Complexity and metapatterns: musical composition with improvisation.[1]

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Abstract:
This article analyzes the possibility of regarding metapatterns as a tool for musical composition with improvisation. To construct context for the ideas presented in the text, it starts with a brief description of some characteristics of my score *U-Bahn 2*, for organ and orchestra. The situation of a group of musicians improvising from a score that uses forms of notation different from the traditional, is analyzed through *Wu-Li*, by Hans-Joachim Koellreutter. After discussing some characteristics of its sound result and Koellreutter's planimetric composition, *Wu-Li* is seen as a process that gives rise to a complex event and questions regarding its identity are brought forth. Through briefly looking at how systemic view and complexity studies see: wholes in relation to their parts, circular feedback chains, self-organization and emergence, form is seen as a self-reconstructing process in time, and *Wu-Li* as composed of patterns of interrelationships. Gregory Bateson's thought is the starting point to understand the use of metapatterns as a tool for musical composition with improvisation, and the tension between his thought in hierarchies and the dynamical aspect of patterns and *metapatterns* leads to the definition of the latter as: *a pattern of interrelationships of patterns of interrelationships*. Coming back to *Wu-Li* and *U-Bahn 2*, the metapattern is seen as an idea that tries to describe tendencies along time in the improvised musical tissue, that are chronographically mapped in the score. Some aspects of the patterns of interrelationships in *U-Bahn 2* and their consequences for the form and identity of the piece are brought forth. The central role of improvising is underlined and leads to the conclusions.

Keywords: Hans-Joachim Koellreutter. Gregory Bateson. Complexity. Metapatterns. Composition. Improvisation.

1. Introduction

Aiming at constructing context for the ideas presented here, it is necessary to begin by exemplifying with one of my scores. All the work that I have been carrying out in my doctoral research is linked to what I have been doing in my music, and not the contrary. It doesn't try to justify my artistic choices, but instead to develop them further, aiming to grasp new possibilities for the use of open forms and scores that use forms of notation different from the traditional.

U-Bahn 2 is a work for organ and orchestra and has been composed to dialogue with the staging of *Le Martyre de Saint Sébastien*, by Claude Debussy, that took place at the Gedächtniskirche, in Berlin, Germany, on the 3rd november 2012.[2] The Kaiser-Wilhelm-Gedächtniskirche is a church left in ruins at the center of Berlin as a reminder of the destruction of the war, with a new church, foyer, tower and chapel surrounding. It has a tunnel of the city's Metro (*U-Bahn*) crossing below, with lines 2 and 9 alternating every two minutes. The resulting sound lasts a little more than 20 seconds, is extremely low and can be heard softly and felt as physical vibration in the body of the church. Through a spectromorphological analysis of the recorded sound, obtained with a portable recorder (Olympus LS-5) held against one of the hollow metal columns of the new church, I have tried to understand the internal movements of

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[2] 3rd november 2012. Interventions by Miika Hyytiäinen, Alejandro Moreno, Aziz Lewandowski and Daniel Puig (Students from the class of Daniel Ott, UdK-Berlin) in: *Le Martyre de Saint Sébastien*, by Claude Debussy; Saint Sébastien: Hanna Schygulla; Solos: Vanessa Barkowski, Olivia Vermeulen, Csilla Csovari; Haupt- und Mädchenchor der Sing-Akademie zu Berlin; Staats- und Domchor Berlin; Symphonieorchester der Universität der Künste Berlin; Organ: Age-Freerk Bokma; Space, Light, Video: Ingo Bracke; Sounds: Torsten Ottersberg; Director, Production, Script: Christian Filips; Musical Director: Kai-Uwe Jirka. Score and recording (from 3rd november 2012, see below) available at http://www.danielpuig.me/danielpuig/music. Two versions of the piece were presented one after the other, with different instrumentations and with the form stretched: first version approx. 40 secs.; second version, approx. 01 min.

this sound by hearing them as a complex system. Having identified the fundamental frequencies (organ) and their common overtones in the recording, these were used as the pitch material for the piece (Figs. 1, 2, and 3). The hearing of this sound as a system is meant to be expressed in the aural and bodily gesture of the musicians, their rhythms, and in the interrelationship of different perceptions of time that coexist in the piece and are interdependent to each other and to the way each musician interprets the score, including the conductor.[3]

This strategy allows the musical form to be stretched or compressed in time, without loosing its identity: the form is tied to the interrelationships of the sounding profiles and some characteristics that emerge from their interactions are kept the same, while new emerge, with the changes in time. The conductor has the freedom to choose: the duration of the form (that can vary between approx. 20 seconds and 2 minutes); the number of repetitions of the piece in the same concert; part of the instrumentation (excluding organ and strings); and the duration proportions (that should be kept the same for each repetition of the piece in the same concert) between the entries of the different instrumentation groups.[4]

