Learning Jazz Improvisation
PhD Thesis
Kathy Dyson 2006

Abstract

The process of learning jazz improvisation is investigated in an exploratory way drawing on schema theory as a possible framework, from both a theoretical and a practical perspective. A schema is considered to be an abstract framework in the mind that both structures and is structured by experience. In this thesis, schema theory relating to a number of disciplines, is explained in detail, focusing on cognitive and motor elements in order to relate these processes to jazz improvisation and thus to provide a theoretical model. The model in turn is used to investigate how conceptual knowledge may be abstracted and generalised; how motor skill in musical improvisation may be developed; how cohesion in improvised lines may be generated; how multi-modal aspects of the skill may be integrated; how novel ideas may occur; how the individual voice is created and how improvised ideas may be communicated. This schema theory for jazz improvisation provides the theoretical ground from which a series of educational workshops (involving both groups and individual musicians), on jazz improvisation learning was guided, observed and interrogated by the author as investigator in collaboration with the participants. A qualitative research methodology is used to collect and then analyse data from the workshops. Evidence from these practical investigations demonstrates the ability for musicians (mainly classically trained instrumentalists), untrained in jazz or improvisation to develop improvisation skills in a naturalistic and holistic manner, which is consistent with a theoretical account of schema theory. The workshop teaching also reveals the value of singing to improvisation development and the recreative/selective nature of memory. The findings, whilst considered speculative and work in progress have wide ranging implications for understanding dynamic

adaptive skill and for educational practice, specifically, how knowledge of the schema might help teachers striving to teach music improvisation.

Introduction

This investigation of how jazz improvisation is learned (in a contemporary educational context) draws on schema theory as a theoretical framework for understanding the process. Applying schema theory to jazz improvisation, I have attempted to provide an explanation of how humans come to be able to abstract and adapt specific information to different and changing musical contexts. As a jazz musician and teacher, this approach begins to provide the ground for explaining how novel behaviour and thinking can be accounted for. Schema theory usefully provides connections to theories of movement and motor programmes by describing a stable yet adaptable framework which forms a basis for linking conceptual ideas, aural imagination and physical skills. The central tenet of the thesis is that higher order skills such as improvisation are guided by schemata which enable dynamic and adaptive behaviour. I propose that during the process of learning jazz improvisation, a series of integrated conceptual, motor, auditory and other schemata emerge and are adapted in the mind to enable the body to perform the requisite musical skills and to allow the individual to create novel ideas and to develop their own individual improvisational voice. The research attempts to understand adaptable dynamic learning process as it occurs rather than particularly focusing on outcomes and also tries to bridge the gap between what the teacher thinks is being taught, what the student learns and how they perceive that learning.

Aims of the research

- To investigate schema theory and its implications

- To relate schema theory to the understanding of jazz improvisation.

- To test the applicability of the theory to jazz by organising and carrying out a series of educational workshops designed to facilitate improvisation.

- To monitor the emergent and developing skills, treating them as schemata if and where possible, drawing on qualitative research methodology to monitor and assess teaching and learning strategies and analyse these processes as data for further theoretical and practical development.

These aims are driven by the following specific questions:

Research Questions

1. What is a schema?

2. How do they relate to learning in general and adaptive dynamic learning?

3. What should a schema for jazz improvisation be able to do? (Proposed model)

4. What are the other current theories of jazz improvisational process and how do they relate to schema theory?

5. How did jazz musicians traditionally learn to improvise and how is this aspect related to the proposed schema theory?

6. How do contemporary teachers propose that jazz is learned and how does this relate to schema theory?

7. How can the schema theory of jazz improvisation be tested within a practical setting?

8. What are the processes, findings and implications of seeking schema emergence and development within a practical educational setting?

9. Where does the research lead?

Jazz improvisation definitions

The Concise Oxford Dictionary defines improvisation as the capacity: 'to create and perform (music, drama or verse) spontaneously or without preparation'. As applied to music: 'the art of performing music spontaneously, without the aid of manuscript, sketches or memory'. These definitions are essentially misleading as any practitioner of improvisation will be aware. In fact, it takes a great deal of preparation, practice and memorisation in order to be able to improvise. Jazz researcher and practitioner Berliner (1994) describes improvisation as involving "reworking pre-composed

material and design in relation to unanticipated ideas conceived, shaped, and transformed under the special conditions of performance, thereby adding unique features to every creation". Improvisation has also been compared to "real-time composing" (Kernfeld, 1988), and many contemporary jazz educators view it as such.

Runswick (2004) has an even broader definition of improvisation based on his notion of the *improvisation continuum*: 'Improvisation is real-time invention applied to one or more parameters in a musical performance.' In Runswick's view, invention is any performance practice where choice is made by the performer, and he views improvisation on a continuum with completely free improvisation being at one extreme and tape playback in which no interpretive elements are present, at the other. Within the traditions of improvisation, Runswick includes Baroque ornamentation, aleatoric practices and Indian classical music, all of which have varying degrees of improvised elements that are viewed as being equally, rather than hierarchically important. Most improvisation however, takes place within a cultural context, and in the jazz idiom improvisation can be viewed from three different perspectives; as a completely free endeavour in which no rules are required (as played for example by Derek Bailey or Han Bennink); as a semi-free activity where certain rules or forms invented by the performers are applied (Antony Braxton or Cecil Taylor improvise in this way), and as a melodic process within a specific idiom based on a historical period usually using some elements of swing (as exemplified by Paul Desmond or Charlie Parker). In this thesis, it is the third perspective- melodic improvisation based on a harmonic progression which is the focus of the study; specifically, how it is developed as a teaching and learning process.

Overview/plan of the thesis

In order to explain why schema theory is being applied to the jazz improvisation teaching and learning context, I begin the first chapter of the thesis by defining schemata and exploring the range of different meanings of the term, so as to prepare the theoretical ground for my overall investigation. In chapter two, I explore further areas specifically pertaining to schemata for adaptive learning and propose a model of jazz improvisation schema theory which incorporates elements from two major strands of schema research: a) the psychological issues surrounding schema formation and content, including memory and possible neural underpinnings relating to schema development and b) the development of motor schemata from a physiological perspective. In chapter three historical, traditional and experiential models for learning jazz improvisation are discussed and compared to the schema theory model. Chapter four investigates how contemporary teachers of jazz propose learning jazz improvisation and includes three alternative notions about improvisational practice from Jeff Pressing, Philip Johnson-Laird and David Sudnow. Chapter five proposes a rationale for the methodology which was adopted to ground the practical work, and a model for data collection and analysis. In chapter six, the planning and organisation of the practical investigation is justified both in educational terms and in relation to the proposed jazz schema theory. Later in this chapter, there is a description and evaluation of a preliminary pilot project of a similar kind, where my own attempts as the teacher to monitor the emerging schema are made. This work enables me to refine my teaching and overall research strategies ready for the main practical investigations. Chapter seven focuses on the main practical investigation which is a case study of one individual engaged in learning improvisation over the period of five weeks. The findings and implications are discussed in chapter eight in relation to the jazz schema

theory itself and to other educational and musical aspects. Finally, conclusions are drawn and possible new ways of developing or extending the research, are discussed.

To begin the overall investigation, this chapter now devotes itself to describing what a schema or schema assemblage is and how it might work during the process of learning to improvise. A schema is a singular instance of the entity and schemata refers to the plural of schema. My basic working definition is that a schema is an abstract framework in the mind that structures experience and is structured by experience. Further definitions by Kant, Piaget et al are explored as they expand on this core idea and help to illustrate the broadest view of what a schema is and how it may be used to illuminates the process of jazz improvisation.

1. Schema Theory

1.1 Descriptions of Schemata

A schema is a dynamic, abstract framework in the mind that structures experience and is structured by experience. The notion of the schema has been documented since the time of Aristotle, who discussed schemata in *The Metaphysics,* and Plato, who wrote about them in *The Meno.* In more recent times, Kant (1787) was the first to describe the schemata that refer to conceptual ideas. He envisaged them as non-propositional structures of the imagination (whereas we now view them as knowledge frameworks of all kinds), and realised that the abstraction in a schema can represent many things sharing the same features in a dynamic state, whilst still providing a structure for understanding and for action. Kant also differentiated between a visual mental image and a schema, defining the image as being essentially a static phenomenon and the schema being a dynamic framework. Below, he describes the difference between an image of a triangle and a schema of 'triangle':

> No image could ever be adequate to the concept of a triangle in general. It would never attain that universality of the concept which renders it valid of all triangles, whether right-angled, obtuse angled or acute angled; it would always be limited to a part only of this sphere. The schema of the triangle can exist nowhere but in thought. (1787/1968:179)

In the 20th century, although schema theory remained at the periphery of psychological research, Head and Holmes (1911) and Head (1920) described the schematic model we have of our body in our mind which is extraordinarily resistant to what it sees as discordant information (for example, persistent feeling and pain in an amputated limb). An implication of Head's research is that the brain can construct a reality independent of the accuracy of sensory information. Bartlett (1932) as a student of Head, elaborated the idea of the schema to incorporate psychological

phenomena. As part of his research on memory, he developed a theory of the schema that is formed when listening to a story and he discovered that what is remembered is based upon the attitude and values that are brought to it i.e. the role of our existing schemata on new information. Rather than passively replicating the facts of the story, we actively *recreate* them to fit with our own existing schema. (Similarly, we also envisage our own particular imagining according to our previous experience and memories.) Bartlett proposed that memory is both selective and recreative: that is, we remember those elements that have particular resonance for us, and which we choose to remember, with each successive remembrance being altered according to our own version or view of the events from our current perspective.

Piaget (1952) related schema formation and function to child development and he thought of schemata as embodied structures which co-ordinate physical actions and cognitive functions in order to respond to every experience that can be related to the schema. He perceived the schema as a unit of thought that grows and differentiates with the experiences of childhood and defined the schema of an action as the structure of the 'generalisable characteristics of this action, that is, those which allow the repetition of the same action or its application to new content' (1966:235). In relation to the schema of an action Beth and Piaget state:

> The schema of an action is neither perceptible (one perceives a particular action but not its schema) nor directly introspectible, and we do not become conscious of its implications except by repeating the action and comparing the results. (1966:235)

Anderson (1977) and Rummelhart (1980, 1984) both suggest that to understand something requires us to choose a schema that can account for it and in the face of an inexplicable situation a new schema must be formed or an old one adapted. In this

view, the schema forms the basis for *all* understanding. Consider for a moment an opposite view, and see why the idea of the schema is so compelling. Imagine coming to each situation entirely fresh in the way that perhaps babies and young children do, and having in each instance to create a suitable framework to understand it. Fortunately many similar situations occur as the child interacts with first the mother or carer, then the family and then the outside world, so that various similar characteristics can be abstracted and used again.

It also appears that schemata can be used to give meaning and coherence to random information. For example, Howard (1976) cites an anecdotal tale of a man hired to lecture a learned audience who, although he was presented as a distinguished scholar, was in truth an actor who read a series of disjointed and disorganised nonsense text interspersed with appropriate jargon and academic phraseology. His audience seemed to make sense of what he said by applying their own schemata; in other words they sought and created their own meaning, allowing them to make sense of the lecture. This example illustrates how meaning is made by the listener and imposed on the disparate elements of the material presented, implying a collaborative and dialogical view of understanding between humans in which knowledge is negotiated and passed back and forth until a reasonably definitive idea is created. The same process could be said to occur in musical performance, with the communicative aspects being present as a collaboration between musician and audience.

The implications of the role of schemata in our understanding are that without the appropriate schema for a particular area of knowledge, a given topic will be incomprehensible to the individual. Similarly, a subject or concept will not be

understood if there are insufficient clues presented in order to call up the relevant schema. Schemata, therefore, are fundamental to learning process. An important educational application of knowledge about schemata is that the teacher presents material that initially comes within the domains of students' existing schemata and subsequently orders new concepts and materials so that they are developed, enriched and linked to the formation of new frameworks. According to Howard (1976:42) material that is not understood within the student's existing schemata will be ignored, compartmentalised or learned by rote and as such cannot be integrated into the knowledge base or developed to higher levels. It is also much more likely to be irrelevant and therefore forgettable to the student.

Memory and schemata are obviously integrated in that the development of a schema allows the individual to abstract the most important elements for them, in any given situation. Rumelhart (1984) suggests that schemata are also used to reconstruct events from diverse and fragmentary sensory information, so that the memory becomes coherent and meaningful to the individual. This notion is in agreement with Neisser's definition presented below, where the schema both modifies and is altered by experience, in a two way process.

> A schema is that part of the entire perceptual cycle which is internal to the perceiver, modifiable by experience and somehow specific to what is being perceived. The schema accepts information as it becomes available at sensory surfaces and is changed by that information; it directs movements and exploratory activities that make more information available, by which it is further modified. From a biological point of view, a schema is part of the nervous system. It is some active array of physiological structures and processes; not a centre in the brain, but an entire system that includes receptors and afferents and feed-forward units and efferents.
> Neisser (1976:54)

The schema is also involved in the amount and quality of information that we remember and the more highly developed and rich the schema, the more likely it is that relevant information is both assimilated and recalled. As well as conceptual schemata, there are also schema theories for motor control which are highly relevant to the learning of jazz improvisation.

1.2 Motor Schemata

There has been some groundbreaking work in this area and of the many researchers/ theorists involved in motor schema work, it is to two key historical figures Richard Schmidt and Nikolai Bernstein that I turn to illuminate motor schema process and its relevance to jazz improvisation.

1.2.1 Schmidt's schema theory of motor skill acquisition

Schmidt (1975) developed a schema theory to account for the learning of motor skill and defines motor learning as: 'a set of (internal) processes associated with practice or experience leading to relatively permanent changes in the capability for responding' (Schmidt, 1988:346). He viewed a motor schema as a set of rules, formed by abstracting information from related movement experiences. Schmidt (like Hebb before him) argued that instead of learning specifically programmed movements, people learn generalised motor programs or schemata and they do this by learning the relationships between the various parameters of a movement and the outcomes. Schmidt's schema model of motor control proposes that there are two different memory systems; the recall schema and the recognition schema, both of which have to be established through experience and/or practice. The recall schema relates outcomes to movement parameters, for example, trajectories, movement duration and

the amount of force needed to execute the movement. The recognition schema relates expected sensory consequences of a movement to the movement's outcome which acts as an internal reference point or comparison between the imaginary correct and actual outcome. A generalised motor programme contains instructions necessary for the execution of a movement but has to adapt to constantly changing situations and therefore requires response specifications or instructions. According to Schmidt (1975), for a schema to be established or used there have to be four sources of information:

1) The initial conditions i.e. information about the starting point of the movement;
2) Response specifications i.e. information about the task about to be executed. 1) and 2) represent the recall schema – the requirements and conditions of the movement or skill.
3) The response outcome compared to the intended outcome which is usually external feedback compared to internal expectation and
4) The sensory consequences of the response i.e. how it felt during and after the movement. 3) and 4) represent the recognition schema and relate to the control and evaluation of the movement or skill.

After a movement is made with a generalised motor programme, the individual stores the four pieces of information described above using the recall schema to create the movement and the recognition schema to control and evaluate it. Schmidt proposes that the schema is formed from the relationships between the elements that are crucial and from the abstraction of such information over many practised repetitions. Of

great relevance to jazz improvisation is the notion that a particular movement outcome (specified by a particular value of the parameter) need not be produced previously in order to be produced in the future: the individual can extrapolate a new movement based upon imagination and the abstracting of information from previously practised movements. In jazz improvisation this would be the execution of a novel movement in response to a new musical idea in the aural imagination, which could not happen without the previous focus on learning specific movements related to learned musical ideas or exercises. The novel response is one of the predictions of schema theory and this is because the basis for producing a new movement is a rule about parameter selection based on the performance of earlier similar movements. Schmidt's model is presented below in diagrammatic form, illustrating the two separate forms of motor schema memory.

Fig. 1.1 Schmidt's schema model for movement.

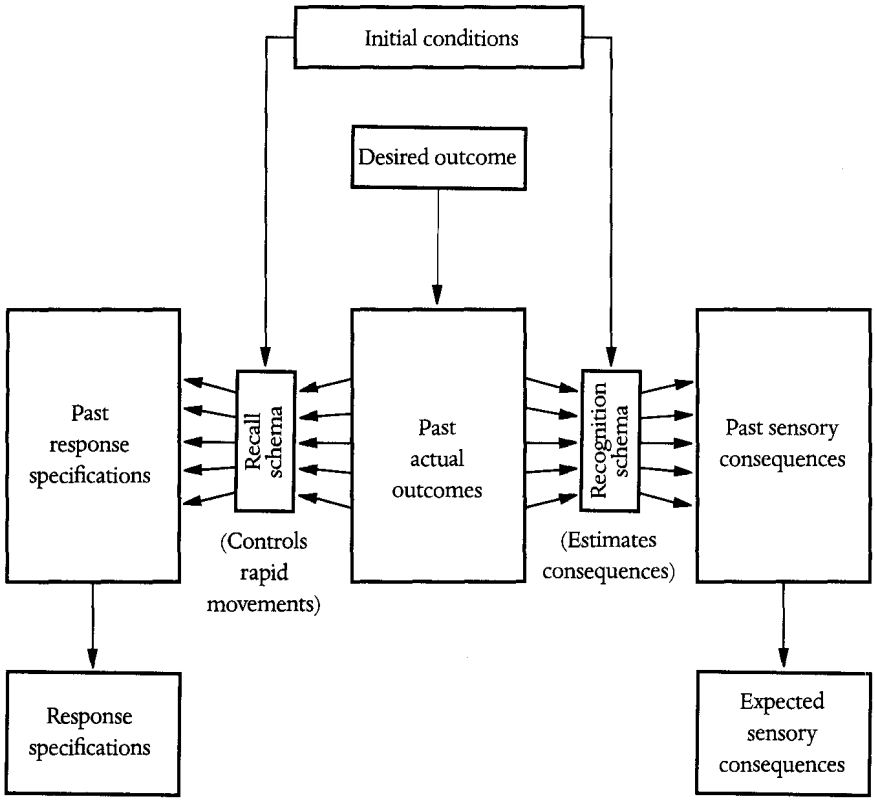

Figure 1.4. The brain anticipates the consequences of movement from past action to prepare and initiate a movement. Reading from top to bottom, anticipated movements begin with a set of initial conditions and a plan of action that will lead to the desired outputs. These are compared with the results of past actions recalled by two types of memory: left, memory of motor commands, and right, memory of sensory data associated with past movements and their effects on the environment. It is therefore possible to recall the expected sensory consequences, or the messages detected by the receptors during and after action over the course of movement. Control of movement involves estimating discrepancies between anticipated and actual sensory data.

From Berthoz (2000:18)

Another aspect of schema theory that has clear implications for jazz improvisation is the importance of feedback both in the results of the learning and in the sensory outcomes. A useful role of the teacher or facilitator is to provide appropriate feedback in the early stages of learning when the nature of the relationship between the various parameters is still unclear.

In Schmidt's view, learning can be transferred if it shares sufficient similarities to a new skill, by the modification of both the recall schema and recognition schema. This type of transfer is also linked to the notion of a generalised motor programme for similar tasks and movements. In addition, the amount of information given to the learner at any one time is crucial in establishing the recall schema. Instructions should therefore be clear and simple with key points, as too much information will cause confusion and stretch the limits of working memory. Also, sufficient time is needed in order to assimilate information and to allow its transfer to long term memory. Bernstein (1946/68) described the plateaux, delays and occasional regressions that occur in the learning of complex skills, as a necessary part of the process in which the brain alters to enable flowing, adaptive and dextrous motor skills to occur under conditions that vary widely. It is part of the teacher's role to recognise and accept these perceived setbacks and to alter any learning programme to take them into account by slowing down information in order to consolidate various elements or by ceasing the instruction altogether for a while. Bernstein also proposed generalised motor programmes and the idea that all movement was adaptive and therefore likely to be schema based. This is of key importance to jazz improvisation because the nature of the skill requires constantly adaptive movement triggered and directed from aural sources some of which will be entirely novel.

1.3 Bernstein's theory of motor learning

According to Bernstein (1946/1968) all motor programmes are essentially adaptive and it could be said, at least in part, that these adaptations are improvisatory in nature. In Bernstein's view, external conditions are so variable that movement can be controlled only on the basis of sensory corrections, and repetition of the same

movement will be accompanied by different motor impulses from the brain to the muscles. This is because the schema provides the framework for the realisation of any pattern of neurons to fire in any place. Thus the schema can be activated by any appropriate groups of neurons and perhaps never by the same group twice. Just as we never think the same thought in quite the same way, so we cannot make the same movement twice, only similar ones.

Consider a simple example: as I go to pick up a cup of coffee, my brain does not know exactly how heavy the cup is going to be and could not possibly calculate it in advance. I have the schema and generalised motor programme for picking up a cup (or any other object), yet I never know exactly how heavy any cup will be because the materials, liquids and volumes vary. My brain does not have all the information, therefore as I pick up the cup, the feedback from the sensory nerves in my hand sends signals which are organised into commands for more muscle support in the arm, greater care because the coffee is hot, better balance as the cup is raised to the lips and so on. Certain movements like hand to target, for example, are so well practised that we seldom get them wrong but we cannot predict the weight of objects in advance (although we have a good idea from experience), and have to constantly adapt movements in our everyday environment. In such a naturally adaptive system, it is but a short step to consciously using the process for a musical or other outcome. In Bernstein's view, the repetitions of a movement are not necessary in order to 'imprint' a trace or programme but rather to *solve* a motor problem many times and to find better ways of solving it.

> Repetitive solutions of a problem are also necessary because, in natural conditions, external conditions never repeat themselves and the course of the movement is never ideally reproduced. Consequently, it is necessary to gain

> experience relevant to all various modifications of the task, primarily, to all the impressions that underlie the sensory correction of a movement.
>
> Bernstein (1946/68:176)

According to Bernstein, after numerous repetitions of the movement, the motor cortex (in conjunction with the cerebellum), will sooner or later develop dynamically stable movement patterns. At this point the sensory corrections cease and the movement becomes stable and automatic in order to protect it from any further changes which might compromise its efficacy. Thus the motor skill is still adaptable for improvement and greater dexterity but it cannot disappear or deteriorate. One never, for example, forgets how to ride a bicycle, even after many years without practice.

In jazz improvisation, automaticity and fluency is reached in the mature improviser usually after many years of practice. Playing is entirely automatic if the performer wishes it to be so, and the source and thinking behind why a certain musical line is played is therefore hidden from consciousness and cannot be explained easily in words. People frequently ask jazz musicians what they are doing and thinking of as they improvise and the response is usually a variation on: 'I just blow, man!' As the conscious control and effort required to perform the skill fades from consciousness, it allows the individual to concentrate on other parameters or external features, including greater interaction with other players. Counter intuitively, Grafton et al (1992) have shown that activity in the primary motor cortex and supplementary areas of the cortex actually *increases* once a movement has been learned and the implication is that non-conscious elements come into play which release consciousness for other activities whilst motor areas are organising information so that the brain can control movement in response to a wide range of environmental and kinaesthetic variables. A further point to note is that if activity in the primary motor

cortex increases once the movement is learned, perhaps the extra activity is indicative of the schema organising itself i.e. abstracting the various elements needed to meet new but similar situations or activities.

Bernstein's model of how a movement is controlled and adapted follows. It demonstrates how the brain organises adaptive movement. The comparator within the cyclical model (see Fig 1.2 which is taken from Berthoz, 2000: 14) establishes what Berthoz (2000:13) describes as the required value. This has the role of detecting errors between the intended and actual movement, which in turn triggers a subsequent correction if necessary. The comparator also recognises when the movement is ended so that the next movement in the sequence or plan can be executed. Finally, it adapts movements in the light of changing external or internal information or conditions. Bernstein considers that it occupies a strategic position between the information supplied by the receptors at the sensory surfaces and the neurological substrates that make the corrections and reorganise the movement. In the middle of a movement, it would not be useful to restart the action because of a changing circumstance, therefore the movement is adapted as it unfolds taking into account the new information. As such, the comparator is a dynamic element comparing changing external states with some kind of internal model. According to the model in this case, the receptor acts as an initiator rather than a regulator of the movement and the suggestion is that this happens by introducing small changes in the trajectory of the movement or by taking an adjacent trajectory.

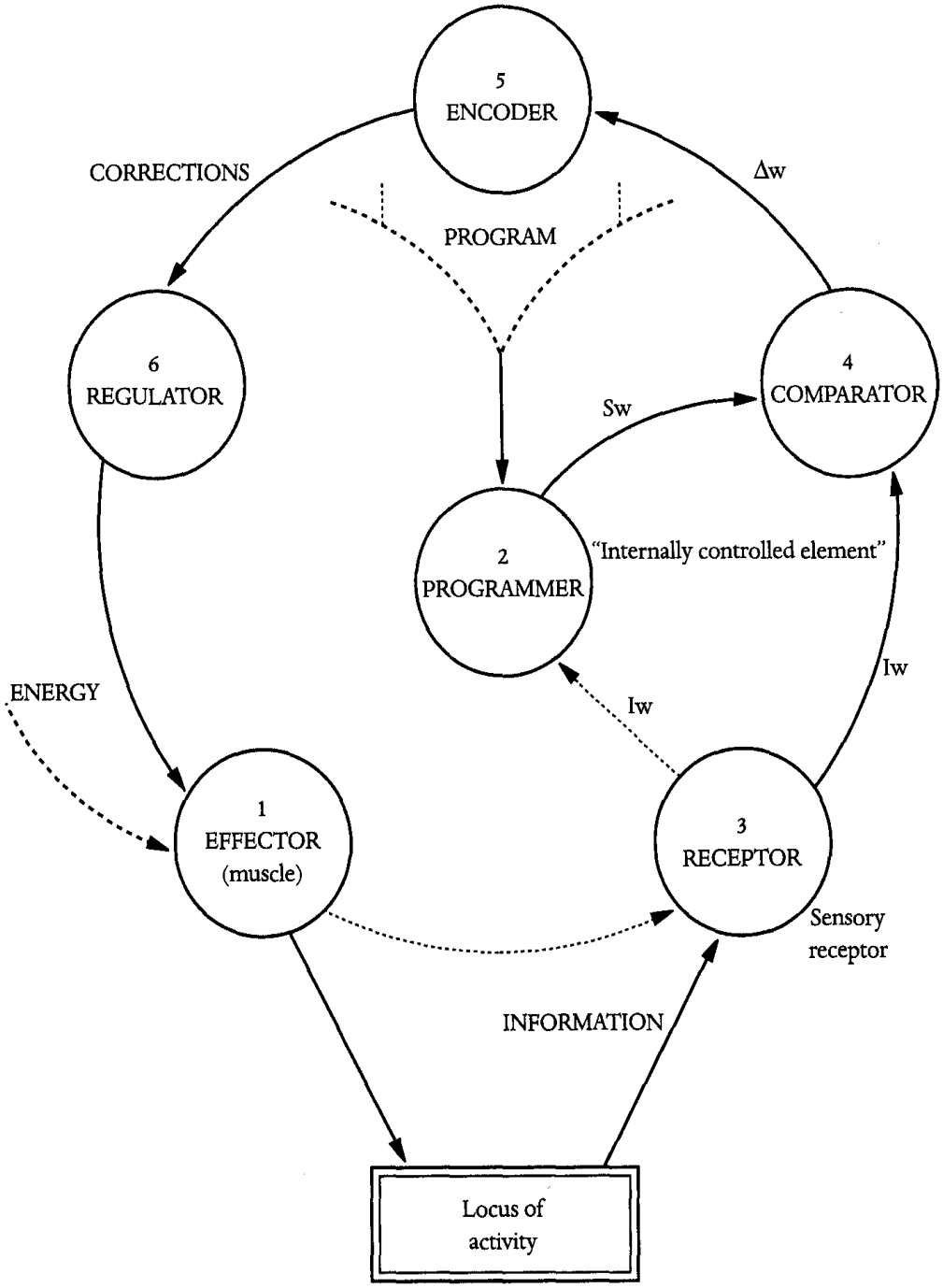

Figure 1.2. Schematic diagram showing the cerebral organization for control of movement proposed by Bernstein.

From (Berthoz, 2000:13)

One of the significant elements of Bernstein's theory of motor learning is that only *target* actions matter, with trajectories of limbs being widely variable and interchangeable, although they usually take the shortest/straightest route. The motor

schema is orientated towards the goal (which is dependent on the will), and the actuality of the movement unfolds using a generalised neural/motor framework. In jazz improvisation, the target action would relate to an aurally imagined or heard idea, and the generalised motor framework would allow it to be played wherever required by the player on the instrument. As Bernstein sees it, in the elaboration of a skill, the brain's sensory systems gradually learn to be more and more skilful in making an instantaneous translation from incoming sensations and perceptions, reflecting the movement process into the 'language' of corrective motor impulses that need to be sent to the muscles. In music, the main difference between learning adaptive musical motor skills in a composed and notated piece of music and in jazz improvisation is that whilst the notated piece can interpreted and played with flexibility, in improvisation the melody has to be created from the imagination and can be completely changed at will as it unfolds.

In Bernstein's view then, motor skill is the ability to solve a motor problem and the learned skill must be practised many times in order for the brain to experience all the sensations, which form the basis of the sensory corrections. But, what is the motor 'problem' of improvisation? It is primarily the linking of aural imagination and auditory feedback with movement and developing the ability to do this task instantaneously, in relation to a harmonic framework and with awareness and responsiveness to fellow players and audience. This motor problem is particularly complex because the imagined musical line is constantly changing, and may require the execution of movements that have never been specifically practised, as for example, in the execution of a novel idea. However, the same ideas pertain; the

‘target’ becomes the next musical idea and as that is unfolding and being played another is forming in direct response to it.

Another insight contributed by Bernstein is that the learning of skilled movements does not proceed in incremental steps or in a smooth fashion. After arduous conscious practice, and many failures, it appears that a person is suddenly able to perform a new skill. Again, this may reflect the schema organising itself non-consciously, hence the sudden acquisition of the skill once all the appropriate elements are assembled. Bernstein is also clear that the skill learning process is relatively slow because of the number and variety of visual, kinaesthetic, motor and cognitive elements that have to be integrated smoothly and efficiently. Motor skill learning within the individual therefore takes as long as the schema takes to form, which will vary enormously from person to person, and Bernstein warns against artificially attempting to speed up the process.

There are also plateaux in the learning process where, despite the best efforts of both teachers and students, progress slows. Bernstein proposes that in such cases, something interferes with solving the problems related to the movement. It may be that some element of the schema has not been assimilated and because it requires a whole integrated framework to be developed, some small misunderstanding or technical problem might destabilise the process. It may require more automatic elements, further understanding or the assimilation of new information, which again cannot be rushed without compromising the quality of the movement. We have all come across the pupil who has learned something fast and inaccurately which is then very difficult to ‘undo’ and correct. This is also borne out in the early stages of

learning a piece of music: the slow precise movements required to ensure the correct notes are incompatible with very quick movements. If an attempt is made to play a newly learned passage too quickly too soon, the movements will be smudged. Conversely there seems to be an optimum tempo for practice; too slow and the music loses all its meaning and flow.

Motor schemata appear to offer crucial understanding for an investigator attempting to research the jazz improvisational process. Schmidt and Bernstein's theories, whilst speculative, account for the learning of movements, their adaptation in response to aural triggers and the increasing dexterity and fluency of the mature improviser. There are other aspects to the schema assemblage of the jazz improviser as well as the conceptual and motor elements, for example social schemata, that have an impact on the learning process, performance practice and group dynamics.

1.4 Social schemata-Alan Fiske's Model

How do social relationships, in the form of social schemata, affect how jazz improvisation is learned? The characteristic feature of social schemata is the way that two or more people co-ordinate with each other so that: 'their action, affect, evaluation or thought are complementary.' (Fiske, 1998:1) In jazz improvisation how one player behaves and performs makes both musical and social sense within the context of other players; their actions complete each other. Indeed, in jazz, as a communal and basically democratic music, it is impossible to progress, without reference to and deep involvement with other players in an equal and complementary relationship. As Fiske (1998:1) points out, relationships are patterns of co-ordination among people; they are not properties of individuals. Jazz musicians typically seek

out others of like mind and similar musical standard to join up with. There are numerous stories related by Berliner's (1994) interviewees involving children and adolescents joining together in bands with real or home made instruments, hanging out and playing at jam sessions, asking questions and being mentored by peers or more experienced players and finally becoming professional players among the community of jazz musicians, promoters, fans, journalists and record companies.

Fiske proposes that all of the diverse, adaptive and multi-cultural and multi-facetted social relationship interactions are based on only four basic models (Fiske, 1991a, 1992). These are: Communal Sharing, Authority Ranking, Equality Matching and Market Pricing. Communal Sharing is a relationship in which people treat a dyad or group as equivalent and undifferentiated with respect to the social domain in question. In Authority Ranking, people have asymmetric positions in a linear hierarchy in which subordinates defer, respect and perhaps obey, whilst superiors take precedence and also pastoral responsibility for subordinates. Authority Ranking relationships are based on perceptions of legitimate asymmetries, not coercive power and are not therefore inherently exploitative. Equality Matching involves relationships where people keep track of the balance or difference among participants and know what is required to restore balance, for example, turn taking, one person one vote, equal share distributions and so on. Money Pricing relationships are orientated to socially meaningful ratios or rates such as price, wages, interest, rents, and so on although money need not be the medium. Fiske remarks that people often use different models for different aspects of their interaction with the same person:

> For example, roommates may divide the rent evenly and take turns cooking dinner for each other (both Equality Matching), buy ingredients for the meal at the store (Market Pricing), share their food and drink at the table without regard to who consumes what and share living and bath rooms (Communal Sharing), pay for long-distance calls according to the costs they each incur (Market Pricing), and one may sell her used car to the other. On the softball field one is a coach, the other player (Authority Ranking); yet in their sexual relations they like to reverse these roles of domination and submission. (Fiske, 1998:4)

The jazz musician will probably be involved in all four types of these particular social schemata as he or she learns and hones their improvisational skill. Communal Sharing will relate to the conducting of rehearsals, forming of bands and peer learning; Authority Ranking will affect jazz musicians relationships with teachers and master players who they will defer to (in an apprenticeship-type model) and who also have a pastoral care role; Equality Matching will take place within performances and rehearsals and relate to the taking of solos, the sharing of composition duties and the organising of material; and relationships involving Market Pricing will occur in the promotion of gigs, payment for performance, CD production and sales, and payments for performing rights amongst others. Jazz musicians will use these models of social schemata to construct and co-ordinate their performances and musical development, as well as to interpret, plan and remember important aspects of the overall process. The models appear to be cognitive by implication but are in fact integral with emotions, motives, needs, evaluative attitudes and judgements. These four social schemata are also generally implicit in nature; people use them without reflection and

would be unable to articulate them clearly. The four models are dependent on cultural parameters, paradigms and prototypes to specify action and can therefore be infinitely diverse. When interacting people use the same social schema model in the same way, relationships tend to be harmonious because they understand each other, have complimentary motives and expectations and judge actions in the same way (Fiske and Haslam, 1998). Thus jazz musicians and their audiences know the kinds of relationships, expectations and behaviour required at rehearsals and performances and this facilitates better working practices, and ease of communication and understanding. Players and audiences for free jazz know the kind of performance and music that will take place and how it will be different for those of more mainstream or popular jazz.

1.4.1 Social schemata: Fiske and Taylor's model

Fiske and Taylor (1984:140) describe three types of processes guided by social schemata: perception, memory and inference. How do these relate to social schemata for jazz improvisation? The authors assume that schemata focus primarily on cognition i.e. on how general information is represented in memory and how new information is assimilated into existing knowledge. In the thesis I make the case that this is just one element of the schema which is relevant to the conceptual schema such as Kant's triangle; motor, aural and other schemata are non cognitive in nature. The authors (1984:141) also stress their belief that the most fundamental principle suggested by schema research (in the conceptual/knowledge based arena) is that people simplify reality by interpreting specific instances in the light of the general case. A second fundamental assumption of the schema concept is that perceivers

actively construct reality, by creating meaning and adding onto it the raw data of 'the objective world'.

Taylor and Crocker, (1981) propose that there are five basic types of social schemata: person, self, role, event, and procedural. Person schemata focus on knowledge about the traits and goals that shape a persons behaviour and capture the perceiver's complex understanding of the psychology of typical or specific individuals. The self schema contains information about one's own personality, appearance and behaviour. Role schemata focus on knowledge about broad social categories e.g. age, race, sex or occupation and how the individual is placed within society. Event schemata explore shared understandings of what typically happens on certain occasions. The procedural schema guides information processing towards schema relevant information (1984:149).

1.4.2 Person and self, social schemata

In terms of learning jazz improvisation, person schemata will affect how players choose others to rehearse, perform and socialise with, in part depending on the similarity of their goals and aspirations and also their musical abilities and tastes, (which need to be suited to each other). The jazz musician's self schema, like anyone else's, may be clear on some attributes and less clear on others, but tend to be self-schematic on dimensions that are important to them. As jazz music and improvisation would be important to the aspiring improviser, they would tend to be defined in some part by those characteristics. Berliner (1994) describes many instances of player's self-schemata being defined by the music and their aspirations within it. The self-schema allows the person to filter incoming information about that particular

dimension allowing us to categorise ourselves in the same way we would categorise others (see Markus and Sentis, 1982 for a review). Being schematic on a given trait means that one is a rapid judge of oneself on that particular trait, which makes behaviour quicker and easier. People also recognise an attribute from their self schemata in others and this helps to connect and bond people, especially in the jazz community where goals and aspirations are likely to be similar. People's self schemata also make them think harder about all kinds of schema relevant information that comes their way, and so their self schema and commitment to the ideas within it becomes stronger and more individual.

A primary area involving social schemata for the jazz musician would seem to be motivation; the motivation to be an equal with and respected by peers and the motivation to play in front of a jazz loving and knowledgeable audience. An example of the social schema being an altering force on the individual may be the fairly recent (over the past 20 years) emphasis on instrumental technique, over perhaps more melodic and holistic approaches. Due to the major influences of, for example, saxophonist Michael Brecker who, like Charlie Parker before him raised the technique of the saxophone to a new level, young players are almost required to reach this standard (on all instruments) in order to be taken seriously by peers, promoters and audiences alike.

Additionally there has been a qualitative change in musician's perceptions and behaviour towards what is viewed by Berliner and others as the 'jazz life'. The jazz life was formerly associated both within the jazz community and outside of it, with total devotion to and assimilation of jazz music through listening, rehearsal,

performance and a range of social behaviours such as hanging out with musicians, going to jam sessions, sometimes drinking and drug taking, argot, extensive touring and travelling and so on. Brecker and to some extent certain British jazz musicians such as Tim Garland and Gwilym Simcock, are examples of consummate musicians who happen to play jazz, while operating within a wide range of musical situations. Brecker and his brother trumpeter Randy recorded with most of the major rock and funk artists in the USA throughout their career and viewed this as a valuable as well as profitable area of their musicianship. That kind of social schema of musician as journeyman rather than purely jazz musician is one strand. The other, is represented by a player like Soweto Kinch who wrote a rap entitled 'The Jazz Planet' which celebrates all of those aspects of the jazz life that are so precious. He along with Abram Wilson and a group of British and USA artists still have the jazz life strand flowing through their work and probably have very different social schemata that influence their musical frameworks.

Similarly the social schemata around women jazz musicians, whilst being a highly complex and contested area is also very different, in that although most male musicians state that the most important aspect for them is the music, nonetheless there is a dearth of top class performing female jazz musicians in an art form that claims to be highly democratic. This area is beyond the scope of this thesis, but the social schemata for jazz playing and socialising does appear to have a predominantly masculine orientation which tends to preclude female performers.

To return to self-schemata, people consistently seek and recall information that confirms their self concepts (Swann and Read, 1981a, 1981b) and for most people the

bias is in a self-enhancing direction as would be expected (Greenwald, 1980b). In other words those aspects of self schemata that are most important to our identity are constantly reinforced in relation to others of like mind. Knowledge of oneself also appears to be more easily accessible to memory than knowledge of others, due to the constant nature of consciousness and the role of emotion and meaning on our self schemata. Self-knowledge also appears to be memorised in a verbal rather than visual way (Lord, 1980) because we are unable to 'see' ourselves as well as we see and therefore can visualise others. Self schemata include areas of specialist knowledge and expertise which for the jazz musician would be related to music theory, instrumental technique, the jazz genre (history, current players, and styles) and a range of approaches to improvisation.

1.4.3 Role schemata

Role schemata for the jazz musician will involve the various social roles undertaken in rehearsals, teaching, peer learning, performance, listening and so on and are used to enable the smooth running and organisation of various social activities related to the learning of jazz improvisation. Certain roles will be *ascribed* roles, like those of age, sex and race and others, *achieved* roles, will be based on ability, training and experience. Both kinds of roles carry with them expectations for appropriate behaviour and standards and these are organised in people's minds as schemata. As well as aiding perception, memory and inference as all schemata do, role schemata have clear behavioural and affective consequences and are involved in the categorisation and often stereotyping of people. However, role schemata in jazz improvisation seem to assist in the learning process by providing clear social guidelines for a variety of empowering and mainly nurturing roles. Band leaders set

the direction of the band but also provide work, a well known name for promotion, organise rehearsals, assign composition and arranging work, ensure discipline is adhered to and are in general responsible for the harmonious working and performing of the band. Some of the negative attributes of bandleaders (including instances of bullying, intolerance of certain personalities, assuming ownership of compositions or being overpaid) are also accepted by the players, if they see overall benefits to being in the band. As jazz is generally viewed as democratic music, roles can and do shift with musicians being bandleaders of their own projects, sidemen in other bands, co-players in co-operative ventures and teachers in workshops.

1.4.4 Event schemata

Event schemata are rather like the scripts outlined by Shank and Abelson (1977) which are frameworks that describe appropriate sequences of events in well known situations. Event schemata for the jazz improviser (and also the listener) would follow the sequence of appropriate events at clubs, concert halls, rehearsals, jam sessions and so on. Event schemata guide information processing in much the same way as for other schemata and also enable the smooth running and organising of events due to the expectations of all parties. Event social schemata are mostly non-consciously carried out (unless there is some kind of inappropriate behaviour or infringement) and profoundly affect how people behave at events. For example, the event schema at a concert hall is for the audience to sit and listen in silence to the band, whereas the event schema at a jazz club is more ambiguous; some clubs insist on and get silence for performers, whilst at others people, talk, eat and clank glasses throughout the musician's performance. Of course at other larger venues, communal singing, dancing and joining in is appropriate and part of the experience. In pantomime, loud audience

participation and feedback is encouraged as an integral part of the show, which would similarly cause outrage at a classical music concert.

1.4.5 Social schema development

As with other forms of schemata, social schemata development occurs as people abstract and generalise information from one or more instances and mature schemata are likely to be more complex and organised than immature examples and therefore increasingly likely to moderate the judgement and the behaviour of the person concerned. In the case of social schemata related to information and knowledge assimilation, mature schemata are not only more organised, but contain more elements that are also integrated and interrelated. The mature jazz improviser is able to perform successfully in a wider range of social schema settings because of the information abstracted through wide experience and the integrated relevant musical knowledge.

1.4.6 Summary of Social Schemata

Although they have only briefly been discussed here, social schemata in all the forms mentioned (person, self, role and event), are fundamental to the learning of jazz improvisation given the informal nature of much jazz learning, considering the democratic and collaborative nature of the music and for motivational and economic purposes.

Having discussed the various elements that may comprise the schema assemblage of the jazz improviser, the next section describes in more detail how the schema itself might work. It is based on Minsky's (1974) five critical questions that he felt needed an answer before the notion of the schema could be taken seriously.

1.5 Minsky's five questions

1.5.1 How is a schema selected?

Schemata are invoked, either purposefully and consciously for some specific task, or they happen spontaneously and automatically, for example in social situations, or in navigating oneself around a new city. Obviously in problem solving situations or in learning contexts where problem solving is inherent, a schema will be invoked in the individual to account for the current situation and to assess its potential. Information about the context or the subject matter will invoke specific schemata which will be consciously used. On the other hand, habitually used schemata that are used everyday, such as those for making breakfast or finding our way to work, are non-conscious and automatically invoked unless something unusual or untoward interrupts them. The question is whether it is possible to think or act in any coherent way without invoking a schema of some kind? It is Marshall's (1994) belief that fundamentally a schema only develops to solve a problem, and whether we agree with this or not depends on how broadly this is defined. We could, of course, take the view that everything we think and do has a problem-solving element, whether it is unconscious or conscious, but schemata may be formed just by our interaction with the world and with others. In this view, schemata may even form without specifically conscious attention

(although non-conscious attention may occur), and involve notions of tacit learning and direct perception.

From work done by Gibson (1979), Trevarthen (1999/2000) and Lee, (1985) it is possible to argue that people are each other's richest 'affordance'[1] and that individuals take in vast amounts of information non-consciously from body language, gesture, intonation and speech, in interaction with others. This kind of dynamic non-conscious awareness may form the basis of non-cognitive and non-conscious schemata that gradually filter through to consciousness and verbal expression, or perhaps stay hidden and influence our beliefs and behaviour in non-conscious ways.

The question of whether schemata are independent of language is contentious, although clearly many schemata are overlaid with or scaffolded by linguistic structures that enrich and further connect them. Johnson (1987) would argue that schemata are essentially pre-linguistic and based on body orientation, physical movement and interactions between other humans and the environment. The 'in and out' schema is particularly pervasive, as described here by Johnson:

> You wake **out** of a deep sleep; peer **out** from beneath your covers and **into** your room. You gradually emerge **out** of your stupor; pull yourself **out** from under your quilt, climb **into** your robe, stretch **out** your limbs, and walk **in** a daze **out** of the bedroom and **into** the bathroom. You look **into** the mirror and see your face staring **out** at you. (1987: 31)

[1] An **affordance** is a property of an object, or a feature of the immediate environment, that indicates how to interact with that object or feature. The empty space within an open doorway, for instance, affords movement across that threshold; a sofa affords the possibility of sitting down on it.

All of the above bodily orientations establish relationships between the body and the environment (and what it affords us), and it is the relationships that are 'translated' into purely thought-based schemata in order for the individual to make sense of a particular situation. As in Schmidt's theory of motor schemata (1976), it is the *relationships* between elements that are abstracted and generalised for elaborated and extended uses, and in this view schemata are essentially embodied and non-cognitive. Schemata that develop into conceptual and verbalisable states are therefore like a dynamic virtual form of our physical interactions, extended to another more complex level for the purpose of understanding ideas or situations. Thus the coherence and unity of adaptive movement becomes the coherence and unity of adaptive thought, which in turn is likely to enrich and extend our physical potential, interactions and skills in the physical world.

Marshall (1994) who studied schema formation in the solving of arithmetical story problems, proposed that the network form of the schema develops from many repetitions of similar actions, forms connections among the various parts of the situation being repeated, and is idiosyncratic and unique to each individual based on past experience, though with generalised elements that are similar enough to be communicable.

Ultimately, schema selection will depend upon what kind of schema is being invoked. Of those that are purposefully or consciously invoked like conceptual schemata, one will be selected which is suitable for any given situation based on matching patterns from past experience. In any situation, there are usually many clues about what is likely to happen and how to go about understanding it, in order for a schema to be

called up. Certain types of social schemata and scripts will be naturally or non-consciously initiated by the environmental circumstance, for example walking into a restaurant will invoke the appropriate 'eating out' schema regardless of the huge variety of restaurants available. Or going to a party of whatever kind will invoke the party schema. Social schemata of the stereotypical kind may be non-consciously selected and hard to alter, whereas person, self and role schemata involving identity can be purposefully invoked as a means of self-development and aspiration.

In the case of the motor schema, a non-conscious process will call up the appropriate schema for the target action based on a generalised program, because the motor problem has been solved to enable this. How this occurs neurologically is still not well understood, especially as we usually begin to make the movement before any conscious awareness of it. The process of how a movement can be made, is better understood. However, the trigger that initiates the motor schema for a voluntary movement is presently unknown. The recall and recognition schemata defined by Schmidt are also essentially non-conscious except for the need for conscious attention and feedback to what is happening.

If we relate schema selection to jazz improvisation, the appropriate schema will depend upon the level of skills already present. In the case of a person who is already a musician, but a novice improviser, schema selection will involve initially invoking their already highly developed musicians' schema for playing their instrument, and for understanding and performing, within whatever the context of the musical genre they learned in. This schema will be a complex assemblage of motor, kinaesthetic, aural, auditory, visual and conceptual elements, with additional conceptual and/or auditory connections from their past experience. The new improvisational schema will emerge

as an extension of already existing elements with more focus, for example, on aural to motor skills without the mediation of musical notation. The novice improviser will then develop the new aural, kinaesthetic, motor and conceptual schemata.

By contrast, the mature improviser will have developed the largely non-conscious schema assemblage for improvisation and be able to draw on it at will in a wide range of different situations. They will no longer be able to say how they learned or what they are doing and rather in the manner of conversation, will imagine an idea or a sense of an idea and be able to alter it at will as it unfolds. In that respect there is no selection of the schema as such, but action to create the sound generated by the non-conscious organisation of the adaptable schema assemblage.

1.5.2 How are additional schemata called in?

Marshall (1996) argues for four discrete stages in conceptual schema use: identification, elaboration, planning and execution knowledge, which each follow on from the previous stage. Identification knowledge activates the schema and is based on multi-modal pattern recognition, whilst elaboration refers to specific examples of the individual's experience alongside general abstractions that describe these experiences. The schema may, therefore provide both a link and an organising framework so that these various experiences can be adapted for future use, and Marshall argues that elaboration knowledge allows the individual to create a mental model of the situation. Identification and elaboration knowledge together generate a framework that allows the individual to create a tentative scenario which anticipates what is likely to occur by imagining what kinds of thoughts or skills might be required in order to cope with the new situation and environment. The priming and

expectation element appear to be crucial to the process and any signposts given by the teacher that anticipate what is likely to happen, seems to be important to the learning process.

Planning knowledge refers to the way the schema can then be used to make plans and create expectations and goals and Marshall suggests we can investigate the formation and development of an individual's schema by examining the extent of their planning knowledge. Although this may well be the case in areas that can be more easily verbalised or where the learner can identify discrete stages in the process, it is more difficult in music, and in jazz improvisation it would be virtually impossible for the mature improviser to explain what they are doing or planning to do in an improvisation, except in a most general way (learners however, may be more able to verbalise the process). Execution knowledge is used to carry out the plans and in the jazz context, this would be playing the music and so involve the fully integrated schema assemblage of visual, aural, oral, motor, kinaesthetic and conceptual elements.

In jazz improvisation, schemata that may be related to and called up for the learning process are many and include motor and auditory to motor schemata triggered from an aural rather than visual source. There are schemata for recognition and memorisation of melody and harmony and conceptual schemata for scales and other related patterns. The basic schemata required to be a musician (for example from a classically trained background) form the starting point for the schema assemblage for improvisation, with changes of emphasis amongst the various component parts of the skill - for example, the strengthening of aural ability and imagination and various aspects of technique; the speeding up of reaction and response times in relation to

aural stimuli and developing high levels of concentration needed to create musical lines instantaneously. Different schemata will be invoked and developed as required during the process of learning the skill and in the case of a trained musician, will include elements of previously learned skills or knowledge, but perhaps require greater facility or an altering of perspective. From an educational viewpoint, if the teacher makes as many connections as possible between the student's previous experiences and the present circumstances, and also between all current elements, this should encourage the invocation of associated or different schemata that will help with understanding and skill development.

