Cycles in Music: Spaces, Experience and Applications in Music Theory and Composition

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Abstract: This paper focuses the idea of cycle and its approaches in music theory, in order to propose further application to music composition. The impulse for reseaching cycle was made possible through a previous research, in which I proposed a conceptual framework for the relationship between music and movement in Capoeira. Here, I first discuss the idea of cycle, then its theoretical approaches, and finally, some compositional processes based on cycles.

Keywords: cycle, composition, creative process.

Introduction

This paper focuses the idea of cycle and its approaches in music theory, in order to propose further application to music composition. The impulse for researching cycle was made possible through a previous research, in which I proposed a conceptual framework for the relationship between music and movement in Capoeira[1].

In the first section, I discuss the idea of cycle, proposing a definition for the term, in relation to cognition and our bodily experience. In the second section, I propose a short discussion about theoretical approaches to cycle, where music and mathematics are co-implicated. Finally, I discuss some compositional processes based on cycles, in order to exemplify the previous discussion.

I. The notion of cycle: a conceptual territory

Cyclicity is understood here as a property which is somewhat characterized through a cycle[2]. The term cycle holds many meanings. We may consider several approaches to define a cycle.

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[1] In my doctoral research – PhD in Music Composition at Universidade Federal da Bahia (Federal University of Bahia – UFBA) – I focused the complex interaction between music and movement, and specially its uses and functions in the creation of compositional processes, taking as reference a context in which it is not possible to establish a clear distinction between them: the Brazilian Capoeira [1]. Capoeira is a combination of music, dance and martial arts that has been developed in Brazil by West African slaves and its descendants and has been exported all over the world. The combination of field work and a critique of existing literature on the interaction between music and movement led to the proposition of a conceptual framework, four concepts which are not mutually exclusive: Cyclicity, Sharpness, Circularity and Surpriseness.

[2] It is important to mention that this approach to cycle in music is based on a previous – and preliminary – effort in a presentation entitled as "A noção de Ciclo em música: concepções e aplicações composicionais" [2], realized at the ANPPOM's Congress, João Pessoa.

From a cognitive point of view, the cycle is an image schema based on our bodily experience[3, p. 362], therefore, it is a basic and easily recognizable concept, since we experience different cycles everyday.

Brower defines cycle in relation to the container image schema, emphasizing its time dimension:

> The CYCLE schema serves to organize our experience of time and the changes by which we measure time [...] The CYCLE schema combines easily with the CONTAINER schema, much of its structure. The circle, being closed, can be conceptualized as a container for motion around its perimeter. [...] [T]emporal containers may be of fixed duration, as in the case of conventional cycles such as minutes, hours, and weeks, or they may be subject to expansion and contraction, as in the case of most bodily cycles. Cycles may also be nested, with larger cycles subsuming smaller ones, producing a temporal hierarchy [...]. We observe [...] opposition in many bodily cycles – the alternation of left and right in walking, in and out in breathing, back and forth in swinging. The alternation may be balanced, so that the halves of the cycle mirror one another exactly. Or the alternation may be asymmetrical, as in the case of most bodily processes of tension and relaxation, with the climax sometimes coming well after the midpoint of the cycle. A wave can assume an infinite variety of forms, and in fact it is this kind of flexibility that allows the schema to play such a pervasive part in our understanding of temporal experience [3, p. 329-30]

Notwithstanding, we propose a conceptual approximation, in order to create a territory for cycle based in three notions (Figure **??**).
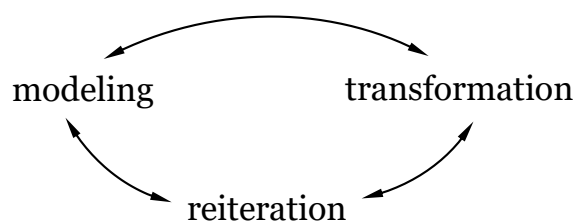

Figure 1: *Notion of cycle based on three concepts*

Modeling is conceived here as a virtual connection between two events which allows us to identify resemblances and correlations between them. In this sense, it is an element capable of promoting the identification of traces, even changing ones, common features of two subsequent events spread in time. In other words, it is a sort of design, schema or contour. This modeling is then continually changing and transforming through time.