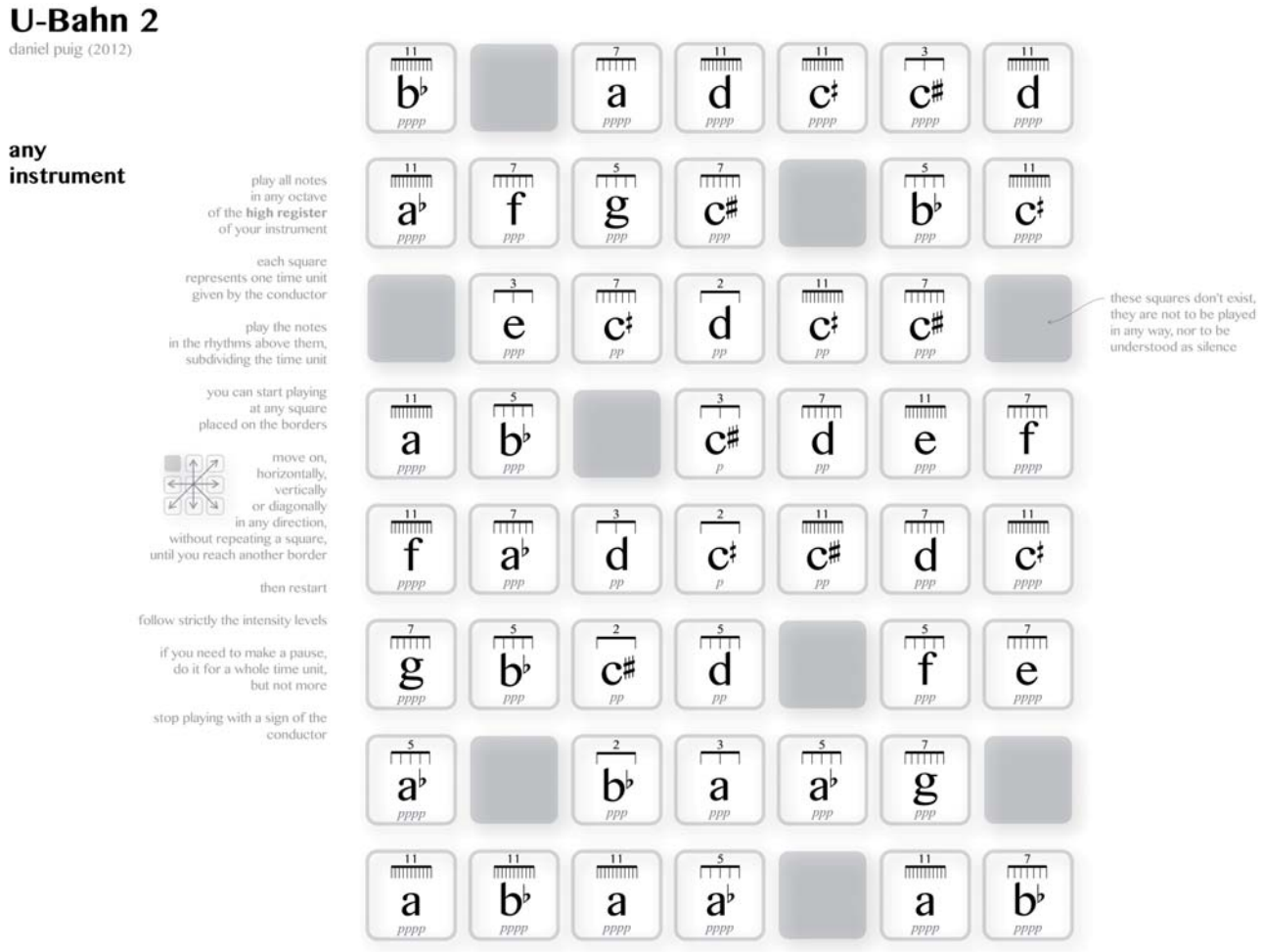

Fig. 1 - **Page 5** of the score of *U-Bahn 2*, Daniel Puig, 2012 (CC BY-SA 3.0).

[3] The initial impulse for the piece, as a dialog with Debussy's oratorio and with the U-Bahn sound inside the church, came from the team involved in the project and was proposed by Director Christian Filips and further developed with Prof. Daniel Ott and colleagues at the Universität der Künste (UdK), in Berlin, Germany. My research internship at the UdK-Berlin (under Prof. Dr. Dörte Schmidt) has been enabled by a Scholarship from the German Academic Exchange Service (DAAD), in a joint effort with the Brazilian Government, through my leave at Universidade Federal do Rio de Janeiro (UFRJ) and my doctorate at Universidade Federal do Estado do Rio de Janeiro (UNIRIO, under Prof. Dr. Carole Gubernikoff and Prof. Dr. Vania Dantas Leite).

[4] See whole score in http://www.danielpuig.me/danielpuig/music.

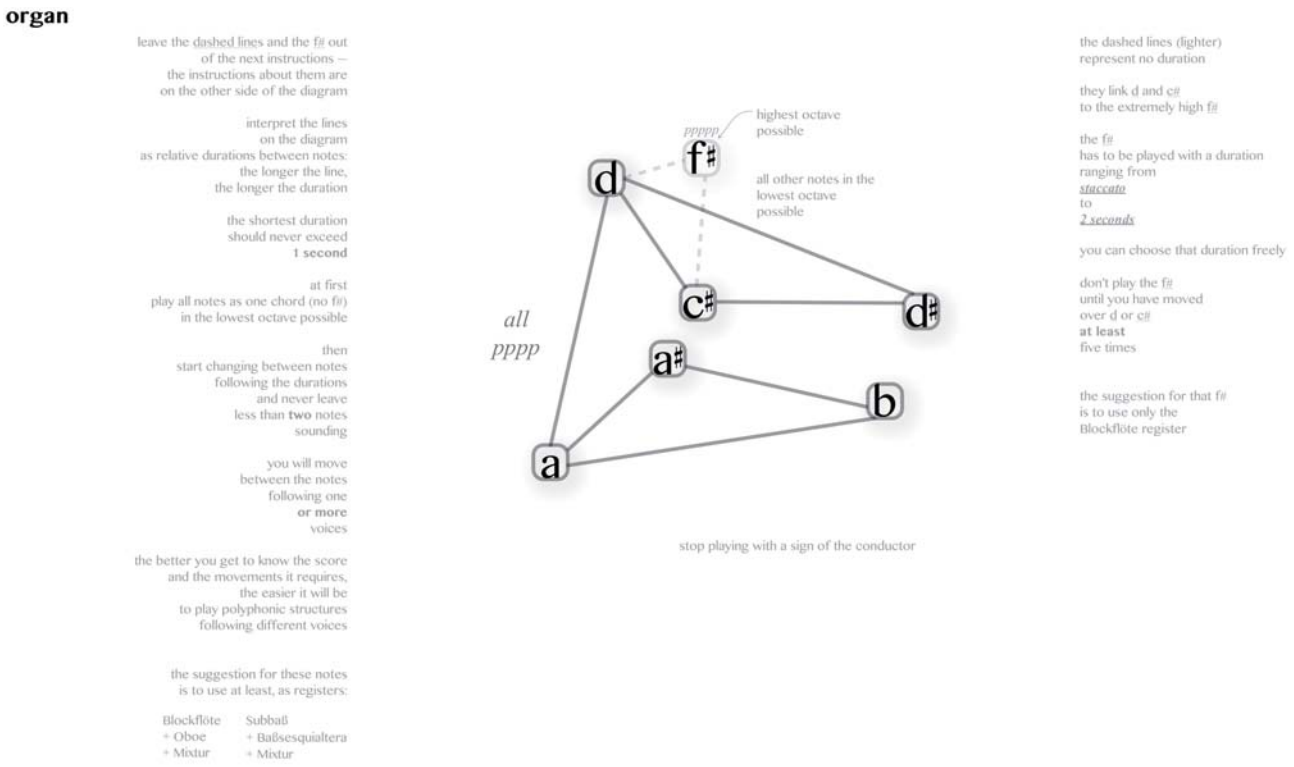

Fig. 2 - **Page 3** of the score of *U-Bahn 2*, Daniel Puig, 2012 (CC BY-SA 3.0).