1.5.3 How are schemata modified?

According to Marshall (1996), there are only two kinds of modifications: enlarging the schema or changing the information that is already part of it. Piaget and Beth (1966:242) describe another process of 'reflective abstraction' whereby each stage of the schema develops into a more sophisticated one. Like Schmidt, Piaget sees this process as an abstraction of the relationships between elements from the previous structure thereby generalising them for future use. Piaget suggests that the abstracted elements should be 'reflected' onto a new plane of thought in a kind of mirror image, but within a different context. He considers that the reflection both relates to previous ideas and operations but also continues them into a new sphere, and it is this that he believes allows for novel actions, thoughts or approaches i.e. the use of previously assimilated knowledge or skills, within a new structure. In addition, the 'reflections' permit new and previously separated systems to be combined and integrated into more complex schema assemblages. An example of this would be Johnson's (1987) previously noted idea of the schema for 'in and out', which develops from the body of

the individual being physically inside or outside various environments. The child is inside her cot or outside in the park; in her father's arms or out of them. From this develops the more complex notion that physically the child could be out of her cot but still inside the house, or out in the park but in the pram. From these basic bodily orientations and interactions gradually develops the language of being in or out of an environment, then inside and outside of the body as a speaking and thinking individual. The schema is then translated or reflected endlessly to describe feelings and thoughts of being in a dream, or a state of loneliness or in a crowd, in a mess, in a state, in love, in a connection with others and so on. As adults we have a clear notion of what being in or out of something is like, both physically and psychologically and how that can be communicated, but the roots appear to be grounded in movement and the orientation of the body in space, and on this basis, Johnson asserts therefore that the foundation for all thinking is non-cognitive.

If we agree with Johnson's theory of the embodied schema as the basis for both thought and action, then the schema may be modified by some form of bodily action and experience, and clearly in the case of improvisation, physical action and movement take a large role in the learning process, supported by various conceptual frameworks. In this view, the schema can only change if it involves some kind of physical or virtual movement, and indeed can only be used fully once the scattered pieces of information or elements of the skill cohere to form a whole framework or gestalt. This in turn poses a problem for exploring schema emergence and development because although it is clearly made up of component parts, the whole and complete structure is what informs and makes coherent the skill.

Enriching the skills or knowledge base and practising the skill or using the knowledge in new or different contexts will therefore also modify the schema. The issue is how the knowledge is abstracted and used, not the knowledge itself. For example, scales are learned by musicians to facilitate technique on the instrument and for memorising and learning music. The basic knowledge of scales remains unchanged, but the uses to which the information abstracted from the scales is put, changes enormously. For example, intervals are used in different ways and in varying harmonic contexts and can be perceived as extensions of chord tones (i.e. the fourth can also be the eleventh). The musician knows intuitively that scales are not practised in isolation (nor are they of much use in their standard format), but rather for what the musician is then able to do with them, which allows them to extend technical, aural and conceptual boundaries. Thus the basic knowledge is personalised to fit the growing unique voice of the individual.

In terms of the modification of social schemata, we appear to need a relatively stable individual and social identity in order to function properly in society, and if they were changed with every nuance or new example, the benefits of schema use would be lost. Fiske and Shelley (1984:173) suggest that well-developed social schemata are likely to be more abstract, complex, organised, moderate and conservative than less well developed schemata because wide ranging instances and experience have gone into making them. Mature schemata are likely to be more complex than immature ones (Linville, 1982b; Linville and Jones, 1980) and more organised in terms of the number and structure of links. For jazz improvisation and the development of social schemata, the mature improviser will have schemata that enable her to improvise creatively in the widest possible social circumstances and be able (with greater

sensitivity), to moderate judgements to allow for and work with ambiguity of information or social circumstance.

1.5.4 How are schemas created?

The many contested theories of how memory works are beyond the scope of this thesis, but Bartlett's view of recreative memory (1932) which has been developed and underpinned with potential neural correlates by Edelman and Tononi (2000), seems to be the most useful model in relation to schema theory and adaptive skill. Similarly to Hebb's proposition of generalised motor programmes, Edelman and Tononi posit that memory is also created and recreated from generalised neural circuits:

> Thus the triggering of *any* set of circuits that result in a set of output responses sufficiently similar to those that were previously adaptive provides the basis for a repeated mental act or physical performance. In this view a memory is dynamically *generated* from the activity of certain subsets of circuits… Under these conditions, a given memory cannot be identified with any single specific set of synaptic changes because the particular synaptic changes associated with a given output and eventually with an entire performance, are subject to further change *during* that performance. So what is called forth when an act is repeated must be any one or more of the neural response patterns adequate to that performance, not some singular sequence or specific detail. (2000: 98)

In this view, the brain can *create* a memory by linking sets of circuits within its enormously varied neuroanatomical architecture and the probability of creating a memory may be enhanced by the activity of emotions and other value systems. The idea of recreative memory explains why memories alter as we age to include current perceptions i.e. we see our memories in a different light as time proceeds and in fact, every time we remember them. It also helps to explain how a schema can be adapted and altered because each time a memory is recreated with a different neurological circuit (although still with many of the generalisable elements in place), a different set of connections is made. Thus, trains of conversation and thought are unique,

unrepeatable and often un-memorisable because new connections and frameworks are being used. The analogy between musical improvisation and the way the brain works in terms of thought process is striking. As Edelman and Tononi note:

> Such a memory (*the dynamic non-representational memory*) has properties that allow perception to alter recall and recall to alter perception. It has no fixed capacity limit, since it actually generates "information" by construction. It is robust, dynamic, associative and adaptive. If our view of memory is correct, in higher organisms every act of perception is, to some degree, an act of creation, and every act of memory is, to some degree, an act of imagination. Biological memory is thus creative and not strictly replicative. (2000:101)

If this view of memory is correct, then the schema is recreated (in generalised neural circuits) and used purposefully whenever the skill itself or something similar is required.[2] Initially however, it appears to be formed through the concentrated attention to and learning of, concrete and specific detail.

Clearly, one vital element for the memory involved in schema development is focused concentration and full attention on the matter to be learned. James (1890) stated that we all know what it means to give something our full attention and suggested that attention itself results from a competition between various 'trains' of thought. This selective state of thinking leads to one 'train' dominating over the others and thereby excluding them. A key implication of attention and why it appears to be selective is to do with the optimum amount of information that can be assimilated by the individual at any one time, which varies greatly. If our current schemata act as filters for information, then only those aspects that we can already comprehend or can act upon will even be attended to. On the other hand, the schema will have to change if sufficiently new information is assimilated within it and perhaps this is where the

[2] Of course, the variety and range of different contexts in which the skill (once initially established) is practised will encourage more associations and connections within the schema.

system tips into chaos and reforms as a stable entity on a higher level of understanding. It is clear, however, that we are selective in what we absorb in terms of both environmental and educational information and only really take notice and give attention to those elements that are different, unusual or particularly resonant for us as individuals.

From an educational perspective there is a need to present information in interesting or unusual ways in order to hold the attention of prospective learners. Similarly, if information is presented in a number of modalities, e.g. visual, aural, kinaesthetic and conceptual, then it automatically becomes easier to remember and to connect with existing schemata. Davis and Tall (2002) suggest that the focus of the individual's attention determines the structure of their schema and describe von Glaserfield's (1981) model of attention which may shed light on schema formation. His understanding of the nature of attention was that it is not likely to be extended over longish periods (as we all assume) but rather:

> A pulse-like succession of moments of attention, each one of which may or may not be 'focussed' on some neural event in the organism. By focussed I intend no more than that an attentional pulse is made to coincide with some other signal (from the multitude that more or less continuously pervades the organism's nervous system) and thus allows it to be registered. An unfocussed pulse is one that registers no content. (1981:85).

'Pulse-like attentional moments' may help to explain the idiosyncratic and individual nature of schemata and their formation, with learners attending to and focussing on many different areas for varying lengths of time. We cannot assume that people hold similar schemata for the same experiences especially when they involve abstract thought. Finding out about the possible differences in individual schemata seems

central to facilitating the learning process and requires much thought about how educational materials and approaches should be developed.

Given the general level of connectivity within the brain, it is natural to assume that schemata will be created as network structures and that the more connections there are between different aspects of the schema and between different schemata, the stronger and richer the schema for a particular skill or understanding will become. Schema memory may change with input from a new modality or by a connection to information from another area. In a complex and adaptive skill such as jazz improvisation, it is likely that connections of the schema will link across modalities, so that for example, aural imagination can trigger motor schemata just as visual patterns and hand, or other body movements can. In addition, conceptual information on how a melody is put together or how the harmony functions, will form other connections that also lead to the execution of movement and music.

Marshall (1995) proposes that to activate the schema, an initial 'probe' is required to one or more of its constituent parts. She implies that the stimuli usually come from the outside environment, and once one part is 'excited', it spreads to all the connections within the schema, (although clearly, it could be generated by thought independently within the brain itself). The notion is that a small idea or trigger of one particular element can activate a hugely complex and interconnected schema.[3] In this view, the probing or excitation of a small 'capillary' of an association or idea,

[3] To illustrate this idea, think of the word 'apple' then review the schema that just the one word triggers, rich with memories and associations. With every word we can evoke a network of images, descriptions, and conceptual knowledge about what constitutes an apple and how apples have been part of our experience.

could lead to the instantiation of the whole root and branch system of the schema. Marshall also believes that connections can either be inhibitory or excitatory so that some connections will promote the spread of activation from one node to another, and others will block it. This suggests that whole schemata can be inhibited if they appear to the mind/brain to be incompatible with other aspects or with the current situation.

1.5.5 How does 'schema memory' change as a result of learning?

In the model of recreative memory, each time the schema is used either consciously or unconsciously, it will be recreated and therefore altered. In terms of how the schema changes as a result of learning, the problem is how the schema can be both stable and adaptive, and this is similar to the problem of memory itself; we have memories that provide us with a stable idea of ourselves and our experience, but they are not fixed or replicated exactly as they were made. When the schema alters or incorporates new information, what precipitates the change is perhaps an influx of information or skill alteration whereby the system properties of the schema cannot remain the same and so perhaps tip briefly into chaos before forming a new point of stasis. As a self-organising system, we may have little control over this process except the will to learn the skill or understand the subject and the willingness to continue to practise solving the physical and mental problems (or a combination of both), that relate to it. The key to the stability yet adaptability of both the schema and memory itself may lie in the creation of many memories of the same event or action across modalities and the learning of movement may provide the model. Adaptive movement schemata are formed and develop from initial focus on a specific task - for example, grasping an object. At the point where the movement is learned and is stable, as mentioned

previously, Bernstein suggests that something happens within the schema to stop the skill deteriorating and a stasis point is reached that forms the basis for other adaptive changes. So for example, once an infant can walk, the skill is stabilised and only *then* can it be adapted to a skip or a jump or a run. These later adaptations cannot occur before the walking is practised attentively, established and stabilised as a skill. Likewise, the skill of walking does not deteriorate during the process of learning to run, and walking itself remains an adaptive skill (albeit innately evolved) because the terrain we walk over is constantly changing. In this view, perhaps schemata are embedded one within the other with core elements that remain stable while others alter to adapt to changing conditions. Unless there is damage to the brain, certain movements, skills, ways of thinking and language structures are never lost, whatever experience may bring to an individual.

1.6 Problems with Schema Theory

The predominant problem is the breadth of the theory and the lack of consensus among proponents of it about what actually constitutes a schema. Kant's definition (1786) of a conceptual schema represented as 'triangle' is an example of schema as a dynamic problem solving tool. Bartlett, (1932) viewed the schema as a way of creating and recreating memories, through individual schema frameworks dependent on the personality and previous and current knowledge and attitudes of the individual. Both Minsky (1976) and Rummelhart (1985) define the schema as a more static framework with 'slots' that are altered depending on individual circumstances. This view of the schema works in relatively superficial social situations where we need to know what to do when visiting a restaurant, for example, but does not explain novel

or truly adaptive behaviour. Neither does it explain how schemata may change completely with experience.

Social schemata (which include person, self, role and event schemata) as defined by Shelley and Fiske (1984) are viewed as organising social interaction and, as with Bartlett's understanding of the schema, the assumption is that perceivers actively construct reality and that generic prior knowledge allows us to function in complex social situations with relative ease. Bernstein (1967) and Schmidt (1975) both focused on the motor schemata involved with movement and motor skill learning. Bernstein's view of the schema was as a circular action-perception cycle with a comparator that alters the schema and therefore the movement process. With Berthoz (2000) and Niesser (1976), Bernstein believed that this aspect of schema theory was a result of the evolutionary thrust towards developing the ability to reorganise action according to unforeseen events. (This in itself is almost a definition of improvisation, with the reorganisation of movement triggered and driven by aural imagination).

Schmidt (1976) viewed the motor schema as memorised relationships or topological links between the many layers of sensory and motor components involved in action which can also account for novelty in skill production, and this is most important in any discussion of schemata for improvisation. Implicit in Schmidt's schema theory is the notion that the generalised motor programme is at the heart of understanding how movement is learned due to Hebb's observations (1948) concerning the ability to write one's name in a variety of contexts. Like many theorists however, Schmidt is vague on the mechanics of schema formation and the major question of how the schema can be both stable and adaptive simultaneously. Piaget (1952) related schema

formation and function to child development and saw the schema as a unit of thought that grows and differentiates with the experiences of childhood. He also defined the schema of an action (1966:235) as the structure of the 'generalisable characteristics of this action, that is, those which allow the repetition of the same action or its application to new content,' Both Piaget (1966) and Johnson (1986) view embodied action schemata (through assimilation, reflection and accommodation) as the basis for abstract thought and their ideas provides a link between the conceptual and motor aspects of schema theory. The scope and flexibility of schema theory and the way it has been applied across multi-disciplinary areas, could also be interpreted as a weakness or inconsistency of the theory. Allied to this is the difficulty of working out ways to ascertain schema content and how it changes dynamically. In fact the answers to Minsky's questions are still almost entirely speculative.

A second major problem with schema theory is the nature of the individually developing mind and the vast array of stimuli and influences upon it, which would tend to indicate a lack of universality in cognitive structure. The problems of defining cognitive structure are based on wide ranging developmental stages and highly individual living/ learning environments, as Schultz points out:

> Defining a cognitive structure is like aiming at a moving target that is changing shape rapidly and randomly while moving rapidly towards an undefined end. Cognitive structure cannot be defined by the static, one dimensional model that cognitive psychology is attempting to identify. (Schultz, 2000).

On the other hand, the outcomes of our learning do appear to be generalisable in part and communicable, indicating an underlying similarity of form or function. The question really is, if the schema is not an appropriate theory for understanding

complex adaptive thought and action then what is? Of the many different theories of mind, three major alternatives are briefly presented below.

1.7 Alternatives to Schema Theory: Dual Coding

According to dual coding theory (DCT), cognition involves the activity of two distinct sub-systems; a verbal system for dealing directly with language and a non-verbal imagery system for dealing with non linguistic objects and events. In the theory, the systems are assumed to be composed of internal representational units; *logogens* and *imagens* that are activated when one recognises, manipulates, or thinks about words and objects. These representations are assumed to be modality specific so there are different logogens and imagens for the visual, auditory, kinaesthetic and motor properties of language and objects. The representations are also assumed to be linked and connected to sensory output and response output so that they can function independently or co-operatively to mediate verbal or non verbal behaviour. In this view cognition is a variable pattern of the interplay between the two systems. The DCT system is therefore more concrete and less abstract than the proposed schema theory.

The empirical evidence for DCT is based on the beneficial effects of concreteness and imagery on memory (see review in Paivio, 2006). Memory performance increases uniformly from abstract words like truth or justice, to concrete words like chair or lobster, by a ratio of 2:1 and is increased in associative memory tasks in which recall is cued by concrete stimulus words. Whether this is more to do with mnemonics and the use of image to aid memory rather than the basis for a cognitive system, is unclear. The DCT hypothesis for improved memory is that concrete words are likely to have

an associated image; i.e. are dually coded, whereas abstract words are not. The evidence from Paivio (1975) and Paivio and Lambert (1981), suggests that non verbal 'code' is mnemonically stronger than verbal code. In a way this should be obvious, and still could be a result of the predominance and strength of the visual cortex; any memory system that uses visual images will necessarily be more powerful. Similarly with sounds, Thompson and Paivio (1994) showed that picture objects and sounds had additive effects on memory, and it is known in teaching practice that if tasks or knowledge are presented in a multi-modal way, then they will be memorised more effectively. The hypothesis here is that there are more and different memories created and that people have different preferred modalities for learning. Some do better through kinaesthetic learning, some through visual and others through verbal or auditory activities. Combinations of these ought to prove the most successful for memorisation and recall. In neurological terms, brain scans have uncovered distinct areas responding to the sensory motor modality of objects and their attributes accessed both by perceptual stimuli and words (see review by Paivio 2006: chapter 6). Dual code theorists make the case that because words that name colours or actions activate the same brain areas as *perceived* colours and action patterns, this supports the functional reality of imagens and logogens. They claim that the brain houses auditory, kinaesthetic and motor imagens and logogens in different locations which are accessed by different neural pathways. What then is the system that connects them and makes our memory and experience coherent?

The DCT theorists notably, Paivio, suggest that cognitive growth is built on multiple learning processes of observation, classical conditioning, operant learning and imitation. The salient stages are identified by Paivio (1971:438) and begin with the

formation of a substrate of non verbal representations and imagery derived from the child's observations and behaviour, related to concrete objects, events and relations among them. Language builds on this foundation and remains functionally connected to it as referential links are formed. As the events, relations and behaviours are dynamically organised through repetition and variation, the DCT theorists state that a 'natural syntax' develops which is incorporated into the imagery, enriched by motor programs from the child's actions and from which abstract verbal skills are attained. The idea of natural syntax appears vague and not as clear as Piaget's concepts of assimilation and accommodation. The only difference between Piaget and the DCT theorists seems to be the emphasis on the functional importance of the verbal and non verbal components of cognitive development (Paivio, 2006:31-32) and the lack of conceptual and motor abstraction.

The notion that non verbal cognition occurs before the development of verbal cognition is obvious and also that it is scaffolded by the language of care givers and later of the child itself. It is very unclear however, how the dual coding system develops without the use of abstraction in some form. Educational implications are also obvious; that early experience should be based on rich sensory motor experiences with concrete objects and events, with gradually associated language experience necessary for the verbal side. There are various research projects to confirm the importance of focus on perceptual and motor skills in young children which result in significant and sustained educational gains over more language/reading/numeracy approaches (Campbell and Ramey, 1994).

1.8 Kelso's Theory of Dynamic Self-organising Learning Systems

The definition of a self-organising system is that its structure appears without pressure from the outside i.e. internal constraints result in alterations to the system but are independent of it. The field seeks to discover rules under which such structures may appear and the kind of forms they take. Similarly, the definition of a system is a series or collection of interacting parts which function as a whole, which has emergent properties that exist at a higher level of explanation.

Kelso (1995) believes that the difficulty in characterising the internal global states of the individual mind means that we largely ignore self organising aspects of the dynamically interacting human, so that in most learning situations, people are treated in exactly the same way. He suggests that the unique background and capabilities that the individual brings to the learning environment should be carefully evaluated before exposure to a new task, although not how this might be achieved. This view is consistent with schema theory, in that learning occurs as a specific modification of already existing behavioural patterns in the direction of the task to be learned. However, Kelso takes issue with the notion of the schema as a framework for unifying and understanding knowledge and integrating skill.

> Usually, some hypothetical construct located inside the head, such as a *schema* or *trace* is said to be built up or strengthened as a result of the learning process. Internal changes may only be inferred through correlated changes in performance that occur with practice. Learning, in this somewhat impotent view, is a covert process forever inaccessible to observation: only the effects of practise may be seen…… Practice produces a directed drift of the response in the direction of the task requirement. In plain terms the subject's performance improves and becomes less variable. Your grandmother could have told you that. (1995:161)

Kelso suggests that skilled performance constitutes a particular kind of spatio-temporal organisation, a pattern in space-time, so that what the researcher of learning

process needs are tools that can identify changes in skill behaviour in terms of the formation and change of patterns. Thus the key to understanding learning for him, lies in extending the theory of self-organisation in non-equilibrium systems in particular, to include the key concepts of intrinsic dynamics (spontaneous coordination tendencies) and specific parametric influences acting on those dynamics. The term intrinsic dynamics represents relatively autonomous coordination tendencies that exist before learning something new. In the broadest definition, schemata may well have these self-organising attributes; Kelso's ideas do not preclude the more dynamic versions of schema theory.

Kelso believes it is possible to quantify these coordination tendencies directly and views learning very much as the moulding or sculpting of intrinsic dynamics. The word education comes from the Greek words *educare* and *educe*, meaning to bring out or develop from latent or potential existence.

> The other key to understanding learning lies in the way specific information, in the form of a pattern to be learned, modifies the intrinsic dynamics. Learning is the process by which the pattern becomes memorised. We say that a behavioural pattern is learned to the extent that the intrinsic dynamics are modified in the direction of the to-be-learned pattern. Once learning is achieved, the memorised pattern constitutes an attractor, a stable state of the now modified pattern dynamics. (Kelso, 1995: 163)

Kelso (1997) also thinks it highly likely that, in common with many natural physical processes, that learning involves the passage from one organised state to another, (i.e., perhaps from one schema to another), rather than from disorder to order. In keeping with the ideas about complexity by Lewin (1992) et al, he posits that dynamic, self-

organising learning systems exist at the edge of chaos, so that relatively small local changes can cause large global alterations.

> Learning may take the form of a phase-transition process that involves stabilisation of the required pattern as an attractive state of the co-ordination dynamics. Changes in behaviour traditionally measured as simple improvements in performance of the learning task are instead the outcome of modifications of the entire underlying dynamics. (1995: 175)

As each person possesses their own individual 'signature' or 'attractor layout', they will learn according to the individual lay out of their neuronal connections and previous formations. Kelso makes a strong case therefore that the individual should be the significant unit of analysis in learning research (rather than the group or the species) and that generic laws of learning may emerge by studying the individual.

Kelso also states that, whether some tasks are learned more easily than others (e.g. in terms of rate of learning and performance efficiency) depends on the extent to which specific parameters (e.g. a to-be-learned pattern) co-operate or compete with existing organisational tendencies. He provides evidence, through a series of graphs, that what is learned is a phase relation that is apparently quite independent of how it is instantiated. For example, as previously noted, once they have learned it, people can write their name large or small, in all kinds of different media, with the hand, big toe or even a pencil attached to the nose! This should mean that learning involves changes in the dynamics of the system that practises the task and also in other co-ordination systems as well and suggests that the degree of abstraction by the brain is very high indeed. The ability of normal humans to write their name with any limb, on any kind of surface, large or small, is directly related to the generalisation and abstraction that

occurs in schema theory. A skill learned by the fingers of the right or left hand, using kinaesthetic, motor and visual modalities, can be transferred with little or no practise to another part of the body and a range of surfaces. The multi-modal schema of the skill of writing a signature allows an individual to abstract the skill and to use it under varying and flexible conditions. The signature is still recognisable as the individual's own whether written in stone or sand or paint or in tiny or huge letters, and its neurological counterpart allows a generalised neural circuit to be used which is adequate to the situation.

1.9 Computational theory of mind

There are two principle ways to view computational theory of mind; the first is the algorithmic computational theory based on the Turing machine and mathematically defining computability in a highly abstract sense (which reveals nothing about how the mind actually works). The second is an information processing model based on the idea that the brain, as a biological entity, processes information from the environment to build up complex representations that enable us to make predictions and behave adaptably. The idea of the computational brain is highly contested, and whilst a full review of the computational theory of mind is beyond of the scope of this thesis, the basic ideas are as follows, from a review by Churchland (2001). The algorithmic school envisages the brain as a series of digital computers that run various programmes (with the underlying analogy of software being run by the hardware of anatomical brain structures), when for example, reasoning takes place. In this view representations are like sentence structure, with syntax and semantic content that can be mathematically formulated. This may indeed be a plausible approach for more narrowly defined brain processes such as thinking logically or playing chess. The

underlying assumption in this view, is that whatever hardware organises learning, it remains static and unchanging throughout life, although the software alters.

The information processing model emphasises the architecture of the brain itself and a common theme running through the many theories, is that the brain is a highly parallel system, with many interconnected elements, whose wiring and connectivity change with human development and learning. In this view, representation is a pattern of activation across neural nets and networks which can be formulated as vectors and vector transformations and thus quantified mathematically in some part. Feedback makes the networks more complex and the hardware/software analogy is rejected on the basis that biological systems have evolved to perform highly specialised tasks. Changes in neurological wiring occur due to experience, and much long standing neural research backs this up, including how learning changes during infancy. Connectionist models have been explored in memory, perception and motor control research successfully but not in complex real life experience of situations. This seems to be the primary limitation of the computational theory of mind; that it lacks a holistic framework because it focuses on smaller elements of skill or knowledge learning and fails to account for the complexities and adaptation of the individual learning in everyday life.

Having discussed schema theory, and its strengths and weaknesses as a theoretical proposition, the next chapter focuses on how schema theory might be useful for learning in general, and then for learning in jazz improvisation.

2. Schema theory for learning

2.1 Abstraction in the emerging schema

The idea of abstraction is very important to the understanding of the nature of schema development in learning a skill but it is difficult to describe how this process of abstraction may occur. However, in extensive research into chess players and particularly in what distinguishes an expert player from merely a good one, both visual and conceptual schemata have been described and explained in some detail. For instance it was proposed by Binet (1894) that in learning to play chess, at the beginning of the process the emerging schema is represented by strong visualised elements which later give way to ever greater levels of abstraction, more dynamic elements and less defined imagery. Binet illustrated this clearly in his observations of blindfold chess games and interviews with players. Blindfold chess players need to be able to: visualise and remember changes in the position of chessmen as they occur; imagine the implications of the changes; follow and predict the play of their opponents and plan their next sets of moves, without physically seeing the chessboard. Novice players told Binet that they imagined the chessboard:

> exactly as if they were looking attentively at the board and the pieces. They retain a veritable mental photograph in which the board appears clearly with its black and white squares, and all the pieces are present in colour and with their characteristic shapes. (1894:156)

Binet considered this to be the first stage of abstraction because whilst it was imagined and contained strong visual images, it was fairly fixed in character and certain insignificant details were missing; it was not therefore a purely replicative or photographic visual image. Novice players had significant problems in playing blindfold chess and the implication is that this emerging first stage schema is likely to

be less dynamic and so less useful to the player because the visual image does not allow the kinds of mental manoeuvring used by the skilled player.

The second intermediate category of players had more skill, but still tended to represent the chessboard visually, although the image was less clear and more impressionistic and simplified. Binet called this the second level of abstraction because the schema was developing and there was much less emphasis on the purely visual aspects, although the players were still unable to play blindfold chess with any fluency. The third category of players, the most skilled, had fully developed schemata which were, according to Binet, 'stripped of all material, concrete baggage.' (1894:159). He states that the colour of the image had gone, along with all the specific details of the chessmen, which were now seen purely as friend or foe. Concrete aspects had ceased to be important to this level of player, but the position of the pieces (or the geometrical schema as Binet refers to it), was retained particularly in the direction of the movement of a piece and the square that it must stop. Binet described this as 'geometrical memory', and because of its dynamic and abstract quality it is a highly developed schema which enables the player to manipulate the elements of the game most effectively in his or her imagination. Thus the master player calls up only general knowledge of where the piece stands in relation to other aspects of his and his opponent's position. What the master has acquired that the novice lacks, is salient and dynamic knowledge of previous games. Indeed, according to De Groot (1978) a Grand Master has a working knowledge of more than 100,000 games. This knowledge may form the schema assemblage of the expert player who uses it to make better and quicker moves. He or she does not analyse more possibilities from the memories of previous games, as for example the Fritz chess

computers does, but rather knows intuitively the better moves and their implications as an abstraction from the vast array of previously assimilated knowledge of games played and analysed. At the highest levels in chess playing, the master will not consciously analyse anything, but rather 'see' the best or right move in the same way that the improviser hears the right phrase.

The changes in the emerging and developing schema are seen clearly in the blindfold chess players because they are imagining visual elements and patterns, and as their visual schema changes to allow greater adaptability, so their level of skill increases. Changes to skill levels in chess players are to some degree quantifiable due to the ranking system that pertains in the competitive arena, which is relatively accurate with regard to skill level and predictive of the likely outcomes of games between players of various rankings. Observing the changes in the emerging schema in a musical setting is more difficult however, because the starting parameters are much less well defined, less reliant on visual elements and highly dependant on more intangible aural aspects.

2.2 Schema development and abstraction in jazz improvisation

Despite the sheer breadth of mind and body processes explained by the various schema theories, what they share is the need to understand how the human mind works in a dynamic sense in real life, and particularly how the individual learns and continues to learn and apply knowledge and skills to various different environments and situations. From such a broad spectrum we need to narrow down and formulate the aspects of schema theory that are relevant to jazz improvisation. The primary schema components required in jazz improvisation would appear to be aural and

motor, with aural memory and auditory feedback triggering and driving the requisite motor schemata to produce the improvised musical line. The primary schema that develops is therefore built on aural to motor connections. However, to generate the improvised ideas within the jazz genre, the player also requires some aural knowledge of the sound and rhythmic feel of the music, and perhaps a reference to at least one historical era for imitative purposes. They also need to have some understanding of the musical theory surrounding jazz, which can be used to scaffold the learning-to-improvise process. These latter schemata are also primarily aural although they are related to listening rather than the imagination of ideas and also to getting a whole aural sense of the jazz musical tradition. The conceptual elements will encompass theoretical information relating to referential musical frameworks (for example, the blues and 32 bar standard); musical theory related to melodic development; variation technique, chord theory and functional harmony. Other conceptual/technical components may relate to specific instrumental technique and the need to develop various motor aspects of the skill rationally i.e. to improve the co-ordination between left and right hands on the piano or the guitar in faster passages or the articulation and tonguing on a wind instrument.

The process of learning to improvise at its simplest involves the development and interactivity of a number of schemata and is essentially similar to the action perception cycle devised by Niesser (1976) From the available information (the background musical knowledge will vary greatly from individual to individual), the player imagines a phrase and in executing it adds to their aural memory, stock of theoretical knowledge and embodied motor skill within the schema assemblage. Kinaesthetic and motor feedback on the flow and route of the movement plus auditory

feedback and comparison of the intended idea and the actual notes played, will be also be added to the schema and alter its structure and connections. This schema assemblage will then be used to organise (non-consciously) the next attempt at an improvised line, which will once again increase the store of multi-modal information available to the player.

To attempt to explore in more detail which aspects of the schema develop and what is likely to be abstracted, we first need to understand the primary elements of the schema for jazz improvisation, i.e. what does one need to know and to be able to do, in order to improvise within the melodic jazz idiom? At the simplest level, one needs to be able to imagine a melodic line (within a harmonic context) or at least the outline or beginning of an idea and to be able to play it on the instrument. The schema assemblage needed to develop the skill is however, not so simple. If we assume it involves three primary aspects: aural memory and auditory feedback, motor skills of varying types and cognitive/conceptual elements for scaffolding the skill, then the schema assemblage will be a highly connected framework incorporating aspects of all three areas. Taking the motor schema first; one needs to be able to move the fingers (and whatever other muscular centres are physically required to play a musical instrument), from triggers directed by aural memory and also perhaps from notation. The motor schema or assemblage has to control movement patterns that are not entirely predictable, in response to aural imagination, auditory feedback and also previously learned patterns based around scales or harmonic content. It would seem to combine therefore, both automatic and continuously adaptive movements in any one timeframe. Both the motor and aural schemata have to emulate and develop the rhythmic aspects of the jazz genre and to embody the all important 'feel' of the music.

In addition, the motor schema has to embody and respond to the emotional content of the improvisation by adding and controlling expressive parameters and by altering timbre. It can therefore be triggered and controlled by a number of the schema assemblage interconnected elements: aural imagination, visual stimuli (including watching the movements in relation to the sound in the early stages), conceptual information learned from patterns and from emotional or affective triggers.

The aural or auditory schema needs to initiate the evolution and imagination of a melody within a harmonic context that is, at least initially, appropriate to the player's own musical tastes and identity, and to the genre itself. To do this there has to be some background of hearing and listening to jazz music as a non-conscious or conscious exercise, in order to build an aural understanding of the sound, feel and frameworks of the music. To be able to imagine a melody or even the gist of one, requires a sense of what melody is; how the rhythmic feel of the jazz genre affects it; how a cohesive melody is created; how ideas can be developed using a range of strategies from analysis of melodic contour to variation technique and how rhythmic energy affects melody. Having begun to understand what melody is, it is then a matter of creating new examples and developing the ideas within them. This process can be initiated by focusing on common jazz repertoire and using the melodic contour, rhythmic energy and variation technique to expand on what is already a cohesive and useful framework. Also within the aural schema will be a developing sense of the harmonic context of the melody and the extent to which it informs melodic development. The harmonic aspect of the schema develops with increasing knowledge of repertoire (and therefore the likely and differing combinations of chords), and conceptual information about how functional harmony works within the jazz genre.

The cognitive/conceptual schema for jazz improvisation is closely interlinked with and can scaffold the development of both the auditory/aural and motor schemata. It is comprised of the more rational knowledge base related to repertoire, music theory, technical aspects of instrumental learning and knowledge of jazz related theory and involves integrating theoretical elements into motor patterns and aural imagination and from there into the more emotional musical voice of the individual player. The contemporary approach to formal jazz education generally employed in many music schools is based on the practice and assimilation of theoretical aspects, from which the more creative improvisatory elements are thought to evolve. This practice is described in some detail later.

Other schemata that are also involved in the process of learning jazz improvisation are those previously mentioned in Chapter 1: person schemata which focus on knowledge about traits and goals that shape other people's behaviour; the self schema which contains information about ones' own personality and behaviour and is particularly important in developing self identity and in focusing on elements that are important to them; role schemata that affect an individual's response to appropriate norms and behaviours attached to a social position and event schemata that relate to what happens on certain occasions and affect behaviour in practice, rehearsals and performances. These schemata primarily influence the improviser's behaviour in a range of social and musical situations and will have many effects on the way that the improviser will develop. In addition there are other schemata for visual and kinaesthetic aspects both of which are vital to the learning of jazz improvisation. Clearly, visual schemata are needed to scaffold movements and motor programs on

the instrument. They are required for interaction and visual clues to musical ideas with other musicians and to read and decode musical notation and other symbols, as well as to respond to audiences. Kinaesthetic proprioceptive schemata form the basis for motor development, bodily posture and orientation, and general bodily awareness and feedback at the core of playing a musical instrument or singing. For the purposes of this thesis, however, the primary focus will be on the motor, aural and cognitive schema assemblages that may inform the improvisational process.

2.3 Possible schema abstractions for beginner, intermediate and advanced jazz improvisers

Given that schemata at different stages of jazz improvisational skill will not only differ between individuals but also between various skill levels; what might the schemata of jazz musicians comprise of? If we take Binet's somewhat oversimplified three categories of schema development (beginners, intermediate and advanced), what might the schema assemblages of a jazz musician look like at these three stages and which elements are likely to be abstracted from one level to another? Starting with a beginner and assuming that they possess sufficient technical musical skill and instrumental control to begin the process, then one of the first abstractions of the musical schemata is likely to involve altering the trigger of motor programmes from visual to aural. Classically or formally trained players are used to playing and learning music from written notation and 'translating' it into movements by relying both on visual and aural feedback for correction. The process of learning music from notation is necessarily slow, especially if someone other than the musician has written it and the composer's whole musical conceptual schemata have to be assimilated by the player in order to make complete sense of the music. Thus the process of altering

visual to aural triggers has to be elaborated in two different ways: the musician has to both imagine their own music and also to develop the aural to motor learning process so that what is heard and imagined can be played instantaneously. Information has to be abstracted from the musical experience of, for example, playing a jazz standard, which alters the trigger for motor programmes from the visual distance between a notated interval on the page, to a sound and then to a physical/spatial distance between the notes on the instrument.

The process of imagining musical ideas (in jazz improvisation) will be based on the previous schemata that the musician has developed for melody and harmony. There are literally thousands of songs, nursery rhymes, and fragments of melodies in the mind which will provide a rich source, but which will vary in content between individuals because of the huge range of musical tastes and styles they are likely to have encountered and been influenced by throughout their life. For jazz however, there is also a stylistic requirement and a harmonic basis, both of which will affect the choice of melody for improvisation and the learner has to abstract enough information to respond instantaneously to the flow of harmony, melodic contour, musical energy and the way that the rest of the group is playing.

Beginners will therefore be attempting to hear and find on the instrument ideas that they have imagined rather than read in notated form, which will be influenced to a high degree by the music they have previously experienced. As mentioned before, one of the ways in which novices can improve their melodic sense is by focusing on developing elements of a known melody and using that as a framework. Using the tune (having first learned it by heart), provides a means of varying the learned

elements within a fairly tight framework, whilst keeping the contour in order to orientate themselves around the whole 32 bar framework. This kind of schema development is similar to the way that jazz musicians approached improvisation in the 1920s and 30s, which involved the development of alternative and similar singable melodies that fit well within the standard framework and use elements or echoes of the tune. The underlying process is still finding the intervals on the instrument from the aural imagination and the main limitation with the strictly melodic approach, might be a lack of harmonic or rhythmic sophistication. Present day jazz educators believe that the beginner needs technical mastery of both the harmonic theory and the instrument before any worthwhile improvisation can occur. They promote the idea of studying vast arrays of scales, patterns, licks and exercises in every key in order to find the intervals automatically and in a way that is unrelated to a melodic line. This rational and harmonically based approach is discussed in detail in Chapter 3.

The beginner using the harmony of the standard for improvisation has another framework which provides a basis for further exploration and more scope for melodic sophistication. Initially however, it appears to be hard for the beginner to incorporate all of the theoretical knowledge required to improvise using harmony with a natural and melodic improvisational voice. The beginner working on the harmonic aspects will focus on integrating some of the theoretical elements (chord tones, key centres, transpositions, related scales), in the imagination and on the instrument. They will necessarily be concerned with what musical ideas will 'fit' the harmonic progression and be consonant with the harmony. This part of the learning process can be viewed as mechanical because on the one hand this practice did not form part of the traditional way of learning to improvise, and on the other, because beginners want to

play the right notes and get to grips with how to play a motif in several keys for example, or how to 'get round' the 32 bar standard.

The schema at this stage then, may incorporate aural, motor and theoretical elements of the skill that are focused on correctness and finding and using the 'right' notes within the harmonic context. In this first schema stage the novice is concerned primarily with 'what to do' which Schmidt (1976) calls the cognitive phase, where the beginner is working out the most effective way to do the task in a problem solving manner. Schmidt suggests that this initial phase is characterised by the largest and most dramatic gains in the whole learning process although performance is usually inconsistent because learners are trying different ways to solve the problem. At this level beginners may also be able to verbalise, to some degree, the kinds of problem solving strategies they are using and what they think is happening. Teaching at this stage would be characterised by detailed work first on the melody and then the harmony of one standard tune, followed by variation and extemporisation of the melody. Great emphasis would be placed on the sound and rhythmic feel of the improvisation and wider timbral and expressive qualities explored. Listening would also form an important and integral part of learning in order to build the background listening schema which informs aural imagination and is the basis for jazz improvisation.

Similarly, for beginners learning in the more traditional way (by transcribing improvised solos from records), the first stage of schema development might be to develop sufficient aural memory to remember for example, a four bar phrase and then to translate it onto the instrument. Transcription bypasses the notational and

theoretical aspects in the first instance and focuses more on the direct translation of heard sound to aural memory to hands (or other musculature) and instrument. Here the beginner is imitating the musical results of the fully developed jazz improvisation schema of a mature player and will be unconsciously assimilating many subtle elements about the development of ideas, the use of timbre and dynamics, the interaction between band and soloist and the way that the solo is communicated.

An intermediate level, might be attained when the improviser can extemporise around the contour of the melody using elements from within it; remember the chord progression; know by sound and sight the various chord tones and appropriate scales and play an improvised musical idea whilst anticipating the next chord or sequence of chords. The intermediate improviser may also be able to play some phrases at will and may be less prescriptive in terms of following every chord change, by focusing instead on the unfolding line and being aware of the harmonic progression in the background. This level, (which is illustrated in the practical investigation described later in the text), provides a tantalising glimpse of the schema developing sufficiently to create an interesting, cohesive phrase or line which then appears to disintegrate again as the skill is still unstable through lack of concentration or the full integration of all of the required elements. Schmidt (1976) calls this the associative phase where the student makes more subtle adjustments to the performance of the skill. At this stage the improvisation becomes more consistent and the progress of it more gradual. This is the point at which Bernstein suggests widely varying the conditions and aspects of the teaching context in order to strengthen and stabilise the skill. In this phase Schmidt also suggests that the verbal cognitive aspects of the task have largely been dropped and that the emphasis is now on the *how* rather than the *which*. The ear

and the ability to 'hear' musical ideas, develops with practice alongside a more sophisticated understanding of the theoretical process. At this level the teaching would involve widely varying the repertoire learned to include many variations of keys, rhythmic and melodic elements. Different approaches and strategies, which are described in more detail in the practical investigation, could now be introduced, with extended work on both the harmonic framework and expressive qualities.

An intermediate level of schema development for the transcribing player might involve memorising and transcribing a whole solo by ear. At this stage, the player will now be familiar with the aurally triggered intervals over some part of the instrument and have developed sufficient aural memory to improve their skills through further transcription or finding their own individual voice - they now have the schema in place to be able to do this. The major advantage of transcription over other methods would seem to be that the player absorbs and imitates in increasingly greater detail a whole musical idea and conception with all its melodic, timbral and rhythmic elements and nuances as well at the emotional power of the music.

What then has been abstracted from the first level to the intermediate? Firstly, the relationships between the intervals in the space on the instrument have been abstracted from all of the tunes learned by heart and explored melodically. Secondly, the motor programmes for executing the music have been expanded to include aural as well as visual triggers. Thirdly, this motor/aural skill has then been integrated with theoretical knowledge about harmony in order to provide a broader basis for improvisation. Fourthly, other conceptual elements have been assimilated, for example, chord symbols which provide a short hand reference for the harmonic

framework. With improvisers in the intermediate phase, there appears to be a growing sense of orientation within the progression and over the course of the 32 bars as they are able to predict in their aural imagination, what is coming up next and respond to it and this sense has been abstracted from repeated listenings and improvising over ever longer time frames within the standard tune.

Fully skilled players are able to transfer previously learned information to any new standard and can even improvise well over tunes that are not well known to them, because their schema now allows greater flexibility and the highest levels of abstraction. At this level, players will not be consciously thinking about the melody, key centres or the harmonic progression whilst improvising on standards with which they are familiar. Like the advanced chess players, they are unconscious of all detail and process, and think aurally or respond to ideas in terms of direction, resolution and unfolding the musical ideas in the moment. The schema incorporates technical, theoretical, visual, aural, motor, kinaesthetic and imaginary elements moulded into the unique style and voice of the individual for the purpose of optimal musical exploration and expression. As skilled improvisers do not have to focus on the details any more, there is time and energy to listen and respond to band members, audience, and new ideas from the imagination, all of which take the improviser to another level of skill. At this level, an improviser is unable to articulate what is happening except in the broadest and most metaphorical of terms, such is the automaticity of the process.[4]

[4] For this reason, I have focused the practical investigation on improvisers who are learning, so that at least parts of the skill may be accessible to consciousness and some verbalisation on their part.

The advanced stages of schema development are synonymous with Schmidt's third 'autonomous' phase of practice which is characterised by automaticity of the skill. This occurs most often after many years and the automatic nature of the skill means that it can now be performed with less interference from many simultaneous activities, which frees up the conscious mind to take in and respond to, other ambient and environmental information. Schmidt (1976) points out that these high-level motor processes are almost never studied in research environments because of the difficulty in controlling and manipulating all the variables and the length of time involved in such a process. At this stage, the teaching would involve: greater emphasis on interactive and collaborative exercises to improve group dynamics and communal improvisation; performance and projection skills, presentation, communication, body language and so on; higher-level ear training exercises; possibly aural/written transcription, recording and transcribing of the player's own solos; a variety of exercises demanding greater concentration, dexterity, technique and creativity, perhaps in the problem-solving mode and possibly collaborative work with other art forms to broaden scope and possibilities.

What elements are likely to have been abstracted between the intermediate stage and the advanced? The aural imagination-to-musculature connection is well established so that the advanced player is able to think of a line and to play it and is also able to change its course at will in response to the improvised melody as it unfolds. The theoretical knowledge has been integrated fully into the schema (through working on specific examples), so that the improviser can now instantaneously translate chord symbols, knowledge of key centres and so on, into sounds that not only fit the harmony, but are also in keeping with what she actually wants to play. As more

repertoire has been added by the player, many different intervallic and harmonic patterns have been assimilated and the relationships between them abstracted to provide a dynamic framework. Skills developed from listening and responding to other band members have also been abstracted especially the speed at which these occur and as further abstraction allows greater automaticity of playing, the mature improviser is able to become more open and responsive to group and audience dynamic.

2.4 Schema theory used to understand the process of jazz improvisation

To summarise, schema theory helps to explain how improvised jazz music is made by providing a framework in which multi-modal (auditory, visual, kinaesthetic, cognitive, physiological and motor) elements can be understood, integrated and enriched by further experience. In Edelman and Tononi's (2000) neurological view, this integration and connectivity can take the form of coordinating separate memories in multi-modal areas or of abstracting the essential elements from the different parts to form one generalised schema. For example, a visual clue may cause the schema made of visual elements to emerge and at any point in the improvisation other elements could take over. Schemata fit well with the notion that skill acquisition leads to ever-greater levels of abstraction and automaticity. For example, what begins as an awkward or slow movement or mental task requiring great effort and concentration gradually becomes a graceful and rhythmic movement or thought that flows naturally into others and becomes unconscious. The enabling mechanism for these greater levels of abstraction, automaticity and connectivity, is the schema.

The schema or schema assemblages can make non-verbal and unconsciously cognitive connections which are particularly significant in the playing of music. Thus, we continually absorb large amounts of multi-sensory information non-consciously from our environment and it appears that the richer the sensory environment for learning, the greater the potential for memory creation and the formation of schemata.

In the case of jazz improvisation, where jazz 'feel' and rhythm are especially important to the music, Trevarthen's theory of the Intrinsic Motive Pulse (1999/2000) provides a physiological parallel to the formation of a rhythmic schema and this is useful not only because it suggests that body movement will enhance the facilitation of the rhythmic schema but also because I am trying to find a theory for schemata that is embodied and explainable in physiological and neurological terms. Trevarthen states:

> In the generating and regulating core of the brain, the Intrinsic Motive Formation, movement-creating reticular networks and nuclei are intricately combined with the neurochemical systems of emotion. The same activating neurons that select movements and control their energy and smoothness also cause changes in emotions felt, and the intensity and "colour" of consciousness. (Trevarthen 1999/2000:161)

This would suggest that schemata are overlaid with emotion both in formation and function and may therefore provide motivating factors (amongst others) in the learning process.

Although the schema provides us with a unique and idiosyncratic framework for understanding unfolding thought and action, it has similar recognisable elements to make communication possible. (Indeed, schemata may be the only reason communication is possible between us at all.) Thus if both performer and listener have

an appropriate schema for jazz improvisation, then it will be communicable between them in a two-way process.

2.5 Schema theory for jazz improvisation

The central tenet of the current thesis is that higher order skills such as improvisation are guided by schemata which enable dynamic and adaptive behaviour and the plan for this section is to formulate a schema theory for jazz improvisation that incorporates all of the aspects previously discussed in conceptual, aural, visual, kinaesthetic and motor areas in order to create a coherent framework for understanding the process. In this theory it is assumed that (as in the practical investigation) the improvisers are beginners but already trained musicians who are proficient instrumentalists and who already have a musical background from which to draw for the development of a new skill. The rationale for using trained musicians in the practical study was to be able to focus on the improvised musical ideas imagined and produced by the players with a background of technique on the instrument. With complete beginners it may have taken too long for them to organise both the imagined idea and the fingering or technical requirements on the instrument simultaneously. Future studies could however, focus on learning improvisation and instrumental technique in tandem, but would have to be conducted over a much longer time period.

2.6 Motor schema for jazz improvisation

To we begin with movement, Schmidt (1975) has stated that when a person executes a move to reach a goal, she 'stores' up to four types of elements: i) the initial conditions

i.e. information about the starting point of the movement provided by the senses; ii) the 'programme' for the motor command built from previous schemata i.e. information about the task to be executed; iii) the sensory consequences of the movement i.e. the response outcome compared to the intended outcome (external feedback compared to internal expectation) and iv) other consequences of the movement, for example, the outcome and how it felt during and after the movement.

In jazz improvisation, the initial conditions are fairly complex, vary from individual to individual and involve the musical and physical context in which the improvisation is to take place. This may include an expectation or anticipation of the melodic and harmonic basis of the song to be improvised around, i.e. a sense of what is required musically from an aural or motor perspective; a kinaesthetic relationship between the player and their instrument which is integrated to the aural and motor aspects; a visual referent in the form of notated music (if used); the level of concentration of the individual, and an awareness of the role of the particular players in the group i.e. a notion of what is expected in a communal way. The initial conditions will obviously also be affected by the physical environment (in terms of heat, light, acoustic) and also by the psychological state of the individual players and the group as a whole (in terms of motivation, confidence, perceived and actual levels of ability and so on).

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The programme for the motor commands relates to the schemata that have already been developed in relation to playing notes on the instrument. As mentioned previously, with classically trained musicians, these will be invoked by visual triggers from notated music and here previous schemata have to be altered or extended to include triggers from aural imagination or other players. So whilst the motor areas

already form a firm basis for the learning of improvisation (complete beginners would have to learn the movements from scratch), the way in which the movements are initiated has to be altered if the musician is to be able to improvise. The motor programmes will be directly related to and integrated with a deep kinaesthetic awareness that the musician has developed with the instrument, which forms an extension of the body schema. Different types of instruments will have varying kinaesthetic properties and also involve different modalities, for example, pianists will be able to use more visual schemata in the development of motor programmes simply because of the visual layout of the keyboard.[5] Brass and wind players will be much more aware of how breathing and embouchure affect the production of notes and the way that these aspects are integrated with hand movements and aural imagination. Their schema assemblages, therefore, may have less emphasis on visual information provided by the instrument.

There are other parameters in existing motor programmes for musicians that have to be altered in order for them to be able to improvise and these relate to aural memory to hand or body movements and the speeding up of response times both to internally and externally generated music. Formally trained musicians are generally used to memorising chunks of music relatively slowly from a visual format, whereas improvisers have to memorise and respond instantaneously to smaller fragments which are both heard and imagined. Finally, in relation to motor command programmes, the musical context is changed especially in relation to the harmonic background of the standard tune and this means that the beginning improviser has to

[5] Other instrumentalist also visualise the piano keyboard whilst learning the sound and position of imagined intervals on their instrument and like Binet's chessboard, these images fade over time as the knowledge they scaffold becomes fully integrated and assimilated.

alter their perspective on their current harmonic understanding and adapt it to the new situation. This process may entail using existing scales or patterns in a new way or making different connections between harmonic and motor patterns and would be an example of conceptual/aural schemata affecting motor programmes.

The sensory consequences of the movement involve monitoring the intended or imagined idea with the actual music produced and relating that to required changes in the movement or series of movements. In improvisation this may be the most crucial aspect of the whole development of the integrated schema i.e. feeling for and finding the intervals spatially on or within the instrument in response to an imagined or heard musical idea. The sensory consequences relate here to movements in space to find the appropriate interval; movements involved in breath control, embouchure and vocal musculature required to support the notes or phrases and visual movements related to monitoring hands in collaboration with aural triggers. As visual, aural, motor and kinaesthetic modalities are processed in the brain at varying speeds, the integration of this sensory information and feedback is a highly complex process. One can imagine that the schema is organising these parameters so that eventually they flow in one unified time frame without conscious effort.

The outcome of the movement or series of movements is the execution of the musical line, which in turn is compared to an idea of the intended outcome and to the notion that the player has in their aural imagination about what sounds good or right in a particular musical context. Whilst the outcomes of the movement primarily affect the aural sense of the player, they also affect the conceptual schema of what is required in the musical context. This process involves musical meaning, and it is a common

experience among players, both beginners and mature improvisers, that to play 'ideas that fit' arbitrarily over the harmonic framework is not really a satisfying experience; rather they strive for creating meaningful musical ideas that are expressive of their own unique voice and musical taste. Therefore, the outcomes of the movements and the musical consequences are bound up with the player's musical and personal identity and the development of their own voice as improvisers.

