement of the regular or irregular sound waves in the higher portion of the sound spectrum, which results in high pitch or noise, or their contribution to the lower part of the spectrum, which contributes to lower and richer pitch or noise.

4) Irregularity of sound: Since pitch ceases to be important in Crama, the inharmonicity of sound is substituted by the *irregularity of* (or: *disturbances to*) sound. Such disturbances or irregularities may refer to the deviation of partials from the original (pure) integers—as is the standard definition of "inharmonicity"—but may also refer to the presence of partials from multiple overtone series that result in beating. (Some might describe such beating as "noise," although it is not technically noise.) Such techniques as multiphonics may result in a high degree of irregularity of sound.

5) Amount of noise: The amount of noise as part of the pitch. This proportionality varies from one instrument to another. For example, the proportion of noise to sound in the flute is much higher than in a clarinet. This is due to the difference in the mechanics of sound production in the flute, as well as the different relationship between fundamental and partials in the flute than in the clarinet.

6) Sharpness of attack: The amount and manner of force employed to produce a pitch. For example, whether the attack is soft, aggressive, or harsh.

7) Noisiness of attack: The amount of energy to produce a pitch in different instruments, and the mechanics of sound production in various instruments. For example, the mechanics of a string instrument's sound production is based upon the repetition of pull and release: the string is pulled by the bow and snaps back. Therefore, sharp attacks create more noise and less pitch. An example of a noisy attack is reh.13, in strings, in Igor Stravinsky's (1882-1971) Rite of Spring. The repeated down-bow motion of the bow, pull, and a very sharp attack will result in a proportionally high-noised and less-pitched attack.

Case study:

The primary purpose of this case study is to discover essential tools which contribute to the creation and organization of form in a sound-based composition. In my case study, I ask the following questions: Do timbres contribute to the creation of the form? Does timbre function as the primary element of form? Which compositional ingredients contribute to the form in a sound-based composition? Were timbres chosen randomly or not?

Why I decided to use numerical values:

My analytic approach is as follows: for each measure of music, the seven different parameters of timbre for each individual instrument were determined "by ear" (upon close and careful listening). Those numeric values were tallied within a seven-place "timbral vector."[26] For

[26] "I am indebted to Lefkowitz, Chapter 13, for this analytic approach."

example, the flute in m.1, breathy sound, is represented by the following numerical values for each contributing element of sound: Number of harmonic partials =1, thinness and thickness of sound = 3, Range of strongest partials = 3, irregularity of sound = 6, Amount of noise = 9, Sharpness of attack = 2, Noisiness of attack = 2. Collecting those numbers within their respective timbral vectors makes direct comparisons between different sounds (whether in the same instrument or in different instruments) possible. The comparison of the numeric values of individual parameters should be quite obvious — such as the number of harmonic partials in one sound vs. another. But it is also possible to compare the totality of one sound with the totality of another. The reason for this is that each of the parameters, ranked on a scale from 1 to 9, represents increasing "*saturation,*"[27] of the relevant parameter**.**As detailed in Chapter 10, the totality — the total timbral saturation — of each sound is determined by adding all of the numbers in the timbral vector**.** Therefore, the total timbre value of the breathy sound in the flute in bar one of Crama is twenty-six. Furthermore, if the timbre value of the second bar of the flute is determined, then the absolute value difference between these two bars and, as a result, the progression of timbre can be identified. This sum is termed the "absolute value,"[28] of the sound. Different aspects of the timbral vectors are used to analyze the sounds in different ways, including line charts that can provide the reader clear visual progression of elements contributing to the timbre, as detailed in subsequent chapters 3 – 9.

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[27] "With the exception of the range of the strongest partials. As this exceptional parameter is the only one not measuring saturation, it was determined that including it in the totality of the sound would not have an adverse effect on the measure of the totality of sound."

[28] "It is arguably the case that measuring the *magnitude* of the timbral vector (determined by the formula <square root of the sum of the squares>) is a more accurate measure of the total saturation of a timbral vector, but as this magnitude is, perhaps, somewhat less intuitive (and since it does not typically result in integer numbers), the less accurate but easy-to-understand <sum of the values in the timbral vector> formula is used instead."

How the value of each sound was calculated:

Granting the premise that the seven elements listed above define the quality of sound, I assign a numerical value, 1 – 9, to each element of sound, table 3. In this way, the total of the absolute value of each timbre can be expressed numerically in each bar. For example, the flute in m.1, breathy sound, is represented in the following numerical values for each contributing element of sound: Number of harmonic partials =1, thinness and thickness of sound = 3, Range of strongest partials = 3, irregularity of sound = 6, Amount of noise = 9, Sharpness of attack = 2, Noisiness of attack = 2. Therefore, the total timbre value of the breathy sound in the flute in bar one of Crama is twenty-six. Furthermore, if the timbre value of the second bar of the flute is determined, then the absolute value difference between these two bars and, as a result, the progression of timbre can be identified.

