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Polyrhythm as a Bridge for Group Improvisation in Brazilian Jazz: An Analysis of the Performance of Trio Corrente

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Abstract

This research aims to analyze the establishment of a communicational basis from polyrhythmic occurrences in the performance of Trio Corrente. The analysis displays moments of group interaction during the piano improvisation section. The research was carried out in three stages: (1) selection and transcription of excerpts from live and studio performances of the trio; (2) musical analysis of the transcribed works; (3) structural analysis of language proposed by Jakobson (1960) and adapted by Vuust, Ostergaard and Roepstorff (2006) to examine communication process through the rhythm. It was found that polyrhythm plays a key role in the non-verbal interactions of the group, and certain skills are required to keep a communicative channel within three specific functions presented in the Jakobson model. Mostly, it involves the ability to visualize and understand groupings of subdivisions, and the capacity to interact and create tensions by relating them to other parameters of music.

KEYWORDS: Non-Verbal Interaction; Polyrhythm; Brazilian Jazz; Trio Corrente.

Introduction: Polyrhythm and non-verbal interaction

The capacity for non-verbal interaction between musicians is an important factor in a musical group performance, since it allows musicians to correct themselves (and each other) without interruption. This type of interaction is typically considered tacit knowledge, given many practitioners are not even aware of it (Jensen and Marchetti 2010). Considering the contexts surrounding popular music and especially Brazilian jazz, it is necessary to conduct research that considers aspects of these realms, such as sound codes that are frequently applied among musicians to communicate and change sound patterns during musical performance.

In the classical music environment, there is a well-structured and established body of knowledge within the conducting educational field; consequently, it is observed that there is a centralization of the conductor as a provider of information transmitted through non-verbal language to musicians. In the case of chamber orchestras, where there is no conductor, there is also a hierarchy within the group. In this case particular musicians assume responsibility for providing codes through non-verbal language for altering the way particular music is played. However, in a jazz context, musicians claim to be part of a democratic group in which there is no central figure as the driver of the performance and everyone can interact and propose ideas through interaction (Jensen and Marchetti 2010). In this sense, learning through non-verbal interaction tends to occur informally as a result of the practices and social environment that musicians share within this specific context.

Some researchers have shown an interest towards understanding the processes involved in interaction in jazz. Pinheiro (2011), for instance, concluded through an ethnographic study that jam sessions provide a bond between musicians. It is due to these sessions that many musicians engage with, observe and imitate others who have a higher level of expertise, thus acquiring a stylistic language. This musical contact can also occur through mechanical means, as demonstrated by Wilf (2012); he shows that jazz students at a school in Boston are ritually oriented towards past influences of individual creativity when they interact with a mechanical source of sound that reproduces tracks of performances by jazz masters.

Elsewhere, Doffman (2011) analyzes a performance of a jazz standard at a jam session in London, in order to develop an understanding of collaborative creativity. His study looks at the momentary interactive execution of the performers to bring a song to a close. The recording and analytical method was based on the integration of the refined analysis of audiovisual data with more conventional ethnographic approaches. The studies of musical communication by Berliner (1994) and Monson (1996), also in the area of ethnomusicology, illustrate the views of musicians on how jazz and improvisation practices relate to their social environments. In Berliner's work, interviews with jazz practitioners have been adopted as a primary source of data, in line with an ethnomusicological approach.

From these perspectives, the main focus is improvisation as a form of social action. When improvising, musicians borrow, quote, transform, and invert music from all sorts of repertoires in their musical play, turning music into something peripheral to the construction of cultural meaning (Monson, 1994). The established communicational basis is generated from this relationship between musical structures, social meanings, cognitive processes and cultural values. In this context, the understanding of micro musical structures and their functions within a macro

context of interaction is to seek comprehension mainly over sound aspects of group improvisation processes. Such knowledge can be an essential step in contributing to the structure of an educational model in jazz musical interaction.

Overall, within the context of jazz, often there is no supervisor who directs the soloist and conducts the rhythmic and harmonic elements, or who provides guidelines for the establishment and development of interactions between players. The closest thing to a hierarchical relationship is directed to the soloist, once he temporarily indicates the directions and paths to be taken:

> In a context of improvisation in which there is a high degree of interaction between performers, communication protocols for changes in the "musical dimension" (which may include reharmonization, change in metricity, change in dynamics and change in genre) are indicated, mainly, by the subject who, at that moment, is responsible for the elaboration of the improvised solo. However, musicians in the rhythmic-harmonic section can also be responsible for indicating these directions, inducing the soloist. (Silva 2017: 19).

In this research, our main focus is to analyze the interaction process within the context of rhythmic practices. Authors like Yeston (1974) and Krebs (1987, 1999) have previously developed the concept of metrical dissonance, which will be relevant for our study. For Yeston (1974), it is defined as a structure that starts from the interaction between two or more rhythmic layers with an arithmetic relationship not represented by multiple numbers. For Krebs (1987), a metrical dissonance is defined by the non-alignment between metrical levels. In this case, there are three to be considered: the lowest and fastest metric level (pulse), the interpretative level (series of regularly recurring pulses that move slower than the pulse layer) and the cardinal level (the number of pulses from one attack of an interpretative level to the next), with some degree of misalignment between them. Although the present research does not make use of the specific tools presented by both authors, it is important to bring this concept of rhythmic dissonance forward, since this research is focused on the overlapping of metric and rhythmic layers, and how musicians interact through it. Regarding the metric dissonance, Krebs (1999) shows a passage from a letter that, apparently, written by Clara Schumman and addressed to a student who enquires about how to play metric dissonances properly:

> You must discover not only where the conflicting passages are, but also how they are constructed, that is, you must research the various layers of which they are composed…I must emphasize the importance of analysis; if you don't know where the metric conflicts are, from the smallest tips to the widest conflicting expansions, you won't be able to feel and transmit the tension that belongs to them (Krebs 1999: 178; 184).

In this sense, the present study focuses on demonstrating and discussing metric dissonances between three instruments: electric bass, drums and piano, within a communicational framework of performance. The layers or rhythmic levels are produced by the members of a Brazilian jazz trio through the improvisation session. Regarding these principles and mechanisms, Davis and Ashley (2005) proposes a

parallel between jazz improvisation and conversation, highlighting the collaborative, interactive and unexpected properties. The authors states:

> Many aspects of conversation involve a speaker's presentation followed by listener uptake, which may include agreement, negation, paraphrase, information request, or clarification. (…) We predict that these principles of collaboration and pragmatics play a significant role in the implicit and subtle communication in jazz improvisation (Davis and Ashley 2005: 2).

Historically, from 1963 to 1968, in the pioneering performances of the Miles Davis Quintet, rhythm became one of the main ways of establishing the group's communication (Coolman, 1997), and ceased to serve only as a fixed metric base when other sound events developed within the performance. In the current jazz scene, according to Hoenig and Weidenmueller (2009), most musicians and groups make use of polyrhythmic resources.

In their research, Vuust et al. (2006) demonstrate how Miles Davis Quintet used the effects of polyrhythm as one of the main communicational channels in music. To exemplify and clarify how this type of interaction occurs, a graphic model was built to identify the polyrhythmic occurrences between the piano, double bass and drums, during Herbie Hancock's piano solo in "All of You" during a live performance at Carnegie Hall in 1964 (Figure 1). The top line represents the piano and the bottom line represents the bass and drums. The vertical columns represent the bar lines and the graphic markings symbolize the rhythmic changes that occur along the stretch (Vuust et al. 2006: 1162).