The sensory consequences and outcomes of the movements relate directly to actual aural information, imagined aural information, visual information and various aspects of musical taste, identity and theoretical knowledge of 'notes that will fit'. Of primary importance also in the process of following the outcomes of the movement, is how it *felt* to improvise as an integrated aural imagination-to-motor-to-sound action. The feeling of practising the emergent skill (at whatever level) is important because the schema appears to be enriched and enhanced by every subsequent similar practice. It would seem critical therefore, to quickly create a situation in which novice improvisers can experience the feeling of improvising, so that all the various elements required in the skill can begin the process of integration through the emergence of the schema.

As Schmidt points out, the schema is not the *set* of the data provided by the movement but their *relationships* i.e. memorised relationships or topological links between several sensory and motor components of action. The focus on the relationship between the various elements allows the most salient aspects of the knowledge or skill to be abstracted, elaborated into an enriched schema assemblage and used in new improvisational situations.

2.6.1 Motor abstractions

The elements likely to be abstracted during the development of the motor schema for jazz improvisation will be different or represent a refinement of the process at the various stages of progression in the skill. For example, the formally trained beginner, who learns a tune by finding the intervals spatially, will then (probably instantaneously) be able to abstract that information into new keys or positions on the instrument. The player will also be able to alter the rhythmic parameters easily to incorporate a change of tempo, metre or changed rhythmic emphasis. Using Binet's terminology, this represents a first stage of motor abstraction because the melodic material has been learned, not created in the aural imagination e.g. the melodic framework is still present although in a changed format.

The second stage may involve initiating the motor program from imagined and heard sounds and this could be developed by using the same melodic framework and extemporising around it in progressively more abstract ways. Imagined ideas may be developed from specific intervals of the tune; motifs developed between phrases; lines imagined using similar contours to the tune, and so on. This stage of the development of the motor schema (which for simplicity we can call the intermediate), is also scaffolded and enriched by the assimilation of the conceptual and theoretical knowledge of harmony and intervals. The improviser can practise a parallel series of scales, patterns and arpeggios that assist in the development of the motor schema by systematically incorporating many combinations of intervals and therefore spatial and motor patterns, to solve the problem of how the imagined and unfolding improvised line is actually executed and continued. The sound of the harmonic basis of the tune provides another framework for the motor schema and aural imagination process to

develop, and the improviser can explore and experiment with sounds against this background, which provides another reference point. The intermediate improviser is still however, dealing with specific movements, scales, harmonic progressions and solving the individual problems related to them.

The third stage of motor schema abstraction (i.e. that of advanced players)[6] will involve being able to imagine and play a musical line without thinking consciously about any outside parameter (e.g. where the notes are on the instrument, the key centre or chord structure or the orientation within the progression). Information used to initiate motor programmes is generalised across the repertoire (and possibly across different musical genres), and there is likely to be little discrepancy between the intended and actual movements (related to sounds) because the player can change the flow of the movement instantaneously, much in the way that we alter the flow of any other kind of bodily movement to reach a target. The improviser no longer relies exclusively on motor patterns but can choose to play what she hears or imagines because the process in now entirely adaptive. This phase, which may continue to develop, is characterised by the player being unable to remember what she has just played, because the movement is within the moment and no longer based on any particular framework. Given that the improvisation may also have been initiated and executed using any generalised neural program, it cannot be remembered exactly, in a similar process to conversation or trains of thought.

The elements likely to be abstracted through the various stages or states of schema development have already been described. They include: the extension or altering of

[6] This is a somewhat arbitrary grouping as, like Piaget's stages there may be no clear cut defining difference between stages and no specific end to the development of the improvisational process.

motor triggers from visual to aural (from notated music to aural imagination); the development of aural and auditory to motor pathways; finding intervals spatially within the instrument; the abstraction of the relationships between the spatial intervals into different keys; the abstraction of the intervals from scales to use in different ways; the assimilation of theoretical information, relating it to sounds and incorporating it into the individual voice of the improviser; imagining more sophisticated musical lines abstracted from more exposure to and assimilation of wide ranging repertoire and developing the sound and ideas that most represent the personality of the improviser and developing the ability to generate ideas and extend them over longer time frames. The information to be abstracted comes from a number of sources with both internal and external feedback.

2.7 Conceptual and theoretical schema for jazz improvisation

The conceptual and theoretical schema scaffolds the more fundamental aural to muscle and motor schema by providing a broader framework than a melodic line and by more systematic use of intervallic patterns. The beginner is made aware of the functional nature of jazz harmony, usually in the form of how chord families relate to key centres and specific scales, and how to recognise these progressions within the jazz standard tune. The separate chord tones have to be learned individually in order to understand how chord symbols work, in relation to the overall key of the passage, and also as sounds. The sound aspect involves the intervallic relationships between chord tones, and the functional relationships between chords in the same and different families. For example, the roles and functions of the minor seventh or dominant chords, the 'colour' of the chord i.e. how it sounds, and the kinds of expressive qualities it engenders both on its own and within a sequence or progression.

The main theoretical problem of melodic improvisation is to understand how the harmonic background is organised and to use it as a framework or reference point (for fellow players and listeners also), without adhering too strictly to the chord tones or scales that underpin chord families. The theoretical schema allows the knowledge to be used like a tool for the more creative purposes of the improviser. Later elements of the theoretical schema might include: knowledge and use of the higher chord tones e.g. ninths, elevenths, thirteenths and altered colour tones like the flattened fifth or sharpened ninth; use of chord substitutions to create interest, and reharmonisation which again, may provide a fresh strategy to an old standard without destroying completely the underlying framework and enabling the improviser (and listener) to hear the tune in a new way.

The scales provide another reference point for the theoretical schema by linking single lines, chord tones and keys and by providing a linear starting point for improvisation, which is other than the melody. Usually in the jazz idiom, scales are learned in their basic form and then practised in modes to allow any scale to be played on any note which can be easily related to specific chords within a given family. This process requires an alteration in aural and motor programme initiation, as most formally trained players begin and end scales on the same root starting note. After the whole scale is learned, it is then broken into intervals, e.g. thirds, fourths, and fifths, to enable the improviser not only to hear the different sounds but also to practise feeling the intervals on the instrument. Specific repertoire can also be used to practise the sound and spaces of particular intervals and there are innumerable ways to make up scalic and intervallic patterns in order to improve technique and the ability to 'get

round' a harmonic progression. Scales can be extended to include blue notes and other colour tones, so that the sound palette and technical scope of the player is broadened further. The varied and creative practice of scales ought to enable the improviser to play what they hear anywhere on the instrument, because the sense of the relationship between intervals is established and integrated aurally and spatially.

In the light of both Piaget's and Johnson's theories of how sensory/movement schemata may be 'translated' into conceptual thought through abstraction and reflection, I am assuming that the development of the conceptual and theoretical schema proceeds in a similar way to that of movement and that from deliberate attention to specific instances, relationships between parameters are abstracted to form the adaptive conceptual schema. Each change of key, altered scale pattern, extension to the repertoire of tunes and chords and the exploration of expressive parameters will therefore add to and enrich the developing schema.

2.7.1 Theoretical and conceptual abstractions

For the beginner improviser, the first stage of abstraction within the theoretical schema will be the assimilation of the factual theoretical information (e.g. component parts of scales, chord tones etc.) from the musical notation, and its translation into spatial movements allied to aural comprehension. The novice is concerned to know theoretically what notes will fit, and has to learn the specific instance in the musical context in order to be able to generalise the information.

Another first stage abstraction is the understanding and use of chord symbols, which represent a different kind of schema by supplying a short hand referencing system.

The abstraction is to understand what chord symbols mean in terms of notes and sound so that they are recognisable in new situations. The symbols allow for and enable a range of varied interpretations of chords in terms of voicing and rhythmic placement within the bar, whilst retaining the basic harmonic framework. In terms of scales, the abstraction comes from their complete memorisation in whole forms across the range of the instrument and then their deconstruction into modes, intervals and patterns. The initial process appears to be the learning of exact and accurate forms and patterns, in ways that the beginner can recognise across the instrument and the abstraction is that they have to be both extended and memorised from previous more fixed ways and possible notated forms.

An intermediate stage would be the use of theoretical knowledge to create improvised ideas within a specific context, i.e. knowing that a section of the standard was in the key of Ab, and using clues from the harmonic progression, the improviser would know to use notes within that key to improvise. The intermediate knowledge of scale patterns and chord tones would provide the improviser with a number of different ways in which to initiate improvised ideas (including the initial use of the melody itself). However, the intermediate improviser would be unable to freely generalise the information into new standards because of insufficient practice with varied conditions and repertoire. They would also be able to recognise the chord symbols and extrapolate various useful elements from them, to begin to inform not just what is likely to be correct in their own improvised ideas but what is characteristic of their own unique voice and what is creative about improvisation. The abstraction of theoretical knowledge at the intermediate stage is therefore about using it to guide

more intuitive and creative process rather than slavish adherence to correct notes within the harmonic framework.

In the advanced stage of theoretical schema abstraction, the conceptual aspects have been thoroughly absorbed and are now integrated with the aural and motor aspects of the process. The improviser will be able play a convincing solo over a standard that she may not know well, simply by using abstracted and generalised information available from a notated copy or from the sound of the music itself. The scales, (their constituent parts and altered notes), have by this time become completely assimilated into the motor and aural pathways of the player, who is now able to call up any interval or pattern of notes at will and can use them in new combinations to create novel ideas. The advanced improviser will be able to cope with difficult keys or transpositions because the theoretical information learned so arduously is now embodied and at the service of more creative aspects of improvisation. In addition the harmonic background has become (instead of the chord by chord progression of the beginner), a flow of changing sounds or colours over 32 bars with the theoretical information absorbed into the unfolding musical line of the improviser. This sense of the progression that incorporates all the practised notes and harmonies provides yet another framework and reference point for the improviser.

2.8 Aural schema for jazz improvisation

The aural schema is rather complex and involves not just learning to imagine, sing or play melodic improvised lines but to do so in the melodic jazz genre, an essential quality of which is swing feel. To do this convincingly and with a measure of authenticity, the player must have previously heard and assimilated a reasonable

amount of jazz music. As I explain in more detail later, for jazz musicians growing up in the early part of the twentieth century (1920s, 30s and 40s), the popular music of the day was jazz and so those players tended to be surrounded by live or recorded examples of it in their everyday environments. This is no longer the case and so the first stage of aural schema development requires that examples of jazz improvisation be heard and felt in the body through movement. For the aural schema to develop I feel it is helpful to sing along with the music and to be able to sing improvised lines, (although some players manage to learn without doing this). So the sense of style and the idiom of the music and its rhythmic components have to be absorbed by the player, to some degree, before they begin to improvise.

The aural schema develops in tandem with the motor and theoretical schemata and after a sense of what is required is established from listening to examples, the second stage is the learning of tunes with a jazz feel in order to absorb the idea of contour, phrase lengths, development of motifs, contrasting sections and the feel and sound of the various intervallic relationships. Novice jazz improvisers of previous generations transcribed (usually by ear) tunes and solos by their favourite players, thereby absorbing the sound and style directly into aural imagination and thence to the motor schema. The process enabled the players to develop the relationship between aural and spatial intervals and to incorporate aurally the theoretical aspects (perhaps unconsciously) that provide the necessary schema framework for their own individual improvised lines to emerge. The aural transcription process also allowed the novice to absorb the more creative and cohesive aspects of the improvised solo by dint of imitating an advanced player and learning the flow of the solo, timbral aspects and various other nuances developed by the improviser over a long period of time.

Obviously, the aural schema will develop in a different way if the improviser is not using transcription, but is also likely to be more individual (if less dynamic) from the beginning. Having learned and memorised a series of jazz tunes, the novice improviser can then begin to vary and extemporise around them, imagining motifs aurally and using intervals from the melody itself.

For the beginner, the aural harmonic background has many elements to assimilate because of all of the possible sounds contained within it. In conjunction with the theoretical and motor schemata, the beginner will listen and absorb the related sounds and attempt to imagine improvised lines using the new harmonically based notes. As with the motor and theoretical schemata, the focus will be initially on playing consonant or correct sounding notes over the harmonic background, but as the schema develops, more colours may be explored and experimented with. The process of hearing the 'right' notes develops in tandem with hearing (and playing) melodies that the improviser likes and wants to hear, motivated by their musical tastes and identity. Similarly, the kinds of ideas that the player imagines will also be influenced by the music they are listening to and that in turn will be guided by the type of jazz or improvisation that most appeals to them. The aural schema development is led by the motor and theoretical schemata but also strongly influenced by the musical personality and identity of the player and the need to play something that is meaningful and not merely to reproduce a pattern or something that will fit. The aural schema is also guided by an often intangible feeling of a musical idea that cannot be quite executed because it is only vaguely present.

The advanced state of the aural schema occurs when the player is able to imagine and execute an idea instantaneously and automatically without recourse to any kind of conscious scaffold or framework. The improvised ideas can be initiated from intervals or the melody or from the contour or energy of the tune or from any aspect of the harmonic basis, at will. Aural memory will have developed over time, so that the player can respond to externally heard musical ideas from other players and can develop ideas over longer time frames, again in a free-flowing way. The development of aural memory also enables the player to quickly learn new tunes and to abstract the information required in order to improvise effectively over them. At this level there is a confidence in the aural skill that allows the player to explore, take risks and to move away from ideas that are predictable, so that the creative skill itself is used to its full potential.

2.8.1 Abstractions for the aural schema

The first level of abstraction is the hearing and assimilating of intervals from the framework of the melody by memorising them and then using them as the basis for extemporisation i.e. adapting the intervals by imagining variations of them. The process of hearing and imagining the intervals seems to have the same neural correlate, so the process of hearing and imagining the sounds appears to be the same. The subsequent stage of the abstraction is to imagine the intervals and melodic phrases outside of the framework of the tune itself which occurs in tandem with the theoretical understanding and the motor schema, and is based at first on correct and specific intervals or melodic phrases within a specific harmonic context.

2.9 Communicative and collective schema for jazz improvisation

The collective schema is based on elements from all of the above but focused outwards towards members of the ensemble rather than inwards on the processes of the individual improviser. It is an aural and visually based schema which is highly attuned and responsive to the musical ideas and expression within the ensemble of players. A first stage of such a schema is being aware of other players within the group e.g. actually hearing them as the improvised solo is unfolding. In an educational or other informal learning setting, players can be made aware of each others' roles by being involved with them as well, i.e. all of the group can learn a bass line or a drum rhythm. A second stage would be for the improviser to be responsive to the overall feel and expressive qualities of the band and for them to reciprocate ideas. It may be difficult for the novice to be responsive to both their own improvisation and to the collective qualities of the group but as the skill develops so does the individual's ability to step outside of the more internal processes and to listen to the musical environment. The process is aided by the need to listen to the underlying harmony and the different ways that chord players will perform harmonically and rhythmically.

The novice player is likely to focus on her own imagined and executed ideas until she can develop through the schema, sufficient fluency and automaticity to become aware of other players and the general musical environment. The player needs to develop a schema that is instantaneously responsive to their musical colleagues and which enhances the more communal aspects of the music. This particular schema assemblage will have aural, visual and kinaesthetic/motor interactive elements (i.e. responsiveness to others' gestures and movements, relating to meaningful musical process). Using the collective schema, collaborative ideas can be developed by

imitating and responding to individual ideas, building particular moods, or altering tempi and time feels. The information that has to be abstracted is the nature and form of another's improvisational style and the kinds of ideas they are likely to be play (in order to be ready to respond to them.) This can only happen at a deep level if musicians are able to play in bands together for long periods of time. [7]

A further stage in the collective schema allows the individual musicians to swap, imitate or develop ideas initially as contours or rhythmic shapes, and later with more clarity and detail. In advanced improvisers there will be a high level of sensitivity across the whole group and many layered communication both on harmonic and melodic levels and also in expressiveness and the use of dynamics. The collective band schema then turns outwards to communicate with the audience in a negotiated, many stranded process, whereby in the ideal state, the audience is also able to influence the music.

2.9.1 Abstractions of the collective schema

The levels of abstraction for the collective schema are similar to those described for the other schemata for improvisation: a vague sense of being within a musical collective (whilst focussing on internal sounds and processes), is abstracted to being more aware and responsive to the harmonic background and rhythmic feel. This in turn is abstracted into specific and accurate responses to melodic or rhythmic ideas

[7] Both the Duke Ellington band and the Count Basie band are good examples of this, where band members developed almost telepathic forms of communication and musical empathy in a collaborative way. For many of the early years, there was little written music for either band: the musicians developed 'on the spot' arrangements of the compositions. Indeed it took newcomers several months to become integrated into the existing structure and to get a sense of the style of the music and the other players, before they could add to the ensemble. Additionally, Ellington wrote specifically to the strength and sound of his players, adding to the generally collaborative schema of what the band individually and collectively was likely to do in the improvised sections.

performed by other players, initially in an outline or contour form and later more exactly. As the group becomes collectively more attuned, so does the level of responsiveness, in that the individual can influence the group in a dynamic and creative way. This level of collective responsiveness and cohesion allows the band to more easily communicate with the audience because the music has become fluid on so many levels that the consciousness of the musicians can focus outwards toward other (responsive) people.

2.10 Audience and listeners schema for jazz improvisation

The audience schema for jazz improvisation is based on their individual and collective previous experience of listening to live and recorded examples of the music, and some expectation and knowledge of the music they are likely to hear during the concert. [8] The complexity of this negotiated process is compounded by the fact that often jazz players are unpredictable and may well have developed or altered their style since the audience previously heard them. Conversely, some jazz players (for example, the Pat Metheny Group) aim to replicate the recorded sound at the live gigs so that the audience will know exactly what to expect. This has a negative effect on some audience members who expect jazz to be a riskier and more unpredictable undertaking. On ideal occasions (i.e. where the players perform predictably enough to be communicative but not so much as to be boring), the audience schema and the band schema become integrated in a two way communicative process.

[8] Clearly there has to be some kind of starting point to listening to jazz improvisation where there has been no previous experience of hearing it- the listening schema also has to start somewhere.

Having discussed the proposed psychological schema assemblages involved in learning jazz improvisation, is it possible to describe any neural correlates for schema theory? The final part of the chapter briefly explores this area.

2.11 Neurological background and possible correlates.

2.11. 1 Neurological description of voluntary movement

Although many different areas and structures in the brain are involved in the control of voluntary movement, the primary motor cortex is a key area (No.4, of the pre central gyrus) which was identified by Penfield (1951) in the control of localised muscle contractions at various locations in the body. By stimulating various areas of the brain in the conscious patient before surgery for epilepsy, Penfield discovered that stimulations to the pre central gyrus triggered localised muscle contractions to the contralateral side of the body and that there was a somatotopic representation of the corresponding parts of the body in Area 4 in the primary motor cortex. The pre motor cortex in Area 6 is thought to help regulate posture by presenting an optimal position to the motor cortex for any given movement. The supplementary motor area appears to influence the planning and initiation of the movement on the basis of past experience, whilst the anticipation of a movement triggers neural activity in the supplementary area. The posterior parietal cortex also plays a role in the control of voluntary movements: it receives somatosensory, proprioceptive and visual inputs and uses them to determine the position of the body and the target in space. It is thought to produce some kind of internal model of the movement before it is actually initiated. This fits well with Bernstein's theoretical model (previously described in chapter 1) in

which the actual movement as it unfolds is checked with the comparator or ideal version.

In Penfield's model of the somatotopic layout of the various body parts, the hand (and face) have particularly large areas due to the complex nature of the movements and combinations of muscles that both have. In fine motor skill movement, for example, in musicians playing instruments, people learn to make very fine movements of body parts that are not normally used in that way. Under such circumstances the surface area of the cortex can grow with practice, suggesting plasticity of neuronal function and anatomy.

In addition to the areas already mentioned the basal ganglia (a group of structures which comprise the caudate nucleus, putamen, globus pallidus, subthalamic nucleus and substantia nigra), play an indirect role in the motor system. They project to the motor cortex, pre-motor cortex and supplementary areas simultaneously, forming the cortico-basal ganglia motor loop which determines what movements will be performed. It is known that the basal ganglia also act as an inhibitor or filter of inappropriate movement and the breakdown of the inhibitory elements cause the uncontrollable trembling movements associated with Parkinson's disease. According to Edelman (2000), it is the basal ganglia that 'store' the automated movements associated with fine motor skill, which allow automaticity and fluency of movement. In terms of the schema, these structures may be involved in initiating such movements as pre-learned patterns, which are then adapted by other structures. Not all circuits in the basal ganglia are motor orientated. Some are thought to be involved in

memorisation and in cognitive and emotional aspects but their role is not well understood and is only partially to do with motor control.

The cerebellum plays several roles in motor control: it stores learned sequences of movements; participates in fine tuning and co-ordination of movements produced elsewhere in the brain and subsequently integrates all of these elements to provide fluent and harmonious movements. In order to be able to do this, the motor, somatosensory and posterior parietal areas of the cortex project massive numbers of axons to the nuclei of the pons within the brainstem. The neurons of the pons then project into the cerebellum. The corticopontinecerebellar tract is a nerve bundle which contains 20 million axons and enables the complex integrated working of the cerebellum. The cerebellum is divided into three parts which connect to a specific structure and function in the brain. The vestibule cerebellum is connected to the vestibule of the inner ear and is involved in balance. The spinocerebellum consists mainly of the vermis, is connected to the spinal cord and controls postural activity and muscle tone. The cerebellum controls muscle tension at all times whilst releasing those muscles needed for movement. The cerebrocerebellum consists of the cerebellar hemispheres and is superimposed on the other cerebellar structures. It is connected to the cortex and contributes to the co-ordination of voluntary movement by ensuring that when one set of muscles initiates a movement, the opposing set acts as a brake i.e. in order for one set of muscles to be used another set must be inhibited. Timing elements are also included in the cerebellar system enabling it to sequence the various functions it controls. For the body to make any given gesture or movement the sequence and duration of each of the basic movements of each body segment involved must be controlled in a very precise manner. A loop circuit in the cerebellum connects

it directly to the motor cortex and modulates the signals that it sends to the motor neurons. The cerebellum also plays a role in analysing the visual signals associated with movement and appears to calculate the speed of these movements (either as objects within the field of vision or as moving body parts) and adjusts the motor commands accordingly. Cerebellar involvement has also been observed in areas of language, attention, memory and emotion.

2.11.2 The role of voluntary movement in improvisation related to schema theory

Voluntary movement plays a vital role in improvisation and is characterised by generalised motor systems that enable adaptive behaviour. Hebb's understanding of the generalised nature of movements learned in writing one's name, has been mentioned previously and he understood that whilst we use our hand and wrist to write our name on paper, we can instantaneously adapt the movement to also include the arm and shoulder when writing our name on a blackboard, for example. Synergies of muscles are incorporated for a wide range of activities related to writing ones' name for instance, in any given setting and therefore ought to be based on a schema whereby the generalised elements are abstracted and adapted to new situations. As Bernstein also realised, the effectiveness of voluntary movement improves with practice, experience and learning, enabling greater adaptivity (especially in higher order skills such as improvisation). Voluntary movement can be both initiated by external stimuli and imagination and similar neural substrates are used in actually making the movement and in imagining making it; hence the value and power of the imagination to motor skill learning.

The activation sequence for motor areas is organised hierarchically and is undertaken jointly with the motor cortex and other neural systems. The first level defines the motor objectives and strategies of the movement and the behaviours that have to be applied in order to achieve those objectives. To look briefly at how a voluntary movement may be initiated neurologically, (for example, placing a finger on a piano key), the key is seen, identified and located in space. Firstly, the prefrontal cortex prepares the plans for this movement. Meanwhile the frontal cortex is receiving information from a large number of axons projecting from the parietal cortex, which is involved in spatial perception. Its analysis of the position of the body and its various parts in space, are essential in preparing for the movement. The basal ganglia are also involved in this aspect of the process.

The brain formulates a plan of action to touch the key using schemata developed from infancy and based on hand to target movements. In this second phase, the pre-motor cortex and the supplementary areas work with the cerebellum to specify the precise sequence of contractions of the various muscles required in the movement. The plan involves the motor systems organising the muscle synergies, and the hand trajectory needed to reach the key, all of which has been practised extensively to allow for maximum adaptive purpose. Thirdly, the primary motor cortex, the brainstem and the spinal cord, work in an integrated way to produce or inhibit the appropriate muscle contractions for the movement. The primary motor cortex determines the force of each muscle group. It then sends the information to the spinal motor neurons and inter-neurons that generate the movement and initiate any postural changes. As the movement is executed, commands are conveyed from the cortical and brainstem descending pathways to the motor neurons and these specify the temporal sequence of

muscle activation, and the angles of bones and joints. The muscular shape of the hand alters in order to prepare to touch the key and feedback occurs at every level so that the brain can judge the effect of the movement i.e. it is not pre-programmed but adapting to each individual circumstance. The identification of the target is governed by the posterior parietal cortex, the planning of the movement occurs within the premotor areas of the frontal cortex and the execution of the movement happens within the primary motor cortex. All three areas are therefore intrinsically involved in the process of improvisation and integrally linked to auditory cortex and aural imagination both of which will provide triggers and ongoing stimulus for movement.

The auditory, motor, visual, proprioceptive and kinaesthetic areas play a key role in improvisation, as do various cognitive areas. Focusing primarily on what appear to be the most important areas and starting from the auditory imagination, sounds are imagined, sung or vocalised in the primary auditory cortex, setting off a chain of movements in the skilled improviser. Zatorre et al (1996) used PET scanning to determine whether auditory cortical areas active in perceiving a real auditory stimulus would also be active when subjects imagined it. The findings showed similar cerebral blood flow patterns in both real and imagined responses along with areas of common activation in the frontal lobes, parietal lobes and the supplementary motor area. The similarities in blood flow imply that the two processes of hearing and imagining music share a similar neural substrate. The Zatorre research also indicated that temporal lobe activation included primary cortical areas in response to real music, and extended into association areas, whereas imagined music occurred exclusively in the association cortex. The implication is that primary auditory cortex responds to and extracts stimulus features from the *external* environment, whereas secondary regions are involved with higher order processes which may include *internal* representations

of complex familiar stimuli. Similarly the supplementary motor area has been shown to be involved when a motor task is only imagined (Rao et al 1993; Wise et al 1991). The activation of this area may therefore be crucial for actual and imagined vocalisation and the execution of movements in response to auditory stimuli, for example, imagined musical lines for improvisation.

Having set in motion the musical imagination, the next stage is to prepare and execute the movements necessary to produce the sounds on an instrument. Initially, the motor programmes seem to be triggered by an internal stimulus, i.e. the imagined music (which may also be embodied in the musculature of the vocal chords). The motor programmes may also be triggered by or overlaid with theoretical knowledge in other cortical areas, i.e. the particular chord or key in which the piece is being played. Visual clues play an important part which is related to both the layout of the instrument, (where this is useful, as in the piano or guitar), and also in relation to notated music which provides further conceptual clues about keys, chords and melodic ideas, in order to initiate the solo. An improviser may well begin with a visual pattern of notes that will fit a particular chord or a contour or interval within the melody. We can assume that all of these elements i.e. auditory, visual, motor and kinaesthetic are at least partially within the conscious awareness of the improviser as they begin to play. The cortex controls the muscles of the hands and fingers through the direct projection from the primary motor cortex, which is integrated with and linked to supplementary motor and association areas. As the imagined sounds are executed by the player, auditory and motor feedback will occur involving perception by various layers of motor control. These include the cerebellum in adjusting motor

commands and the auditory cortex in comparing what is being played with what was intended should be played.[9]

The motor process of executing the improvised musical line appears to involve pre-learned elements which have become automatic and are played as a phrase and more organically evolving, consciously controlled ideas that develop cohesively and sometimes produce completely novel ideas. The automatic elements of motor and some cognitive routines are proposed by Ghez and Krakauer (2000) and Edelman and Tononi (2000) to be 'stored' in the long cortical loops of the basal ganglia which are anatomically insulated from what are considered to be more conscious areas of the cortex. Edelman and Tononi (2000:183-189) propose that automated motor routines and elements of cognitive routines such as speech and language are stored in the basal ganglia and not open to general conscious integration. When needed by the conscious brain, there are specific portals through which this information travels and in the case of music, the automatic programme of, for example, a specific scale or other learned pattern which might fit a particular chord, is executed almost outside of the realms of conscious control. Indeed, consciously thinking about specific automated movements in this regard actually interferes with their smooth running. It appears to be better to let the body execute the task unimpeded by conscious cognition. The process of the integration of automated and non-conscious elements in improvisation is closely related in feeling to conversation or verbalised trains of thought. As I prepare to speak during a conversation, I have a vague idea of the kind of thing I want to say but do not

[9] Subjectively for me as the improviser this evaluative process takes place on three different levels: a basic level of consonance with the background harmony in conjunction with technical accuracy and cleanness of execution; a higher level evaluating whether the music is interesting or unusual (i.e. not the usual licks) and finally whether or not it has feeling and is communicating with the audience.

know exactly how it will come out until it is said and I have listened and watched the response of my companions to see if they also understand. If I am unclear or not conveying the subtleties or meaning I want, I might try to rephrase the whole thing again in another way. As with musical improvisation, I would also be unable to repeat what I had said word for word even a sentence ago, although the gist and the ideas are remembered often over years, and what other people say can also strike me and become highly memorable. Edelman and Tononi's point is that if we had to consciously think about and organise all the grammatical structures and vocabulary involved in speaking or conversing, it would take so long that all meaning would be lost, hence the necessity of non-conscious and automated elements mediated by conscious will and the desire for meaning. Similarly with musical improvisation, there has to be enough automated movements linked to auditory triggers to create a starting point and to develop meaningful musical ideas when the imagination is lacking inspiration. Ghez (1991:652) suggests that the basal ganglia may also compare commands for movement from the pre-central motor fields with proprioceptive feedback from the evolving movement, for regulating or monitoring its consequences. The basal ganglia may also be involved in the initiation of internally generated movements.

Returning to possible neurological correlates for improvisation, the cerebellum is also thought to play a crucial role in the fine tuning of movement by indirectly adjusting the output of the major descending motor systems. The cerebellum is thought to act as a comparator which compensates for errors in movement by comparing intention with performance. It receives information about plans for movement and information about motor performance during the course of the movement, both of which allow it to

compare actual to intended motor response. When the movement is repeated, the cerebellum generates corrective signals to gradually reduce the error and these corrective signals involve feed-forward or anticipatory actions that operate on the descending motor systems of the brainstem and cerebral cortex. The challenge of improvisation of course, is the fact that a constantly changing musical sound is triggering and guiding the whole process, rather than any relatively fixed external parameter such as a notated or memorised musical score. The neurological process therefore involves the instantaneous altering of movements in the light of just previously heard sounds in such a way that the individuality, cohesion of the music and its communicating power are all preserved and developed simultaneously.

Finally, in relation to neural correlates for improvisation, there is a growing body of research related to mirror neurons and social cognition that may profoundly affect understanding of how humans learn. Gallese, Fadiga, Fogassi and Rizzolatti (1996) and Gallese et al (2004) discovered that subsets of neurons in monkey and human brains respond when an individual performs certain actions and also when the subject *observes* the same actions being performed by others. In other words, these neurons not only provide templates for action but direct internal understanding of another's actions, including their intentions and emotions. The researchers above believe that mirror neurons underlie our ability to imitate others and provide a basis for non verbal, non cognitive communication and learning. In aural traditions such as jazz, the ability to imitate not just the music but also the stance, posture and mannerisms of master players has been significant and has enabled the novice to absorb and embody the complete sound and style of a player. The mirror neuron system may also help to explain the ability of the brain to translate visual information into motor programs

because the movement or sequence of movements is not only observed but imitated within the motor cortex. It may also play a large part in the appreciation of jazz music.

Having presented the main body of the theory at the start of the thesis, the next chapter explores some alternative perspectives on the art of improvisation and how it is learned. It begins with a historically based review of how four jazz musicians learned to improvise during the 1920s and 30s and how their schemata developed within their social environments. This is followed by a description of how contemporary jazz teachers in the academic field think that improvisation is learned and includes a brief review of significant jazz methods and texts since the beginning of the 1960s. Finally, two alternative theories of improvisation are discussed: a cognitive model proposed by Pressing (1988) and a computational model developed by Johnson-Laird (1991) and compared to the schema theory model.

3. Alternative Perspectives on the Learning of Jazz Improvisation

3.1 How jazz musicians learned historically

The aim of this chapter is to understand how jazz was learned as an aural tradition within a particular cultural and historical context, in order to assess and compare it with the schema theory model. For this purpose, I have chosen to discuss the early musical development of four American jazz musicians who were learning their improvising skills in the early part of the twentieth century and who developed as professional jazz musicians within what Berliner (1994) refers to as the 'jazz community' at that time. Lester Young (1909-1959), Joe Pass (1929-1994), Charlie Parker (1920-1955) and Bill Evans (1929-1980), were chosen for these comparisons because of their diversity, predominantly melodic approach, individuality, high level of technical skill, influence on the development of the music, and because they all spoke about their early learning experiences in contemporary interviews. There is no doubt that all were innovatory masters of their day, with Parker for example, bringing the technique of the alto saxophone to a new level. All four players' technical mastery played a major role in their improvisational skill and the emotional communication of their musical ideas. How did these four diverse players come to be interested in jazz and to be able to improvise?

3.1.1 Berliner's Learning Model

The four players appear to have been introduced to jazz and learned within the musical and cultural environments described comprehensively by Berliner (1994)

using data he collected from the fifty jazz musicians he interviewed. Their childhood experiences were characterised by the following musical factors:

a) being surrounded by both live and recorded music, in the foreground and the background, as an integral and important part of everyday life;
b) having access to improvisers;
c) being encouraged to participate in musical performances, (particularly in more informal settings, for example, in church, in school, amongst friends and family and on the streets) at an early stage, often from the time they began to play an instrument;
d) having access to informal educational environments in for example, record shops, jam sessions, musician's homes and gigs;
e) playing and experimenting with a range of different instruments before settling on the right one; many players made their own instruments as children, before acquiring a standard one;
f) practising very hard for some particularly formative part of their early life;
g) participating in jam sessions, which provided a way of practising and honing performance skills without the usual commercial pressures;
h) learning from mentors and peers within the jazz community;
i) being responsible for their own learning, as a result of the jazz community's emphasis on autonomous learning rather than teaching. It was the student's responsibility to learn and to find out what they needed to know, which encouraged self-reliance and individuality;
j) using the jazz standard as a basic framework to provide the structure for both individual and collective improvising and gradually developing the theory and practice by studying harmony and altering chords;

k) copying idols by ear from records and playing along with them, in order to gain fluency and to develop aural memory before striking out on their own and developing an individual style. This way of learning is described by Berliner and many of the players as the 'imitate, assimilate, innovate' model;

l) during their formative years as young professionals, they were in thriving and competitive musical environments and had many opportunities to play and develop in a range of bands and situations and to make a living.

By looking at some key aspects in turn and comparing the biographical information about each musician, it may be possible to tell to what extent these generalised aspects from Berliner are applicable to the four featured musicians. Berliner's propositions about the key elements of jazz learning, and eventually excellence, can then be compared with a range of research findings on music learning, which together enable us to draw more detailed conclusions about the viability of schema theory as an account of jazz learning.

3.1.2 Being surrounded by music

Many of the jazz musicians interviewed by Berliner (1994) recalled that they were surrounded by music as children and jazz, being the popular music of the day, was everywhere. The process of being immersed in music on an everyday basis and absorbing it both consciously and non-consciously, is described by Green (2002:22) as musical enculturation, and the effect on the musicians as children must have been immense. It would have enabled them not only to absorb repertoire and the all important swing feel, but also to get a sense of the structure and form of the music at a

deep level. This enculturation process is largely absent from the academic approach to teaching improvisation although there are attempts in curricula (for example Jerry Coker, 1989) to emulate it. Lester Young was the only one of the four to have been surrounded by *live* music as he grew up in New Orleans. He remembered listening to music in the street where the bands used to play in order to advertise the dances of the coming evening, and to drum up support (Shapiro and Hentoff, 1955:22). Likewise, his experiences of playing and touring with the family vaudeville band grounded him in the popular music of the day and provided the background to enable him to develop as an improviser when the time came (Russell, 1973:57).

Charlie Parker, by contrast, was apparently introduced to music via his father's blues record collection (Russell, 1973:35/36). The influences of the sound, feeling and style of the blues singers of the 1920s such as Bessie Smith and Ma Rainey, alongside Blind Lemon Jefferson, Louis Armstrong and Duke Ellington, were profound on Parker, and were evident in his mature playing, forming a bluesy foundation with a bright, strong and emotional timbre for his individual and sophisticated improvisation. His exposure to the blues was, however, intermittent and Parker was not surrounded by music again until he ventured into the gangster-run club scene of Kansas City in the 1930s, in his early teens:

> All of these clubs had live music. The music started early in the evening and carried straight through the night till dawn, the official closing hour, though seldom enforced. At daybreak, roving musicians, finished with their regular jobs, would circulate through the district carrying their instruments and jam until well into the morning. (Russell, 1973:30)

Here Parker absorbed the sounds of the best jazz musicians in the country at the time and although initially unable to emulate them, he began to mime along to tenor saxophonist Lester Young, who was some ten years older, and to absorb the fundamental elements of sound and style needed to understand the jazz form and to develop as an improviser. Joe Pass was also surrounded by music on the radio, on record and at the movies. Indeed, he began to play the guitar in the early 1930s, because of his admiration for silver screen star, Gene Autry, and began improvising by filling in the gaps between the melody lines from tunes he heard on the radio, at the suggestion of his father (Clinton, 1974). Pass's father also encouraged him to pick up tunes that he whistled to him and also to make them up himself.

Bill Evans' spent much of his early childhood listening to his elder brother playing the piano, and, wanting to imitate him, he began playing for himself at the age of five in 1934 (Shadwick, 2002:48). Subsequently, the music that surrounded him was mostly classical as he developed his piano technique and performed in various school ensembles, concerts and competitions. Evans' enculturation was therefore profoundly influenced by classical music, which later formed a key element of his style. Like the other players mentioned here, he listened to and imitated the popular music of the day on the radio and could play boogie-woogie piano by the age of twelve. He also played in his brother's dance band in his early teens which exposed him to dance music and some jazz. Like Pass, he began to improvise on his own, mainly out of curiosity and to alleviate the boredom of the many repetitions of the same tune (Shadwick, 2002:50).

Evans, unlike the others, absorbed both classical repertoire and technique (which he continued to practise throughout his life) and this is amply reflected in his mature improvising style which displays an almost orchestral sense of chordal and harmonic thinking, perfect timing and a concentration and purity of style and melodic line. His approach was also fundamentally different from other jazz pianists and he spent a great deal of time in preparation and thought about his musical ideas as a direct result of the thoroughness of his classical training (Aitkin, 1980). Being surrounded by written music may also have aided his architectural sense of structure of a piece which he explained was at the core of his improvisational approach (Lyons, 1975).

From the start, therefore, all four players were surrounded by music and enculturated into the kind of jazz that they later became actively involved in, thereby providing the background elements necessary for their aural schema development. Diverse live and recorded examples of music which included jazz were simply available to them in their everyday environment to be picked up and absorbed.

3.1.3 Supportive parents

In addition to being surrounded by music in everyday settings of various kinds, all of the four players had parents who supported and actively encouraged their musical activity. Evans' parents paid for piano lessons for him from the age of five and subsequently provided flute and violin lessons in order to broaden the scope of his playing and general musicianship. Joe Pass's father wanted his children to have a future outside of the steel mills that he had worked in and so took every opportunity to help his son with his music, including requiring him to do many hours of practice,

perhaps too much for a child. Joe's father also brought him home all kinds of sheet music and sat down to practise with him on his improvising and scales, although he was not a musician himself (Clinton, 1974).

Lester Young's parents and siblings were all musicians and the family made a living by touring the vaudeville circuit and playing for circuses, dancers, singers and clowns. Young was taught by his father to play a number of different instruments before settling finally on the tenor saxophone in his teens. Parker's mother paid for his first saxophone with money she had saved to help him become a doctor.

In all four cases, there was active involvement on the part of encouraging parents to provide instruments, lessons and performance opportunities for their children. They wanted their children to develop musically and created an environment in which they could reach their potential. In terms of schema development, parents provided activities (either themselves or through teachers), whereby the young players could actively build their skills.

3.1.4 Access to Improvisers

Lester Young appears to have been the only musician with daily access to a live improviser as a child in the form of his multi-instrumentalist father and his live music experiences in New Orleans. Parker heard records and live improvisers in the clubs in his teens and Pass too probably heard improvisers on record, whilst Evans had scant access to improvisers before he joined a dance band at the age of 13. Berliner

considers that access to an improviser was vital to the future development of jazz musicians:

> Children who grow up around improvisers regard improvisation as a skill within the realms of their own possible development. In the absence of this experience, many view improvisation as beyond their ability. (Berliner, 1994:31)

As mentioned in chapter 1 on schema theory, the affordance of the human practising the skill or role is probably the richest form of communication available to another and so will be deeply influential in assisting the schema formation of the novice. This is quite aside from the fact that the improvisation is viewed as a normal everyday activity.

3.1.5 The effect of practice

Sloboda and Davidson (1996:184) cite evidence in their research that high achieving young classical musicians do moderate amounts of informal practice and high levels of formal practice (i.e. structured and technical work) and this seems also to have been true for the four jazz musicians described here. The main difference appears to be in the nature of the practice: jazz musicians tended to follow more informal aurally based practices and were largely self-motivating. Green (2002) describes how pop musicians also use such practices and reveals that they are largely self-taught and self-motivated, particularly as they approach adolescence. Ericsson et al (1993), found (from retrospective data), that professional violinists had accumulated approximately 10,000 hours of practice by the age of 20, again showing high levels of personal self-motivation for the activity.

From their own accounts and descriptions, the four jazz musicians probably did similar amounts of practice with high levels of motivation. They did varying amounts of practice as children, however. Evans worked hard even as a child and claims to have done three hours a day of intensive classical practice (Shadwick, 2002:50). His jazz practice began on the band stand with a dance band at the age of 13, and here he describes how an older mentor helped him to understand how to improvise:

> George would call out the *(chord)* changes for me without ever suggesting that I should have learned them for myself. Finally, instead of thinking of them as isolated changes, I worked out a system upon which traditional theory is based and I gradually began to understand how the music was put together. (Hennessy, 1985).

It is interesting to note that Evans worked out his own theory for jazz improvisation over the chords, presumably by integrating knowledge from his formal classical training and his aurally based informal tuition on the bandstand. It is also easy to see how idiosyncratically a schema for the harmonic background might form given the highly individual ways in which people come to learn their skills.

Pass, like Evans, also did enormous amounts of highly structured, formal practice between the ages of nine and fourteen:

> I guess it came sort of easy; I have certain difficulties, not a lot. But you've got to remember that I grew up playing the guitar. I started when I was nine, and by the time I was nine and a half or ten, I was doing seven or eight hours practice every day. I did two hours practice at six o'clock in the morning before I went to school, and another two hours as soon as I got home in the afternoon. Then I did four hours at night before I went to bed. I did that until I was fourteen or fifteen. I didn't like it – I hated it, but my father was very firm about it: he saw a little something happening, so he figured he'd just push. I don't remember too much how I felt about it except that I'd rather be outside playing ball and things. I never could ride a bike, like even today I can't do these things. But, I know how I learned, and what I practised. (Clinton, 1974).

Apart from the huge number of hours, Pass's practice was characterised by a wide range of different musical activities, all of which contributed to his developing into a highly skilled jazz musician. He was unusual in that he had no teacher, but his father supervised his practice as a non-musician, which was a mixture of both formal and informal practices involving set tasks but also a degree of experimentation. His daily practice schedule included specific technical exercises for learning the guitar fingerboard; ear training and transcribing from records; improvising in between melody notes of well known standards; making up tunes; classical guitar studies for performing chord solos and reading from sheet music for piano and other instruments. He too was performing at the age of fourteen with a trio and happily, making more money on good gig than his father did in a whole week at the steel factory.

By contrast to the disciplined and supervised practice of Pass, Parker (who remained without either a regular teacher or mentor), was beset with difficulties both with the technicalities of the instrument and the nature of the music he was trying to play, making his early progress painfully slow and fitful. Parker's early experiences of trying to learn the saxophone is an example of the sometimes woeful inadequacy of informal learning practices, particularly when the novice is unaware of what he has to learn to acquire the skill. He became interested in playing in his early teens and according to Giddins:

> His first flirtation with music was as fleeting as that of most children who ask for music lessons. At thirteen, he expressed enthusiasm for the sound of Rudy Vallee's saxophone on the radio, and his ever-obliging mother bought him a used and unplayable alto for $45. After she invested a larger sum to repair it, his interest waned and the instrument was loaned to a friend. (Giddins, 1987:28)

Once he picked up the instrument again a couple of years later however, (and certainly by the age of fifteen), Parker claimed to have practised eleven to fifteen hours a day for a period of three or four years. Despite the suggested exaggeration of

such a statement, Parker would have needed to have done something similar in order to make the stunning progress that he achieved by the time he was eighteen. The difference between his first attempts and his mature, highly inventive and technically innovative playing a few years later, were so great that many people thought he must be innately and mysteriously talented and had developed his improvising just through performing. Significantly, fellow alto saxophonist Paul Desmond also thought this as he interviewed him about this early period of his life:

> *Desmond: Another thing that's a major factor in your playing is this fantastic technique that nobody's quite equalled. I've always wondered about that too…whether there was…whether that came behind practising or whether that was just from playing…whether that evolved gradually.*
>
> Parker: Well you make it so hard for me to answer you, you know.…because I can't see where there's anything fantastic about it at all. I put quite a bit of study into the horn, that's true. In fact, the neighbours threatened to ask my mother to move once. We were living out West. She said I was driving them crazy with the horn; I used to put in at least 11-15 hours a day.
>
> *Desmond: yes, that's what I wondered*
>
> Parker: That's true yes. I did that for over a period of three or four years.
>
> *Desmond: …because that is the answer*
>
> Parker: That's the facts anyway. (*Chuckles)*
>
> (1954 Interview for Boston Radio, with Paul Desmond.)

Although it is unclear exactly what Parker practised, we do know that from contemporary accounts, once he decided to learn something he was totally dedicated and focused on it. For example, after a particularly disastrous experience at a jam session in which he was laughed off the stand (knowing how to play only one and half tunes in one key), he was told by a fellow musician that there were in fact twelve

keys. Armed with this new information, Parker set out to learn all twelve so that he would be equally at home in any one of them and in doing so extended the accepted saxophone technique of the day, that basically required only knowledge of the flat keys (Russell, 1973:67/68). Working through the difficulties encountered in E major and B major, for example, was very beneficial for both his aural memory and his technique on the instrument and at the same time he became aware of the varying sound qualities of different keys and the effect that they had on the communicating power of his solos.

Apart from practising as he performed in the family band, Young transcribed solos from records in order to learn his jazz and this practice had a deep effect not only on his aural and technical abilities, but also on his sound because he idolised Frankie Trumbauer's alto playing:

> When I had just started to play, I would buy all his records. I imagine I can still play all those solos off the record. He played C melody saxophone. I tried to get the sound of a C melody on tenor. That's why I don't sound like other people. (Young, Downbeat 1956)

He particularly liked the way Trumbauer 'told a little story' (ibid) and how having played the melody, he would then extemporise around it. It was Young's desire to sound like the C melody sax of his hero, that transformed his tenor sound and made him so distinctive from the heavier timbres of for example, Coleman Hawkins. Young, like many of the musicians interviewed by Berliner (1994) believed strongly that in order to play jazz one needed to imitate a player who was inspiring and to absorb his or her style *before* it was possible to develop an individual voice. Berliner calls this the 'imitate, assimilate, innovate' model and it is based on the notion that

incorporating physically and musically the improvising persona of another, provides a good foundation for creating an individual improviser.

During the 1950s after Parker had been recorded, Pass also transcribed Parker solos later in his teens and the high level of his technique and aural memory is apparent because those particular solos were amongst the hardest, both musically and technically. This helped to give Pass his be-bop orientation when he arrived on the New York scene in the early 1950s. Parker in his turn transcribed Young's solos of 1939 with the small Basie band (Giddins, 1987:35) until the tracks were worn away from endless listenings and also had a similar live idol called Buster Smith who was a key influence.

It is clear from these accounts that the four players practised intensely for a period of time during their youth; that they used a mixture of formal and informal methods to learn, but that for the jazz, their practice was autonomous and self-motivated; that they had mentors or role models to assist in their technical practice and in the conceptual aspects of understanding how to improvise and that they also used transcription as a way of assimilating the complete jazz improvisation of another. To provide a focus for their learning, they all performed at an early age either in informal jam sessions or other low key gigs where they could experiment and develop ideas in a fairly supportive environment. With the exception of Parker (who seems to have lived a speeded up life in all respects), the three other players had been practising for ten to fifteen years before they hit the jazz scene as proficient young improvisers.

3.1.6 Informal and self directed learning

Green (2002:16) defines informal learning as a variety of approaches to acquiring musical skills and knowledge outside formal educational methods, which can be both conscious and non-conscious. They are based predominantly on enculturation and aural approaches and rely mainly on self-teaching and peer learning. The cultural environments in which the young musicians found themselves enabled them to learn in a variety of informal and self-motivated ways. Evans was the only player to have formal classical tuition (although Pass had something approaching it in breadth), whilst most players used the materials to hand around them: the radio, the record player, the movies and whatever access they could get to live music, (though it was hard for youngsters to get into the clubs). Jam sessions provided Parker with ample scope for trying out his newly learned techniques and ideas and for comparing himself to other players. He was always asking questions of friends, colleagues and occasional mentors and found out all of his information that way, guided entirely by his own musical leanings. His great breakthrough though, in terms of individual style was described in his own words as happening whilst jamming with a friend:

> I remember one night before Monroe's I was jamming in a chilli house on Seventh Avenue between 139th and 140th. It was December 1939. Now I'd been getting bored with the stereotyped changes that were being used at the time, and I kept thinking there's bound to be something else. I could hear it sometimes, but I couldn't play it. Well, that night, I was working over *Cherokee*, and as I did I found that by using the higher intervals of the chord as a melody line and backing them with appropriately related changes, I could play the thing I'd been hearing. I came alive. (Giddins, 1987:55)

This revelation led him to explore a completely new approach and to form a new style of jazz (be-bop) which no-one at the time could begin to emulate from his live performances but only assimilated later once he began recording from the mid 1940s

onwards. The style, using upper extensions of the chords, a new kind of technically demanding fast phrasing and the elimination of swing in up tempo tunes, was entirely individual. Parker's astonishing progress from Lester Young sound-alike to dazzlingly original improviser is a testament to establishing a schema assemblage based on intense technique practice, listening and transcription. He then consistently pushed the boundaries to produce something new.

For all of these players, the concept of being *taught* how to play jazz did not exist. At the time, aspiring improvisers had to learn for and by themselves and because of this, beginners took very different routes and therefore ended up sounding highly individual as mature players. Being self taught in the jazz field, they had no-one to constrain them and developed in ways that felt intuitively right and appropriate to them. There is a question of how important informal music learning practices are in developing the skill of jazz improvisation and whether these can indeed be emulated in an academic, institutionalised environment. There is also an argument that without being incorporated into the academy, jazz music would have died when its cultural social and historical context disappeared.

In summary, the most important elements in learning to play jazz from this historical context appear to be similar to many other musical skill learning processes: everyday exposure and therefore awareness of the music (including models of improvisation), was clearly a key element, as was parental support and encouragement. Aurally based learning using imitation played another crucial role alongside the opportunity to perform what was being learned early on in an informal and relaxed way. With a

few exceptions (Joe Pass for example), learning was primarily self-directed, fairly slowly paced and where musicians were taught classically, (as in Bill Evans' case), improvisation in jazz was a natural extension of their other musical activities, developing from curiosity and a desire to extend aural and technical skills.

