The Mediating Effects of ICT upon Music Composition in the Classroom

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Abstract

Composing is well-embedded into statutory classroom music in English schools and Information and Communications Technology (ICT) has played an increasing role in this activity. How ICT affects the composing process and the ways in which teaching and learning might need to change to make the most of the technology's potential are, however, not well understood. Extending the view that creativity is a normal feature of human existence to composing in the classroom, this thesis considers ICT to be a means for pupils to realise their potential without having acquired formal theoretical and practical musical skills.

Taking a holistic view of the composing process, and seeking to take into account as many of the mediating effects of the naturalistic classroom environment as possible, Multimodality was adopted as a theoretical framework. This theory requires a consideration of a wide range of data of many types, for example, from the distinct perspectives of spoken, written, visual, spatial, gestural and musical 'modes'. A key aspect of this theory that was utilised to illuminate pupils' transformations of previously existing musical ideas was 'Design and Transformation'. To facilitate the categorisation, linking and presentation of data, a computer-based tool was developed.

The main finding was that the teacher's learning design is the key influence upon the composing process with ICT, particularly the balance of freedom and constraint in the design of activities. Teachers should be aware that pupils will bring ideas of their own into the classroom and therefore need to be informed about their out-of-school musical activities. Experimentation is an essential part of the composing process and can reveal much about pupils' transforming of prior musical ideas, yet is often not able to be appraised by teachers, with many of the ideas frequently not appearing in the final composition. Pupil role should be considered, both in terms of providing the opportunity to engage in all aspects of the composing process with ICT and also in the creation of a single group product. A key mediator of collaboration was found to be the classroom layout, particularly in terms of furniture and equipment. The multimodal theoretical framework was found to be both useful and illuminative in the context of the music classroom and worthy of further exploration.

Dedication and Acknowledgements

This thesis is dedicated to my wife, Maureen.

I would like to record my thanks to the teachers and pupils who took part in this study, for talking to me and allowing me to video them.

I would to say 'thank-you' to my supervisors Rosamund Sutherland for her constant support and to Laurinda Brown for her encouragement.

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The support of fellow students has also been invaluable. I would particularly like to thank Lawrence, Steve and Sarah.

Finally, I would like to thank my parents for their many years of support for my academic work.

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Author's declaration

I declare that the work in this dissertation was carried out in accordance with the Regulations of the University of Bristol. The work is original, except where indicated by special reference in the text, and no part of the dissertation has been submitted for any other academic award. Any views expressed in the dissertation are those of the author.

SIGNED: N. M. Breeze DATE: 28.02.08

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Chapter 1. Introduction

1.1 The background to the study

This study grew out of concerns that arose regarding the adoption of computers in music classrooms whilst teaching in secondary schools and facilitating in-service courses for practising teachers. Having studied at a London conservatoire, I began my professional life as a musician, playing the trumpet, piano, bass and singing as well as composing and arranging music. The eclectic mix of musical styles that I was engaged with, for example, as orchestral trumpet player, pianist for cabaret and theatre, transcriber of top lines for rock musicians and jazz bassist, was probably formative in establishing what I consider to be my catholic outlook on music.

Following my professional music career, I trained to be a music teacher. I undertook various posts including those of instrumental and secondary classroom teacher, and was later employed as composer-in-residence for a local authority, subsequently gaining a post based at a school with performing arts specialist[1] status. During this time I developed my own philosophy of music education, that in broad terms considered that music should not be an elitist subject but should be equally accessible to all. It seemed strange to me that music was an important part of the everyday lives of young people, yet relatively few would take the subject for public examination at ages 16 and 18. Technology had played an increasingly important part in my roles as music classroom teacher and composer to such an extent (perhaps because I was keen to embrace the possibilities of the new equipment), that I undertook the role of consultant, initially to music teachers within the local authority, and subsequently to a wider audience through my connections as General Certificate of Secondary Education (GCSE) principal examiner with a national examination board. During this time, I noticed that the focus of the courses I was facilitating was moving away from the technicalities of how to use equipment, towards exploring how effective designs for learning could embrace the use of technology in music classrooms. This is exemplified by the work I undertook for the Excellence in Cities[2] programme, facilitating twilight courses for secondary music teachers, hosted by two of the (then) new City Learning Centres (CLCs)[3] in Bristol; the focus of the courses was upon producing schemes of work for year 9 pupils using technology, and involved trialling these schemes with groups of pupils from the teacher's school during the time at the CLC, and the subsequent revision of them in preparation for use in the classroom.

It was while I was engaged in facilitating in-service-training courses for teachers that my

interest in the effective use of technology in the music classroom grew and I began to question how its use, particularly when using computers, changed the processes used by learners. An aspect of my work as composer-in-residence had been working with pupils in school often on an individual basis, both with and without computers; I had noticed that the processes used by the pupils seemed to exhibit differences, dependant upon whether they used the computer or not, and I became motivated to investigate what these differences might be. Also, I came to realise that there were many other influences upon these processes, such as the design of the activity, the physical layout of the equipment and furniture, the potentials of the software and pupils' previous musical encounters. I was particularly concerned that amidst a culture of rapid adoption of technology by school music departments, little empirical research was being undertaken into the many aspects surrounding its use in the classroom. As a result of these issues, I felt motivated to undertake research into the use of computers in the music classroom with the aim of advancing knowledge in this area through the development of a better understanding of the processes engaged in by pupils and with the intention of producing outcomes of use to practitioners.

1.2 Underpinning notions

Before proceeding to describe the research problem and present the research questions, the following underpinning notions are explained in order to enable discussion of them in the following sections.

1.2.1 The learning environment

The learning environment is viewed in this study as consisting of many contributory aspects. Perhaps most immediate to the pupils are the learning resources and tools they use, such as worksheets, whiteboards and computers; however consideration is given here to pupil interactions, the physical arrangement of furniture and tools for learning, the actions of the teacher, extra-curricular music, such as instrumental playing, out-of-school musical encounters and seemingly 'invisible' aspects, such as the expectations and norms of the music classroom built up historically over time and whole school attitudes to music. Closely allied to this notion of learning environment is that of learning design, or the ways in which teachers orchestrate its various aspects to enable effective pupil learning. It is considered that all of these have an impact upon the processes that are investigated and analysed in this study.

1.2.3 The composing process

'Composing' in schools is a relatively recent phenomenon and arose principally from a concern in the 1960s that pupils were not sufficiently involved with the manipulation and shaping of musical elements to create work of their own, as they were, for example, in art. 'Composing' now forms part of the mandatory music curriculum in England and should be engaged in by all pupils aged 5 to 14 educated in government maintained schools. 'Composing' in music classrooms has become characterised by active work in groups of 3-6 pupils using traditional and electronic instruments to create pieces of music to a brief set by the teacher. This is typically part of a larger activity which also involves listening to other music, including teacher models, as well as performing the newly created work. The material selected by pupils and the processes used by them during its manipulation and shaping using computers into a final composition form the basis of this study. The composing processes employed by pupils are inevitably affected by influences external to the immediate composing group and these effects are also investigated. The term 'composing' is chosen rather than 'composition' as the former refers to the process and the latter to the product; it is the process that is of primary concern in this study.

1.2.4 Mediation

This study is predicated on the view that all human action is mediated by tools (Cole & Engeström, 1993; Wertsch, 1991), which refers to a wide range of material and symbolic artifacts. Tools in the music classroom could be computers, worksheets, language (both written and verbal), musical instruments and whiteboards. The use of the term 'mediate' is used here in the sense elucidated by Wertsch (1998). This refers to the interaction between human action and tool, or 'agent and mediational means' (p.25), focusing in this study on the effects on composing in the classroom engendered by the use of computers. Furthermore, tools such as the computer and music keyboard are viewed as tools that not only 'organise and constrain activity' (Pea, 1993: 48) but also carry 'intelligence' within them (ibid., 53) and so contain certain potentials for pupils. However, this 'person-plus' (Perkins, 1993: 89) system consists of more than just the pupil and the computer and music keyboard, but incorporates many other items in its 'surround', such as other pupils, the classroom, the teacher and worksheet - in other words, the whole learning environment.

1.2.5 The computer in the music classroom

Computers are used for various functions related to learning in the music classroom, as

discussed further in chapter 2. The focus adopted for this study has been upon their most popular application, that of MIDI sequencing, which involves the creation of music through the recording of typically short pieces of music via a music keyboard, that are then added to, edited and layered to produce complete compositions. The sequencing software is itself based on earlier hardware sequencers and was originally intended for use in professional music production environments.

1.3 Setting the problem

Following the initial concern to investigate how the computer affected the processes adopted by pupils in the music classroom, the overall aim of this research is to investigate the process of composing with computers in the music classroom focusing on the use of MIDI sequencing.

Active pupil engagement in music composition has been the subject of much debate in England, particularly since the 1970s (Paynter, 1970; Schafer, 1965) which has led to its gradual adoption in the classroom and eventual inclusion as a central part of the National Curriculum for Music (DES, 1991, 1992; DfEE, 1995, DfEE, 1999). The practical issues surrounding group composing have more recently, however, been highlighted (Odam, 2000) and the design of some group activities criticised. Technology has had a role to play in music classrooms ever since the subject was first taught, with digital technologies, especially computers, having been increasingly adopted since the 1980s. These have been linked to two key positive impacts: the raising of standards in composition (Ofsted, 2004a:4) and increased access (Reese, 1995: 37; Byrne and MacDonald, 2002: 268-9), particularly the opening up of composing to pupils without formal practical or theoretical music skills (Airy and Parr, 2001: 44; Mills and Murray, 2000: 141) and the 'democratisation' of music that MIDI software can promote (Chadabe, 2005: 315; Sutherland et al., 2004: 10).

Empirical studies into group composing processes when using computers in the music classroom are rare (Gall and Breeze, 2005; Dillon, 2003), although Seddon (2006) has studied collaborative pairs situated in different countries composing via email; this situation is somewhat surprising since it is the normal mode of engagement for primary and younger secondary pupils when composing with computers as part of the English mandatory music curriculum. However, there have been studies that have focussed on group composition processes without music technology (Fautley, 2005; Odam, 2000; Wiggins, 1999/2000) and those that focus upon composing individually with music technology (Kratus, 1989; Wilson and Wales, 1995; Nilsson and Folkestad, 2005;

Folkestad et al, 1998; Seddon and O'Neill, 2003), which provide insights from related perspectives.

The links between pupils' musical lives inside and outside school in formal and informal settings have recently been explored (Folkestad, 2006; Green, 2005) and calls made for teachers to make increased efforts to link up these aspects of pupils' musical worlds, particularly with reference to music technologies (Crow, 2006). Existing research of music classrooms has tended to take a less than holistic approach to the study of composing with computers, some focusing on compositional products (Davies, 1992; Swanwick & Tillman, 1986; Kennedy, 1999) and others on the musical aspects of composing processes (Kratus, 1989, 1991, Fautley, 2005), often with a tendency to exclude the wider learning environment and its influences upon the process. Yet, group music composition with computers is inherently a process with many distinct yet interrelated aspects; aural (sound), visual (the computer screen, the layout of the music keyboard), linguistic (pupil talk, written worksheets), spatial (pupils and equipment are spatially located in relation to each other) and gestural (pupils communicate by indicating to each other). Holistic studies that attempt to take account of as many aspects that contribute to the composing process as possible, that tell us about the organisation of this process in the classroom, and how it links to pupils' informal and formal musical preferences and experiences have yet to be located by myself and may be non-existent.

This study will investigate:

- group composing with computers in a naturalistic classroom environment;
- the interactions that take place between the pupils, the pupils and the computer and the pupils and the wider learning environment;
- the composing and its relationship to learning design

It is expected that the outcomes of the study will add to the existing body of knowledge concerning classroom composing at key stages 2 and 3 and will be of practical use to teachers.

1.4 Aims of the research

The overall aim, to investigate the process of composing with computers in the music classroom focusing on the use of MIDI sequencing, necessitated the grounding of the research in naturalistic settings, in this case, in primary and secondary classrooms. The first subsidiary aim is to investigate how the learning environment mediates the

transformation of previously existing musical ideas. This subsidiary aim is founded upon the notion of pre-existing musical ideas being available for pupils to transform; these could be those provided through the music classroom environment or from their own musical worlds. The next subsidiary aim is to identify the ideas that pupils select to transform, to investigate their possible origins, and to show how they are transformed during the process of composing. Finally, the third subsidiary aim is underpinned by the belief that the findings would be of value to practitioners, to inform their design of composing activities and hence enhance the learning opportunities for pupils.

The main aim of this study is therefore:

To investigate the process of composing with computers in the music classroom focusing on the use of MIDI sequencing.

The 3 subsidiary aims are:

1. To investigate the mediating influence of the learning environment upon the transformation of previously existing musical ideas.
2. To investigate the origins and transformation of selected pre-existing musical ideas.
3. To produce outcomes of use to classroom practitioners.

1.5 Organisation of the thesis

This chapter has described the context within which the study is placed, presented the research aims and has suggested ways in which it may contribute to the body of knowledge about the process of composing in music classrooms.

Chapter 2 is concerned with providing the background to composing in the curriculum, describing its organisation in the classroom, exploring the statutory requirements, and examining previous research into classroom composition with and without computers. The case is made for a consideration of new theories in order to investigate today's technology rich music classrooms. Chapter 3 describes the pilot study, the emergence of a theoretical framework and associated methodological concerns. Chapter 4 provides the theoretical background to the study, explaining why it was adopted, and outlines its main features, focusing on those that underpin the investigation.

In chapter 5, the methodology for the study is described and explained. It begins with an exploration of the links between the theoretical framework described in chapter 4 and the reasons for the choices made in the methodological design; in particular, it examines their

application in the two educational settings selected for the main studies. The transcription, categorisation, storage and presentation of the data is then described and an overview provided of its analysis in the following 2 chapters. Issues of reliability and validity are explored, ethical issues raised, and in conclusion, the role and interconnectedness of theory and data are examined.

Chapters 6 and 7 focus on the empirical work, presenting an analysis of the group composing data; chapter 6 is concerned with study 1 (secondary) and chapter 7 with study 2 (primary). In each chapter, the learning environment and lesson structure are initially examined before a lesson-by-lesson analysis is made. Firstly, the teacher's lesson designs are explored, followed by an analysis of how the pupils transformed these designs. These transformations are then investigated in the light of the adopted theoretical framework, and finally their possible origins are examined. Each chapter concludes with a general discussion of the pupils' transformations, firstly focusing on the constraints of the lesson design, and secondly upon the origins of the transformations, taking into account the potentials of the learning environment, the possible origins of the transformations that originated outside the classroom environment and the transformation of those provided by the classroom environment. A wider consideration is then made of the transformations within the whole learning environment, concentrating on aspects such as the effects of seating position, the potentials of the visual representation of the music, the effects of keyboard fingering and pupil role.

Chapter 8 provides a higher level analysis of the similarities and differences between the transformations in the two studies, based on the observations made in the preceding two chapters. Firstly, the mediating influence of the constraints of the learning environments upon the composing processes are examined and compared, followed by a detailed consideration and comparison of the origins and potentials of the transformations. Using examples drawn from a sub-section of pupils, their composing is examined and compared in the light of the previously considered constraints and potentials.

The final chapter, Chapter 9, returns to the aims, discusses the investigation and debates the findings, suggesting the possible implications of these for composing in the music curriculum at key stages 2 and 3. Then follows a discussion of the usefulness of the findings for classroom practitioners and an examination of the potential of the adopted theoretical framework for illuminating the process of classroom composing with computers. The chapter concludes by reflecting on the 'research journey' of this study and suggests questions for further research. Owing to the many technical terms used in this study, a glossary is provided, which can be found after Chapter 9.