As part of the process, the numerical value of bar 1 was compared itself then to bars 2, 3, 4…170, then bar 2 to 1 then to itself, then to bars3, 4, 5…170, up until bar 169 was compared to bar 170. This same process was applied to the clarinet, violin, piano, and eventually all thirty-six instruments. This process created a massive database, which enabled me to generate line charts to find information related to the contribution of timbre in creating form. The resulting information led me to discover occurrence, recurrence, relationships, and return, of each value, and then relate their function to the elements which contribute to the creation of form. In this way, one can observe bar to bar progression of timbre and discover the importance and contribution of timbre to form in Crama.

Table.1 shows seven different contributing elements to the quality of sound.

Seven contributing elements to timbre or the quality of sound.
1. Number of partials = **P#** (1 = fewer, 9 = more)
2. Thinness or thickness of sound = **Th/Tk** (1 = thin, 9 = rich)
3. Range of strongest partials = **PR** (1 = low, 9 = high) or, better: (1 = bottom, 9 = top)
4. Irregularity of sound = **I** (1 = regular, 9 = irregular)
5. Amount of noise = **N** (1 = clean, pure, 9 = noisy)
6. Sharpness of attack = **AS** (1 = gentle, 9 = sharp)
7. Noisiness of attack = **AN** (1 = non-noisy attack, 9 = noisy attack)

Disclaimers:

1) The rating of "1" for the first parameter does *not* mean that there is *one* harmonic partial, but that there are *few* harmonic partials. Similarly, a rating of "9" does *not* mean that there are *nine* harmonic partials, but that there are *many* harmonic partials. This rating system is applied to all seven aspects of the contributing elements to sound.

2) This paper is not about orchestration, instrumentation, or timbre. It is about discovering practical techniques, structural procedures, and mindset to create form from timbre.

3) Since the full score and recording of Crama is available on https://www.youtube.com/watch?v=h3toKwPr93I, I did not insert scores as part of the analysis.

4) The contributing elements to the quality of sound were chosen randomly for each instrument to achieve different results, in the course of the case study. For example, the irregularity of sound is not part of the case study in flute, whereas it is part of the case study in clarinet.

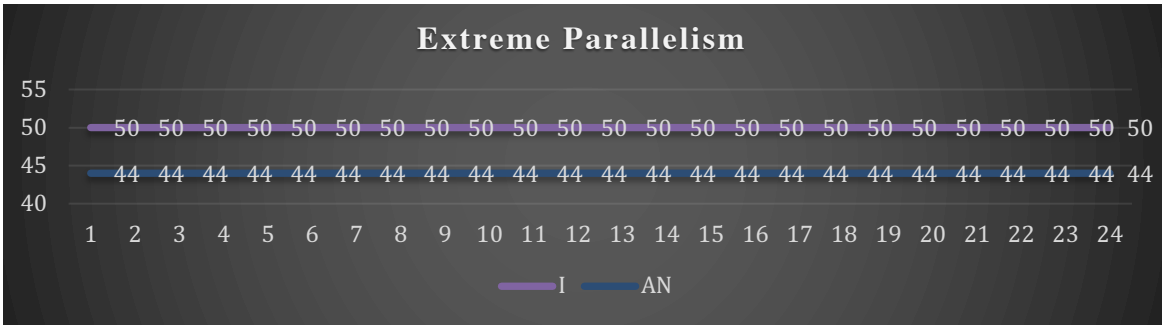
5) The main database to all of the line charts in this dissertation will be available on my website by the end of 2020.

6) This dissertation includes a work for guitar quartet titled Metamorphosis on a Holophonic Texture, which uses timbre as the primary element of form.

