

**Groove!**  
**Its production, perception and meaning in jazz.**

by  
**Mark Doffman**

Submitted in partial fulfilment of the  
MA in Psychology for Musicians,  
Department of Music, University of Sheffield  
on 30<sup>th</sup> June 2005.

<u>Contents</u>	2
<u>Abstract</u>	5
1. Introduction	7
2. 'Three Views of a Secret' :ideas on groove – its production, perception and meaning	10
2.i. Introduction	10
2.ii. Groove as a structure	10
2.iii. Timekeeping as fallibility and control :	
drift, a/synchronisation and control mechanisms	12
a. Drift and a/synchronisation	13
b. Control mechanisms	14
2.iv. Timekeeping as perception	16
2.v. Investigations into musicians in time together	18
2.vi. Roles, groups and cultural process	20
a. Group theory	21
b. Structuration and symbolic interaction	23
c. Interaction within music	26
2.vii. Groove as a messenger	28
a. Meyer and embodied meaning	29
b. Keil and participatory discrepancies	30
c. Monson and intermusicality	32
2.viii. Summary	33
3. Aims and research questions	35
4. Methodology	37
4.i. Study of timing control and synchronisation	37
a. Participants	37
b. Musical material and instruments	37
c. Recording equipment and method	38
d. Analytical method	39

4.ii. Study of listeners' perceptions	41
a. Participants	41
b. Questionnaire	41
4.iii. Interviews with jazz musicians	42
5. Results of quantitative data	43
5.i. Timing data from performances	43
a. Voice leading between bass and ride	44
b. Synchronisation	44
1. Effects of playing intention	45
2. Effects of structure	46
5.ii. Response data from listeners	48
a. Identification of performers' intentions	48
1. Listeners' ability to identify intention	48
2. Effect of familiarity with jazz	49
3. Effect of within-test learning	51
b. Rating of samples for groove	52
c. Association between degree of synchronisation and groove rating	53
6. Discussion of quantitative data	55
6.i. Timing data from performances	55
a. Voice leading	55
b. Synchronisation	58
1. Effects of playing intention	58
2. Effects of structure	59
6.ii. Listener responses	60
a. Identification of performers' intentions	60
1. Listeners' ability to identify intention	60
2. Effect of familiarity with jazz	61
3. Effect of within-test learning	61
b. Rating of samples for groove	62
c. Association between degree of synchronisation and groove rating	62

7.	Results and discussion of qualitative data -	
	interviews with jazz musicians	64
	7.i. Talking and thinking about doing	64
	7.ii. Movement and change	66
	7.iii. Ourselves and others	67
8.	Conclusions	70
	8.i. First thoughts	70
	8.ii. Conclusions to be drawn from the data sets	71
	a. Timing issues in groove	71
	b. Perception of timing and groove	72
	1. Identifying playing intentions	73
	2. Qualitative judgements of the playing	74
	c. Qualitative data – the views of musicians	74
	8.iii. Final remarks	76
	<u>Bibliography</u>	77
	<u>Appendix 1</u>	83
	<u>Appendix 2</u>	84
	<u>Acknowledgements</u>	85



## **Abstract**

This study approaches the idea of groove in jazz through articulating a series of research questions about players' manipulation of timing and listeners' perceptions of these manipulations. These questions were framed by a broader exploration of groove through interviews with professional jazz bass players and drummers.

Data collection comprised both quantitative and qualitative sets. Quantitative data were collected from two separate sources – performance data and listener response data. Performance data came from audio recording of a bassist and drummer playing two choruses of a twelve bar blues.

Performances were played in three intentional conditions, 1) neither player consciously manipulating their timing away from their normal playing, 2) the bass player consciously pushing the beat ahead of his normal playing position and 3) the drummer consciously pushing the beat ahead; each condition was performed 5 times. Listener responses came from 3 groups, 1) Non Jazz musicians, 2) Jazz Listeners and 3) Jazz Musicians; each group consisted of 10 participants. Participants were asked to listen to 6 (2 x 3 playing conditions) of the 15 performance samples and then 1) identify the playing condition and 2) rate the performance for groove. Qualitative data came from semi-structured interviews with 7 professional jazz musicians.

Results of timing data from performances showed that there were significant effects on synchrony between players through playing intention and metrical structure; a consistent pattern of voice leading between both players also emerged. From the response data, no significant results emerged from listeners' identification of playing conditions. There was no significant evidence for group membership affecting identification or for a learning effect within the test increasing correct answers. Listeners' rating of performances showed a preference for the Bass Push condition and least preference for the Ride Push condition. A correspondence between synchrony within performance and groove rating was not shown in a further test.

No single mindset about groove emerged from the interview data. Players revealed very different attitudes towards both the social and musical aspects of groove; all players however described the striking of a groove as a profoundly important aspect of music making. A further unexpected theme emerged – the differences between European and American jazz musicians in their approaches to playing.

This tripartite study of groove contributes a new approach to the exploration of groove using these different sets of data about its production, perception and meaning as a central idea within jazz performance. It is hoped that this will lead to further research in understanding how musicians play 'in' time and 'with' time.



# 1. Introduction

At the heart of our understanding of music seems to lie a number of paradoxes which defy any simple explanation. Though music is essentially a social activity, our responses to it may be thoroughly private and profoundly inexplicable to others. As with dreaming, we can tell our dream to others but at the end of the telling, one senses that no-one else has remotely felt the true nature of the dream. But perhaps music is a means of telling our untellable dreams to one another. It is for humankind a principal means of defying our essential state of being alone.

While most musicians may cite their engagement with music as a way of being with others, within music psychology and musicology, there has been a tendency to focus on the engagement between the musician and the musical text in understanding how music carries meaning and weight for us. In a rather extreme form, Schoenberg articulated the idea that music can be totally objectified when he stated 'Music need not be performed any more than books need to be read aloud, for its logic is perfectly represented on the printed page; and the performer, for all his intolerable arrogance, is totally unnecessary except as his interpretations make the music understandable to an audience unfortunate enough not to be able to read it in print.' (Newlin 1980, p160 cited in Cook, 1990, p227). This tendency could be seen as undervaluing the act of coming together, which for musicians and listeners alike has a profound significance. So where is the action? This study takes as its starting point that it is in the playing together as much as what is played wherein lies the stuff of music.

In music such as jazz where the moment to moment playing has a degree of mobility not dissimilar to aspects of conversation, the idea of interaction between musicians rather than between player and text becomes a much more centrally important idea. At the extreme, one could say that the material is of interest to the player only in the sense that a canvas is of interest to an artist. It is in the doing where the music takes place. Whilst not denying the

importance of performance expression and interpretation in notated music, it is clear that the architectural qualities of a piece, the attention to music as product rather than process are much more important in western art music than to a jazz musician blowing through a twelve bar blues.

The focus of this study is towards an aspect of jazz, which many would consider the principal component in the music but which remains relatively under-researched in the literature; this is the notion of groove. The use of the term 'groove' bears some examination. The word is used in two different ways – as noun and verb. The former refers to the measured, repeating patterns that go to make up the rhythmic ground on which funk, afro-cuban, soul, r'n'b and jazz is constructed, for example 'a 1/6 note funk groove'. The second way in which the word 'groove' gets used within music is to describe how musicians seem to come together rhythmically to create an irresistibly engaging sound. The sense of this felt quality to the playing is the way in which the word is used through this study.

There is a further idea of groove. Whilst it is perfectly possible to have a solo performance of a piece that engages the listener through its rhythm and drive, there is a common expectation and understanding that groove is developed most powerfully between players. It is this interactive quality about groove that is most intriguing and enables it to stand as an expression of social coherence, musical engagement and vitality.

Many musicians are uncomfortable with the idea of uncovering the mystery of performance. They might argue that to dissect the experience of two musicians playing in time together is to miss the point, or to devalue the experience. I can understand this concern but do not share it. The direct experience of playing music and the attempt to understand some of the processes through systematic observation are not necessarily at odds with one another. They do not occur at the same time. When musicians play, they are in some way trying to forget everything they have learnt about music. However, in talking about music and trying to understand its ways, there needs to be a concern with representing what is going on in as objective a

manner as possible. This allows then for comparison; the map of the music can be drawn up in a way that may be useful for others. From the point of view of the researcher, there is a spin-off from objective analysis that perhaps musicians fail to take into account but in fact brings the researcher close to the musician's experience. That is a unique intimacy with the subject matter, something that Cook mentions in referring to Schenkerian analysis (Cook, 2004, p107), which can bring new understanding and may in its own way stimulate as powerful a feeling as the playing itself.

The approach of this project, whilst sharing similarities with a number of existing studies has been to bridge a gap between those which focus on the communicative aspects of performance (for example, Gabrielsson & Juslin, 1996), those concerned with a more experimental, controlled look at jazz timing (Friberg & Sundstrom, 2002; Busse, 2002) and studies which examine musical interaction from a more socially constructed viewpoint (Monson, 1996). While the analysis of jazz performance can no longer be said to be rare, the ambition of this work to look empirically at some central aspects of groove and its communication and also to place this examination within a broader understanding of musicians' attitudes to it is novel.



## **2. 'Three Views of a Secret': ideas on groove – its production, perception and meaning.**

### **2.i. Introduction**

There are various strands of research, conducted mainly in the last ten years, which have sought to shed light on the various dimensions of groove.

Following the outline of the whole study, this review will focus on how groove has been assessed in the literature in terms of its production and perception, and how it has been seen to be meaningful, given its grounding in social and cultural practice.

In the preface to 'Music and Discourse', Nattiez outlines his identification of an essential problem in analysis of music; that the tripartition of musical work into structures, acts of composition and acts of interpretation and the compartmentalising of much research in music leads to contradictions and fundamental problems (1990, p ix).

Whilst this study does not proclaim itself from a semiological perspective, I think it is important to engage with some of the inherent difficulties in trying to separate out the productive, receptive and structural properties of music. Whilst pointing out the problem does not by itself dissolve it, my acknowledgement of this may help in understanding my own focus on current research.

### **2.ii. Groove as a structure**

Whilst the concern of this project is largely with groove as a process and its qualitative aspects, there are a number of papers, for example Jeff Pressing's paper on 'Black Atlantic Rhythm' (2002), which primarily examine the architecture of groove and explain its power largely in terms of its structures.

For Pressing, a groove is

‘ a cognitive temporal phenomenon emerging from one or more carefully aligned concurrent rhythmic patterns, characterised by:

1. perception of recurring pulses and their subdivisions
2. perception of grouped pulses into repeating cycles
3. effectiveness in engaging synchronizing body responses. ‘ ( 2002, p288)

or as he states more simply, ‘ a groove is the temporal foundation of readily danceable music’ (p288).

He attempts to explain how Black Atlantic rhythm has had such an extraordinary impact worldwide. His explanation lies in the interconnection between a ‘groove or feel’ and a variety of overlaid rhythmic devices, such as syncopation, poly-rhythm and beat displacement which he describes as ‘higher level techniques’. The clash of the fundamental groove and these various rhythmic devices results in the establishment of perceptual rivalry on the part of the participant or listener. Perceptual rivalry is seen as having evolutionary benefits such as preparedness, the generation of emotions and the allowance of flexibility of response.

Pressing makes a compelling case for the power of Black Atlantic rhythm and his staged argument is superbly carried through but there are a number of areas which are open to question. Firstly, the explanation is sufficiently distal that it accounts for the powers of very general musical effects better than for a genre. I feel that similar arguments could be put forward to explain the power of rather different musical experiences such as gamelan. Secondly, in an argument not dissimilar to that of Leonard Meyer, Pressing puts forward the case for emotional and cognitive engagement coming through the arousing effects of rhythmic devices over a repeating figure – arousal through deferral. While not disputing the power of this perceptual rivalry in engaging our emotions, perhaps he underplays the expressive power of groove itself. Much Black Atlantic rhythm seems to me to contain extraordinary power and meaning without exhibiting ‘higher level techniques’. Pressing himself

acknowledges that the 'propulsive entrainment of rhythm' can do much to explain emotional arousal.

Finally, and this leads into the major part of this review, Pressing focuses too little on the processual nature of a groove. It is the 'how' as much as the 'what' that engages our attention. He gives relatively little thought to the micro-variations in groove which following Keil (1995) are often referred to as 'participatory discrepancies'. These minute variations in the placement of notes both as inter-onset intervals in one player and discrepancies between players may have much to contribute to any discussion of the power of groove in particular and musical cohesion in general.

### **2.iii. Timekeeping as fallibility and control :**

#### **drift, a/synchronisation and control mechanisms.**

As stated earlier, groove can be seen as structure but it is as a process that is of concern in this study. The moment by moment playing that takes place in a jazz performance is rooted in the timing qualities flowing from the rhythm section, particularly the bass and drums.

The nature of time and timing in music has been treated in the literature across a range of perspectives from philosophical speculations on musical time such as those of Kramer (1988) and Epstein (1995), its control and execution (Shaffer, 1984; Palmer, 1997) to its fundamental role in expressive behaviour (Repp, 1998; Laukka & Gabrielsson, 2000). From a philosophical perspective, Kramer (ibid) considers the dual nature of time in terms of its subjective and objective qualities. He cites J. T. Fraser in developing an argument that time cannot be bound by the law of contradiction; it is capable of being something and its negative at once (ibid, p2). Although Kramer and other writers on time have been primarily concerned its expression in the western art canon, it is possible to see this duality manifest also in groove with its apparent continuous motion as well as the 'objective' set of discrete hits from which it is made up.

However, this survey is concerned less with philosophical notions of time than the rather direct relationship of timing to groove; in particular, the degree of control that performers can exert between them or the extent to which the participatory discrepancies that Keil describes may simply be some form of mildly expressive noise.

### **2.iii.a. Drift and a/synchronisation**

There are some different features exhibited in human timekeeping that are of particular interest in looking at the relative amounts of control and random noise in groove. Firstly, two rather negative aspects of timekeeping that are relevant to groove; drift – the departure from stationarity in the timekeeping of one performer and asynchronisation – the degree of separation between performers in their playing together. These two terms can be seen as horizontal (drift) and vertical (asynchronisation) descriptions of timing processes.

Drift is a well documented yet not so well understood feature of *isochronous interval production* or ISIP, the oldest study being that of Stevens (1886, cited by Madison, 2000, p98). Perfect ISIP can be seen as the principal attraction of the metronome for musicians' practice. Madison (*ibid*, p109) has commented on the increasing importance for musicians of pulse stationarity in performance as contemporary music has become economically and aesthetically bound by time codes produced by machines. This has had enormous implications for how musicians, particularly drummers and bass players, see their own timekeeping increasingly with reference to machines. From a broader cultural point of view, the degree to which musicians move nearer or further away from machine-like time may hold consequences for listeners who have become used to fairly inhuman precision in song recording.

The impact of learning on drift though is in evidence from a number of studies which show that musicians or trained participants can minimise deviation from

a stationary pulse (Gerard & Rosenfeld, 1995, cited in Wohlschlager & Koch 2000, p117; Wing, 1980).

The correspondent aspect of asynchronisation to drift is known as synchronisation error (SE). In both cases, there is a clearly observed divergence from the intended consequence of the action. In the case of asynchronisation, SE is the well-known feature of subjects performing an action ahead of an auditory pacing signal. Perhaps the most significant aspect however is the reduction in resulting SE when auditory signals and movement are used to structure the intervals between pacing signals. Wohlschlager and Koch (2000) have commented that in fact, SE could be seen as an effect that only occurs in the laboratory. Musicians use movement, internal counting of subdivisions and the audible subdivisions in playing to minimise this effect to a considerable degree. The significance in their study is perhaps just as much about the nature of controlled experiments in making judgements about the real world as the effect of learning on timing.

### **2.iii.b. Control mechanisms**

From consideration of general models of human fallibility in timing, I turn to models of control which have been put forward to explain the timing skills required in performance. This is clearly a very significant area of research and it is beyond this study to attempt a comprehensive analysis of the literature. I think however it is important to refer to these models in attempting to look at micro-timings between players for a level of explanation.