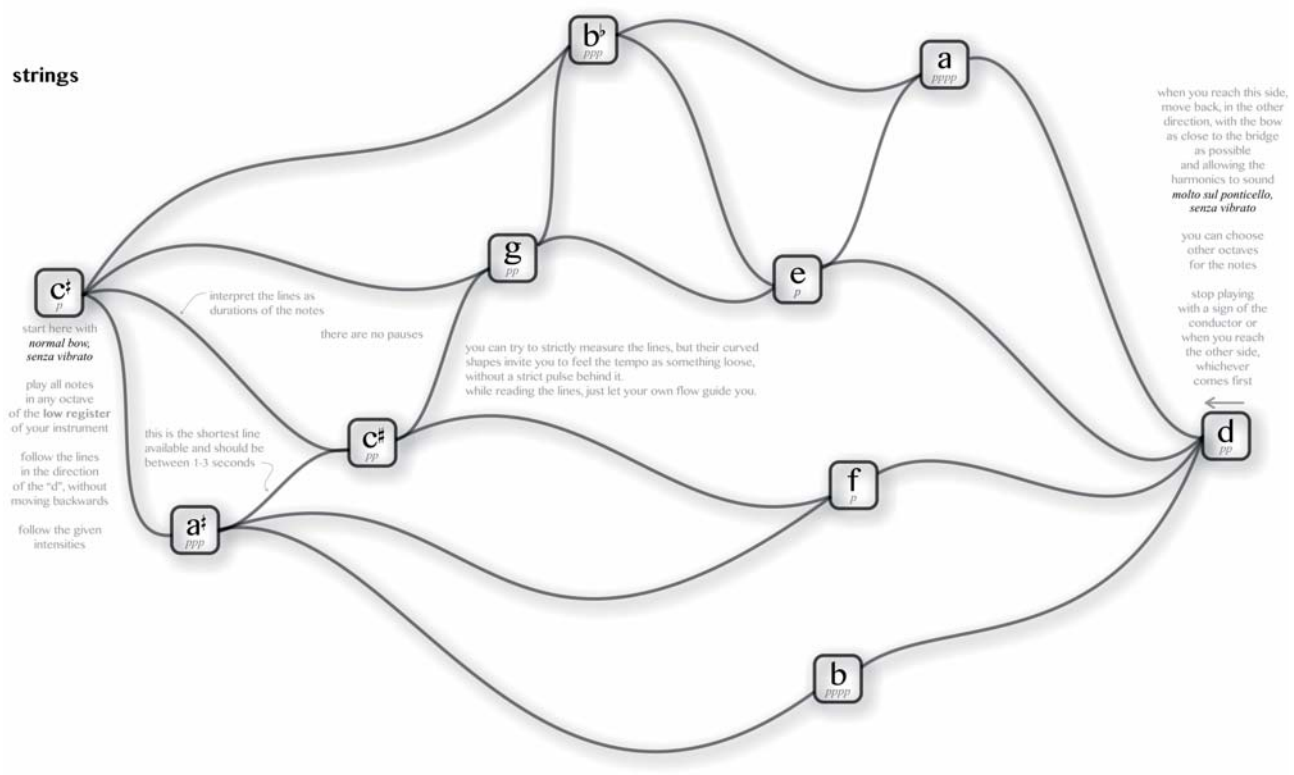

Fig. 3 - **Page 4** of the score of *U-Bahn 2*, Daniel Puig, 2012 (CC BY-SA 3.0).

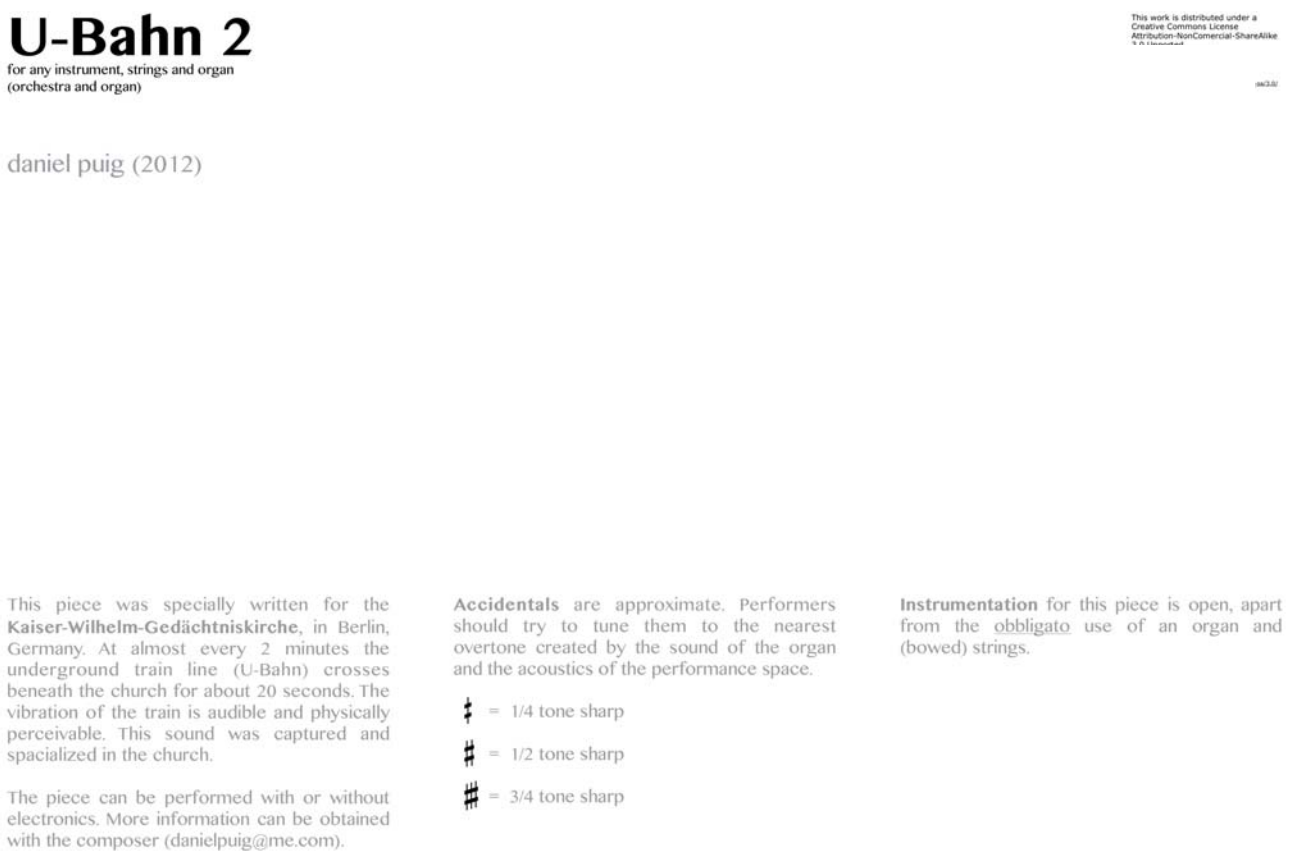

Fig. 4 - **Page 1** of the score of *U-Bahn 2*, Daniel Puig, 2012 (CC BY-SA 3.0).

The metaphorical aspect of permanent destruction of this church, from the physical point of view – in the immense glass windows made out of shards, its exterior conditions, the passage of the train in its underground, etc. –, as well as from the collective and emotional point of view, has been what directed my hearing of the sound that originated the piece. It will be important to clarify some of these aspects at the end of this article, but the brief exposition above is enough to create context for the ideas developed below.

2. *Wu-Li*, by Hans-Joachim Koellreutter

This type of composition presupposes a situation that occurs in contemporary music, where a group of musicians improvises from a score that uses forms of notation different from the traditional. It is also the case of *Wu-Li*, by Hans-Joachim Koellreutter (1990b). This score was first published in 1990 as: a text about *Wu-Li* itself and aesthetic positions by the author; the *Diagram K*, legend and explanatory notes (Fig. 5); and a second diagram showing the possibility of superposing the *Diagram K* over itself, matching two fixed points (Fig. 6). The text (Koellreutter 1990b) is slightly difficult to read, referring in loose terms to other writings by Koellreutter, but also with formatting problems.