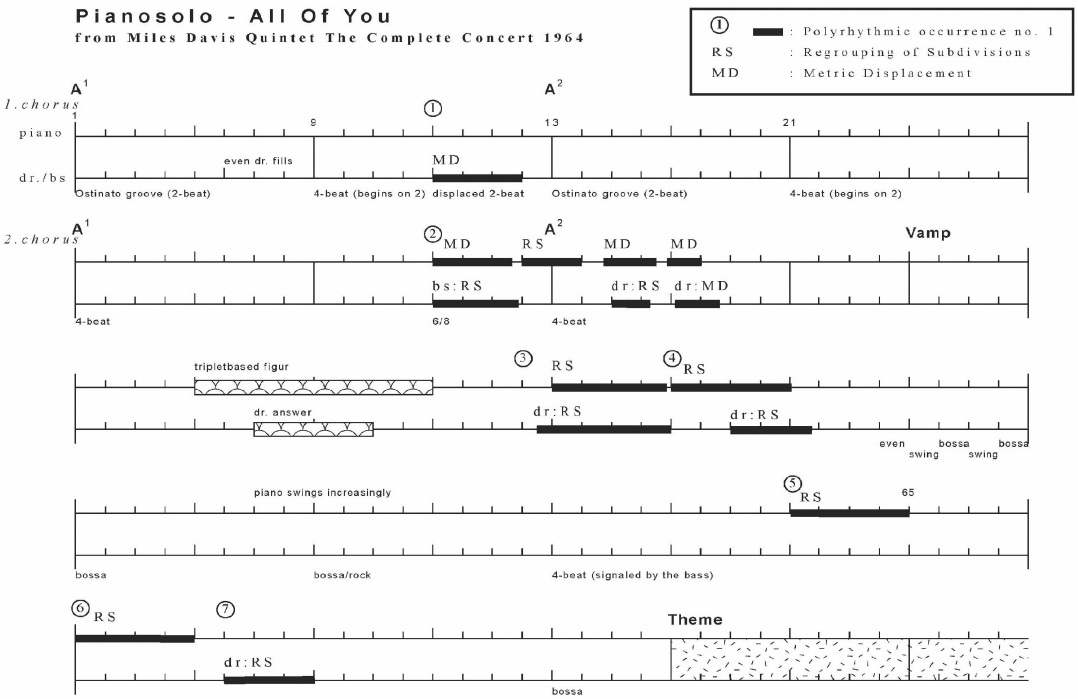

FIGURE 1. Graphic overview of the rhythmic events on Herbie Hancock's piano solo during the jazz standard "All of You" (Miles Davis Quintet, 1964) [1]

When observing the presented graphic model, it is possible to verify that communication occurs when one of the musicians "proposes" a musical phrase or rhythmic variation, which in a short time is assimilated and reproduced by another musician. Based on this established dynamic, Vuust et al. (2006) creates a parallel between the communication model described by Jakobson (1960). The latter author (1960) proposes that the act of communicating occurs when a message is passed on by a sender towards the addressee through a contact/channel, using a certain code, within a certain context. Therefore, applying this model within a musical framework, we have a message (musical phrase), sent by a sender (pianist) towards a receiver/s (bassist and drummer), through a channel (live performance), in a certain code (jazz language) and in a certain context ("All of You" live at Lincoln Center, New York, 1963) (Figure 2).

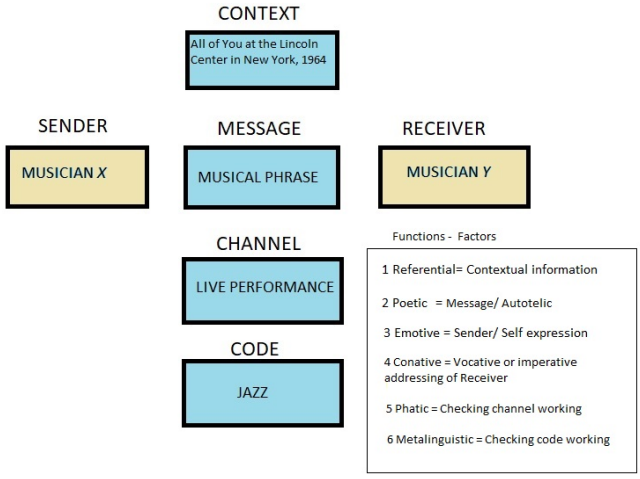

FIGURE 2. Roman Jakobson's communication model, adapted for communication in jazz performance [2]

Within this model, each determining factor for the establishment of a communicative base has a corresponding linguistic function. According to Vuust et al. (2006: 1160–1161), these linguistic functions can be found in different phrases played by musicians:

- Referential function: can be observed by the frequent use of "quotes" in solos. The soloist (Sender) can communicate by quoting parts of another musician's solo with whom he is playing (Receiver), or from other recordings and even melodies from known songs, as a manner to show respect for other musicians and for the tradition of jazz musical realm;
- Conative function: occurs, within this context, when a musical phrase is played by the soloist (Sender), engaging the rhythm section directly and demanding

an equivalent response. In this case, the bassist and/or the drummer (Receiver) assimilate the rhythmic figure and answer the soloist;

- Emotive function: characterizes communicative occurrences focusing on the emotional state of the speaker, which in this case is the Sender (Addresser). It is not very typical for the highly interactive type of jazz music; however, it can be seen in certain passages when the soloist (Sender) goes into his own playing mode;
- Phatic function: serves to establish, prolong or interrupt communication. In this case, it occurs through the breaking of rhythmic patterns as a means of drawing attention and establishing a communication channel. It is language for the sake of interaction and is therefore associated with the Channel factor;
- Metalinguistic function: refers to the sound Code itself and the ways in which it is delivered are seen as of greater importance. In this case, communication generally becomes an exploration of the extent to which it is possible to develop particular musical material;
- Poetic function: is the communicative function that is most often associated with the musical work itself, serving as a central point for the communication of an aesthetic Message between musician and listener. The importance of the listener recognizing the aesthetic value of an improvisation is directly related to the success achieved in the communicative process by the musician.

The receiver, when assimilating and decoding the message according to context and established codes, reproduces the message, promoting a dialogue that gives a new environment or atmosphere to the sound. This process is inserted in a context in which the ways of interacting are built inside the live performance, not only with purely aesthetic objectives, but also as a way of establishing relationships that are part of the social environment of jazz musicians. Within this social environment, the musician's capability is evaluated by other members throughout the performance based on their group playing skills.

There is, however, no singular rule for a successful negotiation. Givan (2016) demonstrates, for example, that Sonny Rollins prefers drummers and bassists who provide rhythmic "stability" and do not incorporate the rhythmic changes proposed by him during improvisations. Once in a live performance in 1975 at Montreux blues, with the presence of three trumpeters (Roy Eldridge, Clark Terry and Dizzy Gillespie), the pianist, the drummer and the bass player changed the rhythmic, scalar and harmonic parameters of the song during the solos to align with the preferences of each soloist. Therefore, the resulting sound will always be a variable of the type of interaction that occurs throughout the performance, as a result of this practice of social skills. Such changes can also be found in the context of Brazilian jazz.

According to Piedade (2006), the first Brazilian jazz groups began to emerge in the 60s, with the merging of jazz and choro, but mainly between bossa nova and jazz. Much of the development of Brazilian jazz has taken place, since then, courtesy of mechanical means of sound production. Musicians start to learn and incorporate musical languages through listening, displacing the function of musical writing (Tiné, 2001). Since the 60s, groups have started to bring together jazz and Brazilian popular music, as well as incorporating national songs and giving them a jazz musicality.

Hermeto Pascoal is considered one of the great names regarding the exploration of polyrhythmic approaches in this jazz context, through his use of irregular rhythms and overlapping metrical layers (Neto, 2008). Egberto Gismonti has also been considered an important name in this sense, using polymetric and polyrhythmic approaches when composing and playing piano (Pinto & Borém, 2013). The Brazilian jazz trios that emerged in the 1960s in Sao Paulo and Rio de Janeiro started to play the Brazilian repertoire within the improvisation structure derived from jazz, making use of rhythmic exploration. Renowned groups to emerge from this time included Tamba Trio, Zimbo Trio, Milton Banana Trio, and Jongo Trio (Bastos & Piedade, 2006).