The psychological study of musical timing has been an attempt to understand the processes by which individual musicians turn thought into deed. These processes are still little understood and there is no single consensus (Gabrielsson, 1999, p516; Summers, 2000, p3) on this central aspect of performance. The central divergence of view hinges on whether control is proscribed by some sort of timing mechanism which coordinates movement or whether more distributed mechanisms which interact together (dynamic

systems) best account for timing control. The latter view can be characterised as being part of a movement away from pure cognitivism towards a more embodied description of cognition (Lakoff & Johnson, 1999; Varela, Thompson & Rosch, 1991; Iyer, 2002).

Both models have some empirical weight behind them. There have been a significant number of studies that have been influential in the development of the timekeeper model (Shaffer, 1981; Vorberg & Hambuch, 1978; Wing & Kristofferson, 1973). Evidence for this comes mainly from reproduction tasks where subjects tap normally at the level of the tactus. Typical experiments use a period of beat induction alongside a metronome and then the subject continues for a period without a pacing signal. The variance in performance (drift) has been put down to the lack of precision in the internal timekeeper (Palmer, 1997, p129). Within the timekeeping approach, there is little consensus about whether a central mechanism or a number of clocks working together is the most appropriate model.

The programming clock has been the dominant model for coordinating movement but as Clarke & Davidson comment,

‘ The preponderance of a radical mentalism has resulted in listeners and performers being regarded as information-processing devices, with inputs and outputs coming to and going from a central ‘unit’ which is located firmly in the head and which has little connection with anything as physical as an arm, a leg, a hand – or even an ear.’ (Clarke & Davidson, 1998, p74).

More recent attempts to remodel control have been influenced by the work of Haken (1983) in developing synergetics as a basis for explaining complex systems. This has led to ways of modeling timing behaviour known collectively as the dynamical systems approach. Whilst timekeeper models are time discrete, the oscillator model of the dynamical systems approach looks at movement patterns themselves (Peper et al, 2000, p37). There are a number of significant contrasts between the two models. Principally, the dynamical systems model is non-linear and has developed complex mathematical tools

to look at movement coordination. It appears also to be capable of building links between neural processes and rhythmic movements (Beek et al, 2000, p26) in a way that motor programming does not and as such could offer a more coherent account of the way in which movement is coordinated.

## **2.iv. Timekeeping as perception**

Perhaps perversely, this survey goes on to look at input after examining output. In fact the separation of the two; 'which came first, the action or the perception?' may be a false distinction (Eck et al 2000, p157). As with production, the perception of rhythm and timing is a large subject. This review will only pick up on a number of points in the literature that are of most relevance to groove.

Crudely put, rhythm and timing can be distinguished by whether they can be effectively notated or not. Rhythms tie in to formal structures through grouping and metrical mechanisms whereas timing is a matter of how this is done. Rather more elegantly, Clarke (1987b cited in Clarke, 1999, p490) has used categorical perception (CP) as a psychological model for distinguishing between rhythm and timing. This ties in with the central idea of compression and separation in CP whereby difference between groups is highlighted and difference within groups is compressed. If rhythm is built up according to Fraisse's model of long and short durations (1982), this corresponds to the idea of 'difference between' and tends towards being categorically separated; similarly, timing could be seen as a feature of within category difference and so tends to be compressed. It is this compression that perhaps allows focus on the larger units of time within music. This does not mean that we are immune from picking up on the gradual, continuous amounts of difference within, for instance, a ride cymbal quarter note pattern. Research seems to indicate that listeners are sensitive to fairly fine gradations of timing (Kendall and Carterette, 1990; Clarke, 1989). The sensitivity towards small difference is described in literature on perception in terms of thresholds and is a central feature in this study. Two auditory thresholds appear significant in groove,

those for interval duration and the order of quasi-simultaneous sounds; in other words, periodicity (length between onsets) and phase (the relative placement of onsets) discrimination thresholds. In both sorts of threshold, there appears to be a degree of agreement that 20 ms and above will see 75% likelihood of correct identification (Repp, 2000). Hirsh's work (1959) on discrimination of temporal orders and Friberg & Sundberg (1995) on interval discrimination are both frequently cited as further support of this. However, these studies have tended to focus on highly controlled, stationary tempi. In this study, synchronisation with non-stationary periods is more relevant. By allowing small continuous changes in a pulse, Hary and Moore (1987) seem to have established that subliminal compensations do occur; that changes in pulse intervals below the threshold for perceiving interval duration do seem to be allowed for in subjects. Repp (2000) points out that this experiment and others have not ruled out phase error correction as opposed to interval duration detection as the key to synchronisation with a changing pulse. Repp's own study concludes that temporal order thresholds do not limit phase correction and that there appears to be 'a level of highly accurate temporal perception subserving motor control, which precedes the level of conscious perception and judgment' (2000; p139). In other words, a fine level of temporal perception can take place without awareness.

The focus of much research in time perception has centred on controlled experiments on discrimination of temporal sequences (Warren, 1993), hierarchies of pitch and rhythm (Lerdahl & Jackendoff, 1983) and models of attending (Jones & Bolz, 1989). However, models of time perception in real world playing have been less in evidence. Jones indirectly points to this problem in looking at the paradox of how subjects can and do metricate musical time despite the fact that true metrical precision is only available when performed by machines. Humans introduce an element of flexibility and variation in time production and similarly have to make sense of this in time perception. Further, not simply the variation from a norm but also the interaction between players is going to add to this complex picture. A central feature of much research in this area is the central dilemma for so many researchers, the degree to which control is lost at the expense of the data

being ecologically sound. This project is looking to shed more light on timing perceptions but using rather more real world input. The following section looks at two papers that also look at timekeeping between players within a more 'real' environment but from differing standpoints.

## **2.v. Investigations into musicians in time together**

As Clarke (1999, p496) states, there is still a considerable amount of work to be done in looking at models of musicians playing time together. This review moves on to two such papers, each with a very different perspective but which both focus on ways of examining micro-timing in performance. Both are of interest not only for their link with my own study but for their very different take on playing together.

Rasch (1979 & 1981, cited in Rasch, 2000, p75) has looked into synchronisation between performers in various small groups within western art music but his findings are of relevance to a study of synchronisation between jazz players. Not only Rasch's findings but his methodology are of interest.

Two issues come up with regard to his methodology. Firstly, the question of where onset takes place. Rasch distinguishes between actual and perceptual onset. Instruments with a definite attack can be compared for onset relatively easily but in the case of bass and ride cymbal, the difference in the rise times of the two sounds does not make for an easy comparison. Rasch gets round the problem by suggesting a threshold for the perceptual onset that he takes to be around  $-15$  dB below the average peak amplitude of the sample. But as he comments, this is a quasi –arbitrary estimation of where perceptual onset lies (2000, p81). The positioning of the listener, auditory acuity, actual onset variations caused by noise in the motor control will all affect this notional point. This will be discussed later in relation to my own study.

His measurements of synchronisation between performers in three separate classical trios were taken through a series of calculations leading to figures for mean asynchronisation for each ensemble per composition. Rasch's findings suggest that synchronisation is affected by a number of factors. Firstly, that differences in rise times may tend instruments towards asynchronisation, secondly, that faster tempos correlate with tighter synchronisation and finally that according to musical role, certain instruments will consistently lead or lag behind others; typically instruments articulating the melody will be ahead of bass instruments.

By contrast, studies of synchronisation in jazz suggest a difference in the timing relationship between the soloist (effectively the melody line) and the rhythm section. A study by Ellis (1991) found two interesting results that directly contradict Rasch's study. Firstly, that the lead instrument (saxophone in this case) was consistently behind the beat by between 10 and 70 ms – clear evidence of a delay in the onset of the lead line and secondly, that asynchrony rose with tempo which again is in contrast with Rasch's data. Whilst there were differences in the recording methods which might account for these different sorts of tendencies, Ellis' findings do seem to correspond with anecdotal descriptions of melody lines in jazz often tending to be behind the rhythm section (MF, drummer interviewed for this study, 2005).

An explanation for why this should be presents more difficulty. Although Collier and Collier (1996) cite mechanical rather than intentional factors in influencing the correspondence between greater lag and higher tempo in saxophonists, this does not explain the general tendency for horn players to phrase behind relative to the rhythm section. If indeed it is the case that this happens across most jazz sax players but not in classical contexts, then the explanation must lie in the stylistic intentions of the player.

A study by Progler (1995) is the closest to my own in attempting to pin down some of the ideas on groove within a rhythm section. Progler purports to demonstrate four points in his study, ' First, participatory discrepancies can be found in musical performances, and these discrepancies are observable at the

sub-syntax level. Second, participatory discrepancies can be measured quite precisely. Third, the amount of play appears to depend on the individual and the context. Fourth, we can begin to make quantitative descriptions of individual performances and get closer to describing personal styles in tangible ways.' (ibid, p49).

The most significant point is the fourth one. Is it possible to create descriptions of individual's ways of grooving and more importantly, can one describe personal styles in tangible ways? Progler's study certainly captures some interesting data about musicians playing with one another but the sample appears too small to generate more than observations. The widely held notion that the ride cymbal consistently is placed before the bass seems to have been confirmed by most of the playing but one drummer in the study consistently 'swung' and yet played behind the bass.

None of the players invited to take part in the study played live. The only examples of live bass and drum pairings were those taken from a commercially available play-along record. Most of the playing was done with pre-recorded bass or drum tracks which themselves were recorded with a metronome click. This had the advantage of making it easy to mix up different combinations of bass and drums to examine different playing relationships but it does beg the question of to what extent the performances were valid, each being quite different from usual live playing with another.

## **2.vi. Roles, groups and cultural process**

From studies that have focused more or less exclusively on timing, I move out to a broader look at ideas of interaction and social groups that may bear some relationship to the notion of musicians grooving together.

Blacking (1973, p98) proposes that 'an analysis of the sound cannot be conceived apart from its social and cultural context. ' and I believe it is a profound comment on how music is to be viewed; however, the various

disciplinary perspectives on music performance enjoy different degrees of success in reconciling sound structure with social structure. Within social psychology, a succession of paradigms has sought to explain social being and some of these will be examined here. While the battle may have been largely won over the last 40 years in asserting that musical sounds cannot be isolated from the milieu in which they are shaped and presented to the world, what is less clear is how in the moment playing can be linked with larger social forces in any meaningful way.

Certainly within music psychology, it is well recognised that the human interactive element of music may have been neglected in favour of more intrapersonal examinations of playing (Davidson, 1997, p209) and in a recent review of psychology papers and monographs by Gabrielsson (2003) the organisational structure of the review (ibid, p223) did not mention any group or interactive category of music making. While it is clear that ethnomusicology and sociology may have more to say on larger cultural shapings of music, it remains surprising that theoretical perspectives on interpersonal and group processes have remained so little used in looking at musicking within psychology.

### **2.vi.a. Group theory**

The accomplishment of groove within group performance, though bound up with the immediate consequences of bodily movement and sensitivity towards time, must also in some way be bound to social structure. One can look to a number of theoretical positions that reflect on how the social positioning of an individual may have impact on any tasks that the individual is to carry out.

Social psychology tends to distinguish between interpersonal and group dynamics although these are interwoven into most day to day interaction and should be viewed as lying on a continuum rather than being opposed positions (Brown, 2000, p6). Group theory from the time of Lewin (1952) has been largely reductionist, that is seeing the structures of groups built in terms

of individual or interpersonal cohesion but more recently, theories of social cohesion have developed away from seeing groups as merely interpersonal relations writ large and attempted to distinguish between interpersonal and group attraction. The question is how and whether such theories are of any help in explaining how a purely musical cohesion such as groove has any correspondence with group cohesion.

There are some areas of group theory that may be relevant. Firstly, the idea of self-categorization and its link with group performance. Categorization theory describes the tendency to accentuate similarities within a group and to accentuate difference between groups. The prototypical qualities of the group are also embodied to a greater or lesser extent within the individuals of that group (Turner, 1985). Self-categorization therefore accounts for conformity to group norms. It also allows for a distinction between interpersonal and social attraction (Hogg, 1992, p100). Both can be personal in the sense that they describe how individuals may be attracted to one another. The difference lies in interpersonal attraction being idiosyncratic whereas social attraction between individuals is developed out of group processes of conformity, stereotyping etc. The attraction is depersonalized. That is, the level of self identity changes to one based within the group (being depersonalized does not mean loss of identity, simply a change in the level of identity).

If cohesion between members of a group can be explained more in terms of social attraction rather than interpersonal attraction, this might in turn explain how musicians can work together in an extremely tight social environment, show extraordinary cohesion in performance and yet apparently not feel interpersonal attraction (Tomes, 2004). Attraction to the group may be promoted within an individual member through the group being successful, the quality of the music making, the stylistic area that the group work in more than any particular interpersonal attractiveness between players.

Taking this further, could there be a tie between group cohesion and the quality of a group's grooving? The link between productivity, and the social cohesion between group members has been the subject of considerable

debate (Mudrack, 1989, cited in Hogg, 1992, p144). There is no simple correlation and beyond that, no explanation of where cause and effect lies (productivity leads to greater group solidarity or vice versa). There are however suggestions that where good performance and cohesion do show an association, it is in groups where there is an internalized norm within the group towards success and productivity. In other words, cohesion itself is no recipe for success without success itself being seen as having a positive valence within the group (Greene, 1989).

Within a jazz group, there are multiple, simultaneous intra-group identities that may shape the cohesion of the playing; being part of a group, belonging to a category of player such as bassist or drummer, being part of a rhythm section, identifying oneself or others as belonging to a 'cohort' of great players. All these different groupings may play a part in shaping how the work at hand is going to be accomplished.

### **2.vi.b. Structuration and symbolic interaction**

Group theory may have some uses in identifying properties of groups and how individuals develop their social being within the norms of that group. There remains however this fundamental problem of how to reconcile the larger forces at work within social structures and the routine interactions that take place in people's everyday lives. This has been a longstanding criticism of much group theory. Developed by Giddens, the theory of structuration is an attempt to bridge the macro and micro levels of social behaviour. Through structuration, Giddens does provide a theoretical link between these ways of seeing social life. Structuration is built on the idea that social systems can be analysed by examining 'the knowledgeable activities of situated actors who draw upon rules and resources in the diversity of action contexts,' (Giddens, 1984, p25). A further important idea within structuration is the degree of consciousness involved in the everyday. Giddens distinguishes between discursive consciousness, practical consciousness and unconscious motives. The way in which jazz musicians engage in groove seems to

characterise much of what Giddens means by practical consciousness and discursive consciousness. Particularly, how musicians engage in such complex and subtle activities without necessarily feeling the need to make explicit the doing of them seems to reflect some of Giddens' thought about the links between the everyday and its hinterland.

Whilst structuration is clearly a more sociological account of individual action within society, Giddens' work also points to the work of the symbolic interactionists as they too, from a social psychological perspective seek to explain human agency. Symbolic interactionism was developed out of the work of Mead in the early part of the last century but became widely accepted only in the last 50 years. The self is no longer seen as independent but rather is produced through our interactions with others and on that basis continually modified. Of all the writers whose work has developed from the ideas of Mead, it is Goffman who may be most relevant in that he was particularly interested in face-to-face interactions.

The writings of Erving Goffman (1959, 1967 & 1986) present an analysis of individual activity that may have some bearing on musicians' work. His ideas of interpersonal relationships centre on the way in which people present themselves to the outside world. The vigour of his argument lies in his sense that the roles that people play are in some way theatrical; that they may not be what they appear to be and may contain elements which are invisible from the onlooker. From the point of view of musicmaking and grooving, these sorts of ideas bring in to the frame, the degree of authenticity that musicians may bring to their performance and how authenticity is achieved. In this respect, Goffman's work provides a useful stepping stone for an analysis of how musicians present themselves to each other and their audiences. His ideas may offer insight into the way musicians present both themselves and their work in the sense that he privileges the idea of identity, a fluid description of self over the more fixed idea of personality. Goffman's work forms part of a wider social constructionist view of identity that hinges on how it is formed through interaction. The problem that I have with Goffman's work in relation to music lies in whether his dramaturgical analysis works quite so well in a real

performance. Much of the power in his writing comes from the drama metaphor applied to very mundane situations; his writing about 1950's America and its preoccupations with social image is apt because he draws the veil aside (his writing style is reminiscent of Eric Berne's psychodynamic view of transactions). While not disputing that there is always some sort of social act being performed, the power of music may very well lie in its allowing some moments of escape from playing a role both for audience and performer. In the end, Goffman's work seems unduly pessimistic for an act of communication that is so fundamentally optimistic.