Therefore, the definition I would like to propose is: in a cycle, a certain modeling reiterates itself by transformation (a cycle not necessarily implicates a repetition, even tough the repetition is the most literal way of reiteration). As a matter of fact, The idea of cycle is one of the most important schemas for time. Cycles organize our sense of time. In music, cycle plays an important role: cycles of songs, cycles of fifths, interval cycles, and so on, are obvious examples. Nevertheless, the notions of cycle should neither be considered as rigid models nor as chains of literal repetition. Even when they are not assumed, there is no doubt they are sorts of cycles and even the most literal way of representing a cycle.

It is important to mention that there is no linearity or cause/effect relation between the three notions, they permeate each other. In other words, most of the time it is not possible to precisely

the beginning and/or the ending, once we are always in the midst of the cycle. Thus, one can only delimit the scope of a cycle through the formalizing interference of an observer. The notions of transformation and reiteration imply temporality, as mentioned by Candace Brower [3]. The cycle is one of the image schemas based on our body experience (p. 328).

Some questions still remain: are there any cycles which don't reiterate? Are there any cycles which don't transform themselves? Are there any cycles with no modelling (more or less literal)? I propose here that the approach of cycle as modelling, transformation and reiteration allows us to understand such nebulous concept.

Concerning the previous research [1], the rhythm, the melodic profiles, the movements and the game itself are cyclic characteristics of Capoeira Regional. For example, Ginga is a basic Capoeira movement which plays a role as a basis for all movements[3].

II. Notions of cycle in some approaches in music theory

Laske's Epistemology of Composition [7] takes the creative process in music as a "Compositional Life Cycle". In this sense, composition is a cycle *per se*. For him, the cycle has four interdependent levels: ideas, materials, implementation, and work. The author discusses the complex network of the creative process, taking both model-based and rule-based composition as complementary approaches.

The notion of cycle plays an important hole in contemporary music theory, especially in *neo-riemannian theory*. Cohn [4] presents a historical overview of this field of study, taking as reference the first edition of Lewin's seminal book [8]. Cohn focuses on Lewin's essay, written in 1982 five years earlier than the book), in order to propose a series of perspectives for music theory.

As a starting point, the *neo-riemannian theory* took as reference models of voice-leading applied to triads, a process also known as triadic post-tonality [4, 11]. Afterward, this model was also applied to other pitch class sets and collections.

It is important to mention the important role of smooth voice-leading and its geometric visualization. Voice-leading is related to pitch-spaces, and in some ways it offers us forms to understand the relationships between aggregates. Morris, for example, asserts [9, p. 95]: "in recent music theory, graphs—nodes connected by lines or arrows – have become important tools for modeling music, musical structures, and compositional systems".

Siciliano [10, p. 222] proposes the maximally smooth cycle of triads as a *toggling*, as expressed in Figure 2.

Figure 2: *toggling: maximally smooth voice leading [10, p. 222]*

Notice that the modeling is the half-step voice leading between two subsequent notes. The transformation always results in new perfect triadic forms. Figure 3 shows the toogling in a geometric approach.

Figure 4 shows a cycle of chords which took the pitch class set 026 as a starting point. Note the smoothness of the voice leading, as the modeling consists of whole steps which transform the chords gradually until it gets back to the original chord.

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[3]For more examples of cycle in capoeira, its significance, and how the cycle in the context suggested me this approach, see the PhD dissertation [1].
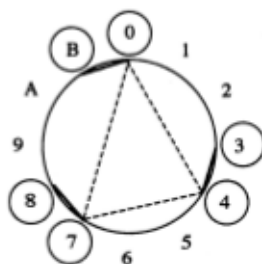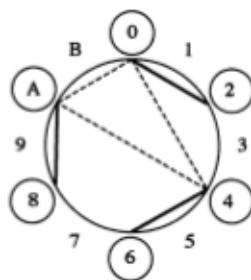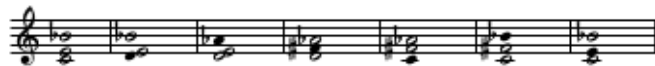
Figure 3: *Toggling in a geometric form: maximally smooth voice leading [10, p. 225]*

(a) Toggling cycle by ic 2.