Nowadays, in the São Paulo instrumental music scene, it is common to find clubs where groups play standards of jazz, bossa nova, choro (traditional and modern), MPB (Música Popular Brasileira), samba, samba-jazz, modern jazz, and tango, among others (Almeida, 2017). According to Silva (2017: 13), the improvised solos and the accompaniment patterns that are played in the performances can follow the grammar of these different musical genres, but it is the way that the regional elements are articulated with jazz structure that brings cohesion to the listeners and musicians in these environments. In these clubs, the remuneration is low and musicians in general do not rely on the fees to survive. In this sense, it is possible to affirm that the working relationship established is informal.

> In general, musicians answer this question by saying that there is a "need" to express themselves and that this need is not satisfied simply with recording in the studio and in rehearsals. Musicians need to perform live. In the conversation with the musicians, it is evident that the financial issue is not what motivates them to leave the house to play in clubs (Almeida 2017: 7).

Trio Corrente is a Brazilian jazz group formed in São Paulo. It is composed of Fabio Torres on piano, Paulo Paulelli on electric and acoustic bass, and Edu Ribeiro on drums. During an interview given to the program “Passagem de Som” (Torres et al. 2013), promoted by SESC São Paulo [3], the group members say that they met each other for the first time on the stage of “Ao Vivo” club, in the Moema neighborhood, south of São Paulo city, and started playing together weekly. In this intimate bar atmosphere, the invitation to record their first album came. The project was not finalized, but a copy of the CD ran through Brazil and United States informally within the circles of jazz, which led to invitations to concerts at national and international festivals.

They released four albums, debuting in 2005 with the title *Corrente*. In 2013 they won the Latin Grammy and later in 2014 they were awarded a Grammy for the album *Song for Maura*. In all their albums, there are original compositions and also other works of Brazilian popular music interpreted and arranged by the trio members (Grajew 2015: 89). [4] Trio Corrente, as well as Egberto Gismonti, Hermeto Pascoal, Ari Hoenig, Avishai Cohen, among others, have made use of polyrhythm frequently, each applying concepts in their own way, with similar principles but different developments. To demonstrate the establishment of non-verbal communication through rhythm in the performance of the trio, excerpts from the piano solo (Pno) of “Lamento” were transcribed, as well as the harmonic

rhythmic base composed of electric bass (E.B) and drums (D.S). The original song was written by Pixinguinha in 1928. It is a Chorinho, typical Brazilian music from the second half of the 19th century, usually in rondo form, with syncopated rhythms and a 2/4-time signature. In this current research, the option to bring an old composition from the traditional Brazilian repertoire is an attempt to demonstrate how the use of improvisation resources in jazz interacts with regional elements: Brazilian rhythmic patterns are conducted side by side with new approaches to group improvisation in contemporary jazz. The Trio Corrente version is analyzed here in two different performances: a studio recording in 2005, and live at the Festival de Artes de Brasília, in Sala Villa Lobos in 2012 (Table 1).

TABLE 1. Sections to be analyzed.

TITLE/ AUTOR	TRANSCRIBED MATERIAL DATA
Lamentos (Pixinguinha)	*Corrente* album (2005). Analyzed section: 1`23``- 2`32``. Piano Improvisation. Bass, drums and piano transcription.
Lamentos (Pixinguinha)	Live at the 1st Brasilia Arts Festival. January 2012. Analyzed section: 1`30`` - 2`21``. Piano improvisation. Villa Lobos Auditorium, Brasilia National Theater. Bass, drums and piano transcription

The two sections correspond to the last chorus of the piano improvisation. The intention, when comparing both parts, is to demonstrate how the context of group improvisation is shaped according to the momentary creation and interaction among musicians, where none of them knows in advance the final outcome of their performance. The demonstration of the interaction through polyrhythmic elements of the chosen sections will be presented in full in the section of graphs of polyrhythmic occurrences. In the first section, transcriptions and analyses of some of the most relevant passages about the establishment of the communication channel based on rhythmic exploration will be presented in the music score.

In addition to the understanding of the structures on which some of the principles about non-verbal communication in jazz is built, the following analysis aims to

contribute in the domain of performance lecturing, by elucidating recurring principles and structures that are often considered tacit knowledge. For this reason, the Jakobson model adapted by Vuust, combined with music transcriptions, are used as a way to make explicit when, where and how the communicational bases occur and which functions, thus, allowing teachers and students to use these strategies easily in their musical practice.

Track 1: "Lamento" (Studio Version)

Polyrhythmic occurrences in the score were highlighted according to each instrument and the dotted lines indicate how long they last for. After each figure, the events were noted considering the aspects of non-verbal and harmonic interaction, always relating to the functions previously discussed in Vuust et al. (2006). The chord relations, when spelled out, are only a guide for contextualizing the original chorus harmony, representing the basic formation of each chord (major, minor and seventh), without considering the harmonic extensions used by the pianist at that moment, which are already noted in the lead sheet.

The improvisation follows an AABB form. The music, which originally was in the key of D major, here is transposed to C major. The rhythm is a samba in 2/4, where the bass and drums follow the rhythmic pattern shown in Figure 3.

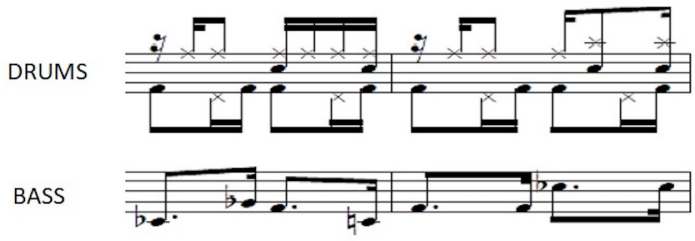

FIGURE 3. Samba rhythmic pattern, bass and drums

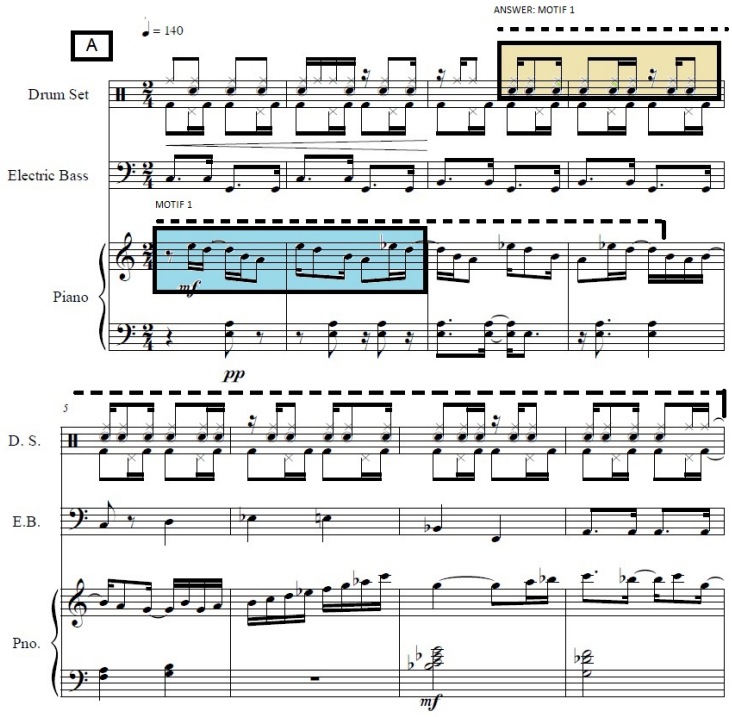

FIGURE 4. "Lamento" (*Corrente*, 2005), piano improvisation (1'23"–1'29")

In bars 1 and 2 of Figure 4, the pianist's right hand plays a motif that is repeated through bars 3 and 4, subsequently assimilated and reproduced rhythmically by the drummer on the cymbals and snare from the second half of bar 3 and repeated over the next five and a half bars [conative function]. However, there is no strong rhythm instability, since the bass and the bass drum remain uniformly within the typical ostinato of samba. Through the melodic motif, there are quartal harmonies in the left hand at the beginning of the section, creating a suspended character even without the use of dissonances. The rhythmic pattern is a traditional syncope widely used in both choro and samba.