It is in the work of Alfred Schutz (1967) that there may be a less bleak view of the way in which musicians manage to work together. Beyond his theorizing of social interaction in general, Schutz was also interested in musical interaction as a unique case and therefore able to shed light on more general ways of being together. He points to a particular problem in understanding social relationships,

' .....whether the communicative process is really the foundation of all possible social relationships, or whether , on the contrary, all communication presupposes the existence of some kind of social interaction which, though it is an indispensable condition of all possible communication, *does not enter the communicative process and is not capable of being grasped by it.*'

(my italics)

(Schutz, 1964, p161)

Schutz refers to the interactive condition as a 'mutual tuning-in relationship' or the way in which the 'I' and 'Thou' become 'We' and he makes use of an analysis of musical experience between composers, performers and listeners as a means of clarifying this condition.

Schutz examines the musical tuning-in essentially through two means. One is to distinguish between inner and outer time (subjective and objective) and the second is the distinction between the polythetic nature of musical meaning – that which cannot be reduced to a single outcome and the monothetic nature of conceptual meaning – that which can be truly articulated as a whole. In

other words, it is the step by step process itself, 'this living through a vivid present in common...which is at the foundation of all possible communication.' (ibid, p173).

Returning to his question of whether the tuning in between us is a precondition of communication or created by it, raises interesting questions about the nature of groove. Is the mutual grooving that can take place in so much music an act of communication or the pre-condition for communication, that is, musical expressivity to take place. Is it best described as the ground on which musical expression can be shaped or does it itself mean things? As well as being an outward measurable expression of time, groove is also the expression of inner time, the shared living of the 'vivid present'.

### **2.vi.c. Interaction within music**

From broader theories of social interaction, I turn to studies focused on social processes within music groups. Atik (1994) and Faulkner (1973) have looked at issues of leadership in orchestral settings but closer to the point of this study is the work on small groups. Both Murnighan and Conlon (1991) and Davidson and Good (2002) have looked at the social and musical relationships in string quartets. Both studies point to the close fit between interpersonal and musical factors in the production of a performance. The second paper gives an example of how interpersonal dynamics and musical process collide. Davidson and Good highlight the way in which interpersonal material is woven through the fabric of a performance. Moving away from string quartets to studies directly applied to the work of the jazz group, Reinholdsson (1995) has developed a comprehensive interactionist perspective on performance. As symbolic interaction theorises on how people continually adjust their actions in the light of others' responses, so Reinholdsson's study of both a trio and jazz quintet investigates how such responses inform further action and how such action is taken to be meaningful. Action in contrast to behaviour thus has this pivotal position in the construction of self (Becker & McCall, 1990, p3).

From a methodological point of view, Reinholdsson attempts to reflect the problems of handling field data by turning to an emic/etic dialectic. Broadly, the emic/etic distinction problematizes the nature of much enquiry in social sciences with its focus on the subject/object, observer/observed relationships. Using both emic/etic approaches to performance analysis, Reinholdsson attempts to return to the more intertwined relation between the two terms envisaged by the linguist K.L. Pike (Pike 1954/67 cited in Reinholdsson, 1998, p77) who set out the initial use of the terms.

From analysis of individual group workings, this review turns to the most complete panorama of the jazz musician's social world, 'Thinking in Jazz' by Paul Berliner (1994). Although much of this exceptionally detailed chronicle of jazz life is involved in areas outside this study, Berliner devotes a considerable portion of the volume to the collective aspects of jazz. It is the breadth of Berliner's scholarship that is most impressive. Using interviews with musicians both in Chicago and New York taken over a substantial period, Berliner has assembled a vast array of ideas and quotations from a large group of musicians; in this respect, he defines a unique feature of his work as being "its involvement with a large enough pool of participants to portray the diverse and complex texture of the larger community they represent." (p5). His book certainly captures many of the musical and social themes which emerge from the community of American jazz musicians and which hitherto have not always been readily understood by those outside that world. The principal themes develop around the learning that needs to precede competent improvisation, how that learning has traditionally taken place, the development of the soloist's skills, and finally the equally important ideas on collectivity and interaction between musicians. The number of players interviewed across a whole range of subjects gives the book an encyclopaedic quality.

The aspect of Berliner's work that appears less satisfactory may be more a reflection of the tensions between the disciplines of psychology and anthropology than a deficiency in the book. Although the work offers enormous breadth of vision, the tendency to accept without question the comments of musicians (buying into the ethnographic protocol of taking

answers as they come) from a socio-psychological viewpoint leaves too many questions unanswered. Given the place of jazz musicians in the larger arena of American society, and given the racial tensions, the sometime awkward position of the music within a dominant and often hostile culture, one might expect a more questioning response to many of the answers that Berliner received. One is tempted to ask whether the fact of Berliner being an amateur jazz musician might have in part led to an unquestioning approach which occasionally could stray into a sort of hero worship. Finally, in contrast to both the works of researchers such as Monson and Reinholdsson, there is a lack of a theoretical framework. The depth of descriptive writing is unquestioned but there is no coherent sense of explanation for the described practices and attitudes and no questioning of such practices. As an introduction to the world of the jazz musician, it may be unparalleled but as ethnography, it sometimes leaves too much taken for granted.

## **2.vii. Groove as a messenger**

The final part of this review looks at the way in which groove can be seen as carrying meaning. In the context of this study, I see meaning as being forged between the control of micro-expressive timing, such expressive variations being picked up and responded to by listeners and the broader cultural milieu in which this exchange takes place. I have focused particularly on the writings of Leonard Meyer, Charles Keil and Ingrid Monson as exemplars of very different approaches to musical meaning.

The question of how music can carry meaning and emotion for us is obviously one of deep significance for anyone engaged in the production of music or commentary on musical life. A musical feature such as groove simply must be meaningful in some way to musicians and listeners alike otherwise why would musicians fuss over it, audiences delight in it and commentators attempt to analyse it, yet the idea of groove carrying meaning is at odds with much of the literature.

The question of meaning has been seen to lie on a continuum between two poles; one at which music's meanings lie immanently within it and the other where music is seen as meaningful only through the arbitrary cultural codes imposed upon it - it can mean anything because it essentially means nothing (Shepherd & Wicke, 1997, p21). A second bi-polar description of the meaningful relationship of people to music concerns the distinction between the intra-personal effects of music and music as part of a set of shared cultural values. This could be seen as a further description of the divide between seeing musical as personal, emotional engagement (the traditional musicological view) and music as a socially constructed discourse where meaning is shaped by wider social forces.

How music means things to people is of course more than just a question of its emotional impact. Emotional engagement with music may be seen as a subset of its carrying meaning for us – formal meaning, contextual and historical meaning are all ways in which listeners may try to make sense of the sounds they are hearing. The emotional and 'feelingful' impact of music's sounds however is usually taken to be the key ingredient for most people (Sloboda, 1985, p1). One of the most influential theorists in understanding musical meaning and feeling has been Leonard Meyer.

### **2.vii.a. Meyer and embodied meaning**

Developing out of earlier studies of musical meaning, for example, Langer (1951), the work of Meyer (1956) lies firmly within a psycho-musicological framework of investigating music's meanings and is an attempt to reconcile the formal and referential positions. He looked at how musical meaning may be derived from the expectations set up by the relationship between musical events; this he termed 'embodied meaning' as opposed to referential meaning which is used to indicate how music can mean things outside itself. Meyer's success lay in accommodating both formal and expressive positions by proposing that emotional significance lay in the very structures of the music.

Although Meyer's theories have been highly influential and represent a powerful statement about the relationship between musical and emotional life, there are two principle objections, one, being general and the second as his work might apply to groove. Firstly, as commented on by Cook and Dibben (2001, p58), certain writers have doubted 'whether Meyer's theory can properly be considered as pertaining to the emotions at all,' in that his work really points to "undifferentiated affect" rather than the specifics of emotions as people might normally understand them such as sadness, happiness, fear etc. It is the intentionality of our separate and specific emotions that is not fully realised in his account of musical meaning. Pertinent to groove is the privileged position that Meyer (and indeed most writers on the subject) gives to musical structure. Crudely put, the more profound the structure, the more the music could enable a profound emotional response; the more sophisticated the melodic and harmonic tensions, the greater the deferred gratification and final sense of resolution. Clearly, an identification of structural complexity with depth of feeling rules out not only most music but most people out of the equation. Whilst it could be the case that most music and people are insufficiently profound to absorb emotional meaning from complex music, it seems much more likely, given the universality of music, that the inadequacy lies in the analysis rather than the analysands.

### **2.vii.b. Keil and participatory discrepancies**

Ethnomusicologist, Charles Keil, has proposed a theory of 'participatory discrepancies' (PD's) which emphasises process over product, feeling over meaning and the idea that it is in the messy relativity between musicians that 'real' music gets made (1995). Keil's ideas came out of his own concerns that theories of meaning in music, for example Leonard Meyer's work, worked well for the western musical canon but failed to account for the profoundly affective aspects of structurally simple music. He gives the example of a well known jazz drummer playing  $\frac{1}{4}$  notes on the ride cymbal and how 'In the hands of a master... straight four technique may be dull as dishwater syntactically but electrifying as part of a process.' (Keil & Feld, 1994, p61). It is an important

point in redressing the balance in so much study of music away from music as object and to music as performance.

Keil's use of the word 'participatory' is more than just the idea of musicians playing together. It tries to capture the sense of engagement that groove processes engender in a way in which the more analytical attending to music perhaps does not (Keil & Feld, 1994; p96). Participation is part of a struggle against alienation. The 'discrepant' part of PD's is more a paean to imperfection. This hymn of praise may be down to two distinct protests in his writing, both aspects of the civilizing process. Firstly, the sense of music in the west that is as a structural object, represented in a performance which aspires to perfection and secondly his rage against the machine. Keil was formulating his ideas just at a time when sequencing software had begun to have a massive impact on music production and I feel his writing overall is an attempt to justify how music feels when humans play rather than machines work.

A concern over Keil's arguments for establishing the idea of PD's is failure to distinguish between an argument around aesthetics and cultural worth on the one hand, and universals of performance on the other. Whilst he is totally correct in making the case that theorists of musical meaning fail to acknowledge prosody in performance in the way that they acknowledge syntax, this does not mean that any theorist of musical meaning would deny that micro-timing in performance exists. Keil may have been one of the first to frame expressive micro timing in groove but to claim these as 'discoveries' and his work as a 'theory', unless I am missing the irony, seems to be working it too far. The significance of these constant variations of timing is surely not in their existence but in how they may pattern grooves in particular ways, and may also describe particular individual's style, not dissimilar to Clynes' work on composers' pulse styles (Clynes, 1986).

The multiple tensions between the musicological close readings of a musical text and more social, broader analyses of music life may have been reduced since the development of 'new' musicology and the attempt to reconcile music with its social/cultural context. For jazz and non-notated musics, the problems

of highly structural approaches to music, however, have remained a bar to fuller understanding.

### **2.vii.c. Monson and intermusicality**

Ingrid Monson's 'Saying Something' (1996) is an attempt to bridge this divide between close reading of musical text and a broader understanding of identity, cultural meaning and discourse. Monson therefore presents a very different account of musical meaning, one that is grounded in language and understood much more as a social phenomenon. While the bulk of Monson's work is framed around an ethnotheoretical account of jazz – musicians constructing their own ideas and accounts of their life, this is framed by multiple discussions of cultural and social theory. The single element of Monson's study that is reworked through the book by reference to language, cultural identity and musical engagement is the idea of interaction. Interaction is presented as having a number of levels; music itself is obviously shaped by it, social networks change through it, and cultural meaning and ideology are developed through it.

The relationship between language and music is clearly a tangled one; linguistic theory itself has been used to describe musical structure from a psychological point of view (Lerdahl and Jackendoff, 1983); new musicology has invested heavily in the structural language of critical theory where text and discourse are often the currency for descriptions of music and finally, in everyday life, the vernacular descriptions of music are often tied to it being like language, ie, its storytelling qualities.

Monson has two distinct but important points to make about the relationships between music and language. Firstly, that the mediating role of language in the production of ethnographic research data is a powerful and highly constructing one. Her point is really about the problems associated at root with ethnographic work; that the transcription is not value free. Even in an area of research such as jazz, in which Monson is very familiar with the territory, there are substantial problems of reporting data not simply in terms

of the faithfulness of transcription but the more charged area of the relations between language and power within American society.

Her second point relates not to the problems of language in methodology but the more central discussion of her book which is the question of the metaphoric relationship between language and music. This relationship has been a central theme in musicology and music psychology. Her argument develops around the idea that cultural activities can exist in figurative relationships with one another (for example, conversation standing for jazz improvisation) and that these relationships exist on two metaphoric levels. Firstly as structural metaphor; she cites the example of players picking up and imitating a phrase played by a soloist (the structural aspect being how these musical voices fit together), and the textual metaphor, an indication of the feeling of the conversation between the players of inclusion, shared values, community etc. It is in this important idea that a core idea of her book emerges; how relationships between musicians occur simultaneously as in the moment musical discussions and also as 'the cumulative construction of cultural feeling and tone over time' (p77).

But Monson also develops from this idea of the figurative link between music and language, the notion of 'intermusicality' which again borrows from textual criticism. Although seeing non-notated music as text creates considerable difficulties, the relational term 'intertextuality' used initially by Kristeva is borrowed to promote the idea that a musical work is not solely of itself; it is constantly linking and linked to other musics. Monson looks at this to illustrate the tensions in jazz between saying something new and acknowledging the past.

## **2.viii. Summary**

This survey has attempted a broad look at some of the different models of examining production, perception and meaning in groove. The trends over the last few decades in music research have tended towards more holistic views of musical process; greater emphasis on embodied cognition (rather than top-

down, input-output models), an increasing awareness of the importance of the interactive in music, and developments leading to a sense of musical meaning being framed by cultural context.

Despite these unifying tendencies, there remains a gulf between separate sub-disciplines in trying to account for meaningful musical experience. There are of course good reasons for research focusing on particular aspects of a musical feature and the difficulties of tying together very different data can appear overwhelming. The remainder of this study does not claim a unified theory for music performance but has attempted to bring some of these disparate areas of research together in one paper.



### 3. Aims and research questions of this project

When jazz musicians talk of the special moments in their playing careers, they may refer to a particularly fluid solo, an unusually rapt audience, a fleeting moment of telepathy between players or being transported by a surging groove. In the literature on jazz across disciplines, there has been a tendency to focus on improvisation and the swing (long-short) rhythm that characterises much of jazz playing at the expense of collective groove. This study is in part an attempt to redress this balance and comes out of my own sense that whilst many aspects of groove can appear inaccessible, there may be underlying patterns of playing and reactions to playing that can help in understanding this process.

As the literature review shows, there are many theoretical approaches to viewing groove. The examination of how musicians may play a groove together could be seen to lie at an intersection between a large number of research areas, any one of which could capture some of the essentials involved in making music that grooves; the investigation of temporal neural processing, rhythm perception and production, the study of emotion and meaning in music, musical structure and style, personal interaction, group process, broad socio-cultural mechanisms and so on.