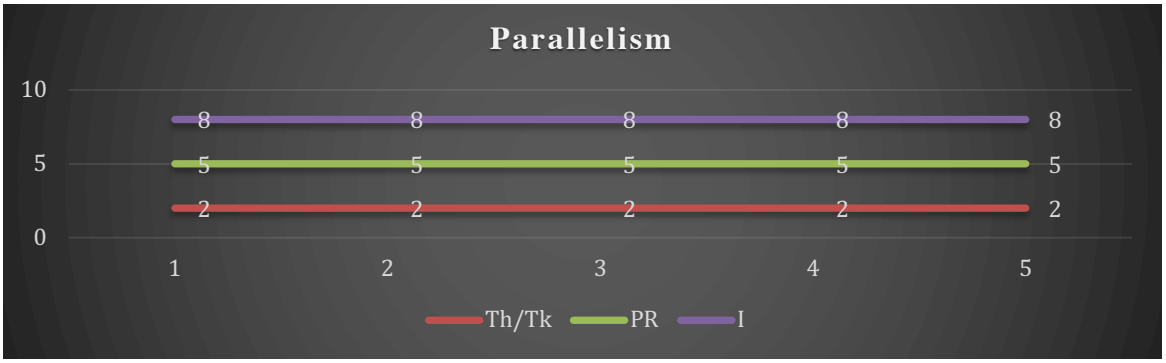
Different motions:

Below are examples of different types of motion that will be discussed in the case study.

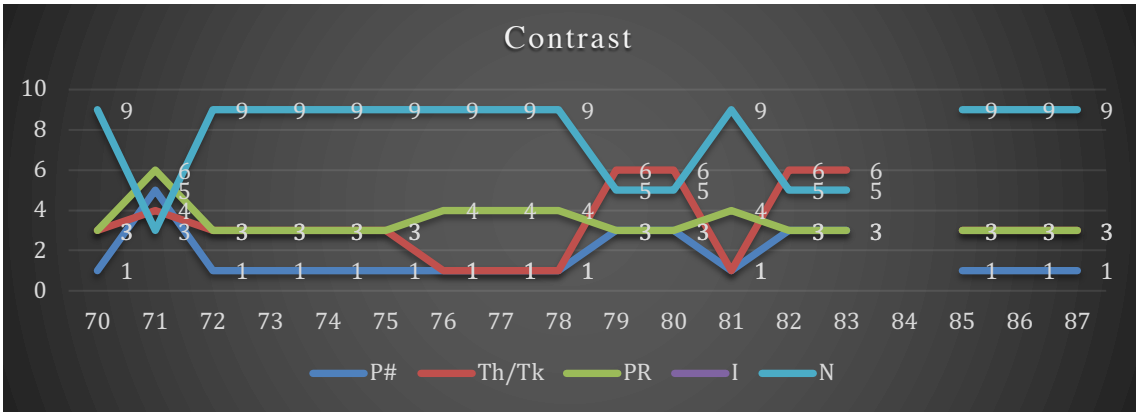
Extreme parallelism: Stagnant motion for significant number of measures.



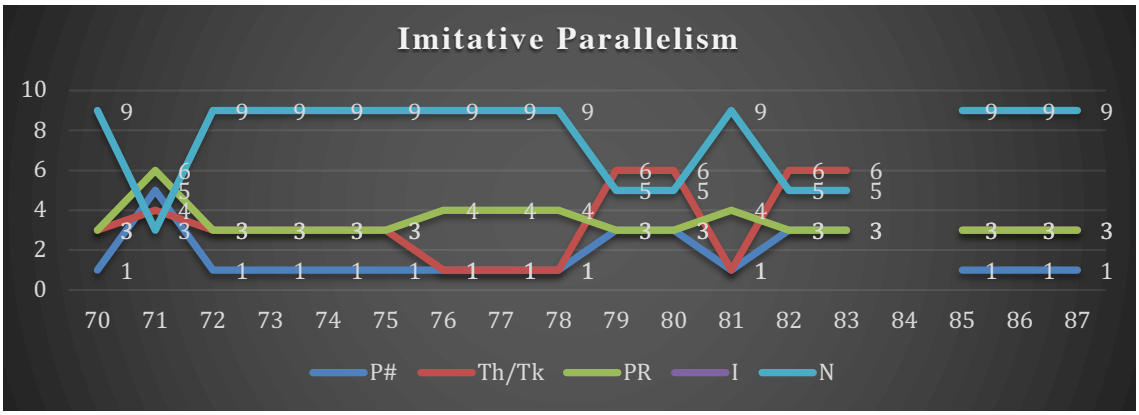
Parallelism: Stagnant motion for 4 bars or more.



Contrast: Opposite motion between different series. The motion between irregularity of sound category and the amount of noise category, bars 79 – 81.



Imitative parallelism: The timbral values move in parallel upward or downward motion without coinciding with one another, number of partials, and range of partials in bars 70 – 72.



The Structure of analysis:

In order to analyze the function of timbre and the process of its contribution to the form, I divided Crama into smaller sections. These uneven sections were chosen based on the progression, evolution, and transformation of motif and timbre, and how they contributed to the form in Crama.