CREATIVE PROCESS IN FREE IMPROVISATION

By

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This dissertation is dedicated to the loving memory of my parents

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ABSTRACT

This research investigates the creative and communicational processes used by improvisers in free improvised performance and the ideologies behind those processes. Two studies were conducted: In Study 1 quantitative data was extracted from a recorded performance with Music Information Retrieval (M.I.R) software with special focus on moments consensually considered by the musicians as "best". Study 2 analysed qualitative data extracted from interviews with improvisers and retrospective verbal protocol regarding the whole performance with special focus on "best moments". The results of Study 1 reveal the use of alterations of musical features such as energy, note density and spectral changes in order to create points of qualitative change in improvised music. Creative strategies revealed by Study 2 include reiteration, the use of error as a motor for generation of music materials, real-time use of processes of musical composition and automatic playing.

Improved conditions of separation of recorded instruments are advised in future research on this subject.

1. Introduction

Improvisation, although being the most widely practiced musical activity, still is, for the non-practitioner, a very mysterious subject. Improvisation pervades many musical cultures around the world. It can be found in the melodic extemporizations of Carnatic musicians, in the electric riffs of a rock guitar, in flamenco melismatic chant or in the melodies coming from the strings of a Portuguese fado guitar player. Notwithstanding being a widespread musical activity, improvisation is the object of many misconceptions, and the way this practice is regarded by the layman ranges from a contact with the superhuman to a "*doubtful expedient*" or "*vulgar habit*" (Bailey, 1992: *ix*). Different reasons contribute to preserve the general misunderstanding about improvisation and to preserve its aura of mystery. The lack of academic interest (Gabrielsson, 2003: 224), the uniqueness of each improvisation and the unrepeatable set of conditions in which it comes to life, renders the understanding of improvisation a difficult matter either for the music student or the layperson. Added to this, the researchers' difficulty in getting improvisers to describe in detail the methods they use to produce an improvised performance (Gibson, 2006: 3). Although the more objective matters (materials, techniques, instruments) are easily scrutinised by musicians, as attested by my personal experience as a musician, the debate about creativity, interplay and meaning rarely takes place among improvisers. Some researchers point to musicians' tacitly-held assumptions about how to improvise as a reason for the difficulty in speaking about this subject (Gibson, 2006: 3). Despite the fact that musicians tend to avoid dissecting the experience of intersubjectivity, I share with Dorfmann (2005: 8) the belief that the activities of playing music and analysing it must not necessarily be at odds with one another.

What happens between musicians during improvisation? How do improvisers respond to unforeseen challenges during the performance? How do musicians coordinate their actions? As these questions do not have easy answers when we talk about jazz, they became even harder to clarify when we address freer forms of improvisation. Without the frame provided by form and melody, with no regular meter or harmonic sequence to guide creativity and communication, the structure of interaction between musicians becomes even more blurred and the mystery about how music is made becomes deeper. How does one analyze a music that creates and defines itself in the moment of its sounding?

The focus of this study tends towards these freer forms of improvisation which, although practiced by a growing number of musicians, receive a scant amount of attention from researchers. Several reasons led me to the choice of this area of improvisation, the first and foremost being my personal involvement with it and the mystery it still represents after so many years of practice. The second motivation comes from my conviction that free improvisation is a much richer field for the study of interaction and creativity than any other form of improvisation. My experience as a player in both areas taught me that, in order to result in a gratifying experience, interaction between free-improvising musicians needs to be even more active than in jazz. Without the support of a referent to provide a set of cognitive, emotional and perceptual structures to aid the production of musical materials (Pressing, 1984 cited in Pressing, 1998: 6) and to guide the production of expectancies (Schmuckler, 1990 cited in Pressing, 1998: 7) the musicians must concentrate on interaction at a deeper level than in jazz, since, in the absence of a set of rules to guide musical production, the direction of music depends upon how each player interacts with the musical materials produced by all the others. Hodson brings attention to this fact when he postulates that "*the more free the structure, the more active the*

interaction will have to be" (2007 cited in Butterfield, 2007: 241). A third reason for my interest in free improvisation arises from the fact that without fully understanding this genre it cannot be fully appreciated. The lack of interest in research focusing on free improvisation allied to the genre's lack of visibility in the media keeps it in relative obscurity. Research on free improvisation can contribute to the growth of a common theoretical foundation for understanding, which, in turn, can lead to a greater appreciation and recognition of the genre. A fourth motivation to embrace free improvisation as a field of research comes from the fact that it represents an overlooked area compared to traditional jazz (Heffley, 2000: 19). If, as stated by Dean (1992 cited in Heffley, 2000c: 2), "…*not only analytical but general scholarship on improvisation is in its infancy"*, the analytical literature on improvisation is virtually all on forms previous to free improvisation (Heffley, 2000c: 2).

What happens between musicians during free improvisation? From the many doubts that arise on the subject of free improvisation two overarching research questions emerge in this study: Which creative processes do free improvisers use during improvisation? What ideologies are at work during free improvisation? For the last two decades I've been addressing these questions from the practioner's perspective. In the present study I will try to formalise these questions from the point of view of the researcher hoping to obtain answers, from which a far-reaching view of the process of improvisation can emerge and from which the improviser can benefit.

The present project shares similarities with a number of existing studies about creativity and interaction between musicians either in the area of jazz (Reinholdsson, 1998; Schögler, 1999; Seddon, 2005; Dorffman, 2005 and 2006; Gibson, 2006) or in free improvisation (Pelz-Sherman, 1998; Sansom, 2005 and 2007; Kossak, 2008). I too share the apprehension declared by other scholars about entering an

area whose concept and context are so much more difficult to grasp than jazz tradition (Heffley, 2000: 19).

Despite the fact that the ephemeral nature of improvisation makes it a rather evanescent subject of study, I believe that the analysis of improvised performance can provide greater insight into all forms of human communication and may be beneficial to areas such as education, performance, music therapy and organizational management. The analysis of improvisation provides important insights into the human communication process, since it brings to light the intuitive co-ordination of psychological factors normally buried beneath layers of linguistic and social conditioning and conventions (Schögler, 1998)

1. 1 What is improvisation?

Derived from the Latin "*improvisus*", the word improvisation literally means "not seen ahead" or "unforeseen". Although Bailey (1992: *ix*) alerts us to the risk of misrepresentation when trying to describe improvisation – "*for there is something central to the spirit of voluntary improvisation which is opposed to the aims and contradicts the idea of documentation*" – several definitions have been proposed. Ernst Ferrand (1887-1972), the first and, for a long time, the only academic devoted to the study of improvisation defined it as "*the creation of music in the course of performance*" (Ferrand, 1957 cited in Nettl, 1998: 10), a description still shared by dictionaries, encyclopaedias, reference works and by Netll himself. Stemming from the double nature of the word improvisation – as a noun or a verb (Bailey, 1992: 221) – different definitions and perspectives about improvisation were brought in. Approaching the word as a noun tends to delineate product-oriented perspectives, as expressed in *The New Grove Dictionary* which defines improvisation as "*the creation of a musical work or the final form of a musical work as it is being performed*" (Horsley et al. 1980, 9:31 cited in Nettl, 1998: 10). If

considered as a verb, the definition emphasises process and context as in the *Harvard Dictionary*: "*the art of performing music spontaneously without the aid of manuscript, sketches or memory*" (Apel, 1969 cited in Nettl, 1998: 11). Other definitions of improvisation stress the simultaneity of composition and performance: "*performance of music at the very moment of its conception*" (Simha Arom in Lortat-Jacob, 1987 cited in Nettl, 1998: 11). The relation with the referent is highlighted in the statement by O'Suilleabhain: "*improvisation is the process of creative interaction between the performing musician and a musical model which may be more or less fixed*" (Michaeál O'Suilleabhain in Lortat-Jacob, 1987 cited in Nettl, 1998: 11). These definitions of improvisation – and many others that can be found in academic literature – do not conflict in their common aim of defining it. Moreover, they may be seen as complementary and reflect the multi-faceted and complex nature of improvisation.

Interestingly, improvisation is rarely defined or used by musicians to define their art (Bailey, 1992: xii), be it in the Western or Eastern cultures. A negative connotation is commonly associated with this word. The Dictionary of Portuguese Language (1999) defines "to improvise" as "*to arrange in haste*", "*to falsely quote*", "*to lie*". This popularized representation of improvisation as synonymous with ad-hoc, chaotic, unprepared activity hinders the use of the word by improvisers, as they know how the activity requires training, preparation and focus. In the present study I will refer to improvisation as a holistic and complex social phenomenon in which improviser, material and surrounding social environment are in close and constant dialogue.

1.2 Models for Improvisation

In order to explain how people improvise, some models of improvisation have been proposed. Pressing (1987) describes improvisation as a skilled performance with error-correction capabilities (closed-loop feedback system) coming from the real-time comparison between intended and actual output. The output should be framed within a specific set of rules or scheme – the referent. According to Pressing, any improvisation is constituted by a series of non-overlapping sections which he calls event clusters. These are musical units characterized by objects, processes and features such as motifs, rhythms, textures, melodic gestures, harmonic progressions or any other musical entities that render these units identifiable as different. Event clusters may occur in time by two methods of continuation: a) by association, when some degree of continuity is present between event clusters or, b) by interruption, when repetition tolerance is exceeded, which call forth new musical directions by resetting some or all of the components of the event clusters. Although this model acknowledges the importance of a considerable degree of residual decision-making whose strategies for explaining intuition, free will, neural activity and randomness cannot be confirmed by any conclusive empirical evidence, this model represents an important theoretical tool for the understanding of improvisation, from jazz to free improvisation.

The perspective on the improvisation process brought by Ramalho and Ganascia (1994) proposes two basic notions: Potential ACTions (PACTs), representing actions or intentions musicians may take during performance, and musical memory, a long term memory where a database of previously heard material resides. The improviser's behaviour takes place in a context – chord grid, audience, environment – and is supported by three modules:

a) Monitoring, a perceptive module that "listens to" the context and stores perceived material in short-term working memory;
b) Planning, a composing module that creates a playable PACT taking into account three elements: short term memory, the improviser's mood and the context, and
c) Executing, the module where the pre-composed PACT is "sent" to the instrument to be heard.

The improvisational model described by Horowitz (1995) stems from his study of the improvisational style of Louis Armstrong around 1926, calls upon research on artificial intelligence and brings to the discussion the "need to make explicit the common intuitions of humans experienced in a genre" (Horowitz, 1995). The model emphasises the chaining of musical ideas – "chunks", similar to the PACTs in Ramalho & Ganascia (1994) – which are activated through hierarchies of different types of structure. The performer's goals and intentionality spread activation to concepts that are embedded in a network of other musical concepts, lending to its realisation downward through a network while the active musical structures of the moment spread activation to related concepts upward in the network.