In this case, it is possible to note that there is an intention to "mirror" the melodic idea generated by the soloist on the part of the rhythm section, without major consequences in terms of rhythmic instability, thus, it can be defined as a conative function. According to Jakobson's model, the pianist is the *sender* and the drummer is the *receiver*. The motif appears to be identified as a *message* by the *receiver* when the *sender* repeats it and makes it understood as a pattern to be. In the case of conative function, more than visualizing rhythmic groupings, it is important that the receiver is able to identify these melodic patterns as a whole, and that the sender is able to generate a cyclical melody, capable of being assimilated and understood within the performance process.

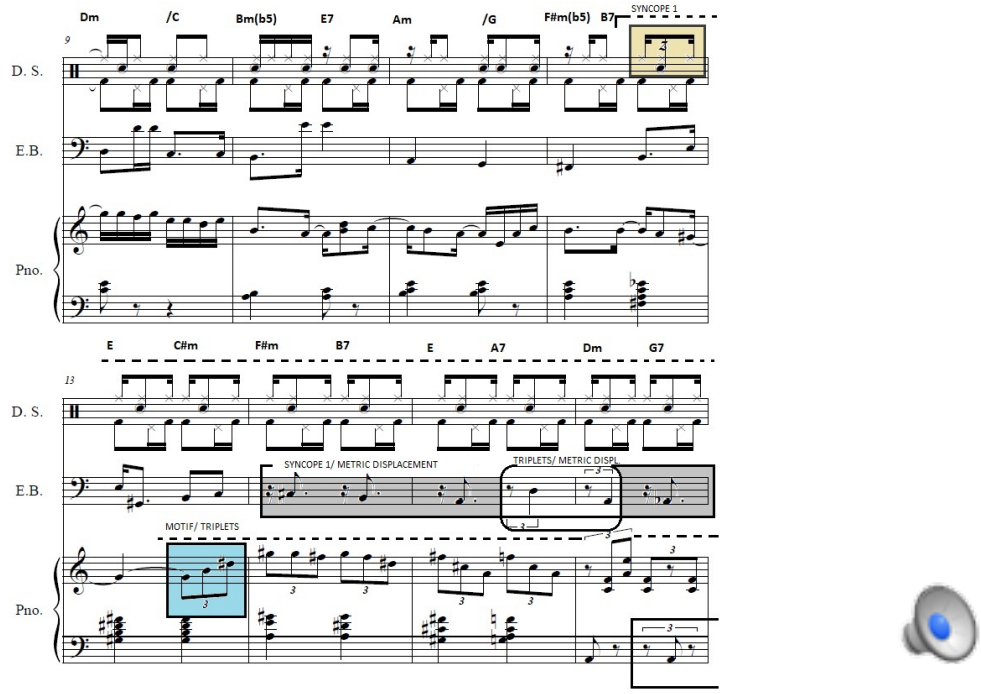

FIGURE 5. "Lamento" (*Corrente*, 2005), piano improvisation (1'30"–1'37")

In the excerpt shown in Figure 5, the drummer starts a rhythmic ostinato on the cymbals and snare drum from bar 12, shifting the strong accent to the second sixteenth note [phatic function]. After bar 14, the bassist starts to respond to the idea, shifting the metric accent to the second sixteenth note of each beat. Between bar 12 and 14, the pianist starts a melodic motif based on triplets that is repeated over the next three bars. When observing the chord relation, it is possible to notice that from bar 14, when the bass metric shift starts, the cadences presented by the bassist generate harmonic tensions that in the previous measures, marked by greater rhythmic stability, did not occur. In the second beat of bar 16, for example, over the original chord of G (V), the bass plays the note A-flat, which serves as a chromatic passage for the next chord (see Figure 6), while the pianist's left hand plays an A-natural and the right-hand plays what would be the eleventh (C) and the seventh of the chord (F).

From this section it is possible to point out a connection between harmonic and metrical dissonances. From this perspective, the movements of tension and release can be accentuated and reinforced through the association of the two parameters (metrical and harmonic). Another hypothesis is that the concern about harmonic issues can, eventually, be left aside as the rhythmic developments are prolonged and explored [metalinguistic function], as if a possible loss of control over the timing could generate greater damage than aspects related to harmony. In this specific case, one can affirm that the maintenance of the communicative base becomes a priority for a successful performance. Thus, there is an important reason for using an analytical model that highlights these musical structures behind communication.

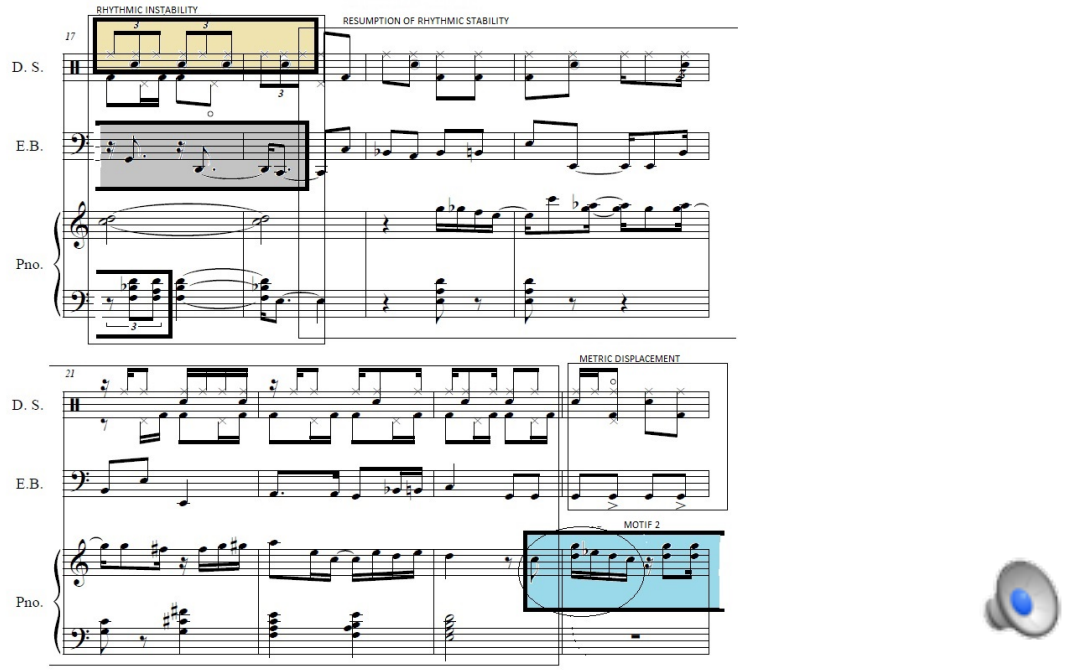

FIGURE 6. Lamento (*Corrente*, 2005); piano improvisation (1′38″–1′44″)

The drummer's response to the displacement in triplets, presented by the pianist in bar 13 of Figure 5, come up in bar 17 of Figure 6. These moments do not line up and end up generating greater instability (bars 16, 17 and 18). In this case, it is noted that upon realizing the instability generated, the pianist stops improvising and plays long notes (bars 17 and 18), waiting until the reestablishment of rhythmic stability (bar 19). With that, it is noticeable that throughout the rhythmic communication process, musicians are subject to "disagreements" and what will actually ensure a good performance is the way they deal with it and find possible solutions.