Many musicians cite the relative positions in time of the different instruments as having an effect on the groove (Collier & Collier 1996, p118). Within the literature on jazz, some musicians have attempted to define this positioning as some sort of creative tension (not being together) whilst others have seen it as an attempt by the musicians to be as close in time (synchronised) as possible; two obviously different perspectives. Some musicians appear to think quite consciously about the manipulation of time when they play with others (being in front, behind or right on the beat) whilst others talk of being oneself and not trying to think too much about one's relation with others. With these quite divergent views in the professional community of jazz players, this study asks

a number of research questions whose answers may shed some light on how groove seems to be worked towards.

- What particular timing patterns take place between a drummer and bass player?
- How effectively can musicians manipulate their position relative to the pulse or each other? Can this be described as conscious control?
- What effect do these positions have on the feeling of the music? Can musicians communicate these subtle shifts to each other and listeners?
- Do these subtle shifts carry any meanings for listeners? Can they be felt as more or less groovy?
- How can the experiences of musicians in their working lives inform any detailed timing data from the above studies?

The aims of this study are to reflect two sets of data, quantitative and qualitative one off the other as a means of gaining insight into this complex process.



## **4. Methodology**

Data collection has been tripartite and has been developed using a flexible design strategy. Whilst, there were some clear research questions, the essentially exploratory nature of this project led to the need for a design that could 'roll with the punches'.

At the centre of this project are two separate studies yielding quantitative data, one to focus on the productive aspect and the other to shed light on the perception of groove. In effect, each was looking at two poles of a musically communicative process. These two studies have been framed by a third set of qualitative data taken from interviews, undertaken to frame the quantitative analysis within a broader context. Each study will be described in detail below.

The three sets of data were:

- i. Study of timing control and synchronisation between a bass player and drummer.
- ii. Study of listeners' perceptions of the playing of the bass/drums pair.
- iii. Interviews with jazz musicians.

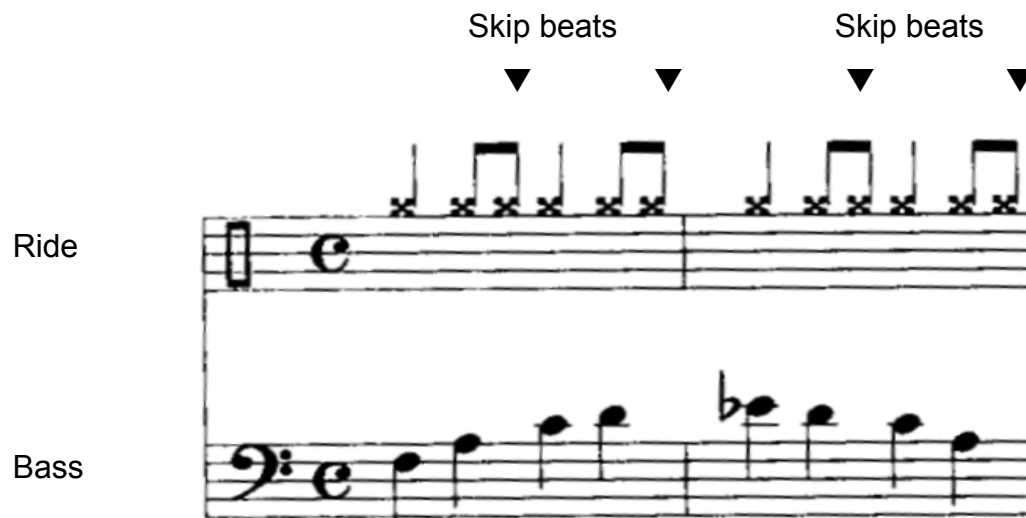
### **4.i. Study of timing control and synchronisation**

#### **4.i.a. Participants**

A pair of musicians; my regular playing partner, RM, on bass and myself as drummer, played the performance samples. Playing was done over 2 meetings in my home.

#### **4.i.b. Musical material and instruments**

The choice of material to record followed the example of similar studies (Progler 1995) in that I chose a 12 bar blues played with a jazz feel; that is a walking bass line and jazz ride cymbal pattern similar to that shown in Fig. 1.



**Fig. 1 Example of typical Ride and Bass Pattern (from Monson, 1996, p54).**

This song form has a number of characteristics that make it a suitable choice for this sort of study. The blues form is centrally situated within the jazz repertoire and for most experienced jazz musicians, the chord progression of a blues is absorbed to the point where it feels almost innate. It was important for the study that the material felt comfortable to the musicians and did not require preparation in learning.

The tempo chosen was 120bpm which would be regarded by many musicians as a slow-medium tempo for this sort of material. Stylistically, both players were referencing contemporary jazz playing in that there was some limited freedom to move away from the walking bass line and ride cymbal pattern as shown in Fig. 1. MD played a ride cymbal while seated at a drumkit but no other part of the kit was sounded. This was to provide a single sound source and also allowed for a similar posture to that when playing the whole kit. RM played his regular acoustic bass without amplification.

#### **4.i.c. Recording equipment and method**

Recording was made with a Sony ECM –MS907 condenser microphone plugged into a Dell Inspiron 5160 laptop with a standard soundcard (Sigma

Tel C-Major Audio Card). Tracks were recorded into Cubase STX. Recording was in stereo with each recorded sample saved as a track within the Cubase file format of \*.cpr. The system metronome in Cubase was used to give a two bar 'count in' and then the musicians played one 12 bar chorus with the metronome. After one chorus, the metronome was programmed to stop and recording began automatically from the second chorus; recording continued for two choruses in total.

The musicians played in three conditions

- 1) Both musicians playing together without consciously manipulating the timing, described in this study as the 'Natural' condition.
- 2) The bass player deliberately played ahead of his normal playing position, described as the 'Bass push' condition.
- 3) The drummer deliberately played ahead of his normal playing position, described as the 'Ride Push' condition.

Each condition was recorded 5 times. In total, 15 samples were recorded. The first sample of each condition was recorded at our first recording session; the remaining 4 samples of each condition were recorded at the second recording session about one month later.

Both sessions took place at my home teaching studio. Both musicians were within 4' of each other during recording. Each of the samples was then exported into a wav file and stored.

#### **4.i.d. Analytical method**

Soundforge, a commercially available wave editor was used to convert each sample recording into a format which allowed for detailed timing analysis of both instruments in milliseconds. For data analysis, the first 4 bars of the second chorus from each of the 15 samples were analysed.

As the two instruments were recorded onto one track per recording albeit in stereo, it was necessary to separate the ride cymbal from the bass by performing an EQ transform on both instruments. Soundforge allows for user

defined transformations of each instrument's envelope. As the frequencies of the ride cymbal and bass are at different parts of the Hz scale, it is straightforward to separate the sounds on the recording using EQ. Each track was processed twice with two different EQ settings, each designed to highlight the bass frequencies and the ride cymbal frequencies. The resulting EQ transforms were cut and pasted into a new file as a stereo image, thus enabling a comparison between the instruments.

The wave editor allows for a microscopic analysis of the waveforms for each instrument. Through a visual analysis, it is possible to compare the onsets of each instrument. Two resolutions (horizontal and vertical) are possible per waveform screen, that is, magnification of the wave period and magnification of the amplitude of the signal in dB's. Typically, the most effective resolution of wave period was 1:32 scale.

However, while the onset of the ride cymbal was extremely clear, the acoustic bass onset was more difficult to ascertain. Rasch (2000, p81) acknowledged that the setting of the perceptual onset for an instrument with a long rise time is semi-arbitrary; his solution was to set this onset at  $-15\text{dB}$  below the average peak amplitude for the instrument. My own target was the hit point about 30% below the peak for each bass note; this typically resulted in placing a hit point on the 3<sup>rd</sup> wave of the bass note. This point was usually somewhere between 5-10 ms from the very beginning of the wave rise.

By highlighting the distance between the bass and ride, I was able to take a measurement of the onset times of each instrument.

Each time was then transferred into Excel 97 and then into SPSS v. 12 Both packages were used in the analysis of the data.

Data analysis went through a series of steps:

1. Input of absolute times into Excel
2. Comparison of onset times and then calculation of onset gap
3. Inter-onset intervals calculated.

## 4.ii. Study of listeners' perceptions

The second set of data came from a questionnaire. It asked participants to :

- Identify the playing intentions of the musicians.
- Rate each performance for groove.

### 4.ii.a. Participants

Three groups of listeners, each of 10 participants, were selected. Each group represented different categories of familiarity with jazz. These groups were as follows:

**Group 1. Non- jazz musicians.** This group was made up of other members of the MA cohort who are all trained musicians/teachers but whose acquaintance with jazz is much less than their awareness of classical repertoire. None of this group would describe themselves as jazz musicians. Listener responses were taken in one session with all 10 participants.

**Group 2. Jazz listeners.** This group was made up of regular visitors to The Spin jazz club in Oxford. All participants attended on a weekly or fortnightly basis and could be considered educated listeners. Data collection for this group was over 3 weeks both at people's homes and my own home.

**Group 3. Jazz musicians.** This group comprised professional jazz musicians drawn from my own playing circle. Data was collected from this group over 3 weeks in people's homes.

### 4.ii.b. Questionnaire

Each group listened to 6 samples, each of 2 choruses in length. Two samples from each playing condition were chosen. Each listener was asked to fill in a questionnaire. (See Appendix 1- questionnaire template)

The questionnaire asked for two responses:

1. Correct identification of the playing intention in each sample. Listeners underlined which of the 3 playing conditions they felt was intended in each performance.
2. A qualitative judgement of how good the groove was in each performance. Listeners rated each performance on a Likert scale (1-5), 1 being 'very groovy' to 5 being 'very ungroovy'.

The jazz audience and jazz musicians had a third column added for any comments that they may have had on the performances. This was not to be used in any comparative way but my sense was that these more expert listeners may have had ideas about the performances that could be useful in conjunction with more general comments about the nature of groove from the interviews.

#### **4.iii. Interviews with jazz musicians**

Interviews were conducted within a semi-structured format. A set of questions was developed along 3 lines of enquiry:

- General questions about their attitudes to groove and playing.
- Social questions related to playing.
- Timing issues in playing.

6 interviews were conducted, each between 45 minutes and 1 hr in length. All musicians were interviewed separately (3 bass players and 3 drummers). One of the interviewees, a drummer brought along a bass player and he joined in the interview at a number of points.

4 of the interviews were conducted in the musician's homes, 2 took place in bars. A Packard Bell voice recording MP 3 player was used to record the conversations (See Appendix 2 – interview questions).



## 5. Results of quantitative data

The results of both sets of quantitative data are shown as follows:

- i. Timing data from bass and drum performances.
- ii. Response data from listeners.

### 5.i. Timing data from performances

The timing data is presented in a series of analyses that identify particular patterns of relative timings. Each of these factors has been analysed in turn across the 3 playing conditions of the timing study – the Natural playing condition (neither player consciously manipulating the placement of their notes), Ride push (the drummer pushing ahead from his normal playing condition) and Bass push (the bassist pushing ahead of his normal playing condition).

Results are presented as follows:

- 5.i.a. Voice leading – who plays ahead or behind
- 5.i.b. Synchronisation – the degree of ‘gap’ between players
  1. Evidence for the effect of playing intention on synchrony
  2. Evidence for the effect of structure on synchrony

### 5.i.a. Voice leading between bass and ride

**Table 1. Summary of Relative Onsets over 3 playing conditions**

	Natural	Bass Push	Ride Push	Total
No. & % of ride onsets ahead of bass	79/80  98.75%	36/80  45%	78/80  97.5%	193/240  80%

Table 1 shows a summary of the bass and ride cymbal lead onsets in each of the three playing conditions given as a measure and percentage. For each playing condition, there were in total 80 hits (5 performance samples each of 16 beats).

In this particular bass/drum pairing, the ride cymbal was the lead voice in > 95% of the Natural and Ride Push conditions, while in the Bass Push condition, the bass led the pair of voices in 55% of the hits. Overall, one can see that the ride cymbal tends to be ahead of the bass 80% of the total onsets. This gives a consistently clear picture of the ride being the leading voice in this rhythm section pairing.

### 5.i.b. Synchronisation

This part of the study looked at synchronisation between the players. The degree of synchronisation could be seen as a consequence of a number of performance parameters. Two particular aspects were examined as follows:

1. The effects of playing intention.
2. The effects of structure.

### 5.i.b.1. Effects of playing intention

The following results were obtained which gauge the relationship between the playing intentions of the players and the subsequent relative synchrony.

Table 2 below, gives a summary of the onset gap between the bass and ride over 4 bars and across the three playing conditions.

**Table 2. Mean asynchronous gap for each condition across all 5 samples and all 16 beats.**

3 Conditions	Mean gap over 16 beats from all 5 samples	Distance of mean gaps from 'natural' condition
Natural	- 35 ms *	
Bass Push	-2 ms *	33 ms
Ride Push	-39 ms *	4 ms

\*minus figure indicates the ride cymbal ahead of the bass.

What is noticeable from this summary table is the considerable difference between the result for the Bass push condition and the other two. The Natural playing condition and the Ride push show relatively little difference, only 4 ms, between them across the performances.

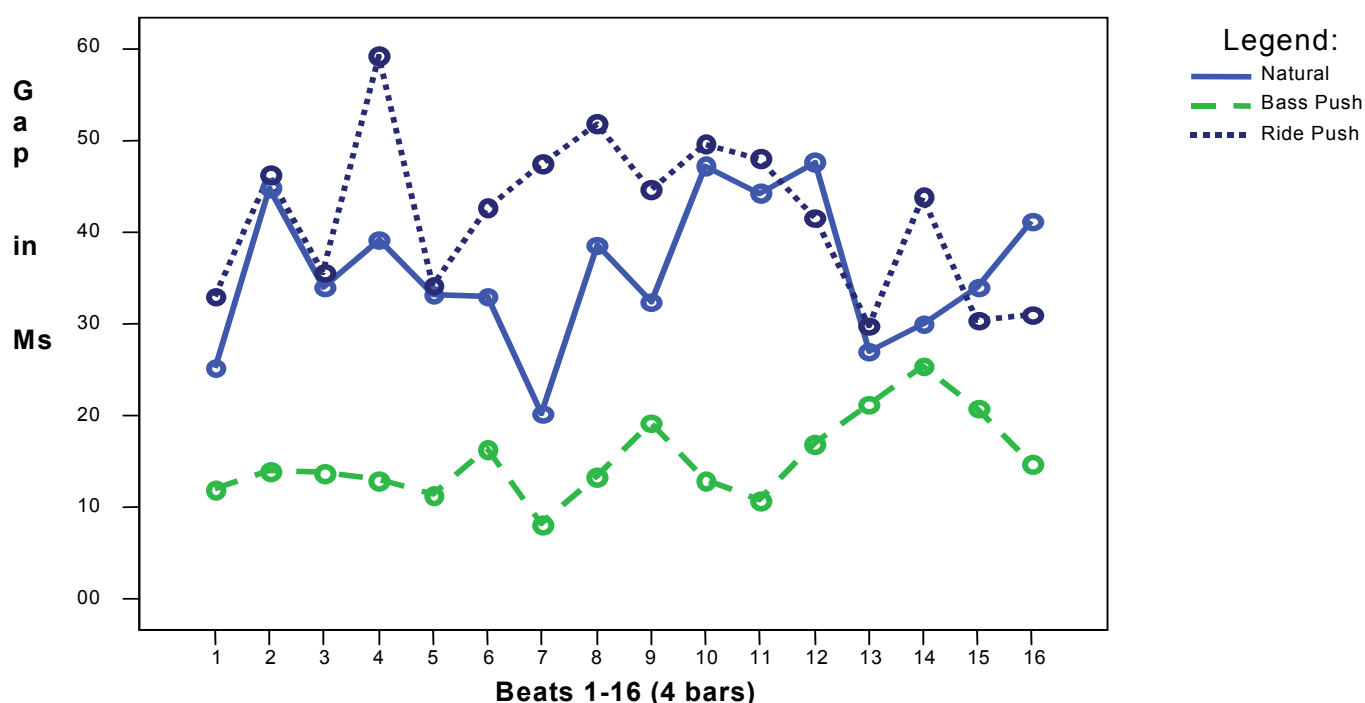
From this general summary of the different mean synchronies to a more detailed description of the onset differences for each of the 16 beats over 4 bars. Graph 1, below, displays the results of a two way ANOVA (factors: playing condition and beat in the bar) performed on the mean asynchronous gap taken from all 5 samples. ( $F_{2,8} = 9.706$ ;  $p = 0.007$ ). The lower that any point sits on the Y-axis, the closer that the bass and cymbal were together on any beat.