The ideas set down by Koellreutter in the text, in a great extent, cannot be easily traced back to their origins outside the composers thought. The difficulty resides in the fact that references in almost all his texts were mostly loose (cf. Koellreutter 1990a & 1990b, as examples; this is a recurring characteristic in his published written work). My intention here is not to discuss the text, although I consider it as part of the score. I wish to look at some characteristics of the sound result of *Wu-Li*, regarding its form and identity, but also regarding it as a process. This is done through a brief analysis of its diagrams and explanatory notes, with reference to the text and discussion of the ideas cited when needed, and based on two recordings of the piece (see footnote 6).

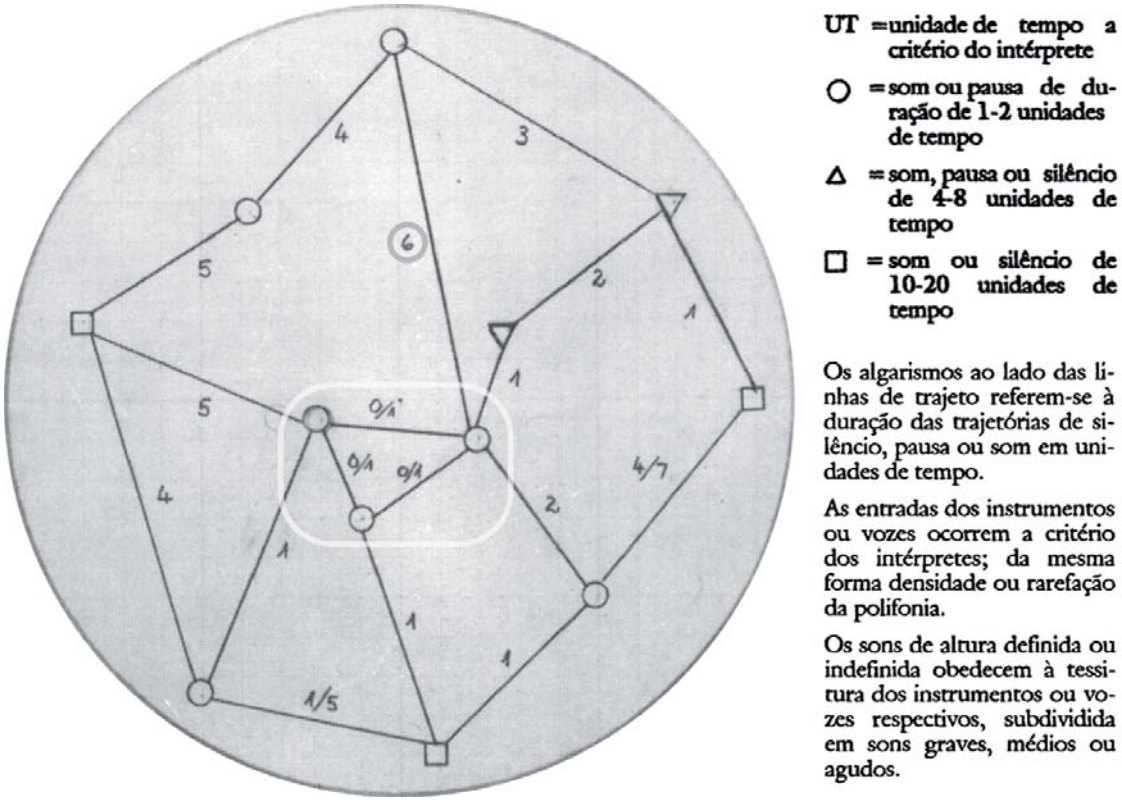

Fig. 5 - *Diagram K*, legend and explanatory notes, from *Wu-Li* (Koellreutter 1990b). Highlighted areas, by the author of this article.[5]

In this "experimental music essay" – subtitle that Koellreutter gave to the text – the instrumentation is open, in number and choice of instruments. In the *Diagram K*, small geometrical forms (circles, triangles and squares) are scattered in an asymmetrical way inside a circumference and connected by lines. There are no fixed pitches, only a division of the range in low, middle and high, according to the characteristics of each instrument. This instruction is written in the explanatory notes (Fig. 5, footnote), with no indication as to which direction the parameters point. (To what side of the page is low and to what side is high?) As it goes unsaid, the vertical axis of the page is assumed as standard, as in traditional notation, with highs above and lows beneath the horizontal axis. This is reinforced by the parallel vertical position of the handwritten numbers in all diagrams.

[5] Translation of the legend and explanatory notes:
"UT = time unit at the discretion of the interpreter
○ = sound or pause with duration from 1-2 time units
△ = sound, pause or silence from 4-8 time units
□ = sound or silence from 10-20 time units

The numbers next to the trajectory lines refer to the duration of the trajectories of silence, pause or sound in time units.

The entries of the instruments or voices occur at the interpreter's discretion; in the same way density or rarefaction of the polyphony.

The sounds with defined or undefined pitch obey the range of the respective instruments or voices, subdivided in low, middle and high sounds."

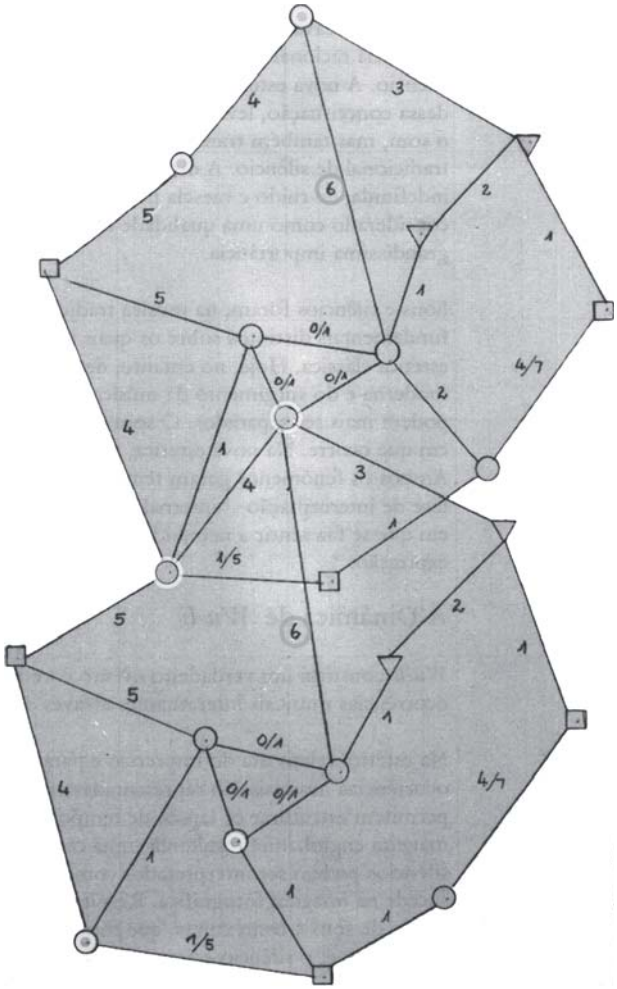

Fig. 6 - Diagram showing the possibility of superposing *Diagram K* (see Fig. 4) over itself (Koellreutter 1990b), matching two fixed points (in the center and echoed in the upper and lower part of the diagrams). Highlighted areas, by the author of this article.