Johnson-Laird (2002) defends the idea that improvisation depends on a principle of algorithmic demands and differentiates the algorithmic processes implied in the creation of improvised melodies and the process of construction of chord sequences. The author considers that a neo-Darwinian algorithm – a process of random generation of musical material from which only the "fittest" ideas would survive – is inadequate for jazz improvisation, as it would produce too great an amount of unviable output. A neo-Lamarckian algorithm is proposed for the creation of an improvised line. This process generates only the ideas that fit the criteria of the genre, hence producing a limited number of possibilities, all of them viable. If, by this criteria, more

than one possibility of musical material is produced, an "*arbitrary choice is rapidly made*" (Johnson-Laird, 2002: 430). According to the author improvisation of jazz melody does not call for the use of a working memory, since there are no intermediate computational results. Johnson-Laird sees his assertion confirmed by the fast speed at which jazz musicians can improvise. On the contrary, he sees the improvisation of chord sequences as a multistage algorithm, hence needing the computational use of a working memory. Considering that chord sequences "*are rarely improvised in public performance*" and are "*based on composed chord sequences*" (2002: 429) Johnson-Laird states that chordal improvisation goes first through a generative stage in which a neo-Lamarckian algorithm is present, then through an evaluative stage that uses a neo-Darwinian process. Regarding meter and rhythm the author proposes three distinct systems of generating improvised rhythmic phrases: a set of prototypes, a set of rules for the production of rhythms and "*a system for timing the notes in a way that swings*" (Johnson-Laird, 2002: 436). This way, the generative process of rhythm would be a one-stage neo-Lamarckian procedure, therefore with no need for a working memory.
Some of the concepts exposed by Johnson-Laird are, in my opinion, susceptible to discussion. The assumption of melody, harmony and rhythm as discrete musical entities and the different set of models proposed for the explanation of their generative processes are somewhat reductive insofar as it discards the holistic perspective I believe to be crucial to the understanding of music improvisation.
To assume that "*the cognitive problem for jazz musicians is to create a novel melody that fits the harmonic sequence and the metrical rhythmic structure of the theme*" (Johnson-Laird, 2002: 422) reduces improvisation to just one of its aspects, leaving out the ones brought to attention by more modern and less tonal forms of improvisation. Since the seminal work of Ornette Coleman (1960) in the sixties, melodic improvisation freed itself from subordination to harmony,

hence the rather simplistic description given of the improvised line as "*a run of notes fairly close to one another in pitch, and then, for variety, introduces some larger leaps in pitch and so on*." (Johnson-Laird, 2002: 437) is, in my perspective, inadequate in describing improvisation as a musical, psychological and social phenomenon. A much more complete view about the construction of melodic contour can be grasped in technical literature on jazz improvisation (Liebman, 1991: 46). Claiming that chord sequences are "*rarely improvised in public performance*" Johnson-Laird approaches the harmonic aspect of improvisation rather as "rehearsed performance" than improvised musical content. The work of Cecil Taylor, Keith Jarrett, Paul Bley, Kenny Werner, Richard Beirach and other contemporary improvisers contradict that assumption and illustrates the real-time generation of novel chord sequences. The ability of Johnson-Laird's model to explain improvisation in its complexity is limited insofar as the definition of jazz that pervades this research is confined to very restrict stylistic and conceptual notions.

1.3 Idiomatic and Non-Idiomatic Improvisation

If in the root of the word improvisation lies the notion of "unforeseen", not all the actions of an improviser are entirely unanticipated. In many different musical cultures the improviser must absorb a broad base of musical knowledge, social conventions and procedures in order to bring coherence to performance. Two main types of improvisation may, in general, be referred to (Bailey, 1992: xi): in idiomatic improvisation, the most generalised form, the performer works within the syntactic rules of a particular style such as baroque, jazz, or Carnatic music and the generative rules of performance are in accordance with the norms of that style or language. This form of improvisation is also called "strict improvisation", "systematic improvisation", "improvisation with a given element", "improvisation within a style" (Sato 1996: 3-4 cited

in Stenström, 2009: 149) or "referent-based improvisation" (Pressing 2002a: 2 cited in Stenström, 2009: 149). In non-idiomatic improvisation the loyalty to any stylistic prescription is not present. Idiomatic elements may appear in non-idiomatic improvisation on a subordinate level, as by-products (Stenström, 2009: 318). More often than not the way in which the instrument is technically addressed is guided by exploratory and experimental principles which, most of the time, defy the scholastic or traditional approach. If, in the sphere of idiomatic improvisation, the system of rules is created by the adoption of some practices and procedures in detriment to others, in non-idiomatic extemporisation, on the contrary, no procedure or attitude is rejected or preferred, as the free improviser "refuses to make any binding choices concerning idioms" (Munthe, 1992 cited in Stenström, 2009: 147). Any technique or resource can be used at any moment (Tuominen, 1998; in Stenström, 2009: 106).

But important similarities exist between these two types of improvisation. In both cases practitioners are working within the boundaries of their instrumental techniques on compelling musical ideas to be shaped within the technical constraints of the individual improviser. In both types of improvisation the improviser "*cannot avoid standing in relation to what has come before them*" (Landgren 2002 cited in Stenström, 2009: 147) and both forms employ a personal database of previously acquired experience, of musical gestures and musical handicraft acquired through time to which the improviser refers in the moment of performance. Every improviser possesses a finite database of gestures, attitudes, reactions and knowledge conditioned by their technical/perceptual/cognitive/ interpersonal limitations that, ultimately, determines their idiom. For this reason, the term "non-idiomatic" should be discussed, since it frequently expresses more the improviser's desire of non-commitment to any specific style or idiom than a true transcendence of idiomatic constraints (Borgo, 2002: 184). Among the authors

questioning this term are Stackenäs (2003: 21 cited in Stenström, 2009: 150) and Tuominen, who argues that "*freely improvised music is, like all other music, idiomatic, since it must be limited and systemized due to an unlimited number of musical options*" (1998: 10 cited in Stenström, 2009: 150). Munthe summarizes this question, arguing "*it is trivially true that all music-making is idiomatic in the sense that it requires some kind of limitations*" (Munthe, 1992: 2 cited in Stenström, 2009: 157). On the contrary, other authors defend a clear distinction between idiomatic and non-idiomatic improvisation and advocate the use of these terms to differentiate the genres. Stenström (2009: 320) argues that non-idiomatic improvisation has not received a "*formal normalisation*" and "*can go anywhere one likes*", normalisation which has brought "*tiredness of the form*" to the idiomatic genre (Stenström, 2009: 320). Along with Stackenäs and Tuominen, I believe this perspective should be called into question. Considering the output of so-called non-idiomatic improvisers in the last decades, and although free improvisation "*can go anywhere one likes*" as Stenström states, a normalisation of principles is noticeable in the output of free improvisers in the last decades. As the absence of rules became the rule, an idiom began taking shape, or as stated by Boyle (2002: 11), "*no rules still implies rules*". At present, a wide range of techniques, approaches and clichés fall under the scope of the so-called "non-idiomatic" improvisation and are *de rigueur* at any performance. Hence I believe that, after half a century of practice, an idiom is evident in freely improvised music, so I will not use the expression "non-idiomatic" improvisation as I do not think it defines the genre under study in a precise manner. Throughout this thesis I will refer to this type of improvisation as "free improvisation". The many different terms used by different authors and at different times - "free music", "total improvisation", "open improvisation" or simply "improvised music" – clearly reveal this music's resistance to labelling (Bailey, 1992: 83).

Is "free improvisation" an appropriate word to describe a genre encompassing such a wide range of musical, conceptual and instrumental attitudes? I believe there is no single word or description that may fulfil that task. Trying to define free improvisation from a single angle would miss the most remarkable of its aspects: its capability to incorporate so many diverse perspectives, from social and cultural to musical and structural. Or as Bailey (1992: 83) vouches: "*Diversity is its most consistent characteristic.*" Thus, while considering the term "free improvisation" as also imperfect to define this music I will adopt it, and share this choice with a broad number of researchers, scholars, critics and musicians. In parallel, I will use the word "jazz" as an umbrella term to refer to a wide range of idiomatic styles in which improvisation is linked to some kind of referent – harmonic, melodic, rhythmic or other.

1.4 Free Improvisation

But what is free improvisation? What is it free from? What is it free for? Improvisation or any other form of music-making, although aiming for freedom of expression, is ruled by constraints of a diverse nature (Pressing, 1998). As stated by improviser Ann Farber: "*Our aim is to play together with the greatest possible freedom – which, far from meaning without constraint, actually means to play together with sufficient skill and communication to be able to select proper constraints in the course of the piece, rather than being dependent on precisely chosen ones*" (quoted in Belgrad 1997, 2 cited in Borgo, 2002: 167). As I defend above, even if scarcely shared or theorized a process of musical improvisation may be it establishes its own idiom and syntactical rules. For this reason free improvisation is not "free" from the constraints of idiomatic organization. Contrary to other forms of performance, in which the resulting musical object is the final goal, "free" improvisation emphasizes process over product

(Borgo, 2002: 184). In this perspective it is free from any product-centred commitment or concern. "*Freedom (in free improvisation) has meant freedom from goals and paths as much as anything else – from self-image, from desire and ambition, every bit as much as to irresistible compulsion and self-determination*" (Heffley, 2000:18).
Free improvisation has its unconditional supporters and practitioners but also a large number of detractors who feel insulted by the disrespect this music shows for musical and social conventions. Not only players are challenged by this music; the audience participation can also take new and creative forms. Contrary to the finished "artistic form" ready to be passively consumed in a mass-market economy, free improvisation invites the audience to the core of the creative process and establishes with them a close complicity as witnesses to an unrepeatable experience.

1.4.1 Brief history of the practice

Although it may be considered mankind's first musical action (Bailey, 1992: 83) the practice of free improvisation as we know it has its roots in Europe in the mid-1960s and evolved from two main sources: the free jazz of the early 1960s and the experimental avant-garde classical music. By the 1950s jazz was dealing with several kinds of formulaic improvisation within a very strict and predetermined division of roles between soloist and accompaniment (Nunn, 1998: 11). Improvisation usually took place within a 12-bar cyclic referential structure of with "call-and-response" phrasal structure – the "blues" – or a 32-bar AABA form (the "American song", as it is commonly called). These formal structures provided a melodic, harmonic, rhythmic and emotional framework within which the improviser should extemporize. In the harmonic field especially there were a limited number of processes involved in jazz improvisation, as shown by jazz pianist Fred Hersch when he recalls

the existence of a mere "*ten or so harmonic patterns*" in the standard jazz repertoire in use at that time (Ross, 1989: 31-35 cited in Berliner, 1994: 79). But, if in the United States, jazz had reached an aesthetic cul-de-sac, the urge to change was also felt by the classical avant-garde composers on both sides of the Atlantic, constricted in the strict norms of serialism. Their search for new musical paths brought into regular use new processes and concepts such as atonality, serialism, micro-tonality, collage and aleatory processes of composition and improvisation. In the United States jazz musicians, especially in the African-American community, promptly adopted this vocabulary. "Free Jazz", or "New Thing" as it was then called, was born from this cultural exchange. The newly acquired freedom from functional harmony and metered time worked not only as a vehicle of aesthetic expression but also as a strong political statement against the appropriation and exploitation of African-American music styles (Jones, 1963; Kofsky 1970; Westendorf, 1994 cited in Borgo, 2002: 168) or, in Jacques Attali and Eddie Prevost's neo-Marxist perspective, as an "*implied critique of capitalism and its related market- and property-based economy*" (Attali, 1985; Prevost, 1995 cited in Borgo, 2002: 168). The role of some African-American improvisers such as Ornette Coleman, Cecil Taylor, Albert Ayler, John Coltrane or Anthony Braxton was central to the evolution of The Free Jazz movement, as were some artist-run collectives: Chicago's A.A.C.M. (Association for the Advancement of Creative Musicians), the Jazz Composer's Guild, New York's "Collective Black Artists" or the "Underground Musician's Association" in Los Angeles. The African-American approach to Free Jazz was very much informed by issues of race, of black social expression, and implied "*a strong emphasis on personal narrative and the harmonization of one's musical personality with social environment, both actual and possible*" (Lewis, 1996 cited in Borgo, 2002: 171), which George Lewis calls the "Afrological" perspective. On the other hand, European musicians, very much

influenced by experimental classical music, were also embracing improvisation and freedom but from a different perspective: with absolute freedom from the personal narrative, culture and conventions, searching for a complete autonomy of the aesthetic object. This "Eurological" perspective, as George Lewis calls it, configured what was first called "European Free Improvisation" and later summarized to "Free Improvisation". British improvisers had an important role in the movement. In Europe, the first relevant experience in Free Improvisation took place in 1963 with the Sheffield based group "Joseph Holbrooke Trio" formed by Derek Bailey, Tony Oxley and Gavin Bryars. Other European improvisers had an important role in the evolution of Free Improvisation in Europe such as Evan Parker, Alexander von Schlippenbach, Hans Bennink, Peter Brötzmann, Misha Mengelberg, Paul Rutherford or artist-run collectives such as the Globe Unity Orchestra, the London Jazz Composer's Orchestra or the Berlin Contemporary Jazz Orchestra. Although the distinction between Free Jazz and Free Improvisation is a difficult one to establish, especially when the former is pushed to its definitional extreme, certain identifiable elements can be found. Free Jazz uses certain "*reference points, be they short composed themes, jazz-playing techniques, or more general structural suggestions and some recognizable 'swing' inflections or syncopations*" (Jenkins,2004 cited in Kaikko, 2008: 2). Elements of Free Jazz and Free Improvisation can be present in the same improvised performance and the relation between these two types of improvisation is one of a continuum rather them contrast (Nunn, 1998: 12).