(b) Voice leading among 3–8[026] trichords in an ic 2 toggling cycle.

Figure 4: *Toggling 026 with a whole step voice leading [10, p. 226]*

The *tonnetz* is a network of triads in a pitch space [4, p. 175], where each triad is related to its homonym and relative forms (Figure 5). This cycle is modeled by four cycles of half-step (marked by circles) in C, C sharp, D and E, presenting its homonym and relative forms in anticlockwise. The central square indicates the *hyper-hexatonic system*.

Straus [11] proposes a series of concepts through which we may discuss atonal voice-leading. His approach establishes tools for connecting different pitch class sets. We point out important notions for cycle, such as Pitch-class voice, Transformational voice leading, Uniformity, Balance, Offset, Consistency, Span, Fuzzy transpositions and Voice-leading smoothness.

In the third edition of his seminal book "Introduction to Post Tonal Theory", Straus also approaches interval cycles[12, p. 154], with examples by Bartók, Ives and Varèse. Unfortunately, he only mentioned simple cycles, with a unique interval. Tymoczko [13, p. 107] also proposes cycles of intervals and its modes of visualization in a geometry of music. In spite of the simple cycles he proposes, Tymoczko's work presents interesting insights for understanding music through geometry[4].

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[4]Due to scope issues, this paper focuses on cycle instead of geometry, Tymoczko's approach shall not be discussed here
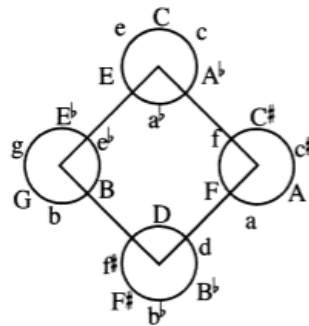
Figure 5: *Tonnetz: hyper-hexatonic system [4, p. 175]*

On the other hand, Gollin [6, p. 143] proposes "compound interval cycles" projected in a pitch space with two or more intervals. Interesting examples are Bartók's *Study Op. 18, 1* (Figure 6) and *Scherzo* from *Suite Op. 14* (Figure 7), in which the modeling is composed respectively by the alternation of major/minor thirds and major thirds/minor seconds. Notice in Figure 8 how cycle 4-5 engenders the octatonic collection (Bartok also extensively uses the 4-5 cycle).
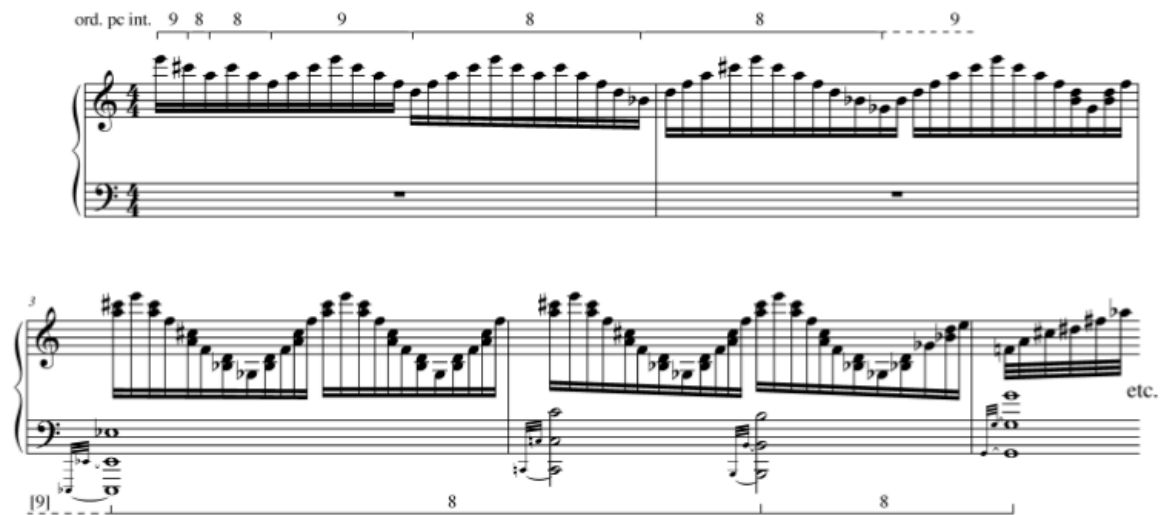