1 See http://www.specialistschools.org.uk/
2 See http://www.standards.dfes.gov.uk/sie/eic/
3 See http://www.bristolclcs.org.uk/

Chapter 2. Music composing in the classroom with computers

2.1 The background to the use of computers for music in the classroom

This chapter outlines how music technology has been adopted in music classrooms and traces its impact upon primary and secondary schools in England through an investigation of inspection and research evidence.

2.1.1 Composition and music technology

The development of musical composition is inexorably bound up with the development of technologies able to be used for its realisation (Middleton, 1990, Pitts & Kwami, 2002). Some examples are:

- the development of instruments such as keyboard instruments, evidenced by the composition of increasingly complex pieces for the organ which developed rapidly during the baroque period by such composers as Buxtehude and Bach and in the development of piano music from the enlightenment onwards by such composers as Mozart, Beethoven, Brahms, Chopin and Liszt;
- the development of stringed instruments, as evidenced by compositions for violin by composers such as Vivaldi and Corelli in the late 17th and early 18th centuries;
- the development of amplification systems in the early 20th century, transforming the acoustic balance of instruments and voices (van Leeuwen, T., 1999: 25) and later, through overdriving amplifiers, for special effects such as those used in rock music by electric guitars (for example, distortion became an integral part of the sound of heavy metal music);
- the development of electronics, allowing for the development of firstly electric instruments such as the Hammond organ (adopted by musicians for use in rock and pop music, though not originally aimed at these contexts), the Moog synthesizer and Fender Rhodes piano (which became almost synonymous with the sound of 1970s popular music) and more recently, the development of digital instruments, such as the Yamaha DX7, Kork M1 and Triton keyboards, each with their own distinct range of timbres and programming possibilities.

The development of sound recording has a much shorter history; from wax cylinders, to magnetic tape, to digital, it has steadily evolved from the late 19th century onwards. Sound

recording was concerned initially with capturing musical performance in real time but evolved during the 1950s to provide the possibility for musicians to 'multi-track', or to record one sound on top of another, which could be undertaken at different times, thus allowing musicians to create complex, multi-layered recordings of which they would not be capable of playing 'live'. The Beatles were one of the first British bands to make use of this technology, famously heard on their 'Sergeant Pepper' album. It was the rapid development of micro-electronics in the latter part of the 20th century that hastened the further development of recording technology, resulting in today's digital music production tools. Itself a development of previous recording technologies, the digital sampler (developed in the 1970s) allowed musicians to use their own or others' musical fragments to layer complete pieces. This provided not only the means to multi-track, although initially this was only possible with relatively short sounds owing to memory restrictions, but also the means to repeat sounds, or 'loop' them, as well as transform them in many other ways, such as changing the pitch, tempo or timbre. These sampling techniques were used extensively in house, hip-hop and techno music, for example, art forms that completely rely on electronic means for their realisation. Indeed Warner claims that:

> Recording gave music a new kind of material reality ... (1996: 49)

As a result of the wide adoption of these recording techniques, Warner also notes:

> ... certain genres of music are inextricably linked artistically to the recorded medium. (1996: 49)

Following on from the stand-alone sampler was the development of computer hardware and software, enabling the sampling and sequencing of musical performances. The popular computers used for music in the 1980s (Atari ST, Amiga and Apple Macintosh computers) employed MIDI as an interface protocol to link to similarly equipped musical devices, such as drum machines and keyboards, in order to sequence musical performances. Additionally, so-called 'tracker' programs were (and still are) popular, being used to sequence multi-layered snippets of audio; music created in this manner continues to be shared amongst its creators via on-line communities today (Lysloff, 2003). It was following the development of higher capacity computer RAM, faster and larger hard drives, and crucially the development of the CPU, particularly throughout the late 1990s that resulted in the ability to record audio of any length in real time, that led to the contemporary situation, where computers are used in most recording studios by the music industry the world over to record, manipulate and create musical performances. The computer provides a complete interactive environment for music performance and

composition, many musicians using it as their main or only means of musical communication.

2.1.2 The adoption of music technology in schools

Since their inception, schools have adopted technological musical tools, whether they be instruments for the accompaniment of religious services (such as the organ or piano), tools for 'musical appreciation' (for example, the gramophone, used particularly in the 1920s and 30s, (Symes, 2004)), tools to be used by pupils (for example, the sequencers and drum machines used in the early to mid 1990s (Reese, S. (1995), Carmichael, J. (1989), Busen-Smith (1999)), or more recently, computers, which can be used for a variety of purposes. The stand-alone sampler, owing to its cost at the time (at least £1000) and the limitation of being dedicated to one task, was quite a rarity in schools in my own experience during its heyday (1980s - early 1990s), although not completely unknown. It tended to feature more frequently in further education colleges where courses were typically more vocational. By contrast, computers have been adopted more enthusiastically by school music departments, perhaps for various reasons, but not least because they can be used for many tasks and are relatively cheap. Although the adoption of computers in music classrooms has continued to grow in recent years, reports indicate that this growth is actually quite slow, Ofsted reporting (2006b) that 'there is too little use of ICT by pupils in music' in primary schools and in secondary schools that 'the provision and integration of music technologies are improving, but remain too variable' (2006a).

In terms of computers, most music departments' resources are limited; numbers of between four and ten computers are typical. The need for computers for MIDI sequencing use to be linked to keyboards, coupled with the need for specialist software, means that computers in other areas of the school, such as libraries, can not normally be used for music. In 2004, Ofsted noted that it was very rare for a music department to be equipped with sufficient computers to allow whole-class use at Key Stage 3 (2004a: 4) and more recently, QCA has noted that further development is still necessary:

> The evidence collected this year indicates that there is still some work to do in developing the use of ICT in music with 16 per cent of teachers indicating that they do not use ICT to enhance performance skills and a quarter using ICT with only a few pupils to enhance composition skills. (2007b)

Government statistics for ICT adoption within schools illustrate the general overall rise in the use and beneficial effects of ICT for classroom music. The following table (see table

1) provides the details of the basis of the 2000 - 2004 schools survey data[1] on which the illustrative graphs that follow (figs. 1 - 4) are based.

Year	Number and percentage of respondents (primary)	Number and percentage of respondents (secondary)	Categorisation of use of ICT in areas of the curriculum	Categorisation of benefit / positive effect of ICT in areas of the curriculum
2000	769 (45%)	714 (42%)	• substantial • little • none	Data not collected
2001	785 (67%)	753 (64%)	• substantial • little / none	• substantial • little / none
2002	840 (70%)	790 (70%)	• substantial • some • none	• substantial • some • none
2003	930 (55%)	810 (45%)	• substantial • some • little / none	• substantial • some • little / none
2004	1015 (42%)	818 (31%)	• substantial • some • little / none	Detail not reported

Table 1 - Detail of government ICT survey data

Owing to the statistical sampling errors that occurred as a result of selecting a sample from the population, the figures were adjusted to ensure they were representative of schools as a whole. The categories used on the survey for schools to describe the level of use and benefit/positive effect within subject areas have changed within the five year period. Therefore, 'little' and 'none' have been combined, as have 'substantial' and 'some' in the following four graphs (figs. 1 - 4). Exactly what is defined as 'substantial', 'some' or 'little/none' is not precisely defined - the schools survey data collection forms used (DfEE, 2000; DfES, 2001, 2002, 2003a) asked schools to indicate what they thought was the best fit for each curriculum area.

The following two graphs for the period 2000-2004 illustrate the rising percentage of computer use for music in English secondary and primary school classrooms[1] (see figs. 1 and 2):

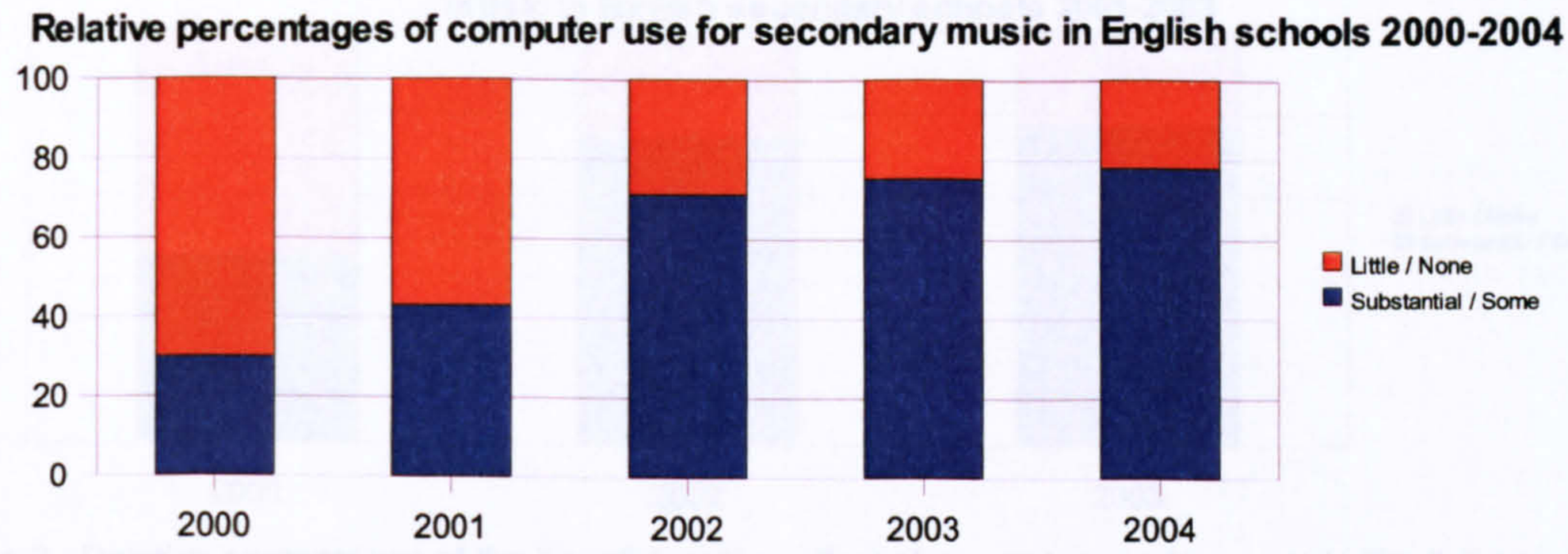


Figure 1 - Relative percentages of computer use for secondary music in English schools 2000-2004

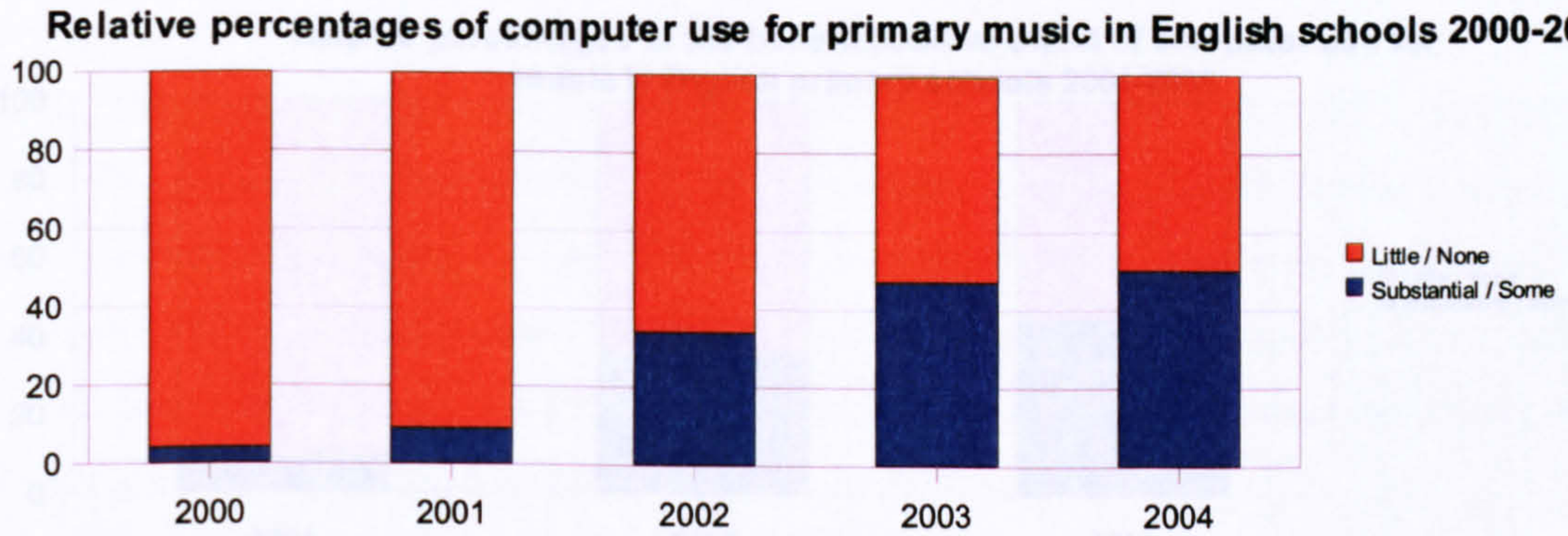


Figure 2 - Relative percentages of computer use for primary music in English schools 2000-2004

However, despite the gradual adoption of ICT, there has been a constantly reported theme of too much variability concerning its provision and integration into the music curriculum (Ofsted, 2002: 3; Ofsted, 2004a: 4; Ofsted, 2004b: 2; Ofsted, 2006a), with some schools not meeting the National Curriculum ICT requirements for music, usually owing to lack of resources. This is in the context of the use of technology for music being considered a good thing (QCA, 2005: 7; Ofsted, 2004a: 4) and its inclusion in the National Curriculum since its inception, particularly in relation to composing.