2 LITERATURE

2.1 Creative process in Jazz Performance

In the last decades the majority of studies on creative and communicational processes between improvising musicians has had small-group jazz performance as its field of research. Although growing in number, studies concerning communication in free improvisation are relatively few. Although this thesis brings into focus the creative processes between players in the context of free improvisation, I also find relevant to the present study the conclusions of previous work in the field of jazz. This relevance comes from the fact that, as both are improvised genres, they share the basic features of improvisation: unpredictable outcome, moment-to-moment contingency, collaboration, oral performance embedded in the social context (Sawyer, 2002: 321). The two genres share otherimportant structural features:

2.1 a) Narrative

Lester Young is credited for a dictum, repeatedly cited among improvisers, which says that an improvised solo should "tell a story". The importance of narrative stated by Young has been restated in the work of countless improvisers, not only in the jazz idiom from Charlie Parker to Cecil Taylor (Iyer, 2004a:393) but also on free improvisation (Burrows, 2004; Lewis, 1996). Narrative, in the context of improvisation, must be understood not in a univocal perspective but as constructed by multiple speakers (Coates, 1997 cited in Sawyer, 2002: 319); in a way the story told by the solo is the story of the musicians themselves. According to Lewis (1996: 111) the emphasis on personal narrative is a clear sign of the strong influence of the African-American perspective (Afrological) on improvised music. Oral tradition and storytelling are central in African culture as a way of preserving history, entertaining and teaching. This

importance is especially evident in subjugated cultures striving to survive (Cliffs, 1993 cited in Hyatt, 2002: 50) as was the case of the slavery system from which improvised Jazz had its origins. The importance of personal narrative is clearly stated by the concept of "*finding one's own voice*", central to improvisers since the early days of black improvised music to present day in the quest of every improviser for their personal expression. From this perspective an improvised performance can be described as an "*encoded exchange of personal narratives*" (Iyer, 2004a:393).

2.1 b) Dialogical structure

As the elucidative title of Ingrid Monson's (1996) book "Saying Something" suggests, improvisation is often regarded by researchers, musicians and public as a kind of "conversation" between the players. The conversational metaphor pervades studies on jazz and in free improvisation. In both areas the antiphonal practice is central to the ongoing musical dialogue. Rather than a telegraphic process of communicating literal meanings, call and response is a collective process that harmonises individual improvisers (Iyer 2004a: 394) independently of style or idiom. The sociolinguistic definition of conversation as talk occurring between two or more participants who freely alternate (Levinson, 1983: 284 cited in Monson, 1996: 81) can also be ascribed to an improvised music performance. Conflict and resolution, thoughtful silence or overlapping discourses, confirming or thwarting expectations, using repetition and timing are aspects of the conversational metaphor common to both jazz and free improvised music.

2.1 c) Prevalence of process over product

A foreknowledge of the final performance is possible neither in jazz nor in free improvisation. Even if, in the case of jazz, there is a previously chosen song, harmonic structure or melody from which to

improvise, the end result is unforeseeable. This fact is a direct consequence of jazz and free improvisation being process-driven rather than product-oriented activities (Borgo, 2002: 184). In improvised music the product is the creative process. Bailey abridges this concept when he states that "*free improvisation is not a kind of music... it is a kind of music making*" (Bailey, 1981: 151). This detachment from the final product makes free improvisation a favoured ground for the study of process in human communication and represents an additional reason for my interest in the field.

2.1 d) The body as the place of generation of meaning

The body is deeply implicated in any musical activity. I believe that, as suggested by Lakoff and Johnson (1999 cited in Burrows, 2004a: 138), "*it is impossible to describe any aspect of mind without reference to the physical body*". It is a truism that music really moves us. Since the late 19th century several authors have brought into focus the relation between physical motion and musical gesture, agreeing that musical phrases iconize the temporal structure of physical acts (Ehrenfels, 1890 cited in Dogantan-Dack, 2006; Kuhl, 2004: 1; Trevarthen, 2000). The meaning begot by the experience of shared time and gesture is grounded in the body (Kuhl, 2004: 15). Recent neurological research confirms those assumptions. Todd, Lee and O'Boyle, (1999 cited in Iyer, 2004a: 396) explain the close relation between music and movement or dance, stating that a perceived rhythmic pulse invokes a mental image of movement and iconizes gesture and physical action. The musical gesture is the key to musical meaning (Kühl, 2006: 3). The most obvious involvement of the body in music, however, concerns the activity of musical performance (Dogantan-Dack, 2006:450). In improvised performance, with its imperative need of real-time interaction with fellow improvisers and/or with the surrounding social context, cognition is structured by the body situated in its environment – that

is, as embodied action (Iyer, 2002: 389). The physical and gestural representation of melodic contour, dynamics or tempo inspires improvisers' rhythmic attitudes and conceptions, which in turn, provides renewed physical stimulus (Berliner, 1994: 152). Kühl (2006:3) brings this process –which he calls "sign cascade" – into focus. Therefore the construction of meaning (semiosis) in improvisation seems to be deeply connected to the body, to gesture and to physical action (Kühl, 2006).

2.1 e) Group creativity

Both areas, jazz or free improvisation, share the key characteristics of group creativity defined by Sawyer (2006:153): improvisation, collaboration and emergence. These features are present in every improvisational group, from theatre and music to everyday conversation or emergency situations. The processes of real-time decision making, the unpredictability in timing and pacing of action of performers and the variability of final results are features that can be found in improvised music from Louis Armstrong to Peter Brotzmann, from the first days of jazz to the modern free improvisers. Group improvisational creativity is collaborative since no single participant imposes an idea on the others. Any contribution for development of action may be rejected by others or, even if accepted, can be perceived differently by different participants and developed in a multitude of ways. Contrary to the general assumption that it results from the successful leadership of a central controller, group creativity is an emergent phenomenon. In the same way a flock of birds is organized without a leader, a group can work as a creative functional unit without any kind of centralised decision making. In that situation, interactional dynamics between group members can create a state – group flow – the final creative product of which transcends the sum of individual contributions (Sawyer, 2006: 148). How do individuals relate to the group? How do individual parts relate to the

group product? What kinds of group process are distinguishable? Creative process in free improvisation can be initiated by the individual but is most often carried out by the group. Nunn (1998: 37) identifies what he calls processes of linear content – whose goal is to create musical content as a single "voice" – and relational processes, which relate identities within the group. These processes can generate situations of transition, gestural continuity and segmental form from which stems form and narrative . These processes can be subjected to simultaneity, hybridization, overlapping and randomness, creating a musical environment of great complexity.

2.2 Perspectives on Jazz Improvisation

From the amount of material of literature on improvisation, the great majority has jazz as its field of study (Gabrielsson, 2003: 245). Paul Berliner's "Thinking in Jazz" (1994) constitutes a very detailed description of the jazz world in its musical, social, cultural and psychological aspects. This ambitious book uses transcriptions of hundreds of hours of interviews with many of the most important American jazz musicians. There is a clear aim to shed light in many of the areas until then unavailable to those from outside the sphere of jazz, although sometimes the interviewees' statements are too much taken for granted by the author, an amateur jazz musician himself. His reverence for the role models represented by his interviewees pervades the text. Despite its encyclopaedic intention, the relevance of Berliner's book to this present study is only partial since the books deals with the ethnographic aspects of the jazz world more than the psychological aspects of improvisation.

Monson (1996) joins a growing list of scholars who insist upon the centrality of interaction in jazz improvisation. She develops a perspective on jazz improvisation focused on aspects of inter-subjectivity and inter-musicality very close to Iyer's (2004a) concepts

of "*encoded exchange of personal narratives*". The book explores two important paths to musical meaning: language and interaction. Quoting from interviews with 14 jazz musicians and analyzing transcriptions of jazz performances, Monson develops a multi-levelled model of musical, social, and cultural interaction inside the group of improvisers. A drawback of this work is the fact that Monson's research relies completely in post-war traditional jazz (bebop) where role-playing was/is strictly defined into soloist and rhythm section and in which the referent is mostly tonal and strophic. In a work published in 1996 the inclusion of analysis of more recent improvisational trends and genres would be expected, a problem also present in Berliner's work.

The research on shared perception of time (Dorffman 2005, 2006 and 2008; Zagorski-Thomas, 2007; Iyer, 2004; Anders, Friberg and Sundström, 2002) focus on how musicians come together rhythmically and how meaning is created from their coordinated efforts. In jazz the terms swing or groove represent the expressive and pleasurable micro-timing coordination between players without which any meaning can be ascribed to the performance. This is clearly stated in the title of a celebrated Duke Ellington/Irving Mills composition: "*It don't mean a thing if it ain't got that swing*". The synchronized perception of time arises out of bodily experience of the self and the sense of being in time with one another. The powerful meaning of this inter-subjective experience is explained by Schögler (1999) and Dorffman (2008: 279) by its relation with the early life entrainment between child and caregiver, the experiential template from which social interaction is modelled. Seddon (2005) and Gibson (2006) investigate the use of inter-subjective knowledge and communication in the production of improvised jazz performance. From video analysis and interviews with participants Seddon reports verbal and non-verbal forms of communication each of which contain three distinct modes: instructional, cooperative and collaborative. He

proposes the concept of empathetic creativity, a form of attunement between musicians that requires non-verbal communication and presents a view about the role of emotion in music as discursive, with emotion regarded as a form of social action rather than an internal state (Seddon, 2005: 49). Gibson (2006) aims to understand the use of "community knowledge" by musicians in the production of improvised performance. Based on interviews and in participant observation in which recordings of the researcher and research participants improvising musical performances together were analysed, this study presents some points that may enfeeble its conclusions. The researcher participates as subject in the research. Describing himself as a neophyte in the jazz world he reveals more concern in understanding the technical rules of improvisation than the dynamics of human communication. His use of melodic line transcription is isolated from the overall components of the real situation: what other musicians are playing, the social and interpersonal frame in which improvisation takes place.

Reinholdsson (1998) offers an interactionist perspective of jazz performance in the context of small groups, from duos to quintets. This in-depth study focuses on symbolic and non-verbal interactions among performers and the creation of meaning in actual performance situations, and uses field-recorded materials (music sessions and recorded interviews). Reinholdsson approaches these questions from a dual perspective: a perspective coming from inside the culture (emic) and from the point of view of the observer, a self-conscious outside perspective (etic). The study presents evidence regarding socio-musical attitudes, role definitions, emotions and self-feelings, symbolic and non-symbolic interaction between musicians. The methodological approach and in-depth analysis of improvised performance brings great consistence to Reinholdsson's study.

Recent research in jazz improvisation include the areas of melody, pitch organisation and phrase. The currently limited amount of

literature in these domains agrees with the idea of gesture and physical motion as a metaphor for melodic contour and phrase. Referring to the work of Deutsch and Feroe (1981 cited in Larson, 2002: 352) and drawing from concepts of physical motion such as "*gravity*", "*magnetism*" and "*inertia*", Larson (2002) explains how these forces operate on an "alphabet" of scales, chords and arpeggios for the generation of melodic content. Larson calls upon Schenkerian analysis to illustrate the importance of expectation in the construction of narrative in jazz improvisation. The importance of gesture as a model of musical structure is also stressed in the work of Kuhl (2004). He defends that view that cognition develops from image schemas of physical and emotional experiences formed in early childhood and suggests that melodic and phrasal features of jazz are organized according to those schemas which have the body as the definite generator of meaning.

The study of group creativity is an area to which the research on jazz is contributing greatly. Improvisation, emergence and collaboration – three characteristics of group creativity – all are present in a successful jazz performance (Sawyer, 2006: 148). Referring to examples from jazz and theatre, Sawyer (2006) explains how creativity happens in the moment of the encounter, how it stems from interactional dynamics within the group and how the end product of a creative group transcends the sum of individual contributions. Sawyer stresses the emergent character of group creativity and drawing on Csikszentmihalyi's (1990) flow theory he suggests that the flow state should be considered not only an individual state of consciousness but also a state susceptible of being experienced in group – group flow. This psychological state of unselfconscious awareness represents the most perfect synchronicity between members of the group, and the groups who attain it are performing at their peak. Prevalence of process over product and the importance of collaborative effort are central notions to improvisation

that have spread from jazz to other areas of research and to activities where a traditional linear systematic thinking no longer gives answers when facing emergency situations or constantly changing environmental conditions.