Durations are defined from a time unit (Fig. 5, footnote), chosen freely by the performer. They are notated in fixed numbers or minimum-maximum intervals, in the *Diagram* as well as in the legend, and may be interpreted as sounds or silences. Each line, that Koellreutter (1990b) called "trajectories", and each geometrical form is tied to a duration or duration interval.

Koellreutter stresses that "entries of the instruments or voices", and "density or rarefaction of the polyphony" (see Fig. 5, footnote) are at the interpreter's discretion. There are no indications regarding other sound parameters. By omitting any reference to a specific instrumentation, in the whole score, he leaves it completely open to the interpreters' choice.

Performers can move freely through the trajectories, rendering the symbols into sound according to their reading of the score. From my perception, their interpretation constructs fluxes of sound events across the different ranges, creating a polyphony, that has its own characteristics and, even though extremely open, is recognizable and has identity. That is how it is possible to ***hear***[6] that, from the interpretation of the smallest triangle of the diagram

[6] Available at Mediathek, Library of the Universität der Künste (UdK), Berlin, Germany (Signatur: WF 0156):
- Video of the concert and talk with Koellreutter, in December 2nd 2000, 19:00, in the Kammersaal, Fasanenstr. 1B, of the (then) Hochschule der Künste Berlin, Germany. Includes performance of *Wu-Li* by the "Ensemble em ensaio de musica experimental" and the composer as conductor (sic). Performers: Per Hauber, saxophone; Keiko Maudai, flute; Chico Mello, clarinet; Burghard Schlothauer, violin; Berthold Tuercke, piano. (KOELLREUTTER, Hans-Joachim; TUERCKE, Berthold; STERNLICHT, Elzbieta. *Gesprächskonzert mit dem Komponisten und Lehrer Prof. Hans-Joachim Koellreutter*. VHS, 100min. Berlin: Hochschule der Künste, own production, 02/12/2000.)
By the ABSTRAI Ensemble (Rio de Janeiro, Brazil):
- Pedro Sá and Daniel Serale, percussion, Escola de Artes Visuais do Parque Lage, Rio de Janeiro, Brasil, May 27th 2011. Available at: http://www.youtube.com/watch?v=ElZRr20GSho. Accessed: [25/3/2013].

(highlighted in Fig. 5), with its short sounds or pauses, accelerated movements emerge in the middle range, inside a flux of more prolongated and breathed, though energetic, sound events in the three subdivisions (possibly overlapping) of the total range.

For Koellreutter (1990b), *Wu-Li* is an example of his *planimetric composition*, as he called his technique for composing graphical scores. He understood "planimetry" as a "chronographic mapping aiming at providing measurements and proportions of the score level or one of it's parts, i.e., the graphical projection of the significant parts of the [musical] passage"[7] (Koellreutter 1990a, p.104). *Diagram K*, therefore, is a graphical projection of the significant parts of the musical passage proposed by him, according to measurements and proportions of a graphical mapping of events in time (chrono-graphic).

From the interrelationship between the musicians, including the score, a complex net of sound events is created, whose most significant gestures are suggested in the score. The score seems to be focused on the interrelationships of sound events and not in the precise definition of parameters. An example can be drawn from the line that has a duration of 6, also highlighted in Fig. 5. It links two short sounds or pauses, but in two very different ranges. The higher one is the highest in the score and the lower one is near the bottom of the middle range. This line also links the higher range to the triangle mentioned before and, again, it seems that the score, this graphical mapping, is a way of communicating interrelationships that build up sound gestures in the performance.

For me, it is in these sound gestures that this music comes to life, as a *complex event*, real, not a projection anymore. They can be variated, but maintain an internal resemblance: the interrelationships between the different durations and ranges, organized in the score as a "graphical projection" of their "chronographic mapping", construct that resemblance. The choices of the interpreters in the moment of the performance itself are reflected in the form that the sound gestures take in time.

> This is a composition in whose macroform each one of its parts, in a certain sense, contains the whole in the manner of an hologram. They are multidimensional and multidirectional sound patterns, capable of being redistributed (variated and/or transformed), a dynamical phenomenon from which other patterns originate (holomovement). It is an authentic dynamical web that, nevertheless, doesn't dismiss the notion of order, employing the diagram to manage variation and transformation, and planimetry to determine the principles of order (Koellreutter 1990b).[8]

Since such a process is, in Koellreutter's words, a "dynamical web" with its non-linear characteristics, and the text is somewhat too linear, it becomes difficult to write about it. For me, the process itself had to be experienced (imagined, many times) to be understood. The best situation was trying out the score, feeling how these interrelationships take form in my body and through the sound gestures that I produce, in interrelation with an instrument or my voice. In this way, the process by which the diagram manages variation and transformation became clear.

The form of *Wu-Li* reconstructs itself in a performance, pointing to the characteristics defined in the score. It seems to play in its jumps and contrasts with the metaphor that Koellreutter (1990b) searched with the chinese words in the title:

> structures of organic energy - in terms of musical structuring: planimetric structuring
>
> path - direction, tendency

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[7] "Planimetria: (...) levantamento cronográfico destinado a fornecer as medidas e proporções do plano partitura ou de uma de suas partes, isto é, a projeção gráfica das partes significativas do trecho [musical]."

[8] "Trata-se de uma composição em cuja macroforma cada uma de suas partes, em um certo sentido, contém o todo à maneira do holograma. Trata-se de padrões sonoros multidimensionais e multidirecionais, passíveis de serem redistribuidos (variados e/ou transformados), um fenômeno dinâmico de que procedem novos padrões (holomovimento). Trata-se de uma autêntica teia dinâmica a qual, no entanto, não dispensa a noção de ordem, empregando o diagrama para manejar variação e transformação, e a planimetria para determinar os princípios de ordem."

> contra-sense: "contraria sunt complementa" (Niels Bohr)
>
> perseverance in ideas - coherence, style, illumination.[9]

An open music is produced, of an extremely variated self-reproductive character. It is dynamical, non-linear, unpredictable and irreversible, since it happens there, at the moment of the performance itself. It is open, allowing each new interpretation to reconstruct it in a new way, resulting in differences in all details of the performance and the form. How can one speak about identity in this context?

Behind the composition, understood as an essay by Koellreutter, there is a political project regarding concert music and arts in general. Koellreutter takes a conscious step away from the traditional concert form and of the naming of the artistic product as "obra musical" (the musical piece, the composition when finished). That, as early in the text as the first paragraph, where he also delineates briefly how he imagined musical performances to happen in the future:

> *Wu-Li* is experimental music. Because experimenting is in the center of its artistic activity. It is not a musical piece [*obra musical*]. It is a halfway between concert music and improvised music. (I believe that the concert as a social form of music will be replaced in the future by the public presentation of individual and/or group improvisations, spontaneous, that is, from free will, or structured, that is, that have methodic disposition.) (Koellreutter 1990b).[10]

I do not disregard the fact that such a paragraph by Koellreutter raises a lot more questions than answers. My intent here is to look at this process of a score focused on interrelationships from the point of view of a composer interested in form and identity. Although there would be a good discussion around what to understand as "obra musical" or experimental music essay, what interests me here is the interrelationship of these two fields. What emerges from it in relation to what we call contemporary music? From another point of view, regarding its identity, is there another way of looking into this process that may help the composer interested in working with open forms?