The schools' ICT survey reported the perceived 'benefits' (DfEE, 2001 and DfES, 2002) and 'positive effects' (DfES, 2003) of ICT in the various areas of the curriculum - the following two graphs illustrate the music results for English secondary and primary schools (see figs. 3 and 4), which indicate that schools have noted an increasing benefit of the use of ICT for music:

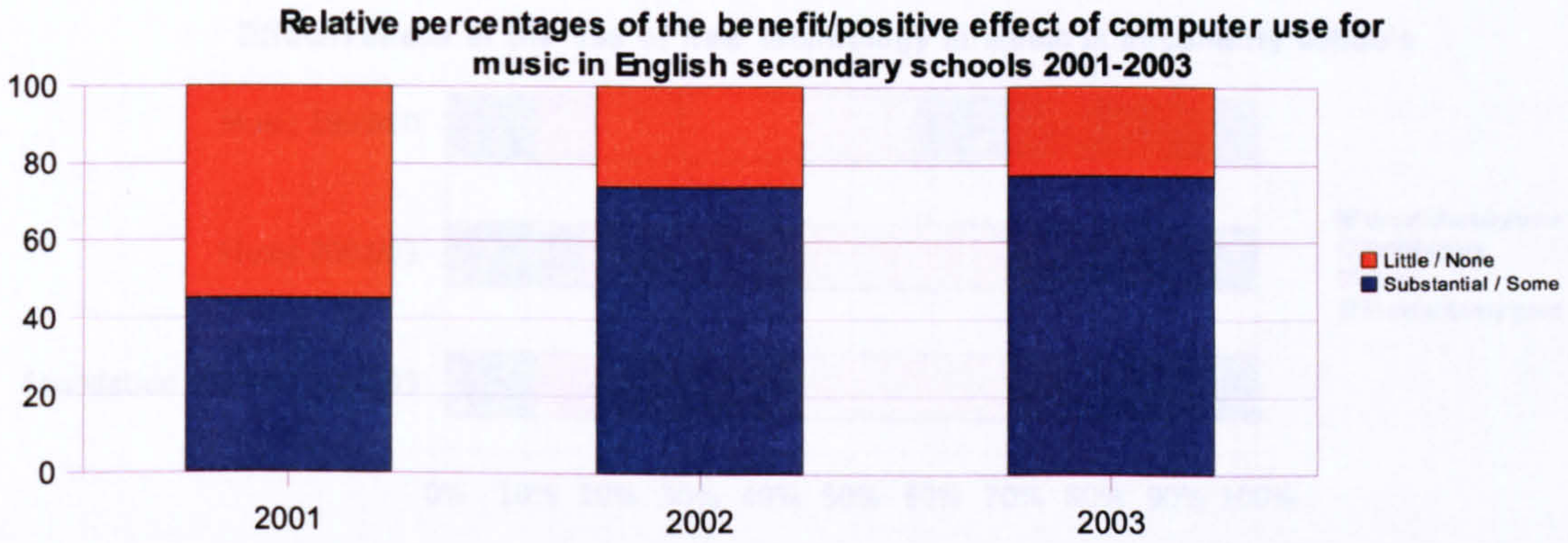


Figure 3 - Relative percentages of the benefit/positive effect of computer use for music in English secondary schools 2001-2003

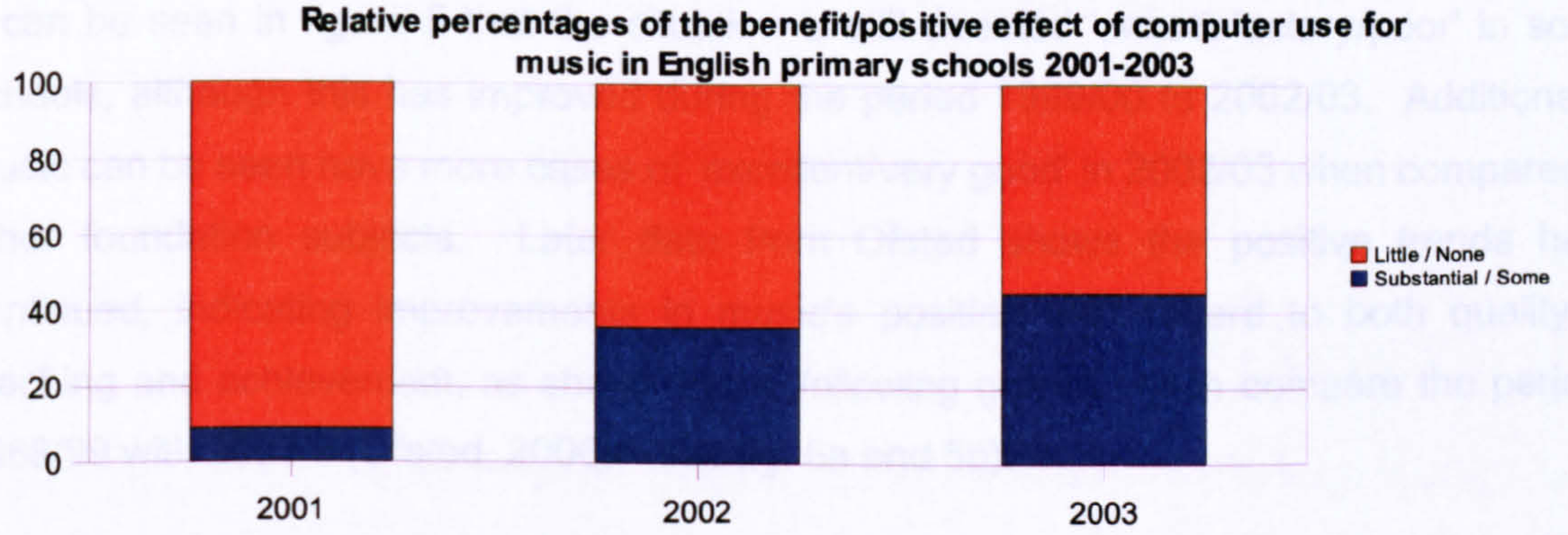


Figure 4 - Relative percentages of the benefit/positive effect of computer use for music in English primary schools 2001-2003

Ofsted Music subject reports have sometimes provided the means to compare the effectiveness of new technologies in the music classroom with the other foundation subjects (Art and Design, Citizenship, Design and Technology, Geography, History, ICT, Modern Foreign Languages, Music and Physical Education). A graph based on data taken from 2002/03 Ofsted subject reports (Ofsted, 2004b) can be seen in figure 5. It should be noted that the categories 'unsatisfactory/poor', 'satisfactory', 'good' and 'excellent/very good' refer to the names of the classifications made by Ofsted inspectors based on decisions made following the consideration of inspection evidence.

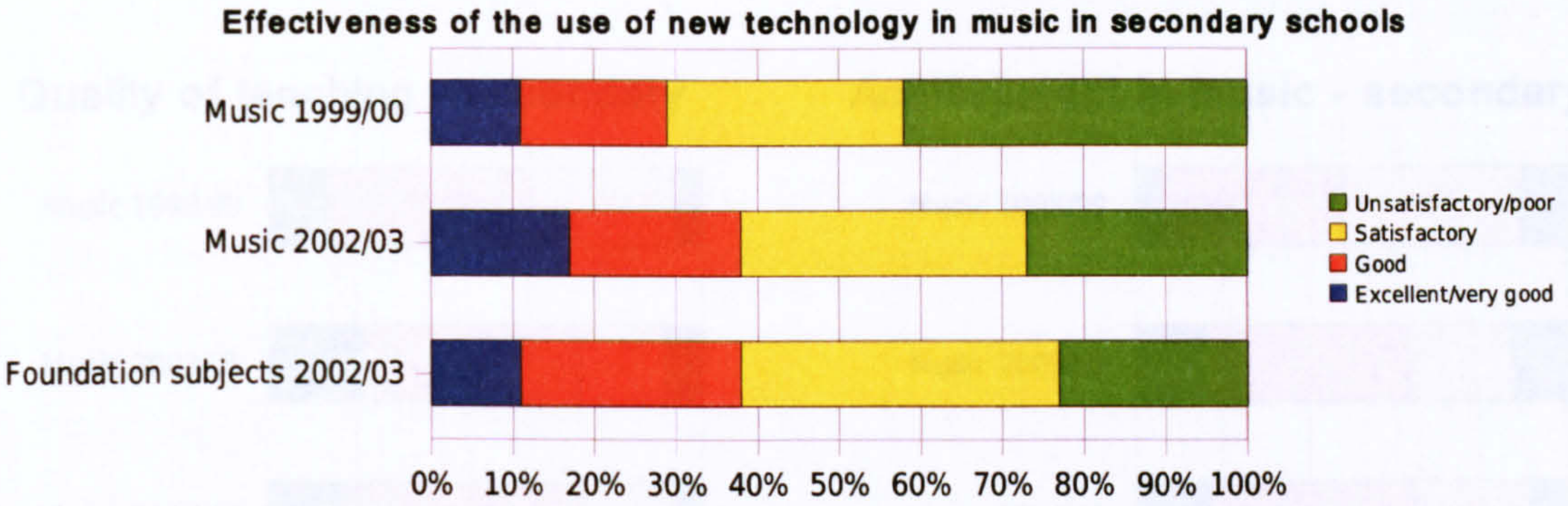


Figure 5 - Effectiveness of new technology in music in secondary schools 1999/00 - 2002/03 (Ofsted, 2004)

It can be seen in figure 5 that the situation is still deemed 'unsatisfactory/poor' in some schools, although this has improved during the period 1999/00 to 2002/03. Additionally, music can be seen have more cases of 'excellent/very good' in 2002/03 when compared to other foundation subjects. Later data from Ofsted shows the positive trends have continued, indicating improvements in music's position with regard to both quality of teaching and achievement, as shown in the following graphs which compare the periods 1988/99 with 2003/5 (Ofsted, 2006a - see fig. 6a and 6b):

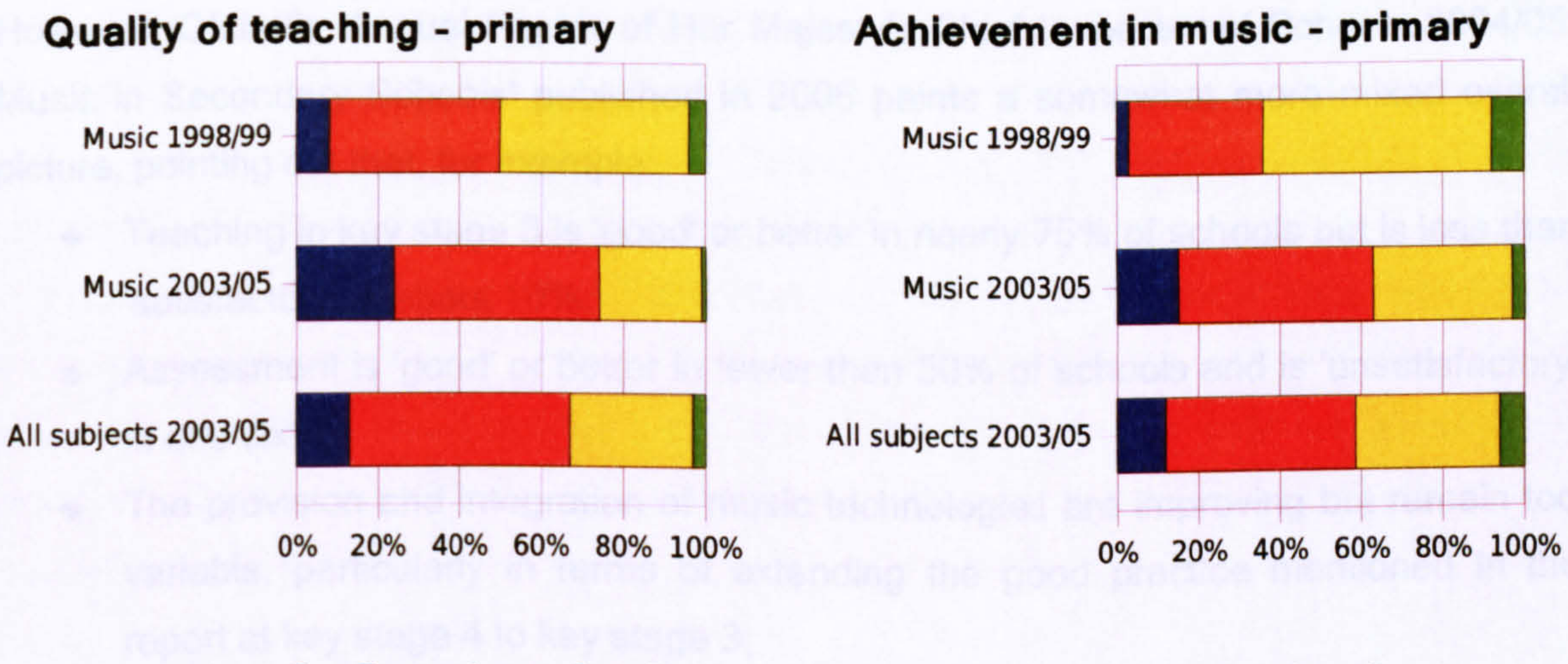


Figure 6a - Comparisons of quality of teaching and achievement in music (primary)

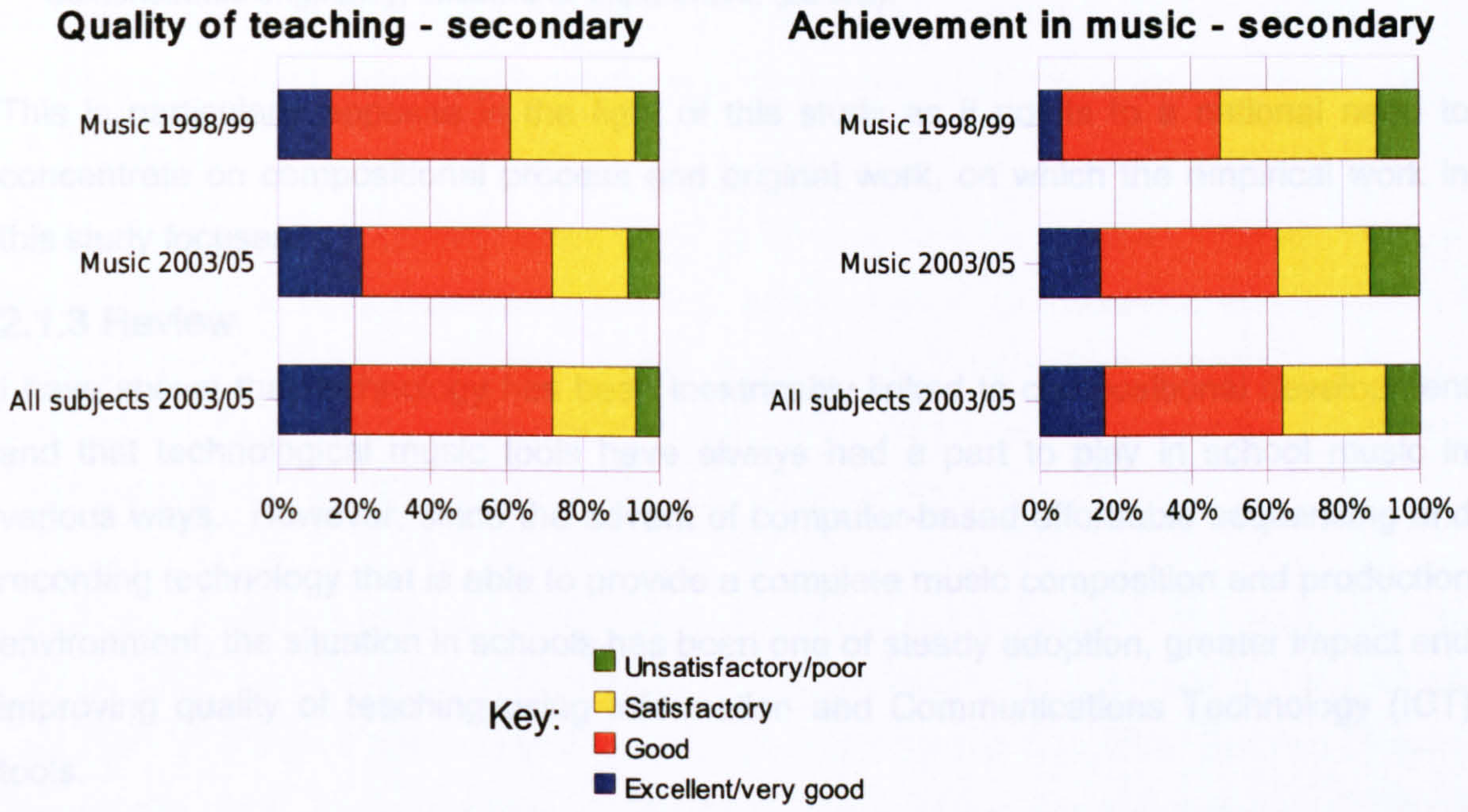


Figure 6b - Comparisons of quality of teaching and achievement in music (secondary)

The Ofsted 2003/04 annual report placed music joint third with history as having the '... highest proportion of excellent or very good teaching at key stage 3 ...' (Ofsted, 2005). However, Ofsted's 'Annual Report of Her Majesty's Chief Inspector of Schools 2004/05: Music in Secondary Schools' published in 2006 paints a somewhat more mixed overall picture, pointing out that, for example:

- Teaching in key stage 3 is 'good' or better in nearly 75% of schools but is less than 'satisfactory' in about 10%;
- Assessment is 'good' or better in fewer than 50% of schools and is 'unsatisfactory' in one sixth;
- The provision and integration of music technologies are improving but remain too variable, particularly in terms of extending the good practice mentioned in the report at key stage 4 to key stage 3;
- Accommodation is unsatisfactory in 30% of schools.