Figure 6: *Cycle of major and minor thirds in Bartók's Study Op. 18, 1 [6, p. 144]*

As I shall further discuss, the idea of projection of multi-aggregate cycles in pitch spaces is a powerful tool for generating material, which allows us, on the one hand, to implode the sonority of a chord by the projection of its constitunt intervals, and, on the other hand, to transform the chord in a pitch space.

In his turn, Morris [9] proposes musical applications of *minimal graph cycles*:

> Graphs may be constructed from other graphs called input relations. Strictly speaking, a relation is a graph of two nodes connected by one or two arrows. However, we will allow input relations to be more complex, assuming they satisfy some context-

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in a more detailed way.

Figure 7: *Cycle of major thirds and minor seconds in Scherzo from Suite Op. 14 [6, p. 145]*
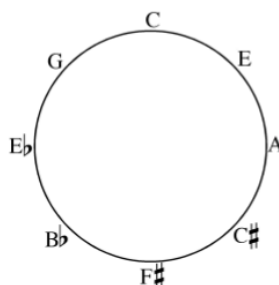

Figure 8: *Cycle 4-5 and the octatonic collection [6, p. 147]*

sensitive definition of simplicity and/or basic importance. So, input relations can be the graphic representation of ordered or unordered sets, partially ordered sets, cycles, and so forth. Both the input relations and the graphs they construct may or may not be partitioned into disconnected subgraphs [9, p. 100]

Figure 9, Morris shows the graph cycle through which he composed the flute excerpt presented in 10. Notice how the cycle starts in 0 (C), and moves step by step, forming a square in the upper left. Then, he starts the square again and departs to the lower part of the cycle, followed by the right part of the Figure. All the paths which make the composition of the excerpt possible are easily recognizable through the graph.

Finally, it is important to mention the work by Pedro Augusto Dias [5], a PhD Dissertation on combined concentric cycles in structuration of pitch in Thomas Adès. Dias analyzes several modelings of cycles and proposes important insights though visualization tools made possible by the geometry of music. Even the work is focused on Adès' processes, Dias presents and discusses important issues on cycles in music, with several examples both in analysis and composition.
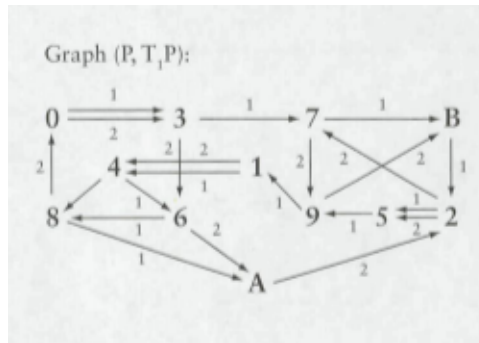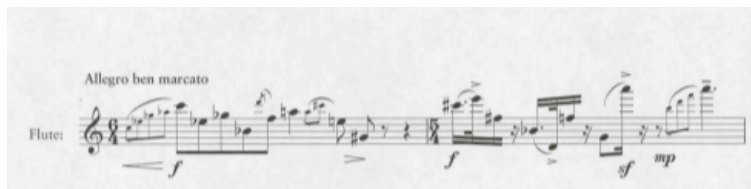
Figure 9: *Morris graph cycle [9, p. 104]*

Figure 10: *Morris' music based on the graph cycle [9, p. 104]*

III. Some applications of cycles in composition

In this section I briefly discuss some applications of cycles in composition[5]. *Fumebianas* is a series of works composed in previous research on the relationship between music and movement in Capoeira [1]. The notion of cycle plays an important role in the process of generation of harmonic material in the series. Interval cycles made possible the creation of harmonic spaces, by the projection of a sonority extracted from the context (pentatonic collection) in relation to the pitch class set 5-16 (especially in its form 03467). Figure 11 shows the smoothness between the two aggregates.
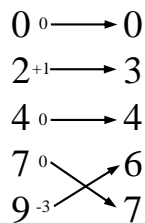