This is the case of corporate culture and organisational management. From mechanistic courses of action, pre-determined approaches and rigid "programs", organizational science is now embracing more flexible strategies with constant interaction of participants and in which the course of action is being constantly questioned and adjusted. This new organizational paradigm faces "*creativity as an emergent property of the relationship between order and disorder*" (Montuori, 2003: 237). This concept is made clear by the management staff at Honda when they say: "*A 1% success rate is supported by mistakes made 99% of the time*" (Nonaka and Takeuchi 1995: 232 cited in Weick, 1998: 554). Mendonça (2002, 2002a) addresses the relation between improvisation and organisational science and shows how real-time decision support systems in improvisation can be central to understanding and respond to non-routine situations or extreme events. Other common features between jazz improvisation and management are pointed out by Mangham and Pye (1991 cited in Weick, 1998: 549) and include simultaneous reflection and action, simultaneous rule creation and rule following, patterns of mutually expected responses, action informed codes, continuous mixing of the expected with the novel, and a heavy reliance on intuition and imagination.

2.3 Literature on Free Improvisation

Studies on the area of free improvisation constitute a minority within the already small amount of work on improvisation (Gabrielsson, 2003: 224). The astonishingly scarce number of hits (4) for a Google search on the quoted string "research on free improvisation" demonstrates how overlooked the field still is. Therefore the work of

the small number of researchers dedicated to the area takes on special importance. In the theoretical ground some work must be considered of importance.

The work of Nunn (1998), Burrows (2004) and Borgo (2005) are all engaged in the search for the definition of free improvisation, its conceptual basis, creative processes and models.

Nunn (1998) describes the process of free improvisation in a multiplicity of situations and possibilities and identifies the stylistic elements indigenous to the practice of free improvisation (Nunn,1998: 30): a) the use of any tonal system and a free mix of tonal systems; b) irregular rhythmic character and irregular phrase lengths that are oriented to physical gesture; c) compound "voice" texture, or multiple independent "voices"; d) multiple stylistic influences of different traditions; e) catalytic and cadential formal processes that function as cues; f) sectional nature, with each section defining a certain musical character or mood, and connected to the subsequent section via transition; g) responsive and quickly changing interaction among "voices" to create various shifting role relationships in real time cadential processes. Nunn identifies multiple processes that "*occur during improvisation, typically at the same time, in hybrid combinations, changing in some way, often quickly, being highly unpredictable how they occur and what relationship they have upon one another*" (Nunn, 1998: 30). According to Nunn, during improvisation the performers establish, maintain and create what he calls "identities" which are melodic and rhythmic elements, gestural shapes, timbre and articulation nuances or any other sort of musical entity. The performers aim to achieve "*gestural continuity/integrity*" by linking together successive identity gestures according to the ongoing implications of the moment (Nunn, 1998: 29). The concept of gestural continuity is regarded by Nunn as a content-related, structural element (Nunn, 1998: 26). Improvisation, rather than being content-related, is a process-oriented social phenomenon.

Therefore, I would regard as a more powerful tool for analysis a notion of gestural continuity informed by process-oriented elements and more grounded on the psychological elements of improvisation. Notwithstanding the thoughtful insights about free improvisation, especially in the cultural, social and historical grounds, Nunn (1998) offers a descriptive rather than analytical perspective.

The interaction between improvising musicians transcends the boundaries of simple stimulus-reaction explanation. Based on this premise, Burrows (2004a) defends a model for improvisation grounded on cognition distribution of musical archetypes. Drawing from the concept of "cognitive distribution" pioneered by Lev Vigotsky which postulates that "*cognition may literally be shared among individuals through the mediation of objects, tools, symbols, and signs*" (Burrows, 2004a: 95) Burrows develops a model of group cognition in which, around the meditational artefact represented by music itself, an hierarchy of relationships of different kinds is structured. The interchange of musical ideas between individuals is mediated by influences of instruments and sounds. Burrows rejects language as a metaphor for improvisation, considering language a system of signs and symbols far too specific for music. In order to explain how improvisers interact he calls for the notion of "archetypes" in the Jungian conception of the term: "*recurrent thematic elements of the unconscious which help to explain the currents and directions of unconscious thought*" (Burrows, 2004a: 112). According to Burrows the meaning and associations evoked by these archetypes depend on the context in which they take place. This way, improvisers use the shared archetypal meaning of sounds to form a meaningful narrative structure. But, according to Burrows, the process of improvisation is grounded in other unconscious processes. Burrow's model stresses the role of the body when, based on his own experience, he states "*improvising musicians rely on their*

bodies to make many important musical decisions" (Burrows, 2004a: 126).

Borgo (2005) presents an acute insight into the process of free improvisation and proposes an approach to the subject from the perspective of nonlinear dynamical systems theory. He defines non-linearity as "*the property of a system whose output is not proportional to its input*" (Borgo, 2005: 2) and complex systems as those where not only is this property present but also evolves in an irreversible medium – such as time, in the case of improvisation. Borgo brings into special focus the transitional moments of performance ("phase transitions") through which the continuous improvised flow is divided into phase spaces, "chunks" which represent phenomenological units of experience which he calls "qualia" (Borgo, 2005: 4). According to Borgo, the different degrees of saliency presented by the qualia establish a hierarchical structure whose transformations provide a sense of complexity. In this study, supported by analysis of recordings of the Sam River's trio, Borgo denies the validity of conventional notation in order to capture the multidimensional reality of improvisation. Instead he proposes the use of "phase space diagrams" in order to bring into focus aspects of the unfolding of improvisation. From his research Borgo reaches some important conclusions: a) the improvisation as a whole can be segmented into sections, phase spaces, on which subjective agreement can be obtained; b) within each section, other sub-sections may be established through the inter-subjectivity of individual "voices"; c) transitions among spaces are triggered by events which have different salience to performers; d) the presence of a transition-evoking event may or may not produce a transition. Borgo (2005) rethinks the deep-rooted notions of order and disorder and infuses into the academic discussion – not only about improvisation but about music in general – a vision grounded in contemporary sciences and, in my opinion, better equipped to give a

deeper understanding of improvisation. Interesting confirmation of the concept of "phase spaces" presented by Borgo (2005) is given by subsequent neurological research on how musicians' brains interact through synchronized goal-directed actions (Lindenberger et al, 2009).

2.4 Background for research

The work of Pelz-Sherman (1998), Schogler (1999 and 2003), Sansom (2005 and 2007), Kossak (2008) and Stenström (2009) present a special relevance to my present study.

Pelz-Sherman's (1998) study on free improvisation – which he calls "Western Improvised Contemporary Art Music" (WICAM) – draws upon psychology, physiology, ethnomusicology, sociology, cognitive science, game and communication theories. He suggests a framework for analysis structured on several modalities of symbolic interaction between improvisers. This framework relies on the assumption that improvised music has an analysable structure different from that of composed music resulting from the interaction of improvisers rather than centralized decision-making. More than a measuring stick for evaluating the quality of an improvised piece, this framework throws light on the structuring principles of interaction between players. According to Pelz-Sherman at a given time each improviser can function as a "sender" or a "receiver" of information, or otherwise be inactive. Narrative structure is created from the projection in time of these roles and relationships between improvising performers. As a research method Pelz-Sherman used "micro-scores", a set of verbal instructions that set forth a particular musical interactional task (Pelz-Sherman, 1998: 86) to be performed by skilled and sincere improvisers in front of a small audience and videotaped for subsequent analysis. Interviews held with the performers were also recorded and were the subject of later analysis. Pelz-Sherman's aim in using these micro-scores is to investigate the process of interaction

"*without entirely stripping this interaction of their musical context*" (Pelz-Sherman, 1998: 87). It can be argued that Pelz-Sherman's "micro-scores", being a set of goal-oriented tasks, plainly contradict the process-oriented nature of free improvisation which can distort the interaction between improvisers. Another potentially disturbing element concerns the fact that instructions are coming from the researcher, an element outside the circle of improvisers.

Inspired by studies of the history of human action and communication, Schögler (1999 and 2003) explores how duets of jazz improvisers coordinate their subjective perception on time in order to create a single musical discourse. He identifies temporal co-ordination as a fundamental precursor to communicative interaction and proposes a comparison between improvised interaction between trained musicians and interaction in a child-caregiver relationship. The study analyses a series of digital records of "blind" improvised duets in which none of the performers could have visual contact with the other. This way the author strived for the elimination of all non-auditory information as verbal or body language. Techniques of microanalysis were applied to the points of qualitative change, since these are points where high intensity of communicative interaction is required (Schögler, 1999: 81). Processes of imitation and repetition prior to change were detected. These procedures ensure the musicians are able to match their ideas and confirm that they are travelling in the same direction. Both studies suggests the presence of three moments in this synchronicity of shared goals: 1) anticipatory building of tension; 2) achievement of goal; 3) period of inactivity (Schögler, 1999: 83) and concludes that synchronicity between musicians significantly increases just prior to musical change. Schögler's studies, although focusing on the same area of research as my present dissertation, uses jazz, a referent-based style of improvisation, as the background for research.

The work of Sansom (2005 and 2007), one of the rare researchers who successfully managed to bring free improvisation into the curriculum of the UK higher education system, focuses on meaning and the construction of the self in free improvisation. He employs Interpretative Phenomenological Analysis (IPA), a qualitative analytic method used in social, health and clinical psychology which aims to explore the individual's personal perception of an event or state rather than attempting to produce an objective record of the event or state itself. Sansom (2005) seeks for a psychological and qualitative understanding of what constitutes meaningful musical experience. His perspective is informed by Julia Kristeva's notion of "meaning as signifying process" (Kristeva, 1973 cited in Sansom, 2005: 4). This extended emic perspective attempts to reconnect the social and psychological elements at play in the process of construction of meaning.

Sansom (2007) once more relies on IPA as a research method. The performances of improvising duos were audio and video recorded and subsequently commented by musicians who where asked about the thoughts and feelings they had during the performance. In this study Sansom observes the self and the characteristics of its interactions in improvisation from a web of relational dynamics organized into diverse relational categories. He concludes that the relational context and processual dynamic of free improvisation emerge from a number of interrelated continua "*which constitute, by actively situating and defining the self, the overall experience's transformational potential and what can be described as its ontological meaning*" (Sansom, 2007: 10).

Kossak's (2008) study on attunement during improvisation employs audio and video recordings of improvised performances with subsequent interviews with performers and analysis of collected data. Attunement is described as "*a psychological, emotional and somatic state of consciousness often reported in spiritual, mystical, or*

transpersonal experiences" (Kossak, 2008: 3) and is commonly known as "peak experience", in psychological literature.

Kossak argues that free improvisation, either performative or therapeutic, shares similarities with non-linear dynamical systems, as both involve a process of connection/disconnection, discordant rhythmic flows (Nunn, 1998 cited in Kossak, 2008: 7). He calls upon chaos theory to give a better understanding of the dynamics of indeterminacy in free improvisation. The empirical research in which this study is grounded involves the video and audio recording of improvised performances and subsequent interviews with participants. From the analysis of data collected during the sessions, ten functional developmental stages or behaviours were detected ranging from the bare "warming up" to attunement. A curious parallel can be traced between this ten-level theoretical scale of elaboration in improvised performance and legendary saxophonist Lee Konitz's practical teachings on improvisation. Although in a more tonal area other than free improvisation, Konitz describes a ten-level process of improvisational expansion of which the higher level is described as "an act of pure inspiration" (Kastin, 2007) which I consider only to be possible in a situation of attunement as described by Kossak (2008). This study brings forth the close relation between performative and therapeutic improvisation and how research in this field can be useful to both areas.