(2006a)

Focussing on the process of composing in particular, Ofsted said that:

> Where units of work demand composition, teachers need to think more about the processes which ensure pupils acquire skills and understanding. In most cases, too little time is spent in experimenting, or 'sketching out' ideas, inventing new sound blends or patterns, mixing them or expanding them, before putting them into structures and recording/storing them. The results

> show too little that moves from pupils copying the styles suggested to them to work that demonstrates originality, initiative or experiment. (2006a).

This is particularly apposite in the light of this study as it points to a national need to concentrate on compositional process and original work, on which the empirical work in this study focuses.

2.1.3 Review

I have shown that technology has been inextricably linked to compositional development and that technological music tools have always had a part to play in school music in various ways. However, since the advent of computer-based affordable sequencing and recording technology that is able to provide a complete music composition and production environment, the situation in schools has been one of steady adoption, greater impact and improving quality of teaching using Information and Communications Technology (ICT) tools.

2.2 The background to composing in the music curriculum

The history of composing as a central component in the secondary music curriculum is relatively short. The introduction of more creative elements to the music curriculum became the object of scholarly discussion in the 1960s, resulting in many influential publications, notably 'Sound and Silence' by Paynter and Aston (1970) and 'The Composer in the Classroom' by Schafer (1965). These books aimed to encourage music teachers to develop their pedagogy to enable pupils to develop their own musical creativity within the classroom through composing. They presented new ways of organising the creative engagement of pupils with the elements of music - a way of experiencing the subject from the 'inside', in contrast to prior classroom pedagogy which predominantly viewed music from the 'outside', exemplified through activities such as singing and listening. They proposed making music in small groups, experimenting with pupils' own as well as abstract ideas.

The Plowden report was part of this general movement, which although concerned with Primary education was to highlight many issues relevant to secondary music education. In particular, it noted that:

> The planning of music as a creative subject lags behind work in language and the visual arts and crafts (DES, 1967:692d)

It suggested that pupils should engage with improvisation and composing but called for more research in this area:

> Not enough is yet known about how to develop children's creative powers in music. Here, research is needed. (ibid., 1967: 692d)

A later report from the Department for Education and Science entitled *Creative Music in Schools* (DES, 1970) provided more concrete information for teachers concerning how the development of 'chidren's creative powers in music' might be achieved and Paynter and Aston's book *Sound and Silence* (1970) published the same year is regarded as a key text in the promotion of creative group work in the music curriculum.

The School's Council project 'Music in the Secondary School' located at York University (1973 - 1982) was directed by Paynter and included leading figures in music and music education of the day, for example, the composers Harrison Birtwistle, Bernard Rands, George Self and Trevor Wishart as well as the head of the music department, Wilfred Mellers. The project's chief goal was to encourage discussion on the way forward for the music curriculum and was subsequently influential in shaping the direction composing in the classroom would take.

The freedom with which Paynter and Aston were suggesting pupils could musically express themselves was new and challenging for teachers, and with the adoption of group composing, music classrooms inevitably became much noisier places, with the possibility of a certain amount of disruption being caused to other subjects (Odam, 2000:110 & 117). A tension that emerged was that some music educators were torn between the opportunities for creativity offered by this new approach and the possible loss of traditional skills, such as harmony and music history (Fautley, 2004: 344).

A leading figure in preparing the path for the formal inclusion of composing into the forthcoming prescribed curriculum was Swanwick. His 1979 book *A Basis for Music Education* laid out the three-part structure that was later adopted for the English Music National Curriculum, which became statutory in 1992; composition, audition (listening) and performance (1979:43). The mnemonic C(L)A(S)P was employed to represent 'the five parameters of musical experience': Composition - Literature Studies - Audition - Skill Acquisition - Performance (1979: 44). Literature Studies and Skill Acquisition were parameters considered peripheral to musical experience, the former referring to the study

of music scores and written work about music, and the latter to technical skills such as playing, singing, aural and music reading.

Swanwick (1988) added much to scholarly understanding of children' musical development in *Music, Mind, and Education* in which, following analysis of 745 compositional products by children, he formulated a Piagetian series of developmental stages famously illustrated as a spiral (Swanwick, 1988:76). He linked these stages to the (then) new General Certificate of Secondary Education (GCSE) examination, (taken by most pupils in English schools in the year in which they are 16), providing 7 possible grade-related criteria for the assessment of composing and listening (ibid., 1988:152-3). The term 'composing' had been chosen by this time by the Secondary Examinations Council (SEC), rather than the former term 'composition' ...

> ...because it emphasized the activity itself rather than the product of the activity. (1986:10)

Following the Education Reform Act (1988), and the setting out of the legislation for the English National Curriculum, Music was confirmed as a mandatory foundation subject that must be taught to all children aged 5 - 14 and the first Music document detailing the framework was published in 1992. The centrality of composing in the National Curriculum was confirmed in the Music working group's division of the subject into four 'attainment targets' ('performing', 'composing' and 'listening' and 'knowing') (DES, 1990:14).

Various changes to the National Curriculum then ensued, but in none of them did composing lose its central position. By the time of the publication of the first statutory National Curriculum for Music document (DES, 1992) the four attainment targets had been reduced to two: 'Performing and composing' and 'Listening and appraising' and this remained in the 1995 revision. Following further changes in 1999, this was reduced to one attainment target, but the Programme of Study was divided into 5 areas, listening and appraising being separated and the new 'Breadth of study' area being incorporated to indicate the types of activities that can consolidate the individual parts of the curriculum as well as provide information about the required depth and range of study. Perhaps the most radical changes to the key stage 3 Music National Curriculum occur in the latest document published in 2007 (DCFS, 2007), to be introduced in schools from September 2008. Some of these are superficial, such as where the nomenclature has changed ('Programme of study' being replaced by 'Key Processes' and 'Breadth of Study' by 'Range and content', for example) but others reflecting a change in emphasis, such as the

increased focus upon previously non foregrounded areas, such as the use of a 'Key concepts' section, where 'Cultural understanding' (in which musical 'tradition' now plays an enhanced role), 'Critical understanding' and 'Creativity' now have their own sections. This reflects a renewed focus upon these areas, mirrored in the new key stage 3 (ages 11 - 14) music professional development programme, which is designed to integrate with the National Strategy (DfES, 2006a).

A key principle adopted since the earliest considerations of this framework was that of a holistic delivery:

> ...we believe that the study of music is and should remain one which integrates all the aspects of musical experience which we have highlighted (DES, 1991:15).

This is actualised in the classroom activities orchestrated by teachers, where performing, listening and composing may be undertaken within a single activity. More recently, composing became a mandatory requirement for A-level Music and Music Technology specifications, although it has always been a core component of Music GCSE since the first examination in 1988 (Secondary Examinations Council, 1986; Southern Examining Group, 1986). In GCSE, composing is often undertaken in response to a brief and a more recent addition (from 2002) has been the implementation of the 'Areas of Study', which require pupils to compose within a certain style or musical genre.

What is prescribed in the National Curriculum as composing activity has changed little over the years. In the 1992 National Curriculum Music document for key stage 2 (ages 7 - 11) the 'End of key stage statements' were:

> devise and develop musical ideas within simple structures. (DES, 1992: 6)

and

> communicate musical ideas to others, and record compositions through the use of notations. (ibid., 1992: 6)

For key stage 3, these were:

> compose, arrange and improvise music, developing ideas within musical structures. (ibid., 1992:8)

and

> revise their compositions and notate them appropriately for subsequent performance. (ibid., 1992:8)

In the first statements for each of the two key stages, it is interesting to note the progression from 'devise and develop' to 'compose, arrange and improvise'; the language employed by the National Curriculum document to indicate progression within each area, although having been selected with care, has found difficulty indicating this progression precisely. The notation of the compositions was not necessarily meant to imply that standard western music notation should be used (NCC, 1992: C11), notations relevant to the music being composed, such as TAB, chord symbols, and graphic scores being considered appropriate. In the 2007 document, a new section labelled 'Key processes' contains the new statements for key stage 3 composing:

> create, develop and extend musical ideas by selecting and combining resources within musical structures, styles, genres and traditions (QCA, 2007a:182)

and

> improvise, explore and develop musical ideas when performing (ibid., 2007a:182)

These new statements cover very similar ground to the 1992 ones; however, whereas the 1992 and 1995 documents mention improvising in a 'variety of 'styles', the 1999 and 2007 documents expand these key stage 3 statements to:

> Create (produce), develop and extend musical ideas by selecting and combining resources within musical structures, styles, genres and traditions (ibid., 1999:20 and 2007a:182)

The expanding of the description to include 'styles', 'genres' and 'traditions' is closely aligned with the new guidance in the national strategy for key stage 3 and places increased emphasis on context (DfES, 2006a). A musical 'style' can be considered the most closely defined of these three categories, describing music linked by the common use of musical conventions relating to the use of melody, rhythm, harmony and instrumentation; examples would be baroque, or rock 'n' roll. A 'genre' is a wider categorisation, perhaps describing music for a given purpose, such as for dancing or for ceremonial use . A musical genre could consist of many styles, for example, music for a film might contain various different styles of popular music. The last category, 'tradition' is the most openly defined, and could contain music of many genres; an example would be Western classical music (ibid., 2006a). Mention of music notation in the 2007 document is made in the 'Range and content' section, where it states that the study of music for key stage 3 should include:

> Staff notation and other relevant notations in a range of musical styles... (ibid., 2007a:183)

This statement is very similar in intent to the 1992 version. In the new 'Key concepts' section in the 2007 document, 'creativity' is defined as:

> Using existing musical knowledge, skills and understanding for new purposes and in new contexts (ibid., 2007a:181)

and

> Exploring ways music can be combined with other art forms and other subject disciplines (ibid., 2007a:181)

The first of these statements seems to view creativity as developing music for something external to itself, i.e. 'new purposes' and 'new contexts', rather than within itself as exemplified through developing work within a style or genre. Similarly, the second statement echoes this externality through developing suggested links with other art forms and subject areas. I will discuss further what I understand by 'creativity' in chapter 3.

2.3 How composing is organised in music classrooms

Composing at key stage 2 tends to be organised differently to that at key stage 3, reflecting the distinct organisational structures, differences in available resources and teachers' experience of music at those key stages (Gall and Breeze, 2007). Owing to the current staffing arrangements where most primary teachers teach all of the curriculum subjects, (of which music is one), opportunities for music in the classroom are variable; constraining factors may be a teacher's lack of music expertise and the typically limited teacher training time allowed for music (ibid., 2007: 46). Music classroom activities in different primary schools vary greatly, but often feature a good deal of whole-class work involving singing and the use of classroom percussion. Some schools may employ a music specialist, who is sometimes shared with other schools. Composing may or may not feature at all in the primary music curriculum, even though it is part of the National Curriculum programme of study at key stages 1 and 2; it will depend on the teacher's experience.

At key stage 3, a specialist music teacher will normally be employed, who will teach music throughout the school. A class of 30 pupils will typically work in small groups of between 2 and 6 to a brief provided by the teacher. These briefs will be designed to cover, as the current National Curriculum requires, a wide variety of musical styles from different places and times. A group composition may be worked on typically for 4 - 6 weeks, or a half of a traditional English 3-term school year, allowing time for 6 projects per year. Music lessons at key stage 3 (ages 11-14) typically seek to integrate all four of the National Curriculum's

specified principal activities (Performing, Composing, Appraising, Listening, and applying knowledge and understanding). As suggested by the key stage 3 National Strategy for the foundation subjects, lessons are usually divided into 3 sections; launch, main body and plenary. In a lesson where composing is the focus, the launch might consist of an outline of the brief from the teacher, or a brief recapatulation of the progress of the various groups and an outline of their work for the coming lesson; the body of the lesson will consist of group composing, and the plenary might be made up of small group performances of work in progress to the whole class followed by appraisal by other pupils.

In composing groups where 'real' instruments are used, pupils might use portable keyboards, school percussion instruments, instruments they may be studying inside or outside of school (for example, flute or trumpet) or their voices. Good co-operative working skills are ideally required (Odam, 2000: 111) where pupils work together effectively, allowing each member of the group the opportunity to share their views on the composition in progress. Teachers may choose to organise pupils by ability, perhaps into mixed ability or same ability groups, or perhaps into friendship or non-friendship groups. The emerging composition may be notated as it progresses but the choice of notation may be left up to the group - it need not necessarily be traditional western staff notation or guitar tablature, but could be a graphical notation or a list of note names. As previously mentioned, noise in the classroom may be a problem, so that where facilities allow, teachers may choose to send groups to practice rooms or other remote spaces in order to allow groups to hear themselves more easily. Often, performing is naturally integrated with this activity, as the group may well be expected to play their work to the whole class at the conclusion of the activity. The inclusion of computers for composing work in the classroom presents new challenges for classroom organisation, which are discussed in the following section.

2.4 The organisation and nature of computer tools for music composing in the classroom

2.4.1 Statutory requirements

Mention of Information and Communications Technology (ICT) equipment for music in the National Curriculum is made from the very earliest documents, although its scope has changed. It has often been linked to music composing; in 1992 it was suggested that when revising their compositions, key stage 3 pupils might communicate more complex ideas using a ...

> ... widening range of cues, signs and symbols and recording equipment (DES, 1992:8)

The use of 'computers and electronic equipment' are mentioned as examples at key stage 2 in order to 'explore and use a widening range of sound sources' (ibid., 1992: 6), but their use is not mandatory. At key stage 3, an example is given of 'use a computer program to store, alter and replay a composition and print the score' (ibid., 1992: 8). The use of recording equipment at key stage 3 is repeated in the later 1995 document in the context of refining and completing compositions (DFE, 1995:7). There is a significant shift in the programme of study for key stage 3 in the 1999 document where there is no ICT reference in the section on composing but under 'Listening, and applying knowledge and understanding' there are two references:

> identify the resources, conventions, processes and procedures, including use of ICT ... used in selected musical genres, style and traditions. (DfEE, 1999: 20)

and

> identify the contextual influences that affect the way music is created, performed and heard [for example ... impact of ICT ...] (ibid., 1999: 20)

Here, there is a notable shift away from the practical application of ICT in the earlier documents to being able to identify appropriate use and impact. This is echoed in the key stage 2 programme of study where mention of ICT is made in connection with knowing how music is produced (ibid., 1999: 18). However, despite not being mentioned in the 'Key processes' of the 2007 document for key stage 3, ICT is included with reference to composing in the 'Range and content', stating that music study should include:

> The use of music technologies to create, manipulate and refine sounds (QCA, 2007a:183)

There is also mention of ICT in the 'Curriculum opportunities' section of this document:

> Develop individual performance skills ... including the use of music technology (ibid., 2007a:184)

However, it is notable that this is linked to performing rather than composing. Despite these changes of emphasis and lack of scope in many of the statements, ICT adoption for composing in music classrooms has continued steadily - this is discussed more fully in section 2.4.3.

2.4.2 Computer-based tools used in the classroom

There are various computer-based tools typically found in music departments. These have been grouped here into the following categories:

MIDI and audio sequencing - these tools enable the sequencing of MIDI and audio data, examples being Cubase[2] and Logic[3]. Music can be entered in many ways (for example, in real-time via music keyboards and other MIDI equipment, in step-time, using a combination of music and computer keyboards, or with the mouse), and edited in various representational environments, including graphical and score-based, and can be played back. This type of software is often referred to as a music production tool.

Scorewriting programs - a tool aimed primarily at the production of a musical score and possibly instrumental parts in preparation for performance. The music is represented in the form of notation symbols, usually western staff-based but can include other formats, for example, TAB. Data is entered in the ways mentioned above for MIDI and audio sequencers and can be played back. Facilities for the detailed editing of playback parameters are relatively limited. Examples are Sibelius[4] and Finale[5].

Music theory training - software packages aimed at at teaching notation-based music theory. An example is Music Ace[6].