3. Complexity

Complexity studies and systemic thinking have drawn my attention in trying to answer this questions. The different lines of thought in these areas share many common aspects in relation to their world views. One of these aspects, is trying to see *wholes*, the qualities and properties that emerge from them and the interrelationships that constitute them, without disregarding the qualities of its parts. For these views of complexity or complex systems, the whole is more than the sum of its parts, but it is, *at the same time*, less than the sum of its parts, whose qualities and properties can be inhibited by the organization of the whole.

> Once the whole has emerged, it can reduce or inhibit the action of specific individual components. Take, for instance, a large-scale social organisation (*sic.*): however complex, varied and efficient in its performance, the whole organisation can never be as rich and complex as each single human being participating in it. It induces simplified, typified behaviours that are functional to the whole, but detrimental to the individual (Di Scipio 2011, p.101).

These wholes have characteristics of self-organization, that are intimately linked to the presence of *circular feedback chains*, responsible for the dynamical self-regulation of the

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[9] "estruturas de energia orgânica - em termos de estruturação musical: estruturação planimétrica
"caminho - rumo, tendência
"contra-senso: "contraria sunt complementa" (Niels Bohr)
"perseverança nas idéias - coerência, estilo, iluminação."

[10] "*Wu-Li* é música experimental. Porque, nele, o experimentar é o centro da atuação artística. Não é uma obra musical. É um ensaio. É um termo médio entre música concertante e música improvisada. (Acredito que o concerto como forma social da música, do futuro, será substituído pela apresentação em público de improvisações individuais e/ou grupais, espontâneas, isto é, de livre vontade, ou estruturadas, isto é, que têm disposição metódica). (...)"

system. Be it in the *self-eco-organization* in Morin (2007), in Maturana and Varela's *autopoiesis* (1980) or in the *self-organization* in most system's thinkers (Ramage & Shipp 2009; Demo 2011), the importance of the idea of circular feedback chains is central, as being responsible for fluxes of information that lead to the *emergence* and sustain of certain characteristics.

> The notion of *emergence* evoked here is not at all metaphorical. It has been adopted across various research domains (...) to intuitively refer to the process by which a collection of interacting components shows collective behaviour (...); in other words, higher-level properties of a *whole* are brought forth and sustained by several interconnected lower-level components mutually affecting each other (Di Scipio 2011, p.100-101).

The idea of emergence, in this sense, presupposes the understanding that that which emerges is: *irreversible*, can only be studied taking *time* into account and cannot be replicated; and *irreducible*, it resists a study through the reduction to its smaller parts. For Morin (2007, p. 8), "what is important in emergence is the fact that it is indeductible from the qualities of the parts, and thus irreducible; it appears only parting from the organization of the whole."

Analyzing characteristics of complexity and seeing it from the point of view of an evolutive dialectic process, Demo (2011, p.24) stresses that complex phenomena "produce modes of being that are always of becoming as well. They behave in a reconstructive way: they do not reproduce themselves linearly, they reconstruct themselves non-linearly."[11] The idea of emergence is tightly linked in that way to the idea of a self-reconstructing process.

4. Form, identity and metapatterns

Therefore, for me, it is not the case anymore to see the form in *Wu-Li* (or *U-Bahn 2*) as an external parameter, but as a self-reconstructing process, that occurs in the moment of the performance itself. Its presentation is not static, but dynamical and complex and has to take into account the special interrelationship of the whole and the parts, that is made of relative autonomy and, *at the same time*, profound dependency (Demo 2011, p.17). This is concurrent with Koellreutter's reference to Niels Bohr's principle of complementarity (Page 7) and its consequences for the discussion of formal paradoxes, not by proposing a solution for them, but as a way to face them, by considering the complementarity of antagonisms and their productive play, as stressed by Morin (2007, p.16).

Being a complex process, it is irreversible and irreducible. The complexity of the process itself fosters the *emergence of the form*, that does not exist outside the real performance. This does not deprive it from having *identity*, of being recognizable, much more now by the characteristics of the process, than the succession of planed parts.

It was through a reading of Gregory Bateson and his criteria of mental process (Puig 2012) that it became clear to me that analyzing the situation as a system and applying to it the criteria proposed by Bateson, it is possible to understand the whole group of musicians and the score as *engaged in a single mental process*. In this context, the score can be seen as a point through which collateral energy flows into the system, i.e., a point through which messages come from another system. Interrelated to that, the messages that the score contains can be seen as *metamessages*: messages about messages, messages that say something about the context of other messages. Bateson's use of the concept of metamessage draws from the work of Whorf (1956) in metacommunication. Identifying kinesic and paralinguistic elements as metacommunicative sings in our verbal communication, metacommunication understands that:

> The full meaning of the communication thus does not depend only on literal verbal meaning, but is codetermined in a critical way by the intensity and inflection of the voice, facial expression, accompanying gestures, secondary signals that we are sending to bystanders, etc. (...) Meta-communication provides clues as to how the verbal message should be decoded; it is a signal

[11] ... "produzem modo de ser que são sempre também de vir a ser. Comportam-se de maneira reconstrutiva: não se reproduzem linearmente, reconstroem-se não linearmente."

> about a signal. The same verbal message framed by different metacommunication can mean something entirely different, including its opposite (Grof 1981).

To give basis to his thought, Bateson ties this dynamic of messages and metamessages to the idea of hierarchies of logical types (Bateson 2002; specially pp.106-119), as understood from the work of Bertrand Russell and Alfred N. Whitehead in their *Principia Mathematica* (1910). In their case, a solution for formal paradoxes is given through the understanding that the paradox is a formal confusion of the hierarchy of logical types. Borrowing from their example, Bateson (2002, p.108) analyses, among others, Epimenedes' paradox: "Epimenedes was a Cretan who said, 'Cretans always lie.'" The paradox is evidenced when we ask: could Epimenedes be telling the truth? The answer is "If yes, then, no" and, *at the same time*, "If no, then, yes." Paradoxes of this kind impose a problem to logically structured theories, since they can invalidate them as a whole. The solution encountered by Russell and Whitehead consists in realizing that the proposition of the paradox represents a confusion in logical typing. The class is of a higher logical type than its members and should not be mistaken for a member of itself. When talking about Cretans, even being one, Epimenedes puts himself in a hierarchical class above them and, therefore, in a different logical type, beyond the injunctions of what he states. This, in turn, dismisses the paradox, but stresses the binary nature of looking at paradoxes in terms of hierarchies: it creates a directionality and an unending recursiveness.