Stenström (2009) proposes a model for improvisation consisting of a closed feedback loop with three important moments: i) Perception: listening, coding of incoming sensory data; ii) Decision-making: conscious or unconscious evaluation and selection of possible responses and iii) Action: motor output. This way, improvisation would unfold in constant cycles of moments i, ii and iii that could occur at two levels: a gestural level (partial), when sounds are grouped together within the context of phrase, and a sectional level where gestures are grouped taking into consideration a broader,

global view of the improvised piece. The more experienced the improviser, the more he can focus on both partial and global aspects of the improvisation (Stenström, 2009: 304). In his model of improvisation Stenström introduces the concept of feedforward as an *"internal model of the coming actions of the co-player(s)"* (Stenström, 2009: 306). In the loop that constitutes Stenström's model, this "*irrational*" component appears at a moment of decision-making (ii). According to this model, the degree of complexity of improvised behaviour depends on two limiting elements: attention, viewed as a dynamic component constantly vacillating between gestural and global levels, and memory. Short-term memory operates both in gestural and sectional levels, in a framework of 7±2 units, although its procedural power can be increased by conceptually chunking these units in larger groups. Long-term memory, which Stenström calls "extended memory" is an ever-present resource that handles pieces of information and action from diverse areas such as theory, musicianship, repertoire, and technique (Stenström, 2009: 307).

3 Aims

The aim of the present study is to investigate the creative processes and ideologies present in freely improvised performance by a trio of players. Points of agreed qualitative change are proposed as a means of accessing information regarding these issues.

4 Methodology

For this research two studies were conducted: Study 1 focused on performance processes in free improvisation and Study 2 on performance ideologies and backgrounds of the improvisers. Separate accounts of these studies are given. This choice of methodology takes inspiration from previous research on standard jazz performance (Schögler, 2003 and 1999; Gibson, 2006; Dorffman, 2005 and 2008). The present study makes application of the methodological approach employed in these studies to free improvisation.

4.1 STUDY 1

Performance Characteristics of Free Improvisation

In this study an improvised performance by expert musicians was analysed using automatic feature extraction from audio, focusing on the "best moments" of performance. Each one of the musicians was separately questioned about which moments they considered to be the best. By overlapping these moments a series of six segments was found. These segments represent the moments unanimously considered by the musicians as “best moments”. The musical features of these segments were extracted using Mirtoolbox.

The portfolio of data presented here comprises the audio recording of the complete performance with sound separation of microphones (each microphone in a separate channel); the video recording of the performance; the quantitative data extracted by Mirtoolbox.

4.1.1 Participants

For this study three male musicians aged from 37 to 51 were recruited, all of them regular practitioners of free improvisation.

The criteria for approaching and inviting musicians for the project were not primarily guided by instrumental proficiency or command of any specific musical language (classic, jazz or other). The processes

of interaction in free improvisation can function meaningfully even between improvisers with different levels of instrumental skill. (Stenström, 2009: 309). My choice of a trio setting was guided by the communicational possibilities of this formation, which enables dialogue of each improviser with two different musicians and narrative lines. The choice of musicians to take part in this study was oriented primarily by their attitude towards free improvisation, their life-long dedication, their seriousness and commitment to the genre. With this in mind I contacted PC, an active saxophone and flute player, a professional musician dedicated almost exclusively to free improvisation, with several CDs released under his own name and working in the area of composition for theatre, cinema and animation. As I gave him a very general explanation of my study, he willingly accepted to participate. It was left to him to choose the other elements of the trio. He chose BP, a clarinet player and MM, a cellist, both of whom PC regularly plays with and who are equally committed to the genre. I contacted BP and MM in order to give them a brief explanation of the project and to ask for their collaboration and permission, which was immediately granted. It was agreed with PC that, if the recording quality was of an acceptable level and the musical outcome pleased the musicians, the master recording of the concert would be granted to PC for future edition and CD release. In order to keep the naturalistic surroundings of the project a token entry charge of 5 Euros was fixed. Moreover, it was agreed that the total amount coming from the entries would be handed to the musicians at the end of the concert. None of the musicians participating in the project received any other financial incentive to take part.

4.1.2 Materials

A 34 minute improvised performance by the trio was audio and video recorded. As we are dealing with totally improvised music the performance had no prescribed score. No pre-composed materials had been prepared and there was no rehearsal material for this performance. Besides alto sax PC doubled on soprano sax and flute. BP played soprano and alto clarinets

4.1.3 Procedures

My first concern was towards creating an environment for data collection that was as naturalistic as possible. I decided on organizing a concert in a Lisbon venue, a small cultural centre (http://www.zedosbois.org/) where regular art exhibitions, conferences, film festivals and concerts regularly take place. Art rock and free improvisation have a regular presence in their small concert room. This way I tried to avoid bringing to the moment of performance any interfering elements that could arise from playing freely improvised music in front of an audience not acquainted with the genre. Moreover, the room, seating an audience of 40 people from a total of 80, offers video recording facilities of semi-professional standard that would be of practical use for the project. When contacting the venue's management, I informed them about my reasons for organizing of the concert. The project got instant permission and support.

Considering the relatively short performance (34 minutes) and considering that people could go in and out of the concert room, no intermission was planned. Moreover, it would interrupt the flow of improvisation and would bring to the performance disruptive elements of a social character such as the audience reaction, expressed opinions about "How are you enjoying this?", the players perception of critics or fellow musicians in the audience; all elements that could alter the creative flow of performers.

In the days following the performance, and prior to the personal interviews to be included in Study 2, the video recording of the concert in mpeg format was sent to each player, asking them to identify in the video timeline the "best moments" in the concert. No indication was given about what "best moments" could mean. From overlapping the musicians' individual answers, a series of consensual "best moments" was found. Those moments would be the focus of further qualitative and computational analysis.

This way points of qualitative change have been identified, points where high intensity of communicative interaction is required (Schögler, 1999: 81). In order to understand how "best moments" differ from other points in performance, some musical features were chosen and quantitatively analyzed using Music Information Retrieval (MIR) techniques. MIR is the interdisciplinary science of retrieving information from music and allows a musical document to be described by a set of features that are directly computed from its content (Orio, 2006: 2). Selected excerpts of the audio and video recording were analysed through this method. From this combination of data analysis methods I intended to provide a cross-examination between the subjective impressions reported by the players regarding interaction and communication and the objective changes in audio signal reported by MIR analysis.

4.1.4 Apparatus

Audio was recorded by a professional technician with his own professional hardware. This ensured both the quality of equipment and the quality of audio recording. The audio data of the performance was recorded into a Mac laptop using Apple Logic Pro 8 software via a Motu 828mkII audio interface and Focusrite OctoPre 24-bit/96 kHz ADAT Card.

Table 1 – microphones used

#	Instrument	Microphone		Type
1	Flute	Studio Projects C4		cardioid
2	Alto and Soprano saxes	Shure SM57		cardioid
3	Cello	AKG 414 TLII	direct input from cabinet	hypercardioid
4	Soprano clarinet	Shure SM57		cardioid
5	Alto clarinet	Shure SM57		cardioid

Microphone placement was a major technical concern, on which depended not only a good sound quality but more importantly the best possible separation between instruments. Aware of the fact that, with acoustic instruments playing close one another, a complete separation between instruments was impossible, cardioid microphones were chosen and special attention was given to microphone placement.

Microphone 1 was placed close to the embouchure hole of the flute.

Microphone 2 was used to capture both alto and soprano saxophones. When capturing the alto, it was placed close to the saxophone bell. When the soprano saxophone was being used, this microphone was placed between the player's hands in a central position in relation to the horn. The cello was captured by microphone 3, placed near one of the f-holes and also by direct input from the amplifier used by the player for his own monitoring. Both clarinets were captured by mic 4, placed in the central part of the horn and mic 5 pointing at the instrument's bell. A problem was detected during the greater part of the performance: the body movements of the musicians and consequent placement of instruments in and out of the capture range of the microphones constituted a problem during the whole

performance and created fluctuations of quality and separation in the recording. This problem was especially noticed on the woodwind instruments.

The performance was video-recorded with a tripod-mounted high-definition Sony HDSr5 camcorder. The camera was place in a fixed central position in front of the stage. In order to achieve a smaller file size, and since the high definition recording was not essential for this project, the recording was converted to a mpeg file with the following specifications:

Size: 2.41Gb

Duration: 35’ 43’’

Video: NTSC DV, 29,97 fps, with a resolution of 720x480

Audio: 48000Hz, 16 bit, stereo

4.1.5 Data Analysis

Musical features from the performance were extracted using Mirtoolbox 1.2.3 (June 2009 version). This Music Information Retrieval (M.I.R.) is a MatLab toolbox developed by Olivier Lartillot, Petri Toiviainen and Tuomas Eerola at the Department of Music of the University of Jyväskylä in Finland. It is conceived in the context of the “Tuning the Brain for Music” project financed by the European Union (FP6-NEST). It is free, open source software that can be downloaded from the developer’s webpage (www.jyu.fi/music/coe/materials/mirtoolbox). It offers an integrated set of functions dedicated to the extraction of musical features from .wav and .au files. Its design is based on a modular framework whose building blocks form a basic vocabulary which can be freely articulated in new original ways. Before data extraction all the .wav files analysed in this study have been normalised, meaning that the amplitude of all audio files was increased to the maximum level without the introduction of any distortion.

Among the questions concerning the differences between "normal" moments in performance and those considered the "best" by the musicians, some become prominent: Are "best moments" louder or quieter then the rest of performance? Do they comprise a greater or lesser density of notes? How does the timbral quality of the group vary in those moments? In search for answers to these questions four musical features were considered relevant and are analysed in Study 1. They encompass different areas: Intensity, rhythm activity and spectral analysis. These features are:

1) RMS energy (Root Mean Square Energy) is a feature in the area of musical dynamics; it was computed by the *mirrms* operator in Mirtoolbox and indicates the global energy of the audio signal.
2) The *mireventdensity* operator estimated the average frequency of events, i.e. the number of note onsets per second, a rhythm feature.
3) The high level analysis operator *mirentropy* in MIRToolbox returns the relative Shannon entropy, a value used in information theory which is "*a measure of the amount of information the signal carries*" (Shannon and Weaver, 1949 cited in Camarena-Ibarrola and Chavez, 2009: 5). The feature whose entropy is analyzed in this study is the composition of audio spectrum, by default in MIRToolbox. The relevance of spectral entropy as perceptual feature is stated by Camarena-Ibarrola and Chavez who build the construction of a robust audio-fingerprint model in this feature (2009).
4) Spectral centroid is a musical feature that represents the geometric centre of distribution of the audio spectrum. This feature is a good predictor of perceived brightness in sound especially when studying "*bands and ensembles where there may be many notes of different timbres being played*" (Schubert,

Wolfe and Tarnopolsky, 2004: 656). It is computed by the *mircentroid* operator in Mirtoolbox.

The values found for these features in the so-called "best moments" were to be compared with the values found for the same features in the larger sections where these "best moments" occurred. Since saxophone and clarinet were recorded using two microphones I decided to consider for my study the mean value of data extracted from these microphones. Since the cello was recorded using direct input and a microphone, I opted to only consider for my study the data extracted from direct input. This way, and although a hyper-cardioid microphone was used to record the cello, I tried to avoid sound leakage.

4.2 STUDY 2

Performers' backgrounds and performance ideologies

In this study I expected to grasp the performers' musical background, their perspectives about the experience of making music together and their views about what that particular concert meant to each one of them. This study includes interviews conducted with improvisers involved in Study 1. Data collected during these interviews was subsequently submitted to qualitative analysis. The portfolio of data for Study 2 includes the audio recorded interviews with the musicians and the transcription (in Portuguese) of those interviews.

4.2.1. Participants

The trio of male improvisers involved in Study 1: PC, playing saxophone and flute; BP, playing clarinets (soprano and alto) and MM, a cellist.

The average age of interviewees is 46 years old and the average time

of practice is 35.3 years. The average age they began playing music was 10.6 years.

4.2.2. Materials

The interview questions were structured around four different topics: a) questions 1 to 7 refer to identity issues and personal musical history; b) questions 8 to 12 regard performance issues; c) questions 13 to 20 focus on the particular performance recorded for study 1; d) the audience role in performance is addressed in questions 21 and 22.

The interview's complete set of questions can be found in Appendix A.

4.2.3 Procedures

Subsequently to the performance each one of the musicians were individually interviewed. In each of these meetings, and given the semi-structured nature of the interview, the set of questions was the point of departure for an extended conversation about the topics. After this, I invited each musician to watch the video recording of the performance. At any moment the interviewee could stop the video and enlarge upon how he perceived that particular moment in the music. Special attention was given to the moments considered by the musician to be the "best".

The interviews were audio recorded for subsequent transcription.