Sample sequencing - software tools that allow for the sequencing of provided and user-created samples, (or loops) of music, often in discrete styles, into complete performances. Editing facilities for the included samples are usually provided as well as the ability to record users' own sounds. Music creation is generally made using drag and drop techniques. Sophisticated tempo, time-stretch and transposition facilities are usually available. Examples are eJay[7] and Acid[8]. These products have effectively taken the place of earlier 'MOD' or tracker programs[9], although these still live on today; a current example is Renoise[10].

Curriculum support materials - this software supports commercial schemes of work. Examples are the CD-ROMs that accompany New Music Matters and Composing Matters[11].

Musical instrument and ensemble information - these tools are usually packaged in the form of CD-ROMs and contain information about musical instruments, including recordings of their sounds, information about ensembles they play in and where they come from in the world. Examples are Microsoft Musical Instruments[12] (now discontinued), and Meet the Instruments of the Orchestra[13].

General guides to musical styles / genres / traditions - a software form of musical encyclopedia. An example is the Attica Guide to Classical Music[14].

Encyclopedias - these are general encyclopedias, such as Microsoft Encarta[15] and Hutchinson's Encyclopedia[16], usually supplied on CD-ROM

Programs such as Apple's GarageBand and Sony's ACID Music Studio effectively span more than one of these categories, in this case MIDI sequencer, multi-track audio recorder and sample sequencer. Software and hardware aimed at professional use are also sometimes found in schools; examples are the recording system Pro Tools[17] and audio production package Nuendo[18]. However, owing to their complexity, their use is typically restricted to older pupils.

Information on the choice of music software used by departments is scant. One of the few available surveys was undertaken by the Fischer Family Trust[19] between 2000 and 2003 (Fischer Trust, 2004), with data contributed by 442 secondary music departments. The following graph illustrates the numbers of users in the survey who reported high usage (10 plus) of particular software titles, presented in ascending order (see fig. 7). Following this, there is another graph, that categorises these software titles according to the software 'types' listed above (see fig. 8):

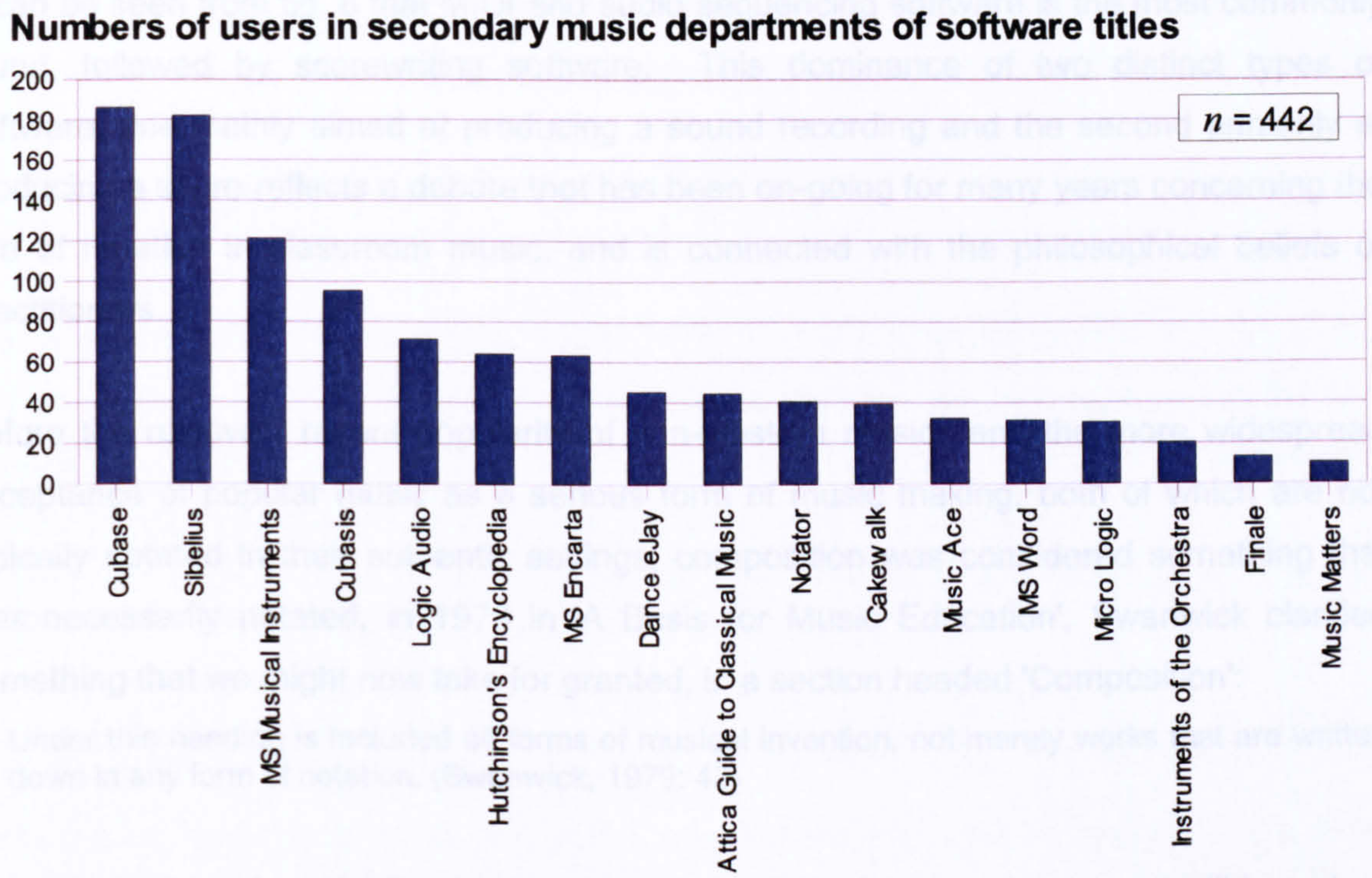


Figure 7 - Numbers of users in secondary music departments of software titles

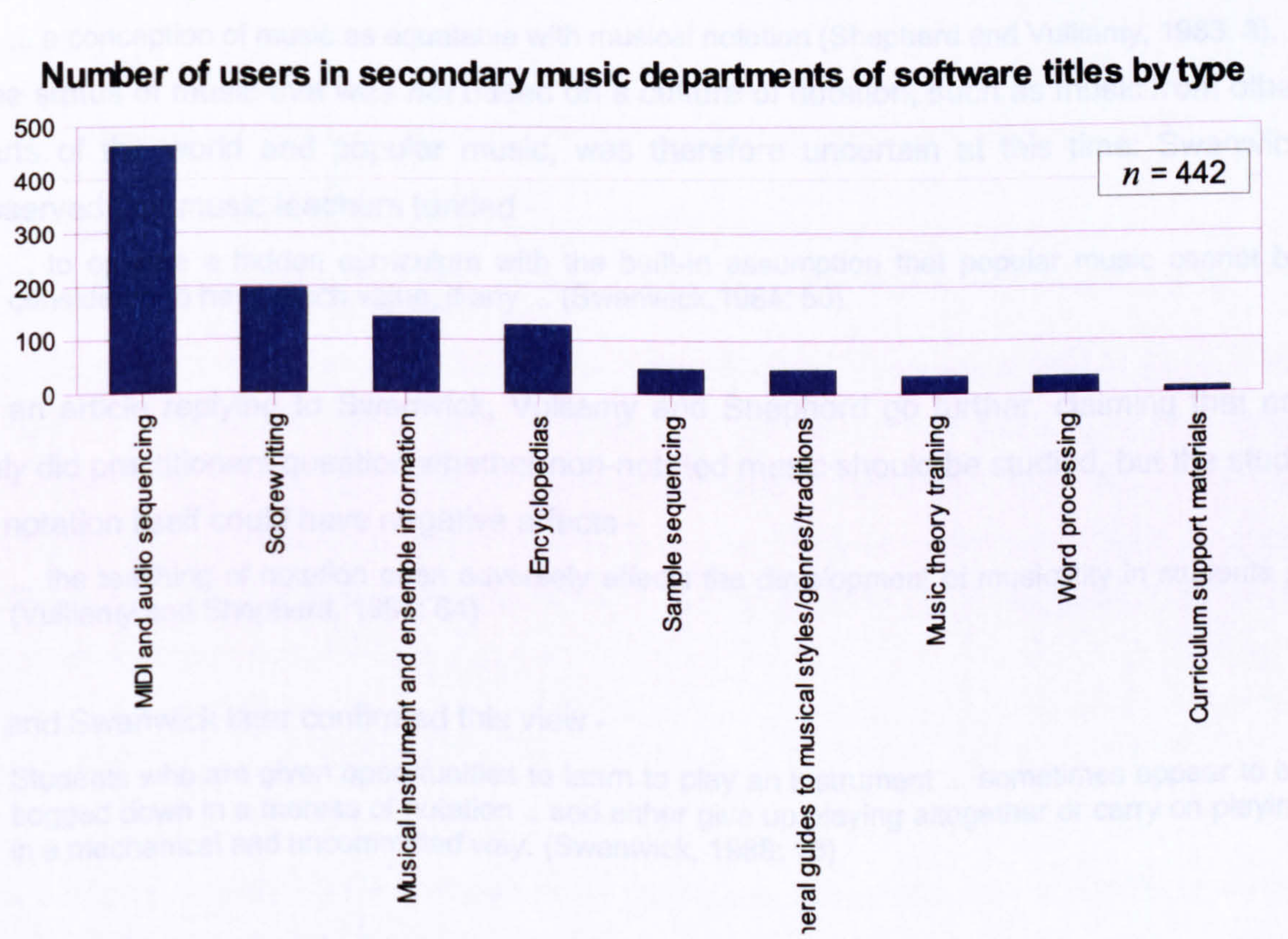


Figure 8 - Numbers of users in secondary music departments of software titles by type

It can be seen from fig. 8 that MIDI and audio sequencing software is the most commonly found, followed by scorewriting software. This dominance of two distinct types of software, one mainly aimed at producing a sound recording and the second primarily at producing a score reflects a debate that has been on-going for many years concerning the role of notation in classroom music, and is connected with the philosophical beliefs of practitioners.

Before the relatively recent popularity of non-western musics and the more widespread acceptance of popular music as a serious form of music making, both of which are not typically notated in their authentic settings, composition was considered something that *was* necessarily notated; in 1979 in 'A Basis for Music Education', Swanwick clarified something that we might now take for granted, in a section headed 'Composition':

> Under this heading is included all forms of musical invention, not merely works that are written down in any form of notation. (Swanwick, 1979: 43)

In 1983, Shepherd and Vulliamy claimed that music in English schools was still based on an ideology of -

> ... a conception of music as equatable with musical notation (Shepherd and Vulliamy, 1983: 3).

The status of music that was *not* based on a culture of notation, such as music from other parts of the world and popular music, was therefore uncertain at this time: Swanwick observed that music teachers tended -

> ... to operate a hidden curriculum with the built-in assumption that popular music cannot be considered to have much value, if any ... (Swanwick,1984: 50)

In an article replying to Swanwick, Vulliamy and Shepherd go further, claiming that not only did practitioners question whether non-notated music should be studied, but the study of notation itself could have negative affects -

> ... the teaching of notation often adversely affects the development of musicality in students ... (Vulliamy and Shepherd, 1984: 64)

... and Swanwick later confirmed this view -

> Students who are given opportunities to learn to play an instrument ... sometimes appear to be bogged down in a morass of notation .. and either give up playing altogether or carry on playing in a mechanical and uncommitted way. (Swanwick, 1988: 13)

A more recent study by Hultberg (2002) echoed this concern in the identification of two main approaches to music notation: 'explorative' and 'reproductive'. Teaching methods based on the latter approach -

> ... may even prevent professional musicians from applying musical understanding developed later (2002: 185)

However, alongside the gradual acceptance of popular and world musics into the music curriculum (Swanwick, 1988: 103), it became necessary for teachers to reassess the role of notation, especially in the light of the (then) new National Curriculum, which initially positioned notation with reference to composing by requiring pupils to -

> use and understand increasingly complex signs, symbols and instructions including conventional and graphic notations (DES, 1992: 8)

... and to listening and appraising as -

> read and use different notations, including staff notation, graphic scores and chord symbols (ibid., 1992: 9)

... suggesting that notation was part of the teaching of composing. However, in the 1999 revision, notation was no longer mentioned with reference to composing, but was confined to 'Listening, and applying knowledge and understanding', which required pupils at key stage 3 to -

> identify the resources, conventions, processes and procedures, including ... staff notation and other relevant notations used in selected musical genres, styles and traditions (DfEE / QCA, 1999: 20).

... and that at key stage 2, pupils should be taught:

> how music is produced in different ways ... and described through relevant established and invented notations (ibid., 1999: 18).

... suggesting that notation was now not necessarily part of composing but its application should be understood. The National Curriculum review for key stage 3 music, to be introduced from September 2008, contains very similar statements to the 1999 document, but clarifies what is meant by 'staff notation' and 'other relevant notations'. Odam presents a view of the role of notation that accords with that understood by myself to be adopted by most secondary music teachers today -

> Secondary teachers should never allow the task of writing notation to become divorced from the musical context. The need to write something down must be there, otherwise the motivation to learn will not arise. (1995: 46-7)

The place of notation in the curriculum as discussed above provides the background to why there might be preferences for MIDI and audio sequencing software (not mainly notation-based) or scorewriting software (notation-based) among secondary music

teachers. Although MIDI and audio sequencers *can* notate music and scorewriters *can* produce recordings of music, these are not their primary functions. Although practitioners might have a preference for one of these types of software as their main teaching tool, in practice, departments may possess both types of packages, owing to examination board requirements to produce scores and recordings for GCSE and A-level music examinations. Although the preferred composing tools might be MIDI and audio sequencers, which can be used for notating music, it is often thought preferable to have dedicated scorewriting software packages for key stage 4 (ages 14-16) and post-16 pupils to use for their notation needs, sometimes transferring the performance-based files from a sequencing tool into a notation program.

Help and advice to enable practitioners to adopt music technology in classrooms has been forthcoming. The government has provided 3 key publications to help teachers maximise the potential of music technology; the National Council for Educational Technology (NCET, 1997) published 'The Music IT Pack' in 1997, which contained several thematic booklets aimed at music technology adoption in the classroom and was sent to all maintained secondary schools in England. Further materials were provided the next year by the (then) new British Educational Communications and Technology Agency (Becta, 1998) entitled 'Music Technology in Action' which contained booklets on MIDI sequencing, using CD-ROMs, keyboards and sound processing. In 2005, the pack 'Embedding ICT @ secondary: Key Stage 3 music' (DfES, 2005) developed jointly by the key stage 3 National Strategy and other partners, contained materials providing practitioners with advice on how to use music technology effectively in their teaching.

There have also been commercial publications aimed at helping teachers adopt music technology into their teaching, for example 'ICT Activities for Music 11-14' published by Heinemann (Murray et al, 2002). There are also many on-line government music ICT resources such as teachernet[20], Curriculum online[21] and National Curriculum in Action[22].

Other advice has come in the form of a National Strategy Key Stage 3 booklet entitled 'ICT across the curriculum: ICT in music' (DfES, 2004a) which made strong links with the Information and Communications Technology (ICT) curriculum but did not provide much concrete advice for teachers about how to apply its messages in the music classroom. Practical help was supposed to be provided for teachers by the New Opportunities Fund (NOF) ICT training, but this was considered to have been of little practical help:

> The impact of the New Opportunities Fund (NOF) training on teaching and learning in music has been negligible (Ofsted 2004a: 4)

Effective training for teachers appears to have been more localised, as it was reported (ibid., 2004a: 4) that many classroom music teachers were self-taught with regard to music technology, some received in-house training, and some had visiting teachers provided by Local Authority music support services.