Within the framework proposed by Vuust et al. (2006), this long rhythmic unfolding beginning from bar 12 and extending through bar 18 is associated with the metalinguistic function. It is in the metalinguistic function that musicians deal with the consequences resulting from the exploration and development of the rhythmic rupture proposed in phatic and conative functions. It contributes to the relationship of tension and release within the context of tonal music, giving more meaning and movement to improvisation sessions. As demonstrated, they add elements through listening and interaction, supporting each other and determining when it is necessary to cease and resume the rhythmic stability. Therefore, knowing the moment to stop playing and resume music together is also a skill for the communication channel to be completely successful. It is about having musical skills to develop tension and release in a group performance, with no previous indication of how, where and when.

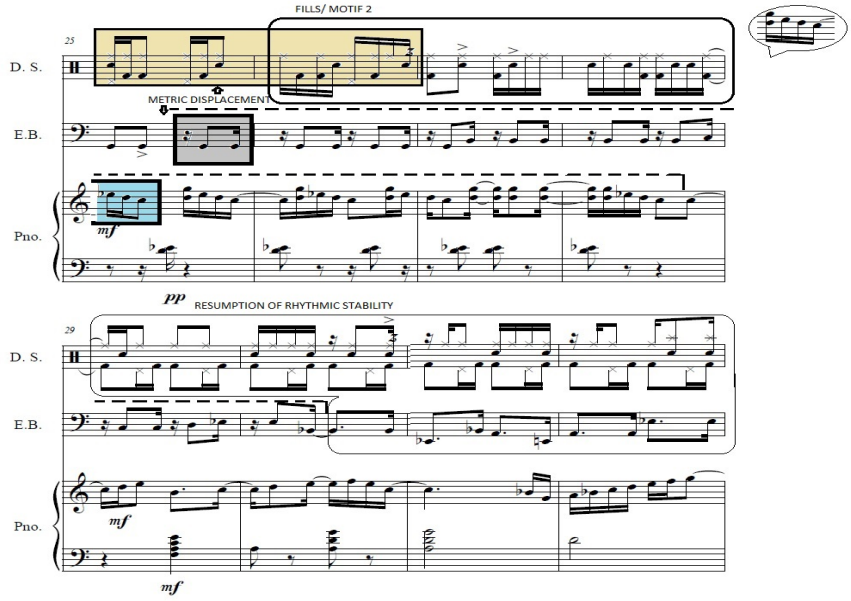

FIGURE 7. Lamento (*Corrente*, 2005), piano improvisation (1′38″–1′44″)

In the figure above, the bassist proceeds with the initial metric displacement proposed in Figure 6, shifting from the second eighth note to the second sixteenth note, in the middle of bar 25. The drummer, who initially had joined the same shift, now is mirroring the rhythm proposed by the melodic motif from the piano. The exploration of a metric break is prolonged by the drummer until bar 28 and up to halfway through bar 30 by the bassist.

Other communicative bases were generated in the studio version and will be demonstrated later in the graphs of polyrhythmic elements according to the model of Vuust et al. (2006). So far, it is possible to identify that the use of polyrhythmic elements for the establishment of a communicative base occurs frequently in the studio performance. Next, excerpts from the last chorus of the piano improvisation will be presented from the live version of the same song, performed by Trio Corrente in Brasília.

Track 2: “Lamento” (Live Version)

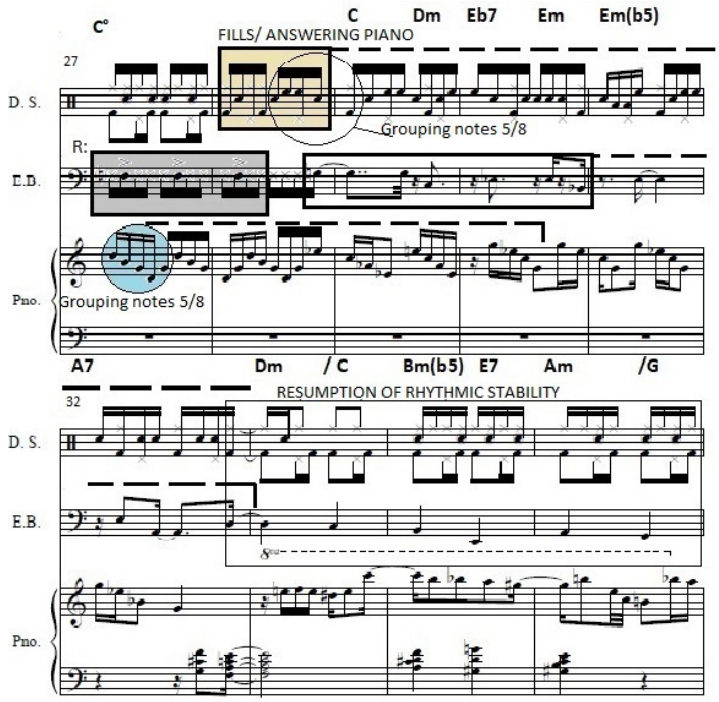

FIGURE 8. "Lamento" (*Ao vivo em Brasília*, 2012), piano improvisation (1'36" –1'43")

In this excerpt, it is the pianist who first generates a melodic line that is repeated for three and a half bars. After the beginning of the variation, it is assimilated and reproduced by the drummer one bar later, and then repeated for the next five bars. This rhythmic-melodic variation creates groupings of five sixteenth notes, and has a melodic contour that is assimilated by the drums. In this case, the drummer uses the tom-toms, snare and floor tom to create the sense of contour of the high and low frequencies, as per the piano part. The bass player also generates rhythmic alternations that break stability by shifting time on sixteenth notes.

In this section, the establishment of a communication basis through the conative function is carried out between pianist and drummer. It is important also to point out that the breaking of the rhythmic stability (phatic function) presented by the bassist, in this case, is not assimilated by any other musician. However, despite not having a connection with the communication base established between piano and drums, the displacement played by the bassist contributes to the metrical dissonances proposed by the other members. As noted, the concept of metrical dissonance is understood as the overlapping of metrical layers (Krebs, 1987). Thus, metric dissonance in this case is established between the pulse, the metric layer generated by the piano/drums combination (conative function) and the bass metric layer displacement in sixteenth notes.

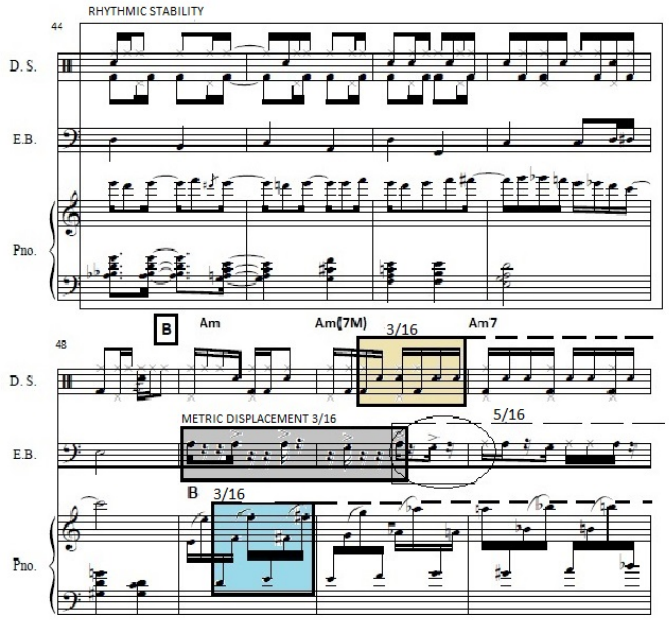

FIGURE 9. "Lamento" (*Ao vivo em Brasília*, 2012), piano improvisation (1'48" - 1'56")

The beginning of part B is highlighted by metric changes. The bass first proposes a metric shift, grouping three sixteenth notes (phatic function). Next to that, the piano performs a chromatic upward melodic movement from the note E, which also occurs through a cycle of three sixteenth notes. One bar later, the drummer also joins this metric shift. However, immediately after that, the bass player starts a new displacement that occurs in cycles of five sixteenth notes. From then on, piano and drums keep together with a metric displacement of three sixteenths, parallel to the electric bass displacement of five sixteenths (metalinguistic function).