Figure 11: *Smoothness between pentatonic collection and the pitch class set 5-16*

The dialog between the two sonorities allowed me to propose cycles of transpositions of 5-16 through interpolations of two subsequent pentatonic intervals. Figure 12 shows these interpolations and how they were constructed, and Figure 13 shows the application of the cycle in

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[5]The intent of this section is to provide examples of applications of cycle in composition. I hope just to show a few examples, in order to illustrates the issues previously discussed in the paper. For more detailed analysis, the scores and recordings are available in `https://guilhermebertissolo.wordpress.com/`.

Fumebianas Nº 5.

Figure 12: *Cycles of 5-16 transformed by two subsequent pentatonic intervals*

Figure 13: *Cycles of 5-16 transformed by two subsequent pentatonic intervals - Application in Fumebianas Nº 5*

In Figure 14 I show a sequence of chords based on the projection of the sonorities in a pitch space. It is important to notice the three reiterations of the cycle, each generating different trichords. Figure 15 shows the application of the material in *Fumebianas Nº 5*.

It is possible to generate, gradually transforming, multiple cycles of chords in this space, while maintaining resemblance to the sonority of Capoeira.

In *Fumebianas Nº 4*, I proposed two different interval projections, from 5-16 and pentatonic collection, in order to generate pitch spaces. Thus, I constructed pitch spaces based on cyclic projections of the interval of each set, as shown in Figure 16.

Figure 14: *Creating pitch spaces*

These pitch spaces were the basic map through which the piece moved. For example, I took the modeling 3, 2, 2, 5, 5, 5, 6, 4, 4, 5, 5, 4 and 5 and applied to both cycles, generating different materials from the same path in two different spaces (Figure 17). This type of strategy was applied throughout the series.

Finally, in *Fumebianas Nº 5*, I generated material by an algorithmic process made possible through cycles of superposed patterns of eighth notes. Figure 18 shows the modeling, where different patterns of eighth notes are separated by pauses. These cycles started with five eighth pauses, and then four, and so on, until we get just one eighth pause.

Figures 19 and 20 show the application of the first and last cycle. It is important to notice the gradual intensification process which takes place through the first part of *Fumebianas Nº 5*. As the

Figure 15: *Creating pitch spaces: application in Fumebianas Nᵒ 5*

Figura 4.44: Espaço de alturas em *Fumebianas Nᵒ 4*: pentatônica-03467

Figure 16: *Two cycles of intervals*

texture gets more and more dense with every new cycle.

IV. Final considerations

Cycles plays an important hole both in composition and music theory. The numerous approaches to cycle allow us to better understand music and its creative process. Cycles are important ways of visualization, once they allow us to think in terms of espacialization.

As I argue above, I believe cycles connect our bodily experience to the "allegedly abstract" pitch spaces. Once we think in terms of metaphorical projections, bodily spaces help us to understand

Figure 17: *Same path in two different pitch spaces*

Figure 18: *Cycles of patterns*

Figure 19: *Cycles of patterns: five eighth pauses*

pitch spaces and even create them. I propose that our experience of cycle is a key to understanding music as a complex of experience, cognition, space, geometry and culture.

Figure 20: *Cycles of patterns: one eighth pause*

The concepts of cycle I propose here were inspired by Capoeira's movements. Therefore, cycle has a meaningful cultural significance in this context, and my point of view was strongly impregnated by this significance. The cognitive meaning of cycle as an image schema is fundamental, as expressed by Brower [3, p. 325], since "image schemas that lend coherence to our bodily experience are metaphorically reflected in conventional patterns of melody, harmony, phrase structure, and form".

Finally, I argue that cycles and their graphs in pitch spaces are so capable of making sense to us, and the geometry of music is so significant, due to the power of metaphorical mapping through which the relationship between notes, chords and harmonies take on meaning through our embodied cognition. Ultimately, the space in music is eminently cultural. In other words, we experience music spaces as we perceive bodily spaces, with both cognitive and cultural meaning. Thus, it is fundamental to develop tools for understanding music spaces through visualization, in order to better analyze and create music.

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