3.1.7 Traditional ways of learning jazz improvisation and schema theory

A number of aspects of the traditional ways in which jazz musicians learned seem to be of significance to the schema theory of jazz improvisation. Firstly, the musicians described grew up surrounded and enculturated by the music that they would later be actively involved in and so would have absorbed the form, sound and feel almost unconsciously, providing a foundation for the more practical elements of the emerging schema. The implication both for the theory and for present day learning (outside of the historical and cultural beginnings) is that a fundamental feel and understanding of the form of the music has to take place through listening, if the schema is to be wholly effective.[10]

A second issue arising from the traditional ways of learning is the emphasis on aural approaches, imitation and performance in developing the skill. The implication is that aurally based transmission and subsequent development of improvisation, provides an unmediated and direct method of learning that encompasses and incorporates the schema of another. In this view, having assimilated the style of another more masterful player (gradually absorbing the more subtle rhythmic and melodic nuances

[10] The absorption of jazz music as a natural part of everyday activities and interactions is a further distinction between the past and the present: the learning of jazz improvisation is currently a more cerebral or intellectual activity, rather than part of an all encompassing 'jazz life'. No distinction was made by the aforementioned players between their music and their life, and this I think has changed.

and for example finally being able to play along with the master improviser), the technical and imitative process becomes the foundation for developing the individual schema. Essentially this process elaborates on previously learned ideas and imagining new ones using already developed aural to motor schemata. The player will also have developed a sense, through transcription, of cohesion, dynamics, timbral qualities and a range of expressive parameters that presumably inspired him to play jazz in the first place.

A third significant factor in traditional learning is the role of performance early on, and all of the four players were performing as children or in their early teens during the process of becoming improvisers. There seems to be something important in the way that performing enhances and strengthens improvisation, perhaps by building confidence (under the right circumstances), and the sense of vitality of communication between musician and audience.[11] It seems reasonable to assume then, that in the development of the schema, performance is a vital ingredient and one that can be purposefully added in an educational context in order to enhance and enrich it.

A fourth factor is the self-directed nature of the learning, which Green (2002) includes with aural and peer learning, as part of the informal practices that pop musicians use today to develop their skills. It is true that whilst the four players took responsibility

[11] Clearly, most of the early experiences of performing related by the musicians were of an informal and supportive nature in the company of family, friends or a particular mentor. The more competitive and tougher environment of the jam session had different results and repercussions for Parker, for instance, and the humiliation of his early experiences forced him to practice and to more fully engage with the process of improvisation at a deeper level. Either way, performance has a profound effect on the development of the individual improviser.

for their own learning in jazz, they were all in a musical and cultural environment where many aspects of the skill could be picked up in their everyday life. Whether this is the same or different now is hard to tell. It could be argued that for example, children now have access to a much wider range of music through their i-pods and the internet, although experience of live music varies greatly between individuals. The fact remains that unmediated and self-motivated learning (whilst appearing chaotic), with specific support at the right time, does seem to provide a most effective form of learning. The reasons are not difficult to understand; self-motivated and self-directed learning will proceed from a starting point and at a pace that is most appropriate to the learner, and will be based entirely on natural interest, enjoyment, and curiosity which is unconstrained.[12] The process falters when the learner encounters technical or other problems that they do not know how to deal with or when they proceed along a path of learning that turns out to have been a blind alley. Another perceived negative aspect is the length of time this kind of experiential learning can take. Jazz musicians who learned in this way and then went on to a lengthy apprenticeship within the jazz community, describe the whole learning process as 'paying your dues'; implying that the music requires that kind of long haul commitment in order for the musician to be able to play anything individual and meaningful. In terms of schema development, it does appear that it takes a long time (normally ten to fifteen years) before the player is capable of truly individual and meaningful improvised musical utterance. The implication for the schema theory of jazz improvisation is that the learner should be encouraged to take responsibility for their learning from the start and that the teacher

[12] In an interview with me, virtuoso alto saxophonist Nigel Hitchcock described how as a child of nine or ten, he transcribed aurally by and for himself, the improvised solos of Charlie Parker in real time from the record, almost in the spirit of a game. He said that no-one had told him how difficult it was, and therefore he entered into what was essentially a highly complex problem-solving aural to motor exercise, with a sense of fun and curiosity. This childlike feeling of fun and play has never left him and is invoked whenever he improvises.

should be supportive and provide information when required. In other words the learning should proceed under the direction of the learner and the teacher's involvement and feedback should be minimal.

Finally it is clear that the four players engaged in large amounts of formal and informal practice at various times, suggesting that both are definitely needed to acquire the skill. As all of the musicians (except Parker) were learning to play their instruments anyway, the jazz aspects were an extension of their normal practice and represented another level of complexity to the problem-solving nature of practice that develops the schema. In addition the four players continued to practise and to develop, elaborating their skill, and in Evans' case creating a more distilled and condensed version of his individual jazz voice. This continuing process of development means that the skill is never really learned fully and that the schema must be enriching, refining and developing itself in a complex skill like jazz improvisation, throughout life.

Importantly then, although all of the musicians described were readers of music, their jazz improvisational skills were developed primarily by aural means using imitation first to provide the framework to explore their own ideas. This is in sharp contrast to the way that jazz improvisation is taught today in formal educational settings where generally, a notation based method predominates over more aural aspects of skill learning. How do contemporary jazz teachers propose that jazz improvisation is taught and learned today, and how does this compare to traditional methods and also to schema theory?

4. How teachers have proposed learning jazz improvisation

4.1 Introduction

The major proponents of academic jazz education, since it began in the early 1960s, have tended to view improvisation as real-time composition and to present learners with patterns and procedures using the be-bop style as a model. Their main focus is on the harmonic framework underlying the jazz standard (and in outlining chord-scale patterns which will fit it), which is used as a basis for the emergence of more novel or creative ideas. A major criticism of the formal educational approach is that it has fixed the 'language of jazz' at the be-bop period of the fifties through the use of notated patterns which are presented visually and which encompass this complex harmonic based style. This approach appears to come directly from a European cultural tradition in which notated music is given priority and in which improvised jazz music is seen as a skill to be learned, rather than a way of life to be adopted. The older, more organic and ad hoc 'black' approach is centred around aural traditions, particularly of imitation and the development of aural memory, and is strongly infused with the notion of jazz playing as a way of life. Berliner argues that living the jazz life refers to:

> the unrelenting demands of a jazz career and to a particular orientation to the world of musical imagination characteristic of jazz community members. They refer to the total immersion in the music's language that its rigours demand if players are to attain fluency as improvisers and enjoy continued artistic growth. (1994:489)

The Euro-centric version of learning jazz has had a profound effect on both the development of the music itself and how it is perceived outside of the original cultural environment in which it flourished. The result of this narrow focus has been the

neglect of many of the styles prominent before and after the 1935-55 era: the emphasis on solo over communal improvisation; the attainment of technique for its own sake above expressive musical content; the placing of certain types of jazz and star soloists as 'art' music in concert halls and the perception that many young players sound the same because their improvising skill has been based on similar foundations. The traditional assimilation of the previous generations' ideas via imitation and transcription, has also been neglected in the notated model. Likewise the presentation of patterns and scales reveals little about how a cohesive solo is developed, indeed, a review of contemporary jazz method books noted that beyond introductory lessons on traditional devices, theme and variation technique, repetition and chord-scale patterns: 'little insight is provided on how to turn the theoretical materials "into melodic gold".' (Smith, 1983: 79-80).

Below is a table that includes some of the most influential jazz texts of the past forty years, with a brief description of what they contain.

3.2.1 Selected review of jazz methods and manuals since the 1960s

Name	Text	Methodology	Comments
David Baker	Various Improvisation Manuals 1965-2003 *Turnbacks* (1968), *Jazz Improvisation* (1969), *Improvisation, its Nature and Practice* (1980), *Improvisation: a comprehensive method for all musicians* (1987), *Arranging and composing for small ensembles* (1988), *Jazz Pedagogy: a comprehensive method for teacher and student*' (1989).	Be-bop based, suggests learning scales, arpeggios and patterns before any improvisation is attempted. Introduces notated patterns for specific chord progressions and then makes them more sophisticated by adding colour tones. Catalogues of modal, pentatonic and lydian scales are practised in every key as a preparation for improvising. The focus is chord/scale and chord arpeggio improvising by numbers.	Narrowly defined 'jazz language', over focused on technique and 'patterns that fit' over expression and individuality, emphasises (initially at least), written forms over the aural tradition methods and tends to fossilise repertoire. Neglects timbral, experimental, communal parameters. Swing feel not addressed till very late on.

Berliner	*Jazz: The Infinite Art of Improvisation* (1994)	Ethnomusicological study based on musician's own observations of their learning processes. Loosely based on the 'imitate, assimilate innovate' idea, centred in oral traditions, communal learning, mentoring and so on.	Interesting and insightful account using language and vocabulary analogies to illuminate the improvisation process. Musicians own experiences can be contradictory and unrevealing about learning process. Much of it not open to consciousness and glossed and recreated in memory to seem like a logical and rational step-like movements to competency and then artistry.

Jerry Coker	*Improvising Jazz* (1964)	One of the very first instruction manuals for jazz improvisation. Makes the case that the intellect is the only factor over which there is conscious control therefore the intellectual approach to jazz is the only useful one. Bases the method of learning and standard and applying correct scales. Emphasises the need to create and learn your own motifs. Continues with ensemble work and communal approaches.	More balanced than Baker but still notation rather than aurally based. More emphasis on creating individual motifs rather than copying others or reciting patterns. Some basic analysis of melody and melodic contour as related to improvisation as well as functional harmony and chord tones. Swing not addressed till late in the method. More holistic and natural method.
Jerry Coker	*Patterns for Jazz* (1970)	Pattern book for all chords in 12 keys beginning with triads and developing over the extensions. .	Useful for improving technique but emphasises written over aural learning.

Graham Collier	*Interaction* (1995) *Jazz Workshop: The Blues* (1988)	Focus on learning jazz communally; on expressive, dynamic, and textural parameters within fairly simple harmonic contexts. Much more experimental and potentially creative emphasising individual sound and ideas and the development aurally of group compositions and improvisations.	Major contribution that focuses on the vitality of the music and its fundamental rhythmic and timbral nature. Encourages good rhythmic feel and learning by ear and heart form the beginning. Listening is of paramount importance. Eschews notation and teaches aurally. De-emphasises be-bop and places less emphasis on technique.
Bill Dobbins	*The Contemporary Jazz Pianist: a comprehensive approach to keyboard improvisation* (1978)	Has the aim of developing musical mind, ear and individuality, but starts with complex theory including chord families and modal scales. Emphasis on piano techniques such as LH voicings and accompaniment. Very similar approach to that of Baker and Coker.	Similar approach to Baker and Coker but with piano based exercises. Much preparation before any improve is attempted and a vast amount of complicated theory without much explanation of its purpose. Pages of anonymous exercises!

Hal Crook	*How to Improvise: An Approach to Practising Improvisation* 1991	Focuses on one small area of learning to improvise at a time and then integrates that learned aspect back into the whole. Basically it uses strong constraints to develop one particular field and to reduce some of the many variables. He emphasises that this is practice and not a performance method. It begins by getting learner to rest and play; learn melodies and contours of melody; manipulate short and long chord lengths; using guide tones in harmonic progression; varying dynamics; timbral effects; usual scale/chord patterns; elaborating on rhythm etc. More sophisticated harmonic and scalic devices are introduced at the end.	A slightly different way is used to develop similar material with an emphasis on listening and using time consciously to create phrases. Although there are many written out examples, the focus is on developing the music of the individual; creating motifs and so on and pacing the music. Also specialising on one particular aspect for a while is less confusing to the beginner improviser.
Howard Roberts	*Superchops: jazz guitar technique in twenty weeks* (1978)	Book of challenging guitar voicings for standards which the student records for ten minute blocks very slowly and improvises over in even quavers. This is done for fifty minutes a day until it is learned when the tempo of the standard is increased. Several standards are learned; technique is improved and individual improvisation is practised in a rigorous manner.	The aim is to improve 'chops' i.e. speed strength and stamina. However the method provides a creative approach to improvising because the focus is on melody and the repetition forces the player to really dig deep and find new material and ideas. Improves several aspects of improvisation simultaneously and is a highly disciplined approach.

Sam Most	*Metamorphosis: Transformation of a Jazz Solo* (1980)	Eleven standard progressions are presented and Most has written examples of solos over them, in a systematic way; beginning with minim guide tones, then crotchet chord tones and passing notes. This is followed by exercises using thirds; varying the rhythmic context; chromatic tones; fourths; pentatonics and finally a bitonal approach. Most suggests playing though the exercises with the chord accompaniment and then making up similar examples.	A good way of introducing beginners to a range of possibilities over standard progressions and encouraging them to explore the different sounds, intervals and rhythmic approaches for themselves. It presupposes quite a lot of theoretical knowledge and background but provides a constrained was of learning about improvising that is exploratory rather than imitative of any particular style or player.
Jimmy Giuffre	*Jazz Phrasing and Interpretation* (1969)	Aimed at teaching jazz phrasing and feel through notation, this method emphasises good rhythmic skills and internalising rhythm and articulation. The text is comprised of two stave melodies; one represents the 'straight' version of the music the other the jazzy version. His aim is to make the music come alive and in later stages students are encouraged to provide their own interpretations. Advanced work also covers melodic contour and the moving forward of phrases so that the music has both momentum and inner form.	One of the few texts to work specifically and centrally on jazz feel and phrasing through notation but focusing on expressive qualities in the music. Pre-requisites are good reading skills and improvisation is not mentioned although beginners would get an elementary understanding of jazzy lines through the melodic examples provided.

John Mehegan	*Jazz Rhythm-The Improvised Line* (1962)	One of a number of texts produced by Mehegan whilst he was jazz tutor at the Julliard School. After discussing the components of swing, he notates 10 versions of a 12 bar blues in parallel so that the student can compare the content and phrasing of for example, Bessie Smith and Hampton Hawes. He provides chordal progressions for the blues in a similar way with examples from Louis Armstrong in 1924 to Bernie's Tune in 1944. The book ends with a series of transcriptions taken from similar period and featuring a range of players.	This is another comprehensive approach that defines and describes the stylistic changes through the many eras of jazz so that the learner gets a feeling of how the music becomes more sophisticated. In this regard he is unique as most methods start at be-bop. The use of already written transcriptions is limited to analytical value, because the aural element involved in transcribing has been done by others. However, by having all the transcriptions in parallel the learner is easily able to compare and contrast different soloists and musical eras and should be able to make up their own examples, without requiring huge amounts of theoretical understanding or technique.

John Mehegan	*Swing and Early Progressive Piano Styles* (1964)	Follows a similar format to the previous example focusing specifically on piano players beginning at James P. Johnson pre 1920 and culminating in pianists from the early 1960's. The approach here is chordal, based on real styles of the players and also works on walking basslines.	Here Mehegan maps the territory and provides good examples that may be attempted by the beginner without too much background knowledge or technique. The opportunity to start simply and then develop harmonically is sound and enables learners to begin to practise improvisation from the beginning incorporating theoretical and technical aspects as they become relevant.
Transcription Books	Example: *Charlie Parker Omnibook, transcribed by J.Aebersold and K. Stone* (1978)	Examples abound of books of transcriptions from those of Louis Armstrong in 1924 to present. The idea is to gain insight into the solos of others and to improve technique by learning to play them. It also enables learners to analyse solos, and to see how ideas are developed over longer periods.	These have proved very popular over the years although as mentioned previously, a major component of transcription is the aural aspect. Unless the transcription book is accompanied by the music, both the feel and phrasing is difficult to convey using purely notational methods. Also many players are unable to make the leap from their current technical standard to that of say, Charlie Parker and need to be shown how best to use the transcriptions. .

Fake Books	*The New Real Books, Vol 1.* (1988), *Vol 2.* (1991), Vol *3.* (1995*)*	These books now proliferate and contain a vast repertoire of standard American show tunes; jazzy pop and funk repertoire; jazz tunes sometimes related to one particular composer like Ellington or Mingus; evergreens that can be played as standards and so on.	Prior to the advent of fake books, most jazz tunes were learned by ear either on the bandstand, or from recordings. Sheet music was also a source of repertoire but usually contained the voiced chords in the piano and was more sophisticated than using just chord symbols. The use of fake books tends to reinforce the notated aspects and they are now used in performance to the detriment of band interaction.
George Russell	*Lydian Chromatic Concept of Tonal Improvisation* (1959)	A way of playing in a controlled way outside of the tonality of a harmonic progression using a variety of ambiguous and many coloured lydian scales.	Places emphasis on the Lydian scale over the standard major scale and the concept of tonal gravity, thereby increasing both the tonal and atonal possibilities for improvisation using notation. An interesting way to broaden the ear.

Thom David Mason	*Ear Training for Improvisers: A Total Approach* (1981)	A listening based approach using patterns to learn to hear chords and scales and uniquely using solfege as an ear-training tool for improvisation. Begins with the aural learning of intervals; develops singing and playing exercises based on solfege and the intervallic relationships between notes, then applies this material to various chord progressions.	One of the few aural-based method books using solfege in an unusual way to define and learn intervallic relationships within chords and progressions. Emphasis on singing first and then transferring the sung motif or pattern to the instrument.
Jamey Aebersold	Play along records and CD's from 1980-present	Recorded backing tracks with various rhythm sections for improvisers to use.	These tracks have provided a useful way for novice improvisers and those not working regularly, to practise their improvisation. Used in isolation however, the approach emphasises a 'star' soloist over a more communal stance and has tended to fossilise certain standards over others.

Two of the most influential pioneers of formal jazz education and among the first authors to publish manuals on the subject in the early 1960s, are David Baker and Jerry Coker. I focus on these particular teachers, because they characterise the mainstream of jazz education in the USA (which has historically made a big impact on the European approach), and have continued to organise and teach jazz curricula in

higher education institutions to the present day. They also embody the more rational and consensual thinking about the way to learn jazz improvisation within formal educational establishments.

4.3 David Baker's method

Beginning in the 1960s, David Baker produced a series of improvisation methods for all instruments (1968, 1969, 1980, 1987, 1988, 1989), focusing on different elements but all based on the scale pattern approach that he pioneered. The books provide notated variations of scales, altered scales, arpeggios, patterns for specific harmonic features like II,V, I progressions, turnarounds, exercises over specific intervals such as fourths and combinations of all of the above, with the expectation that they will be transposed into all keys by ear. Baker was one of the first jazz musician and educators to publish a formal method on learning to improvise in the jazz idiom and as such was both highly successful and influential.

Baker's overriding idea (exemplified in the method), is that beginners in particular but also improvisers at every level, need to have a comprehensive and encyclopaedic knowledge, facility and fluency with scales, scale patterns and chord arpeggios and also a fairly rigourous conceptual understanding of functional harmony, *before* they are able to begin to create an improvised musical solo. His notion is that in learning the scales modally in all keys, broken into patterns and then mixed with chord tones, the musician builds technical facility and confidence on the instrument: the ability to imagine scale and arpeggio patterns and how they might fit together and gradually the

ability to play something individual that sounds consonant over a harmonic framework.

In relation to the schema theory of jazz improvisation, Baker's method ought to provide practice in finding and learning all of the possible combinations of intervals that the player may need in order to develop their schema for improvisation. Given that all the exercises are intended to be played with metronomic accuracy and at gradually increasing tempos, they should also improve fluency, technique and speed of aural imagination and when practised thoroughly, this is the case. What is missing however is any systematic way of turning the exercises and intervals into melodies or cohesive ideas that might lead to the development of the individual voice of the player. The result, where the method has been comprehensively adopted in formal educational settings, is that players sound (at least initially), generic, as their background work has been very similar. As both timbral and communal aspects of the music are de-emphasised, there has been a tendency for players sound to lack timbral individuality and for the more collaborative aspects of improvisation to be neglected in favour of a 'star soloist' plus accompaniment model, which has been assisted by the proliferation of Jamey Aebersold play along recordings. As we have seen, traditionally, schema development was highly idiosyncratic and based on the music surrounding the player and in particular the sound and style of an accessible idol. Similarly imitation and transcription, whilst not as comprehensive as the Baker exercises, provided the novice with a coherent model of a mature improviser: something that the repetition of intervals does not do.

If we compare this to the informal learning practices defined by Green (2002) and to the early experiences described by the four jazz musicians in the last chapter, we see a diametrically different approach at work. Whereas, the informal practices are based on enculturation and aural approaches and the learner being autonomous, Baker sets out a notated and systematic framework. Whereas the social and cultural contexts in which the players learned their musical skills enabled them to pick up elements naturally and at the appropriate time, Baker's notated material is presented all at once and purely from his perspective. Also in areas like functional harmony, Evans for example, learned how it worked aurally and from clues given by a mentor, so that he absorbed it in an idiosyncratic and organic way. The notated approach presents the material in a theoretical and one dimensional manner which may not be appropriate to every learner. In addition, the sheer volume of information, harmonic concepts and patterns to learn before improvisation can be attempted, goes against the general learning process in which small amounts of information are absorbed and adapted to the skill.

In relation to schema development, the chord scale approach advocated by Baker is based on and leads to a specific jazz style of be-bop which, as mentioned previously was developed by Charlie Parker in the late 1940s. The individual improvising voice of the player develops from assimilating the music of their era and then producing a variation on it and so it seems somewhat arbitrary to impose the be-bop genre on successions of students as a baseline. A more systematic historical approach is the one used by Mehegan (1964) and described briefly in the table, in which he compares and contrasts, on a bar by bar basis, the varying approaches to the blues beginning with improvisations by Bessie Smith in the 1920s and ending with Hampton Hawes in

1954. To begin with the elaborations and developments of the melody from recordings in the 1920s for example, by the great exponents of the period: Louis Armstrong, Bix Beiderbecke, the Duke Ellington band and then to follow the increasing sophistication of improvised lines through the big band swing era, then be-bop, birth of the cool and beyond to fusion, seems a more thorough and developmental approach.

As an alternative viewpoint to the domination of academic jazz education with chord scale methods, I propose that there is already a wealth of melodic musical knowledge present and available within the aural imagination of the player to draw on in developing the improvisational process, concurrently with learning some of the very necessary technical and stylistic aspects. This melodic sense, based on songs and tunes that the player has learned throughout their life, should provide enough background sources for the beginner to start improvising without having first to internalise a whole array of technical, harmonic and theoretical concepts. Both Green (2002:28) explaining how pop musicians learn, and the four jazz musicians, describe learning repertoire aurally i.e. songs and melodic fragments (riffs, bass lines etc.) as the basis for developing their musical and improvising skill. Green mentions (2002:24) that there appear to be three types of listening involved in aural learning: purposive (with the aim of learning something specific); attentive (which has the same level of detail without any particular objective in mind, and distracted, where the music is listened to on and off. Pop musicians report using all three types of listening while learning songs and are able to play the music naturally just by long periods of listening. They do not consciously attempt to learn songs, but rather pick them up through constant listening, and the same would probably be true of the jazz musicians. The long periods spent listening, absorbing and imitating the music aurally is the main

difference to the more academic notation based approach, where the aural elements are used to back up the more theoretical and technical aspects.

What seems to occur using the Baker approach is that by neglecting the more natural melodic entry point, musicians tend to get locked into translating a chord symbol or key centre into a scalic pattern or arpeggio which can be executed to *fit* the theoretical notes of the chord, rather like improvisation by numbers. Aside from being an extremely laborious task, beginners seem often confused between the theoretical, visual and aural complexities of this method and quite unable to play in a natural way. A better approach might perhaps be to develop individual musical ideas, initially in response to the melody (including the feeling it evokes and the contour it provides), adding conceptual and theoretical information as and when it is needed by the player, to develop and extend ideas. It comes back to what does one need to know in order to be able to improvise in jazz and Baker believes you need the framework of scales and patterns in all keys before anything else can be attempted.

4.4 Jerry Coker's method

Like Baker, Jerry Coker was one of the first players and teachers (again, in the early 1960s) to think about and produce a method for the teaching and learning of jazz in academic or more formal education settings. He also based his ideas on the jazz music of the 1950s. Aware of the changing social and cultural environment of jazz musicians, his first book, *Improvising Jazz* (1964) was intended, according to Gunther Schuller in the foreword, 'to fill the gap left by the demise of the jam session and the

road-travelling band.' (1964: viii) and Coker's own stated aim in his introduction follows:

> This book is designed to equip you with the understanding of the theoretical principles used in jazz, presented in a logical sequence as they apply to the ultimate improvised performance. (1964:2)

The stated aim highlights the fundamental difference in approach from traditional aural methods which were anything but logical or theoretical, being primarily based on sound and movement. Coker (unlike Baker) begins his first method with the framework of a standard and simplifying this further, examines a blues progression, defining the basic chord symbols and outlining the relevant scales. In this way he introduces the contextual nature of chords and the establishment of standard progressions for jazz improvisation, although still emphasising the theoretical over actual practical guidance. His next step is to provide an example of an improvised blues line which is analysed as a form of theme and variations. Having also described linear melodies consisting mainly of eighth notes, Coker suggests the beginner *read* transcriptions of jazz solos whilst simultaneously listening to them on record:

> We cannot emphasise this practice too much; it will benefit you in two important areas: (1) It will develop your ear and pitch memory to the extent that you will eventually be able to transcribe your own ideas while you are improvising; and (2) by studying the solos and styles of already proficient improvisers, you will gain a deeper understanding of the improvised solo and will discover various methods and ideas for the handling of improvised material. Your sense for evaluating the merits of various soloists will also increase as you discover which solos can bear the scrutiny of analysis. (1964:14)

Coker is suggesting the use of transcription but without the essential aural to motor aspects crucial to the learning process. He does however believe that it is important for the beginner to get a feel and idea for the underlying structure and deeper elements of the solo rather than just the fragments and how they might be put together. He also

proposes that beginners create a 'licks' book of original motifs which will eventually become part of the player's repertoire, and suggests that they compose two a day. As banal and simplistic as this sounds, trumpeter Randy Brecker[13] and his brother saxophonist Michael Brecker have been transcribing their own solos since they started playing. Brecker tapes himself improvising over various different sets of changes and then transcribes his own solos, writing any particularly good riffs, motifs or lines in his book. He explained that these help him to hone his own sound and actually to play his own licks again-it makes him focus on sounding more like himself![14] A secondary benefit is the improvement in sight reading (which enabled both Brecker's to become top studio players). Coker believed that the conscious development and variation of good motifs is fundamental to strengthening the relationship between performer and audience. The performer should create sufficient interest by balancing the need for a certain amount of predictability and repetition with contrasting difference and changes in the melodic line.

In next explaining how the rhythm section works in jazz, Coker prepares the improviser for the group sessions that form a large part of the book. In emphasising and encouraging jazz learning as a creative communal group activity, he is unique with Collier (1995) and much closer to the organic experiential learning approach described earlier in chapter 3. Coker sets out a disciplined method for learning to improvise within the ensemble by suggesting that the performers analyse and study the piece to be learned before they rehearse so that they are not struggling with the

[13] Describing his practice at a seminar at Leeds College of Music in 2001.

[14] It is interesting to note that most improvisers cannot remember exactly what they have just played: Brecker can only remember it by recording and transcribing his own solos. This is indicative of the dynamic and emergent skill that jazz improvising is: like conversation or trains of thought, wholly new ideas are created which are not memorised.

basics and can focus on more creative elements. During the rehearsal itself, the rhythm section plays some choruses on their own, so that the sound and feel of the chords is absorbed in time, then the solo players play roots using long notes. The main idea is to keep the progression fairly slow and simple at the start and players are encouraged to internalise it and to cease reading it quickly, thereby developing concentration and aural focus. Players are then assigned different chord tones for the long notes and gradually layers of complexity are added with motifs, arpeggios, scales and so on. Coker suggests that beginners play all together at first to build confidence, focusing on chord tones so that a consonant sound is made. Once the basic progression is learned and understood, guide tones are used to create a framework and cohesive melodic line as a basis for improvisation. The aim is for improvisers to decide on the most important chord tones by ear and to use them to outline the harmony, then to write down a solo incorporating these so that the visual modality can also be used to memorise the progression.

For the development of aural ability and technique, Coker proposes learning relative pitch on the instrument to enable heard pitches and intervals to be played as spatial patterns and the process is aided by the fact that each pitch has a slightly different tone colour from the others. He develops this idea through dictation exercises directly from recording or sound to instrument and then memorisation of the different timbral qualities of certain pitches. More theoretical concepts are added at this point to include sophisticated chords and colour tones.

In relation to schema theory, Coker's early method appears to reinforce some of the best elements of the experiential and traditional way of learning. He also uses the framework of the standard as a referent for the more theoretical ideas thereby providing a focal point and framework for schema development. He proposes a communal way of practising that benefits all aspects of skill development and encourages collaborative strategies for improvisation and learning, enabling the band as a whole to function as a working unit and to create a supportive environment. He does not try at this early period to include every possible combination of intervals that the beginner might need, but focuses on the specifics of a particular tune or progression, increasing the likelihood that something generalisable will be abstracted from the specific instance.

The ideas presented in the early works are in sharp contrast to later approaches in which Coker suggests ways of organising a jazz curriculum in a college setting (1989). Ideas for the curriculum comprise the usual areas of jazz history, theory, piano, improvisation, analysis of styles, composition, arranging, recital and pedagogy. How Coker organises his course is however, unusual because for a whole year he proposes that the jazz students work on jazz history, jazz piano and jazz theory without practising improvisation at all. When the students do finally begin to improvise, (and against his previous advice to form proper bands), Coker suggests that the class in conducted with 'play-alongs', i.e. recorded backing tracks featuring competent but unresponsive rhythm sections. His reason for this is that there is insufficient time to teach the rhythm section players how to accompany properly and that beginners need strong rhythmic support. The implication of his previous advice was that *all* players benefit from understanding how the rhythm section works and

how rhythm section players approach their tasks. Indeed, there is much to be said for beginners learning drum rhythms, bass lines and piano voicings to help them in their improvisation. Yet in this book, Coker is adamant that the class should focus on solo improvisation rather than the group concept, and in the process loses a lot of valuable jazz education. This approach also consigns the rhythm section to the role of accompanists providing a background for the 'more important' soloists: a practice that has led to many a boring jazz group. The workshop approach proposed by Collier (1995) uses group improvisation as a starting point and the rhythm section (if there is one) learns their skills in conjunction with everyone else. Beginner improvisers in a group need to become aware of all the other players: how they might participate in the group's sound and the overall structure of the music. Rhythm section players have to learn how to improvise; soloists have to learn how to accompany and how to respond to accompanists and so on. This process should begin early, when everyone is of a similar standard so that the group can cohere and develop as a unit.

In Coker's later curriculum, the improvisation classes began by applying digital and 'essential patterns and licks' to exercise tracks of play alongs. The first song is a John Coltrane tune called *Giant Steps* which is highly complex chordally with fast moving key changes. It was initially written as an exercise to develop Coltrane's technique when he was already a competent player, and seems overly difficult as a tune for beginners. There is no mention of creating a melody or looking at melodic contour or extemporisation: the elements that Coker chooses are purely chordally based. This procedure is continued for several weeks until the patterns are learned and then extended to other be-bop tunes, II, V, I progressions and the like. The process then includes modal tunes and the aural familiarisation of all scale tones, pentatonics and

fourth intervals, followed by the blues. Thus it is clear that by the 1980s Coker has altered his initial thinking about how to learn jazz improvisation and replaced it with a chord and scale method similar to Baker's. The assumption again is that a long period of background information assimilation is needed before the player can attempt improvisation.

What are the other theories of improvisation and how do they relate to how players' learned traditionally and academically and also to schema theory? Pressing (1988) has written probably the most commonly cited review of the theory of improvisation and proposed his own cognitive model linked to the computational theory of mind prevalent at the time of writing. I argue that his theory is too defined by separate 'moment by moment' activities i.e. it lacks suitably dynamic framework.

Johnson-Laird (1991) proposed a computational theory of improvisation which I question on the basis that the computer programme he devised simply failed to produce music remotely like jazz. The reason being that motivational, generalising and abstracting frameworks (schemata), feedback and consciousness were entirely absent from the predominantly algorhythmic processing of the computer. By contrast Sudnow (1978) proposes a theory of improvisation (based on his own learning of improvisation at the piano) which is founded on motor learning and memory. He suggests that it is the *hand* which learns, scaffolded by various cognitive processes and not vice versa, as is often assumed. This notion directly supports the schema theory of jazz improvisation because it links aural memory with physical space on the

instrument (in the form of intervals) and to practising the movements required to find the right notes.

4.3 Alternative models for improvisation

4.3.1 Pressing's cognitive model and ideas about improvisational skill

Pressing (1988) was one of a few researchers to have engaged fully with the complexity of improvisation and to have attempted to explain it in neurological and physiological, as well as psychological terms. He emphasised the need to distinguish between the different approaches and processes of learners and skilled improvisers in any proposed theory and his stated intention in the 1988 paper was to answer the following questions: How do people improvise? How are improvisational skills learned and taught? How can novelty (within improvisation) be explained? Included in the introductory literature review which defines the scope of the theory, he describes briefly the many possible substrates of the improvisation process including an outline of the control of movement by the central nervous system; motor and skilled performance generally and motor schema theory by Schmidt (1975). Those areas of relevance to improvisation concerning anticipation, timing, and motor memory are discussed briefly in relation to the imagining, co-ordination, execution and feedback from an ongoing improvised musical line. Discussing time scales for the control of movement, Pressing (1988:137) makes the point that neurological 'processing' speed seems to be greatest for audition and touch/kinaesthesia, out of all the sensory systems. Both relate directly to improvisation and provide a psychological interpretation for why improvisation has been developed in music to a far higher degree, that in other art forms.

Before proposing his own theory, Pressing discusses the role of intuition and creativity in the light of much anecdotal evidence from musicians about how truly creative improvised music comes to them seemingly from outside sources, and appears only marginally within their control. He also discusses how computer generated improvisation might be developed using a problem-solving model.

The proposed model for improvisation is presented below.

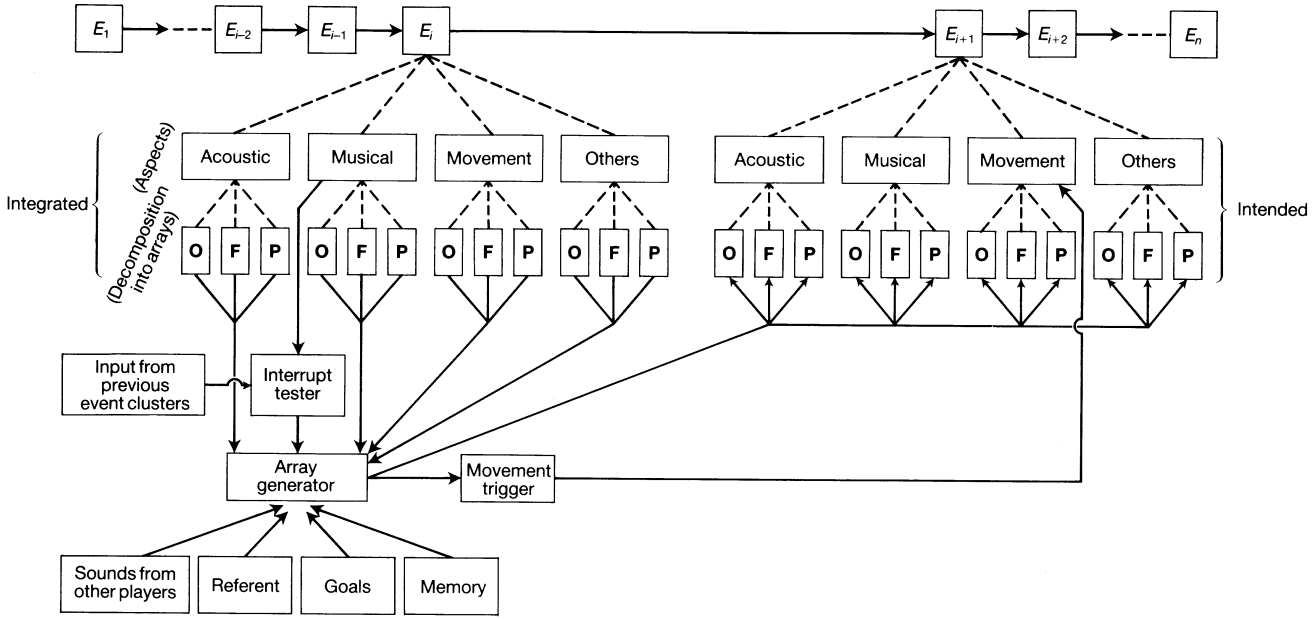

Fig. 7.4 The improvisation model in diagrammatic form. Only the process $E_i \rightarrow E_{i+1}$ (intended) is detailed. Each event cluster E_i is present in a number of partially redundant aspects, and each of these is decomposed into object, feature, and process arrays. Largely on the basis of musical representation a decision about type of continuation is made by an interrupt tester. In accordance with this decision an intended array decomposition is generated, with input from E_i arrays, referent, goals, and memory. This decomposition acts as a set of constraints in the generation of musical action, and production of E_{i+1} is subsequently begun by a movement trigger at t_{i+1}.The diagram detail shows what happens in the time interval (t_i, t_{i+1}), so that the indicated decomposition of E_i is integrated (that is, intended plus actual forms of E_i are combined), whereas the indicated decomposition of E_{i+1} is intended (no feedback has been received yet). Hence **O**, **F**, and **P** at time point t_{i+1} do not have indicated outputs.

Pressing's cognitive model of improvisation is examined in detail here because it is one of the few attempts to understand the process from a number of perspectives. The model is useful both in terms of defining what improvisation might be and in what may be happening in the mind and body as the performer improvises. It does not begin to explain how improvisation is learned or how coherent ideas and an individual voice develops. Pressing begins by stating that any improvisation may be partitioned into a sequence of non-overlapping sections. It may be, but is it actually put together like that or in more of a gestalt way? The way that certain improvised solos develop over time, implies that deep structural frameworks are at work, even if we do not understand how they are formed and are not consciously aware of them. These sections are described as 'event clusters' and they are put into the form of an equation as *Ei*. The equation is then: I (improvisation) = {*E1, E2.....En*}. Pressing assumes that every improvisation is actually generated by triggers at specific time points which he calls *t1,t2...tn* that initiate the movement patterns appropriate to affect intended musical actions. At each time point, schemata for action are triggered and as schemata are adaptive, subsequent fine motor tuning based on feedback, goes on after each time point. In other words, these are not discrete time points but like the event clusters, will overlap. There may also be a referent *R* which is an underlying guide or scheme used by the musician to generate improvised behaviour. This could be the standard tune framework of an AABA melody and chord progression or other compositional device. Also within the equation, *G* will be the goal (if there is one) and *M* is long term memory. The goal may be a point of resolution within the standard tune i.e. at the end of the first eight bars or driven by the internal logic of the musical line, or it may be the build up of intensity.

The process of event cluster generation is now described by Pressing like this: ({*E}, R, G, M) I –Ei+1*. Decision making in the (*i*+I) situation may extend back before *t1* depending on the degree of pre-selection used by the performer. Obviously, the mature improviser is influenced by his musical environment and other band members, so for group improvisation, other players would add their own distinct time – point sequences and also interact. Pressing's equation now looks like this, with *K* as members of an ensemble: ({*E*}, *C, R, G, M*) i2—*Eik=1 k*=I….*K*. *C* is the performer's *k's* cognitive representation of all previous event clusters produced by the other performers and expectations of their likely future actions.

Pressing then breaks each event cluster into partly redundant aspects: the acoustic aspect which is produced and sensed sounds; the musical aspect which is a cognitive representation of the sounds in terms of music; technical and expressive dimensions and the movement aspect which includes the timing of muscular actions, proprioception, touch, spatial perception and the central monitoring of afferents. Visual and emotional aspects will also be involved and there may be others. Pressing suggests that each aspect exists in intended and actual form: the intended form is specified at a particular time point and the corresponding actual form is constructed from sensory feedback. I feel it is more likely that the intended form, whilst initiating the schema, is vague enough to be unspecified until it actually unfolds as a musical line. As it is played, the improviser then responds to that, not to some wholly preconceived idea. In a previous quote, Bill Evans mentions this and the desirability and delight for the improviser of *not* knowing what is coming next. To return to the conversation analogy, (not in terms of seeing improvisation as a language, but rather in the sense of a dynamic and adaptive process), we may change what we say in

response to the feedback (both verbal and in the form of body language) we receive but the process is to elaborate or extend the idea we have just put into words.

It may be that we have the whole phrase in non-conscious neural structures (such as the basal ganglia) which becomes conscious as it is spoken, but given the nature of schemata and their generalisable features, I find this hard to imagine. There has to be some kind of comparator (as in the Bernstein model) but what it is and how it actually functions, is very unclear. Pressing states that the gap between the intended and actual forms is reduced by training in musicianship and improvisational practice. I disagree; very often novice improvisers do not even know what they intend, but play remarkably creative fragments of music and aim to control or modify them. Similarly, many play phrases that they feel have come 'out of blue', which again they try to repeat, refine or emulate with varying results. I feel the process is much less linear and more chaotic than described by Pressing, especially in the early stages when the schema may be organising itself. Pressing also considers that in the mature improviser, the intended and actual form, are almost complete, which I question because jazz musicians like best to create new and different ideas rather than relying on licks and so forth. New ideas cannot often be intended but rather arise from a continuous process of exploration and experimentation, often within a range of musical contexts.

Here is a summary of what Pressing thinks happens when a musician improvises, using his model:

A. *E* is triggered and executed perhaps with a time spill.

B. Each aspect of *E* is decomposed into objects, features and processes. An object is a unified cognitive entity: parameters describe the shared properties of objects, and processes are descriptions of changes in objects or features over time.

C. These entities are affected by the notion of cognitive strength which indicates attentional loading, and the importance that a given factor has in the performers' perception. Even if certain musical features can be identified as objectively present, if the player attaches little use or attention to them, then their value would be zero.

D. The production of *E* depends on the basis of long-term factors like the use of the referent, current goals, stylistic norms and so. Pressing posits that there are only two methods used to continue a solo: associative and interrupt generation. In the former, the improviser picks a new array of objects, features and processes with which to effect continuity between the event clusters, $Ei, Ei+1$. In this way he proposes that novel ideas could be generated. For interrupt generation, the improviser breaks off from current idea into a new direction resetting many component objects, features and processes.

E. Associative generation is based on similarity or contrast. In the former most of the array components stay approximately the same. In the contrast type of association generation, at least one strong component of feature or process array must alter. He suggests that the most powerful and general types of improvisational control are those cued to features and processes.

F. Interrupt generation is based on resetting all or a significant number of the strong array components.

G. The choice between association and interrupt generation may be modelled by a time-dependent tolerance for repetition.

H. Once the requisite objects, features and processes are selected for all relevant aspects, tuneable cognitive and motor sub programmes are set in motion that generate a specific action design. At this point we are at *ti+1* in the equation and the first loop of the process *Ei-Ei+1* is complete. Pressing suggests that the entire improvisation is build up by iteration

There are a number of questions arising from this model: first, is it the case that there are only two ways of extending the improvisation? There are famous recordings (for example, John Coltrane playing *A Love Supreme)* of musicians repeating the same phrase over and over, developing it in intensity rather than melodically or rhythmically. My view is that it is not an iterative process as with an algorithm, but a non-linear system, triggered by schemata with a longer time frame than Pressing envisages. Harmony is not mentioned by Pressing and yet is a unifying referent for both the improviser and listener and provides a constraint and a framework for cohesion that purely melodic or free improvisation lack. Given that novice improvisers spend many years getting to grips with harmony in the process of creating melodic lines that fit it without being prescriptive, the model ought to take this aspect into account.

Pressing posits that his improvisation model is characterised by redundancy i.e. an ascending phrase of D, F, A, B could be viewed as a B dim chord, a diatonic sweep to C, or a Dmin6. Such redundancy of description and generation allows for a broad flexibility in the choice of musical ideas so that whatever creative impulse presents

itself, the motor program will be able to execute it. In terms of the schema theory, it allows the same information to be generalised throughout a range of changing contexts and is part of the process of abstracting the relationships between notes rather than replicating the phrases *per se*. Pressing believes that the control of these processes is heterarchical and non-conscious rather than hierarchical, corresponding to the feeling of letting go, and going with the flow. This notion relates to the idea of a schema assemblage comprising of the motor, musical, acoustic and emotional elements, with different parts of the system leading the improvisational line at any particular point. I feel there is no doubt that the development of the skill leads to non-conscious process in the service of dexterity, fluency and emergent creative coherence, but whether it is heterarchically or hierarchically organised, is unknown.

Pressing suggests that object, feature and process arrays are formed due to the interaction of innate creative abilities and the environment, and that over the course of the improviser's life, new arrays and components are constantly being created by new perceptions and perceptual groupings. The schema theory view would be that the emergence and development of schemata gradually enables the skill of improvisation which is creative to a greater or lesser extent depending on the kind of social and cultural environment the person finds themselves in, and the amount of practice they do. In this view, musical improvisation is seen as an extension or cultural elaboration of innate and natural forms of skill assisted by schema development, (like movement and language) which allow for adaptive and dynamic interaction with the world. Given this, we have to ask why everyone is not naturally a musical improviser.

Necessarily, novel ideas are rare, but can occur because the schema will provide the scope for new movements in response to a new musical idea. Pressing proposes a second common source of behavioural novelty: the motor enactment of novel combinations of array components. For example, if a child has played loud and fast and soft and slow but not soft and fast simultaneously then the new combination will provide a novel experience. How does this relate to the notion of the schema? New combinations of activities can be incorporated as a matter of course. Pressing takes the view that novel actions are built by primarily distorting existing ones, but it is more that existing actions generated by the schema can be endlessly adaptive among many parameters including sensory information from the environment, i.e. musical ideas from other players. Pressing provides examples of possible improvised continuations of a three note ascending motif. The main question is why and how one particular phrase is chosen over another. At the heart of these questions is the nature of volition and the mind-body problem about which there is no consensus. Pressing provides four alternative perspectives on how this may happen:

- The intuitive perspective, where the individual taps into a powerful source that dictates the way the music flows naturally. Although this may appear fanciful, it need not necessarily imply that it is unscientific.

- The residual decision making process (after specific learning) reflects the individual's freewill. The improviser as a unique conscious entity can affect the course of the music in ways that they are not even conscious of, based both on internal and external variables.

- A physicalist perspective proposes that complex decision making is an emergent property of being a human interacting with a range of different environments. Freewill is illusory or misleading as a metaphor for certain

- complex characteristics of the system. In other words it is the hand which decides what to play!

- Randomness: where whatever residual slack is left in the system, random generators take over. It certainly feels like this at the beginning of the learning process and perhaps randomness is phased out as the skill develops.

Pressing feels that it should be possible to distinguish between the validity of intuitive and random perspectives (although it is not clear how he would do this), but not between free will and physicalist ones, because it is in the nature of improvisation to be unrepeatable both in execution and it its environmental background.

The development of improvisational skill is only touched on at the end of the model, and clearly, it has much in common with the emergent results of practice in other types of skill development for example, improved efficiency, fluency, flexibility, capacity for error correction and expressiveness. Added to this in the practice of musical improvisation is inventiveness and the achievement of coherence, which are in fact opposite in aspect: novelty is sought to avoid repetition and coherence is only achieved through some degree of structural unity, which is possible only through repetition. I would add that also related to the practice of musical improvisation is the development of the improvisers' individual and unique voice. The individual voice is

bound up with timbre, phrasing, musical inventiveness and a predilection for the kinds of musical lines that express the individuality and identity of the improviser.

Pressing proposes that the specific cognitive changes that allow inventiveness, cohesion and the raft of other skills needed for improvisation are:

1. An increase in the memory store of objects, features, and processes in musical, acoustic, motor and all other aspects;

2. an increase in accessibility in this memory store due to the build up of redundant relationships between the constituent parts and the aggregation of these parts into larger cognitive assembles;

3. an increasingly refined attunement to subtle and contextually relevant perceptual information.

What Pressing describes is the development of the schema; the increasing generalisation, abstraction and integration through the range of requisite skills and honing of motor, auditory and theoretical information. The main difference between improvisation as an open skill and the more fixed skills of say a classical musician, is that the fixed skill situation evolves towards a minimal size attention set whereas the unpredictability of improvisation demands that the attention focus remain wide.

4.3.2 Conclusion

The central features of the model are as follows: it is reductionist because the cognitive structures of processing and control are broken down into acoustic, musical, and movement aspects, and each of these are then broken down into characterising elements (array components). The model is synergistic and capable of behavioural novelty due to the extensive redundancy of the cognitive representations and the distributed and non-linear character of the outlined control processes. Pressing considers that the fundamental process of improvisation is the stringing together of a series of event clusters during each of which, a continuation is chosen based on association or interruption which act as constraints on the new material. The model was intended to be used to design an improvising computer programme. However, the underlying major philosophical questions about free will and the origins of decision making processes and voluntary movement, remain a sticking point to a deep understanding of improvisational process. It was Pressing's intention to organise experimental work to distinguish between his four types of answers: intuition, freewill, physical causation and randomness and to test the basic assumptions of the model, although this does not appear to have happened.

The major problem with the model is that it describes well what may be happening as improvisation takes place (albeit in a complex way) but does not explain how improvisational skill develops to allow for fluency and cohesion as well as novelty.

4.3.3 Later thoughts from Pressing on the development of improvisational skill

In a later paper (1998b) Pressing discusses the nature of improvisation as a more holistic activity, and the question of how both flow and cohesion are developed within it. He sees improvisation as a system of expertise and develops ideas of how improvisers might increase fluency and range by adapting to psychological constraints on improvisational expertise and communication. Pressing stresses the general nature of much skill in jazz which is acquired in the normal way through concentrated practice, sustained attention and evaluative feedback, although in jazz improvisation, complete learning is also highly dependent on participation in communal activities (such as jamming and performing) and peer and mentor input. Pressing argues that all improvisation is constrained by psychological, physiological and neurological process in real time which involves co-ordinating a range of cognitive, auditory and motor features. But this is true of everything we do and in improvisational process we are relatively unconstrained – that is the whole point. Pressing believes that deliberate practice helps to minimise the effect of these constraints (if that is indeed what they are), by creating tools which allow the improviser to concentrate on higher order aspects, and here he is more explicitly aware of for example, cohesion and coherence in a melodic musical improvisation.

> Only if the coherence problem is addressed with a sufficiently powerful set of skills and tools can the performer operate on a substantially higher level of musical thinking and interaction, exhibiting sensitivity to nuance, context, development and reference structures. (1998b:8)

Exactly so, and it is perhaps schema theory that enables cohesion to be developed through a solo because is allows an abstract time-sensitive view of the process unfolding, within which adaptations and changes can be made without altering the communicating power and idiosyncratic nature of the individual player.

One way in which a constraint is supplied to jazz improvisation is through a *referent* which Pressing defines as: 'a set of cognitive, perceptual or emotional structures (constraints) that guide and aid in the production of materials.' (1984) In jazz, an example of a referent would be the standard American 32 bar song form comprising of chords, melody and words in an AABA format, as described in previous chapters. As a notated and aural generic framework, the standard song provides a private and communal melodic, harmonic and rhythmic starting point and reference point for practising and performing improvisation. Standard tunes are also useful for developing a diverse repertoire with a range of expressive and emotional approaches and, most importantly, for communicating between musician and audience by providing a framework for recognition and expectation. The common element of the referent provides internal and external cohesion and enables both thought and action to be channelled quickly and smoothly so that higher order skills are more likely to emerge. In keeping with his extensive work on computer programming and Artificial Intelligence, Pressing is fond of the idea that we have limited 'real time processing power' which, if it is focused on mundane or basic details, will be unable to develop skills such as interaction, highly attuned perception and fine motor skills. If we agree that 'real time processing power' is an issue in the human mind, then the schema provides a short cut to the laborious moment by moment view of action in which every parameter has to chosen and re-chosen by the brain. The schema provides a way of initiating movement (or thought or speech) purely through a vague, goal directed thought which can be finely tuned or altered as it unfolds in a holistic process.