In conclusion, the variety of music technology tools suitable for music composing in the classroom provides alternatives for teachers, the fundamental choice being between the sound-based MIDI and Audio sequencer and the score-based notation program. Which of these is adopted as the principal tool for composing may well depend on practitioners' musical preferences and philosophies, as previously discussed. Training for the use of music technology in the classroom has been patchy at best and non-existent in many cases, although published and on-line help is available. New teachers may fare better than their more experienced colleagues as they will probably benefit from music technology training in teacher-training institutions; however, for many, it appears the most effective solution is either help from colleagues or self-tuition.

2.4.3 The organisation of computer tools in the classroom

Composing in the classroom at key stages 2 and 3 without the use of computers has generally been organised on a group basis, that is, pupils typically work in groups of 3-6 using acoustic and electronic instruments. The introduction of computers into the classroom provides challenges to the continuation of this method of organisation owing to their general lack and to the number of pupils that can work at a workstation simultaneously; therefore, the numbers of computers available for use in music classrooms has a direct effect upon how they are used in practice. If there is just one machine, it could be used by the teacher (Ofsted, 2004a: 6) to provide backing tracks to accompany whole-class singing. If just a few computers are available, perhaps 2-4, these could be distributed almost anywhere, from inside small cupboards to corners of rooms and in practice rooms (Odam, 2000:117). According to Ofsted, there are rarely enough computers for whole key stage 3 classes to engage with computers at the same time, but a class lesson in which 5 computers were available is described (Ofsted, 2004a: 6), 5 groups of pupils working using acoustic instruments and utilising the computer to act as a

backing track. Another option where a limited number of computers is available, is to organise pupils in such a way that some groups work at computers, and others work in the larger, 'traditionally' sized groups, on the same task (Odam, 2000: 117); yet another option is that also referred to by Odam (2000: 117), as the 'mixed economy' approach, where groups of pupils could be involved in a variety of tasks at one time. 15 computers is generally considered sufficient for whole key stage 3 classes to engage with them at the same time (Ofsted, 2004a: 6), as two pupils to a computer has become the most common arrangement. Sometimes, teachers arrange for 3 pupils to work at a computer (see chapter 6). When there are enough computers for a whole 30-pupil class to use, then the room organisation has been observed to become more standardised (Gall and Breeze, 2003). In particular, it has been noted that there are three configurations that are common (Gall & Breeze, 2003:49, Sutherland et al., 2004:2) (see figs. 9 - 11 below):

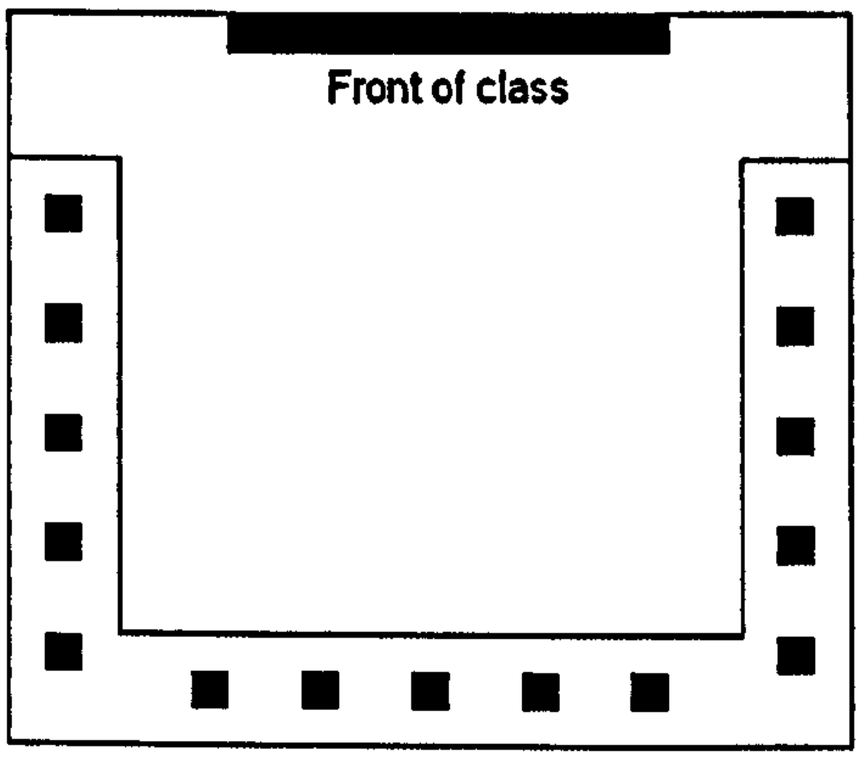


Figure 9 - Layout 1: pupils sat around the outside of the room

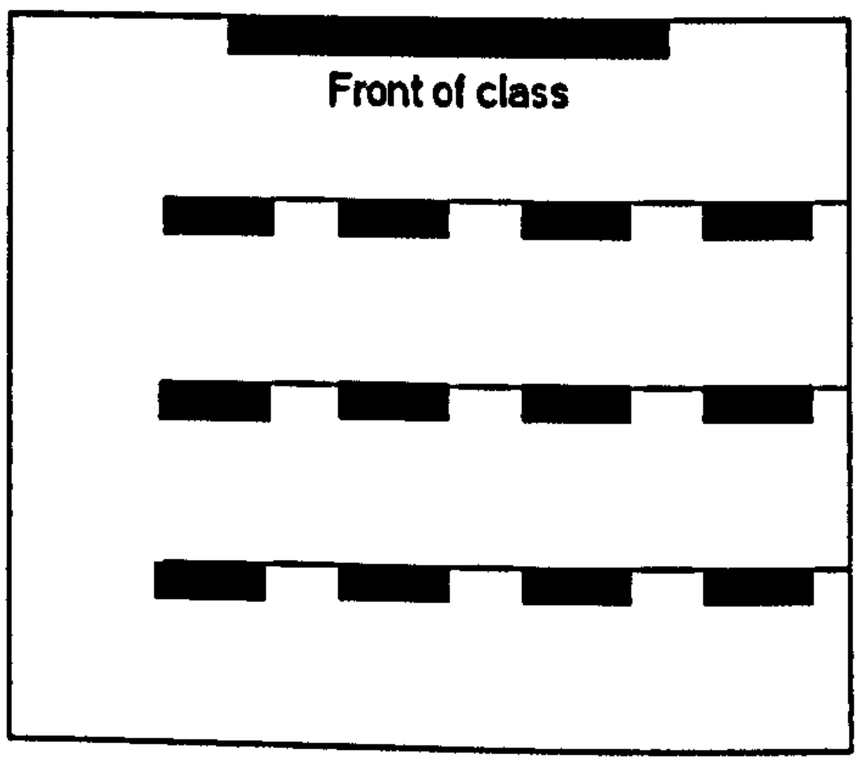


Figure 10 - Layout 2: pupils sat in rows

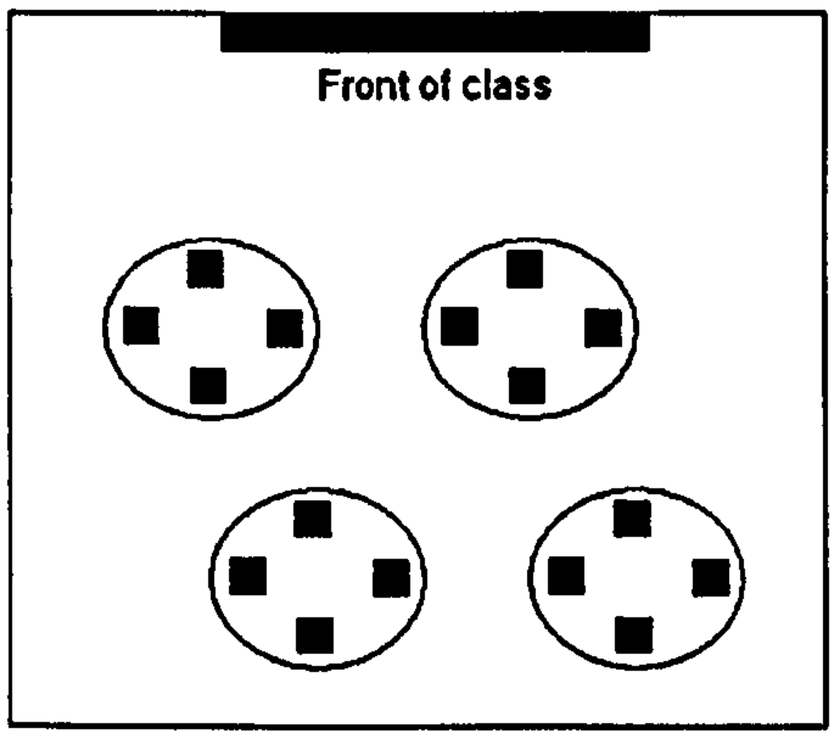


Figure 11 - Layout 3: pupils sat on four 'islands'

Each of these layouts appears to offer various potentials: layout 1 leaves a space in the centre of the room for other items, such as a performance area or perhaps other tables and chairs arranged for written work. The pupils are facing the wall all the time and so other pupils are not in view - this could be used where the teacher wanted to minimize distractions from others. To see the whiteboard, all the pupils need to turn their chairs, some round 180^0; layout 2 had three rows with all the pupils facing the front of the classroom, so the whiteboard and teacher were easy to see. In the particular example observed, it was noted that space was tight in this particular layout, with the pupils' chairs touching the row behind, making collaborating with others difficult; layout 3 has four islands, making collaboration easy and was reasonably convenient for most pupils to see the whiteboard (Gall & Breeze, 2003:49).

Central to issues of the organisation of space and pupil grouping in the music classroom is the notion of pupil role during engagement with the computer; this area is currently under-researched. In broad terms, using a music computer workstation offers two distinct roles, that of the computer operator and that of the player of the music keyboard, which provides two very distinct pupil learning experiences. In the most successful observed lessons (ibid., 2003: 48), teachers had taken this into account, planning into the lesson a certain length of time pupils would stay in one role. Gall and Breeze (ibid., 2003) found that sometimes teachers had not done this, resulting in one pupil taking control of one role, such as operating the computer, or playing the music keyboard for the whole lesson, thereby restricting the scope of the learning experience for both of the pupils in the group. In discussions with teachers (Gall and Breeze, 2007: 47) the allocation of roles within a group using computers was identified as needing to be carefully planned to avoid the limiting of composing experiences for pupils.

2.5 Research into the process of music composing in the classroom

Music composition in the classroom, especially since its inclusion in the National Curriculum, has been the subject of much research. Some of this has focused on compositional products (Davies, 1992, Swanwick & Tillman, 1986, Kennedy, 1999) and others on compositional processes (Kratus, 1989, 1991, Fautley, 2005). Researchers have focused upon composers with varying degrees of experience, including professionals, those at college and novices; I will start by focusing on models developed through observation of professional composing and then go on to consider models of pupils' composing, before considering the assessment of composing.

2.5.1 Models of professional composing

A theme, which researchers have revisited many times, is that of the 'stages' of the composition process. Through being able to categorize what these might be, observers have attempted to demystify composition's somewhat elusive nature. The following examinations of the work of various scholars demonstrate a wide measure of agreement, the first notable contribution being that of Wallas (1926) in *The Art of Thought.* The four stages he proposed (Preparation, Incubation, Illumination and Verification) have been influential in shaping subsequent observers' work. One of these is Sloboda; in his 1985 book 'The Musical Mind: The Cognitive Psychology of Music' he draws upon composers' views of their own composing spanning 150 years to produce a summary of their reported individual processes. He focuses upon agreement, demonstrated across the various accounts, concerning the existence of two stages: 'inspiration' (an idea appears in consciousness) and 'execution' (the idea is subject to a series of more conscious and deliberate processes of extension and transformation) (Sloboda, 1985:116). He claims these are found in every branch of artistic activity and maintains that whereas the artist has a whole range of techniques, the composer has:

> ...no such repertoire for generating the first germs on which to exercise his craft (ibid., 1985: 116)

He notes that it is much easier to observe what composers actually do with their ideas than to elucidate where they come from, and the criteria that composers use to reject or modify ideas is not clear. The diagram below representing the composition process is taken from 'The musical mind' (Sloboda, 1985 - see fig. 12):

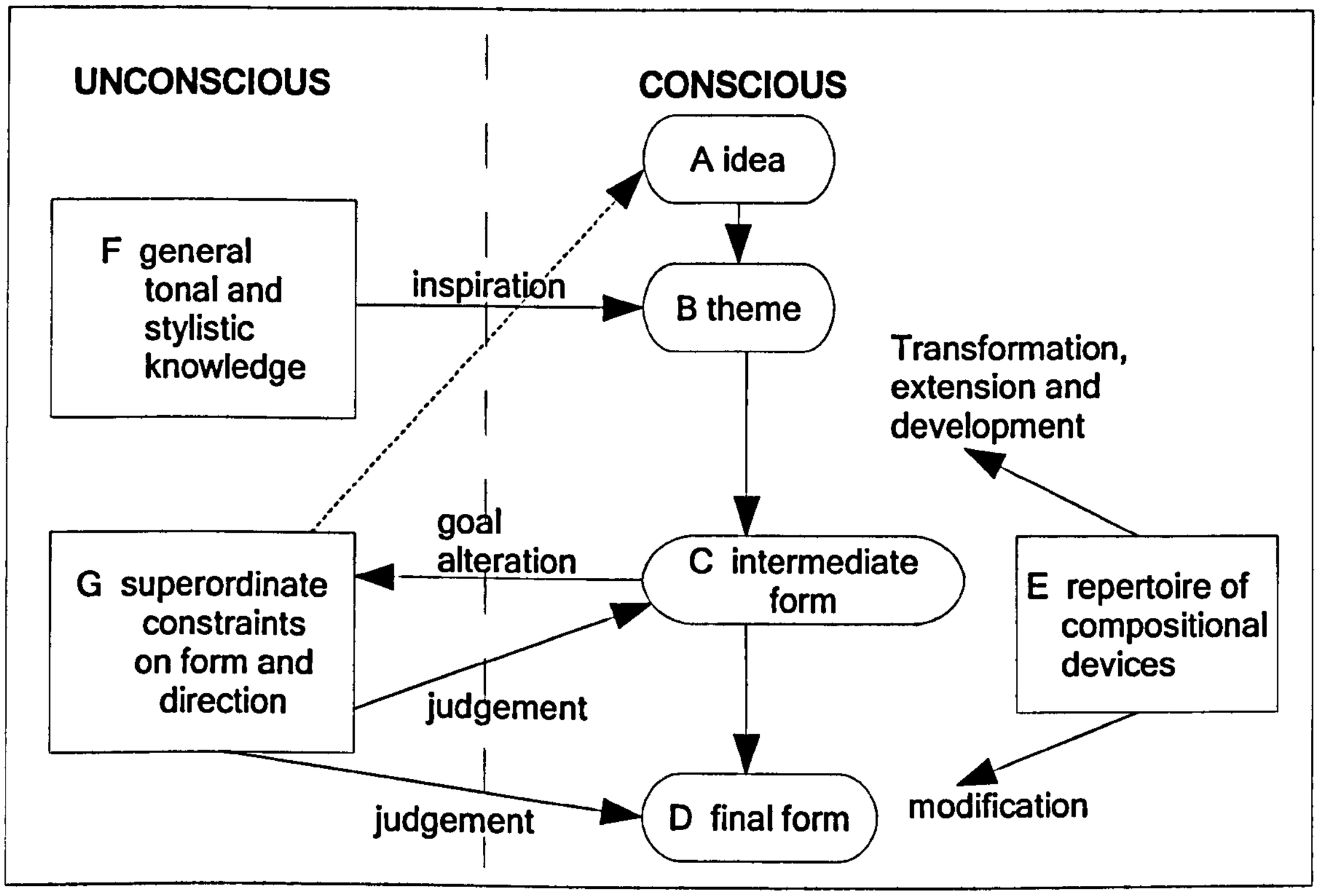


Figure 12 - Sloboda - the composition process

Vera John-Steiner (John-Steiner, 1997) has, following interviews with many eminent artists, written about how creative people think, and claims (as does Sloboda) that there are similarities 'across domains of creative endeavours' (ibid., 1997:152). She considers that the creative process begins with a

> ...web of ideas, which may be started at one time and then put aside until needed in a new composition... (ibid., 1997:152)

... and links this to evidence of the composition processes employed by Beethoven and Tchaikovsky. There then might follow a period of extensive work, followed by a period when composers might leave the work for a while. She likens the composing of a large and complex work to the writing of a novel.