4.2.4 Apparatus

Interviews were recorded with a Sony MDWalkman MZ-R70 mini-disk and ECM-MS907 Sony microphone.

5. Results

5.1 Study 1

The performance recorded for Study 1 has an overall duration of 34 minutes. From its graphic representation 6 sections can be detected (Fig. 1).

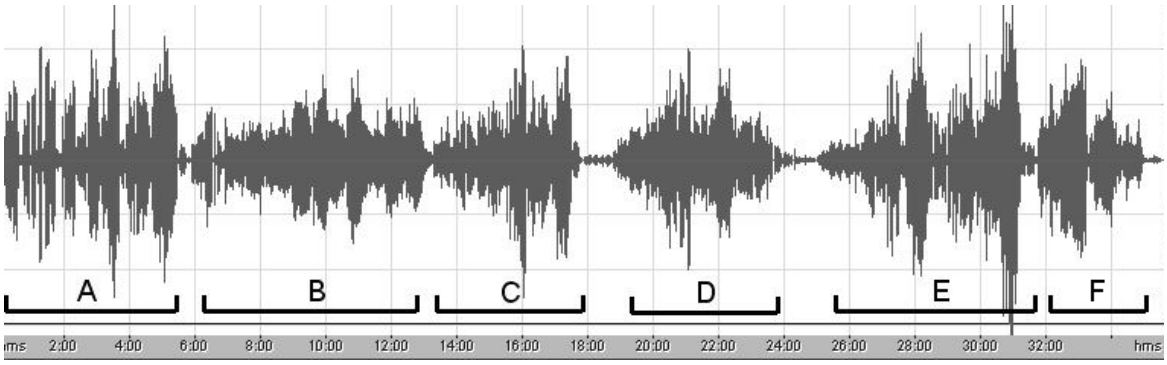


Fig. 1

- Section A from 0’ to 5’ 27’’
- Section B from 5’ 52’’ to 13’ 15’’ (7’ 22’’)
- Section C from 13’ 30’’ to 17’ 31’’ (4’)
- Section D from 17’ 52’’ to 23’ 47’’ (5’ 54’’)
- Section E from 25’ to 31’ 22’’ (6’ 21’’)
- Section F from 31’ 43’’ to 34’ 18’’ (2’ 34’’)

These sections emerge not only from a graphical point of view but also from a communicational perspective. The end of each one of these sections represents a point of collective resolution of musical ideas subsequently punctuated with applause from the audience.

The overall musical action evolved around a main axis constituted by PC and MM. From video and audio analysis of the performance, BP’s

overall musical role emerges as a more following and confirmative than an assertive one. This is supported by data from his interview.

Along the performance two main roles were apparent: MM's cello with a motor/rhythmic/time-keeping function and the woodwinds of PC and BP in a more improvisational/soloistic role. This distribution of functions may be seen as the influence of jazz on the musicians of the trio, as every one of them was, at some point of their careers, a practitioner and a listener of jazz, especially MM.

The peak of intensity occurred by the end of minute 30, that is to say, at 90% of the performance's duration.

During the performance, PC was the element with more initiative, giving musical suggestions, changing the pace of events and in a way or another, contributing a great deal to musical decisions. This leading attitude had its parallel in PC's body language, body movement and generally in the way he used stage space.

No verbal contact between musicians and public took place at the end of each section. Verbal communication with the public was limited to the introduction of the musicians' names at the end of performance.

By mapping each of the players' opinion about the "best moments" in the performance, a series of 6 segments were found which were unanimously considered the "best" by the musicians. This is represented in Fig. 2.

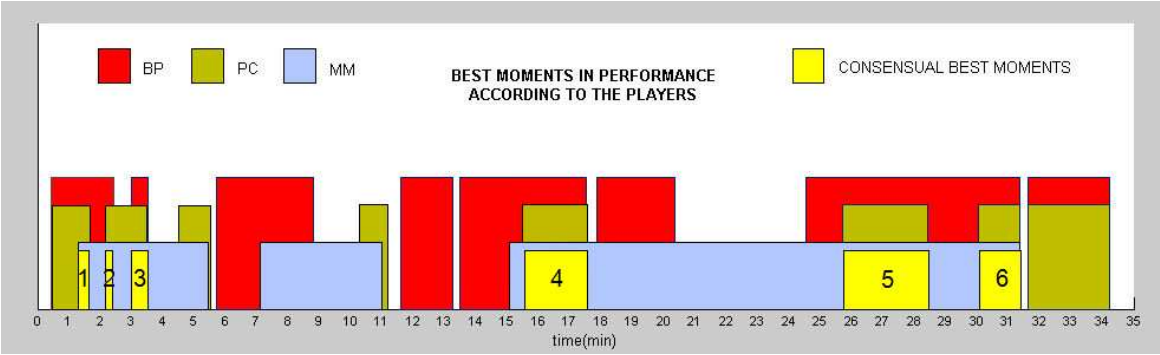


Fig.2

"Best moments"

"Best moments" are distributed by section as follows:

In Section A:

- Segment 1 (1'38'' to 1'43''),
- Segment 2 (2'10'' to 2'20'') and
- Segment 3 (3'00'' to 3'42'')

The instruments involved in these segments were alto sax, soprano clarinet and cello.

In section C:

- Segment 4 (15'26'' to 17'29'')

The instruments involved in these segments were alto sax, soprano clarinet and cello.

In Section E:

- Segment 5 (25'55'' to 28'30'') and
- Segment 6 (30'07'' to 31'22'')

The instruments involved in these segments were alto sax, alto clarinet and cello.

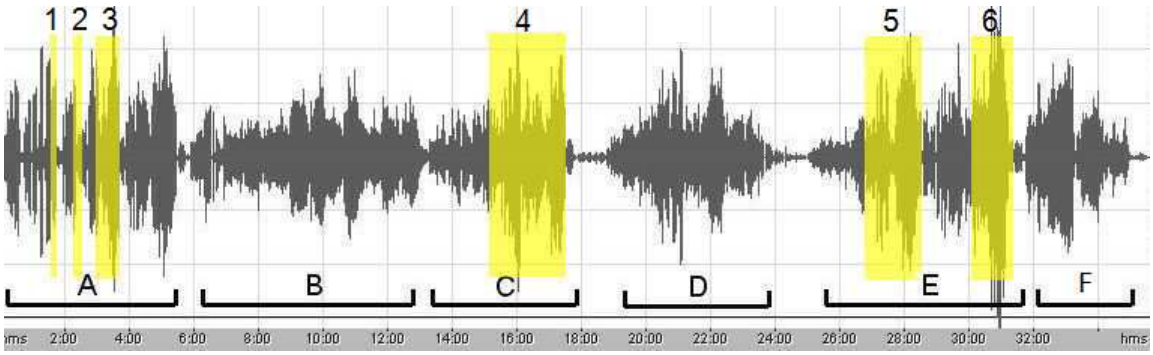


Fig. 3

Distribution of "best moment" by Sections

The coincidence of "best moments" with the peaks of acoustical intensity is noticeable from the graphical analysis of Fig.3.

The choice of graphical representation derives from the conviction that the most meaningful comparison between musical features is the

one that offers the most complete vision of each segment - since they are the main units under focus – hence being the more capable of telling "the musical story" of that segment.

From calculating the variation of the each of the musical features from the mean value of those features in the section where the segment occurs, a series of 6 graphics, one for each segment, were produced.