From this more detailed description, one can see that the Bass Push seems to be the most stable of the 3 conditions with a narrower width between the largest and smallest onset gaps (of about 17 ms). As shown in Table 2, the

Natural and Ride push conditions share similar mean timing gaps and in Graph 1, one can see a further similarity – a tendency towards more extreme difference between narrowest and widest gap (about 27 ms difference for the natural condition and 28 ms for the ride push).

The greatest divergence between the conditions appears on beat 4 and less marked but noticeable also on beat 7. By contrast, beat 13 (the first beat of the 4<sup>th</sup> bar) shows a reasonable degree of synchrony across all 3 conditions.

**Graph 1. Mean onset asynchrony between bass and ride over 16 beats**

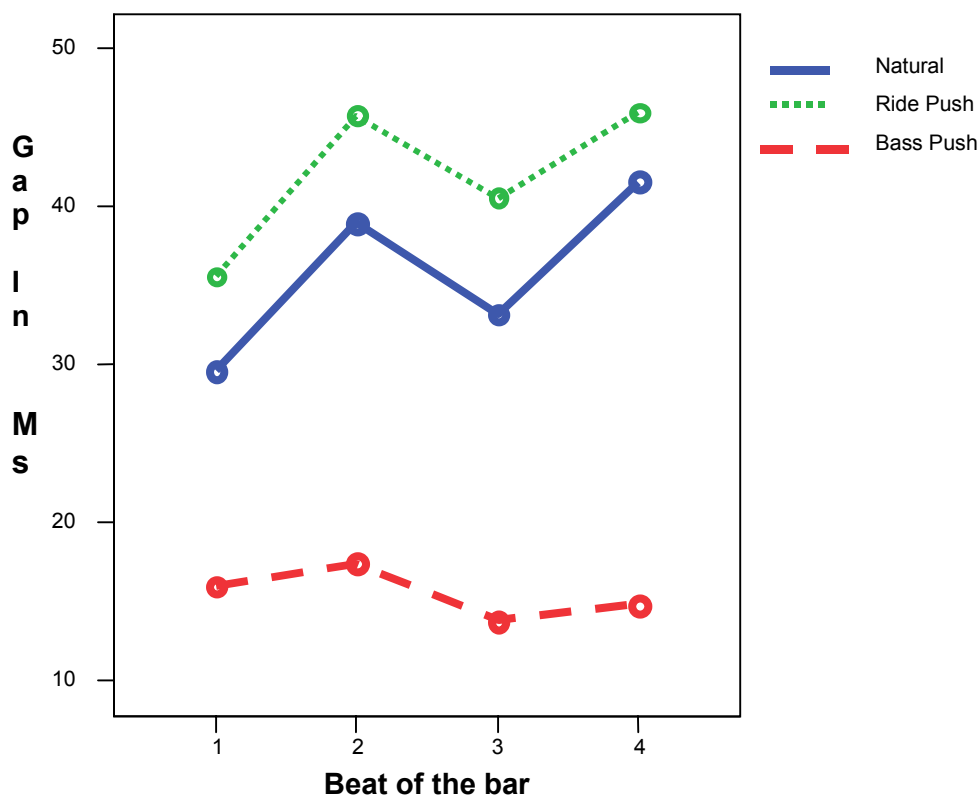


### 5.i.b.2. Effects of structure

The second question concerned the degree to which structural aspects may have had some impact on the degree of synchronisation in the different playing conditions.

A two factor (playing condition and beat of the bar) within subjects ANOVA was run to check for any structural patterning that might emerge ( $F_{3, 12} = 3.614$ ;  $p = 0.046$ ). Significance was shown.

**Graph 2. Degree of synchrony calculated for each beat**



Graph 2 shows the mean asynchrony between bass and ride for each beat of the bar, taken from all 5 performances. It suggests that there is a tendency to come together more at beat 1 and beat 3 of each bar than for beats 2 and 4. Two of the conditions – the Natural and Ride push continue to show a very similar pattern, underlining the analyses in Table 1 and Graph 1. In contrast, the Bass push line shows greater synchrony between the instruments on beat 3 and then beat 4 rather than beat 1. There is also much greater consistency of gap between instruments across all four beats in the Bass push condition, whereas the other two conditions display more elasticity of synchronisation over the 4 beats.

## **5.ii. Response data from listeners**

The second part of the study looked at how correctly listeners identified the playing intentions of the musicians and also how they rated the performances for the degree of groove. The results are set out as follows:

- a. Identification of performers' intentions.
- b. Rating of samples for groove.
- c. Association between degree of synchronisation and groove ratings.

### **5.ii.a. Identification of performers' intentions**

There were three particular points of interest regarding the communicability of the performer's timing intentions -

1. Whether such small differences in timing variations could be picked up by listeners.
2. Whether the effect of familiarity with jazz would have an influence on the success of listeners in identifying timing intent.
3. Whether a within experiment learning effect would impact on the number of correct answers.

#### **5.ii.a.1. Listeners' ability to identify intention**

First analysis of listeners' ability to identify playing intention was carried out by cross-tabulation of the two variables, playing intention and identification. This was to test if there was an association between answering correctly and the playing condition. Was it easier for listeners to spot a particular playing intention over another? This was supplemented by a Chi-Square test  $X^2 = 5.958$ ;  $df = 2$ ;  $p = .051$ . Significance was not shown but was only just above 0.05.

**Table 3. Contingency table showing cross-tabulation between playing condition and identification of condition by listeners.**

			Listeners' Answers		Total
			Correct	Incorrect	
<b>Condition</b>	Natural	Counted	25	35	60
		Expected	32.7	27.3	60.0
	Ride Push	Counted	36	24	60
		Expected	32.7	27.3	60.0
	Bass Push	Counted	37	23	60
		Expected	32.7	27.3	60.0
<b>Total</b>		Counted	98	82	180
		Expected	98.0	82.0	180.0

There is a contrast between the correct identification of the natural playing condition and the other two conditions. The two manipulated conditions both score around 20% more correct answers than the natural playing condition.

#### **5.ii.a.2. Effect of familiarity with jazz**

The second question concerned the extent to which familiarity with jazz might allow listeners a greater sensitivity to timing intentions and this be reflected in more correct answers.

Each playing condition was exemplified by two performances. The correct/incorrect scores from respondents to each playing condition were combined. In a similar way to the previous analysis, a cross-tabulation and Chi-Square test were performed on the data between the two variables '*group*' (Non-Jazz Musicians, Jazz Listeners and Jazz Musicians) and '*correct/incorrect answer*'.

**Table 4. Contingency table showing cross-tabulation between listener group and correct/incorrect answers.**

			Listeners' answers		Total
			Correct	Incorrect	
<b>Listener group</b>	Non-jazz musicians	Counted	27	33	60
		Expected	32.3	27.7	60.0
		% correct /incorrect	45.0%	55.0%	100.0%
	Jazz listeners	Counted	36	24	60
		Expected	32.3	27.7	60.0
		% correct /incorrect	60.0%	40.0%	100.0%
	Jazz Musicians	Counted	34	26	60
		Expected	32.3	27.7	60.0
		% correct /incorrect	56.7%	43.3%	100.0%
<b>Total</b>		Counted	97	83	180
		Expected	97.0	83.0	180.0
		% correct /incorrect	53.9%	46.1%	100.0%

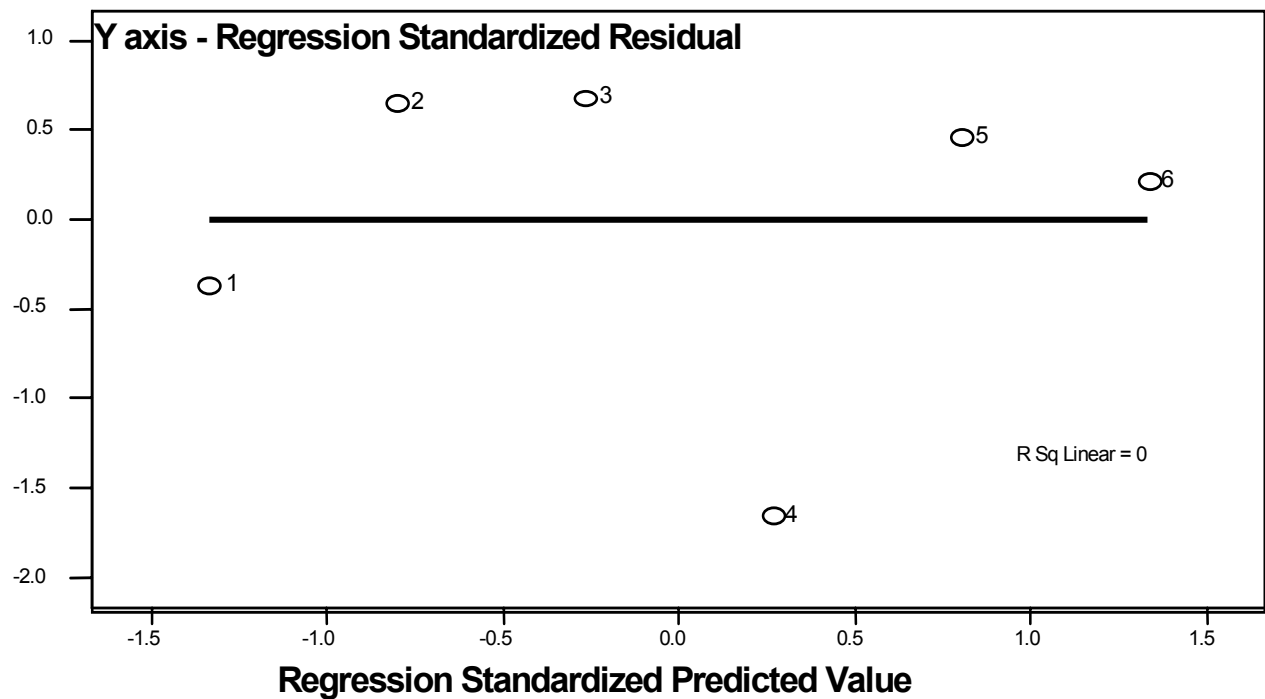
Chi-Square analysis showed  $X^2 = 2.996$ ;  $df = 2$ ;  $p = .224$ . Both the Chi-Squared and p numbers indicated that there was no association between correct answers and group membership.

From the raw data, non-jazz musicians appeared marginally less able to identify playing intention with a score of 45% while jazz musicians and jazz listeners scored roughly the same (56.7% and 60% correct respectively).

### 5.ii.a.3. Effect of within-test learning

Beyond learning over time through exposure to jazz, a further type of learning may have taken place. The number of correct answers over the course of the listening experiment would be expected to rise if there was a learning effect over the course of the listening.

**Graph 3. Scatterplot of 2 variables: percentage of correct answers correlated with order of performances. Evidence of learning effect over 6 performances?**



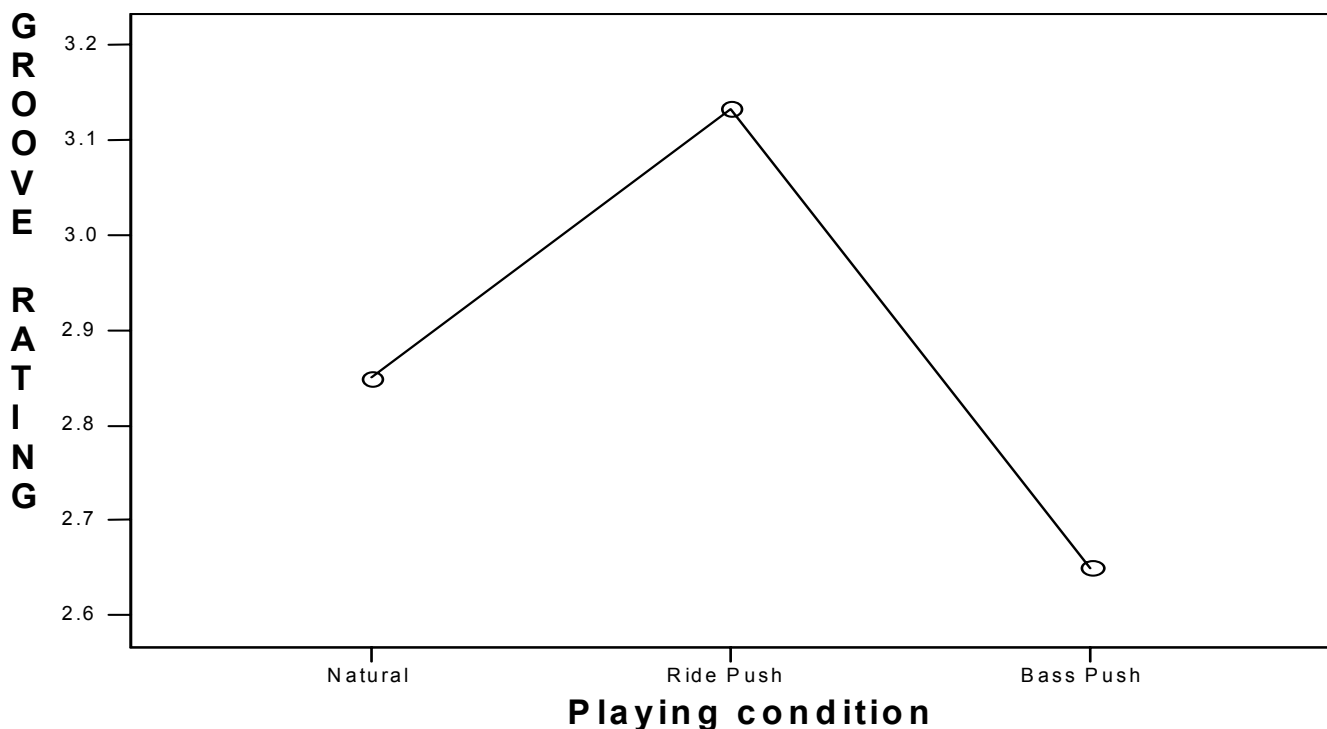
Graph 3 shows the scatterplot of percentage correct answers correlated with the performance position. The regression line shows that there appears to be no visible association between getting answers correct and the performance position in the test.

### 5.ii.b. Rating of samples for groove

Graph 4 shows how all participants rated each of the performance samples in terms of groove. This was a quite different judgement to the previous identification of the performers' intentions. This was a purely qualitative statement about how successfully the performers were adjudged to have played good groove.

Graph 4 was constructed from a single factor within-subjects ANOVA ( $F_{2,118} = 3.325$ ;  $p = 0.039$ ) showing all participants mean rankings of each performance condition. Note that the higher the ranking score, the less satisfactory the performance was judged to be (1 = very groovy, 5 = very ungroovy).