2.5.2 Models of pupil composing

More recently, scholars have become increasingly concerned with models of the processes employed by pupil composers as distinct from the professional models described above (Burnard, 2000; Burnard & Younker, 2002; Fautley, 2005; Hickey, 2003; Seddon & O'Neill, 2003). An useful view of the composition process, from the perspective

of electroacoustic composers is presented by Savage and Challis (2002) in their digital arts project with a secondary school and a young offenders' institution. They represent it diagramatically as follows (see fig. 13):

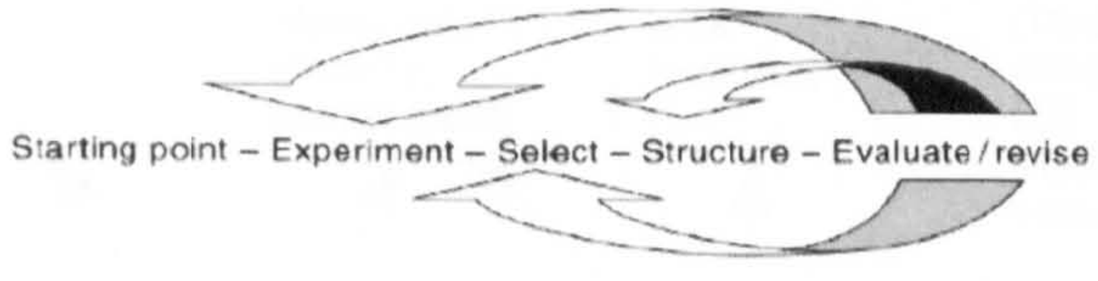


Figure 13 - Savage and Challis - the composition process

The stages they show are very close to Wallas's: Starting point = Preparation; Experiment = Incubation; Illumination = Select & Structure; and Verification = Evaluate / revise. Savage and Challis point out that the loop back from 'Evaluate' to earlier stages is important and results in a ...

> ... compound process rather than a simple process of accumulating or structuring material. (ibid., 2002:11)

Another 5-stage model of the composing process is provided by Hickey (2003 - see fig. 14). This model is particularly notable for its inclusion of influencing parameters external to the manipulation of the musical elements themselves; task motivation, previous experience and 'music aptitude', social environment and use of 'creativity-relevant processes'.

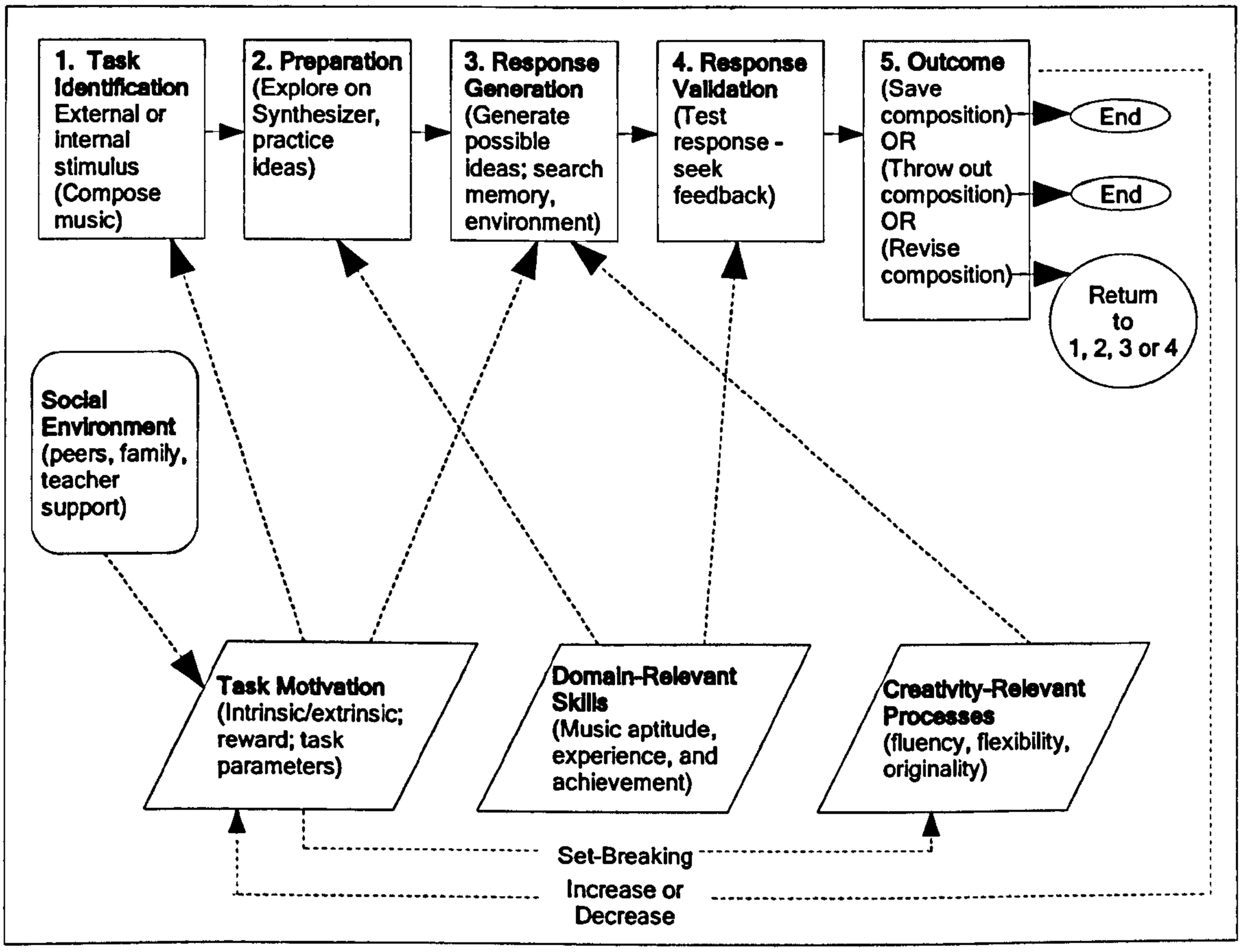


Figure 14 - Hickey - the composition process

Peter Webster's 'Model of Creative Thinking Process in Music' is another attempt to model the composing process: his four stages - Preparation, Time Away, Working Through and Verification are not unlike the stages identified by Wallas in 1926. The 'Time Away' element is reminiscent of that of the observations of Vera John-Steiner, where work is left for a while before being revisited. Webster's model is somewhat complex and aims to provide all the conditions necessary for each stage. However, one important element of it is the dynamic process of creative thinking alternating between divergent (imaginative - many ideas are considered) and convergent (factual - various possibilities are evaluated and a solution found) thinking over time. Below there is a diagram by Webster, produced for the Research in Music Education Conference at Exeter University, UK in 2003 (see fig. 15):

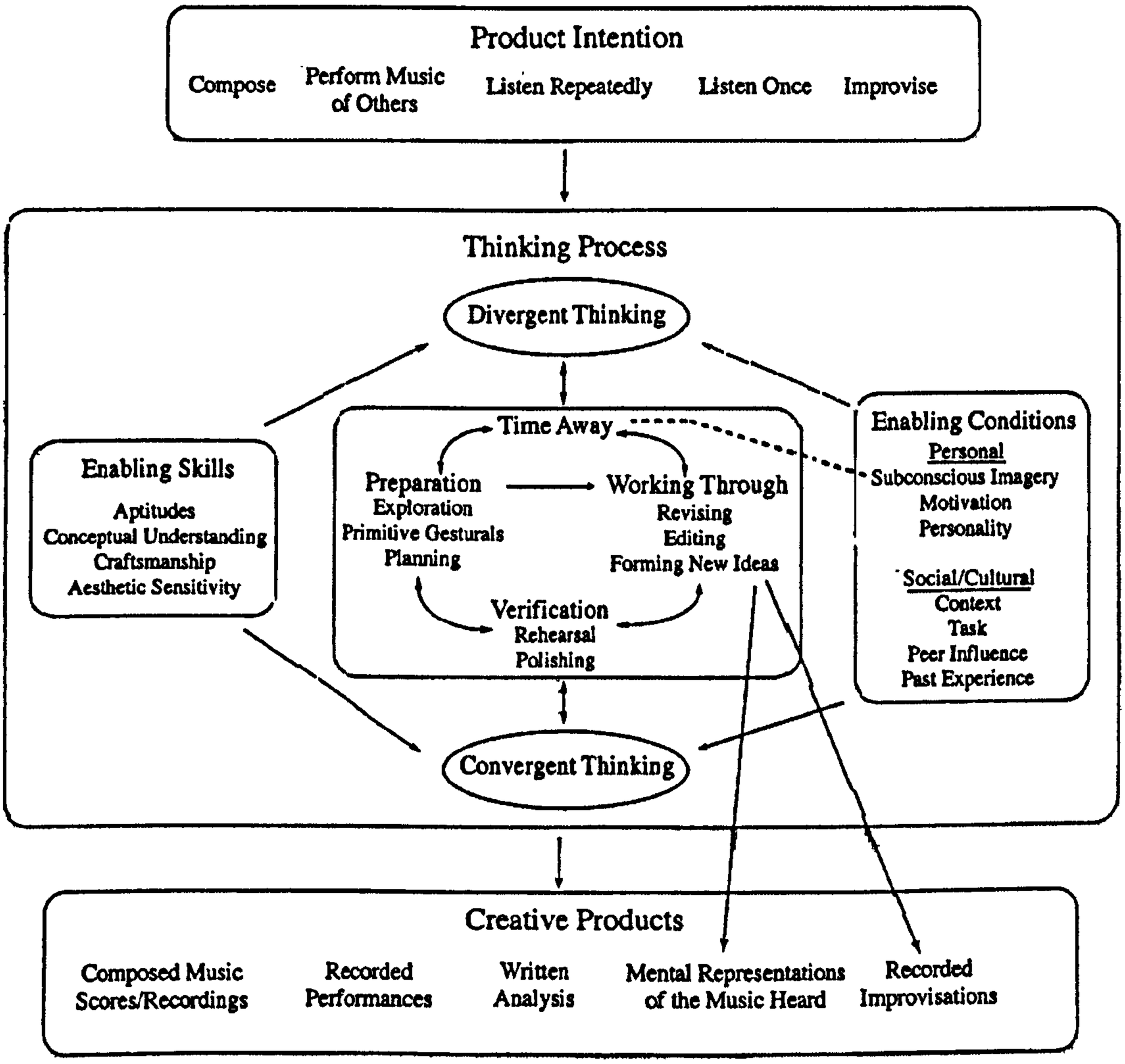


Figure 15 - Webster - the composition process

The model produced by Fautley (ibid., 2005:46) of *group* composing is significant as it is the first to represent this non-individualistic process. It contains 9 stages and interestingly, contains several loops, notably from stages 3 to 2 and from 8 to 7, mirroring the Savage and Challis principle of revisiting experimental sections prior to moving on (see fig. 16):

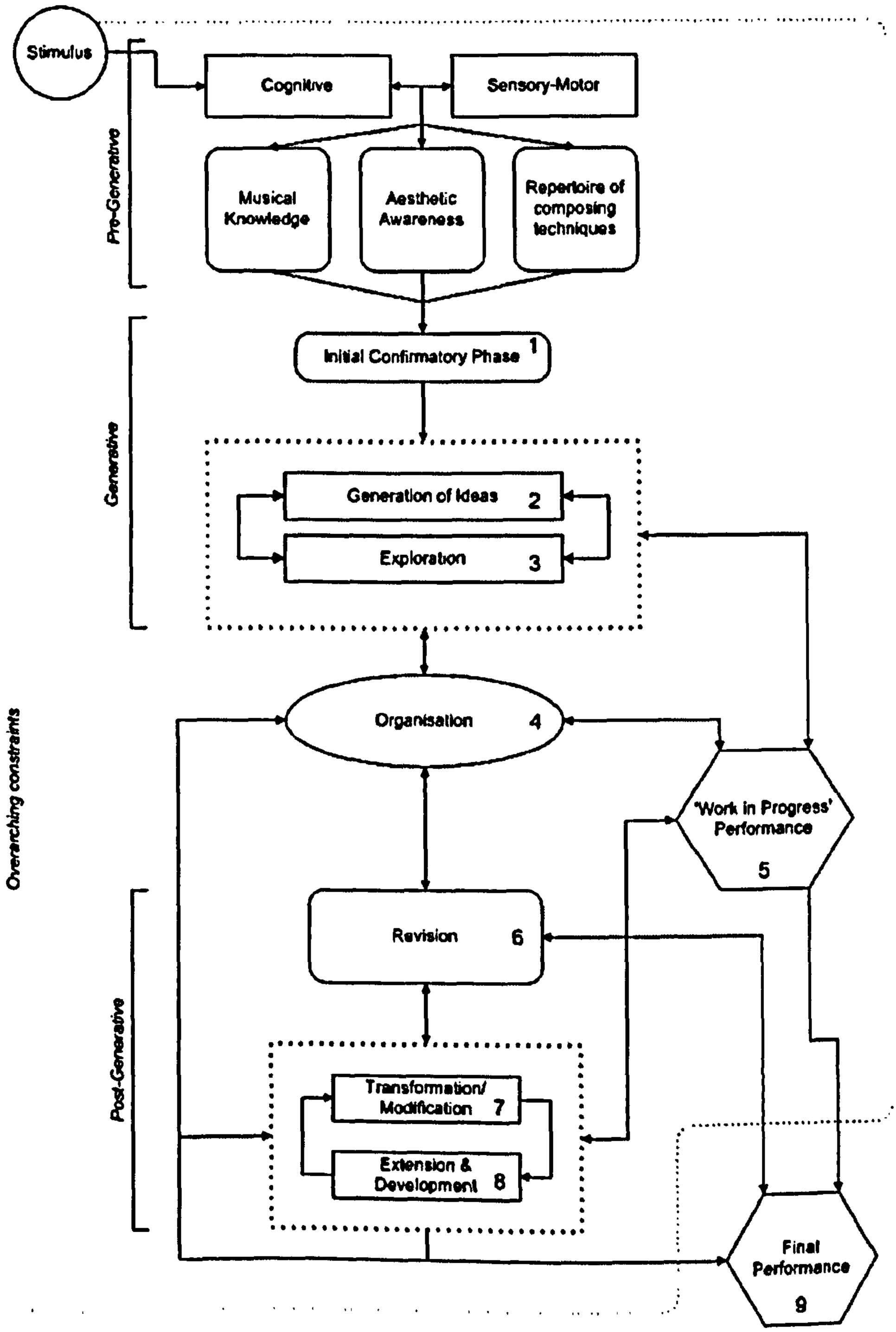


Figure 16 - Fautley - the composition process

Burnard and Younker (Burnard and Younker, 2002) take a different, more qualitative approach to describing the individual composing process. They utilise the Wallas (1926)

stages for their framework in order to explain and illuminate a variety of strategies and pathways employed by individual pupils. In common with Hickey, they maintain the individual approaches taken to composing may be due to external influences, such as cultural contexts, instruments played, formal training, style of music, choice of instrumentation and the ability to employ self-regulation strategies. From this they draw out characteristics of composing with regard to creativity and its uniqueness, concluding with advice for teachers, the first of which is:

> Understand fully the creative process (ibid., 2002: 259)

The approaches described above to demystifying the compositional processes employed by professional and pupil composers provide distinct perspectives; another is provided through a consideration of the assessment of creativity in composing; my own understanding of 'creativity' is discussed in chapter 4, section 4.2.2.