VARIATION OF FEATURES IN SEGMENTS

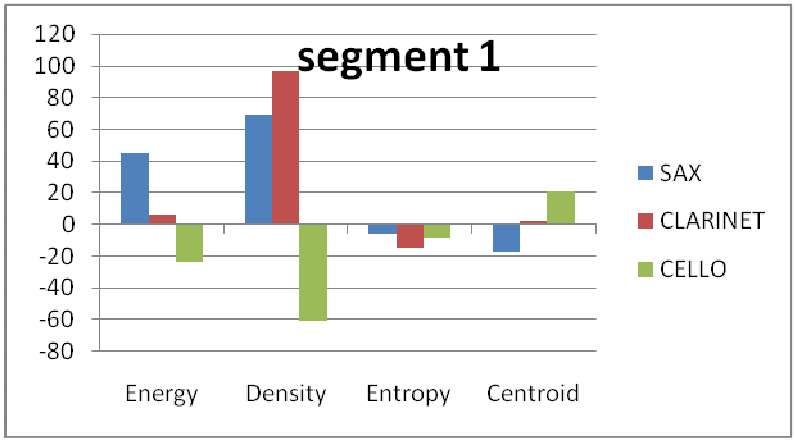


Fig. 4

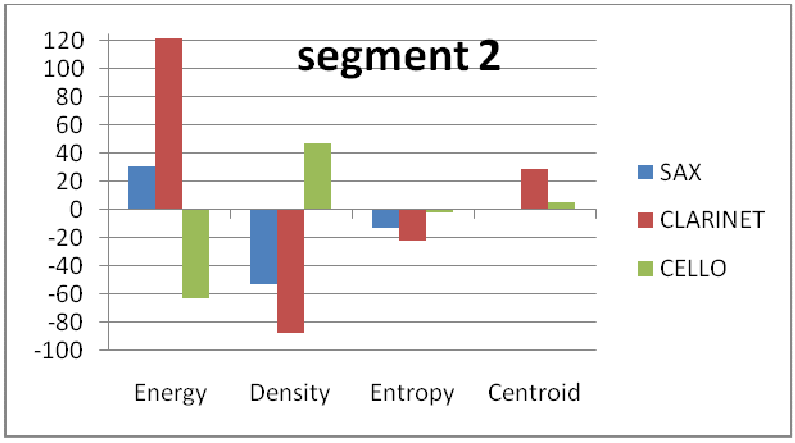


Fig. 5

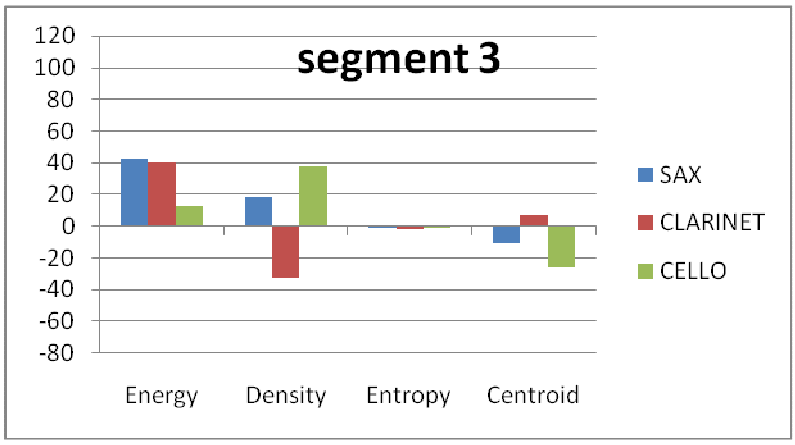


Fig. 6

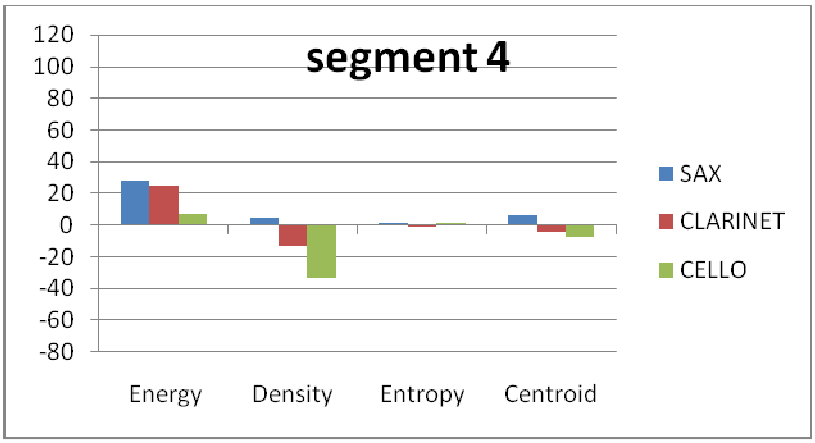


Fig. 7

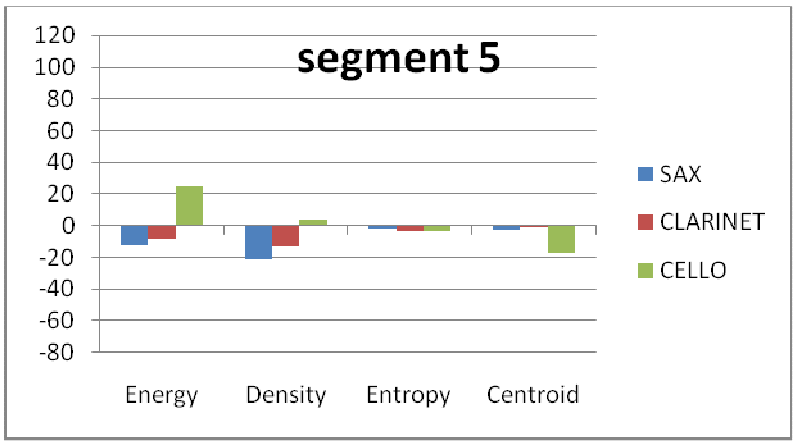


Fig. 8

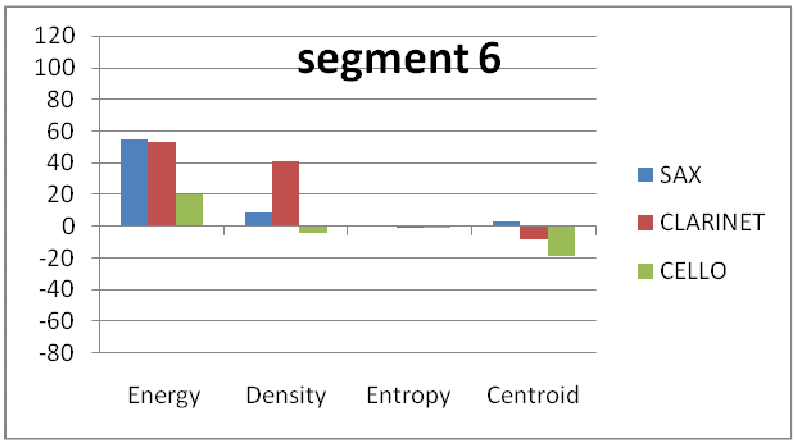
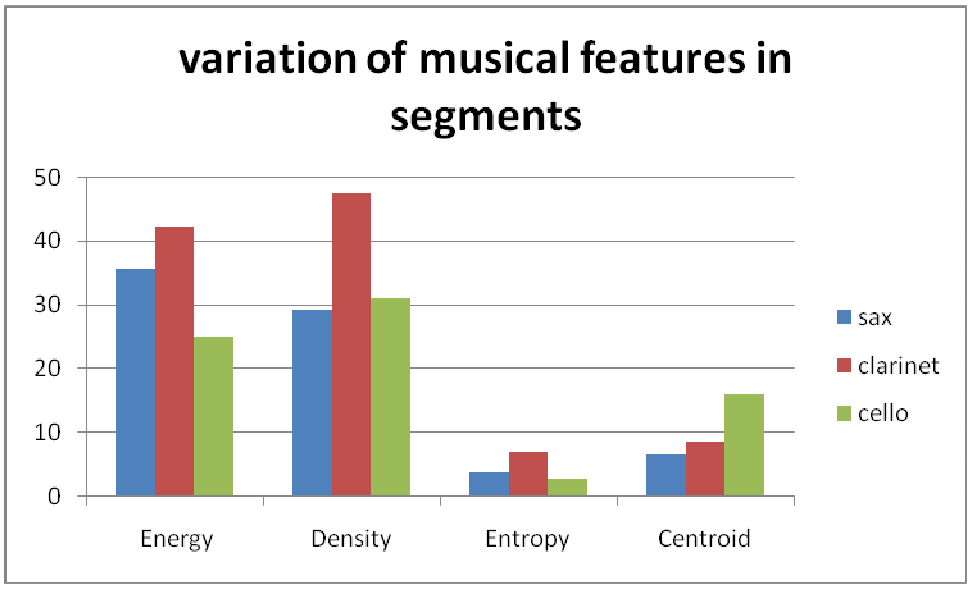


Fig. 9

In order to facilitate an easier understanding of which of the four musical features under study presented greater variations in segments, I opted for using the same scale for all of them. From the analysis of the graphics it can be perceived which musical features changed more dramatically in each one of the moments unanimously considered as "best" by the musicians.

- In all the studied segments, energy and density of notes were the musical features that presented a more noticeable change.
- The prevalence of negative values (below average mean) for entropy of spectrum in almost all the segments suggests a higher organization of spectrum and a lower degree of uncertainty occurring at moments considered "best" by musicians.
- The variation of the spectral centroid occurring at moments of qualitative change in the music suggests the importance of spectral and timbral aspects of performance also evident in interviews.



5.2 Results of Study 2

Although the results from this study cannot enable a generalisation about the background and ideology of improvising musicians in general – only three subjects were interviewed for this study – they can shed some light on important issues about the way improvisers think and practice their art. Considering the frequently observed difficulty, as pointed by Gibson (2006: 3), in getting improvisers to describe in detail the methods they use to produce an improvised performance, I believe that the data gathered from the interviews included in this study represent a rare and prolific moment. From the analysis of the interviews several areas come into view: the background of the musicians; their musical influences; the way they practice; how they describe their music; the function of their instruments in the music being played; the way they think about their music in the moment they produce it; how they relate, socially and musically, with other musicians and the audience; how they assess the music they produce; their impressions about the particular performance recorded for the present study and the reasons why they preferred some moments of the performance more than others.

5.2.1 Musicians' background and formative years

The background and formative years of the interviewed musicians includes a more or less extended contact with classical music learning. Although acknowledged by all of them as a valuable time, the contact with classical music would come to an end, sooner or later. The reasons pointed for rejection of the classical music studies include search for individuality, the high levels of technical proficiency required with the exhausting practicing schedule that implies (PC), the lack of interest in playing pre-composed music (BP) or too "*heavy*", "*hard*" and "*rude*" teaching methods and the general dislike of classical training methods (MM). After quitting classical training, the option for mainstream jazz as the new area of study was common to all three interviewees. PC and MM enrolled the only jazz course available in the country at the time, where they spend around 2 years. BP applied for the same course but was not accepted. After this brief contact with jazz, all three musicians chose self-learning and peer-learning as favoured processes of musical development. From these musicians, MM was the one with a longer relation with standard jazz practising. To the present day he still uses jazz tunes as technical etudes. The transition to the self-taught period of formation included, to all the interviewees, a change from the initial instrument: PC, from flute to saxophone; BP from flute to clarinet; MM from guitar to double bass and later to cello. Hence, all these musicians are self-taught in the instrument they regularly play. During interviews PC and BP expressed their regret for discarding academic instruction so early in life. They both agree with the beneficial effects of classical training in order to achieve a higher degree of technical proficiency. During the interviews all the musicians referred abundantly to the importance of improvisation in their lives as a form of self-expression and as integral component of their personality.

5.2.2 Influences

Jazz and contemporary classical music was a common influence on these musicians. Brief periods at jazz school or self-discovery of bebop (PC), Dixieland (BP) or free-jazz (MM and PC) left important traces on the musicians' development expressed by the musical materials they practice even today ("*while practicing it is compulsive to play some standards…*" (MM); "*classical music is a huge universe and that always interested me*" (PC).

5.2.3 Practice

Regarding the practice of the instrument, musicians informed that their individual practice sessions usually cover a short warm-up period which can be occupied with basic materials: long tones (PC), scales and exercises, BP and MM), jazz standards (MM) from which they go directly to improvising. As described by the musicians, these practice sessions are long sessions of solo extemporisation "*as if I was in a solo concert*" (BP). These accounts reveal the little separation - if any- between the acts of practice and music-making in the context of free improvisation.

5.2.4 Description of music

Overarching the musicians' descriptions of their music – which goes from "*contemporary music*" (PC) to "*wacko music*" (BP) – is the conversational metaphor as shown by the many references to "talk" during interviews: "*…and the conversation goes on…* "(PC); "*something interesting enough to talk about…"* [referring to improvisation], "*When I improvise I'm dialoguing…*", "*That's like talking to somebody…*", "*I felt that PC started talking more intentionally*"(BP); "*I was trying to understand what he is talking about*" (MM).

Also the impulsive, sensorial, ephemeral character of music are recurring aspects in the way all these musicians talk about the music: "*It's an instinct I have…*" (BP); "*the sensorial communication has such a great importance…"* (MM).

5.2.5 Musical Thinking

The musicians give different accounts of the thought processes occurring during improvisation.

It can be an intense intellectual process ("I think of lots of things at the same time…" –PC), appealing to several processes of musical transformation ("dismembering of the phrase, stretching the phrase and using all possible and imaginable compositional techniques…" – PC) or an automatic process, a moment of going "blank" (BP). He suggests a similarity with surfing – which he practices – in which the present moment vanishes ("I don't recall thinking about anything at all…that's what I look for…that purity and truthfulness" – BP). This alteration of temporal perception described by BP is explained by Sarath (1994:127 cited in Boyle, 2002:18): "T*emporal awareness in improvisation is implosive, forever discarding the linear relationships between past and future coordinates for the stability and self-sufficiency of the moment.*" The strategies pointed by the musicians for generation of musical material include the simple act of listening and reacting (MM), the construction of a mental database of pre-composed musical objects (PC) and the use of involuntary motor habits (BP). PC draws attention to the necessity of the use of simple musical structures that may be easily called to working memory. This seems to contradict Johnson-Laird (2002) when he states that improvisation does not call for the use of intermediate memory.

The musicians talked about the use of reiteration as a process of creating tension and musical personality as stated by PC – "[musical] *ideas become interesting through reiteration*" and MM – "*if you do*

something during 30 seconds it is boring, but if you keep it for 4 minutes it grows a personality".

The conversational metaphor and the assumption of improvisation as a musical dialogue between musicians is constantly present in the way musicians think about their music .The words "*talk*", "*language*", "*dialogue*" and "*conversation*" were recurrent during the interviews: "*that's like the flow of a conversation*" (BP); "[the error] *is solved and the conversation goes on…*" (PC); "*I try to understand what* [the other musician, during improvisation] *is talking about…*" (MM); "*What I want with my language…*" (BP).

Although admitting their existence in free improvised music, the musicians view errors as a motor of creativity. Interviewees cite technical flaws (PC and BP), playing without relating to what is happening musically at the moment (PC) or the "*disruption of musical unity*" (MM) as events that could be considered errors. Even so, errors are embraced by all the interviewees as a creative element whose resolution can be a motor of creative behaviour.

The importance of tone, tone colour and timbral aspects of improvisation are very much present in the musicians concerns as expressed by "*timbral coherence*"(MM), "*the instrument as a tone producer*", "*timbral explorations…*" (PC).

5.2.6 The concert

Since PC and MM had a more intense and closer musical and personal relationship and ongoing collaboration on long term projects, this trio was perceived by all the musicians involved as a duo (PC and MM) to whom a third player was added: "*It was us* [MM and PC] *plus a clarinet player*…"(MM); "*It's evident there's a weaker bond* [between BP and PC]" (MM, watching the video recording); "*BP is clearly less experienced than we are…"* (PC).

The assessment of the overall musical quality of this performance was biased by each player's personal perception. "*I felt I hadn't used all the energy I had…*" (PC); "*I made a solo…basically it was only me…I was very happy…I was fascinated…*" (MM); "*I think it did not went very well, regarding my own playing…It was median…I'm talking mostly about myself,*" (BP).

The overall performance was considered of median musical quality by the musicians.

5.2.7 Preparation

Although the performance was completely improvised the musicians got together for a preparation meeting the day before the concert. In this meeting no musical text was rehearsed. The three musicians improvised freely to confirm the musical empathy evident in previous performances, as expressed by BP: "*As soon as we start playing we saw the empathy was there…*"; this need of confirming the empathy between the musicians is also expressed by MM: "A*lthough we were confident, we played together the day before…"* . PC stresses a social and psychological function of the rehearsal:"*The* [rehearsal's] *main objective was to create an uninhibited relation* [among the musicians]"(PC).

These declarations provide important insights about the function of rehearsal in free improvised music. Although no music text is ascribed to the performance and no technical issues must be addressed during the rehearsal, this represents a moment of test and reassurance about the empathy and communicational skills among the musicians.