Taking the thought about metamessages to that of *metapatterns*, that is, *patterns of patterns*, Bateson was conscious of the problem that hierarchies would inevitably lead to an empty concept (Bateson 2002, p.10) because of their rigidity and binary thought, but he took it a step further, by developing tools for his methodology and stressing the dynamic character of these patterns and metapatterns (Bateson 2002, Cap.I; Ramage & Shipp 2009, p.13). The tension between hierarchies and the dynamical aspect of patterns is found throughout his main book, *Mind And Nature: a necessary unity* (Bateson 2002). This is one of the main critics Demo discusses in relation to systemic structures: a lack of dynamic, because of its recursiveness and directionality. Nevertheless, Bateson was trying to see that, which has an "identity that is not of the same thing always, but of the same thing in process, in becoming " (Demo 2011, p.13).

In trying to explain patterns, Bateson (2002, pp.74-75) uses the phenomenon of *moiré* as one of the examples. Moiré can be explained like in Fig. 7, meaning that a third pattern emerges from the combination of other two.

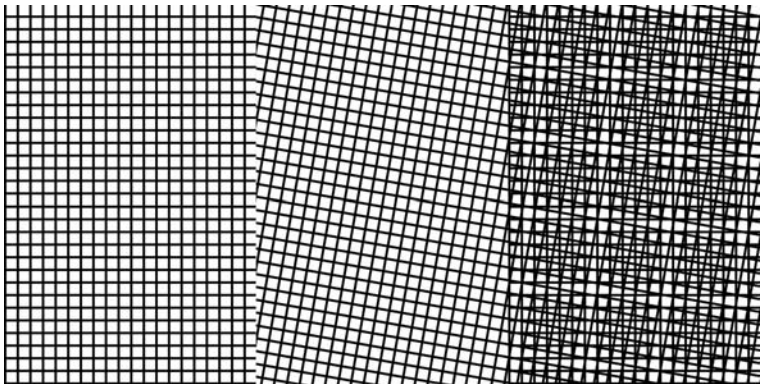

Fig. 7 - *Moiré* phenomenon: a third pattern emerges from the combination of other two (10° rotation). Source: Wikimedia Commons (Moiré_grid.svg).

For him:

> First, any two patterns may, if appropriately combined, generate a third. Second, any two of these three patterns could serve as base for a description of the third. Third, the whole problem of defining what is meant by the word *pattern* can be approached through these phenomena (Bateson 2002, p.75).

The whole book (Bateson 2002) is an expansion of that thought to different areas and scopes, from the list of presuppositions (Cap.I), to the observation of different phenomena (Caps. III, IV & V), to the methods of inquiry (Caps. III, V & VII), to the metalogue[12] (Cap. VIII) and the epistemological conclusions. Bateson's work is an example of what he was trying to exemplify by the question: what is the pattern which connects? (Cap. I). His patterns in living beings, were always patterns of interrelationships and his analyses are a zig-zag between classification and process, trying to see their "becoming". In going from classification to process, Bateson (2002, pp.11-12) could see patterns in constant change.

As a simple example, the pattern that emerges in Fig. 7 can be understood as a *pattern of interrelationship*, looking at the act of superposing and rotating as the interrelationship between the two initial patterns. This interrelationship is not casual or unforeseen, it has been placed there by an intentional process, by someone, aiming at exemplifying something that cannot be reduced to the analysis of its parts in isolation. In fact, this pattern of interrelationship connects any moiré phenomena in similar conditions. But there is also a specific characteristic in Fig. 7, that is critically tied to its final result and appearance: its rotation in 10º (degrees). Relatively small differences in the rotation, seen from the perspective of the degrees' scale (one three-hundred-and-sixtieth of the circumference of a circle), may result in dramatical changes in the resulting pattern. (One has to try it, to see.)

This is also the case of *Diagram K*, where the *interrelationships of pitches and durations* chosen by Koellreutter are graphically mapped in the symbols and lines of the score, in their geometric relations and in the possibilities of choices. From their interpretation, sound patterns emerge along the improvisation, and a complex polyphony, a complex event, that cannot be explained from only looking at its parts or reducing it. This should not go without saying that it can be seen as intimately tied to the acoustic space where it occurs, to the participation of the audience, to the instruments used and to the bodily gesture of the performers, as well as their interplay with the sound result and all these aspects (and certainly, more) together, as a whole.

Looking at *Wu-Li* from this point of view of complexity, seems to point out to me that this music is composed as a set of interrelationships. That is to say, it was thought out, and notated as a way of communicating the idea. There are clearly different patterns of interrelationships, as the ones pointed out in Fig. 5. and many others. These patterns of interrelationships are all tied together in a whole. In this whole, all pitches, durations and other sound parameters (including those not mentioned and, therefore, free for the improviser) are fluctuating around certain values, openly set. In this sense, the only thing fixed in the score is a dynamical structure. Or, from another point of view, a non-linear system capable of innumerable results but always keeping the same pattern, like in a strange attractor (Puig 2010). Or, from yet another point of view, as a *pattern of interrelationships of patterns of interrelationships*, a *metapattern*.

That is also the reason why it is possible to superpose the *Diagram K* over itself on the two fixed points shown in Fig. 6. By doing so, all duration interrelationships are kept the same, but there is an increase in the subdivision of the ranges (low, middle, high, are much more subdivided). Just as an example, this strategy makes it possible to have a variation of the pattern highlighted in Fig. 5 emerging. The repetition of the smallest triangle achieved by superposing the diagram includes the possible interpretation of the same or almost the same sound gesture in two different ranges: one lower, but not as low as the lowest range, and another in the higher part of the middle range (Fig. 6). This possibility is fostered by the placement of the line with a duration of 6 (Figs. 5 & 6), which now links both triangles in different ranges, *and*, by its repetition above, still fosters the same link between the highest range and the middle range.

Expanding this thought to the whole score, I can see that the metapattern here is just an idea. An idea that tries to describe tendencies along time in the improvised musical tissue and that is chronographically mapped in the score. As open as it is, *Wu-Li* still has identity, by the specific interrelationships that constitute it. From the interpretation by real performers,

[12] "A *metalogue* is a conversation about some problematic subject. This conversation should be such that not only do the participants discuss the problem but the structure of the conversation as a whole is also relevant to the same subject." (Bateson 2000, p.1; see Part I for examples.)

recognizable patterns emerge, whose traces become clear in its form, understood as a self-reconstructive process in time.

5. Metapatterns (in)(from) the score

Thinking about the score in this way, seems to point out to me that the score can be seen as a way of communicating messages that tell something about the context of other messages it contains. This implies the idea that its graphical representation, any text, symbol, color, their disposition on the page (one could refer to composition in graphical design and visual arts), the format of the page, letter type, type of paper, the use of other materials than paper, their format, disposition and properties, ..., are also ways of communicating messages that tell something about the context of other messages, metamessages. When interpreted in sound gestures, they can be seen as extending to metamessages of the sound result.

As an example, Figs. 1, 2 and 3 represent an attempt to work with three coexisting senses of time in *U-Bahn 2*. This choice is linked to: my interpretation of the original recording of the Metro sound passing below the church, with its internal movements; the sound of a Metro from the actual platform; my interpretation of different senses of time that coexist in the church itself; and the acoustics of the space, when filled with the sound result of the piece. It is also echoed in the body movements of the performers, including the conductor.