**Graph 4. Mean ratings of groove for each playing condition**



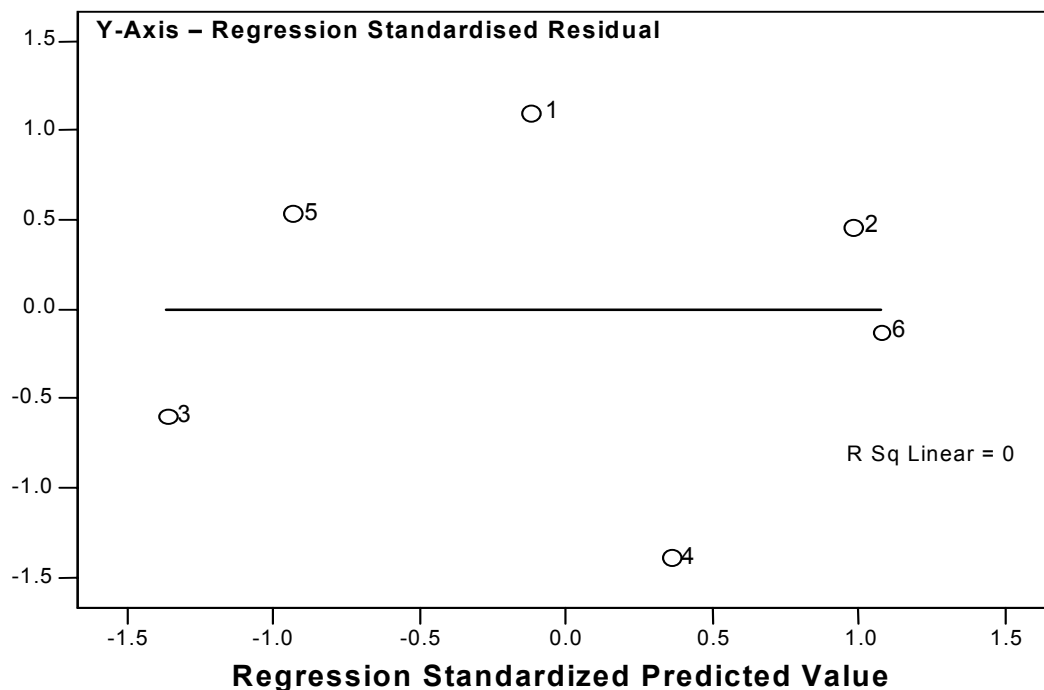
Participants expressed a preference for the Bass Push as the most groovy performance type with a mean score of 2.65; the Natural playing condition

was rated as 2.85, and the Ride Push with a score of 3.13 was considered least groovy.

### 5.ii.c. Association between degree of synchronisation and groove rating

The next stage of the analysis was to get some indication of why particular samples were rated highly or not. In line with the often cited idea amongst musicians that groove is a function of good synchronisation between players, I wanted to test whether this idea was reflected in the data.

**Graph 5. Scatterplot of association between synchrony and groove rating for the 6 performances.**



Graph 5 shows a scatterplot from a Linear regression analysis on two variables - timing gap between instruments (IV) in each performance and rating of each sample for groove (DV). Although the statistical summaries from the linear regression at first suggested some very weak effect (Adjusted R Square = .052; beta coefficient = .492), Graph 7 suggests no linear association between the ranking of the performances for groove and the synchrony between the instruments.



## **6. Discussion of quantitative data**

### **6.i. Timing data from performances**

#### **6.i.a. Voice leading**

The question of which voice leads in the playing relationship between bass and drums is one about which many musicians express an interest (interview from this study with JM, 2005). There is no single model of playing ahead or behind that is universally accepted as preferable and few studies of timing have anything to say about this. One such study did identify the ride as generally occurring ahead of the bass (Rose, 1989; cited in Collier & Collier, 1996, p124). Progler's study (1995), an attempt to shed light on Keil's ideas of participatory discrepancies is too limited to make any general conclusions but there are some interesting comparative features with my own study.

In Progler's study, the bass/ride relationship was measured using two different performance models. The first type of performance was measured in relation to a pre-recorded bass or ride tap pattern. The second type was sampled from a commercially available tuition record; this most fits with my own study in that there was no metronome involved and so the playing most resembled a real playing situation. This part of Progler's study was especially consistent with my results above with the ride cymbal consistently occurring before the bass line. In both of Progler's performance types, the ride tap was generally played ahead of the bass line and Progler confirms that the predominant playing approach in his study appears to 'rely on placing the ridentap before the bassline (or the bass after the ride, depending on which way one perceives it).' (Progler, 1995, p46).

The use of a metronome makes comparison with that part of his study difficult. Once a metronome is used as a reference point, then the interaction between players is changed considerably. Progler's results show that two drummers playing with a pre-recorded metronomic bass line had very different ways of playing the ridentap. One consistently played ahead of the bass and the other consistently behind.

One of the interesting features of the metronome studies which Progler does not comment upon is the fact of there being no 'live' playing and so no opportunity to synchronise together through visual cues and gestures. This was not something that I examined in this project. Further work needs to be done to characterise the impact of body movement in helping to co-ordinate time within groove music.

A rather different account of the bass/ride relationship is given in Keil (1994, pp 60-64). He looks at bass/ride pairings and comes up with a fairly impressionistic account of what makes for a successful pairing. He distinguishes between drummers who play 'on top' of the beat and those who 'lay back' and ties this partly to the physical motion that they use in playing the cymbal. Similarly he divides bass players into those with a 'chunky' sound and those with a 'stringy' sound. Keil's analysis offers the idea that there may be distinguishable models of playing which contribute to a particular type of groove. Keil's own feeling is that 'chunky' bass players and 'on top' drummers work well together. In common with more ethnomusicological studies of jazz, the lack of hard data makes comparison between studies difficult.

Related to my own study, I would characterise my own playing as 'on top' as the timing data suggests and characterise my bass colleague, RM, as a more 'chunky' rather than 'stringy' player. In this respect, my characterisation of our playing relationship accords with Keil's thoughts on what makes for a good bass/ride pairing. However as RM (Discussion, 2005) pointed out with regard to the bass, his attack will vary depending on the material being played and the effect that he is after at any one time. By reducing ways of playing to rather crude descriptors as Keil has done, one begins to lose the richness of detail and change in a performance. Analysis is in danger of moving towards caricature.

A number of ideas come to mind with regard to this ahead/behind aspect of the timing relationship. Firstly, and most importantly is that the data does suggest that there **is** a relationship. Given that this co-ordination takes place

at around a liminal level, it could have been expected that the bass and ride would move in and out of lead onset in whatever condition. In fact, there is considerable stability in this relationship. As the playing intention changed, so the degree of being ahead/behind changed in a predictable way. The Natural playing condition was characterised by the ride cymbal leading virtually on every beat. When the bass pushed, this 'aheadness' reduced considerably and when the ride pushed, the 'aheadness' increased but in a more marginal way.

In looking at relative timing positions, a number of difficulties come to mind. Firstly, the degree to which it is possible to locate the onset of certain instruments. In this study, the two instruments involved have very different attacks. Whilst my measurement of onsets was consistent, the decision about where to fix the onset of the bass was difficult. Some writers have questioned whether this asynchrony is simply a mechanical lag that is a result of the different rise times of instruments (Collier & Collier, 1996, p134). My own study does not answer this but it seems an important factor in trying to make sense of these timing differences. One possible solution would be to compare timings done in Midi with the same performance through audio. It may then be possible to look at actual and perceptual onsets in a more meaningful way.

Secondly, if musicians are not playing to a metronome, then where is the beat relative to which they are playing? In the case of jazz, I would suggest that the beat is a combination of the count-in to the piece of music, each player's own perception of the count-in and each player's ongoing negotiation of this within the group. There is also the question of each musician's role in the band and their personal conceptions of responsibility for the beat. For example, JB (bass player) told me that 'I feel as though I am the beat...'. He saw his job as providing the time for the rest of the band 'in a musical way and not just in a metronomic way.' (JB, interview for this study, 2005).

## **6.i.b. Synchronisation**

### **6.i.b1. Effects of playing intention**

The degree of synchronisation showed some change as the playing condition was manipulated. This indicates that the players in this study were able to consciously control their timing in the performance examples.

However, the degree of change from the Natural playing condition was very different between the Ride and Bass push. Graph 1 and Table 2 show that the most distinct playing condition is that where the bass player intended to play ahead of his usual placement. Much less distinct from the Natural condition was the Ride push which revealed a much closer fit to the usual playing relationship of the two players. One might expect that the degree of change between the Natural playing condition and the other two might be more uniform. The fact of this very skewed difference suggests that

- 1) the usual ride cymbal tendency to be ahead of the bass was a factor in limiting how much the drummer felt able to manipulate further the amount of push in his playing. Similarly, this tendency for the ride to be ahead of the bass might have given the bass player more room for manoeuvre. In other words, there is some sort of centripetal tendency that tends to prevent any further significant widening of the playing gap and also allows for a large reduction in this gap.

AND/OR

- 2) The bass player had a more marked ability to manipulate the gap than the drummer. It could be that the drummer simply could not translate so well the difference between playing normally and playing ahead from intention into action.

Given that the study was conducted in a semi-natural setting, that is, without a metronome and with both players playing live, my feeling is that the degree of manipulation is tempered to some extent by musical sensibility. The extent to

which one can play around with the time is constrained by notions of good taste and perhaps more powerfully still, an 'instinct' towards synchrony. This is speculative and would require more investigation but the way in which the asynchrony in the manipulated conditions appeared to be affected by voice leading (as suggested in 1. above) may suggest some sort of magnetic pull towards being together.

### **6.i.b.2. Effects of structure**

There is a body of research, especially studies of western art music, which points to the effect of structure on expression. Applied to this study, it seemed appropriate to look at whether particular metrical accents may have some sort of expressive effect on micro-timing. Do players come together more at particular points in the bar where there is a stronger metrical pull?

This gap reduction between players of about 33% on beat 1 from the other beats does suggest that there is some influence of the strong beat on players' coming together. Collier & Collier (1994) and Rose (1989, cited in Collier & Collier, 1996, p123) have looked at how players seem to convey an elasticity of time at the beat level while showing a global sense of stable timekeeping at the bar or section level.

Two possible reasons for this apparent effect come to mind. Firstly, the strength of metre and structure on players' sense of timing. Lerdahl and Jackendoff (1983) in their analysis of tonal music looked to a grammatical account of musical organisation. In respect of rhythm they identified both grouping and metre as the principal rhythmic components in a piece. For the purposes of this study, the interest lies in their definition of accents. They distinguished between phenomenal, structural and metrical accent and it is the latter two that may be part of the explanation for this coming together between instruments at beat 1. Within a 12 bar blues, beat 1 of bars 1,5,9 is both structurally and metrically strong bringing together the harmonic and metrical at one point. This coming together for structural/metrical reasons could be argued from two sides – that the effect of structure/metre is to bring in the players from their 'wandering' or that the players are in some way

wanting to highlight these points in the music. Jazz musicians do seem to show an acute awareness (from my own experience) of the 4 bar building blocks that go to make up so much in the repertoire. What is less clear is whether the structural/metrical power of beat 1 should necessarily pull musicians together. One could argue that these strong points could equally allow more 'gap' between players as the underlying structure is so supportive at those points.

Perhaps a more plausible account for recurrent smaller gaps at these particular points lies in the use of 'skip' beats on the ride cymbal which may aid the anticipation of the next beat. These skip beats (see Figure 1, p38) typically but not universally appear just before beats 1 and 3 which would accord with the findings of this study. Studies of timing in the literature do seem to suggest that the more information between beats, the greater the likelihood of synchronisation (Wohlschlager & Koch, 2000).

## **6.ii. Listener responses**

### **6.ii.a. Identification of performers' intentions**

#### **6.ii.a.1. Listeners' ability to identify intention**

This set of data did not show a significant result but was only just beyond the significance threshold. Therefore, with some caution, the data might suggest that the effect of players manipulating their timing is possibly communicable to listeners. What is less certain is how such a possible effect is communicated. The correct identification of the two pushing conditions lay around 60% whereas correct identification of the natural condition was about 41%.

How is this difference accountable? Studies of serial order identification correlate correct answers with larger timing gaps. One might expect a ranked order of correct answers corresponding to a greater degree of onset gap between instruments.

If this were the case, the Ride Pushing condition should be most correctly identified as its typical onset asynchrony is relatively large; similarly, one would expect the Bass Pushing condition to be most difficult to identify as the timing difference between instruments was very slight. Since the timing gap data for both Ride and Bass Pushing conditions lie on either side of the Natural, this does not suggest that the size of onset gap between instruments necessarily helped identification in this study.

There may well be other factors that influence listeners' decisions about these playing conditions. Another variable that has not been included as a principal object of study but that might have an effect would be dynamic level. The relative volumes between the two instruments may well change between conditions, reflecting a particular intensity on the part of one or other of the players. This squares with evidence within performance literature that it is sometimes difficult to isolate timing, dynamics and timbre changes, one from the others, in looking for communicative effect.

These factors beyond timing may need to be examined in a further study if one is to get a clearer picture of what contributes to a listener's perspective on expressive timing in groove.

#### **6.ii.a.2. Effect of familiarity with jazz**

The results from this data suggest that there was no significant difference between groups in their ability to identify the playing conditions. One might expect a familiarity with jazz to have an impact on this identification; however, there appears to be no long-term learning effect visible here.

#### **6.ii.a.3. Effect of within-test learning**

The lack of significance in the data suggests that there was no learning effect over the course of the performances.

### **6.ii.b. Rating of samples for groove**

The results of the rating of groove showed a significant preference for the Bass Push, then Natural and finally Ride Push condition. It appears from this that although listeners could not identify the playing condition to a level of significance, listeners were broadly able to distinguish between performance samples and so make a qualitative judgement about them. In other words they could hear some sort of qualitative difference but were not clear what they were hearing. These results are comparable with studies of identification of temporal order, such as those done by Efron (1973) in which listeners appeared to hear 'qualities' of sound orders but not necessarily identify which sound came first (discrimination between orders as opposed to identification of orders).

### **6.ii.c. Association between degree of synchronisation and groove rating**

Having established that listeners were able in some way to distinguish between playing samples, if not identify them correctly, the study went on to look at a possible link between the playing intentions of the musicians and the groove ratings. Graph 4 showed the order of preference for groove as 1<sup>st</sup> - Bass Push, 2<sup>nd</sup> - Natural and 3<sup>rd</sup> - Ride Push and these rankings correspond directly to order for the mean degree of synchrony in each condition. The Bass Push condition being the most synchronised and the Ride Push being the least.

Graph 5 shows the results of a scatterplot to look at the possible association of groove ranking and synchronisation for each of the 6 performances (as opposed to the groove ratings in Graph 4 that were only taken for the 3 conditions). This more detailed examination does not show an association between timing and groove rating. This contrast between the congruence of groove rating and timing gap for each condition and its lack when examined for each separate performance is quite marked (that is the difference in analyses leading to Graphs 4 and 5). More work would need to be done to ascertain which is the most convincing level of analysis. From this study, one

would have to give more weight to the results in 5.2.c, Graph 5 (association of groove rating and timing for each performance) rather than 5.2.b, Graph 4 which simply shows a broad correspondence between rating and synchronisation in each condition (i.e., no statistical test of association).

There are of course other variables within performance that could also have an impact on listener's qualitative assessment of groove.

- Particular moments in a performance may have a disproportionate effect on a listener's judgement. At various points in the sample performances, there are particular 'hits' where the bass and ride may 'come apart' and this sort of larger timing discrepancy may well unduly influence assessment of an otherwise good performance. In other words, a non-linear relationship between performance and judgement. Small changes in performance could trigger unexpected assessments in listeners.
- Changes in the quality of a performance over a longer time period in the sample. Subtle changes in the relationship between bass and ride, tempo change and variance in timbre or dynamics could well exercise further subtle influences on a judgement of groove. Is the listener rating the performance from their judgement of the earlier or later part of the sample? In other words, subtle changes in performance over its length may exert influence well beyond that of the degree of synchronisation.



## 7. Results and discussion of qualitative data - interviews with jazz musicians

The third set of data from interviews with professional jazz musicians yielded the thoughts of bass players and drummers about their relationship with each other as a musical and social experience, and brought out also the various attitudes that rhythm section players have towards groove and timekeeping.

Three themes emerged which I want to explore. These were:

- i) Talking and thinking about doing.
- ii) Movement and change.
- iii) Ourselves and others.

### 7.i. Talking and thinking about doing

Jonathan Dunsby (1995, p33) has written extensively on the intrusion of thought and language into the activity of performance and the dangers, as musicians often perceive them, of knowing too much. What is magical about musical performance, its inscrutability, is at risk of being lost through analysis. A complex set of attitudes about how musicians think and the extent to which they feel they should think about what they do came over strongly in these interviews.