5.2.8 The instruments

The relationship with the instruments is expressed by the musicians in different forms. BP stressed the importance of technical proficiency in order to express the musical ideas, while PC reflected a certain degree of humanisation of the instrument when he states that *"since I don't hurt them, the instruments are good to me…"* Contrary to MM, who played cello during all the performance, the woodwind players double on other instruments. Other than alto sax, PC played soprano sax and flute; BP played soprano and alto clarinets. The change of instruments by the woodwind players promoted changes of colour, texture and register and helped in the overall construction of form throughout the performance. The beginning of new sections in the performance always coincided with a change of instruments by PC and BP. Although the use of non-orthodox approaches can be noticed throughout the concert (multiphonics, high-tones, micro-tuning, key-clapping) the more radical use of the instrument is displayed by MM (from 24' 24'' to 28' 25'') where he uses the cello like a hammered dulcimer.

The musicians expressed different views about the role played by the instruments in this performance. PC states that, in this type of music, there is no ascribed role to any instrument while BP points out that the traditional roles of accompaniment and solo are distributed to all the musicians throughout the performance. On the contrary MM sees the role of the cello, in this performance, as a rhythmic supportive one.

5.2.9 "Best moments"

Although very vague and evasive explanations were given about the reasons for the preference of moments in the performance - the "best moments" analysed in Study 1 - some aspects may emerge from the interviewees' declarations. BP mentions the dialogic character of some excerpts or the melodic content as the main reasons for his

choice. MM indicates timbral qualities, contention and reiteration as a motive of qualitative change in the performance while PC, very laconic about the reasons of his choice, mentions "*rhythmic understanding*" between members of the trio.

DISCUSSION

Contrary to other research in this area (Pelz-Sherman, 1998; Schögler 1999 and 2003) this study opted to preserve the naturalistic settings in which the recorded performance took place. This includes the researcher's non-interference and his complete absence from the social, musical or personal circle of the musicians before and during the improvised performance which I believe to be an important sanction for results.

The analysis of the computed data presented in Study 1 suggests that several processes are present in free improvisation and used by improvisers in order to achieve qualitative change in music a) increase of acoustical intensity and musical events density, b) the increase of spectral organisation and c) variations of timbral qualities. These results seem to corroborate Schögler (1999) findings when he reports the building of tension as anticipatory of moments of synchronicity in free improvisation. The analysis of data provided by Study 2 evidences discrete communicational and creative processes that occur collaboratively during free improvisation:

a) The use of reiteration as an important process leading to qualitative changes in the music. This conclusion also confirms Schögler's (1999) findings regarding the use of repetitive processes prior to moments of change in improvised performance;

b) Errors as a source of musical ideas;

c) The real-time use of processes of musical composition;

d) the musician's conscious appeal to a database of musical objects gathered during practice/improvisational sessions, as pointed out in the interviews, reinforces Stackenäs, Tuominen (cited in Stenström,

2009: 150) and my own conviction, expressed previously in this study, about the idiomatic character of free improvisation;

e) The ontological importance of improvisation: the processual dynamic between musicians emerge from a number of relational continua which fosters identity-formation through opportunities for the discovery and expression of self. These findings agree with Sansom (2007) who pointed to the transformational potential of improvisation;

f) Study 2 also shows the use of automatic playing generated by motor response in improvised performance. This may shed some light on what Stenström (2009), previously reviewed, refers as the "*irrational*" components that appear at the second stage of his model for improvised action (Stenström, 2009: 73), stage in which decision-making processes take place. Based on the results of study 2, I propose that the "*irrational*" components referred by Stenström are moments in improvised action in which the decision-making processes are annulled and automatic "*action-playing*" prevails. Hence, a pendular model of free improvised action may be proposed

i) Perception: listening and coding of incoming sensory data; ii) Action: motor output.

CONCLUSION

The compromise between naturalistic conditions of performance and the circumstances of sound-capture revealed to be a difficult one to balance. I suggest the repetition of this study with improved conditions of sound capture in order to avoid the "sound leakage" that, in some extent, occurred in the present research. In future studies of this kind and in order to minimize this problem I propose the exclusive use of instruments that can be recorded by direct input (D.I.).

Free improvisation is a manifestation of a complex musical process which is deeply rooted in emotional, intellectual and cultural forces.

The present dissertation and the two studies here included, represent my intention of a deeper understanding of musical free improvisation. From an emic perspective, I tried to bring into light the importance of aspects involving socio-musical attitudes and backgrounds, self-image and the perception of the other, role definition and symbolic representation. The results obtained by computational treatment of quantitative data, although restricted to a limited number of musical features, show a significant alteration of those features in moments of qualitative change during improvisation. I hope the cross the conclusions of this study contribute to a deeper understanding of free improvised performance and help to foster more interaction between the players and more engaging and fulfilling musical moments.

Word count: 15.000

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APPENDIX A

Interview to musicians

Regarding Identity issues:

1. How long have you been playing the instrument?
2. What kind of musical education have you had and how do you value that.
3. How many hours a day do you assign to the practice of your instrument ?
4. How do you occupy practice time?
5. Do you practice improvisation?
6. (To PC) The group has your name in it (PC trio). In what terms (musical or other) does this fact reflects your leadership?
7. Do you listen to others artists within the genre?

Performance issues:

8. How would you describe the music you usually do?
9. How do you prepare yourself for an improvised performance?
10. What characteristics do you look for in the musicians you play with?
11. What elements contribute for a good interaction between the musicians?
12. How would you describe an extraordinary successful concert?

About this concert

13. Was there any preparation for this performance? If so, what was rehearsed/arranged/combined?
14.

15. Are there any fixed elements (compositions, scores, maps, schemes) in your music?

16. What is your opinion about the role of the instruments? Do they play different roles in this trio?

17. Do you use any strategies or creative games for production of musical ideas?

18. Are there mistakes in this type of music?

19. If so, what could a mistake be?

20. Why did you choose those particular moments as the “best” in the performance?

About the Audience:

21. How does the audience influence your performance?

22. Are you aware of audience reactions?

23. Any thing you want to add?

APPENDIX B

Data for Study 1 (collected with Mirtoolbox operators)

RMS in Sections (*mirrms*)

RMS	SECTION A	SECTION B	SECTION C
Sax (mic 2)	0.027223	0.024546	0.037061
Flute (mic 1)	0.063546	0.051997	0.067276
Mean	**0,0453845**	**0,0382715**	**0,0521685**
Clar high (mic 4)	0.046826	0.039909	0.028248
Clar low (mic 5)	0.049847	0.036968	0.043468
Mean	**0,0483365**	**0,0384385**	**0,035858**
Cello (D.I)	**0.035559**	**0.03875**	**0.03889**

RMS in segments (*mirrms*)

RMS	SEGMENT 1	SEGMENT 2	SEGMENT 3	SEGMENT 4	SEGMENT 5	SEGMENT 6
Sax (mic 2)	0.037875	0.042859	0.042848	0.031786	0.031823	0.061474
Flute (mic 1)	0.093495	0.075859	0.086782	0.066228	0.059483	0.10025
Mean	**0,065685**	**0,059359**	**0,064815**	**0,049007**	**0,045653**	**0,080862**
Clar high (mic 4)	0.042123	0.078889	0.077324	0.050054	0.026753	0.041139
Clar low (mic 5)	0.060577	0.13496	0.058084	0.042403	0.039014	0.068528
Mean	**0,05135**	**0,1069245**	**0,067704**	**0,0462285**	**0,0328835**	**0,0548335**
Cello (D.I)	**0.027132**	**0.013255**	**0.040006**	**0.041328**	**0.048584**	**0.046614**

Entropy of spectrum in sections (*mirentropy*)

ENTROPY OF SPECTRUM	SECTION A	SECTION C	SECTION E
Sax (mic 2)	0.82977	0.82551	0.84529
Flute (mic 1)	0.78656	0.77435	0.79129
Mean	**0,808165**	**0,79993**	**0,81829**
Clar high (mic 4)	0.79951	0.80646	0.80369
Clar low (mic 5)	0.85429	0.83431	0.80241
Mean	**0,8269**	**0,820385**	**0,80305**
Cello (D.I)	**0.74023**	**0.69732**	**0.71808**

Entropy of spectrum in segments (*mirentropy*)

ENTROPY OF SPECTRUM	SEGMENT 1	SEGMENT 2	SEGMENT 3	SEGMENT 4	SEGMENT 5	SEGMENT 6
Sax (mic 2)	0.78434	0.71583	0.82947	0.83188	0.82501	0.84649
Flute (mic 1)	0.73475	0.69378	0.78105	0.78927	0.77444	0.80126
Mean	**0,759545**	**0,704805**	**0,80526**	**0,810575**	**0,799725**	**0,823875**
Clar high (mic 4)	0.70963	0.63242	0.79336	0.80268	0.77604	0.80203
Clar low (mic 5)	0.70483	0.6582	0.82869	0.83536	0.77167	0.80058
Mean	**0,70723**	**0,64531**	**0,811025**	**0,81902**	**0,773855**	**0,801305**
Cello (D.I)	**0.68226**	**0.72421**	**0.7299**	**0.70479**	**0.69185**	**0.71439**

Event density in sections (*mireventdensity*)

EVENT DENSITY	SECTION A	SECTION C	SECTION E
Sax (mic 2)	1.8091	1.1628	1.2941
Flute (mic 1)	2.2012	1.7704	2.1768
Mean	**2,00515**	**1,4666**	**1,73545**
Clar high (mic 4)	2.9823	2.085	3.3366
Clar low (mic 5)	2.7811	1.4741	2.5546
Mean	**2.8817**	**1,77955**	**2,9456**
Cello (D.I)	**3.5498**	**3.5711**	**6**

Event density in segments (*mireventdensity*)

EVENT DENSITY	SEGMENT 1	SEGMENT 2	SEGMENT 3	SEGMENT 4	SEGMENT 5	SEGMENT 6
Sax (mic 2)	3.4	0.8	1.8339	1.2686	1.0971	1.3604
Flute (mic 1)	3.4	1.1	2.9056	1.8054	1.6392	2.414
Mean	**3.4**	**0,95**	**2,36975**	**1,537**	**1,36815**	**1,8872**
Clar high (mic 4)	4.673	0.4	2.072	1.5207	2.8137	4.6946
Clar low (mic 5)	6.6667	0.3	1.8339	1.5777	2.291	3.6143
Mean	**5,66985**	**0.35**	**1,95295**	**1,5492**	**2,55235**	**4,15445**
Cello (D.I)	**1.4**	**5.2**	**4.8823**	**2.3909**	**6.4857**	**5.9749**

Spectral Centroid in sections (*mircentroid*)

SPECTRAL CENTROID	SECTION A	SECTION C	SECTION E
Sax (mic 2)	2342.5793	2247.5819	2450.4639
Flute (mic 1)	1931.6914	1950.6941	1903.7039
Mean	**2137,13535**	**2099,138**	**2177,0839**
Clar high (mic 4)	1386.4617	1480.1863	1565.7824
Clar low (mic 5)	1699.1773	2007.9167	1459.5765
Mean	**1542,8195**	**1744,0515**	**1512,67945**
Cello (D.I)	**1064.7725**	**761.8511**	**1047.2426**

Spectral Centroid in segments (*mircentroid*)

SPECTRAL CENTROID SEGMENTS	SEGMENT 1	SEGMENT 2	SEGMENT 3	SEGMENT 4	SEGMENT 5	SEGMENT 6
Sax (mic 2)	2061.8	2470.5377	2241.7711	2340.5134	2415.6633	2490.1948
Flute (mic 1)	1495.8352	1821.6916	1586.922	2131.1361	1804.6618	1993.8513
Mean	**1778,8176**	**2146,11465**	**1914,34655**	**2235,82475**	**2110,16255**	**2242,02305**
Clar high (mic 4)	1282.5279	1691.1287	1335.6414	1402.7577	1536.7722	1445.7005
Clar low (mic 5)	1877.1882	2281.7523	1954.1816	1927.4812	1462.7438	1321.996
Mean	**1579,85805**	**1986,4405**	**1644,9115**	**1665,11945**	**1499,758**	**1383,84825**
Cello (D.I)	**1282.5886**	**1121.159**	**786.6051**	**702.452**	**865.238**	**848.7513**