Another tool for improvisational fluency arises from the creation, maintenance and enrichment of an associated knowledge base in long term memory. The richness and refinement of this base is reflected in a master's ability to find faster better solutions and to respond flexibly to diverse musical situations. The novice has incomplete knowledge which is strongly context specific – in other words she has not learned yet to abstract the information – and can therefore only apply a particular riff or pattern or idea to one key or one situation. Connecting various elements is a key quality of the mature improviser's skill, and again the schema provides a framework in which the various motor, cognitive and physiological elements can be linked so that cohesion and other high level properties begin to emerge. Pressing suggests that declarative knowledge is merged with direct procedural knowledge in the construction of generalised motor programmes, and that efficiency of action and artistic expression are the two main forces that shape how the individual selects the appropriate information and guides its integration.

The culturally predicted knowledge described above and related to referents, is added to by the individual performer's continually growing store of associated musical ideas. These are developed by listening, composition, sight reading, improvisational practice, rehearsal and so on.

> Overall, the knowledge base will include musical materials and excerpts, repertoire, sub-skills, perceptual strategies, problem-solving routines, hierarchical memory structures and schemas, generalised motor programmes and more. It is a cauldron of devices collected and fine-tuned on the basis of optimising improvisatory performance. (1998b:11)

As Pressing suggests, one task of pedagogy might be to create a systematic framework of these elements, but he argues that it could never be complete. Baker

(1969) and Coker (1989) would argue that this is what they have done with their method books but perhaps the notated approach represents only one strand of a hugely rich and diverse skill. The fact remains that jazz improvisers develop their skills in a very idiosyncratic way and any pedagogy should enable them to develop more easily or creatively.

4.4 Computational model for improvisation by P.N. Johnson-Laird

Another alternative to schema theory is a computational approach described by Johnson-Laird (1991) who states:

> The theory concerns what the mind has to compute in order to produce an acceptable improvisation. A theory of what is computed is not, of course, a theory of how the computation is carried out. (1991:291).

Johnson-Laird's rationale for the formulation of a computational theory of improvisation is that skilled improvisers have little or no conscious rational access to the mature skill and are therefore unable to verbalise and explain their experience of it, except in the vaguest of terms. He posits therefore that those aspects necessary to illuminate the process are hidden from both the individual improviser and the observer alike and require a separate 'disembodied' theory to account for them. This idea is questionable: firstly, the novice (like anyone learning anything) is much more consciously aware of the process of learning to improvise and may be able to verbalise it or at least their perception of it, to some degree. Secondly, an observer can independently listen to the novice and their accounts, in conjunction with the music and attempt to ascertain how the learning process is proceeding. Thirdly, a computational theory neatly disposes not only of a plethora of mind/body questions and systems within the individual but also the musical context and the social

interactions with other band members and audience, all of which affect the outcome of the musical improvisation.

The question of whether the mind 'computes' at all, is also controversial given the wealth of current neurobiological and psychological evidence to the contrary. Each human brain is unique in its anatomy and organisation especially at the level of its synapses because of the idiosyncratic nature of individual experience. Computers by contrast are created from standardised components and work with similar operating systems. Secondly, the uniqueness and unpredictability that the process of development gives to the human brain allows for a wide range of responses and behaviour even within a similar environmental situation. If we accept Edelman and Tononi's (2000) theory that memory is recreative, this is diametrically opposite to the information processing model of memory in a computer which replicates and 'remembers' the exact information that has been stored within it through a digital system. Recreative memory has no storage 'place' as such and is a quality of the dynamic system (the interaction of circuitry, synaptic changes, biochemistry, value constraints and behavioural dynamics), which serves to select an output that repeats a performance. According to Edelman and Tononi (2000), the brain is an organ designed to seek meaning rather than 'process' information and therefore the replicative memory of a computer would be of no use to a human functioning in the world. In this regard, the Russian neurologist Luria (1968) described the life of a man with almost perfect multi-modal and vivid recall, who was quite unable to lead a normal life, or indeed to create meaning or abstract information from his experiences.

If we agree with Hebb, Arbib and Bernstein that many neural 'programmes' are generalised, then once the skill is learned, any neural circuit appropriate to the movement or thought can be called up to execute it; the skill is not fixed into a permanent trace in a specific place, but is an attribute of the whole neural system. This is quite unlike a computer where information is fixed and stored in a particular place.

I have previously made the case that improvisation is fundamentally a natural activity – as natural as the train of conscious thought – and therefore because of the inexactitude, unlikely to be algorithmically or logically based. Likewise, voluntary movement is assumed to be based on the initiation of a motor schema and adaptively changed with feedback as the action unfolds (Bernstein 1946/68). The brain appears unable to compute the weight of a cup before it is lifted or the incline of a hill before the body walks up it. Neither would it be able to predict the physiological changes needed to move the body forwards over the change in terrain and gradient. These are all adaptations based on feedback and generalised motor programmes, appropriate and unique to any given situation, and there is no reason to believe that other cognitive and brain systems work any differently. Lastly, the environment of the embodied brain is complex, multi-modal and constantly changing; the individual cannot exist outside of her worldly environment (for long), and therefore the brain is an adaptive organism receiving and responding to information from which it seeks meaning, quite unlike the information fed (passively, consciously and using codes), into a computer. For the reasons above, whatever happens in the mind when a player improvises cannot be reduced to a computation or any other one-dimensional rational idea. A computational model based on illuminating one particular aspect of the process might

be a more fruitful endeavour. Schema theory on the other hand can incorporate the psychological and physiological constraints mentioned above, and is above all an adaptive framework for the abstraction of meaning.

Johnson-Laird's theory proposes that the mind generates improvisations either by the manipulation of specifically structured symbols or with the use of 'representations' in which explicit structure is not present. The use of symbols to describe cognitive process is now considered to be problematic, due to the realisation that all thought and behaviour is adaptive.

> Our goal of understanding the brain and replicating human intelligence with computers will no longer be served well by using the term "symbol" (or "representation") to refer interchangeably to experiences of representing something to oneself, to neural structures/processes, and to forms in the world such as words in a computer programme. (Clancey, 1993)

Throughout Johnson-Laird's attempt to programme a computer to improvise both rhythmically and melodically in a jazz idiom, he faces problems because a fixed symbolic approach is impossible to use in an adaptive improvisational setting. For example, he attempts to programme the computer to imitate a rhythmic jazz swing feel but finds that both the concept and sound of swing impossible to analyse because:

> There is no precise account for this style: musicians acquire it by listening to virtuosos and seeking to emulate them, and, though they develop a discriminating ear for what swings and what does not, they are unable to explain the underlying rhythmic principles. (1991:294).

He is forced to judge as a human listener when the rhythm sounds 'right' because this rhythmic feel cannot be reduced to a fixed set of programmable parameters; just as the individual player is responding and adapting as the music unfolds, to a range of internal and external factors which will never happen in exactly the same way twice.

The ‘natural’ sounding way in which a good bass player is able to move seamlessly through various time changes and styles in the course of a performance, requires an awareness of moment by moment alterations within the musical process and a responsiveness to them which would be almost impossible to programme into a computer.

Similarly as Johnson-Laird attempts to programme the computer to improvise a melody, he begins with the doubtful premise that:

> No sophisticated plan appears to govern the structure of an improvisation above the level of individual phrases. (1991:296)

No evidence is provided for this claim and it is contradicted by the fact that improvised solos at the highest level have a unity and cohesion about them that implies an inherent structure, even if it is created non-consciously by the player. To take one example, Wes Montgomery’s improvised solo on *Round Midnight* (1959) displays all the attributes of a through composed piece, with development of ideas and unity of conception, although Wes himself could not read music and never studied it formally. How this happens simultaneously within the flow of an improvised solo is one of the key questions about the process, because it is clear that underlying principles of form are at work even if they are poorly understood. As described previously, various external factors (like the standard tune) act as an individual and communal reference point and as a means for internal and external cohesion, therefore melodic improvisation in the jazz idiom clearly does not operate in a vacuum, but within well defined musical, cultural and historical norms.

Johnson-Laird's assertion that melodic jazz solos are phrases held together by the harmonic progression of the standard, is also simplistic for the reasons above, and because some melodic improvisation is not based on any harmonic sequence. He reduces the entire improvisational process for both musician and computer to the generation of a pattern for the rhythmic phrase and the generation of correlated series of pitches for the notes in the phrase, but the problem of how the jazz musician generates the notes is still unexplained. Johnson-Laird suggests that a grammar similar to a linguistic model is used to create phrases using minimal amounts of 'processing power' (1991:297). The linguistic grammar analogy originating from Chomsky (1968) is based on the building of meaning through single words into phrases and longer syntactic structures. However, Chomsky's theories of grammar and deep structure in language have yet to be proven in terms of musical form, as even at the most basic level, language structures can be broken down into ever smaller elements of meaning, whereas this is impossible in music.

Jackendoff and Lerdahl (1983) used a similar linguistic model to create a theory of generative musical grammar, which appears to work for harmonically hierarchical structures in western classical music. They analysed the grouping structure of motifs and phrases, their metrical structure, the hierarchy of pitch structure and tension and relaxation of melodic elements in relation to harmonic form, in various pieces of classical music and suggested that there are universals in music and that the ability to organise musical structures, is innate. However, the generative theory of tonal music cannot apply to atonal music or indeed any music, which does not have a conventional 'western art music' hierarchical harmonic structure. We are certainly able to compose, improvise and hear musical wholes i.e. we have auditory gestalt,

which seems to imply a structural system, but our visual modality also seeks meaning in wholes and patterns which are completely unrelated to language or any kind of narrative form.

There is a case to be made however, that improvisation follows a similar pattern to conversation, or conscious trains of thought, and Edelman and Tononi (2000) speculate with a theory that the basal ganglia parallel neural system works for both language and music, in isolating elements of verbal and musical skill, and subsequently initiating their learned and consequently automatic aspects unconsciously. They propose that the conscious elements in the cerebral cortex and thalamocortical system trigger these unconscious loops (of grammatically correct sentence structures, or previously learned scale patterns) so that the thinking/playing time is speeded up. They also argue that having to think of every aspect of, for example conversation, would slow up the communicating purpose of speaking as well as the flow of thought and response. We are not consciously aware of the neural process in a vast number of bodily functions including voluntary movement, and the automaticity of learned actions frees up the conscious mind to respond and adapt to other environmental conditions.

The proof of a comprehensive computational theory of jazz improvisation is in the resulting improvisation by computer, and this is unconvincing. The computer generated series of chord progressions based on II, V, VI, III, IV and I chords are random aggregations and even when 7th and b5 substitutions are added, the results are underwhelming. The computer operates in a context free zone with no sense of the idiom; no awareness of the melody associated with the progression; without any

feedback about its appropriateness and with no interaction from other players. The fundamental driving force for a beginner improviser; the desire to learn the skill, is also absent along with the inspirational experience that prompted the wish to learn in the first place. All of these aspects including the vital role of imitation, are only available to the embodied mind acting and interacting with the unpredictable and changing world in which chance and chaos play a fundamental part. To help to illustrate this, listening to the great Scottish tenor sax player Tommy Smith live for a couple of hours recently, I became aware of the following:

1. The structure of his solos was only loosely based around the harmonic progression; he took great flights outside of the time and key centres and was able to change his approach depending on the mood and the material, so that timbre, tone, articulation, phrase lengths, tempi, volume and so on were altered at will to suit the demands of the moment.

2. He did not appear to 'choose' any phrase, but just let phrases unfold in a coherent and cohesive way that could be followed by the band and the audience alike. I believe that it is not understanding as such, (because there is nothing to understand), but rather a shared aesthetic or notion of musical space. In that sense, the best jazz improvisation is a collaborative action and cannot reach its highest form and flow without the interaction of the listening audience.

3. The group, comprising saxophonist, pianist, bassist and drummer, (all performing acoustically), were so responsive that within the space of

one or two notes at any tempo, they could change rhythm, feel, and expressive qualities. Each band member appeared to be able to change the dimensions of the music at will, and was equally influential in this respect, setting off on a different track which all of the others followed quickly. Levels of concentration were so high that this exciting but risky and 'on the edge' strategy came adrift briefly only once in 2hrs 40 minutes of intense playing.

4. All of the music was invested with a wide-ranging emotional power the mood of which altered from wistful to playful, to raucous, to tender, all within the space of one solo.

5. Solos appeared to unfold in a musically logical and cohesive manner. They made perfect sense within the context of the standard and the unique style of the performer, but were in no way predictable.

The adaptive nature of the skill is of paramount importance and the key issue is the sublimation of all technical elements to the movement and the creation of a particular mood and feeling, the integration of that mood with other players and the communication of it to the audience. There may be innumerable motor and conceptual schemata, cognitive strategies, unconscious routines, aural memories and imagination, but they all serve the same purpose: to move the music at will in the direction determined by the individual and the collective in such a way as to be fully communicable, on a moment by moment basis.

In attempting to program the computer to create a walking bass line, Johnson-Laird suggests three possible ways that human players might do this:

1. Each note in a bass line is chosen from the set of notes comprising the current chord. (This happens in part because there are always some chord tones within the bass line in order to outline the harmonic framework. However, pure chord tones would be extremely boring.)

2. Bass players have a series of motifs and phrases, which they can call on and put together. (This was discounted by Johnson-Laird as being too cumbersome and difficult to execute, although Berliner (1994) cites many examples of players referring to licks, motifs and patterns they have learned, which they call upon in order to be able to play something when inspiration fails them.)

3. Bass players choose their notes according to a number of criteria: chord tones, progressions, and melodic contour. I would add: known licks and phrases; response to rhythmic and melodic interaction with the band, response to the mood of the piece, mistakes, experiments and interaction with the audience. Perhaps the choice of notes depends upon the exact requirements of a situation; the mood; fellow musicians; the type of material or venue; the audience and so on.

Johnson-Laird writes a programme that selects the next interval in a melodic contour and then its pitch and also programs the computer to recognise chord types and use

acceptable passing notes between chord tones. The example of a generated bass line which he provides sounds very strange indeed, with uncharacteristic leaps, overuse of b5 passing notes and a complete lack of cohesion and natural flow. Novice human bass players coming up with a similar line, would be responding to information about what they sounded like and would realise something was wrong even if it took them a while to work out exactly what. It is unlikely however that they would produce something so unnatural sounding: beginners tend to focus on root and fifth notes until they can keep time. As a next step, they may begin to add passing notes and try to produce a coherent flowing line. These processes are relatively slow and organic and work on small areas of competence and understanding at the beginning. Throughout the learning process, the novice is interacting with other musicians and receiving feedback, which causes modifications to their ideas and skills or indeed, at times, complete revisions of them. The computer can only work on information given to it and lacks the basic motivation of the human to improvise, hence the random sounding bass lines and chord progressions.

It may be that any attempt to create a standard computer programme (as opposed perhaps to a robotic version), for jazz improvisation will be beset with problems because of the importance of cultural, social and emotional contexts within which it is played. Fundamentally, the embodied mind never replicates any action or thought implying that the whole working processes of the brain are adaptable and flexible. Edelman and Tononi (2000), also make a strong case that brain operations in perception and memory (both of which are integral to schema formation and development), involve selection not instruction. This implies that the brain works in an almost improvisatory manner and there is no evidence for pre-established neural

codes or indeed any kind of representational or symbolic codes like those used in a computer. They propose that instead of being guided by effective procedures (which would suggest codes), the brain is governed more by a degenerative set of effective structures- the complete opposite of the way a computer works. Add to this the effects of the wide rage of neurotransmitters; blood flow; hormones and electrical signals and it becomes clear how difficult it is to create dynamic higher order skills on a computer. Lastly, rules of logic appear only to apply to learned rational thought, not to brain process *per se* and information from the environment is perceived and received in a multi-modal and non hierarchical manner, completely different from the ways information is received by a computer.

Despite the shortcomings of the computational theory of improvisation, Johnson-Laird persists in his view that fundamentally creative improvisation involves computational processes and suggests that these might occur algorhythmically in three ways. The first is the combination or modification of musical elements at random, which he describes as 'neo-Darwinian' and is based on natural selection. This is clearly not the case since his 20 experiments at randomly generated computer improvisations sounded so un-jazz like. The second suggestion is the constrained used of various combinations of notes in which pre-existing knowledge is used to guide the choice of materials. The third suggestion is that some criteria are used to initiate the ideas and others to develop and continue them depending on evaluative feedback. All three notions seem limited and reductionist and cannot adequately explain the generation of novel ideas.

In conclusion, computations of the brain for learning improvisation cannot exist in disembodied isolation because they have to adapt to changing internal and external circumstances and environments. The generation of improvised musical ideas is related to aural imagination, memory and the development of motor schemata to implement them, and although some practice for the novice requires imitating and replicating ideas and patterns, the mature skill requires the development of high levels of concentration so that all the learning can be adapted to the requirements of the moment and the music at hand. It is a dynamic and never ending process completely alien from mathematical repetition and replication.

4.5 David Sudnow's embodied model

David Sudnow's (1978) account of how he learned to improvise on the piano presents another perspective on the skill, by describing the process (or as much of it as he can verbalise), as it unfolds in time from his own viewpoint. He proposes that it is the body and specifically in this case, the hand, that learns the skill and rejects the notion that internal theoretical knowledge guided by cognitive processes informs body movement. He suggests instead that the hands 'learn' where to place themselves in relation to spatial, proprioceptive and auditory parameters and feedback. He questions the notion that the learning of a skill progresses from specific detail to abstract principle and suggests the opposite: that we move from abstraction or rather I think he means a vague understanding of something, to a concrete instance. Sudnow also proposes the generalisation of motor programmes in the brain suggesting that this is a reflection of the capacity of anatomically and structurally different regions to provide similar outputs or results and adds to the complexity of attempting to understand neurological process.

Sudnow describes how he began to improvise by using basic scales, phrases and chords that he learned at the keyboard and played to fit, with specific chords and harmonic progressions, much in the manner specified by Baker and Coker. He had lessons from a teacher who showed him a repertoire of musical ideas and what he called 'pathways'. Yet, despite much effort did not understand how the teacher chose the appropriate phrases, and so remained for some time bound by rules he thought existed for the whole process. This is partly because Sudnow's teacher was unable to explain how he decided what to play, because the process had become unverbalisable and automatic to him.

The next stage he referred to as the 'gestalt' stage in which musical wholes were recognised and reached by the hand with a degree of automaticity. These included scale and melodic patterns, but also finding chords. Incidentally and unsurprisingly, the path of his learning to improvise did not run smoothly, although he was directed by a teacher, and he was faced with various difficulties including a harrowing (but common) experience at a jam session where he was quite unable to reproduce the ideas he had practised at home. His major point is that the only way to find out how to perform the skill is by doing it, and enabling the hand (and the other synergies of muscles that support it), to learn spatially in relation to the keys and scaffolded by cognitive processes.

At the third stage, instead of solely visual or conceptual patterns triggering the hand, he began to *hear* ideas and combined learned and heard music which resulted in

another intermediate stage where some of the ideas came off and some do not. Finally he 'goes for the jazz' and found his hand reaching for notes without any particular (verbalised) instructions from the conscious brain. This is the stage that is marked by dexterity, flow, cohesion and all those other fine movements and effortless elements that mark the mature skill.

Throughout his account, Sudnow is preoccupied with and intent on playing fast and the crucial turning point in his development as an improviser came through watching the slow and utterly co-ordinated body and hand movements of pianist Jimmy Rowles, playing ballads and 'caressing the melody'. He writes:

> More than any other single experience, it was listening to Jimmy Rowles that marked the crucial turning point in my fourth year of study, when very significant changes began to occur in my path to improvisation. (1978:73).

By concentrating on breathing life into melodies and copying the exact body movements of Rowles, (as many young jazz players used to copy the stance and movements of their idols), Sudnow developed a new way of being at the piano which later also affected his faster improvisations. At this point, he heard auditory 'glimpses' of how it would be to really play jazz and to call up phrases at will. He also realised that his hands resembled other jazz piano player's hands i.e. his hands changed physically as his improvising skill developed.

The copying of Rowles posture and movement is highly significant and Sudnow watched him (in a way that resembles Trevarthen's (1999/2000) body to body communication), not just once, but 'for months, night after night…' (1978:74) From this deep level of observation Sudnow was able to abstract a sense of how Rowles

came to improvise musically, and in turn was able to embody the same process in his own playing. It is interesting that the interaction with the teacher and the rational explanation of musical pathways, was not enough for Sudnow to understand the process, although by the time he came to watch Rowles, he had been playing for four years and may have been at a point of readiness to assimilate the information. It is also interesting to note that the knowledge was 'out there' to be picked up in body movement outside of cognition and language and yet related to an aurally based activity. The implication for schema theory (along with other movement related discussion by Johnson and Bernstein), is that body movement, language, gesture and posture may be far more crucial to the learning of jazz improvisation that is perhaps realised and that this should be reflected in teaching methods and pedagogy.

By the end of the book, (some five years later), Sudnow writes:

> I sing with my fingers, so to speak, and only so to speak, for there's a new being *my body* and it is this being (here to so to speak) that sings. (1978:130)

The significance of Sudnow's ideas is that he focused on the body, implying that it leads the physical learning of improvisational skill, whilst being scaffolded by cognitive processes in the mind. His notion that the novice begins with the specific (i.e. the pattern, or motif) and develops it into something altogether vaguer (because it allows for complete freedom of aural imagination), is also interesting and supports the idea of a schema based theory for improvisation.

Having explained the schema theory of jazz improvisation and argued that it provides a useful theoretical framework through which to understand how the skill develops; the next stage is to attempt to seek evidence for the schema through the practical

investigation. The focus of the practical work is a series of jazz improvisation workshops with both groups and individuals in which the process is taught, observed and recorded. In the intervening chapter before the practical work is described, there is a discussion about the kinds of qualitative research methods that are most appropriate to the practical investigation of the emerging schema and the rationale for their use.

5. Qualitative Research: Questions, Issues and Methods

Introduction

Although some of the work surveyed in chapter 1 on schema theory referred to cognitive schemata and therefore incorporated more quantitative research methods, I made that case that schemata in jazz improvisation may be non-cognitive in nature, especially those related to aural and motor processing: cognitive schemata scaffold what is essentially a physical skill driven by aural imagination and feedback. The practical research later presented in this thesis, which focuses more on the aural to motor aspects of learning improvisation, therefore requires answers to questions that relate primarily to process rather than specifically to outcomes, and qualitative methods are suited to this purpose. The emphasis on flexibility of design and in studying holistic and dynamic events within their natural setting provides a good basis for the study. However, there are wide ranging problems and issues around the need to assess and validate qualitative research in a rigourous way. There are also wide disagreements in the field about the nature, purpose, practice and status of its methods. It is for these reasons that the next section will justify a specific use of these methods in the current thesis.

5.1 What is qualitative research?

Murphy et al provides the following definition:

> Qualitative research involves the collection, analysis and interpretation of data that are not easily reduced to numbers. These data relate to the social world and the concepts and behaviours of people within it. (1998:3)

The dictionary definition is: concerned with or measured by quality. Smith (2003:1) defines it thus:

> Qualitative analysis is concerned with describing the constituent properties of an entity, while quantitative analysis is concerned with describing how much of an entity there is. (2003:1).

There are a number of supposed distinctions between qualitative and quantitative approaches which increasingly appear to overlap particularly as research and research areas become more multi-disciplinary and broader in scope (Murphy et al, 1998:4). Qualitative work is seen as being generally inductive by nature (inferring a general law from particular instances), and quantitative research as being deductive (inferring particular instances to a general law or principal). Deduction is based on Aristotelian logic: all birds have beaks; this creature before me has a beak; therefore it must be a bird. Obviously this kind of logic only works when the first statement is absolutely certain: here the duck billed platypus could also be said to have a beak, as could the dolphin, and neither are birds. The inductive method formulated by Bacon in the fifteenth century proposed that the careful study of many individual cases would lead to a hypothesis and then onto a generalisation or a law. Good research probably involves both deductive and inductive reasoning or a combination or even cycles of the two approaches. In addition qualitative research can also be done in a deductive way where prior theories are tested in new research.

5.2 Why qualitative research has been adopted here

There are five features characteristic of qualitative research practice:

1. **Adopting the perspective of the people being studied**

Here the problem is of meaning: whether human behaviour is meaningful and whether the researcher can understand and explain the meanings of another. An alternative view posited by ethno-methodology is that it is more important to understand what people *do* as opposed to what they think. They question the feasibility of truly uncovering the meanings of participants in the following ways: firstly, the meanings may be inaccessible to the participants themselves; secondly the way that the participant acts in this one particular situation may have no bearing in another and thirdly, that the researcher does not and cannot simply reproduce the participant's meanings objectively. In the process of selection and interpretation, the researcher inevitably filters, frames, and generally mediates the account or observation through their own subjective perspective. Simply uncovering and explaining participants meanings is therefore fraught with difficulty, and the researcher has to address rigourously how they intend to deal with the problems, especially avoiding anecdotal evidence and their own prior assumptions on the observational analysis.

2. Description of the setting of the study

Similarly with description: it can never be an objective or value-free exercise in itself because it is not a direct reproduction of reality. There are likely to be many equally valid descriptions of a setting and again, there are inevitably theoretical assumptions behind them. The key is for researcher to state their research assumptions at the start, during the process and in the findings.

3. Emphasis on the context and on holism

A great strength of the qualitative research process is the emphasis on holism and understanding phenomenon in context, in a complex and natural way. This is the opposite of isolating and controlling variables that takes place in most quantitative research.

4. Emphasis on process

Much quantitative work is focused on outcomes, whereas a characteristic of qualitative research is its emphasis on process and the dynamic nature of life. This goes hand in hand with a preference for longitudinal studies and prolonged engagement with the setting being researched. Under these circumstances (even with the misgivings over objectivity), it seems more likely that real insights and useful information will be found, because the researcher will be steeped in and completely engaged with their subject.

5. Flexibility of design and a reluctance to impose *a priori* frameworks

The emergent nature of research design in many qualitative methods also enables real insights to be garnered because the researcher has not imposed prior assumptions on either the participants or the data. This discovery focused approach allows for great flexibility, depending upon what the researcher actually finds.

5.3 The relationship between qualitative and quantitative work

The choice between one method and another (or both) depends upon what the researcher wants to know. The questions in the present study require a qualitative approach particularly as they focus on process rather than outcomes i.e. the process of improvisation and on the interaction and perceptions of teacher and learner, which are related to schema theory. The primary reason for using qualitative methods in the practical investigation is that the subject and ideas in question (the emergence and development of the schemata for jazz improvisation), are essentially invisible and unquantifiable phenomena. There are currently no quantitative methods subtle or wide ranging enough that would reveal this process in a suitably measurable way. The research process and purpose was to seek evidence for the schema theory in jazz improvisation, by exploring and interpreting the teaching and learning process, in a normal educational setting. Thus, the practical investigation was focused on real teaching and a complex skill to be learned, within a natural educational environment, in order to fully engage with the subject. The most important aspect is that the method suits the question, and researchers need to be very clear not just about the questions but also about the ultimate purpose of the research and whether the method is suitable, for example, to wide dissemination.

Qualitative work is often associated with idealism and quantitative with realism, but the material world offers a form stable physical reality that is hard to refute. In qualitative domains what matters is what people perceive to be true rather than what might objectively be true. Ultimately we can only perceive the world in ways that are consistent to the physical organisation of that world. In this view Gibson (1966) proposed that humans (and animals) are in a 'systems' relationship with their

environment and that it is necessary to study natural settings in order to understand behaviour. Gibson's view (which is known as ecological perception), is that perception depends entirely on information in the 'stimulus array' in the particular environment that the organism is interacting with, rather than sensations that are influenced by cognition. In this view the environment provides 'affordances' which allow perception to occur, and the way these affordances are viewed can vary considerably. For example, a wave may be felt or ignored by the whole body of a fish as its natural environment; jumped through by a porpoise or provide a view of the fish to a seagull. It may represent a source of energy and fun to a surfer or a means of drowning to a non-swimmer; it may allow a sailor to make a certain manoeuvre or force an engineer to build a sea wall. Our perception has evolved in tandem with the physical world which provides a continuous and stable flow of information to which we can respond. This view is entirely consonant with Johnson's (1987) idea that abstract thought evolves from physical activity and interaction within the environment, and establishes the importance of movement and the physical world at deep levels within the human psyche. In terms of qualitative research, it ought to enable us to trust the process of observation, dialogue, analysis and evaluation of a natural setting more, because the organisation of people within their physical environment should provide an appropriate and meaningful framework for the research process.

Realists believe that objective truth is possible in the physical world and that scientific method based on deduction and logic provides descriptions and explanations that are literally true. As mentioned previously, the problem with this attitude is that science can only produce its 'truths' within a particular historical context (informed by

beliefs) and using the tools available to it. As Kuhn (1962) reminds us, hard science can produce spectacularly wrong ideas which persist until a new paradigm shift produces a change of perspective which suddenly requires the rethinking of previously accepted ideas.[15]

Deduction is associated with quantitative methods and induction with qualitative, however, all quantitative work depends to some extent on inductive thinking particularly at the devising and imagining stage of an experiment, and deductive qualitative work is equally valuable. Similarly, the usual dichotomy between artificial and natural environments for research i.e. natural settings, against laboratory experiments, is equally misleading as qualitative and quantitative work can take place in either setting. The same underlying principles apply: good research always challenges or is at least aware of the assumptions on which it is based.

5.4 How does qualitative differ from quantitative methodology?

Quantitative 'scientific' research methods have evolved broadly from positivism which has recurred throughout Western thought from Ancient Greece to the present day. The positivist position, based on Compte's nineteenth century viewpoint, is that 'all genuine knowledge is based on sense experience and can only be advanced by means of observation and experiment' (Cohen et al, 2001:8). Essentially this has been taken to mean that the researcher sets up an experiment to produce certain results based upon what they (by hypothesis and deduction) think will happen. All decisions about the research strategy are taken in advance and any thoughts or judgements that

[15] The paradigm shift has a lot in common with the schema. For example, the eye was regarded as little more than a camera for centuries and that particular schema with all its attendant implications, had a negative effect on the development of the thinking about vision

might occur during the process are eliminated by 'objective' systems that are usually reduced to statistics or some kind of numerical or other highly limited formulation. The positivist methodological viewpoint has the following characteristics (Ashworth, 2003:11):

- There is a single, unitary *real world*….this is realism.
- The individual is part of this real world, and so such processes as memory, emotion and thought are events in the real world with *definite enduring characteristics.*
- The purpose of science is to set up experimental situations in which the characteristics of these psychological processes can reveal themselves, and this will allow the processes to be modelled.
- The world can be described in terms of measurable variables which can interact with each other in determinate ways.
- The models (mathematically formulated where possible) will show how variables interrelate, especially how they relate to each other in cause and effect fashion.
- The purpose of research is to test hypotheses regarding relationships between variables, and to reach, by closer and closer approximation, theories which can begin to be regarded as having the status of scientific laws.

In this view, as Ashworth goes onto mention, qualitative researchers set aside the notion of the real world in favour of how people formulate their own versions of reality. This pluralistic and diverse viewpoint is far more complex and less clear cut than the positivist position and it realises that the world is seen from innumerable

different perspectives all of which are valid. It is clear that human meanings are integral to human experience and thought and have little in common with casual variables as envisaged by positivist scientific approaches.

The problems associated with the positivist approach have stimulated what Robson (1993:59) calls 'post-positivist' science. Under this title, he groups a large number of new qualitative approaches, some of which I will describe is more detail later in the text. These are: post-positivistic, hermeneutic, ethnographic, phenomenological, subjective, humanistic and naturalistic. The new paradigm methods are seen as being particularly useful in studies involving people in uncontrolled and natural settings.

5.5 What are the major problems concerning the nature and practice of qualitative research methods?

Murphy et al (1998:1) outlines four main areas that are problematic within the field of qualitative research:

What can we know about the real world apart from our perceptions of it?

If understanding is only about personal perception, then the world can be infinitely redefined to suit our own view of it. An alternative viewpoint is that the physical world imposes a structure that is also explained by physical laws which are fairly stable (at least until the paradigm shifts described by Kuhn, 1962). The natural sciences have been highly successful in using scientific method and logic and have disregarded the problem of what the relationship is between perception and reality, whilst claiming objectivity. [In reality we now know (Bargar and Duncan 1982; and Shipman 1988) that scientific method especially in imagining theories, possibilities and experiments, is actually closer to the qualitative approach than expressed in the

formalised logical way in which the research process is described in journals and papers. Scientific activity in practice and the way it is presented are very different things. Robson (1993:62) goes as far as to say that the confirmatory process of doing the experiment and writing up is 'essentially run of the mill' because the inspirational and imaginative effort has gone into the thinking and creation of the hypothesis and this is because of the quantitative emphasis on what can be proved, measured and otherwise 'confirmed'. However, in social activities, perception is important as it forms the basis for action and behaviour and therefore must be taken into account in any research approach. It could be argued that social organisation forms a framework in a natural setting and that this provides the basis for analysing people's understanding of their role and place within it.

Induction and deduction.

Whilst induction is associated with qualitative work, and deduction with the quantitative approach, good science involves both aspects and the decision about which to use should be made on the basis of whether the method will answer the question effectively and efficiently.

Fact and value.

Both qualitative and quantitative research can be committed to a certain set of values (or ideas) and the data used to prove them. We can at all stages of enquiry question our values and those of others, in relation to the study. We can also ask how someone comes to hold a particular belief, and finally which ideals or beliefs should be adopted.

Other people's minds.

We do not know what other people are thinking but accept that their actions and behaviour are the result of some kind of internal process and that this process can be perceived, interpreted and responded to. The problem is how to do it: historically in qualitative research the answer was by an act of imagination, sympathy or empathy to attempt to put oneself in the position of the participant or respondent. This has changed recently to a more process based approach in which researchers examine the practices or behaviour of the participants and consider what kinds of generative process might be necessary to produce them. But, how valid are findings that reconstruct the motivations, intentions and perceptions of others and what kinds of frameworks are used for interpretation? We return again to the presentation of data by the researcher that allows the reader to check and verify the results to provide a framework of corroboration and also for the researcher to consider actual or possible data that does not conform to the theory or finding.

5.6 Qualitative Research Methods

A major element of the empirical research process involved observation and the following description outlines some of the advantages and weaknesses of using it as a research tool.

5.6.1 Observation

Observation is a central qualitative method and generally, the researcher adopts the stance of a learner who is there to understand what is happening within the natural setting (Fielding: 1993). The process of observation is refined and distilled as the study progresses, because the researcher will, once again, not want to define the scope of the study too narrowly at the start (Silverman 1993; Hammersley and Atkinson

1995). Observation studies can focus on process rather than inputs and outputs, and done properly, this makes them very valuable. Qualitative observational work is usually conducted over a long time frame with the interaction of the researcher and participants as part of a natural setting. As such, it is unlike more structured observational schedules where the researcher avoids any interaction and is present for only a short time, seeking to treat the observed behaviours outside of the social, temporal and historical context. In these more defined studies, participants behaviour is observed and coded according to pre-specified categories i.e. the researcher already knows what they are looking for (Emerson:1981). Qualitative observation is much more flexible and open-ended: the intention is to find what is there and understand it without pre-conceptions or prior assumptions, in terms of the participants' own categories and in relation to the wider contextual features of the setting.

5.6.2 Types of observations

There are a number of observational roles that the researcher can take within a qualitative study, which range on a continuum from being completely hidden from the participants, to full participation within the setting being observed. Silverman (1993) discusses two different types of participant observation: the interactionist and the ethno-methodological. The interactionist perspective takes the viewpoint of the participants, and attempts to understand their meanings of both the action and the interaction (Bryman, 1988). The ethno-methodological stance by contrast, focuses on observable behaviour rather than motivations or attitudes:

> The question that ethnographers have traditionally asked-"How do participants see things?" –has meant in practice the presumption that reality lies outside of the words spoken in a particular time and place. The question-"How do participants do things?" – suggests that the micro social order can be

> appreciated more fully by studying how speech and other face to face behaviours constitute reality within actual mundane situations. (Maynard, 1989:129).

The role of observer and the effect that the role is likely to have in the ensuing research process is crucial in qualitative work, and can range from full participation to avoidance of any interaction. Fully participant observation aims to 'take the viewpoint of those studied, understanding the situated character of interaction.' (Silverman, 1993:48) Silverman also makes the point that participant observers are interested in understanding the routine or ordinary rather than the extraordinary (Silverman, 1993). Most qualitative researchers adopt an intermediate position between the two extremes but the researcher can also have different roles on different occasions or times of the research process. Gans (1982) identified three roles for the observer: total participant, researcher participant and total researcher. He proposed however, that being a total participant is the best option because it allowed complete immersion in the situation (1982:54). He goes on to suggest that this period of immersion has to be temporary and is followed by other roles and analytical methods if the researcher is to be successful. The key issue is the rationale that the researcher adopts for using a particular observational role because the researcher will always enter the field with a broad perspective and it is important to be explicit about what that is. The research report is a representation of the study setting not a replication of it, and as Silverman states: 'Contrary to crude empiricists, the facts **never** speak for themselves.' (Silverman, 1993:36) In addition, the impact of the researcher on the situation being observed should be taken into account, although longitudinal studies and long engagement within the setting are likely to naturalise the effect of the researcher's presence. A final key point is that researchers should be open in their

observations and clearly explain to participants the underlying purposes and methods of the research, whilst being aware that the participants may not fully understand that purpose.

As the research setting in the practical investigation was educational, I chose an observer/participant role in which as the teacher, I had to decide on and direct activities and also respond to the behaviour of the participants. Clearly, this kind of role has a significant impact on both the data that is obtained and the way that it is subsequently analysed. I chose this particular role, (rather than assigning it to another and observing more objectively), because my experience as a jazz musician and teacher gives me a background context and understanding suited to doing this research effectively. As a practitioner and performer, I am aware of the various physical parameters and conceptual frameworks that need to be in place in order to improvise (and regularly practice it). As a teacher, I continually observe students and adapt information and methods to very different individuals. The aim of the practical investigation was to test the schema hypothesis for jazz improvisation within a real and natural educational context, with a range of individuals who were essentially collaborators and who were encouraged to be autonomous and to direct their own learning from the beginning. This required the creation of a safe psychological and physical space in which experimentation and exploration was encouraged and in which taking risks was a non-threatening experience. I knew from previous experience and especially working with volunteers, that I could facilitate the learning of improvisation by participant musicians fairly quickly, within a positive and open environment.

As a participant observer, my role was focused on teaching and so recording the sessions on tape and video enabled reflective analysis at a later date. As such, I appeared not to be observing, so much as teaching and responding, which I hope helped to create an informal and relaxed atmosphere. In the preliminary workshops, I recorded the proceedings on mini-disk. In the case study, I chose to video the process, having found that purely audio recordings were not detailed or subtle enough and that the use of body movement, gesture and facial expression was another key to understanding the internal learning process of the participant. All observations were conducted openly and with the express permission of all of those involved, who were in turn, invited to listen or watch the results and inform later analysis.

5.6.3 Collecting data in observational studies

Descriptive observation is the usual starting point, and Spradley (1980) suggests nine dimensions on which the data can be collected: space (the physical lay-out of the room or place); actors (names and relevant details of the participants); objects (the physical elements within the space); acts (specific individual actions); events (particular occasions); time (the sequence of events); goals (what actors are attempting to accomplish) and feelings (emotions in particular contexts). The first step then is to build up a narrative account and then to look beyond or further into to it, in order to seek pattern, generalisations and so on.

The practical research described in this thesis uses observation as a primary method as I was seeking to find evidence of schema formation and development and therefore focused on those aspects. The process could be described as analytic induction (Denzin, 1970) whereby a hypothesis is put forward, (in this case the schema theory

of jazz improvisation), the situation is studied in the light of the hypothesis (i.e. is there evidence of schema development?) and then either new questions arise which require a new hypothesis or the research is developed further by studying a new case to see if the findings are generalisable.

Even though, obviously, one human communicating and observing another is a rich 'affordance', it is important to avoid bias or to take it into account in analyses. Robson (1993:203) suggests the following 'lay person's guide' to the recording of participant observation: firstly, information should be captured unambiguously and comprehensively, (this was done with video recording), then added to with on the spot observations taken during the event. (This was not really possible in my research, because I was teaching, except to alter the flow of the lesson in order to work on another area or to develop a particular idea). As a routine action, the notes and the recording should be reviewed as soon after the event as possible while it is fresh in the memory and to ensure that fine details are not lost. This process may take as long or longer than the observation itself, and Lofland and Lofland (1984) suggest five types of materials to be included in the record: running descriptions as facts; recalls of forgotten materials; interpretative ideas (i.e. ones that support the research questions and ones that elaborate on it); personal impressions and feelings, i.e. your subjective reactions and reminders to check for more information.

5.6.4 Selective attention

As Robson points out (1993:202), we are selective observers because of the nature of our perceptual processes i.e. we filter out those visual aspects that do not resonate for us. Our experience and personality will affect what we pay attention to and what we

actually 'see' when we are observing, therefore some features will appear to be more relevant to us than others. Robson suggests that to help to counteract the selective bias that is built into our physiology, researchers should 'make a conscious effort to distribute your attention widely and evenly.' (1993:204). Similarly, there is the problem of unconscious interpretation and 'the rush to judgement' (Robson, 1993:204) that seeks to interpret or categorise data on the basis of partial information. This means that incongruent data or even later events are marginalised or not taken into account in the final analysis, so it is important to keep an open mind and not just seek (and find) the data that is sought. In the same vein, it is also important to write up any notes especially in writing a narrative account, soon after the event has occurred in order that selective memory does not come into play.

5.6.5 Participant observation in small groups

Robson (1993:205) believes that the researcher should be able to get to know and to interact with everyone in a small group project, again, to reduce the potential for bias. The problem with group research, even on a small scale, is the amount of rich and multi-layered data that it produces. In fact, the main reason for the change from working with groups in the pilot stages, to a case study for the major part of my practical research, was in order to focus attention and observation on the learning process of one rather than several people. In the practical workshop research, interactive elements between group members and the overall group dynamic were interesting factors that were inevitably missing in the 1:1 case study, and perhaps those particular aspects could be studied separately at a later date. As Robson points out, (1993:205) there is such a wealth of varied information within a group setting

that the researcher could probably find supporting evidence for any kind of initial theory, thus re-iterating the importance of not confirming preconceptions.

5.6.6 Shortcomings of observation methods

A major shortcoming of observation is that underlying principles relating to observed behaviour, are not easily elicited through observation alone and may require other research methods, like interviewing to be used in conjunction with it. There is a continuing debate about the relative merits of interviewing and observation, (Murphy et al, 1998:5) and observation is necessarily time consuming and labour intensive. However, it does allow the researcher to see how people behave rather than how they say that they behave, which is a problem with interview responses. Interviews may generate large amounts of interesting data that may be relevant to the area being researched, but there is a major problem in validating it.

5.7 Interviewing

A qualitative approach to interviewing (as opposed to the more structured quantitative approach), is used in order to account for the dialogic nature of human interaction and to draw out and understand the meanings of another on a deeper level. Standardised interviewing techniques treat all participants in the same way (despite the fact that interviewees will probably interpret the questions differently), and remove the interview itself from the context. The strength of qualitative interviews that can assess and elaborate on the participants meanings (Bloor, 1994; Charmaz, 1983b) must be balanced against the view that all types of interviews are social situations where either person may be trying to create an impression of some sort. Similarly it may be

difficult for interviewees to know, understand or verbalise the basis of their actions or beliefs. Thus it would be wrong or misleading to treat interviews as any kind of accurate or objective report within the research process. Interviews are accounts of participants' ideas, feelings and actions and should be understood within the context of the circumstances in which they occur (Baruch 1981). Another major shortcoming of interviewing is that the mass of rich data obtained from such sources is difficult to validate because there is no way of telling whether it reflects people's true behaviour or not.

Powney and Watts (1987:ch2), make a distinction between respondent interviews and informant interviews and in the former case the interviewer is in control and has a structured or semi-structured interview framework which she adheres to. Informant interviews are, by contrast, more focused on the agenda and perceptions of the interviewee, who will be more in control of the process. The interviews (many of which have turned out to be more like dialogues) that occurred with participants in the practical investigation, were based more on the informant model as they were centred on their perceptions, and direct responses to learning approaches and activities. Many dialogues and narratives were initiated by the main participant in the case study. Group interviews and questions were asked during workshops to ascertain whether any part of the learning process was open to consciousness and whether indeed the teaching approaches were working. In the longer case study, interviews of greater length were conducted, again, focusing on the participant's views, perceptions, ideas and aspirations and only led in a general way by the interviewer. The next section discusses the strengths and weaknesses of case study research.

5.8 Case studies

A case study is a specific instance that is designed to illustrate a general principle (Nisbet and Watt, 1984:72). It provides a unique example of a real person in a natural setting and takes the context into account as a powerful determinant of cause and effect. Case studies also have a wholeness and integrity about them that is suited to the dynamic nature of much complex natural human activity (Sturman, 1999:103) which requires in depth study over a long period of time. Hitchcock and Hughes (1995:322) suggest that the case study approach is particularly useful when one has little control over events. They consider that the case study has the following characteristics (1989:317): it is concerned with thick and rich description of events pertaining to the case; it provides a chronological narrative; it blends description with analysis; it focuses on the individual and their perception of events; it highlights specific relevant aspects; the researcher is integrally involved in the research and the richness of the case is portrayed in the writing up. The temporal, geographical, organisational and other contexts, will enable a framework to be drawn up, but the study could also be defined by the characteristics of the individual or the participant's roles. Nisbet and Watt (1984:91) warn against researchers falling into the following traps in writing up descriptions of case studies: journalism which focuses on the more striking aspects of the case in order to sensationalise; selective reporting i.e. choosing only those aspects of the account that support your particular ideas or conclusions; an anecdotal style, instead of a rigorous analysis; striving to generate deep insights from low-level data and blandness, i.e. blindly accepting the participants views or including nothing contentious within the account.

5.8.1 Types of case studies

There are several different types of case study and Yin (1984) identifies three types in terms of their outcomes: a) exploratory (as a pilot to other studies or research questions), b) descriptive (providing narrative accounts), and c) explanatory accounts (for testing theories). Merriam (1988) also identifies three types of case studies which concur with Yin, as descriptive, interpretive and evaluative. The ideal use of the detailed case study would probably be to complement a quantitative study or more general large scale research work. The advantage of case studies (from Adelman et al, 1980) is that they are reasonably publicly accessible, especially if they take a narrative form, allowing for wider dissemination and effect. This is especially so if the researcher explains clearly the rationale and the methods involved in the research process of the case study, so that the reader can make up their own mind.

Case studies are a step towards action and the insights gained from them can be put directly to use in a variety of ways: for individual self-development; for staff development; to shape policy or for evaluation. Case studies with sufficiently rich description can be reinterpreted at a later date in the light of new knowledge or from a different perspective, and therefore continually add to understanding. By describing complex and multi-stranded reality embedded within a social setting, case studies can represent a range of different viewpoints and perspectives within the same situation and therefore more truthfully reflect life itself. Although they only look at one instance in depth, they can provide insights into other similar cases, to allow generalisations to be drawn from them, or at least, to begin to do so. Similarly, Nisbet and Watt's (1984) add that case studies speak for themselves, because the whole context is made clear and captures unique features that might otherwise be lost in

larger-scale, more general research. In addition, case studies can be undertaken by one researcher within a wide range of settings i.e. no research team or expensive equipment is required and the case study can embrace and include unanticipated and uncontrollable events or situations.

5.8.2 Problems with case studies

The main weakness is that the results may not be generalisable or only with great care: it is extremely difficult to validate the findings given the un-objective nature of the case study and they are prone to observer bias particularly if the observer has preconceptions or prior theories that they are attempting to prove. Smith (1991:375) states that: 'The case study method…… is the logically weakest method of knowing. The study of individual careers, communities, nations and so on has become essentially passé. Recurrent patterns are the main product of the enterprise of historic scholarship.' This is a prejudice against case study methods but the problem remains of how to make this type of qualitative research both reliable and valid.

5.9 The Assessment of Qualitative Research

5.9.1 Validity

Indications of the difficulties of assessing qualitative research have already been mentioned briefly and the whole area is highly contested. One main issue is that the concepts of validity and reliability are paradigms that relate to quantitative methodology and therefore are difficult or inappropriate to apply to qualitative areas. If this viewpoint is adopted however, it is hard to see how qualitative research can be assessed at all because if the findings cannot be represented as even an approximation

of the truth, then the value of the research itself is questionable. If the research findings, as in this case, are to be used to enhance or improve a real-world activity (i.e. the teaching and learning of improvisation), then the researcher, participants and readers must have confidence that the findings are as true as the context and current conceptual ideas allow. It is of course, impossible to ascertain that the findings are objectively truthful for all time.

There tends to be, in contemporary qualitative research methods, a checklist mentality towards validity whereby the researcher ticks all the appropriate boxes and can claim valid findings. Unfortunately, the application of a series of rules does not necessarily enhance the validity of a particular project and there are a series of assumptions behind the requirements for validity that need careful questioning. For example, respondent validation of research proposes that the researcher presents the analysis to participants for feedback on the validity of the conclusions. Given that this is possible, the assumption is that participants will act as unbiased assessors, commenting on draft reports or descriptions. There is no basis in fact for this: participants may have their own agendas and, given that the research aim and purpose was outlined to them at the beginning, they may be unable or unwilling to give an 'objective view.' Similarly, they may present inconsistent responses over time or in the same interview, so that the use of participant validation should be see more as enhancing or expanding on information, rather than validating it in any meaningful way. A singularly important role for participant verification is where the researcher misinterprets or mistakes some form of action or behaviour, which the participant can alter or illuminate.

5.9.2 Triangulation

Triangulation is another recognised test of validity whereby a combination of methods is used to study the same phenomenon. The word triangulation itself refers to a quantitative technique of physical measurement (used by navigators, map makers and military strategists), in which several locational markers are used to pin-point a single spot or objective. Triangulation techniques in research attempt to explain more fully, the richness and complexity of human behaviour, by studying it from more than one standpoint or perspective. The single observation in hard science (medicine, chemistry, or physics) may be enough to provide unambiguous data but is simply not adequate to explain the complexity of much human behaviour. This is especially so since it has been observed that research methods sometimes act as filters through which the environment is selectively experienced. As research methods are never neutral (Smith 1975), it is important that the researcher knows that the results or findings are not purely the result of using one particular method.

Triangulation is perceived as a useful test of validity and whilst it can strengthen aspects of the data analysis, there are a number of problems regarding its role in qualitative methodology. A major criticism of triangulation is the assumption within it that a multiple data source is superior to a single data source or instrument (Silverman 1985). In addition, Lincoln and Gruba (1985:307) argue that the search for theory and methodological triangulation is epistemologically incoherent and empirically empty, for the following reasons: firstly, the importance of analysing data in context is diminished and it encourages researchers to focus on one form of reality that is verifiable. More fundamentally, the agreement of data from two different sources is not proof of their validity; they may both be wrong! Thirdly, there is the issue of

corroboration of findings: the researcher will be looking for ways to corroborate what she thinks is the truth of the findings, whereas a more valid approach may be to search for instances which refute the general thinking or theoretical bias. In other words the validity of research analysis may be strengthened by the inclusion and explanation of inconsistent or negative cases, rather than the presentation of corroborative data using different methods. Indeed, 'negative case analysis' is proposed by Lincoln and Gruba (1985:219, 301) to add more credibility to naturalistic enquiries alongside prolonged engagement in the field, and peer debriefing (by a disinterested and objective peer).