The bassist and pianist, from the beginning of part B, do not categorically follow the harmony of the original chorus. On the first beat of bar 50, where the chord of A minor with a major seventh would originally be, both the bass and the piano play the G-natural, followed next by the G-sharp on the piano (A-flat), but with the bass maintaining the G-natural. These harmonic "mismatches", however, do not occur in places where there is no establishment of a communicative channel, as in the end of part A (bars 44 to 48). In bar 51, over the minor seventh chord, the piano plays the notes G-sharp and B-flat. In this case, in addition to maintaining the metric figures already established in the communicative channel, there seems to be a greater concern regarding the maintenance of the symmetrical chromatic phrasing, rather than keeping the original harmonic coherence of the chorus.

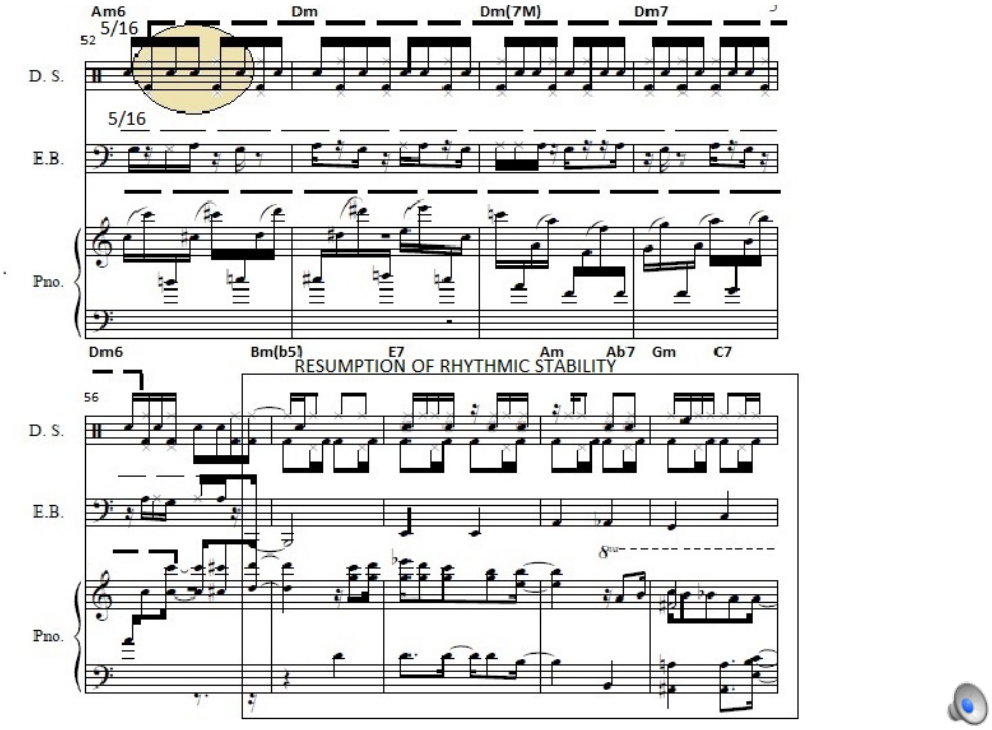

FIGURE 10. "Lamento" (*Ao vivo em Brasília*, 2012), piano improvisation (1'48" – 1'56")

In this excerpt, which is a sequence of what was presented previously, the bassist continues with the metric displacement of five sixteenth notes and the piano of three sixteenths. However, the drummer, who was mirroring the pianist one bar prior to it, ends up adopting the metric displacement of the bassist. Here, it is clear how each member can dialogue in different ways with more than one musician – "speakers" can interact with different musicians by taking up different rhythmic ideas. The communicative channel can generate simultaneous and overlapping combinations. In this case, there is a metric dissonance through the overlay of the soloist's motif on the rhythm section (metalinguistic function). As in the previous section, both the piano and bass maintain the same motifs previously established and, apparently, there is a greater concern with maintaining this than with the harmonic coherence: the piano follows the upward chromatic melodic movement and the bass pedal continues with the notes A and G. Upon returning to rhythmic stability, the standard harmony is also resumed by both. Here, once again, the dissonances are overlaid, concerns regarding harmonic and melodic structures are displaced and it seems that the most meaningful aspect of performance in this moment becomes the communicative channel.

The graphs of polyrhythmic occurrences of all of the excerpts presented in Table 1 are organized below according to the theoretical framework proposed by Vuust et. al (2006).

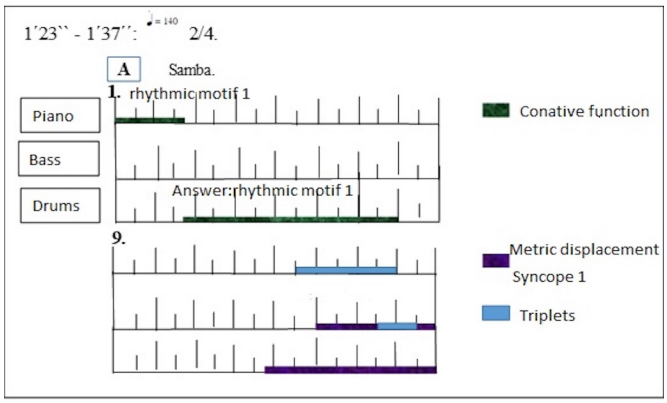

FIGURE 11. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Corrente*, 2005), Part A

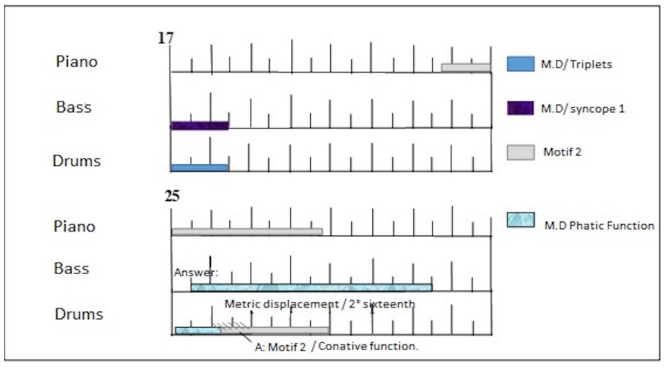

FIGURE 12. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Corrente*, 2005), Part A'

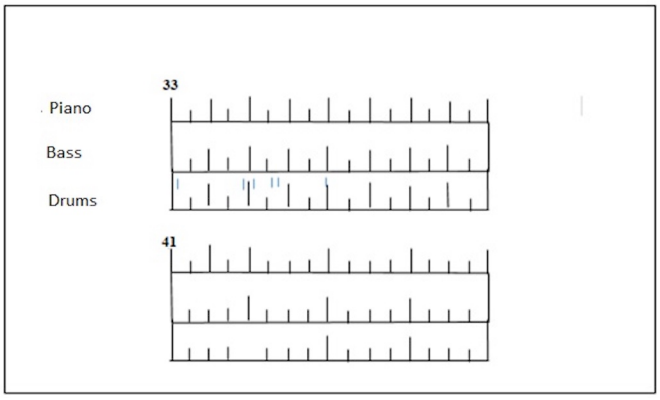

FIGURE 13. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Corrente*, 2005), Part A''