There were two sub themes that also became clear. I feel that these two were linked in a particular way; that is the degree to which groove can be 1) usefully discussed and thought about and 2) consciously controlled.

TH, a bass player, put the inconsistencies about talk and playing as  
 “..it’s so weird; you think you have nailed it [*groove*] and it slips through your fingers. Your mouth goes one way and your sound goes another.... People say this and do that. “ Another bass player, JB, put its inscrutability as follows,

“ It is a conundrum, a paradox; you can’t solve that. You can’t make yourself go there – you just have to allow it to happen, allow it to stay there; it’s very elusive, but you know when it has happened. Sometimes, I will play something and think that was good and the moment you think that, it’s gone and the next thing you play sounds the same as it always does...” .

Both comments illustrate the fragility in the relationship between thoughts/words and the raw doing of the grooving. This can be seen as being not just a distinction between procedural and declarative knowledge but an example of how many musicians see that words are inadequate in dealing with the elusive nature of grooving together. This is a more complex issue than musicians simply denying that there is anything to say about the matter – the six hours of interview for this study do not support that claim.

The second theme to emerge from how jazz musicians are ‘thinking and doing’ is not about their commenting on the elements of groove but about conscious control during playing. Musicians talked of groove having a ‘life of its own’ or ‘...something happens and it’s more than anything you were trying to do; some energy just comes and sweeps you along and stuff works and you find you can play something that you hadn’t even thought of..’.

The issue of control partly arises as of necessity. Some of the players that I interviewed made the point that thoughts arise about the groove usually when things are not working – ‘ when you are playing with people, a lot of the time it either works or it doesn’t...and a lot of the time when you are playing with people who you feel comfortable with, no one is thinking about that consciously.’ One of the bassists commented that ‘ there comes a point where you have to be hands off and just try to let it happen on its own...’ . Bill Evans, the great jazz pianist, in his liner notes for ‘Kind of Blue’ writes of the ‘conviction that direct deed is the most meaningful reflection [*and*] has prompted the evolution of the extremely severe and unique disciplines of the jazz or improvising musician.’ (1956, cited in Keil 1994, p58). It may not be so surprising therefore that jazz musicians, however articulate, find it hard to talk about groove given that they spend their lives trying to remove thought from the process and engage fully with the ‘direct deed’. To return to Jonathan

Dunsby, 'thinking hard comes so naturally to those engaged in music that often they don't see it for what it is.' (1995, p10).

## **7.ii. Movement and change**

Musicians also talked about the degree of change and adaptability in a performance and indeed over a lifetime of performing. The idea of shifting one's musical position to suit goes against some of the ideas expressed above about relinquishing conscious control. The degree to which musicians feel able to adapt to one another however, is also tied to the relationship of the individual to the group. Reinholdsson (1995) comments on how there is a tension within improvising music between getting one's own point across and contributing to the overall success of the performance through sacrificing one's own voice.

AD commented '...I sometimes spend time listening to the drummer and the other players, trying to settle in that way, altering my playing to get an average and then other times, I think maybe I should play exactly how I feel with a bit of ignorance involved; you have got to have your own time...there has to be an element of dogmatism' and MF confirmed this point saying, '..there have been situations when I have thought, I will go with them but generally it doesn't work; you have to feel the beat where you feel it '.

Citing an instance of working with a famous American player, MF talked about how 'it was so hard to fight it and it got to the fourth tune and I thought I would just sit back on the beat and I did, and of course then the whole feel of the band went weird and the bass player sort of looked at me to say 'what's happened' and he goes on to comment that ' though give and take is good, when it comes to time and feel and a framework which people can play on top of, you can't really muck around with it...'.'

The idea of change over a long period of time was discussed with all interviewees. How did they feel they had changed in their attitude to playing groove as they had developed? Everyone felt that there had been changes in

their playing. Interestingly, JM felt that over time he had begun to play more in the centre of the beat and had become more tolerant of the width between players in articulating the groove – ‘with age and experience, it probably gets wider.’. DW’s experience was the opposite; that over his playing career, he felt that he was moving toward playing more on top of the beat. Both types of change appeared to be linked to their playing different types of music that encouraged a different feel or working with particular musicians who set them playing in a different direction.

### **7.iii. Ourselves and others**

Two elements emerged from these interviews about how musicians viewed their relationships with others, one expected and the other rather unexpected. Firstly, the more obvious theme of how musicians work with one another within a group; the second element was about awareness of the difference between European and American jazz, a cultural divide.

I was interested in the relationship between personal liking and the ability to play with one another. Whilst the interviewees agreed that it is preferable to work with musicians that you get on with, some players felt that the social aspect of playing was not too important. They cited not only their own experiences but some well known examples of bands that made great music but did not get on with one another (the album ‘Moneyjungle’ by Duke Ellington, Charles Mingus and Max Roach being a famous example). Common goals, a ‘certain level of professionalism’ (JB interview) accounted for this ability to work to task in spite of personal differences. AD mentioned that although one should be able to make it work, ‘often it can be for musical reasons that you do not get on; the social and musical are related. If you don’t like someone’s playing, you won’t hang out with them.’ In that sense, one can see how a virtuous circle may emerge between the playing and the socialising.

The divisions between European and American jazz emerged from all interviewees without being prompted. There were a number of points that are

relevant to this discussion. Firstly, there was a sense of an energy in the playing of time in American jazz that set it apart from European jazz. The latter appeared to be more accommodating and flexible – less metronomic. DW put this down to a ‘forward motion’ in the groove; TH looked to the broader differences in culture as an explanation ‘.....dealing with Americans in music is a big thing....when you come across Americans, its bang, its there, its this and this and this and there are a lot of non-negotiables...’. JM similarly looked to fundamental reasons for this difference in attitude to playing and the playing itself, ‘ ...so the way you survive in the States is, there are a million people waiting for to do your gig, so you have got to be unassailable and that’s why they get so strong, I think.’.

These two elements could be seen to represent the intra and inter group dynamics. Although the idea of making great music without being able to get on well may seem counter-intuitive, studies of group cohesion tend to support the idea that personal liking is not a necessary condition for accomplishment of a particular task. More than that, cohesion itself is not necessarily correlated with success; evidence shows that only in groups where norms that value success operate does cohesion have an impact on successful outcomes. This may make sense of some of the perceptions in this study that it is not necessary to get on well with other players to groove together.

The second element points to the way in which jazz cultures may develop along different lines. Most of the interviewees talked about the ‘American thing’ and being aware of difference in both the time feel and also in the attitudes of musicians towards playing. Some common ideas emerged about the energy and drive of American players – both in their timing and their ideas on performance. Less explicit but near the surface was the sense of ownership of the music. One bass player referred to the respect that was due American players as the music came from there. However all the musicians also felt that the European and American ways of playing were just different, not necessarily better or worse.

This identification of difference between American and European groove, points to one of the key components of this study - the degree to which we can attribute meaning to something as basic and nebulous as groove. My contention would be that meaning emerges as a consequence of both the momentary response to a groove and the cultural ground on which that response is shaped. The power relations in jazz, between European and American musicians (not necessarily on a personal level) cannot help but mediate any 'gut' response to hearing or playing with an 'other' culture. We bring to the groove as much as the groove brings to us at any moment. We do not simply hear a groove and respond; musicians and listeners hear **through** their own experiences and attitude.



## 8. Conclusions

### 8.i. First thoughts

A central problem of musical analysis described by Nattiez, in his work towards a semiology of music (1990), is the tendency to fragment research between composition, interpretation and perception. His study is an attempt at unification of these different levels of exploration; a way to see how they co-exist. This study has been similarly motivated; the aim has been to explore how an apparently simple musical fact such as two people moving sound in time together contains a number of quite different worlds within it. How do these worlds mesh together if indeed they do?

The title of the project highlights production, perception and meaning. Although these three elements are linked to each of the three sets of data, it would be mistaken to read these data as directly corresponding to these terms. The quantitative data of the study **do** examine the link between production and perception. I have looked at production through some quite specific research questions; what groove patterns emerged in terms of voice leading and degree of synchronisation? How much are players in control of the micro-timing involved in groove? How did the different playing intentions affect drift? Questions of perception were linked directly to these issues of control and timing. Could different groups of listeners pick up on the attempts of the players to structure a groove in particular ways? More than that, what did listeners make of the performances – can one feel anything from a set of detached musical examples devoid of melody, containing a heap more ‘ground’ than ‘figure’?

However, the third term of the title, meaning, does not so neatly fit within a single set of data. The qualitative data from interviews with musicians were designed to broaden the rather narrow set of figures that the quantitative studies yielded; the interviews were not a direct commentary on the quantitative data nor were they meant to provide the ‘meaning’ in the study. The qualitative data do however reflect my own belief that the details of a

performance cannot be separated from the larger rituals, beliefs and interactions of the musicians involved. My hope was that some sense of the 'meaning' from groove might emerge from the coming together of these different studies.

## **8.ii. Conclusions to be drawn from the data sets**

### **8.ii.a. Timing issues in groove**

Two areas stand out from this study – one that tends to fit in with existing data and the second that may inform existing and new research into timing. Firstly, the nature of voice leading between bass and drums. The data show some consistency with anecdotal reports and other jazz studies that the ride cymbal tends to be the leading voice in the groove. While this is not an absolute condition and many bass drum pairings may show a different relationship, this does appear to adhere to a fairly standard pattern.

The unresolved question was the degree of certainty about the onset of the bass. How accurate was the judgement about where to place the bass 'hit'? This is obviously critical to any data that are designed to show voice leading. The distinction between actual and perceptual onset may not be a problem if both voices share a similar rise time. However, the ride and bass are almost acoustic opposites. A future study may get round this by comparing a midi sample of bass and ride with an audio sample. The degree of asynchrony in each type of sampling may assist in making a more accurate judgement about the bass onsets.

The second area to emerge may be an answer to Progler's thinking (1995) about the degree to which musicians may control the micro-placement of notes in a groove. My case study suggests that a degree of conscious manipulation of the beat at these threshold states is measurable. The playing intentions of moving ahead of the beat, translated into milliseconds, showed that the musicians in the study could play around with micro-time in some sort of consistent, intentional manner. The degree of measurable change was not the same for the ride and bass push however. This may be explained by

voice leading. The ride was played almost always ahead of the bass in the Natural condition. This may have allowed for the greater degree of push from the bass as the ride was already close to some sort of limit. I infer from this that each player was at some level, conscious or not, aware of the boundary up to which they could push the groove without it being distorted to the point where it might break apart. More work needs to be done to understand precisely where these limits may lie. My sense is that a more controlled experiment, involving a stationary pulse as referent may allow researchers to gauge how far a musician can push forward or pull back before the groove collapses.

Does this sort of measurement help musicians? My answer is yes, if used with care. In my own case, the consistent way in which I played ahead of the bass in this study sometimes involving a gap of 30 + ms was not something I expected. It has led me to re-evaluate my sense of note placement. If this sort of information about micro-timing helps musicians refine their awareness and think further on their own playing, then this can only be a good thing. However, if a musician loses confidence in their timing through this sort of information, it can be a damaging experience. Some of the musicians in the interviews expressed the view that groove is not the same as 'timing' – it is a more 'basic' part of playing. Whilst I don't hold this view, it expresses for me the idea that some musicians share that these things are best left alone. I feel strongly that provided this information is handled within a well-developed pedagogy, then it could be very valuable for players in refining their sense of time and playing with one another.

### **8.ii.b. Perception of timing and groove**

The second phase of this study looked at the extent to which listeners may be able to hear the playing intentions of musicians and also how they rated the performances as examples of groove.

### **8.ii.b.1. Identifying playing intentions**

Although there is a body of psycho–acoustic experimental work which has looked at the perceptive abilities of listeners in identifying the order of tones. I am unaware of any studies that have looked at listener responses to real playing of quasi-synchronous tones. Of course it is important to underline that listeners were not being asked to rate the order of quasi-simultaneous tones as such. Rather they were being asked to identify changes in the onset relationship between the two instruments. In fact the order of tones for most of the playing remained the same, that is the ride cymbal occurring before the bass.

The results of the listener responses were far from conclusive. The correct identification of the playing intentions by all three groups of listeners failed to show a sufficient level of significance overall. This is in some contrast with the playing musicians being able to make a distinction between these playing conditions and act on it. Why then was it so much harder to hear the distinctions? There are a number of reasons. Firstly, listeners were not given any examples of the conditions before the test – this sort of reference might have led to a greater ‘hit rate’. Secondly, in this sort of semi-real listening, although the overall pattern of timing for each condition varied over 2 choruses, the peaks and troughs of timing variation within the overall pattern make judgement of this sort very difficult. If the asynchrony had been set at  $x$ ,  $y$  and  $z$  ms for each condition on every beat, then it is possible that a much higher rate of identification would have resulted. However, that would not have fulfilled my research criterion of listeners paying attention to real playing. Thirdly, the musicians, beyond their expertise are also making use of kinaesthetic and visual modalities in their own production/perception loop whereas the listeners were reliant in this case only on their hearing.

### **8.ii.b.2. Qualitative judgements of the playing**

The second part of the listener response study involved the rating of each performance for its groove. On a typical gig, audiences are voting for the groove at any particular moment literally with their feet. An audience that is moving with the band, that is tapping its collective foot, I suggest, is an audience that is feeling the groove. How much of this response is due to a purely rhythmic communication and how much is down to who is playing, the nature of the venue, the communicative intensity of the performers' gestures and stage presence, the emotional expectation that an audience brings into the space is all open to question.

An assessment of groove, without the accompanying musical layers and outside a typical listening environment, should allow for a more direct judgement of the groove. Comparisons between the groups of listeners' judgements and between the different performances did not show a link between listener rating and synchrony of the players. However, when the both performances for each condition were amalgamated, the overall ratings corresponded with the degree of synchronicity. It is clear that considerably more work needs to be done to assess the extent to which listeners can make sense of these subtle timing variations.

This judgement on the part of different types of listeners asks questions of the effectiveness of this part of the study and also a broader question of musical understanding. Although I attempted to give each group of listeners the same definition of groove to listen out for and rate, clearly, the Non-jazz musicians who had much less exposure to jazz may have struggled to really **feel** what I was talking about. The results of the ratings for groove did not suggest any difference between the groups but were they rating the same thing?

### **8.ii.c. Qualitative data – the views of musicians**

In answer to my question, 'What does groove mean to you?', unsurprisingly, none of the musicians described it in terms of a timing gap! Their language

captured some of the intangibility of groove; it had a 'physical pleasure', it was the way that sound made you dance, it breathed, it represented something akin to a spiritual state but it was never numbers. From the sizeable ethnographic studies of jazz through to this project, the range of metaphorical language that is used to make sense of groove gives some indication of how difficult it is to pin down and how it is seemingly full of contradictions.

From a sample of only six musicians, I am hesitant to draw any sweeping conclusions. From the outset, this set of interviews was designed to accompany the two sets of quantitative data rather than act as the third part of a tripod. It has however been a valuable part of this project in two ways. Firstly, the varied views of musicians on playing together act as a continuous reminder that reducing a musical phenomenon such as groove to a set of timing data or groove rankings is to capture only a part of it. This is not to diminish the value of the results in this study but to reflect that it is the polysemic nature of music wherein lies its power. Groove is constituted simultaneously through a set of technically driven, co-ordinative skills, personal experience and social setting.

Secondly, the relationship between the broader social/cultural issues of playing groove together and the detail of moment by moment playing is a complex one. Evidence from musicians about the relationship between social and musical engagement was conflicting. Most players however seemed to distinguish between these, a distinction upheld by studies of group cohesion in which personal attraction does not necessarily impact on the effectiveness of task performance. On quite a different level, the musicians did feel almost without exception that there was some different quality in the playing of Americans and Europeans that could be felt in the detail of a musician's playing yet could be traced back to their cultural milieu.