Maxwell (1992) argues that it is not necessary for qualitative researchers to use positivist quantitative tests of validity because they are often irrelevant in naturalistic settings and suggests that 'understanding' is a more suitable term than validity in qualitative research. Similarly, Guba and Lincoln (1989) suggest that *authenticity* is a more useful notion and that it is the meaning that the participants and the researcher give to the data and the inferences drawn from it that are important. Compte and Preissle (1993:338) argue that for authenticity to be a test of validity, the following issues should be addressed: fairness, i.e. there should be a complete and balanced representation of the multiple realities in, and constructions of a situation; ontological authenticity, where the research provides a fresh and more sophisticated understanding; educative authenticity i.e. the research should generate new appreciation of the situation; catalytic authenticity whereby the research gives rise to specific courses of action and tactical authenticity in which the research should be of benefit to those involved in it, i.e. the ethical issue of beneficence.

There are other forms of validity relating to the external aspects of the research i.e. the degree to which the findings can be generalised and Lincoln and Gruba (1985:316) suggest that to aid external validity, researchers should provide sufficiently rich data for readers to determine whether transferability is possible. In the case of the current jazz research, there appear to be many areas of schema and skill development that may be generalisable for other areas of knowledge. Ecological validity in qualitative research is based on the premise that the researcher deliberately does not try to manipulate variables or conditions. This is partially the case in my own research where the learner improviser was a collaborator in the research and was encouraged to be autonomous and to use materials and approaches presented as they saw fit. On the other hand, the educational setting itself was manipulated to the degree that it was chosen by the researcher, and is therefore, not an entirely naturalistic setting. For example, I as teacher/observer/researcher chose a specific educational approach or activity depending on previous skills, current interests and the make up of the group. Within that setting, individuals were given the choice of how they would proceed: but many aspects were directed. To some extent also, my theories and pre-conceptions (based on previous experience), about the best ways to encourage and facilitate this kind of learning, added to the manipulation of the conditions.

Catalytic validity strives to ensure that the research leads to action and during the practical investigation the action of changing people through learning took place as part of the process regardless of the outcomes. The findings were intended to alter (where necessary) the attitudes and perception of teachers about how people may learn and more specifically to change the way jazz improvisation is taught within the academic setting. Lincoln and Gruba (1986) suggest that again, the criterion of

‘fairness’ be applied to the research, meaning that it should augment and improve the participants’ experience of the world and that is should also empower them. From this viewpoint, the jazz research developed and empowered the participants and is intended to do the same for future players and teachers through the findings. The teaching materials were specifically designed not only to test the schema theory but also for effective learning and practice. Many approaches were designed to enable participants to develop as improvisers and to my knowledge the case study participant has continued to work on and use the materials in her own teaching and performing. The research process has also benefited my own understanding and teaching practice enormously especially observing, listening to and analysing the interactions between myself and students and watching closely the learning process in a number of different students.

Finally, it is perhaps also worth noting that Scheurich (1996) views the methodology of validity as a tool for powerful research interests to set boundaries on what is considered to be acceptable research, i.e. to define worthwhile knowledge. The issues of empowerment, action and change are therefore crucial and central to the ethics of the research process and it requires that the researcher question her role and responsibilities throughout.

5.10 Purpose and rationale of the empirical research-how does it test the schema theory?

The main research process and purpose was to seek evidence for the schema theory in jazz improvisation by exploring and interpreting the teaching and learning process, in a normal educational setting. The practical investigation was focused on real teaching

and a complex skill to be learned, within a natural educational environment in order to fully engage with the subject. The primary methodology was to plan a series of lessons based on an understanding of and also the predictions of schema theory described previously. The aim was then to observe the resultant learning process, the teacher pupil interactions and dialogues and evaluate the improvised music being produced, to seek evidence for the emergent and developing schema. The empirical work therefore was attempting to track the emergence and development of the schema assemblage for jazz improvisation by setting a series of tasks designed to enable that development, and then to evaluate and reflect on the outcomes. It was seeking to identify those areas where the novice improviser is able to abstract information from specific instances and use it in new situations. For example, a jazz standard was learned, to provide a referent for future jazz standards: the melody was memorised with the harmonic framework heard behind. The purpose was to begin to develop stronger aural to motor connections previously triggered by visual notation, as jazz schema theory proposes that aural (actual and in memory) to motor connection is the primary driver of the improvisational process. This is in turn scaffolded by theoretical and conceptual information on the nature of melodic jazz music. The memorised jazz standard (an example of specifically learned sounds and intervals) was then used to vary the melody in some major way. In the case study, the melody was played unrehearsed in ¾ as opposed to the original 4/4 to see if the information from the intervals and the contour of the original tune could be abstracted. From this simplified standpoint of altering a learned tune, the teaching developed melodic (and later expressive) strategies to learn purer forms of improvisation based initially on melodic form and contour rather than harmony. Long periods of time were spent learning and playing the first standard in the repertoire on the basis of both Bernstein and

Schmidt's proposal that the first parameters of skill learning have to be learned thoroughly before being developed and stabilised through more varied and variable practice strategies.

After the sense of melodic improvisation had been initiated, the sound and theory of the harmonic framework was focussed upon as a scaffold for further schema development and for to provide another referent. At this stage, the research process was to seek evidence for abstraction of harmonic ideas to assess their assimilation and generalisability. Throughout the later stages of the learning process I was looking for more general schema development that showed a musical understanding of parts, or the whole of the standard. For example, instances of cohesive phrases or transpositions that anticipate different sections of the tune, or ideas generated from the melodic or rhythmic energy of the tune that may indicate the schema generalising, abstracting or connecting different elements of the skill parameters. Similarly, I sought examples of increased technical capability through an improvisation, indicating the gradual evolution of automaticity, flow and dexterity associated with advanced skill learning through schema development. Associated with improved technique is the idea that novice and expert players view technical problems and parameters differently and I wished to explore how the perception and actuality of technical aspects affected schema development.

In addition, work on expressive parameters was introduced to ascertain whether emotive, provocative or evocative words or pictures as stimuli, altered in any fundamental way, how the novice improviser approached the generation of musical lines. The idea was to call on a different area of imagination, associative memory and

possibly visual memory, to connect with or unlock a new area of the existing 'jazz improvisation' schema. Within the group work, collective approaches to improvisation were used with the intention of assessing their effect on the individual schema, but with the exception of imitation within the group, this proved too difficult to monitor. In addition to facilitating the learning and observing its process and outcomes, I was also interested to explore the individual learner's assessment of their own skill learning and whether any aspects of the emergent schema were open either to consciousness and verbalisation: hence the number of spontaneous verbal questions asked of learners at various stages of the process. In particular I was keen to find out what the novice improviser was thinking as they attempted to improvise (if anything): whether it provided any insight into schema development or if conscious thought was irrelevant to the process. I was interested in the extent to which conscious rational thought was used to underpin the process or whether more intuitive processes were used by the students. All of these aspects could of course, have provided enough material for a PhD in themselves!

Underlying these questions is the major one of whether the schema is essentially a self organising system in which the consciousness of the learner plays a secondary role. With regard to motor learning, both Bernstein and Schmidt predict that variable practice in the latter stages of skill learning will stabilise the skill, and evidence was sought for this by varying the scope and type of standards learned, and also improvisational strategies. Evidence of the stability of the skill was also explored by introducing new standards and evaluating how the intermediate improvisers coped. Schema theory predicts that novel ideas occur as a result of schema growth and I therefore also sought examples of novel improvised ideas particularly in the case

study where new ideas were more clearly evident from more mundane and exercise based material. Lastly, schema theory (with Hebb, 1948 et al) predicts that generalised motor programmes evolve from specifically practised movements and evidence of that was sought during the learning of improvisation in conjunction with the abstraction of movement parameters.

6. Practical Investigation: Preliminary Educational Workshop Study

6.1 Aims

The primary aim of the pilot project was to test initial theoretical hypotheses about the formation of schemata during the process of learning jazz improvisation. A secondary aim was to facilitate the effective formation of schemata for jazz improvisation among the learners using specially chosen and organised materials and exercises.

The main research question was whether schema development could be monitored using observation, questioning and analysis of music produced, during workshops in which the learning was happening i.e. whether any part of the process was open either to the consciousness of the participant or to the outside observer. A second question was whether the organisation of the material and teaching approaches into a schema based model, affected the learning process, and if so, how to improve on the effectiveness of these during the ongoing research.

6.2 Introduction

The theory posits that generalised aural, conceptual and motor frameworks (schemata) are built up, (or abstracted from received information) during practice of a task to be learned. It should follow therefore that if the participant focuses on a single aspect of the task, later varying the contexts or ways in which it is performed, the schema

should be more effectively formed, and the knowledge and skills more easily transferred to similar but new situations.[16]

The common reductionist approach to learning to improvise (see **3.2.1** on jazz education methods and manuals), focuses on learning scales, motifs, fragments and other patterns from harmonic sequences, which are gradually assembled in progressively longer sections to form a whole solo. This is essentially a 'language' based model that views the creation of improvised musical ideas as learning a 'vocabulary' of appropriate musical 'words and phrases' and building them up to construct 'sentences' and then 'paragraphs'. Implicit in this view is that musical coherence and individuality develop from being able to manipulate the materials of intervals and scales until all the patterns are assimilated and any combination of them can be played. From this basis, (which takes a great deal of time and practice), more creative approaches are assumed to emerge and evolve. The pattern based chord/ scale method has evolved from studies of be-bop phrases in which the smaller motifs were learned individually and then reassembled in longer phrases. Having argued against this method and for a more individual and musical approach from the start, in the practical research, I wanted to begin by using the melodic contour of a standard as the basis for improvisation and to explore all the possibilities within it, before moving on to an analysis and understanding of the melody within the context of the harmony.

[16] This notion is now in itself questionable; Genessee (2000) referring to recent neurological research on learning, notes that 'the flow of neural activity is not unidirectional, from simple to complex; it also goes from complex to simple.' The implication is that different areas of the brain respond to both 'parts and wholes' simultaneously and so teaching should move between one and the other. An example would be in the teaching of reading, phonics would be taught alongside the meaning of words and the narrative flow making up the story. Genessee (2000) states that 'Brain research indicates that higher order brain centres that process complex abstract information can activate and interact with lower order centres, as well as vice versa.'

I was seeking to develop the idea of improvising a cohesive melodic line over two, four, eight and sixteen bar sections and having achieved that, to see how the developing schema was used by the students to learn similar standards but each with a defining difference. To this extent, my approach to teaching was also being shaped by my knowledge of schema theory. Observation during the workshops, recordings and feedback questionnaires from the students were all used in an attempt to triangulate and so assess what was achieved and how it may work both theoretically and in future investigations.

6.3 Method

The research took place in a workshop setting in two-hourly sessions over a period of nine consecutive weeks and consisted of 18 hours of playing and tuition with additional practice by some individuals in between. The students were Lindsay Aitkenhead, viola, Jessica Hall, viola, Ruth Dyson, recorder, Steve Turner, guitar, Carolyn Hill, piano and Konstantinos Dmitri, piano. These classical instrumentalists were volunteers from Sheffield Music Department with one being an advanced student from Chetham's music school. Classically trained players were chosen in order to focus on investigating how improvisation skills emerged, rather than, for example, basic technical problems associated with instrumental technique. The aim was to isolate and work on the more musically imaginative aspects, knowing that fundamental classical instrumental technique was already in place. This was the only 'experimental' constraint put on the research process. The other aim of the pilot project was for the musicians to work as a jazz group, with a mix of chordal and single line instruments and to create a natural and informal educational setting where

they felt free to take risks and were under no pressure to produce 'great' music. Also, given the importance of creative collaboration in jazz improvisation, there are many benefits to learning the process in a group setting, the most important of which are imitating and learning from peers.

The intention was that all the teaching/facilitating, should be educationally useful both individually and collectively, and therefore the most effective approaches were sought out of a selection, all of which were intended to be beneficial to the student. There was no control group, as this did not seem appropriate in the educational context of the project. The case could be made that over a period of nine weekly lessons, whatever the method, any reasonably motivated student would have learned some of the basics of improvisation, if only assimilated from observing and listening to the rest of the class. What was sought, however, was qualitatively different approach based on melody which allowed the novice to improvise within a narrow framework fairly quickly. It was important to me to facilitate the students' knowledge of how it felt to improvise, so that the initial feeling could be developed (in order that the schema could also develop), and to emphasise the strongly individual nature of improvisation that need not necessarily be based on chord tones or patterns but rather on the rich melodic resources of the individual player. The first task was to use the melody of a standard tune, as a source of intervals, contour and rhythmic energy over 32 bars, so that the student was provided with both an easily learned framework to enhance and develop, and the means to do the same in other contexts.

The second task was to attempt to follow this process as it occurred within the individual and the group. This provides a number of challenges for the researcher

(some of which are common to all research into learning processes and some which particularly affect improvisation). These include;

- the varying lengths of time needed for individuals to learn material and skills;
- whether the activities are really appropriate to the learners;
- the question of whether these processes are open to consciousness and if so, at what level;
- the likelihood that learning does not proceed in discrete and rational stages which can easily be identified;
- whether the verbalisation and explanation of a learner's understanding a) hampers the process of learning a sophisticated practical skill and b) whether it illuminates the process;
- whether we can gauge an improviser's skill and understanding from the results of their playing.

The third task was to create and alter materials and approaches in the light of the above research, to develop better ways to facilitate the process and to try and understand how people learn within a musical environment. My goal was to understand the process enough to create a broad approach to improvisation which facilitated high-level individual and creative learning, for use by general music and instrumental teachers, so that improvisation may become an accessible musical skill, like any other.

6.4 General objectives

These were relevant to all sessions and were taken forward into all new tunes and pieces.

- To facilitate the emergence and development of a schema assemblage for improvising using the standard tune, *Autumn Leaves*. (This particular piece was chosen because a) it has sequential melodic motifs in the tune; b) it follows a fairly standard harmonic chord progression which changes key and c) it can be played in many and variously different ways easily i.e. using time changes, altering tempo, feel, dynamics and mood.)

- This was to be done by:

  - Learning the melody by heart and being aware of the structure and melodic contour;

  - Playing the learned tune by ear in different keys beginning with those nearest to the original and working towards more distant keys;

  - Playing the learned tune in different tempi and rhythmic feel;

  - Extemporising around the melodic contour and moving gradually away from the original intervals and time signature;

- Understanding the chord progression both conceptually in terms of functional harmony and as physical spaces on the instrument/voice as chord tones, intervals and patterns;

- Using the rhythmic ideas and structures to develop ideas and using the energy of the original rhythm in the melody as inspiration for improvising;

- Working specifically with jazz feel and swung quavers by singing, clapping, moving and playing;

- Integrating all of the above elements in stages, so that the improviser becomes fully aware of the possibilities;

- Developing a progressively cohesive solo over longer phrases from two, to four, to eight to sixteen to thirty two bars in length;

- Applying these approaches and knowledge to new standards;

- Constantly connecting and linking all these various aspects of the learning with the students' own experience of how it feels.

6.5 Thoughts on the curriculum

My decisions on the curriculum or repertoire for the jazz research were made according to previous experience and my desire to structure lessons around schema theory principles. Kelly (1995/7) highlights three views of curriculum;

1) Curriculum as content and education as transmission.
2) Curriculum as product and education as instrumental.
3) Curriculum as process and education as development.

In the curriculum as content, knowledge is viewed as absolute, existing outside of the student with the value being in the subject matter itself rather than any interaction with the learner. Curriculum as product is essentially that which I have outlined in the planning here, with clear objectives. This view assumes that learning works in a fairly linear way and that scientific methodology (by clearly defining intentions and expecting outcomes) actually aids the learning process. Curriculum as process is where both teacher and learners participate in deciding and implementing what is learned, allowing a co-operative and dynamic approach to develop in which neither the knowledge nor methodology is static. For the purpose of the practical investigation, the curriculum as product model was chosen, based on my experience as a jazz improviser and teacher, in order to explore and experiment with a new approach to learning improvisation, (initially based purely on melody). The justification for a defined curriculum over a more collaborative approach (which might be considered more appropriate to the learning of jazz improvisation) is based on what I thought the students needed to know in order to be able to improvise melodically. Free improvisation could be tackled without any curriculum or in a process based way, but melodic improvisation requires: learning repertoire; knowledge of feel and time; an understanding of collaborative ways of working; conceptual knowledge and very high levels of concentration and listening skills, all of

which need to be introduced to the students in a coherent way in order to enable high order skills and thinking to develop.

6.5.1 Methodology for the curriculum

To test the notion that melodic improvisation based on a standard tune is a good introduction to all jazz improvisation, I chose a series of jazz standards with interesting sequential melodies and fairly typical standard jazz harmony. *Autumn Leaves* was chosen as the first tune because it is relatively simple to learn; easily adaptable to numerous variations and does not require any knowledge of swing feel to make it work. In the workshops, the standard was learned by heart, then played in many different keys by ear and used as a framework and contour for extemporisation as a way into improvisational process. The second stage was to learn the chord progression as a series of related chord tones, and then a progression of key centres, and to broaden the initial melodic ideas to incorporate various harmonic elements. Expressive qualities, exploration of timbre and jazz swing feel were incorporated in the exercises and at every stage individual expression and musical ideas were encouraged in conjunction with the very necessary imitation of each others ideas.

The second stage of the process began again at a slightly more sophisticated level with the introduction of a new standard with a defining new element: a rhythmic twist, a different time signature; an unusual melody or a broader range of key changes within it. The aim of the educational approach was to link previous knowledge and skills; to develop a new aspect related to previous work and to improve concentration, listening skills and technique in the process whilst retaining a good humoured and safe psychological environment. Had the course been allowed to continue beyond the

planned nine weeks, the curriculum would have expanded to take in the whole range of jazz standards across eighty years and to introduce the students to the full scope of jazz styles and approaches in order to better develop their own. Indeed, a true jazz curriculum would ideally have involved in depth and concentrated listening to the music as a core component, as many jazz musicians described doing as youngsters (Berliner 1994). However, for the current research, I chose to focus on the practical improvising skills and on students listening to each other rather than listening to the repertoire itself.

I considered it good teaching practice to base the lesson planning and delivery on Ausubel's (1963) and Smith's (1998) methods which use the 'advance organiser' to lay out to students what will happen in the lesson as a preliminary taster; how this particular lesson fits in with the whole subject; what I think the students should be able to learn in the time available and how the activities relate to previous and future work. According to Smith (1998), all lessons should be taught from visual, aural and kinaesthetic viewpoints to maximise memory of the particular subject and should include some 'performance'. Obviously musical improvisation classes will automatically contain all of those elements but it is useful to remember the various modalities in other less practical areas. Theoretical musical concepts for example, could be notated and visualised on instruments, heard and then played. At the end of the lesson, the content, activities and subsequent implications were reviewed with additional ways of developing the ideas in practice at home. Feedback and suggestions from students were incorporated into the following week's sessions to make the planning process more collaborative and responsive.

6.6 Summary of the pilot project jazz workshops; lessons learned and significant findings

The three students who attended the first session learned the tune *Autumn Leaves* by heart easily and were able to play it immediately in various different rhythmic formats: as a waltz, a tango and a Latin tune. They were also able to transpose it by ear at will; to create rhythmic motifs between the long notes and to extemporise a new melody based around the intervals of the tune. The transformation of the tune itself were done by the students without practice as a natural extension of learning the melody, indicating that even this simple process was schema based and therefore open to adaptation. The feedback questionnaires provided some information about how the students felt. They were pleased to find out how easy it was to alter and extemporise around a simple tune and felt confidence in developing their skills over the coming weeks. During the first session, they had already experienced the feeling of improvising (from a melodic framework) and were beginning to understand the possibilities. The results of the first session indicated that a schema based approach using a standard and extemporisation of melody, could be a useful way of teaching improvisation in a natural and melodic way. The group workshops sessions were helpful to students because of the imitation, musical ideas, knowledge and support provided by the group, but it was also more difficult for me as teacher/researcher to focus on the developing schemata of a number of participants at once.

The second session was intended to develop the ideas of the first week by including some harmonic elements: explaining the shorthand of chord symbols; learning chord tones and integrating this knowledge with the work already done on the melody. However, several new students came to the class and it was decided to revise the

previous work on melody for the benefit of all. Some of the intended work on chord tones was done towards the end of the afternoon, which focused on roots and thirds of the chords, and motifs based on them. The students appeared to find this activity more difficult. The student feedback from the questionnaires was not particularly revealing: most did not mention the use of the melody; one expressed the difficulty of thinking about the conceptual/theoretical elements of the harmony whilst playing at the same time and another wanted to visualise the chords on the piano rather than the viola she was playing. It was useful to them as classically trained musicians to analyse the harmony, as it helped them to understand the melody better. Therefore in the future, with similar students, the two aspects may be fruitfully taught in tandem. There was also both a concern that students could not hear themselves properly because everyone was improvising at the same time, and an overall lack of confidence in using the harmony as the basis for improvisation because of their stated lack of theoretical knowledge. The introduction of chordal and theoretical concepts appeared therefore to slow down and inhibit the more natural flow of the melody-based improvisation. It was also interesting that classically trained musicians with a background in analysis were so unconfident about working with the harmony of a simple standard, but perhaps this was due to unfamiliarity with chord symbols or differing terminology. I had suggested that everyone improvise collectively in order to dispel anxiety or self consciousness amongst the students, but I soon discovered that, given a safe psychological environment, they were happy to take it in turns to improvise on their own, within the group. Students liked to listen to their peers and the person improvising could hear and concentrate better.

In the third session, the aims and activities focused on continuing work on the chord tones of *Autumn Leaves* and on extending the chordal work to include larger chunks of harmony in the form of chord families and key centres. Modes were introduced as an alternative improvisational approach, to develop more linear and scalic ideas (which the students absorbed easily), and all the previous melodic, chordal and harmonic work was connected in a final 'free blowing session'. The aim was to integrate each new approach with a previous one and to work on areas that needed specific attention, for example the harmonic background. All students improvised on their own in front of the class and were able to construct a solo making musical sense and incorporating a range of different melodic and harmonic approaches. In addition, they were utterly absorbed with the process and played for one and a half hours without a break. The student feedback reflected the positive aspects of this class with higher confidence levels and better understanding of the harmonic background. One student wrote that she was still envisaging the chords through 'a mental image of the piano, which is very slow.'

To provide a contrast and to extend the rhythmic and harmonic parameters of the skill, in the fourth session, a new tune was introduced; *Bluesette* by Toots Thielemans – a jazz waltz with a sequential tune and more sophisticated harmony. The tune was learned by heart swiftly, although the students had more difficulty with the chords – especially those that did not fit in with the previously learned II, V, I model. There were also many more changes of key to assimilate and get under the fingers. They did however appear (by the end of the session) to have absorbed the new progression relatively easily, having spent so much time on *Autumn Leaves*. In the feedback questionnaires, they stated that they could relate knowledge and skills already learned in *Autumn Leaves*, to the new tune. One student explained that it was easier for her to

learn the music in a 'flowing, moving-through-time way, rather than breaking things down into ever smaller components'. The same student also applied chord theory to learning the melody so that it made theoretical as well as aural sense to her.

In response to the feeling from the students that we needed to work on the more rhythmic aspects of jazz improvisation, the plan for Session 5 was to continue working on *Bluesette* and also to do specific exercises on rhythm. For this I chose to do a blues based workshop in which the chordal elements were greatly simplified and the focus was on listening, creating an internal pulse, instantaneously responding to other players and solid rhythmic feel. The result of exploring the blues changes after so much more sophisticated jazz harmony was that the students felt easily able to improvise and very confident in their new skills. As the blues progression is so simple, they were able to concentrate on the overall development of ideas over the twelve bars and to responding quickly to riffs and motifs played by others. A collective piece was devised in which players improvised backing figures behind the soloist and made an on the spot arrangement. Feedback from this lesson highlighted the value placed on learning purely through listening, by the students. They particularly enjoyed the musically interactive elements and the freeing up of the improvisational process that playing the blues progression provided. The indication was that the students learned best, and had most confidence in the learning, where listening and group interactivity were at their highest. Theoretical and visually notated approaches not only seemed to slow up and make the process more academic, but also sidetracked the listening and responding elements that the students found most effective. Predominantly aural approaches which formed the basis for traditional jazz

improvisation learning appeared to be the most effective and enjoyable for schema development.

In session six, the intention was to continue developing the aural learning from the previous week by extending the blues format to learn a be-bop blues by Thelonius Monk, *Straight No Chaser*, and to continue working on *Bluesette*. The tune of *Straight No Chaser* was used to spark new rhythmic ideas, because the phrases of the melody (which is a repeating, slightly altering motif), go across the beat and the bar and it has unusual offbeat accents. The standard blues chords were also extended to provide new colour tones in the form of minor seventh to dominant chords and hence different melodic possibilities. Rhythm was also the focus in *Bluesette* where a range of rhythmic phrases were explored in 3/4, again as an extension of the 4/4 phrases previously learned. To keep *Autumn Leaves* in mind, and to extend the work already done, as a final activity, the students were presented with a re-harmonised version by pianist Andy Laverne and a discussion ensued on the various sounds and effects evoked by the new chords. On reflection, it was early in the improvisation process to introduce the notion of re-harmonisation, but the chord playing instrumentalists enjoyed playing through the new progression and contrasting it with the much simpler original. The obvious next stage would have been to improvise over the re-harmonisation, which was not done in the end: it was enough to alert the students to other possible strategies and approaches. Student feedback was positive even though I felt the class was quite tired. One student wrote: 'the Monk (*Straight No Chaser),* tune had significantly expanded my ideas about the improvising possibilities on the blues.' Interestingly they felt that they still had a problem with harmony and particularly in hearing the changes whilst improvising at the same time.

After collaborative reflection on the process of Session 6, the focus on rhythm was continued with the introduction of: *Well You Needn't* by Thelonius Monk, to explore more off-the-beat rhythms and unusual rhythmic emphasis. Work was also planned on the use of chromatic chord patterns and improvising over relatively static progressions, both of which occur in the Monk tune. To develop improvisational ideas and to keep the blues in mind, we also learned a walking bass line for the blues. The students were very excited by the rhythmic energy and unusual phrasing of *Well, You Needn't* and by its call and answer nature and by focusing again on the melody initially, some very interesting improvised ideas resulted. There was also practice on moving motifs up a semitone (from F7 to Gb7) to fit the chromatic and repeating chords, which the students found quite difficult at first, indicating that the repetition of improvised phrases exactly in a new key was still hard for them, and that this aspect of the schema was as yet underdeveloped. The implication was that whilst, the general outline of a phrase or an answering phrase was relatively easy for them to imagine and play, more exact forms and phrases presented a problem, implying that the abstraction of intervals and movements to make them had not fully occurred.

The plan for Session 8 was to continue with *Well You Needn't* and to practice repeating motifs in different keys, by focusing initially on creating a one bar motif to transpose up a semi-tone from F7-Gb7, whilst keeping the rhythmic energy of the tune. This still seemed to pose a few problems especially in the transposition section of the tune. To incorporate work on the blues and to add to the repertoire, another tune was learned – *Sister Sadie* by Horace Silver, (which is blues-based call and answer piece) – with a view to exploring that format some more. The call and answer phrases worked well, with much improved listening and response and the intense jazzy and

swing based nature of the melody provided good rhythmic energy for the students to improvise. The notion of using space within the solo to pace the melodic ideas and give breathing space for phrases was also introduced and students played through various exercises leaving gaps and starting the phrase on different beats of the bar. They also worked with density and sparseness of notes within the phrase. For the first time in the feedback questionnaire, I asked the students what kind of mental pictures they had whilst improvising. One said: 'A combination of shapes guided by the instrument, squiggly patterns, responding to rhythmic patterns of others (and to a lesser extent melodic/harmonic things.)', and another: 'I'm looking at the piano keys, trying to visualise chords and scales and shapes in them. I usually play according to patterns that I see, rather than things that I hear, but sometimes I hear ideas in my head and try to play them.'

The final session was intended to consolidate material learned to date and to leave those students who were interested, with ways of continuing to practice what they had learned. In an attempt to begin the process of understanding schema development, and the interests of educational research, I wanted to find out if possible, what the student's had learned over the nine weeks, and began with a revision of all the tunes from memory, in order to find out how much had been remembered by heart. *Autumn Leaves*, *Bluesette*, and *Sister Sadie* were well remembered but the students had problems with *Straight No Chaser* and *Well You Needn't*. The first three tunes were relatively straightforward, both melodically and rhythmically, whereas the last two required a new rhythmic sophistication and understanding that clearly need more time to develop. The implication is that the first standards were easily assimilated into the student's existing schemata being relatively straightforward, but that the more

complex and idiosyncratic Monk compositions required more listening and abstraction which delayed schema development in that area. Also, overall, less time had been spent on them during the nine week period. All of the various different approaches to improvisation were also revised: melodic extemporisation; deliberately leaving spaces in the improvised line; harmonic progressions; using repeated intervals; modal scales; call and answer phrases and rhythmic density and sparsity. Suggestions were made about how students could continue to develop their improvising skills once the workshops had ended by using 'chops practice' (a specifically disciplined way to practice improvisation), and the wide range of approaches already introduced.

The second half of the last session was devoted to writing a short jazz piece for the rest of the group to play with the students performing and improvising around it. The aim was to assess how much of the jazz idiom the students had assimilated over the nine weeks and to begin to assess their developing schemata. To simplify the process, I suggested the students use a standard chord progression from one of the tunes already learned, or a blues as a basis for the composition. After writing, the students were asked to teach the piece to the group aurally. One of the tunes was then chosen and worked on more fully, with students creating textures, background figures and riffs and responding to solo phrases, as group members took it in turns to improvise. The indication from this part of the session was that the students had absorbed sufficient elements of the jazz form and style to compose and improvise over a basic blues progression and to teach it to each other aurally.

From listening to the players and taking into account responses from the student feedback, on average, they could remember and improvise confidently on three of the six tunes we had learned over the nine weeks. They enjoyed writing the jazz tune and composed some interesting pieces. Two students likened it to the process of improvisation especially using existing chords and two said that they would write more. Three said that they would continue improvising and one that they might continue, depending on time commitments. However, they all seemed reluctant to form a group or band for this purpose, not having understood that the basis for learning in jazz is group collaboration and interaction. Two could improvise without looking at their instruments whilst two could not, and all felt more confident about improvising, with three out of the four stating that more practice would give them more confidence. I asked what the most important aspect had been for them in the workshops and they stated:

- 'Learning a new way of playing as I have been playing 'classically' for most of my life! And also playing with other people is valuable.'
- 'A growing grasp of jazz harmony.'
- 'I now feel that I have different techniques for improvising available to me. I now have a way to approach it whereas before I felt overwhelmed and didn't know where to start.'
- 'I now know the process for improvisation. I know how it is done even though I might not be 100% ready to do it by myself. I know and it doesn't seem that difficult anymore.'

I asked whether they could quantify what they had learned over the nine weeks and the responses ranged from 'producing and developing motifs' to 'a better feel for improvising melody and connecting what I do on the instrument with what I do in my head.' Two participants mentioned having a better understanding of the process of improvisation, implying that they would be able to continue those processes on their own.

6.7 What I learned as a researcher as a result of the pilot project

In summary, the main elements learned from initial sessions were that the teaching material and approaches worked in a general way; the questionnaires were not very useful at eliciting insightful responses, for people are simply not able to articulate in words what was happening to them in practice. Also, although I could structure my teaching according to schema principles, it was extremely difficult to monitor whether what was being achieved by the students was in fact schema development. It became clear that students had very different perceptions and perspectives on what they had learned and that much of the learning process was not verbally definable at any deep level.

Firstly, using the melody as a framework for extemporisation/improvisation seemed to be successful, although, as all the participants were already technically proficient musicians this would be hard to prove definitively, and would require a control group of less technically able musicians to verify. It appeared to be useful to spend a relatively long time working on the same tune (*Autumn Leaves*) because it enabled students to improvise of over progressively longer time frames, and the success of

their first 32 bar improvisations were indications of this. Also, the constraints placed on the improvisation by first focusing on the melody and then the chord tones kept the process simplified at the beginning, allowing the students to build skill and confidence. The overall approach was validated by the students learning of *Bluesette* with ease and one student's point about the positive aspects of learning the music in a 'flowing, moving through time way' rather than breaking things down into small components, also helped to give credence to the approach and materials. In terms of schema theory, the focus on specific intervals and one tune enabled immediate adaptation and continuing abstraction of elements to new tunes. The harmonic aspects of the schema appeared to take longer to assimilate and develop, perhaps because of the introduction of theoretical elements or just the amount of information that the students had to deal with. From an educational perspective, predominantly high levels of confidence appeared to indicate that the teaching was working, mainly by focusing on one parameter at a time, by emphasising the individual creative voice in developing melodic ideas and by creating a safe psychological environment. Student feedback suggested that more work was required on rhythm, especially swing feel, and on the particular sound qualities of different types of chords and how they can be used expressively, and also on analysing the harmonic structure in conjunction with learning the melody.

Secondly, in response to student feedback: a) it seemed useful to focus more on the listening elements and to encourage individual playing within the group in order to facilitate it, and b) perhaps the harmonic structure should be introduced with the melody to aid understanding. It was clear that more aurally based approaches were

effective for schema development and that these should predominate in any future work.

Thirdly, the questionnaires did not provide deep insights into the learning process and the possible reasons for this include varying individual interpretations of the same question, preconceived notions about what the researcher wants to hear, and the difficulty of verbalising the learning process (even if it is open to consciousness). This indicated a need either to alter the questions in order to elicit different responses or to alter the way in which the questions were asked. Students were therefore asked more questions spontaneously during the workshops, in the hope of eliciting more intuitive insights and more work was done on asking the right questions for questionnaires at the end of the sessions.

Fourthly, it was clear that students had very different perceptions of what they had learned from lessons that had seemed to me to be simply constructed and with very clear purposes. As mentioned previously, the students may indeed learn similar things but their individual perception of them is very different. The major learning for me was that proving the existence and development of the schema will be difficult, and that it would perhaps be better to focus on one individual, rather than a group for the main study.

Finally, the last point is the perennial teaching problem of the gap between what was planned (rationally) for the lesson, and what actually happened during its course. This is particularly the case in the introduction of new information based on what has

already been assimilated (or not) and how this affects the existing schemata of the students. The gap necessitates a certain flexibility between what the teacher thinks is needed to acquire the skill and how long the student takes to actually do it, hence the disparity between plans and actual activities. As a general rule, in the jazz improvisation workshops, if the activities were producing a flow of music and fruitful practice, I tended to let them continue regardless of the plan. Similarly, if students wanted to continue or repeat certain exercises, these autonomous decisions also took precedence and this kind of flexible practice is part of the way in which jazz musicians would normally work.

From later sessions I understood that students learn in very different ways. For example, one will benefit from a highly theoretical and rational approach whereas another will want to base everything on what they hear and can imagine aurally. Some are orientated by visual patterns on the instrument (especially piano and guitar) and others have to begin with aurally based patterns, which makes it harder for them to envisage the shape and components of the chords. It is important, therefore, to ensure that a wide range of activities and a good mix of rational, theoretical, aural and intuitive approaches are covered in every lesson. In addition, students were willing to improvise on their own given the judgement free environment; they preferred to hear themselves clearly and also liked listening to other peoples solos for both interest and inspiration. The students appeared to be fairly accurately aware of their levels of skill and shortcomings and asked to work on specific areas, for example, rhythm and the jazz swing feel. It was apparent too, that non-chordal instrument players would be assisted if they could see visual representations of the chords on the piano. It might therefore be useful to spend a session purely on harmony worked out at the piano.

6.8 Summary of second practical study

The second preliminary workshop consisted of ten students doing improvisation for an undergraduate improvisation module: Alice Coulam, alto saxophone; Lindsay Aitkenhead, viola; Wei-Wei Kung, voice; Chris Scott, piano; Yuko Takahashi, violin; Jacky Hill, flute; Nick Fletcher, double bass; Lisa Hoyland, baritone saxophone; Peter Turner, flute and Bethan Lee, and Esther Trewinnard both on clarinet. Chris, Nick and Alice had some previous experience of jazz improvisation, whilst the others were beginners (or at least claimed to be.) The workshops were recorded on mini-disk and as I was either teaching, playing or in dialogues with the students, during the sessions, I responded to the flow of the class as I would do normally i.e. developing ideas or exercises as required, slowing down or speeding up the introduction of new materials and so on, depending on how the class was responding. This process is part of ordinary educational practice and no attempt was made to alter what I considered to be the natural flow and progression of the lessons. The classes were planned in a similar way to the first study, whilst incorporating changes suggested by the students, and focused on the learning of tunes; extemporisation and improvisation using melody as a starting point and the later introduction of harmony and chordal aspects.

The main finding from this particular class was that the students collectively had a significant effect especially in imitating and extending each other's improvised ideas. In addition, like the first group, they were able to transpose improvised ideas into new keys within a short space of time, indicating an area of schema development which allowed them to generalise and transform elements of the tune into different keys i.e. the information about the relationships between the intervals had been abstracted

quickly and easily. One of the tunes that were learned at this session was *One Note Samba* by Jobim, and the technical difficulty of the piece lies in the transpositions of the middle eight into difficult keys at a relatively fast tempo. During the improvisation over this section, several players imitated the tune to help them through it and many echoed elements of the melody throughout their own solos to orientate themselves through the progression. Another clear strategy used by several players was to play a note or phrase that fitted in both keys to ease transition into the new key and this was imitated throughout the group. Whilst improvising four bar phrases around the group, they also imitated and developed ideas and were able to follow the form of the 32 bar tune without getting lost, again indicating a grasp of the whole piece, even whilst playing fragments of it. These exercises were developed into eight bar phrases and finally the students were able to improvise over the whole 32 bars individually. Certain players then began to take more risks and to go for ideas, (also using timbre), with variable results, but great energy, and when eventually they were distracted or got lost in the progression, other players would play parts of the tune to reorientate them, and backing figures on the roots and fifths of the chords to assist. Overall, this particular group used the collective musical sense to develop as improvisers in a creative and intuitive way by being able to be responsive to the musical environment despite being novice jazz improvisers.

6.9 Can we learn anything about the developing schema from these two sessions?

The second preliminary workshops were characterised by dialogue between me as facilitator and the participants, which seemed to provide more insight into the process. I asked questions of the students as they played, and received some interesting answers about their perception of the improvising process. A student (L) expressed

(probably on behalf of all), the notion that she found it **'hard to feel the harmony behind me'** and so was unable to continue developing her improvised ideas. The idea of '*feeling* the harmony' rather than hearing it implies that at a higher level it is sensed and embodied rather than merely heard and that once it is felt (presumably through the whole body), then it is possible to predict and to imagine ideas based on predicting the sound of the harmony. W viewed the harmony as **'a safety net for me'**; a thing that could rescue her if she tried something beyond her technical skill. As a result of the metaphorical safety net she said: **'initially I had the feel of the tune in my head and then I got more adventurous in my approach.'** This was indeed true; she took quite spectacular risks resulting in exciting and 'on-the-edge' improvisations. She too used the word *feel,* not *hear,* and it is either a deeper and more embodied sense that is being referred to here by both students or verbal imitation suggesting a desire for shared meaning (as well as music!). The implication is that schema development incorporates deeply felt (as well as heard) understanding of the sounds of the harmony and that at this level it then becomes possible to improvise both more rationally (i.e. using learned strategies) and creatively. W also said: **'It's good to be experimental and see how far you can test the boundaries'**, indicating that to her, normal improvisational process is bounded both by melodic and harmonic structure and constraint and needs to move beyond that. W was testing the boundaries before she really knew what they might be and she appeared to have by-passed the need for assimilation of existing frameworks, which is probably reflects her character and personality.

W was the first person to experiment with timbre by using Louis Armstrong type growls most effectively within her improvisation and this was appreciated and

imitated by the rest of the group on their various instruments. She explained that; **'I tried to imitate, you know, to get the gruff sound of the brass** (*demonstrates*).**'** She was already thinking about how the timbre and sound might affect the improvisation and naturally experimenting with different sounds, whilst being aware that the growl is a standard jazz trumpet style. Crucial to the idea of schema theory is that each unique individual absorbs and assimilates information idiosyncratically and whilst a lot of what they learn will be similar; they will each perceive what they have learned differently because of the variance of individual experience and environment. W perceived that the boundaries are to be broken before really knowing what they are; L perceived that she has to feel the harmonic framework before she can improvise melodically; she had no conception yet of going beyond that.

B liked playing over the middle section in *One Note Samba,* with the keys changing from Eb to Db Major. She said: **'I enjoyed working towards the contrast. Just thinking of like letting it …… but I always expect the second half, the third section of C to be shorter** *(laughs)* **because was it last week? It was shorter than the first section?'** Again B seemed to want to be able to just let the improvisation flow by sensing the harmony at the right point and time. She also realised that the first tune we played the previous week had only eight bars in the final A section (of the AABA form) whereas *One Note Samba* has sixteen bars (it is an ABA form). So already she had a sense of the 32 bar standard AABA format which she had to alter to fit the different tune this week; the schema has incorporated the 32 bar format and now has to adapt to a 40 bar tune of 16, 8, and 16 bar sections respectively.

Y expressed concern that we had no bass and drums and it was difficult for her to keep in tempo. She was probably hearing the standard jazz group here and the class 'rhythm section' of guitar and piano with other instruments filling in with long root notes was not quite the same! Sometimes the *ad hoc* rhythm section also got out of sync with players going three times round the A section and so on. Y said that she was thinking about the harmony more sometimes (instead of a melodic line?) which she considered 'dodgy' and then realised that the boundaries or stylistic parameters are not as strict as they are in classical music, so she had more space to play what she liked.

In the second session a week later, the consensus amongst the students after playing *One Note Samba*, and *Sister Sadie* (by Horace Silver), was that the improvising process had got harder for them. There could have been a number of reasons for this: their idea of a 'good' improvised idea had changed and developed so that they could not play their former licks; they had added theoretical information about the chords and harmony to cope with (and this is invariably confusing at first); or maybe they were just more aware of what they were playing and how it sounded and were perhaps getting bored with it. Y said**: 'I mean, this one, to follow the harmony, progression or whatever, I think it's easy but erm, I'm getting used to the improvisation itself but sometimes I don't have much ideas of a melody, so I think that improvisation is in a sense, it's really improvisation just like the colour of your heart or whatever. But at the same time you have to have some basic idea or some experiments like for example I just used this** *(demonstrates idea)***. If you have like, some materials which you can invent from it would be better but I don't have much experience of that so I just like cant' get……'** I think that Y was saying that

the improvisation process should be more like a feeling and yet you still need to have some kind of framework or materials to use in order to express it. There is also a sense of the frustration in the learning process: it feels (and often sounds to the outside listener) that the ideas are almost coming together, but not quite. It is like a glimpse of a shape or shadow that takes some time to come into focus. The sense is that the unifying yet intangible shape is the schema organising itself and coming together briefly and intermittently at the beginning of the learning to allow the learner to improvise an interesting idea or phrase.

B said: **'I'm finding it a bit harder because I'm trying to think of new ideas.** (*Everyone assents and laughs here).* She continued: **'Yeh, because I'm trying to play something that I haven't experienced before. If I was doing it for a job I'd just play the same things over and over again because you'd find something that sounds good and just keep to it. If my lifeline depended on it I'd try and make it sound good as opposed to try and think of new things.'** Thus for B, ideas that sounded good and worked were not the same as pure improvisation, where thinking of new ideas is more important. B is I think, referring to jobs which pay with the phrase: 'if my lifeline depended on it' where she would have a more pragmatic approach and the idea is to make the music sound good for a paying audience. Indeed, in a later session another student referred to this approach to improvisation as composition in which the player finds a musical idea that they like, then learns it and repeats it forever after as a fixed idea. It is interesting that even at an early stage, the students quickly become bored with ideas that work and that they can play easily, and actively move on to acquiring the more dynamic and difficult aspects of the skill.

E said that she also found improvising more difficult and I asked why: **'I'm not sure. I think I was listening to the wrong thing: I kept listening to W singing the tune and I don't know if I really should have been listening to the rhythm.** (*Everyone laughs with W*)**. No, but the piano and the guitar has got the chords and the harmony and a bit more rhythm. I don't know why but I think maybe because you need to know these more, my ear just sort of goes straight to the melody.'** E was listening to the tune (which W was singing in order to orientate herself and the rest of the class through the standard), and then found it hard to stray from that. A strategy that should have aided her became a restrictive element not allowing her to focus on the chords and the harmony properly.[17] As no-one else mentioned this, I assume that the rest of the students could have the tune in the background as an indicator of the progression without being overly drawn to it or influenced by it. E was however, unable to filter it out and went on to try and explain: **'I don't know, it's just like, I think that when you play and you're trying to hear the melody, there's more of a chance that it sounds wrong or sounds not so nice because there's less notes – it's like in a line.'** E saw the improvised melody as a linear form from which she had less choice of notes (and not those that might clash with the tune itself), contrasted with the possibility of the more vertical harmonic possibilities created by the chords. Instead of viewing the melody as a framework of possibilities, she saw it as restrictive because any improvisation would have to fit in with it. E continued: **'I mean, it's just like from what you hear. If you're not like, listening to the whole harmony you don't hear it fitting in with the harmony you just hear it sort of… I dunno, I can't explain it really.'**

[17] A similar situation occurred in a later case study with a student for whom the melodic approach to improvisation just did not work.

W also realised that she had been singing the same interval to initiate her improvisation every time: **'I realise one thing I'm fond of doing for the past, including this session, three sessions, whenever we are doing the *Sister Sadie* I always like to go with my little idea as a kind of propeller to make me start** *(demonstrates by singing the seventh to the tonic motif she likes)***. I'll start improvising just from that spot. So somehow I feel that humming for me personally, if I hum the melody it's like a safety cushion, ok, I'm on the right track. It helped me actually – sorry if I put you off.** (*laughs*)**'**. W viewed starting with the same idea as a way of launching her into others; the imagery of flying is significant with the notion of the same phrase as a 'propeller' used to get her airborne. She also again used the word safety in relation to the melody this time; she saw it as a 'safety cushion' there to catch her if she fell off.

L had been singing and teaching *Sister Sadie* to her pupils (because she liked it) all the previous week and so now knew the tune well, although admitted to not knowing the harmony in the middle section. She was playing the violin rather than the viola (which is her normal instrument), that particular week and said of her improvisation on the violin: **"Cause I can't work out where the notes are on this** (*the violin*) **I don't really play it, it means you have to do it completely by ear.'** I think this means that L was not using any of the usual patterns or signposts on the instrument but rather responding with her aural imagination and somehow finding the intervals in the smaller space of the violin neck. Her strategy in the middle section (which has different dominant chords and a chromatic section), involved just responding to the sound of the harmony: **'I couldn't remember what the chords were in the middle and I can't really play the violin so I just threw caution to the wind** (*laughs*) **to**

see what happened.' L found it liberating not to have to think either of the finger patterns on the instrument (relating to chord tones, scales and so on) nor of the theoretical aspects of the harmony, but just to respond to the sound slightly after the event.

P had practised *One Note Samba* at home, and when I responded positively to this and the class laughed, he said: **'No, I mean I'd practised the tune a bit, last weekend: I had a go with it and got it, know what it sounds like and tried to get round it. I couldn't quite remember the chords but I think I could remember it roughly, it wasn't too bad.'** He knew 'what it sounds like', presumably both with the melody and the harmony and so 'got round it.' Again, even at this early stage, students realised the difference between 'getting round it' i.e. playing something that will work and which sounds alright and playing something creative or new for them.

C was one of the few students who said that improvising was not difficult for him: **'I found it easier. I think perhaps it's just in there and it probably won't leave me for a few years.'** He seemed to be describing the sense of having internalised the whole tune with melody and harmony. Previously he had (somewhat reluctantly) admitted to having practised by 'taking the thing apart' and learning the notes of the chords and then the entire progression. Having internalised it, he wanted to do more with it: **'Yes, a little bit especially where this bit comes in** (*demonstrates the rhythmic chords of the first section)***; I'm trying to do something a bit more on that.'** He continued: **'Yeh I was just trying to play around with that really. Yeh, it's firmly written in my skull.'** This is interesting terminology; he does not talk about feeling but about writing; something being firmly written, but in the body. I

ought to have asked whether he envisaged the piece in written notation or sensed it through time as the solo unravels but did not. The schema would not consist of a 'firmly written' trace but rather of a stabilised pattern governed by probability which could be adapted at will. Either way, C considered that he has learned the standard and had the means to explore different ideas within his improvisation.

Later in the same session, freer improvisation was explored using silence and noise, based on Peter Schaeffer's workshops, where the students are encouraged to listen to ambient sounds around them and to discuss what they consider to be noise and music. These ideas were used as a basis for collectively 'composed' and improvised pieces which the group (divided into three) then devised. During this session words were also used to invoke musical ideas as a source for group improvisation. Essentially, I wanted to provide a contrasting improvisational activity from a new relatively unconstrained perspective; to see how the students responded and to work out whether what they were doing was radically different to the more structured work and if so, how and why. In all the freer sessions, there was a tendency for the students to come up with musical clichés and to portray some of the words literally. For example the word 'train' nearly always elicited the standard Ellingtonian rhythmic model whereas it could have been abstracted and more subtle, and many of the contributions were similarly like bad film music. The students' focus was also on creating a relatively fixed piece i.e. creating a structure, rather than an improvisation, in marked contrast to their previously desire not to fix something but to actively create ideas. It is clear that some students have greater sensitivity to sounds than others: they can hear more and concentrate better. Some (especially the younger ones), find experimenting with timbres hilarious i.e. it is not seen as a serious activity to explore the effects of new

sounds and perhaps this is associated with their previous experiences of atonal music. This is a pity because it limits the possibilities, but may be understandable given their classical music training. In terms of schema theory related to freer improvisation, it could be argued that the kind of schema the students appeared to have, was a limiting and limited framework and that a lot more work, both in devising educational approaches and in researching how they work, would have to be done in order to understand how a schema or schema assemblage for free improvisation might work.

As previously mentioned, working with groups and teaching improvisation made it very difficult to monitor schema emergence and development, hence the reason for moving to case study for the main body of the research. L had been a student in some of the group improvisation classes, wished to continue and when asked, agreed to take part in more intensive one-to-one teaching research. The next chapter describes the research process and outcomes.

7. Main Practical Investigation

The classes took place on a one to one basis, for two hours per week, over five weeks with L, a classically trained folk viola player, at her house.

7.1 Aims

The aims of the first session were: to introduce the research; to explain the rationale behind the activities; to establish an approximate starting point for the teaching and baseline of L's existing knowledge in the aural, physical and conceptual areas of skill; to find out what L aspired to learn in the short and long term and to create a safe and informal atmosphere for her to learn in.

7.2 Methodology

The case study research sessions were recorded on video with the agreement of L, because during the pilot study it became clear that important visual elements relating to student and teacher gestures and other interactions were necessarily absent from the initial audio recordings. Video recording allowed the learning process to be explored more deeply by analysing L's body movement in relation to both the music produced and her verbal responses. Throughout the case study, I asked L for her perspective and perception of what she was doing and thinking at frequent intervals and noted the attendant body language.

During this particular series of lessons I intended the educational work to be collaborative in order to encourage L to be autonomous as a learner and for myself as the teacher to be responsive to her suggestions and wishes. Analysing the video, it

became clear however, that most of the work was in fact teacher led although the decisions made at the start about what L wanted and needed to learn (based on her existing skills and understanding), were collaborative in nature. Making L aware of what she needed to address and outlining the elements of the course to be followed may also have assisted in preparing her for what was to follow. From L's own performance of tasks set by me and from verbal indications of her levels of understanding, it becomes obvious to both, what was required (and realistically feasible), over the series of lessons and a framework developed that was also visualised on a mind map. The aim was still to track the emergence and development of the schema and to use a similar form of activities to the group workshops, but to focus on the process with one person and to engage in more dialogue to gain further insights.