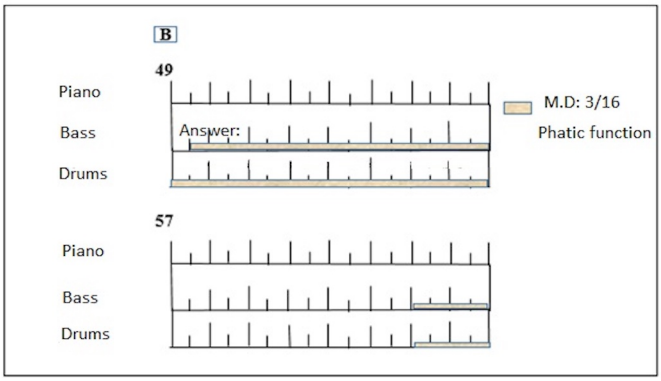

FIGURE 14. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Corrente*, 2005), Part B

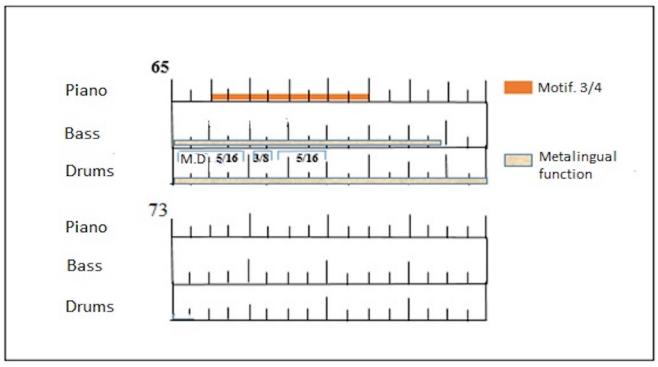

FIGURE 15. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Corrente*, 2005), Part B'

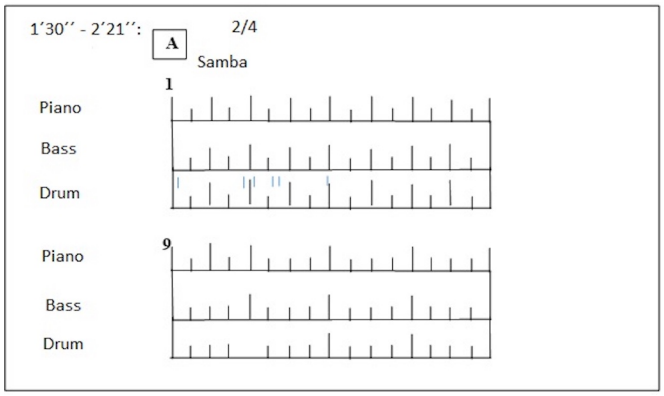

FIGURE 16. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Ao vivo em Brasília*, 2012), Part A

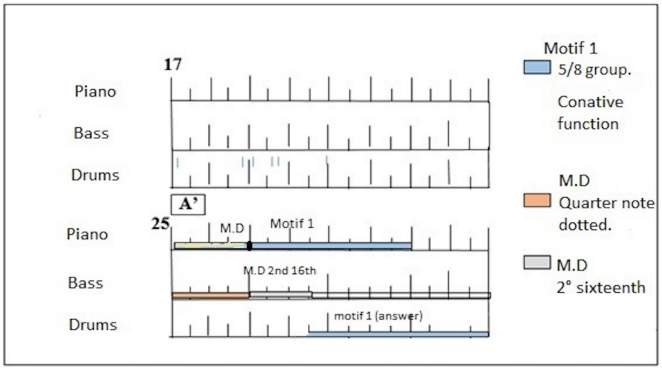

FIGURE 17. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Ao vivo em Brasília*, 2012), Part A'

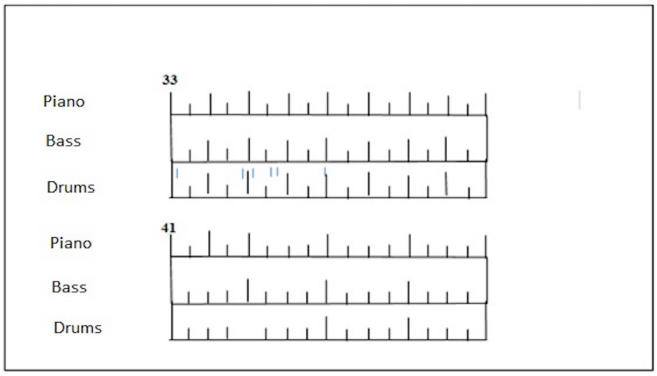

FIGURE 18. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Ao vivo em Brasília*, 2012), Part A''

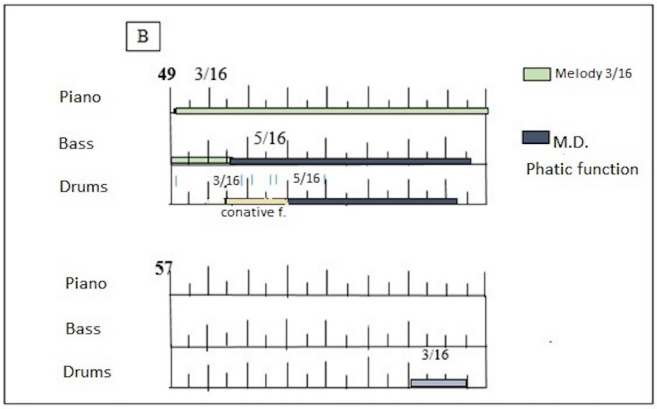

FIGURE 19. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Ao vivo em Brasília*, 2012), Part B

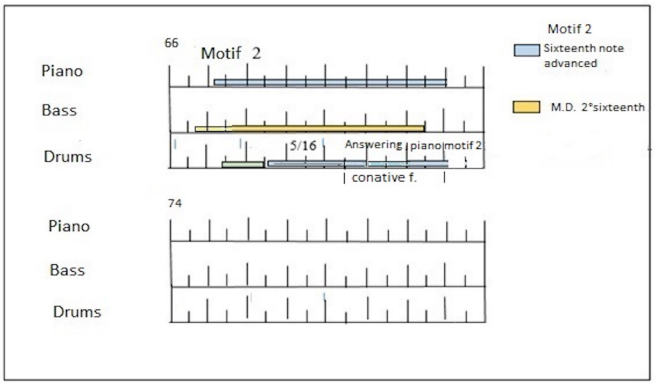

FIGURE 20. Graph of polyrhythmic events, piano improvisation in "Lamento" (*Ao vivo em Brasília*, 2012), Part B'

Based on the results found, it is possible to verify that there are similar places where there is a break in metric and the establishment of a communicative channel when comparing both performances, as in bars 25 and 49. The way "messages" are sent and received by musicians maintains a certain pattern throughout the analyzed section, based on the model proposed by Vuust et al. (2006). The phatic and conative functions serve to "break" the metric uniformity and propose a communication channel. Another function found is metalinguistic, which is observed in the unfolding of the musical material initially proposed by the other two functions. To illustrate this data, Tables 2 and 3 demonstrate the functions found, how often they occur, which musicians act as senders and receivers, the time between assimilation (in time signature unit) and the response generated.

TABLE 2. Functions and Characteristics of Polyrhythmic Events, piano improvisation, "Lamento" (*Corrente*, 2005)

Function	Ocurrences	Sender	Receiver	Time between assimilation and response.
Conative	2	Pianist	Drummer	4
		Pianist	Drummer	4
Phatic	3	Drummer	Bassist	3
		Drummer	Bassist	1
		Drummer	Bassist	1
Metalingual	3			

TABLE 3. Functions and Characteristics of Polyrhythmic Events, piano improvisation, "Lamento" (*Ao vivo em Brasíla*, 2012)

Function	Ocurrences	Sender	Receiver	Time between assimilation and response.
Conative	3	Pianist	Drummer	3
		Pianist	Drummer	3
		Pianist	Drummer	7
Phatic	2	Bassist	Drummer	3,5
		Bassist	Drummer	3,5
Metalingual	3			

When observing Tables 2 and 3, it is possible to verify that the conative function messages are always sent by the pianist, who in this case is the soloist. The motif generated is rhythmically assimilated by the drummer and then played. However, it is important to note that in this specific case, the pianist plays the solo section and provides more melodic material, a source of content to establish the conative function. Phatic function messages, on the other hand, do not require melodic material and can be generated by the rhythmic section, as a way of breaking metric uniformity and establishing a communicational basis. In this case, the sender is always the drummer and the receiver is the bassist. The assimilation time of the sound material when linked to the phatic function, in general, is shorter than in the conative function. It is important to emphasize that the visual contact between the musicians was not considered here. A survey that involves an audiovisual analysis of the performances can bring more answers about how much of this contact can interfere with the assimilation time.