How to make sense of these different levels within a study is challenging. Doise, in his significant study of research methods has described the problems of articulating the different levels of social process in psychological experiments and the way in which the 'experimental paradigm tends to isolate

and reify elements of a more complex process' (1986, p10 ). Part of the attempt in this project has been to at least recognise this factor when analysing the minutiae of 4 bars of playing groove against a background of interpersonal and cultural relations.

### **8.iii. Final remarks**

My introduction points out how musicians are sometimes, perhaps rightly, suspicious of attempts to unpack the whole experience and reduce it to elements that appear disengaged from one another. As a practising musician, I can understand this suspicion. However, this project has given insights into the way in which musicians do carry their ideas through into sound. The consistent manipulation of pulse at the finest levels of motor control has been demonstrated. These subtle shifts of timing have also been shown to be detectable by listeners to some degree. The qualitative judgements made by listeners of the performances need to be treated with some care as any sort of rating of 'groove' carries many assumptions, understandings and misunderstandings about what groove is. More work needs to be carried out into how groove works its magic on us in order to be able to interpret listener's responses to it.

This project went beyond the quantifiables of production and perception to the question of how this stuff called groove can be framed as meaningful for performers and listeners. The premise of the project has been that even something as basic as a pulse played by two musicians carries layers of significance well beyond its apparent capability. Groove is expressive. However, this exploration acknowledges that much work needs to be done to make more sense of the many overlapping levels of feeling and meaning that groove can engender.



## **Bibliography**

Atik, Y. (1994). The Conductor and Orchestra: interactive aspects of the leadership process. *Leadership and Organization Development Journal*, 13, 22-28.

Becker, H. S. & McCall, M. M. (eds) (1990). *Symbolic Interaction and Cultural Studies*. Chicago: University of Chicago Press.

Beek, P. J. , Peper, C. E. & Dattertshofer, A. (2000). In P. Desain & L. Windsor (eds.), *Rhythm Perception and Production* (pp 9-33). Lisse: Swets & Zeitlinger.

Berliner, P. F. (1994). *Thinking in Jazz: the infinite art of improvisation*. Chicago: University of Chicago Press.

Blacking, J. (1973). *How Musical is Man?* Seattle: University of Washington Press.

Brown, R. (2000). *Group Processes* (2<sup>nd</sup> ed.). Oxford: Blackwell Publishing.

Busse, W. G. (2002). Toward Objective Measurement and Evaluation of Jazz Piano Performance via MIDI-based Groove Quantize Templates. *Music Perception*, 19, 443-461.

Clarke, E. F. (1989). The perception of expressive timing in music. *Psychological Research*, 51, 2-9.

Clarke, E. F. & Davidson, J. W. (1998). The Body in Performance. In W. Thomas (ed.), *Composition - Performance - Reception* (pp. 74-92). Aldershot: Ashgate Press.

Clarke, E. F. (1999). Rhythm and timing in music. In D. Deutsch (ed.), *The Psychology of Music* (2nd edition, pp. 474-500). New York: Academic Press.

Clynes, M. (1986). Generative Principles of Musical Thought: integration of microstructure with structure. *Journal for the Integrated Study of Artificial Intelligence, Cognitive Science and Applied Epistemology*, 3 (3), 185-223.

Collier, G. L. & Collier, J. L. (1996). Microrhythms in Jazz: a review of papers. *Annual Review of Jazz Studies*, 3, 117-139.

Cook, N. (1990). *Music, Imagination and Culture*. Oxford: Oxford University Press.

Cook, N. & Dibben, N. (2001). In P. N. Juslin & J. A. Sloboda (eds.), *Music and Emotion: theory and research* (pp 45-70). Oxford: Oxford University Press.

Cook, N. (2004). Computational and Comparative Musicology. In E. F. Clarke & N. Cook (eds.), *Empirical Musicology*. Oxford: Oxford University Press.

Davidson, J. W. (1997). The Social in Music Performance. In D. J. Hargreaves & A. C. North (eds.), *The Social Psychology of Music* ( pp 209-228). Oxford: Oxford University Press.

Davidson, J. W. & J. M. M. Good (2002). Social and Musical Co-ordination Between Members of a String Quartet: an exploratory study. *Psychology of Music*, 30, 186-201.

Doise, W. (1986). *Levels of Explanation in Social Psychology*. Cambridge: Cambridge University Press.

Dunsby, J. (1995). *Performing Music: shared concerns*. Oxford: Clarendon Press.

Eck, D. , Gasser, M. & Port, R. (2000). Dynamics and embodiment in beat induction. In P. Desain & L. Windsor (eds.), *Rhythm Perception and Production* (pp 157-170). Lisse: Swets & Zeitlinger.

Efron, R. (1973). Conservation of temporal information by perceptual systems. *Perception and Psychophysics*, 14, 518-530.

Ellis, M. C. (1991). An analysis of 'swing' subdivision and asynchronization in three jazz saxophonists. *Perceptual and Motor Skills*, 73, 707-713.

Epstein, D. (1995). *Shaping Time: music, the brain, and performance*. New York: Schirmer.

Faulkner, R. R. (1973). Orchestra Interaction: some features of communication and authority in an artistic organisation. *The Sociological Quarterly*, 14, 147-157.

Fraisse, P. (1982). Rhythm and tempo. In D. Deutsch (ed.), *The Psychology of Music* (pp. 149-180). New York: Academic Press.

Friberg, A. & Sundberg, J. (1995). Time discrimination in a monotonic isochronous sequence. *Journal of the Acoustical Society of America*, 98, 2524-2531.

Friberg, A. & Sundstrom, A. (2002). Swing Rations and Ensemble Timing in Jazz Performance: evidence for a common rhythmic pattern. *Music Perception*, 19, 333-349.

Gabrielsson, A. & Juslin P. N. (1996). Emotional Expression in Music Performance: between the performer's intention and the listener's experience. *Psychology of Music*, 24, 68-91.

- Gabrielsson, A. (1999). The Performance of Music. In D. Deutsch (ed.), *The Psychology of Music* (2<sup>nd</sup> edition, pp. 501-579). San Diego: Academic Press.
- Gabrielsson, A. (2003). Music Performance Research at the Millenium. *Psychology of Music*, 31(3), 221-272.
- Giddens, A. (1984). *The Constitution of Society: outline of the theory of structuration*. Cambridge: Polity.
- Goffman, E. (1959). *The Presentation of Self in Everyday Life*. New York: Doubleday.
- Goffman, E. (1967). *Interaction Ritual: essays on face-to-face behavior*. New York: Pantheon Books.
- Goffman, E. (1986). *Frame Analysis: an essay on the organization of experience*. Boston: Northeastern University Press.
- Greene, C. N. (1989). Cohesion and productivity in work groups. *Small Group Behavior*, 20, 70-86.
- Haken, H. (1983). *Synergetics: an introduction*. (3<sup>rd</sup> ed). Berlin: Springer Verlag.
- Hary, D. & Moore, G. P. (1987). Synchronizing human movement with an external clock source. *Biological Cybernetics*, 56, 305-311.
- Hirsh, I. J. (1959). Auditory Perception of Temporal Order. *Journal of the Acoustical Society of America*, 31, 759-767
- Hogg, M. A. (1992). *The Social Psychology of Group Cohesiveness: from attraction to social identity*. New York: Harvester Wheatsheaf.
- Iyer, V. (2002). Embodied Mind, Situated Cognition, and Expressive Microtiming in African-American Music. *Music Perception*, 19, 387-414.
- Jones, M. R. & Boltz, M. (1989). Dynamic attending and responses to time. *Psychological Review*, 96, 459-491.
- Keil, C. & Feld, S. (1994). *Music Grooves: essays and dialogues*. Chicago: University of Chicago Press.
- Keil, C. (1995). The Theory of Participatory Discrepancies: a progress report. *Ethnomusicology*, 39 (1), 1-19
- Kendall, R. A. & Carterette, E. C. (1990). The Communication of Musical Expression. *Music Perception*, 8, 129-164.

Kramer, J. D. (1988). *The Time of Music: new meanings, new temporalities, new listening strategies*. New York: Macmillan.

Lakoff, G. & Johnson, M. (1999). *Philosophy in the Flesh: the embodied mind and its challenge to western thought*. Chicago: University of Chicago Press.

Langer, S. (1951). *Philosophy in a New Key*. Cambridge, MA: Harvard University Press.

Laukka, P. & Gabrielsson, A. (2000). Emotional Expression in Drumming Performance. *Psychology of Music*, 28, 181-189.

Lerdahl, F. & Jackendoff, R. (1983). *A Generative Theory of Tonal Music*. Cambridge MA: MIT Press.

Lewin, K. (1952). *Field Theory in Social Science*. London: Tavistock Press.

Madison, G. (2000). On the nature of variability in isochronous serial interval production. In P. Desain & L. Windsor (eds.), *Rhythm Perception and Production* (pp 95-113). Lisse: Swets & Zeitlinger.

Meyer, L. B. (1956). *Emotion and Meaning in Music*. Chicago: University of Chicago Press.

Monson, I. (1996). *Saying something: jazz improvisation and interaction*. Chicago: University of Chicago Press.

Murnighan, J. K. & Conlon, D. E. (1991). The dynamics of intense work groups: a study of British string quartets. *Administrative Science Quarterly*, June, 165-186.

Nattiez, J. (1990). *Music and Discourse: toward a semiology of music*. (Trans. by C. Abbate). New Jersey: Princeton University Press.

Palmer, C. (1997). Music performance. *Annual Review of Psychology*, 48, 115-138.

Peper, C. E. , Beek, C. J. & Dafertshofer, A. (2000). Considerations regarding a comprehensive model of (poly)rhythmic movement. In P. Desain & L. Windsor (eds.), *Rhythm Perception and Production* (pp 35-49). Lisse: Swets and Zeitlinger.

Pressing, J. (2002). Black Atlantic Rhythm: its computational and transcultural foundations. *Music Perception*, 19(3), 285-310.

Progler, J. A. (1995). Searching for Swing: participatory discrepancies in the jazz rhythm section. *Ethnomusicology*, 39, 21-54.

- Rasch, R. A. (2000). Timing and synchronization in ensemble performance. In J. A. Sloboda (ed.), *Generative Processes in Music: the psychology of performance, improvisation, and composition* (pp. 70-90). Oxford: Clarendon Press.
- Reinholdsson, P. (1998). Making Music Together: an interactionist perspective on small-group performance in jazz. *Acta Universitatis Upsaliensis: Studia Musicologica Upsaliensis*, Nova Series 14. Uppsala: Uppsala University.
- Repp, B. H. (1998). A Microcosm of Musical Expression: 1. Quantitative analysis of pianist's dynamics in the initial measures of Chopin's Etude in E Major. *Journal of the Acoustical Society of America*, 104, 1085-1100.
- Repp, B. H. (2000). Subliminal temporal discrimination revealed in sensorimotor coordination. . In P. Desain & L. Windsor (eds.), *Rhythm Perception and Production* (pp 129-142). Lisse: Swets & Zeitlinger.
- Schutz, A. (1964). *Collected Papers (Vol. 2 - Studies in Social Theory)*. The Hague: Martinus Nijhoff.
- Schutz, A. (1967). *The Phenomenology of the Social World* (G. W. F. Lehnert, Trans. 3rd ed.). London: Heinemann Educational Books.
- Shaffer, L. H. (1984). Timing in Solo and Duet Piano Performances. *Quarterly Journal of Experimental Psychology*, 36 A, 577-595.
- Shaffer, L. H. (1981). Performances of Chopin, Bach and Bartok: studies in motor programming. *Cognitive Psychology*, 13, 326-376.
- Shepherd, J. & Wicke, P. (1997). *Music and Cultural Theory*. Cambridge: Polity Press.
- Sloboda, J. A. (1985). *The Musical Mind: the cognitive psychology of music*. Oxford: Oxford Science Publications.
- Summers, J. (2000). Mental Timekeepers, Internal Clocks, Oscillators and Complex Dynamics: Introduction. In P. Desain & L. Windsor (eds.), *Rhythm Perception and Production* (pp. 3-8). Lisse: Swets & Zeitlinger.
- Tomes, S. (2004). *Beyond the Notes: journeys with chamber music*. Woodbridge: Boydell Press.
- Turner, J. C. (1985). Social categorization and the self-concept: a social cognitive theory of group behaviour. In E. J. Lawler (ed), *Advances in Group Processes: theory and research: Vol. 2* (pp. 77-122). Greenwich: JAI Press.
- Varela, F. J., Thompson, E. & Rosch, E. (1991). *The Embodied Mind: cognitive science and human experience*. Cambridge, MA: MIT Press.

Vorberg, D. & Hambuch, R. (1984). Timing of two-handed rhythmic performance. In J. Gibbon & L. Allen (eds.), *Timing and time perception* (pp. 390-406). New York: New York Academy of Sciences.

Warren, R. M. (1993). Perception of acoustic sequences: global integration versus temporal resolution. In S. McAdams & E. Bigand (eds.), *Thinking in Sound: the cognitive psychology of human audition* (pp 37-68). Oxford: Clarendon Press.

Wing, A., M. & Kristofferson, A. B. (1973). Response delays and the timing of discrete motor responses. *Perception and Psychophysics*, 14, 5-12.

Wing, A., M. (1980). Timing of movement phases of a repeated response. *Journal of Motor Behavior*, 12, 113-124.

Wohlschlager, A. & Koch, R. (2000). Synchronization error: an error in time perception. In P. Desain & L. Windsor (eds.), *Rhythm perception and production* (pp 115-127). Lisse: Swets and Zeitlinger.



## APPENDIX 1 – Listener questionnaire template

### LISTENING RESPONSES

Playing intention – CIRCLE ONE DESCRIPTION

Rating of groove - CIRCLE ONE NUMBER

Perform-ance	Playing Intention	Very groovy to Very ungroovy 1.....5	Comments
1	NEUTRAL		
	BASS PUSH	1    2    3    4    5	
	RIDE PUSH		
2	NEUTRAL		
	BASS PUSH	1    2    3    4    5	
	RIDE PUSH		
3	NEUTRAL		
	BASS PUSH	1    2    3    4    5	
	RIDE PUSH		
4	NEUTRAL		
	BASS PUSH	1    2    3    4    5	
	RIDE PUSH		
5	NEUTRAL		
	BASS PUSH	1    2    3    4    5	
	RIDE PUSH		
6	NEUTRAL		
	BASS PUSH	1    2    3    4    5	
	RIDE PUSH		

## APPENDIX 2 – Interviews with musicians

### **A) Interviewees:**

Bass players: AD, DW, JB, and TH (who attended with MF)

Drummers: JM, MF, SB.

### **B) Initial questions for interview**

#### **General**

What does groove mean to you?

Have your ideas about playing and groove changed as you have developed ?

Is it something that you have deliberately practised? If so, how? Do you think that this can be taught?

Where would you place the importance of grooving in relation to soloing within jazz?

#### **Social**

Are there particular players that you enjoy playing with?

Can you describe why?

Are there players that you find it difficult to play with?

Can you explain this?

Is it possible to groove well with someone that you dislike?

Have you found that your musical relationship with someone is in some way connected to your social relationship?

Do you feel that you lead or follow in the groove?

#### **Timing issues**

In the course of playing a piece, (what are you thinking of in relation to the groove?)

Do you think in terms of timing issues?

Are you looking to change things or keep them the same?

Do you prefer to play in front of the bass/drums or behind?

Is it more or less the same for you or do you change the way you play depending on who you are with?

## Acknowledgements

Particular thanks are due to a number of people for their help.

My thanks to Professor Eric Clarke for his insight and support throughout this project – a real inspiration; to Peter Hutchinson for his ever-ready software expertise and advice; to Jon Seagroatt for recording and MIDI help ; to Sin-Yi Cheung for her SPSS wisdom; to Raf Mizraki for his wonderful bass playing and enthusiasm for music; to all the interviewees and questionnaire respondents for their thoughtful responses and not least, thanks to other members of the DLMA team for their friendship over the last two years.

Final gratitude to Anna, Tom and Luke for putting up with my tantrums etc over the last year.