In Fig. 1 time is linked to a pulse, given by the conductor. It is also in this way that the conductor decides the length of the piece, by choosing the pulse. Every square is to be played inside one pulse, with repetitions of the same pitch and following the given dynamics. Performers should start from a border and move in any direction, a square after the other, until they reach another border. Then, restart the process. All pitches should be played in the higher octaves of the instrument and the instrumentation (any instrument) is left to be chosen beforehand by the conductor. Time is fragmented – by the pulse, its fortuitous individual fluctuations, and by the rhythmic micropolyphony –, as are the windows of the church and the daily reminder of destruction. The organ (Fig. 2) follows a time that I would call the time of the motor. There are no stops, the movement is continuous and, although not loud, the resulting sound is too much pervasive. The choice of a dynamically changing cluster in the lowest octaves possible, gives it a faint rumbling effect. The time of the strings (Fig. 3) could be seen as the time that resists measurements and just passes. Differently from the lines that connect pitches for the organ, the lines for the strings are curved, inviting the performers to feel time as a flow (this information is also written in the score). The conductor senses time as tight to the pulse chosen, but at the same time in the flow of the other two. That, reinforces the critical role of hearing and interacting with the whole form, while it reconstructs itself.

The identity of the piece is reconstructed by the interrelationships around these perceptions of time and their echoes in pitch, intensities and durations, as well as in the body movements that they induce. There are spectromorphological and theatrical results that emerge from their interrelationships and are kept across the different total durations of the piece, while further results emerge from the stretching or compressing of the form in time. For the première, electronics were used. The orchestra was placed on the altar, on the opposite side of the organ and a circular spatialization of the recorded[13] U-Bahn sound was diffused around the audience, in a very slow pace. The spatialization can be thought out for each place the piece may be performed, without compromising its identity. In that matter, the electronics may also be totally left out, as indicated in the first page (Fig. 4) of the score.

It is from this point of view, that I look at the score as a way of trying to communicate the patterns of interrelationships that constitute relatively smaller complex systems, that nevertheless have a strong identity on their own, as rich and complex in my view as every human identity behind them. The sound gesture of the organist (Fig. 2), for instance, is tight to a

[13] The recording used in the concert (see footnote 2) was made by Torsten Ottersberg, with a [Sennheiser XXXX] microphone, placed in the center of a self-made concave reflecting panel facing one of the walls of the new church (whose structure is an octagon). [–> source has to be checked]

rhythmic movement of the fingers, with a pace set freely, that has a non-linear motor-like characteristic, with a dynamic blur of frequencies in the low spectrum and their changing overtones enhanced by the registers. The performer is aware and controls all of these aspects. At the same time, this interacts with the orchestra, that is asked to tune the microtones to the overtones of the organ (Fig. 4). This ability presupposes a performer aware of sounding overtones and proportions in overtone series, as well as takes into account the acoustics of any performance space with an organ.

The other two sound gestures coming from the orchestra have each one a different pattern of interrelationships. The strings open up in microtonal clusters, with two spectromorphologies crossing into each other (*normal bow, senza vibrato* and *molto sul ponticello, senza vibrato*, see Fig. 3), and may come back to unisons at different times. The other instruments, with a possibly changing instrumentation, only maintain as a pattern of interrelationship their very soft rhythmic intricacy, within a microtonal spectral harmonic content. Certain inharmonicity is expected, due to fluctuations in intonation and differences in construction and technical possibilities of each instrument.

There is a clear contrast between these three patterns of interrelationships, that enables the changes in instrumentation. Their overall envelope is controlled partly by the conductor and partly by the individual performers. Altogether, the three patterns of interrelationships build another one, that contextualizes them in new meanings: in a second order look, still from the point of view of the composer, the score also tries to convey a pattern of interrelationships of these patterns of interrelationships. The metapattern, again, is just this idea that sets tendencies in time to the whole and its parts, as sound result. For me, it seems clear that the score contains, in this sense, messages about the self-regulation of the process (as for example the indications about time, tendencies, levels of energy). Self-organization and self-reconstruction of the form, and therefore emergence, only take place in the moment of the performance itself, through the choices of the performers. In such an open, improvised music, its specific qualities and properties can be foreseen, aurally imagined in their unpredictability, and chronographically mapped in the score, but will always be different in each performance. They are complex, and resist an analysis that tries to reduce them to the characteristics of their parts. On the other hand, the parts and their interrelationships can be relatively clearly set, as shown above.

Assuming that the idea is conveyed effectively *in* the score, it also needs to be reconstructed *from* the score by the performer.

6. Improvisation and complexity

The act of improvising, that is, of finding solutions for the musical idea proposed in the moment itself that they are needed, is what puts the whole process in motion. The sound characteristics, as well as the self-regulation and the form of the process, are defined from the performer's decisions. That happens together with the way the score is set, with the messages and metamessages that are part of it and with the types of communication and interaction with which it engages the performer. These things are all tight together and part of the reconstruction of the musical result and of the reconstruction of the creative process itself.

By interpreting the score, the performer will recreate hers/his own piece, inscribe it in hers/his body (gesture, sound results with the instrument or voice, muscular and affective memory, etc.) and maybe in other types of notation; during rehearsals, she/he will dedicate time to find good results and creative solutions; in the moment of performance, use the maximum of hers/his potential to try to recreate the best of that process, while still finding new solutions. Such a dynamical process can be seen as a process where improvising is profoundly tight to its complex dynamic. Improvisation, with its openness, puts into motion the patterns of interrelationship evoked by the score. In the performer's improvisation, the self-reconstructive process of the form and the reconstruction of identity take place. The openness of improvisation also brings with it the risk that the piece does not reconstruct itself in a specific performance, since it is the product of complex interrelationships. This risk is real, but it can be faced as

productive, active in the process and partly responsible for its reconstruction. It is from this risk, in my view, that comes an important impulse for the actual existence of the piece. For this reason, I personally think that the score should be an invitation to the musical thought that it tries to unveil. As any invitation, it can be refused. But it can also, if accepted, become more than what it was meant for at first, because other *people* are coming into the process.

7. Conclusions

It seems clear to me that the idea of a *metapattern*, as *a pattern of interrelationships of patterns of interrelationships*, can be regarded through complexity as a tool for musical composition with improvisation. This points to the possibility of its extension to other aspects of musical performance, as the graphical representation of the score, the bodily movements of the performers, their theatrical results, the acoustic characteristics of the performance space (and therefore ethnomusicological characteristics), any visual aspect included in the performance, and others, not discussed here.

This tool helps me to grasp new possibilities for the use of open forms and scores that use forms of notation different from the traditional, but it is just a tool, nothing else. It is just *one* way of considering things, and, for sure, always historically determined. It has been important for me to become aware of the shortcomings of these considerations and the advantages of expanding the view to different approaches and learning from them by comparison. There is still a lot to learn and these lines represent only a snapshot of a process of research. What happens in the artistic ground is complex and bound to improvisation. Few words needed.

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