7.3 Summary of activities and rationale

The initial exercises were intended to provide a starting point for the work on improvisation and a baseline from which to attempt to follow the developing schema over the period of five weeks. The first exercises involved assessing the extent of L's aural memory for simple rhythmic and pitch exercises (i.e. short phrases to be clapped or sung back) which were later elaborated to include call an answer responses and internal rhythmic feel. L was asked first to imitate clapped rhythms to ascertain the limits of her aural memory for rhythmic patterns, which began simply, and gradually increased in complexity and sophistication. Internal rhythm exercises were carried out to see whether L had consistent internal rhythm and responsiveness to another player. Call and answer rhythmic phrases were used to see how L developed them and to judge immediate and creative rhythmic response. Singing exercises were used to

extend the work on aural memory by adding pitch, to ascertain the length of phrase and kinds of music that L could remember from a single listening and over several repetitions. The tunes began with simple folk melodies and rounds and gradually progressed to jazz and Latin tunes with offbeat and swung feel phrasing. The intention was to begin with music that L was already familiar with in her existing schema and then to broaden the examples to include jazz music which she had some prior experience of.

L volunteered to learn a jazz standard by heart on camera, in order to attempt to follow the process and strategies she used in memorisation. This activity was important to understanding schema development because the theory posits that from specific instances of skill (or theoretical learning) elements become generalised which are transferable and which lead not only to adaptation but also to novel behaviour. In addition, in this research, the learning of a melody forms the basis for improvisation using the melodic contour as a way of developing the schema, and observing how the tune was memorised provided insights into why and how elements of music are learned at one particular point in time and not another. Learning the tune was followed by extemporisation and transposition by ear into different keys, and variations in tempi and rhythmic feels. Questions were asked about L's existing knowledge of jazz harmony as an introduction to the idea of improvising using the harmonic background and to begin to assess her 'background schema' of jazz improvisation i.e. those parts of the theoretical schema that will underpin the more practical elements.

To develop the harmonic basis for improvisation and also to ascertain L's practical knowledge of the subject, the creation of motifs was explored to see whether L could make use of the chord tones within the harmonic framework and take the ideas through the chord changes. Subsequently, the notion of key centres was introduced as a reminder, as we had worked previously on this in group workshops, and to see if a more scalic and linear approach affected L's improvisational ideas. For contrast, later in the session, expressive parameters in improvisation were also explored to gauge the effect on the improvised lines and to explore whether this approach would be useful. Lastly, questions were asked to see what L aspired to learn over the five weeks and a practice schedule was devised by L herself on the basis of the afternoon's activities. In the following description, the letters and numbers refer to specific parts of the transcription which are printed in full in the appendix. All of the above exercises were developed within the previous group workshop settings, but were somewhat condensed in this first session of the case study, both because L had worked in this way before and in order to set some kind of starting point for the research into the schema development of one individual.

7.4 Discussion and Findings from the first session relating to melody

In the initial exercises to find a base line of skill, L's aural memory was challenged by complex rhythms and melodies although it was highly attuned and focused on shorter and more standard 'on the beat' music. It was apparent and became more so as the session progressed, that L's schema for listening and hearing jazz was underdeveloped. It also became clear that L made up parts of the rhythm (and melody) where she had forgotten or not heard the phrase correctly, although on the occasions when she did this, both the rhythmic and melodic aspects had contours and echoes of

the original music. It was evident that L had not heard enough or assimilated the sound and feel of jazz at this particular point in time, due to the lack of jazz rhythmic and melodic sense and also on her own admission. She did not have the sound of the music in her head and it did not feel natural to her musical sensibility. **R19: 'When I first started playing around with this** (*jazz music*)**, I felt that I didn't have "the-whatever-it-was" in my <u>head</u> that would do it. It was almost that I couldn't <u>hear</u> it because I wasn't used to it.'** (*L's emphasis*.) This proved to be a problem, for without a background sense of the flow and sound of the music, it was difficult for L to emulate the jazz feel and indicates the importance of the background listening schema which has to evolve before any meaningful jazz improvisation can take place.

Similarly with melody: simpler folk type tunes were well remembered and sung back by L but jazzier motifs and tunes were more problematic. Listening carefully to the recording, it appeared that L's memory altered some part of the melody on one occasion which was recreated in the next version and then it seemed to be difficult for her to alter to the correct form later. What is entirely unclear is what happens on one occasion to stabilise a memory that is not apparent on another. Another significant factor in terms of memory was how, when L had listened with high concentration to a two bar phrase in order to memorise it, and then could not reproduce the aural memory either on the voice or the instrument, she approximated it (in a similar way to the rhythmic exercises), using the overall contour. She then either remembered the changed version in subsequent renditions or gradually filled in the specific details from successive listenings to the same phrase. This is illustrated in more detail at **S18** the transcript in volume 2. During a later dialogue about what L was thinking of during the singing exercises she said: **S35 L: 'Whereas at the moment, when I'm**

remembering, (I was aware of doing it then actually), I'm looking... I'm looking for repetition and I'm looking for big intervals and remembering where <u>they are</u>; and I'm <u>not</u> thinking of the phrasing or the overall shape of it at all, so yes, we need to do some work on that.' (*L's emphasis*.) The impression is that the memory is providing anticipatory links or sounds to help L through the exercise which actually interfere with the active process of concentrated listening. L seemed to be consciously listening for the unusual details rather than the global structure of a phrase, although what she actually remembered (perhaps non-consciously and through the schema), was the contour or the overall outline. For L, it was almost as if highly rational and conceptual elements came into play in what is an aural memory to hand (or voice) exercise i.e. imagined intervals translated into physical hand shapes/movements and spaces, executed on the instrument. During the first session, a repeating motif was L's rational approach to music (she is also a mathematician), in seeking structure, conceptual understanding, repetition or unusual musical elements. For example, she invariably remembered the highest notes of a phrase or melody in the right place.

What does this indicate about schema formation? Perhaps, that general outlines or contours form the basis of aural memory from which specific instances are filled in and as they are memorised, the relationships can be abstracted. Alternatively, the creation of a general contour highlighting the remembered elements may indicate a particular learning strategy. It is also described by Sudnow (1976) who proposes that the skill of improvisation moves from the vague and generalised to the more specific.

The indication from these initial exercises was that L's aural memory was highly developed and attuned to the music that she was familiar with i.e. classical, folk and

Kletzmer. With the background listening schema for jazz dormant (L had listened to jazz as a young person), it was hard for L to memorise or respond to jazz phrases or typical swing rhythms. Within the new jazz idiom that incorporated unusual rhythms and blues related patterns, L could not recall phrases over two bars in length. However, (with hindsight and later information), it became clear that integral to L's understanding of melody is the harmonic framework in which it is embedded, and this was entirely absent from the initial exercises. L may have been able to deduce the harmony from the more traditional songs but not with the jazz phrases, hence her difficulty in accurately copying those particular melodies. I was not aware of this at the time, however.

L offered to learn the Jerome Kern tune *All the Things You Are* on camera so that I could observe the process and this exercise is described fully in volume 2. In this particular activity, I was looking for any evidence for the self organising nature of the schema: how the memorisation process appeared to be working and whether the specific intervals learned within the tune were stable enough to be adapted in a variation exercise. It was also an opportunity to introduce a 32 bar jazz standard as a referent and of showing the development of a melodic contour. I observed the process without comment or any verbal input and L learned the tune without any harmonic background. Significantly, however, L was hearing/imagining her own version of the harmony as she learned the tune and then later played the melody with the notated chords at the piano. After playing the tune and the chords twice more on the piano, I asked L whether the written harmony was as she had imagined it to be. **L28 L: 'Most of it is how I thought: some of it isn't or it's not how I would harmonise it if I was….from what I'd… It's not how I'd harmonised it in my head from what I**

was playing. Er, some of that I put down… well it's been harmonised in quite a complicated way and I think somebody's just been playing with it for the fun of putting some extra harmonies in. K: 'Right.' L: But yeah, the broad outline of it is how I imagined.'

This interesting response may indicate that L had some kind of harmonising schema which did not yet fit the jazz idiom and it would be intriguing to know how she would have harmonised it. The other possibility is that L had heard this tune somewhere before and recognised the chord changes incompletely from a past memory of it. L reiterated: **L29 L: 'It's not how I'd harmonise it in my head from what I was playing.'** Perhaps L imagined the tune harmonised in a folk-based way: it seems unlikely that she would have heard the intricate and sophisticated key changes unless she had remembered the piece from a previously heard recording.

Having learned the tune of *All the Things You Are* by heart, I then asked L to perform it in different ways, to see how easily she could adapt it by ear, and therefore to ascertain how the schema was developing for the tune i.e. whether the learned relationships between the intervals could be abstracted and adapted to a new context. I began by demonstrating the jazz swing feel on the guitar and adding off beat rhythms in the accompaniment. **E12** At the third time of playing the tune by heart, with the guitar accompaniment, L came in with a 'straight' swing feel, altering the rhythmic emphasis of the notes. It is interesting to note that L changed the feel of the tune immediately in response to the energy and rhythm of the accompaniment: it was not entirely jazzy but very different from her previous renditions and quite unlike the notated form. L also added slides and slurs as well as shortening some notes and

lengthening others. Overall, L played with verve and confidence incorporating the rhythmic changes without missing a beat, just by being focused on the accompaniment. This would seem to indicate that the schema for this tune had developed sufficiently for her to adapt it and to add small changes by being given hints from and imitating the aural musical context. L's learning of the melody by that stage also appeared to by automatic enough for her to add different articulations, indicating that schema development was already enhancing the adaptable nature of the emergent skill.

The same exercise was repeated in ¾ time, which required a very different rhythmic approach, a diminution of the notes and a general lightening of the phrasing. I counted the tune in at a slower tempo, having realised that the pace was accelerating and then played an example of the jazz waltz rhythm whilst singing the tune as a model for L. **E18** This was the fifth time with the guitar accompaniment and first time in ¾ and now that L was concentrating on altering the rhythm, the intonation became less focused. L came in with the ¾ rhythm, added some notes and slides and it felt more jig-like than jazz waltz, in keeping with her background in the folk idiom. L played a few extraneous strings but completely altered the learned tune both rhythmically and melodically to fit with the new ¾ accompaniment. This kind of immediate adaptation of a melody is taken for granted but requires a whole aural/physiological conception of the tune that can be remoulded to fit a different time feel and L could do this with a new and unfamiliar tune, spontaneously and completely naturally. It appears to be an indication that a trained musician is a natural improviser and that the time taken to learn the skill of improvisation in the jazz idiom, is involved with technical parameters, creating ideas and cohesion within the style, not learning the act of

improvising itself. The process of immediate adaptation of imagining the new form of the tune in relation to the altered accompaniment, whilst keeping similar contours and outlines is strong evidence for the existence of the schema in that the relationships between the intervals had already been abstracted and could be altered rhythmically at will. In this case, the tune was compressed, lightened and moving more quickly through the harmony and it is also noteworthy that this kind of adaptation can occur so soon after a tune is learned.

After a 70 minute break L played the *All the Things You Are* by heart again **R2** to ascertain how much of it she had remembered because she was very sceptical that she could memorise the tune so quickly. This area relates to whether the schema is stabilised after one particular episode of learning or whether it requires practice sessions separated by time in order to complete memorisation. L's view from her own past experience was that it would take several days to memorise the tune thoroughly. With a couple of prompts from me, she had fully remembered it by the third time through, but in a later version, with some altered rhythms, rather than the original notated one that she first learned. The process appears to be that when the piece is recreated from memory, it is not reproduced exactly: subtle changes are made based on different elements of the melody or a misremembering and these changes are incorporated into the next version. The piece, in this instance, was therefore in a dynamic state, not fixed but being reworked or altered with each performance. For L this seemed like a non-conscious process i.e. either she did not notice that the melody was different at all or only when there was a great incongruence between the actual notated (but un-nuanced), tune and her version of it.

7.5 Activities related to harmony

In this section, L's knowledge of jazz harmony was sought, again for the background schema, and the improvisation exercises were extended to include the functional harmony of the tune in the first few bars of *All the Things You Are,* with a view to developing harmonic improvisation. There was a brief explanation of chord families and how they related to the first eight bars of *All The Things You Are*: VI, II, V, I, IV in Ab (Fmin7, Bbmin7, Eb7, AbMaj7, Db Major) moving to II, V, I in C major (Dmin7, G7, C Major). As I played these chords, L played long notes on the roots, thirds and fifths over them to memorise both the chord progression and the elements of the chords. The intention was to provide another framework for the emerging schema and more scope for the improvisation strategies. L then created one bar long motifs to play across the chords with varying success by focussing on the theoretical elements to orientate herself through the progression.

This vertical harmony exercise was followed by a more linear task using the scales of Ab and C major and the aim was to find how the scalic approach affected L's improvisational ideas. The overall effect of L's scalic improvisation, at this early stage was a wandering, unfocused line which without the constraints of the chord tones, bore only a vague relation to the harmony. L was however, already anticipating the key changes well and quickly able to improvise through the changing keys. I suggested that she approach the linear model from a strong chord tone to orientate herself better within the progression, which she subsequently did to good effect **K5**. This enabled L to play tones from the underlying chord root movements which made more musical sense. On the eighth repeat of the first eight bars of the progression **K58** L improvised a truly interesting and beautiful line which she continued to develop

over the whole sequence. This seemed to be an example of the creation of a novel idea within the schema process and was quite unlike the improvised ideas played preceding and after it, implying that the schema is self organising and outside of conscious control. Even at such an early stage of skill development, the schema appears to enable the execution of novel ideas if only for short periods of time.

7.6 Exploring expressive parameters

Towards the end of the first session I introduced the idea of exploring more expressive approaches to improvisation which emphasised mood, dynamics and timbre in conjunction with the previous work on harmony and melody. The aims were to see whether a fundamentally different approach affected the development of the schema and to find out whether focusing on expressive aspects altered the way the beginner approached improvisation. Was there a qualitative difference between melodic and harmonic improvisation and that based on a mood, feeling or particular timbral quality? The aim within the exercise was still to provide some form of constraint but to keep the theoretical and technical aspects to a minimum and to explore more intuitive and imaginative areas. I suggested to L a number of words that evoked a different mood and subsequently she improvised over the chord progression of *All the Things You Are* having decided to play it in turn sadly, madly, gently, in a dancing mood and angrily. The effect of this more deliberately expressive approach was to alter L's playing dramatically. The 'sad' version produced a change of pace and phrasing in which L seemed more in control of the music, which had greater melodic interest. She simplified and slowed down many phrases and in the process created more effective lines and stronger ideas. In the 'mad' version, L initially sounded as if she were playing dissonant circus music, using call and answer phrases and chromatic

lines. This was the first time that L had deliberately used dissonance in her improvisation, and she added many string and bowing effects for example, slides, swoops, fast chromatic passages, and double stops. The music had tremendous energy and really came to life, indicating just how powerful the use of a word or emotion can be to the improvisation process.

From this initial brief work on using expressive qualities to stimulate improvisation, it is clear that more work should be done to explore why and how this approach works. In this specific case, the music produced was so completely different from that based on the melody and harmony of the tune that again, it appears that some aspects of improvisation are as much about unlocking and bringing out what is already there, as imposing restraints and structures. Whether this represents a different schema or an extension of the one already developing in melodic and harmonic ways, is not clear. In a later lesson L used a particularly poignant image to inform her improvisation again, with startling results.

In summary then, by the end of the first session it was clear that L was already using chord symbols explained in a previous workshop and could play the piano using them to understand the sound and structure of the harmony and melody better i.e. she was already involved in the process of developing the theoretical and practical elements of the harmony and specifically, using the clear visual patterns on the piano to help her understand them. Looking at the chords, L was seeking structural, conceptual and aural connections and working out how the melody fitted with the harmony. L could not imagine a tune without a contextual harmonic background and in *All the Things You Are,* at the start, when harmony was provided, she imagined her own from the

symbols, which did not match Kern's in places. The fingering and embodiment of the music helped L to memorise it by connecting a sound and written note to a movement and physical space on the instrument. During this first session, L was thinking in terms of unusual intervals and fingering patterns, whilst simultaneously making the sound, rather than visualising the notation. In general, L took a problem solving approach to exploring improvisational strategies using a combination of theoretical, aural and technical elements to decide which note or series of notes to play next. Constraints (of melody and harmony) provided a framework for L that was useful, and exploring expressive parameters was both creative and fruitful for her, as she played much more musically and with melodic focus using these. In terms of schema development, whilst remaining speculative, L's ability to play the tune of *All the Things You Are* immediately in a ¾ jazz waltz feel, having learned it in a straightforward 4/4 rhythm, does imply a schema framework which has abstracted the relationships between intervals and can now adapt them to a new context unrehearsed. The background jazz music schema comprising of jazz heard and any previous understanding of it, had enabled L to understand the chord symbols and harmony, and the already learned motor schemata for playing the viola, was obviously being enhanced with more emphasis on aural parameters and triggers. The sound and feel of jazz music was however clearly not yet in her aural imagination and so could yet inform the improvisational process.

7.7 Session 2

7.7.1 Aims

The aims of the second session were ascertain L's progress during the previous week and to explore her perception of her own developing improvising skill. A second aim was to continue work on *All the Things You Are,* to try to see how her musical ideas were developing (with a view to seeking evidence for the growth of the schema assemblage) and to extend them using a variety of different strategies and approaches. One of the predictions of schema theory is that the specific parameters of the skill have to be thoroughly learned before variable practice is introduced, hence the focus on one standard and it referential framework. The work was to include the following: the swapping of four bar phrases, requiring more interactive and quicker response; transposing the tune by ear, again to work out the stability of the schema; improvising on the transposed chords for a similar purpose; introducing a new, simpler tune (*St. Thomas*) and learning a tune aurally to strengthen the primary aural to motor connections proposed by schema theory, to increase repertoire and vary the style of pieces (*Don't Get Around Much Anymore*).

The second part of the lesson consisted of listening to a Maria Schneider Jazz Orchestra piece (*Allegresse)* to develop aural abilities and to introduce L to some new music but also to ascertain broader aural memory skills and to begin to enhance the listening schema. In the final part of the lesson Monk's *I Mean You* was learned aurally, to extend listening skills, incorporate more jazzy rhythms and develop repertoire.

7.7.2 Methodology

The lesson was organised in a similar way to session 1 in that a range of activities based on improvising to an accompaniment were conducted, and extended where possible to include new pieces, techniques and approaches. The main aim, as previously stated, was to help L to develop her improvisational skills in a holistic and musical way, whilst attempting to follow the process of schema development through observation and questioning.

7.7.3 Activities and outcomes

L began by describing her work and thoughts about it during the previous week. L was becoming aware of the gap in her listening knowledge of jazz (highlighted in the previous session) and was taking responsibility for her own learning by seeking different players to listen to. She was also thinking about the kind of style and sound that she wanted to imitate. L had found that she was unable to improvise on her own, (mainly due to lack of accompaniment), in the same way as she had in the lesson and felt at this juncture that the process was just too difficult for her: **R2 L: 'And I felt this is just too hard-I just can't do it. So…. but I didn't give up; I thought I would broaden the range of what I was listening to see if there were any clues to be found there and I also thought I'd tackle technical things because that seemed like something positive that I could do.'** L seemed to understand that she had to be able to imagine more musical ideas within the genre, in order to be able to improvise with more fluency and individuality. She listened to Jean-Luc Ponty a jazz violinist: **R5 'So, I listened to that and I thought, you know, there's lots of options for what sort of sound to make: there's the following the voice option; then there's the following the tradition of jazz violin playing or there's trying to make something**

else out of nowhere, which is a bit, I suppose, what the viola is..' L was beginning to be aware of and to explore the options for sound and approaches through wider listening specifically associated with her instrument.

L had focussed her practice on technical aspects and significantly, had simplified the complex position fingering on the neck of the viola by imagining it to be the neck of the guitar. By moving her whole hand up and down the neck, to change keys and chords, she was able to keep the same fingering which allowed her to focus on the sound of the notes. Describing the process L said: **R7 L: 'I thought another way of tackling the chords is to treat the fiddle neck like a guitar and instead of trying to figure out the chords wherever they might be, to use a similar fingering for all of them and shift up and down more.' R8 L: 'Which is loads easier because you're using the same finger on the same part of the chord and all you have to remember is whether it's major, minor or seventh.'** In other words, this changed perspective gave a consistency to the fingering patterns and simplified the complex technical problems in that area that may have been inhibiting L's improvisational ideas. This strategy which used a visual pattern approach on the fingerboard is interesting and perhaps stems from watching what I was doing on the guitar. L had imposed imaginary frets on the viola and so instead of changing positions (with altered fingerings and spacing); she simply moved the pattern back and forth as one would on the guitar. This appears to indicate the formation or evolution of the schema for technical parameters i.e. finding an individual way to internalise the physical and conceptual aspects of the chord tones (and scale notes) using a logical and consistent fingering pattern. Whether this simplified approach to fingering was carried over in the folk and classical music that L also played, is not known but there seemed not to

be a conflict between the standard fingering procedure that she had used over many years and the new fingering for improvisation.

In the second week L also realised that jazz improvisation is essentially a communal art and that playing with others is crucial to and enhances both the learning and performing process, so she had been practising with a bass player. She had also played the violin for ease and contrast and found that the physical differences between the viola and violin had altered her approach to improvisation, specifically because of the higher register in the violin and the comparative smallness of the body and neck of the instrument.

During the teaching/facilitating activities, *All the Things You Are* was revisited, with L improvising in a more confident and controlled manner and more cohesively over longer periods. Overall, L's phrasing was over a longer time-frame i.e. eight or sixteen bars rather than two to four bars and had more cohesion melodically. When I asked L how she felt about the improvising she said: **A2 L: 'Bits of it were nice',** implying that she was not really aware of the qualitative change in her playing. The beginner improviser compares their current performance to the times when the solo really came together briefly and they are not aware of the general qualitative difference and incremental progress. Fours, in which L responded to two-four bar phrases played by me, were also developing well and because this requires a quick answering response, indicated that higher level motor/aural skills were at work. This positive response was an indication of schema development in the area of automaticity of aural to motor connections, which enabled her to listen to my playing as well as to the progression, whilst performing her own improvised ideas simultaneously. It means that L was able

to move into higher levels of skill albeit briefly because her concentration was not yet sufficiently developed to consistently integrate all the necessary elements. She also accompanied me by playing bass lines and chord tones much more rhythmically and was finding her way through the changes well.

More work was done on transposing *All the Things You Are* into a variety of keys to assess the stability of the schema and the technical fingering aspects. L was asked what she was thinking of during the transposition: **T1 L: L: 'The intervals. It sort of, it goes off the map where** (*thinks and looks up*) **it's a bit of the tune where it goes into an easy key and now by shifting a semi-tone it goes into difficult keys. So I suppose that bit felt like an anchor before and now feels like…. blimey.'** Interestingly, L uses a known territory metaphor of the map and going off it, presumably into uncharted areas. She is also aware that the key changes to a more difficult one and perhaps that too holds her back in the middle section. Similarly, she saw the middle eight of the original key as easier than the surrounding harmony and therefore like a safe 'anchor' point within a moving sea of changing chords. I suggested to L not to think of the chords or notes conceptually but rather the relationships between them. If the relationships between the original intervals had been thoroughly abstracted, schema theory predicts that they can be adapted into a new context (in this case a key). However, there may still be technical fingering problems even with a simplified system because the neck of the viola is not long enough to encompass every key as the guitar is, (hence the variable fingering patterns that are traditionally learned).

To extend the exercise, L then improvised in the transposed key and came adrift in the second section which she then related back to the framework of the original melody, although now in a new key. In the middle section, she simplified the line somewhat but in the correct keys and then again related the line back to the tune in the last section, wandering slightly out of the key at the end. This indicates, however, a very high level skill i.e. of improvising by ear whilst transposing what is already a complex tune. L does supremely well at even attempting this at such an early stage. In terms of the schema, it appears that it was developing for the harmony as well as the melody because L was able to abstract the relevant information to improvise in the transposed key, albeit whilst returning to the tune at times. This appears to be a large amount of information to be able to extrapolate and adapt from one tune. I asked L what she felt about her improvising at this point and she accurately assessed where she was: **T4 L: 'There are places where it really goes and other places where I completely lose it. But when I lose it, it's like there are places I can catch up with it, just about.'**

Again, there is a sense of the bigger picture forming and the overall knowledge of the standard providing a framework for finding a way through it over time. L was also aware, as before, of when the improvisation was working and when it was not, although she was still not quite in control of the process. When the improvisation works in the early stages, it seems almost arbitrary from the student's perspective and outside the conscious will of the beginner improviser. This is perhaps indicative of the non-conscious self-organisation of the schema which is at work behind the scenes directing the fingers and establishing neural links between hands (or other parts of the body) and aural centres (particularly aural memory).

After several successive choruses of *All the Things You Are* in the transposed key, we returned to the original key of Ab and I asked L how she felt her improvisation went: **T5 L: 'A big feeling of relief.' 'My fingers knew where to go in that one.'** This response seems to endorse the view that letting the fingers 'go' (out of conscious control), and the schema organise the movement is a key element in successful improvisation and we perhaps inhibit this process with the will, by consciously thinking about it, or with too much theoretical information. Just relaxing or feeling relieved seems to unlock more improvisational ideas and when this happens, the player, counter intuitively, sounds more in control and as if they have more conscious input into the process, which is the opposite of what appears to be taking place. The notion of the fingers knowing where to go is also telling, like a glimpse of the physicality of the learning process where the fingers move in space to find the imagined sounds. The motor schemata are essential to this process and much of the practice involves this spatial awareness guided by changing aural imagination and feedback of the actual music produced.

Traditionally, (as described in chapter 4) those beginner improvisers who transcribed solos learned the intervals on the instrument by memorising a fixed recorded solo in small chunks and gradually improved speed, technique and aural ability to play the whole piece along with the soloist. They were copying the musical ideas instead of creating them and by this means were also able to absorb and assimilate the jazz style of the period. By the end of this process or many similar exercises, the player could feel for and find a whole range of jazz inflected intervals and phrases by ear and having developed that facility, and having the sound of the music embedded in their aural memory, they went on to develop their own ideas and move away from the close

imitation. It is probably more difficult to make up ideas as well as implement them at the beginning in the more academic educational process, but seems more natural and everything played is individual, if sometimes a bit mundane. The main problem for the beginner improviser is hearing something that sounds like jazz.

As a contrasting exercise, L learned and played *St Thomas* by Sonny Rollins which is a short (16 bar) calypso with a simple chord progression. After the harmonic complexity of *All the Things You Are,* L found *St Thomas* relatively easy to improvise on and to transpose quickly. As in previous activities, she also used the tune for extemporisation and the rhythmic phrasing and stop sections within it. Gaining in confidence over the next few choruses, L began to anticipate and sometimes got ahead of the beat. This may be an indication that as the schema develops, with knowledge of the repertoire; it leads to greater predictability and anticipation from the improviser. It seems that here, the anticipation and the willingness to play something appropriate to the changing chord, ignored the listening feedback where L should have heard the mistake. For example, there were clashes between the anticipated and actual tonalities and harmonies that were not intended.

Throughout the lessons, I had emphasised the need to be able to sing both the melodies and the improvisations before transferring them to the instrument. The effect of the singing exercises (which seem to encourage more coherent melodic lines in a better jazz feel), appeared only to apply to the instrumental improvisation for a short time, i.e. the stronger and more relaxed sung improvisation were carried over into the next instrumental chorus, but not beyond. L, like most of the participants in the research was able especially at the start to sing better and more coherent improvised

lines than she was able to play. Whether this indicates an innate improvising schema for the voice, based on tunes learned or perhaps linked through vocal musculature to the improvisation that takes place in speech, is unclear. Later in the improvisational process, L felt that she was better able to improvise on the instrument instead of the voice simply because of practice and the number of different frameworks that she used, (including conceptual and fingering), to scaffold the process. With regard to the listening schema, L was by this time, beginning to hear variations to the notated chords played by myself, in particular, chromatic passing chords, again indicating new levels of aural ability and awareness.

During the second part of the lesson we listened to *Allegresse* by Maria Schneider, (a intricate, thirteen minute long composition for a large jazz orchestra), with a view to exploring what L could hear in a new jazz piece, structurally, compositionally, improvisation wise, timbrally and so on, and also to gauge her aural memory. Overall, the listening session (which was the first concentrated work done in this area), indicated that L needed to continue to listen to a wider range and type of jazz music in order to understand the idiom more thoroughly and assist with her improvisation.

A third tune was played in this session: *I Mean You* by Thelonius Monk, which features offbeat and over the bar phrases in a be-bop style unlike any of the tunes previously played. During the subsequent learning of the harmony, L recognised the II, V, I pattern cropping up again and this recognition may indicate the developing schema for harmony and an understanding that this pattern is one of the recurring elements in the jazz standard and therefore transferable to similar situations. L said of the piece: **L10 L: 'This one's got a complicated tune and easy chords.'** This was

L's perception of the tune but in fact, it is relatively simple with many repeating motifs and a call and answer form. It is the placement of the rhythm that is more difficult and the strength of the off beat rhythmic feel. L's classical and folk schemata appeared not to be attuned to this yet. When the improvisation began, it had the hallmarks of a folk tune, particularly because of the movement of the first two dominant chords (F7-Db7) and the 'hoe-down' feel of the soloing was difficult to alter perhaps because the progression reminded L of something she already knew and played in the folk idiom.

7.7.4 Summary of findings in session 2

From this second session it was apparent (from descriptions by L of her activities during the preceding week), that L was listening to a range of jazz violinists and thinking about the kind of sound and type of improvising she would like to be doing. Technically, she had simplified the complex position fingering on the neck of the viola by imagining it as the neck of the guitar (with frets) and moving her whole hand up and down, to change keys and chords. This process had helped her enormously because it condensed the fingering problems, allowing her to concentrate more on the sound and melodic elements. The schema here appears to encompass an efficient short cut to improving fingering capabilities. At this point also, L realised that jazz improvisation is essentially a communal art and that playing with others enhances both the learning and performing process.

Overall throughout the lesson, L was improvising in a more confident and controlled manner and more cohesively over longer periods. This was especially true of fours exchanged with me, which were developing well, with swift and appropriate

responses and much imitation, indicating higher skills at work and the development of the schema allowing aural and motor elements to be created over a longer time frame. Significantly, as well as transposing the tune of *All the Things You Are,* L was able to improvise in the aurally transposed key for some of the time, indicating high levels of adaptation within the schema, especially with regard to the relationships between intervals in the new key. However, in playing a new and much simpler tune, *St Thomas,* L found it almost too easy to learn and transpose and in anticipating the various parts of the tune and chords, tended to get ahead of the beat. The schema here appeared to be predicting too strongly and overriding the actual aural elements as they unfolded.

Although the singing exercises worked well for learning tunes by heart and for improvisation, the positive effect of the singing (which appears to encourage more coherent melodic lines in a better jazz feel), only lasted for a chorus or two, once transferred to the instrument. The listening session (which was the first concentrated work done in this area), indicated that L needed to continue to listen to a wider range and type of jazz music in order to understand the idiom more thoroughly and assist with her improvisation. During the learning of the final tune, which L found difficult to play by ear because of the irregular placement of the riff, she recognised the II, V, I chord progression cropping up again (even though I had yet to explain the prevalence of this type of progression), and this recognition is an indication that the developing schema is recognising harmonic patterns in new situations.

7.8 Session 3

7.8.1 Aims and method

This session was halfway through the case study research, and I asked L to fill in an interim questionnaire to describe her perception of her progress. The questions centred on how L thought her improvisation was developing; whether the initial goals should be altered; what she had learned that week during practice; what the focus should be for the next three weeks; what she had listened to; whether she was singing; what she enjoyed most about improvising and which approaches were most fruitful in the lessons.

Generally L felt that the improvisation was **'coming together quite nicely'**, **Q1** and that she would keep her original goals (of being able to improvise competently over any standard and to incorporate improvisation into other areas of her playing), even though she now realised they were probably too ambitious within the given time frame. During the preceding week, L had taught the tune of *I Mean You* to members of her family aurally, and this had enabled her to really assimilate it properly and to understand the importance of learning it that way (rather than by reading notation). Indeed, she had learned it herself not by using the notated copy, but by recording the chords on the piano, with a metronome and singing the tune over them, which represents a new strategy for her. She had also focused on the *sound* of the harmony before seeing it in the conceptual rational form of notated symbols. Overall, L felt she could see how elements of the solo fitted together over a longer time period so that her solos were not just reacting to the next chord but to the flow of the progression. Both singing and listening had become more important to her and central to the improvisation process rather than being supplementary.

When I asked L why she had not used the notated music (which had previously been her preferred method of learning) she said: **Q13 L: 'Oh, I had a look at the music and thought it was completely impossible** (*looks up, thinks)* **em, to work it out off that.'** This seems quite an odd response from a reading player. Perhaps because we had focused so much on a purely aural approach in the lesson, the reading became what it actually is in reality; a form of code and a very different process altogether. L stated that during the translation of the sung line of *I Mean You* onto the viola, she became aware of the 'thinking note' that she had added during the lesson in order to make the pentatonic phrase more logical to her **Q14**. The adding of the note to make the phrase what L wanted it to be, rather that what it actually was, links back to the first session where she was adding notes to *All the Things You Are* on one particular occasion of recreated memory which then became part of the next version. In the case of *I Mean You,* it is perhaps evidence of the previous schema for a pentatonic phrase overriding the actuality of auditory feedback and imposing itself on memory. It was only when L was accompanying herself and singing the melody with the added note (which made the tune out of synch with the chords), that she realised her mistake.

L had continued to guide her own learning by widening her listening to include pianist/composer Thelonius Monk and the trombonist Annie Whitehead. She also made her own decisions about the content and style of her practice sessions. L felt that she needed to work on rhythm more for the next three weeks and as previously seen in the pilot studies, stated that what she most enjoyed about improvising was **'When I do something I don't expect** *(laughs).*' **Q6.** Like the players in the earlier workshops, the implication is that it is the creative and more intangible aspects that drive musicians to become improvisers and that the perception of the player is that at

least part of the process is accepted to be non-conscious and not fully controllable. From the perspective of the developing schema, under optimum circumstances, the schema organises the various aural, conceptual and motor parameters to present something unexpected and almost outside of the conscious control of the improviser. This feeling from improvisers, that ideas come out of nowhere, is elaborated by L: **Q7 L: 'Yeah, something really nice sounding comes out that you didn't plan or when you get an idea, a sort of technical idea for something and you think you'll give it a go but it sounds quite different from what you thought it was going to** (*shrugs*) **and that can be nice.'**

L decided that singing was a most useful element in the lessons and described the connection between the voice and the instrument: **Q11 K: 'Yeah, I think what happens is your musical imagination develops and it's a bit like, well it's not quite the same because we're not talking about meaning, but it's a bit like when you understand in a foreign language, long before you can actually speak or construct a sentence, you can actually attune yourself and hear; you can more or less understand what people are saying to you. It's that kind of process.' Q12 L: 'It's when you stop again listening to the individual words and you start listening to the sense of the whole thing together, isn't it, because you don't understand all the words.'** This seems to be the feeling of the schema developing; the gestalt feeling of understanding the whole, which might disintegrate again if you begin to analyse or break it down into say, chord patterns.

7.8.2 Activities

During this session, work was focused on developing the improvisation for *I Mean You* with the intention of using the more be-bop orientated energy of the tune to take the improvisation into a new direction. I also asked L to close her eyes to see whether focusing purely on the sound (rather than the visual patterns on the fingerboard), made any difference to the quality of her improvised ideas. L used the last riff of the tune (*I Mean You*) to begin her improvisation and was slightly insecure at the start with the themes wandering more and moving in a stepwise scalic motion, but at the end of the second eight she played a wide and high interval. Throughout the continuing solo, it appeared as if she was exploring wider, different intervals and trying out new ideas. L also used the pentatonic intervals from the tune and more examples of crotchet triplets taken from the tune, especially in the middle section. In the last section L imitated the tune and played a faster triplet quaver run before landing on a distinct colour tone of the seventh which she played for a while.

The improvisational skill still appeared to be unstable and easily derailed by distractions or lack of concentration, but L was already confident enough to take risks by experimenting with bigger intervals and sounds and trying out different chord tones and rhythmic elements. The question of whether there was any difference musically when she closed her eyes is difficult to answer, but she appeared to take more chances without the visual modality keeping her hand correctly in place on the fingerboard. Without her eyes, she seemed to concentrate purely on aural to hand movements and imagine a more varied set of sounds. There appeared to be a better shape to the musical contour and more contrasting ideas in places.

However, L's perception of what she had felt and played with her eyes closed was very striking. **Q27 L: 'What happened was,** (*L kept looking outwards and forwards)* **it focuses you much more on the sound and takes you away from being who you are standing here and all of a sudden the sound sounded like somebody else** (*shrugged and smiled*) **that was really weird.'**

K: 'What do you mean it sounded like somebody else?'

Q28 L: 'It sounded really good; (*smiles)* **I was amazed.'**

K: 'It always sounds good; I've been listening to the videos, it always sounds good- right?'

Q29 L: (*laughing*) **'Yeah,** (*nods no*) **but you know what I mean, it doesn't usually sound good to me while I'm playing it.'**

K: 'Why is that?'

Q30 L: 'I don't know. Anyway, *(shrugs*) **it removed it from the sort of here and now and it also meant that** (*stops, looks left*) **yes there was a picture in my head of the relationships between the notes, I can't explain it really** (*shakes her head no*).'

K: 'Was it like a sheet of music?'

Q31 L: 'No, it was nothing like a sheet of music; it was like a three dimensional or more than three dimensional thing with some sort of strings stuck in the middle.'

K: 'These strings?'(*On the viola*.)

Q32 L: 'Yeah or like an abstraction of those strings.'

K: 'Right, so it's like the relationship between notes or chord tones?'

Q33 L: (*thinks-looks ahead and up to the left*) '**I think between notes but it's alright because the background and the harmony is there now, I can think about the**

notes, you know what I mean? I can think of the notes in relation to whatever, yeah.'

L was concerned that having experienced this kind of expansive feeling she would not be able to find it again **Q35 L: 'Yeah** (*laughs*) **- it won't be anywhere near as good as that again**.'

K: 'No, no. What do you mean?'

Q36 L: 'That sometimes that sort of thing happens and you can't capture it.'

I explained that for me, the whole point of improvisation was not to *capture* anything but to train yourself to be in a psychological state where you were open to a wide range of improvising possibilities. L then described how in the past, she had deliberately used improvisation to generate material for a song or composition, 'captured it' and fixed the melody so that it was then the same each time. Later, L said that closing her eyes had made her want to play more gently: **Q42 L: 'Yeah not gent... that's the wrong word erm,** (*thinks*) **I suppose it made me pay more attention to the sound that was coming out, to the shaping of each individual note. So, gently maybe is the right word.'**

Why should closing her eyes have such a profound effect of L's perception of her improvising skill? Perhaps, with her eyes open, she was focusing on playing 'the correct' notes based on visual patterns on the viola fingerboard and removing the visual modality forced her to actually listen and to respond to ideas aurally and without a conceptual or visual strand. It was almost as if by closing her eyes, L disconnected her self-consciousness so that she heard herself as if she were listening to someone else, perhaps in a more objective way. The visual modality tends to

ground the individual in the present situation because their identity is bound up within a visual context in which they are present in mind and body and closing the eyes lessens that. When L listened with her eyes closed, what she heard sounded good; she said: **Q28 'I was amazed.'** I tried to reassure her that nothing had changed from my perspective; she always sounded good. So here we find out, not unexpectedly, that L does not generally like what she plays. Does this negativity inhibit the learning process? Does it help to enjoy and like what we are playing or is this just a by product? Many of the great jazz improvisers had extraordinarily high standards and expectations of their playing that were entirely different from those of their listeners and audience. Trumpeter Dizzy Gillespie for example, stated in an interview towards the end of his life, that he could recall having played what he considered to be a good improvised solo, only once. L could not or did not wish to say why her improvisation did not sound good to her, but that closing her eyes **Q30 'removed it from the sort of here and now and that yes, there was a picture in my head of the relationships between the notes. I can't explain it really**.'

As to what 'it' was, L describes the image as a three dimensional or more 'thing' **Q31** with an abstraction of the viola strings in the middle of it. We might imagine this as a visual image of the schema but there is no reason to suppose that a schema can be imagined in any visual form and is more likely to be L's imaginative response to my ideas and attempts to encourage her to verbalise processes that may not be truly verbalisable or communicable. The relationship part between the notes is however interesting because that is how Schmidt (1975) envisages the schema working and how information and understanding become transferable i.e. the relationships between movements or elements are memorised, not their actuality. I had not mentioned this

aspect at all to L and so this is more objective and indicates that Schmidt's theory may have a humanly definable, perceivable form, which can indeed be visualised and imagined. L sees the relationship between the notes overlaid against a background of harmonic knowledge that she has gained over the past weeks. The final interesting aspect L mentions is that closing her eyes made her pay more attention to the sound and although this is obvious, beginner improvisers concentrate so hard on 'getting the notes right' that sound and timbre are virtually forgotten and yet are of paramount importance. Focusing on the shaping and quality of each individual note seems a good exercise in itself.

L began to improvise over *I Mean You* a second time, saying **Q43 L: 'I'll just try starting somewhere else.'** She played again with her eyes closed and began in a strikingly different manner, unfettered from the previously played arpeggio figures and indeed from slavish adherence to the chord tones altogether. L used a much simpler approach overall and appeared more controlled; she used the triplets but in a quite unformulaic way and seemed to be following a tune, and not imitating riffs or phrases.

I asked L what it felt like on that occasion to play with her eyes closed: **Q44 L: 'Not as stunning as last time obviously 'cause it's not so much of a shock and I was like thinking that time rather than focus on the fifth of the chord I'd focus on the third, so it was a bit of an experiment rather than… so it didn't come together in the same way.'** In this instance L had added conceptual information about chord tones and so perhaps the feeling of pure sound and form was not as striking. She was also expecting the change of focus from visual to aural, because of her previous experience.

Later in the session L remarked about the experience again; it had clearly made a great impression. **Q51 L: 'That shutting your eyes was just stunning and the most staggering thing about it was just, as I say, I suddenly heard myself like I was listening to somebody else and it sounded like somebody who knew what they were doing and it was like…** (*Makes a wide eyed and shocked facial expression to convey the surprise of the feeling*)**.'**

K: Just tell me what you said before about the space.

Q53 L: 'Yeh (*smiles)* **I was really surprised 'cause when I shut my eyes there was this enormous space** (*makes an open round gesture of the arm and hand*) **inside my head and I was really amazed that there was all that space there and there was all the time and space in the world just to put it together and make it happen. Then when I shut my eyes a second time and I had spent a lot of time playing around the fifths the first time and I'd not really meant to but that was how it came out. The next time I thought I'd play around in the thirds and then the space in my head had shrunk back to being sort of viola neck size with a few fingers flying around.'**

K: 'Yes, so what we should try and work on is creating the space again, so that you feel like you've got the musical space to play what you want.'

L: (*smiling)* **'What an amazing feeling to have that huge great thing just in** *(points to her head*)**.'**

This expansion and shrinking of space in the imagination as a direct result of shutting off the visual modality (by closing the eyes), is very striking, altering L's perception of how much time and space she had to create her improvised solos.

In the second half of the lesson, we returned to *All the Things You Are* and L found it easier to play rather than sing an improvisation. She herself felt that this was because the fingering 'anchors you down' **AT1** and provides another framework for memory and orientation through the tune. Thus it was at this point easier for L to play rather than sing because she had the fingering as well as the aural and conceptual frameworks to guide her.

More work was done on the expressive parameters for an improvised solo, and as on previous occasions, asking L to improvise in a particular mood or to a certain word, completely changed her whole approach **AT5**. Overall, her improvisation was more adventurous (some ideas worked, some not) and experimental. L moved away from basic chord tones to colour tones and non-chord notes and used longer and more interesting phrases. It is hard to say why this should be the case except that by focusing on a feeling and therefore on expressive sounds and their development, the conceptual, theoretical and visual aspects are put in the background, and this makes for a stronger, and more cohesive improvised musical line. Pressing's view (1988:139) that: 'In a sense, the performer is played by the music.' seems apposite here: the schema appears to organise the aural, conceptual and motor elements so that the body moves to the flow of the music with the barest minimum of conscious control by the novice improviser. But to do so, the conditions have to be optimum on every level, including concentration and various distractions can throw the beginner off balance.

During this part of the process, L realised that 'getting lost' was not such a major problem. **AT13 L: 'So getting lost turned out to be quite creative because you just carry on with what you're doing and you get back, sooner or later.'** This indicates another turning point in which L realised that mistakes are going to happen during improvisation, which could enable a more creative melodic phrase and that once the progression was fully assimilated, it was easy to find the way back into it. There was at this stage, a certain relaxing in her physical stance and attitude and some lessening of her anxiety and seriousness about the whole activity.

From my perspective listening to L's improvisation, increasingly good ideas came together, sometimes remarkably good, for brief periods and then the whole process seemed to disintegrate again, as if descending into chaos. L realised that (far from being a problem), it can be creative to get lost and find your way out of it interestingly, rather than play something predictable or easy. L could now improvise in 5/4 as well as ¾ and 4/4 and was aware that quotes from other tunes could be used during the improvisation, to give clues to listeners and to make solos sound more effective. L was also using timbral effects, for example, pizzicato for contrast and interest. I was interested to see whether L would incorporate these positive and interesting elements from the expressive exercises, into improvised solos at other times.

7.8.3 Summary of Session 3

L had continued to learn *I Mean You* outside of the lesson aurally rather than refer to the notated music and this had helped both the learning process and the improvisation. Closing her eyes had an impact on L's perception of how and what she was

improvising, although it had slightly less impact on the actual music produced and proved to be an empowering and confidence boosting event, helping L to relax into the process more. In terms of the schema, focusing on aural rather than visual/ conceptual aspects enabled a more natural flow of improvisation (perhaps by removing visual distractions as well as patterns), and allowing greater focus on aural, auditory and motor elements of the solo. The focus on sound was explored fully during work on the expressive parameters with the emphasis on the changing quality of sound. The ensuing dialogue helped to illuminate several areas including the notion (prevalent amongst beginners and classically trained musicians) that you have to 'capture' good ideas and fix them somehow, instead of creating a state of mind and body in which different ideas can flow and develop.

7.9 Session 4

7.9.1 Activities

L described her progress and activities during her own practice in the previous week. She had explored further expressive parameters in a notated folk tune with her viola teacher, by imagining herself in a particular physical space and situation. The resulting communicative power of the music she played had shocked both L and her teacher. The creation of a powerful mental image accompanied with a feeling, is like an extension of the expressive work that was done on a more superficial level in the previous week and tapping into an emotional well spring is something that Berliner's interviewee's (1994) mention. L had worked on several more technical aspects **C4** including playing the scales and modes of F# and Gb which had confused her in the last session. She had used her simplified fingering approach to practice a range of

modal scales and was beginning to understand the principle of starting any scale on any note to allow the maximum possibilities for improvisation. This could be viewed as schema development abstracting intervallic relationships to form the larger harmonic picture and a move away from seeing scales as separate and specific patterns. It is interesting that L often focused her practice on technical aspects that aided her conceptual and technical prowess, rather than the more intangible improvisation process. This was partly due I think, to her rational nature and also due to the difficulty of practising improvisation on your own, even with pre recorded backing tracks.

L had worked on her chops practice tapes[18] for forty minutes at a time in order to learn the chord tones and progression of *All the Things You Are* more thoroughly. The chops tape process initiated by Roberts (1978), forces the improviser to focus on purely melodic aspects of improvisation by paring down the harmonic background, removing all rhythmic variation (the player performs quavers throughout) and by playing the progression for ten minutes at a time non stop, so that all riffs, patterns etc are exhausted within the first couple of choruses. Again L had focused **C6** on playing the tune in different ways **'and then sometimes doing improvisation'**. She had also worked on diminished chords in *All the Things You Are* and *St Thomas* remarking: **C8 L: 'Yeah and there's a couple in *St. Thomas* as well and that led me into looking at the way the notes change; you get a line out of the thirds or the fifths or whatever that's quite interesting as well; notes that stay the same and notes that**

[18] A 'chops' tape is a recording of the chords of a standard performed by the player to a metronome, initially at a very slow tempo, which is gradually speeded up over time. The aim is to learn the chords progression slowly and systematically by focussing on improvising a continuous melodic line over the basis recording (Roberts, 1972).

change.' This comment reflected L's rational and analytical style; she liked to understand music conceptually as well as just by hearing it.

A new tune, *La Fiesta* by Chick Corea was learned aurally to introduce L to a fresh type of jazz tune with several different sections, and the eight bar bolero rhythm was used as a basis for improvisation. The aim of this activity was to focus on more rhythmic elements. A section where we swapped improvised phrases over the eight bars was particularly successful and enjoyable.

After a break, work resumed on *All the Things You Are* with exercises in which deliberate gaps were placed in the solo to give L time to think and to create a slower sense of phrasing. This was followed by focusing on making dramatic or surprising entrances and exits from musical phrases. The idea was to make the improvisation memorable to both players- to catch attention whilst incorporating the previous ideas of leaving spaces.

7.9.2 Outcomes and how they affect the schema theory for improvisation

L was using some of the techniques of the improvisation class i.e. learning tunes aurally, in other musical contexts indicating that she felt comfortable with them and could abstract useful information from them. She had also practised the more expressive approaches in the context of her folk viola playing with significant effects. Her modal scale practice allowed her to view the scales (starting on any note) in a different and more practical way, instead of seeing them as fixed eight note patterns and this may represent schema development in both technical and aural areas enabling the broader picture. L also looked at the difference between Gb and F# scales because

that had been a point of confusion particularly in the Monk tune. L increased her chops practice during the week which would have aided fluency, technique and the creation of ideas.

The aural learning of *La Fiesta* was quite slow but followed a pattern (similar to previous occasions when learning tunes), in which L approximated general contours and phrases, until the notes were heard properly and the correct notes filled in accurately. Also there was the usual confusion between various parts of the tune and sections, which continued for several successive choruses and then suddenly fell into place correctly. In addition, L asked questions about the melody indicating again that she conceptualises musical information in order to help her to learn it. So for example, she confirmed the names of the long notes in the melody, even though it was being learned aurally. At this stage in learning a new piece, L was still imagining the notes and looking to find the intervals knowing conceptually what they were rather than hearing a sound and feeling for it, because previously, her motor triggers have been visual rather than aural. Also, as previously, L added notes to fill in the tune if she could not remember the original and this would not have occurred if she had learned the tune from notated music.

Listening to L's improvisation of *La Fiesta,* it became apparent that she was perfecting a good idea over several choruses. The first playing of a good or interesting phrase appeared to be accidental or exploratory, and then the idea was recognised and remembered. The next time around it was played again and imitated over the chords or developed in another way, and although the process seemed almost compositional, there was a sense of unfinished business about it; the idea did not quite come off the

first time and so needed returning to. At the twelfth chorus, L took the viola away from her neck and looked up as if deciding what to play next. Starting in the low register, she used the pasa doble rhythm and played an ascending scale adding double stops in the next chorus. She adapted this as I played stops on the guitar, making the sound and bow strokes more percussive and adding double stops later and then turning to the low note roots of the double stops. L played them for a chorus developing the motif into rising octaves for variation. Playing the same progression over and over appears to draw out of the individual's musical resources. L did not play the same ideas for very long before varying or experimenting with them. After this last idea, she stopped of her own accord and did not say anything illuminating about what she had played; just that it was 'ok'. The implication of perfecting an improvised solo over several choruses was that L was hearing a different or better version than the one she was actually playing and moving closer towards it on each successive solo. This developing ability to remember and elaborate on previous ideas whilst comparing them to another imagined strand, indicates a high level of skill and a degree of automaticity (linked to schema growth) within the playing, to allow other elements (like aural memory) to become integrated.

At this particular stage, it was also clear that L was using a much wider range of strategies in her improvisation because the chords were simpler in a tune like *La Fiesta* and because her confidence as an improviser was growing. She was extemporising around the original melody; using different melody notes in the same rhythm; using fragments of the melody to orientate herself and elaborate on and employing a wider range of timbres, registers and effects. For example, double stopping and bowing effects; creating space within the solo and listening for a few

bars to collect herself; taking motifs through the changes; perfecting an idea over several choruses (being able to remember and develop the ideas) and experimenting with more rhythmic elements using stops, gaps and octaves. L varied her approaches and ideas frequently so that one element did not appear to dominate the process.