Conclusions

The aim of this research was to analyze the establishment of a communicational basis from polyrhythmic occurrences in the performance of Trio Corrente. For this purpose, excerpts from the trio's interpretations during studio recordings and live performances were selected and transcribed, followed by discussion of musical analysis. Then, in order to understand the interaction between members as a communicative phenomenon, the model of structural language analysis proposed by Jakobson (1960) and adapted by Vuust et al. (2006) was used to investigate non-verbal communication by means of rhythm. In this sense, some functions presented in their model were found: conative, phatic and metalinguistic. Based on that, it was found that polyrhythm plays a central role for a non-verbal communication in the performance of Trio Corrente. The referential function, which involves quoting existing melodic motifs, was not found in these excerpts. The absence of emotional and poetic functions is due to the fact that these communicative channels are established particularly between musicians and listeners, and involves sensitive and other inner aspects of players that would be difficult to approach within the scope

of this work. In this sense, the present research only contributes to the understanding of the performance through communication between musicians.

It was found that the phatic function is established primarily among musicians in the rhythmic section. The communicative channel is established primarily between drummer and bassist. The conative function is the main way of breaking the metric uniformity for establishing the communicative channel of the soloist. In the metalinguistic function, all members of the group can develop and explore the rhythmic and harmonic contents within the communicative channel established in the first two functions. The total time between the assimilation and reproduction of messages in the phatic and conative functions was longer in the case of live performance when compared to studio performance.

It is possible to verify that in most cases, decoding a message occurs through the visualization of the grouping of subdivisions. That is, a metric shift or a melodic motif tends to be grouped in cycles. In this way, it is possible to generate an equivalent response that makes sense within the initial message generated by the sender. In the graph of polyrhythmic events and in Tables 2 and 3, an idea of the average time elapsed for the assimilation and reproduction of a message to occur is presented. In the studio performance, the time for assimilation and reproduction of the message within the conative function is always longer than in phatic function. One possible explanation for this fact is that some melodic cycles can be longer in the conative function, and demands more time to be assimilated by the receiver than the rupture by metric displacements in phatic function, as suggested by the piano lines in Figure 4, the end of Figure 6 and Figure 7 for example. In addition, the different melodic lines played by the soloist in these cases do not show similarities, which suggests that it is more difficult for the receiver to deduce the melody generated before it is fully presented by the pianist. In the case of the phatic function, there are similar metric displacements in both studio and live performances. For example, in both sessions there are groupings of subdivisions in three sixteenth notes, as well as the incorporation of the triplets and sixteenth notes in metric displacements. Thus, these repetitions make it easier to quickly deduce the message to be assimilated and reproduced by the receiver. A point that reinforces this idea can be observed in the live performance: The melodic lines played by the pianist (conative) in Figures 8 and 9 are shorter and more easily perceived as groupings notes than in studio version, where there are syncope patterns (Figures 4 and 6). In this case, as shown in Table 3, the assimilation time in conative function is slightly smaller than in the phatic function. However, there is no single rule to explain the assimilation process within communicative functions. As shown in the graph in Figure 20 and Table 3, the addressee may take much longer to respond to a message. This can be rooted in a difficulty to decode the message, but it can also be an option of not adhering to a short-term rhythmic instability, or to overlay another rhythmic layer different from the proposal. Other methods that include interviewing musicians or analyzing audiovisual performances can provide answers in this sense.

There are also common places where the metric uniformity is broken in both performances. As shown in the graphs of polyrhythmic events, at the beginning of B section, for example, there is always a rupture that is followed by metric dissonances and rhythmic exploration. One hypothesis is that there is a choice

(conscious or unconscious) about peak locations, where the group reaches maximum intensity during improvisation. In this case, the use of metric and harmonic dissonances serves as tools to achieve that moment, and in the sequence, the tensions and dynamics go down again. It is important to note that dissonances and consonances occur in parallel both in the harmonic and in the metric field, and seem to highlight and value each other. There may also be an intention to emphasize aspects of the music itself, such as the beginning of B section, for example, or the end of a chorus and a solo, through these dissonances. Despite these common places occur, the content of the messages within their respective functions and the ability of the musicians to interact through them is what will guarantee an original and different performance from the previous ones.

Generally, when considering all these processes involved in group improvisation related to the three functions discussed so far, it is clear that the members of the trio have the capacity to produce rhythmic structural units, and decode and assimilate those produced by other members, mainly through rhythmic groupings and displacements. The trio's musicians are also able to deduce musical phrases, understand harmonic relationships and tensions and maintain a communicative basis through dialogue and the overlapping of these elements.

Based on the results found, it is believed that the model in question, combined with musical analysis, is an important tool to understand the interaction from the perspective of musicians when playing in group, bringing knowledge about processes that can generally be considered tacit. Jakobson's model sheds light on the types of communication throughout the performance, demonstrating how specific functions can be employed and strategically taught to ensure a good practice and music outcomes. In each one of them, specific skills must be required. For example, in the conative function, one must know how to propose, develop and assimilate melodic contours when playing in a group, within the tempo and the metric structure. In the phatic function, it is important to have knowledge about grouping of subdivisions and rhythmic displacements; and in the metalinguistic function, to explore and develop metrical and harmonic tensions, relating them to each other. In all functions, a central point is the ability to listen, understand and interact through metric dissonances. This provides the musician who usually plays in a group with the acquisition of important skills related to his own making and listening to music. Based on the results obtained in this research, other studies urgently need to be carried out in order to investigate the psychological processes that govern the non-verbal communication of musicians in group performance situations. In this sense, the study of polyrhythm as a bridge to improvisation in jazz groups becomes an important path to be followed in this direction.

Endnotes

[1] Graphical overview of salient rhythmic events in Herbie Hancock’s piano solo in the jazz standard “All of You” (Miles Davis Quintet, 1964). Top line represents the piano, bottom line drums (Tony Williams) and bass (Ron Carter). The ticks correspond to barlines. The overview shows rhythmic communication between the piano and drums (dr)/bass (bs) on two different elements: 1) polyrhythms and 2) swinging/even 8th notes. The polyrhythmic/polymetric occurrences divide into 1)

metric displacement (MD) and 2) regrouping of subdivisions (RS). Occurrences 1 and 2 are dominated by metric displacement, establishing the communicational channel between drummer and soloist, whereas the rest of the polyrhythmic occurrences are regroupings of subdivisions. The main communication (occurrences 3 and 4) coincide with one of the dynamic climaxes of the solo. Polyrhythms 3 and 4 are preceded by tension created by bitonality produced through Hancock's "outside" playing, corresponding to ¬S1 in Greimas' square and followed by Williams' extending the polyrhythm beyond the barline, while Hancock stops his polyrhythmic pattern, corresponding to ¬S2.

[2] Based on Vuust et al (2006: 1160) and Roman Jacobson's model of the act of communication in "Closing Statements: Linguistics and Poetics", in: Thomas A. Sebeok, Style In Language, Cambridge Massachusetts, MIT Press, 1960, p. 350-377

[3] SESC – Social Service of Commerce – is a private entity that aims to provide well-being and quality of life to workers in this sector and their families. The organization frequently promotes shows and interviews with renowned artists of the current Brazilian music. Further details on the entity can be found at: https://www.sescsp.org.br/.
[4] More details about the group can be found on the website: http://triocorrente.com/.

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