In *All the Things You Are* **C18** after the break, I asked L to deliberately put spaces into her improvising by playing four bars and leaving four bars rest, in order to see if consciously making spaces affected the quality of the improvisation or the perceptions of the improviser, and if so, how. In other words, I asked L to ignore the impulse to play something all the time. This strategy appeared to allow L time to think and produced a series of imitative sequential patterns indicating more control over the process. During these exercises L was staring intently at the viola fingerboard and so was perhaps relating visual patterns to aural sequences in a purely rational way. A subsequent exercise on the same tune, intended to further develop the process, involved L again focusing on making dramatic and memorable entrances and exits using echoes of previous ideas as a way to create cohesion. The aim was to make musical ideas distinctive enough to be memorable both to the improviser and the audience and L experimented with discord and the effect of it on the improvised line **C21, C22.**

The conscious and deliberate use of dramatic effects (dynamics, tremolos, pizzicato, double stops), had an energising effect on L's improvisation and served (like the previous work on expressive qualities) to give L more possibilities for sounds and effects within an improvised solo. In the midst of several solos, there was one strikingly beautiful line, at the end of which L lost track of the progression and did not

resolve the phrase. From this and other examples, it is clear that distinctive and musical phrases appear to be remembered better and over longer time periods, just as Bernstein proposed with the schema theory for movement; good and correct movements are remembered whereas incorrect or badly organised ones are not.

Another characteristic of L's improvising at this stage, was that she did not hear the necessity of resolving towards the ends of phrases or sections and this gave an unfinished and wandering quality to the music, as if something was left in mid air. The reasons for this were unclear, as most of the music she was experienced in playing, had places where chords and sections of harmony were resolved. The focus within the developing schema was still perhaps fragmentary, and L was not fully aware of longer resolving phrases or indeed, liked to improvise without resolution.

Similar ideas and motifs were now cropping up throughout the solo as L attempted to incorporate or develop them across keys, indicating a firmer grasp of the materials and improved aural memory. Overall there was more clarity in the improvised lines; a clear outline of the harmonic progression and when L was lost, she soon found her way back in again. Again, the overriding impression is that the schema 'tunes in' for a while actively co-ordinating all aural, motor, visual and conceptual elements at a high level to produce a fine and appropriate improvised line only just within the control of the novice. The schema then 'tunes out' (especially if the player becomes aware of the idea and perhaps due to the lack of sustained concentration), and the line disintegrates or wanders. The focus vanishes and the player is floundering about hearing remnants and echoes which they then try to play. As the skill progresses these 'tuned in' moments seem to happen more often.

At the end of nine successive choruses, I asked L how useful the exercises had been: **C29 L:** (*thinks)* '**Yeah, again it's like…… yeah I got warmed up when I stopped thinking about what the chords were then all of a sudden I could play; it's strange isn't it?'** The improvisation did not sound very different from previous work in the lesson, but L *felt* freed up and it is this feeling that is most important because the actual notes of the improvisation can be changed in an instance but the feeling of empowerment and being free to improvise takes longer to imagine and call up. These changes to the affective elements involved in improvisation appear to be crucial to the development of the process and may perhaps be more important than the technical/ conceptual parameters.

For the last exercise, I asked L to think about density and sparseness of notes within a phrase and to consciously use more or fewer notes. I also asked her to experiment with phrase length and to create a mood at the same time, which she decided, would be a dance, using the waltz rhythm. The mood was intended to be delicate and wistful.

At the end of seven choruses which did not sound appreciably different from previous ideas, I asked L for her views on this last activity: **C33 L: 'What was more interesting is when you said wait for every third of fourth idea because then your brain chucks out loads of ideas; it's surprising how many there are.'** L implied that her aural imagination produced many variations and ideas, not just a single option, especially if there was sufficient time given for them to develop. How or why one particular idea is chosen over another is not known but ought to be integral with the current physical and motor skills of the player; i.e. they would not be

able to play an idea beyond their technique although they may be able to imagine it. This notion would require more experimental work to ascertain.

L also mentioned several times the notion of playing the 'safe' option as the first or easiest thing that springs to mind, rather than giving herself the time and space to play something interesting or more difficult. **C38 L: 'But it's also if you have to go somewhere fast onto the next note, you go somewhere safe nine times out of ten, so it gives you more room to do things that are less safe.'** Like the participants in the pilot study groups, L was aware of playing safe in her improvisation and this appears to be the same process whatever the level of experience of the player; the more creative approaches are sought but sometimes do not happen. At this point also, there was still a feeling from L that the music was controlling her. In response to a comment from me that the tendency is to play lots of notes and leave no spaces L said: **C34 L: 'And once you've started it you've got to carry on haven't you?'**

7.9.3 Summary

The indications from the fourth session were that consciously directed exercises creating drama and using effects, actually broadened the scope and possibilities of L's improvising and that more exercises in this and the expressive domain could be fruitfully explored and developed. By this time, L appeared to be using a wider range of strategies in her improvisation and at times everything came together to produce some startling and interesting improvised lines. L's state of mind and perception of how she was doing were clearly fundamental to her motivation, even though they appeared (at this stage) to have a minimal effect on the actual music produced. Being in an open, relaxed and aware frame of mind is however crucial to developing as an

improviser and L seemed to have reached that state more often in this session. In terms of schema development, there was still a strong sense of L being controlled by the music in some sense and of the schema 'tuning' in and out; providing glimpses of great music and then chaos. However, L's perception of this was variable; at times she was aware of a good idea, at others not and the process of improvisation was almost independent of her state of mind or consciousness of it. The notion of playing 'safely' again cropped up and the exercise of not playing the first idea that came into her head helped L to choose from a range of ideas and to be more actively creative and 'unsafe'! At this stage, L was only at times in complete control of the music, for the most part it was 'playing' her with varying results.

7.10 Session 5

The main purpose of the final session was to review work done; to evaluate progress where possible and to suggest areas for future practice in order for L to continue the process.

7.10.1 Activities

During the previous week, L had been practising scales and tunes in different positions: **F2 'I've been doing a lot of playing things in different positions like reworking the tunes in different positions and working all the scales in all the different positions which suddenly made lots of technical things tie together.'** Elaborating about her previous understanding that scales (on the viola from a classical training perspective), could only be played in one fixed 'right' place with the correct fingering L said: **F2 L: 'and of course, there isn't a right fingering; there's**

wherever you happen to be when you want to play it.' F4 'I pick a scale for today's practice and I've been doing all the hard ones as you suggested and then just going through five or six different positions and playing it in each of those positions. You realise that you use some of them an awful lot and some of them not very much at all because they're awkward anyway. As you said about chord positions, you're stretching your hand in ways that you wouldn't normally because in a classical piece you tend to finger it in the easiest way and then keep playing it like that.'

The alteration and broadening of scale knowledge may indicate technical/conceptual schema development to incorporate the understanding that any scale can start on any note in any position. This allows the improviser complete technical freedom of expression, because they can play the note they hear in a range of places on the instrument and is about moving away from a fixed internalised pattern, and seeing a bigger and more flexible picture.

L had tried playing the violin again in her improvisation practice and found that whilst it used to be easier (because of the size, sound and non-transposition), it was now harder, because she had worked more and solved various technical problems on the viola. It is interesting to note the way the parameters change as skills are developed on an instrument. The singing was less useful to L as she developed more understanding and improvising skill on the viola and she could feel herself moving to the intervals on the viola whilst she was singing them without the instrument! The physicality of different instruments and the ways problems are solved on them during the process of learning to improvise are clearly significant and integral to the more invisible

psychological and conceptual elements. Playing the violin (instead of the viola) also made L think of different ways of improvising: **F7 L: 'But it's interesting, again it just makes you think about the tunes in a slightly different way, so it's quite good to play them on the violin and see what you can do on that, and it's so much easier to go up high. I've been trying to put harmonics into things just because it sounds nice and having listened to some of these CD's, it's an effect that people use quite often and it's easy, so it's a good effect that.'** There is a lot more research that could be done about the relationship between the instrument and the player and how its layout and sound affects the way they approach and create improvised lines.

The activities in the final session began with *La Fiesta,* where L used a range of approaches in the improvisation and where the overall impression was one of increasing experimentation and risk-taking against a background of greater confidence in the basic materials. The simple and repeating chord progression obviously assisted the process here, but the rhythmic impetus of the tune and pasa doble rhythm provided a basis for all kinds of new and inventive ideas. Interestingly, during the last choruses (19-24) most of the phrases were resolving onto the root at the end and although this reflected the tune at that point (as it did in the other standards), this is the first time that L had deliberately resolved musical ideas at the end of a phrase and this gave the music a stronger and less wandering quality.

The chorus of fours **F8** between L and I was particularly interesting and successful in that L responded well to my four bar ideas with imitative motifs and answering phrases indicating a high level of developing skill involving immediate and appropriate musical response. Many of the phrases were also copied and extended or

the rhythmic elements of them developed and this was in sharp contrast to earlier attempts which got bogged down in aural and technical problems. Included in the fours were a range of dynamics, density of notes, timbral effects and varied scale, arpeggio and motivic features i.e. the improvisation was not restricted to purely melodic or rhythmic areas. This particular exercise was also lively and open to more exploratory and risk-taking ideas.

The overall feeling of this session was of great progress: L was more creative and thinking of one chorus at a time rather than smaller phrases and there was generally more energy and several instances of the improvisation coming together well over the eight bar sequence. In addition, L was actively imitating, copying and responding to elements played by me in exact forms or as answering phrases. The other difference between this and her first improvised choruses were the new ideas that were generated; there is much less recurrence of the Kletzmer ideas and more rhythmic energy. Most important was the feeling of fun, not laborious seriousness, but perhaps this would not have been attained without the previous work enabling a freer response.

I asked L what she felt the difference was between the improvisation of this and last week: **F10 'It feels more solid.' F11 'Yes and it's sort of flowing.'** The contradiction between solidity (or stability) and fluidity, highlights the problem of attempting to describe what is happening during the process of learning to improvise. It also sums up the main issue about what a schema is i.e. a stable structure that allows the creation of adaptive changes and fluidity. It is hard to envisage how all these elements could be embodied in a single structure or framework. I followed up

this line of questioning to ask L what she was thinking of at the time and she could not really say. I took this to be a sign of total concentration in the moment during the improvisation process so that the conscious mind was not 'thinking' at all or verbalising or judging. The improvisational process was happening in the present and because it was unadulterated (or conceptualised) response, the schema was allowed uncluttered free rein and the ensuing improvisation was at a high level of energy and skill.

I asked L to sing a few choruses again to ascertain any differences between sung and instrumental improvisation at this stage. This exercise was not a success in that it seemed to represent L's improvisational skills at a previous level rather than in the present. I asked L how she felt: **F14 L: 'It was harder at first because the tune's like it's in my fingers now.'** Having focused on played improvisation, it was now harder to L to sing and she related this to her fingers; the music was in her fingers now and not her vocal chords any more. **F15 L: 'and once the tune's in your fingers you don't have to think about it any more.'** This is obviously so, except that with the improvising, *all* the potential movements have to be in the fingers also, not just the relatively fixed parameters of a tune. It is the potential movements relating to all of the potential intervals (learned through a range of different tunes), that takes the schema time to organise; there are so many variables including timbral ones.

I asked L to sing and play at the same time to help to reconnect the voice to instrument process and she found this to be useful: **F20 L: 'It was and I was also…. it frees…..it takes all that thinking about what your fingers are doing away because you're actually focusing on the voice. Well, you're focusing on the what**

note and how it's going to be; on the sound of it rather than the technical problems and I was thinking, I'm not sure if I can just like... it's weird isn't it? Doing jumps and things and just making them bigger and bigger and still seeing if I could sing them so I was testing myself out.'

L's perception was that the improvisation is better with the voice which I'm not sure is true but she seemed more confident doing it this way. L also said that she focused on the sound of the voice and the note rather than any technical element although it was clear from her own description of the process, that sometimes the fingers rather than the voice lead or at least appear to do so.

There followed some work on *I Mean You* with L singing as well as playing and when asked how different the process was when using the voice she replied: **F20 L: 'It wasn't a huge amount; the voice got me going but then I wanted to play in parts of the instrument that my voice wouldn't stretch to.'** This remark seems to highlight again the apparent conflict between different physical parameters and also indicates that L did not use her voice frequently under normal circumstances. More research work needs to be done on the role of the voice in developing instrumental improvisational skill as there is clearly not a direct correlation between them.

The final questionnaire sought to elicit L's views and perceptions of her progress over the five weeks, particularly on the effectiveness of the teaching/learning approaches and ways of continuing her practice, and only succeeded in this aim on a practical and superficial level. (As previously mentioned, the responses to questions asked spontaneously during the research were more revealing). Her first comment was that

the length of the lessons was too short, as were the one week gaps between them and she always felt that she ought to have done more. L enjoyed the one to one lessons better than the workshops because of the greater time spent on playing and not being self-conscious amongst others. She also wanted to continue her improvisation but within the context of a performing group and so was looking for jam sessions where she could do this. She had become aware of the value of communal playing in jazz during the lessons (especially the jazz feel in the accompaniment) and had also begun to enjoy practising again because of all the new possibilities available to her.

8. Findings and implications of the practical investigation and how they relate to schema theory

8.1 Evidence of beginner schema development – the abstraction of intervals from a melody to a new variation

One of the most compelling pieces of evidence for the schema, from the practical research (both in the group workshops and the case study), is the ability of students to immediately adapt a tune they have learned by heart into new rhythmic variations and different keys, without prior rehearsal or practice. This was clearly observed in the case study in the first session, when L learned the tune of *All the Things You Are* by heart. She was then asked to perform it in different ways, to ascertain how the schema was developing i.e. whether the learned relationships between the intervals could be abstracted and adapted to a new context. As I accompanied her on the guitar with a swing rhythm, L changed the feel of the tune immediately in response to the different energy of the accompaniment, which was very different from her previous renditions and quite unlike the previously learned notated form. L also changed the articulation by adding slides and slurs, as well as shortening some notes and lengthening others and played with verve and confidence incorporating the rhythmic changes without missing a beat, just by being focused on and responding to, the accompaniment. This would seem to indicate that the schema for this tune had developed sufficiently for her to adapt it and even to add small changes by being given hints from and imitating the musical context of the accompaniment. L's learning of the melody by that stage also appeared to by automatic enough for her to add different articulations, indicating that schema development was already enhancing the adaptable nature of the emergent skill.

Similarly, when the same exercise was repeated in ¾ time in a jazz waltz feel, (which needed a very different rhythmic approach requiring a shortening of the notes and a general lightening of the phrasing), L was able to instantaneously 'translate' the tune into the new time feel and rhythm. She completely altered the learned tune both rhythmically and melodically, to fit with the new ¾ accompaniment and this kind of immediate adaptation of a melody requires a whole aural/physiological conception of the tune that can be remoulded to fit a different time feel. L could do this with a new and unfamiliar tune, spontaneously and completely naturally. The skill appears to be an indication that a trained musician is a natural improviser and that the time taken to learn improvisation in the jazz idiom, is involved with technical parameters, creating ideas and cohesion within the style, not learning how to improvise itself. The process of immediate adaptation by imagining a new form of the learned tune in relation to the altered accompaniment, whilst keeping similar contours and outlines, is strong evidence for the existence of the schema in that the relationships between the intervals had already been abstracted and could be altered rhythmically at will. In this case, the tune was compressed, lightened and moved more quickly through the harmony and it is also noteworthy that this kind of adaptation can occur so soon after a tune is learned. It indicates the first stage of schema abstraction in that it abstracts basic information from the tune in the form of extemporisation i.e. there is no real creative improvisation as yet.

The fingering and therefore the embodiment of the music also helped L to memorise the tune (and the therefore the abstractions), by connecting a sound and written note to a movement and physical space on the instrument. During this first session, L said

that she was thinking in terms of unusual and larger intervals and fingering patterns, whilst simultaneously making the sound, rather than visualising the notation. In general, L took a problem solving approach to exploring improvisational strategies using a combination of theoretical, aural and technical elements to decide which note or series of notes to play next. Constraints (of melody and harmony) provided a framework for L that was useful, and exploring expressive parameters was both creative and fruitful for her as she played much more musically and with melodic focus using these.

8.2 Schema theory related to understanding the harmony

L was presented with chord symbols that were explained to her in a previous workshop and then played them on the piano in order to understand the sound and structure of the harmony and melody better. She was therefore already engaged in the process of developing the theoretical and practical elements of the harmony and specifically using the clear visual patterns on the piano to help her to hear and understand them. Looking at the chords, L was seeking structural, conceptual and aural connections and working out how the melody fitted with the harmony. It became clear during the research process that L was unable to imagine a tune without a contextual harmonic background and in *All the Things You Are,* at the start, when harmony was not provided in the accompaniment, she imagined her own from the symbols, which did not match Kern's in places. This indicates a first stage schema for harmony because L was still attempting to understand chord tones and sounds from the written symbols and was not fully aware of the related functional harmony, being at an early stage of listening and assimilating jazz harmony in general. The background jazz music schema comprising of jazz heard and any previous

understanding of it, had enabled L to understand the chord symbols and harmony and the motor schemata which was already learned for viola playing, was obviously enhanced with more emphasis on aural parameters and triggers. The sound and feel of jazz music was however, clearly not yet in her aural imagination and so could not sufficiently inform the improvisational process.

8.2.1 Evidence for the developing/intermediate schema for harmony- the abstraction and recognition of chord progression from one standard to another

In the second session *I Mean You* by Thelonius Monk was played, in a be-bop style unlike any of the tunes previously attempted. During the subsequent learning of the harmony, L recognised the II, V, I pattern recurring again from *All the Things You Are,* which may indicate the schema developing for harmony and an understanding that this pattern is transferable to other standards in different keys. As a teacher, I had not focussed specifically on the II, V, I progression although I had explained it in terms of chord families in relation to a particular key. L was subsequently able to find other examples in new material which helped her in improvising over new standards (as was the intention).

Referring to the same tune (*I Mean You)* L said: **L10 L: 'This one's got a complicated tune and easy chords.'** In fact, the tune was relatively simple, with many repeating motifs in a call and answer form; it was the placement of the rhythm that was more difficult and the strength of the off beat rhythmic feel. L's classical and folk schemata were not attuned to this and as she began her improvisation, it had all the hallmarks of a folk tune particularly because of the movement of the first two dominant chords (F7-Db7). The folk feel of the soloing was difficult to alter, perhaps

because the progression reminded L of something she already knew and played. This is evidence that the overall listening schema was as yet undeveloped in the jazz be-bop idiom and that what L heard within the melody, she did not understand in relation to her previous listening. As she learned the melody aurally, she came to understand it better and to realise that she was adding a note (that she called a 'thinking note', see below) to make the phrase more like the pentatonic falling phrase she was used to.

8.3 Schema theory relating to expressive parameters- evidence that a different process is at work

Another important finding was that working specifically on expressive parameters rather than melodic or harmonic aspects enabled L to generate strikingly different improvisatory ideas. Her attention to sound, melodic flow and timbral effects were greatly enhanced by focusing specifically on more expressive approaches and de-emphasising the harmonic elements (although we had previously worked on these). More research in this area would be highly beneficial because it seems to draw on other more affective sources within the individual and this kind of approach might be used as a means of 'unlocking' or liberating ideas already present within the improviser. Overall, throughout the project, L brought a rational and conceptual way of dealing with music to bear on the learning of improvisation which proved to be both a strength and a weakness because on several occasions, L anticipated musical phrases based on logical and known patterns, for example, the pentatonic scale and these replaced the actuality of the aural phrase (i.e. in the first phrase of *I Mean You*). The expressive work removed all of these aspects and the resultant improvisations were of a different order and style, implying that there may be several different voices within the improviser that require drawing out. Perhaps expressive work should be

done in tandem with more technical and conceptual practice from the beginning. Whether this represents a different schema or an extension of the one already developing in melodic and harmonic ways, is not clear. It should also be noted that work had already been done on the melodic and harmonic basis for improvisation which perhaps L was able to draw on in expressive work in a more intuitive way. In a later lesson, L used a particularly poignant image to inform her improvisation again, with startling results.

8.4 Schema theory related to wider listening within the jazz idiom

Evidence of schema theory in the second session related to L's listening in the week between lessons and her realisation that she needed an aural (as opposed to theoretical or conceptual) model or series of them, in order to decide what kind of approach and sound she would use in her own improvisation. This was indicated by her following description of listening to Jean-Luc Ponty, a jazz violinist: **R5 'So, I listened to that and I thought, you know, there's lots of options for what sort of sound to make: there's the following the voice option; then there's the following the tradition of jazz violin playing or there's trying to make something else out of nowhere, which is a bit, I suppose, what the viola is..'** This was the first occasion that L had listened to jazz violinists specifically in order to understand their approaches to improvisation and to inspire her own ideas. It is part of the broader listening schema required to develop aural memory and imagination.

During the second part of the second session when L heard *Allegresse* by Maria Schneider, she was clearly unused to listening to contemporary large ensemble jazz and unsure of the time feel, instrumentation and various elements involved in the

compositional structure and improvisation. The listening session (which was the first concentrated work done in this area), indicated that L needed to continue to listen to a wider range and type of jazz music in order to understand the idiom more thoroughly and assist with her improvisation. The general jazz listening schema is vitally important for developing aural memory and a sense of the rhythmic feel and harmonic possibilities involved in learning improvisation. During the progress of the lessons, L continued to guide her own learning by widening her listening to include Thelonius Monk and the trombonist Annie Whitehead, and by making her own decisions about the content and style of her practice sessions.

8.5 Schema theory and evidence of the technical schema developing

Indications of the development of a technical schema were also present in the second session when L focussed her practice on technical aspects and significantly, had simplified the complex position fingering on the neck of the viola. She imagined it to be the neck of the guitar (with imaginary frets) and moved her whole hand up and down to change keys and chords, thereby keeping the same fingering and allowing her to listen more on the sound of the notes. Describing the process L said: **R7 L: 'I thought another way of tackling the chords is to treat the fiddle neck like a guitar and instead of trying to figure out the chords wherever they might be, to use a similar fingering for all of them and shift up and down more.' R8 L: 'Which is loads easier because you're using the same finger on the same part of the chord and all you have to remember is whether it's major, minor or seventh.'** This changed perspective gave a consistency to the fingering patterns and simplified the complex technical fingering problems that may have been inhibiting L's improvisational ideas. The strategy, which used a visual pattern approach on the viola

neck, is interesting and probably came from watching what I was doing on the guitar. It appears to show the formation or evolution of the schema for technical parameters i.e. finding an individual way to internalise the physical and conceptual aspects of the chord tones (and scale notes) using a logical and consistent fingering pattern. Whether this simplified approach to fingering was carried over into the folk and classical music that L also played, is not known but there seemed not to have been a conflict between the standard fingering procedure that she had used over many years and the new fingering for improvisation. The schema here appears to encompass an efficient short cut to improving fingering capabilities.

8.5.1 Schema theory and further evidence of technical/motor schema using the fingering as another framework for improvisation.

Later in the second session L returned to *All the Things You Are* and found it easier to play rather than sing an improvisation. She herself felt that this was because the fingering 'anchors you down' **AT1** and provides another framework for memory and orientation through the tune. Thus, it was at this stage easier for L to play an improvisation rather than sing it because she had the fingering as well as the aural and conceptual frameworks to guide her. This provides further evidence for the development of the technical/motor/fingering schema and how it is another useful improvising framework, although perhaps based initially on visual patterns. The singing proved less useful because there was not fingering framework: the muscles of the voice were working invisibly.

8.5.2 Schema theory and evidence of abstracting information into other contexts and extending the motor/technical schema with modal scale practice

L was using some of the techniques of the improvisation class for example, learning tunes aurally in other musical contexts, indicating that she felt comfortable with them and could abstract useful information from them. She had also practised the more expressive approaches in the context of her folk viola playing with significant effects. Her modal scale practice allowed her to view the scales (starting on any note) in a different and more practical way, instead of perceiving them as fixed eight note patterns and this may represent schema development in both technical and aural areas enabling the assimilation of a broader and more flexible picture. L also looked at the difference between Gb and F# scales because that had been a point of confusion particularly in the Monk tune.

8.5.3 Further evidence for the development of technical/motor schema

There was further evidence for the development of the technical/motor schema in the fifth session, when L had been practising scales and tunes in different positions: **F2 'I've been doing a lot of playing things in different positions like reworking the tunes in different positions and working all the scales in all the different positions which suddenly made lots of technical things tie together.'** Elaborating about her previous understanding that scales (from a classical training perspective), could only be played in one fixed 'right' place with the correct fingering L said: **F2 L: 'and of course, there isn't a right fingering; there's wherever you happen to be when you want to play it.' F4 'I pick a scale for today's practice and I've been doing all the hard ones as you suggested and then just going through five or six different**

positions and playing it in each of those positions. You realise that you use some of them an awful lot and some of them not very much at all because they're awkward anyway. As you said about chord positions, you're stretching your hand in ways that you wouldn't normally because in a classical piece you tend to finger it in the easiest way and then keep playing it like that.' The alteration and broadening of scale knowledge may indicate technical/conceptual schema development to incorporate the understanding that any scale can start on any note in any position in order to allow the improviser complete technical freedom of expression (because they can play the note they hear in a range of places on the instrument). This is about moving away from the fixed, internalised pattern and using scales as a flexible tool.

8.5.4 Evidence of intermediate technical/motor schema development-the fingers 'knowing' where to go

After several successive choruses of *All the Things You Are* in the transposed key, the tune was played in the original key of Ab and I asked L how she felt her improvisation was progressing: **T5 L: 'A big feeling of relief.' 'My fingers knew where to go in that one.'** This response seems to endorse the view that letting the fingers 'go' (out of conscious control) and the schema organise the movement is a key element in successful improvisation and we perhaps inhibit this process by consciously thinking about it or by layering it with too much theoretical information. Schema theory predicts that motor programmes will become increasingly automatic and non-conscious as the skill develops and L's explanation of her fingers knowing where to go without her conscious input reinforces this notion.

8.6 The developing schema is indicated by the use of a wide range of improvisational strategies

During the second session it appeared that the schema for improvisation was developing because when *All the Things You Are* was revisited, L was improvising in a more confident and controlled manner and more cohesively over longer periods, playing phrases of eight or sixteen bars rather than the two to four bars she had attempted initially. Instead of looking at each individual chord or phrase, it appeared that L was thinking in terms of moving through the harmony and attempting more intricate lines. When I asked L how she felt about the improvising she said: **A2 L: 'Bits of it were nice',** implying that she was not really aware of the qualitative change in her playing. The beginner improviser seems to compare their current performance to the times when the solo really came together briefly and they are not aware of the general qualitative difference and incremental progress.

Later in the fifth session, it was clear that L was again using a still wider range of improvisational strategies especially on *La Fiesta* because both the melody and the chords were simpler and because her confidence and ability as an improviser was growing. L was extemporising around the original melody; using different melody notes in the same rhythm and using fragments of the tune to orientate herself and elaborate on by employing a wider range of timbres, different registers and effects. For example, she used double stopping and bowing effects and created space within the solo by listened for a few bars before continuing with the improvised line. She also played the same motif through the changes altering it to fit the harmony and perfected an idea over several choruses because she could remember and develop the ideas, whilst experimenting with more rhythmic elements using stops, gaps and octaves. L varied her approaches and ideas frequently so that one element did not

appear to dominate the process, and this appears to indicate the developing schema allowing her to use a variety of different approaches and sounds.

There was also evidence for continuing schema development through L's response to two and four bar phrases initiated by me. This whole area developed progressively over the course of the research period and appears to reflect the changing nature of the schema and therefore the ability of the player to respond automatically and appropriately in imitating phrases. The positive response seems to indicate schema development in the area of automaticity of aural to motor connections, which enabled L to listen to my playing as well as to the flow of the chord progression, whilst performing her own improvised ideas simultaneously.

8.6.1 Evidence of schema development with the ability to improvise in a transposed key

In the second session, evidence of the developing schema was indicated by the fact that L was not only able to transpose the melodies and rhythmically alter them at will but also to improvise in the transposed keys. She used the framework of the melody in the new key to guide her when she got lost, then explored the harmonic background of the new keys. This indicates a growing level skill and increasing schema sophistication i.e. of improvising by ear whilst transposing (chordally and melodically), a relatively complex tune. In terms of the schema, it appears that it was developing for the harmony as well as the melody because L was able to abstract the relevant information to improvise in the transposed key, albeit whilst returning to the framework tune at various times. The information abstracted from the standard,

therefore involved not only the intervals of the melody but the root movements and types of chords and appears to be a large amount of information to be able to extrapolate and adapt from one tune. I asked L what she felt about her improvising at this point and she accurately assessed where she was: **T4 L: 'There are places where it really goes and other places where I completely lose it. But when I lose it, it's like there are places I can catch up with it, just about.'**

8.6.2 Evidence of schema development –anticipating too soon

On a slightly less positive note, when L learned and played *St Thomas* by Sonny Rollins (which is a short AAB format 16 bar calypso with a simple chord progression), she found it relatively easy after the harmonic complexity of *All the Things You Are,* and was quickly able to transpose it and to improvise over the chord progression. As in previous activities, L also used the tune for extemporisation and imitated the rhythmic phrasing and stop sections within it to good effect. However, as she gained in confidence and fluency, L began to anticipate the chords and phrases and often got ahead of the beat. This may be an indication that as the schema develops, it leads to greater predictability and anticipation from the improviser. It seems that the anticipation and the willingness to play something appropriate to the changing chords, overrode L's listening feedback which should have been hearing the mistake. For example, there were strong clashes between the anticipated and actual tonalities and harmonies, which were not intended. The ability of the brain to filter out what it considers to be dissonant or irrelevant information is (as previously noted) an integral part of schema development because it is impossible for a person to take in all of the sensory information presented to them on a daily basis. This indicates the

importance of recording improvisation (and other musical practice) in order for the improviser to really hear what they are playing, as opposed to what the brain decides is happening or is focussing on. The area of filtering also relates to Pressing and Johnson-Laird's ideas about the 'limited processing power' of humans: the very structures that enable comprehension, cohesion, integration of information and broad understanding, may in certain circumstances also restrict or limit the same processes.

8.7 Evidence of intermediate schema- altering the ways of learning a tune from notated to aural

Further evidence is provided for the development of the intermediate schema when L decided to learn *I Mean You* aurally, rather than from the notated copy, which was previously L's preferred method of learning. When I asked why L had not used the notated music she said: **Q13 L: 'Oh, I had a look at the music and thought it was completely impossible** (*looks up, thinks)* **em, to work it out off that.'** This seems quite an odd response from a reading player, although perhaps because we had focused so much on a purely aural approach in the lesson, the reading became what it actually is in reality; a shorthand form and aide-memoire. L stated that during the translation of the sung line of *I Mean You* onto the viola, she became aware of the 'thinking note' that she had added during the lesson in order to make the pentatonic phrase more logical to her **Q14**. The adding of the note to make the phrase what L wanted it to be, rather that what it actually was, links back to the first session where she was adding notes to *All the Things You Are* on one particular occasion of recreated memory which was then repeated in the next version. In the case of *I Mean You,* it is perhaps evidence of the previous schema for a pentatonic phrase overriding the actuality of auditory feedback and imposing itself on memory. It was only when L

was accompanying herself and singing the melody with the added note (which made the tune out of synch with the chords) that she realised her mistake. This activity also indicates the positive use of the voice to learn a melody; something which altered in usefulness throughout the learning process depending on L's skill level.

8.7.1 Evidence of intermediate schema-not only playing notes that fit but creatively exploring improvised ideas

The intermediate schema is also indicated by the change in attitude from beginner improviser wanting to play something correct which fits with the harmony, to the person who takes risks and enjoys the fact that improvisational process will not always be controllable. L said that what she most enjoyed about improvising was **'When I do something I don't expect** *(laughs).*' **Q6.** Like the players in the earlier workshops, the implication is that it is the creative and more intangible aspects that drives and sustains musicians to become improvisers and that the perception of the player is that at least part of the process is accepted to be non-conscious and not fully controllable. From the perspective of the developing schema, under optimum circumstances, the schema appears to organise the various aural, conceptual and motor parameters to present something unexpected and almost outside of the consciousness of the improviser. This feeling from improvisers, that ideas come out by themselves is elaborated by L: **Q7 L: 'Yeah, something really nice sounding comes out that you didn't plan or when you get an idea, a sort of technical idea for something and you think you'll give it a go but it sounds quite different from what you thought it was going to** (*shrugs*) **and that can be nice.'**

8.7.2 Evidence of intermediate schema development- relaxation and the ability to cope with 'mistakes'

During this latter part of the process, L realised that 'getting lost' was not such a major problem. **AT13 L: 'So getting lost turned out to be quite creative because you just carry on with what you're doing and you get back, sooner or later.'** This indicates another turning point in which L realised that mistakes happen during improvisation which could enable a more creative melodic phrase and that once the progression was fully assimilated, it was easy to find the way back into it. There was at this stage, a certain relaxing in her physical stance and attitude and some lessening of her anxiety and seriousness about the whole activity. The relaxation and calming element is often referred to by sports coaches as the point at which the athlete is really able to cope with and extend their new skills because a degree of competence, fluency and automaticity has been achieved. This appears to be the case at this stage of L's skill: there was a noticeable change of attitude from mildly stressed to light hearted and relaxed, as if the process has been assimilated at a deep level and could now be practiced fully.

8.7.3 Evidence of the developing schema –extending rhythmic and timbral parameters

At this stage, further evidence for the developing intermediate schema was indicated by the fact that L could now improvise in 5/4 as well as ¾ and 4/4 and was aware that quotes from other tunes could be used during the improvisation, to give clues to listeners and to make solos sound more effective. L was also using timbral effects, for example, pizzicato and double stopping for contrast and interest. Some of these

elements were incorporated into the melodic and harmonically based improvisations towards the end of the five weeks.

8.7.4 Evidence of schema development: using general contours that are later filled in with more detail

Many times during the process, general contours of a tune were memorised and then the specific details filled in. For example, the aural learning of *La Fiesta* followed a pattern (similar to previous occasions when learning tunes), in which L approximated general contours and phrases, until the notes were heard properly and the correct notes filled in accurately. Also there was a similar confusion during the learning and memorising process, between various parts of the tune and sections, which continued for several successive choruses and then suddenly fell into place correctly. In addition, L continued to ask questions about the notes of the melody indicating that she conceptualised musical information in order to help her to learn it. For example, she confirmed the names of the long notes in the melody, even though it was being learned aurally. At this stage in learning a new piece, L was still imagining the notes and looking to find the intervals knowing conceptually what they were rather than hearing a sound and feeling for it, because previously, her motor triggers have been visual rather than aural. Also, as previously, L added notes to fill in the tune if she could not remember the original and this would not have occurred if she had learned the tune from notated music.

8.7.5 Evidence of improvement in aural memory and the development of the schema for longer ideas

There is evidence for improvement in aural memory and the development of the schema for improvisation over a longer timeframe, in L's improvisation of for example, *La Fiesta.* It became apparent that L was perfecting a good idea over several choruses and was only able to do this as a result of improved aural memory and a sense of the longer, more developed musical idea. The first playing of a good or interesting phrase appeared to be accidental or exploratory, and as the idea was recognised and remembered, the following time, it was played again and imitated over the chords or developed in another way. The implication of perfecting an improvised solo over several choruses was that L was hearing a different or better version than the one she was actually playing and moving closer towards it in each successive solo. This developing ability to remember and elaborate on previous ideas whilst comparing them to another imagined strand, indicates a higher level of skill and a degree of automaticity (linked to schema growth) within the playing to allow other elements (like aural memory) to become integrated.

8.8 Evidence that the schema is still at an intermediate stage- lack of resolution

There was a further indication that the schema was at an intermediate stage during the fourth and fifth sessions, because a characteristic of L's improvising at this stage was that she did not hear the necessity of resolving towards the ends of phrases or sections and this gave an unfinished and wandering quality to the music, as if something was left in mid air. The reasons for this are unclear; she may simply not have been aware of the lack of resolution or was too bound up in the improvisatory process to focus on

it. By the final tune (La Fiesta) of the last session, L was resolving at the ends of sections and where needed during the progression, indicating that the schema elements had further developed.

8.9 Evidence of generalisation of schema

Also by the fourth and fifth sessions, similar ideas and motifs were now cropping up throughout the solo as L attempted to incorporate or develop them across keys, indicating a firmer grasp of the materials and improved aural memory. She was beginning to be able to choose phrases and to adopt a specific musical identity. Overall there was more clarity in the improvised lines; a clear outline of the harmonic progression and when L was lost, she soon found her way back in again. This would seem to indicate the beginnings of a generalisation within the schema and the development of the individual voice in which certain phrases or motifs are preferred over others.

8.10 Evidence of schema developing -leaving safe options behind

L mentioned several times the notion of playing the 'safe' option as the first or easiest thing that springs to mind, rather than giving herself the time and space to play something interesting or more difficult. **C38 L: 'But it's also if you have to go somewhere fast onto the next note, you go somewhere safe nine times out of ten, so it gives you more room to do things that are less safe.'** Like the participants in the pilot study groups, L was aware of playing safe in her improvisation and this appears to be the same process whatever the level of experience of the player, i.e. the more creative approaches are sought. At this stage also, there was still a feeling from L that the music was controlling her. In response to a comment from me that the

tendency is to play lots of notes and leave no spaces L said: **C34 L: 'And once you've started it you've got to carry on haven't you?'** This provides evidence that the schema is still at an intermediate level, although well beyond the initial 'playing safe' and getting the right notes stage.

8.11 L's perception of schema development

Later on in the improvising process, I asked L what she felt the difference was in her improvisation, between one week and the next: **F10 'It feels more solid.' F11 'Yes and it's sort of flowing.'** The contradiction between solidity (or stability) and fluidity, highlights the problem of attempting to describe what is happening during the process of learning to improvise. It also sums up one of the main issues about what a schema is i.e. a stable structure that allows the creation of adaptive changes and fluidity. I followed up this line of questioning to ask L what she was thinking of during her improvisation and she could not really say. I took this to be a sign of total concentration in the moment during the improvisation process so that the conscious mind was not 'thinking' at all or verbalising or judging. The improvisational process was happening in the present and because it was unadulterated (or conceptualised) response, the schema was allowed uncluttered free rein and the ensuing improvisation was at a high level of energy and skill.

8.12 Indications of the developing viola schema - singing and violin playing are not longer as useful to the improvisational process

Also in session 5 was some evidence that the schema for improvisation specifically on the viola was developing because, L had tried playing the violin again in her

improvisation practice and found that whilst it used to be easier (because of the size, sound and non-transposition), it was now harder. L had by this time, worked more on the viola and solved various technical problems on the instrument, particularly on fingering and scales. It is interesting to note the way the parameters change as skills are developed on an instrument. The singing was less useful to L as she developed more understanding and improvising skill on the viola and she could feel herself moving to the intervals on the viola whilst she was singing them without it! The physicality of different instruments and the ways problems are solved on them during the process of learning to improvise, are clearly significant and integral to the more invisible psychological and conceptual elements. There is a lot more research that could be done about the relationship between the instrument and the player and how its layout and sound affects the way they approach and create improvised lines.

When I asked L to sing a few choruses, the exercise was unsuccessful, in that it seemed to represent L's improvisational skills at a previous level rather than in the present. I asked L how she felt: **F14 L: 'It was harder at first because the tune's like it's in my fingers now.'** Having focused on played improvisation, it was now harder to L to sing and she related this to her fingers; the music is in her fingers now and not her vocal chords any more. **F15 L: 'and once the tune's in your fingers you don't have to think about it any more.'** This is obviously so, except that with the improvising, *all* the potential movements have to be in the fingers also, not just the relatively fixed parameters of a tune. It is the potential movements relating to all of the potential intervals (learned through a range of different tunes), that takes the schema time to organise; there are so many variables including timbral ones.

8.13 Indication that the schema provides cohesion and improvement in aural memory

The overall feeling of the last session was that L had made great progress and was more creative and thinking of one whole chorus at a time rather than smaller phrases. There was generally more energy and several instances of the improvisation coming together well over the eight bar sequence. In addition, L was actively imitating, copying and responding to elements played by me in exact forms or as answering phrases. The other difference between this and her early improvised choruses were the new ideas that were generated: there was much less recurrence of ideas in the folk idiom and more rhythmic energy. Most important was the feeling of light heartedness, but perhaps this would not have been attained without the previous work enabling a freer response.

8.14 Evidence of schema development related to memory

Other findings from the individual case study relate primarily to memory and how this may work in relation to schema development. A significant finding at the start of the research process was that during the learning of a melody from musical notation, L would change a note or rhythm as part of the process of memorisation and for some inexplicable reason that change would become fixed and integrated into the next version as a dynamic process. This was part of (an essentially improvisatory) overall strategy by L in which music forgotten or memorised incorrectly, was made up to fit the harmonic and rhythmic framework of the standard. L also remembered the contour of a phrase and approximated it in a generalised form before filling in the specific details on progressive listenings. She was however, only consciously aware of

seeking unusual features or large intervals, and perhaps her memory was providing anticipatory links to these kinds of features. The question of why an element of knowledge or skill is memorised on one occasion and subsequently fixed is not understood, but perhaps has to do with the neurological change from short term to long term memory. It is also probably affected by the number of times that particular memory is recreated. What elements allow memory to be alter movement on one occasion and not another? Perhaps the stabilising elements of the schema process inhibit constant change, which would not allow anything to be learned, but on occasion enable some element to be altered and over time, as the schema develops, the smaller errors are corrected.

The mismatch that was often observable in L between what she remembered as the tune and what she sang back was appears also significant to schema development because the implication is that the memory has the original correct version or a contour of it, with which to compare with the actual one being sung. Or it may be that the brain, having evolved to detect patterns just 'knows' that the sung version is different in some way from the original in aural memory. In either case, the question of whether a whole or partial solo is created in the mind which is then executed by motor schema or whether we merely adapt an idea and go with the flow of it, remains unanswerable.

Another finding related to memory was that the learning and memorising of a melody appears to proceed in a chaotic fashion, not in a series of rational steps (as most things are taught). It appears that suddenly after much confusion, preparation and problem solving, the piece is learned all at once and played in one time frame. Viewed as

whole and gestalt framework, it could be that *all* of the elements required for the schema to work have to be in place before it can operate. It may also be evidence of the self-organising nature of the schema and might explain the sudden feeling of knowledge or skills 'falling into place' in much learning process, especially after long and arduous effort.

Still related to memory, another finding was that L's aural memory was challenged by more complex jazz rhythms and melodies because she had not heard enough of the music to comprehend them, as her background listening schema was firmly based within the western classical and folk tradition. As a result L tended (initially at least), to change rhythmic or melodic elements that appeared incongruous to her to fit her own schema of the appropriate rhythm. This 'established musical background knowledge schema' was so strongly felt in L that at times the difficulties of incorporating alien rhythmic patterns appeared to almost cause her physical pain, as evidenced in grimaces recorded on video. This relates to the point previously made in the general findings about the need to have a background schema for the style and genre of music through listening and deep assimilation, before embarking on the process of learning to improvise.

8.15 Evidence for the self-organising nature of the schema

Indications of the self - organising nature of the schema were present throughout the individual case study research. At many times during the practice of improvising using vertical and more horizontal aspects of the harmony, it became clear that after solving the various aural and motor problems in various different ways, L would suddenly play a perfect or interesting improvised line in which all the elements came

together in a highly integrated and musical way. The solo line would then drift away again to be replaced with more prosaic music. It appears that the schema organises the various multi-modal processes, and that at the beginning, it focuses in and out rather like a radio signal until higher levels of skill and concentration are developed and sustainable within the individual. Thus even at the beginning L was able to improvise some interesting, novel and creative phrase but not consistently.

8.16 The varying effect of singing on schema development

It is interesting that the effect of singing exercises on L's improvisation varied throughout the process. Sometimes it was useful to create more musical and coherent lines and at other times it was a restraining influence because of motor skills being developed on the instrument and there was a conflict between what L could hear, sing and play. As an aurally based process, I felt that singing ought to be beneficial, however, more work needs doing in this particular area.

8.17 Closing the eyes and how that affected schema process

Asking L to close her eyes had a profound (and positive) effect on her perception of her own sound and style and how much space and time was available to her in the improvised solo. Closing her eyes focused L on the *sound* she was making by removing all visual patterns (L often stared at the fingerboard of the viola for long periods). It also seemed to remove time constraints allowing her to think and play in a relaxed way. The image that she saw of an abstract viola is similar in dynamic quality to that of the most experienced blind-fold chess players described by Binet (1966) and also close to how Schmidt (1975) viewed the relationship between movements and

elements in schema development. It might be useful to expand on work with the eyes closed and to encourage the development of images which may help the improvisation process. A final issue here is that in L's case, closing her eyes also shut out her consciousness of who and where she was so that she just listened with a positive judgement. The effect of a negative 'voice in the head' may be counteracted in some way, perhaps using exercises that require higher concentration.

The effect of this positive feeling was felt during the subsequent improvising, where L realised that getting lost or making a mistake could turn out to be a creative sidestep and that the actual mistake does not matter much (unlike in classical music). This understanding relaxed L and the music generally. It was noticeable the way that L created and perfected an idea over several choruses; it began as a vague contour or motif and was gradually developed over successive choruses indicating the schema at work in a compositional way. It was also noticeable that L was using a wide variety of strategies for the improvisation; extemporisation, fragments of melody, different timbres and other effects and so on.

8.18 General Findings

The most significant finding across all the practical research was that the participating musicians were naturally able to improvise in some form from the beginning of the process. In other words, in the trained musician, the schema for improvisation would appear to be already in place, although dormant, underutilised or neglected. This was indicated by the fact that, without exception, students were able to take a jazz tune that they had learned by heart and without prior practice, play it in a different time, style or key. This in itself provides strong evidence for the existence of the schema;

the melody, (learned from notation, memorised in aural memory and spatially as intervals on the instrument), was adapted instantaneously and without rehearsal to fit altered parameters. In later exercises, the tune was transposed with the same ease where the spatial relationships between the intervals were remembered but where notated conceptual elements were used i.e. transposed keys, chords and chord tones, these appeared to inhibit the physical process. The implication is that improvisation is a completely natural activity for a musician and that the difficulties related to it are technically, culturally and stylistically based. In addition, improvised ideas that were sung first (in the initial workshop settings), sounded stronger and more musically coherent and grounded although this element was compromised slightly as their instrumental skills developed.

A second general finding was that the use of conceptual and theoretical knowledge to scaffold the improvisational skill at the beginning was not particularly helpful to the majority of players and perhaps confusing to the fundamental aural imagination-to-motor process that is the primary driver of schema development. In other words, improvisation itself appears to be founded primarily on a real or imagined sound transferred to motor schemata, and only after this is established does theoretical information help to either develop understanding or further instrumental technique. The schema for imagination to muscle movement again seems to be naturally present and merely in need of exercising, especially with regard to spatial awareness of intervals (previously triggered by musical notation).

A third finding was that individuals perceive and understand what they have learned very differently, even though they may have assimilated and produce similar skills.

This finding is based on the many different responses to the question (what have you learned today?) asked during a workshop where only one participant answered with a response relating to the material that was actually taught. This might be an issue of communication/verbalisation or something more fundamental about how the individual brain operates but in any case, the schema appears to be idiosyncratic and highly dependent on previous experience.

A fourth finding is that the schema appears to be self-organising given that the improviser is practising solving the associated problems, so that it can organise and integrate the multi-modal elements. As a consequence, during practice, all the elements of a successful solo come together periodically (often to the surprise of the student), and then disintegrate again, until the schema is stabilised and well established. Practising a wide range of different tunes in varying contexts seems to help with this stabilising process as Bernstein and Schmidt both predicted in schema theory. Extremely high levels of concentration are required in order for the brain to juggle and organise the various parameters: (aural, motor, kinaesthetic, visual and conceptual), and the process is mostly unconscious and difficult to verbalise on the student's part except in a post-rationalised way. It is as if they seek to find some underlying reason for a process that is almost beyond their conscious control (excepting the will and motivation to do it). Likewise, peer learning, imitation and collaboration also appear to be significant in the improvisation process and proceed again, in an almost a non-conscious fashion with players soaking up ideas and approaches from other players.

A fifth finding is that (unsurprisingly) unless the sound and feel of the music has been assimilated and absorbed in some form, previously by the improviser, it is impossible for them to improvise in the jazz genre; hence the importance of listening and transcription in more traditional methods of learning.

8.19 What are the implications?

The primary implication from the research is that improvisation is a naturally occurring skill that largely remains dormant due to the educational and cultural norms that predominate in much of Western society. The schema for improvisation is already present because there is much evidence to suggest that the brain is organised in a schema based way: i.e. all skills from walking to thinking are learned in a physically based way and are adaptable to the unique and individual circumstances we come across through life. When improvisation is based around melody and voice initially, the naturalness of it becomes apparent because everyone is able to sing an improvised melodic line (we have after all, a huge repertoire of songs to draw on). However, all the musicians involved in the research project had difficulties in improvising a similar line on an instrument without any kind of framework and the process had to be learned rather than just woken or unlocked. The implication is that if improvisation was begun at the start of learning the instrument and in tandem with the learning of notation, then it would also be a prevalent and natural skill. The problem of 'translating' aurally imagined or sung sounds onto the instrument for classically trained musicians is that they have habitually triggered motor patterns from visual notation and this process has to be altered so that sounds move the muscles.

The implication of a second finding; that conceptual/theoretical information in most cases, hinders rather than scaffolds improvisational process at the beginning, is also significant. Most standard jazz improvisation methods are based on assimilating much theoretical information, particularly in harmony, before any real work begins on improvisation *per se.* To contrast this with more traditional methods, historically, most players learned by aurally transcribing solos from records, which would tend to strengthen the aural to motor and muscle processes. There is no doubt that conceptual and theoretical information relating to chordal and harmonic aspects of tunes is necessary at some point in the learning process, but perhaps beginners need to focus on more basic elements at the start.

The idiosyncratic way that students perceived what they learned has implications for all teachers and suggests that a number of multi-modal and very different approaches to teaching the same subject would be most beneficial to students. It also has implications for assessment if students have difficulties explaining clearly what they have learned: learning process that cannot be verbalised requires different kinds of evaluation.

The apparently self-organising nature of the schema also has significant implications for teaching, which suggest that more effort should be put into creating the right environment for schema development especially if it is largely out of the conscious control of the student. Rather than focusing on outcomes or targets involving the assimilation and regurgitation of large amounts of information, time might be better spent in creating physical and psychological environments in which the brain can

operate optimally, strengthening all the connections required to create multi-modally operating higher order cognitive and motor schemata.

8.20 Major issues that remain unresolved

Of the many issues that remain unresolved (along with the many questions still to be answered) about a schema theory, two seem to be highly significant. Firstly, the existence of the schema is currently un-provable at any kind of psychological, physiological or neurological level. I have made the case in this thesis that the schema is a systems property and given that it could be called up by any set of neurons in a recreative memory model, i.e. never in the same way or place twice, it is unlikely that any proof of its existence will be found in the near future. Yet, although it is hard to imagine an experiment or series of them that would show definitive proof, it is equally difficult to envisage how dynamic and adaptable motor and thought process could work without some kind of schema structure. Greater understanding of memory is needed and in particular how and why memory is altered on one occasion and not another, if we are to fully comprehend how the schema can be both a stable framework for the recreation of a thought or skill and adaptable to new ideas or elements, at the same time. What happens in the stabilising process (if indeed that is what it is) and then in the altering process? How can it be both fluid and stable simultaneously?

Lastly, the view put forward in this thesis, is that the brain appears to work in an improvisatory way, based on assemblages of schemata that have been learned and abstracted fundamentally through movement, (either consciously or not). This may have profound implications for the ways in which we learn and educate others.

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