2.6 Research into the processes employed by pupils when using computers for composing in the music classroom

Empirical studies into group composition processes when using computers for composition in the classroom are extremely rare (Gall and Breeze, 2005; Dillon, 2003), although Seddon (2006) has studied the composing of collaborative pairs of pupils situated in different countries where work was shared via email; this situation is somewhat surprising since this is the normal mode of engagement for key stage 2 and 3 pupils when composing with computers. However, there has been empirical research into the processes employed by individual pupils when composing in the classroom with computers. One of the earliest examples is work carried out with children aged 7, 9 and 11 by Kratus in the USA with electronic keyboards (1989); in addition to the composing products, he also recorded the 10 minute experimentation period leading up to the performance of the composition. He found, like Swanwick (1988) before him, that there were developmental differences demonstrated by the strategies employed by children of varying ages. The chief age-related differences noted by Kratus were that for 7-year-olds, improvisation was more appropriate than composition, and that 9-11 year-olds were able to use -

> exploration, development and repetition in a manner consistent with reports of adult composers' compositional processes. (1989: 5)

A study by Folkestad (Folkestad et al., 1998) detailing research into the composing of fourteen 15-16 year-old participants, demonstrated that the use of music technology (in this case a computer workstation running Master Tracks Pro, a multi-timbral synthesizer and headphones) changed the *what* (the musical content and style) and the *how* (the ways of creating music) of the composing process, resulting in two different ways of music creation - 'supplementary use' (where the computer is used as an arranging tool for the music) and 'integral use' (where the computer is used an integrated tool in the composing process) (ibid., 1998: 84). Folkestad used what he terms 'portfolio method' (ibid., 1998: 85) to collect multiple computer files (using the 'save as' facility) at regular intervals during the composing process, a technique that is now common, and additionally undertook interviews with the participants. The outcomes of this research was the construction of a 'typology of compositional styles' (ibid., 1998:87) whose two overarching categories were the 'horizontal' (where the music composition and its arrangement are separate processes) and 'vertical' (each section of the music is completed in terms of its composition and arrangement before moving on to the next) modes of composition.

Dillon (2003) is one of few observers who has undertaken empirical research into group composing with computers. In her study, eJay was used by groups of 2 and 3 pupils who were videoed as they worked. From the transcriptions and coding of their spoken dialogue and other interactions, she found that the participants were able to able to develop a shared understanding of the task using generally short and focused fragments of speech and that conflict or periods of argument 'may not be conducive to collaborating on creative tasks' (ibid., 2003: 895). Also, communication between participants occured in ways other than through dialogue: '... musically, non-verbally and via the computer, through actions and the explicit manipulation of the compositional structure ...' (ibid., 2003: 895).

Seddon & O'Neill (2003) examined differences in composition strategies using Cubase exhibited by adolescents who had received formal instrumental music tuition and those who had not, and found that those who had benefited from formal instrumental tuition spent less 'exploratory' time. Nilsson and Folkestad (2005) report on a 2-year empirical study of 8-year old Swedish children which identified five different variations of composing music, each placing a different object in the foreground of the activity:

i. the synthesiser and the computer;

ii. using the activity as a means to express personal fantasies and emotions;

iii. the playing of the instrument;

iv. the music itself;

v. the task.

Their results highlighted the importance of the period of 'play' before the main composing process started, which was most imaginatively realised when the task was not in the foreground and therefore the activity was not within a 'pedagogical framing' (Nilsson and Folkestad, 2006: 34). They recommend that educators should regard creative music making as play rather than as a school task and should aim to vary their methods in order to suit all children. A request common to most studies into composing with computers is that more research needs to be undertaken.

2.6.1 The assessment of creativity in composing

The assessment of creativity has been long considered to be subjective, but has come into sharp focus with the inclusion of composition into public music examinations, for example, the General Certificate of Secondary Education (GCSE); it should be noted that it is the compositional *product* that is examined (by the teacher through the awarding of criteria-referenced marks) and moderated (by the board, a sample of the marks awarded by a school being compared to the moderation team's own standardised marking of a representative range of samples and adjusted if they fall outside the tolerance limits) - not the composing *process*, although aspects of the process can be noted in the pupil commentary that accompanies the composition itself. Various techniques for measuring creativity in the composition have been developed; Amabile's (Amabile, 1996) 'Consensual Assessment Technique' is considered by many (Hickey, 2001) to be a reliable measure. Another tool, Webster's 'Measure of Creative Thinking in Music' (MCTM) (1989: 22) is also considered worthy although it has been criticised on the grounds that owing to the factor analysis techniques it employs, it tends to measure divergence and convergence (see 'Webster's model of creative thinking in music' shown in fig. 17) rather than 'genuine creativity' (Hickey, 2001).

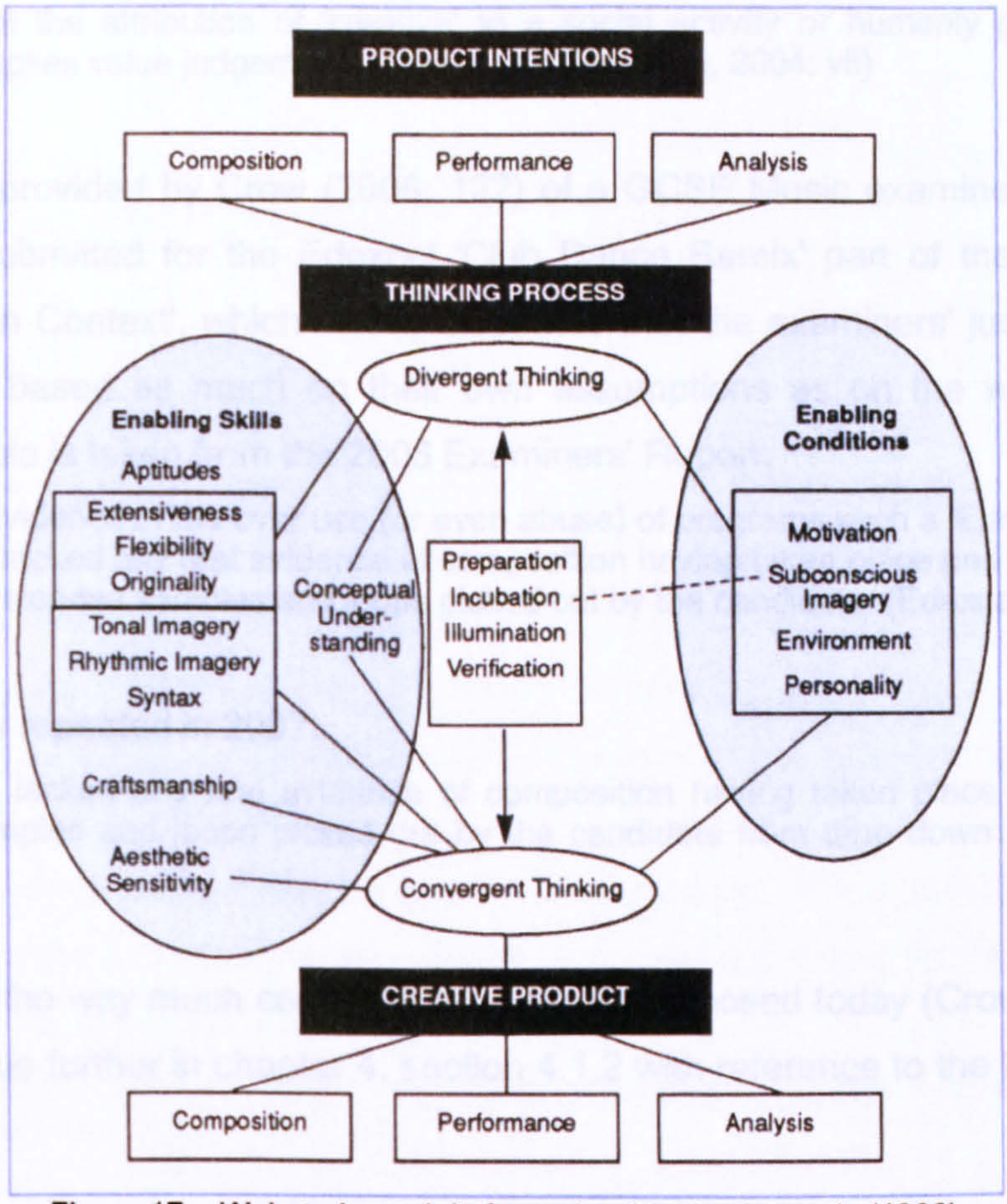


Figure 17 - Webster's model of creative thinking in music (1990)

Byrne et al. (2003) have used Csikszentmihalyi's Experience Sampling Form (ESF) assessment tool to measure 'flow' as experienced by university students during composing in an attempt to assess their creativity and consider that it might be useful to consider its inclusion in the secondary school music classroom (ibid., 2003:286).

My own view is that attempts to measure the 'amount' of creativity in a composition is an attempt to apply an 'objective' quasi-scientific approach to measure something that has as much to do with its perception and interpretation as it has with the work and its transmission. As compositions are perceived and interpreted by humans, they bring to their perception former experiences, attitudes, historical and cultural values that can affect the intended 'objective' measurement. To remove these values from the process of 'measuring' creativity is to remove the emotional and spiritual responses to music, which are so important to the way humans perceive and experience it. This view is echoed by Negus and Pickering (2004: vii):

> ... the meaning of creativity is integrally tied to changing historical processes, technologies and social conditions, and conceptions of individual and society. It is precisely because of such

> conditions that the attribution of 'creative' to a social activity or humanly produced artefact necessarily implies value judgements (Negus and Pickering, 2004: vii)

An example is provided by Crow (2006: 122) of a GCSE Music examiners' report about compositions submitted for the Edexcel 'Club Dance Remix' part of the Area of Study 'Popular Song in Context', which clearly illustrates that the examiners' judgements about the work were based as much on their own assumptions as on the work itself. The following example is taken from the 2006 Examiners' Report:

> There is still evidence of the over use (or even abuse) of programs such a 'Ejay' (sic) and 'Acid'. These pieces lacked any real evidence of composition having taken place and were rather just a selection of preloaded samples and loops picked out by the candidate. (Edexcel, 2006: 12)

This was largely repeated in 2007:

> These pieces lacked any real evidence of composition having taken place and were simply preloaded samples and loops picked out by the candidate from drop down menus. (Edexcel, 2007: 12)

And yet, this is the way much commercial music is composed today (Crow, 2006: 123). I discuss this issue further in chapter 4, section 4.1.2 with reference to the theories of C. S. Peirce.

2.6.2 Classroom composing with music technology - the way forward

Mills and Murray (2000) discuss Ofsted inspections of key stage 3 music lessons where ICT was included and elucidate what they consider to be good practice and raise issues of concern. They state that:

> ICT, used well, promotes higher attainment in music ... (2000: 129)

...which is a view echoed by Odam (2000:116) and again 4 years later by Ofsted (2004a: 4). They draw out other themes that have strong resonances in other music classroom research:

- the use of ICT in music should not dominate curriculum time;
- equipment reliability and suitability are issues; teachers need to be able to troubleshoot simple technical problems with technical support being required for more serious issues (Odam, 2000: 117);
- teacher competence in the use of ICT needs addressing (ibid., 2000:124);
- the adoption of sufficiently personalised learning tasks needs addressing.

They noted, however, that:

- the role of the teacher was central;
- the use of ICT increased pupil motivation;
- the use of sequencer templates and a large screen for teacher demonstration that all pupils can see are a good idea.

Much research prior to 2000 focused on the potentials of music technology, but more recently, observers are sounding warnings concerning its use. One of the earliest of these was Odam (2000) who raised some key points about the adoption of technology concordant with those of Mills and Murray and also raised the issue of the networking of computers to allow for easier administration of tasks by the teacher. More recently, Cain (2004) has argued that advances in music technology have made necessary the development of a new theory and conceptual framework for music education and bring into question the very meaning of the terms 'performing' and 'composing' that have become such a large part of the lexicon of school music. Crow (2006) echoes these concerns about new technologies (specifically compressed music formats such as mp3 and 'DJ' programs) and musical learning:

> One of the key questions for educators is what musical learning will take place when pupils engage in a musical activity. (2006: 124)

He maintains that this has resulted in a need for:

> ... music teachers ... to rethink, redesign, develop and resource a 'new' music curriculum. (ibid., 2006: 127)

This is indeed a challenge, especially in the light of the new National Curriculum and Music National Strategy materials, which perhaps do not take this fully into account.

2.7 Conclusions

This chapter has provided the background to contemporary composing in the music classroom with computers. The adoption of computers for music composing in English primary and secondary schools can be viewed as the continuation of a long history of the appropriation of technological tools by schools for music. Perhaps owing to the differently organised arrangements for the teaching of music in the two distinct phases of education, English secondary schools use more computers with greater impact than primary schools. Inspection has been a key driver in the adoption of this technology, with the government body Ofsted linking it to higher attainment (2004a); however, recent reports have indicated

that the current need is for teachers to give greater consideration to compositional process and design lessons so that pupils can experiment with their own original ideas.

Official endorsement of the previously developing role of composing within the music curriculum was provided by the publication of the National Curriculum for Music (DES, 1992). Composing has remained a central part of the English National Curriculum and is embedded within the newest revision due for introduction in schools from September 2008. Music activities are considered best organised in a holistic project, so that performing, composing and listening may all be integrated and thematically linked.

Resourcing music classrooms so that all pupils can use a computer for composing is expensive and has rarely been undertaken so that all pupils in a class can use a computer simultaneously. There is a general move towards a situation where pairs of key stage 3 pupils can all use a computer for music lessons, requiring the provision of 15 music workstations in a typical classroom. Intermediate arrangements are adopted by practitioners where this ideal is not yet met, exemplified by Odam's 'mixed economy' approach (2000: 117). Although research is scant in this area, an issue for music teachers is the layout of the classroom where computers are used as well as that of pupil role.

What type of music software to use in the classroom has not been a straightforward choice for music practitioners, with the adoption of software tools for music at key stage 3 becoming somewhat polarised around the provision of a sound-based tool (such as a MIDI and audio sequencer) or a score-based tool (such as a scorewriting package), in turn seemingly linked to teachers' underpinning philosophies. However, MIDI and audio sequencing programs were the most popular software tools in secondary schools in 2004. There has been some professional help provided for teachers by the government in the use of computers in the music classroom, but this is often most effectively delivered at the local level, perhaps by colleagues, friends or through self-tuition (Ofsted, 2004a: 10).

There has been little empirical research focusing upon group composing processes when using computers in the music classroom but allied studies of professional and group composing in school without computers and individual composing with computers in various settings is useful in illuminating and helping to understand the issues. Existing models of the assessment of creativity are considered to be problematic as value judgements are inevitably placed on composition products owing to the social and cultural contexts in which they are perceived. Additionally, there have been calls for a

reassessment of the music curriculum in the light of recent technical developments as they prompt a re-evaluation of the meaning of the terms 'performing' and 'composing' in the current classroom music context (Crow, 2006). There has also been a suggestion that a new theory of music education is now needed owing to the perceived undermining effects of music technology (Cain, 2004).

In the next chapter, the pilot study is described, providing the background and reasons for the choice of theoretical framework that was adopted for the main studies and that led to the research design. The development and trialling of the methods used in the main studies are also outlined.

1 Source: statistics from the Department for Education and Employment (DfEE, 2000), Department for Education and Skills (DfES, 2001, 2002, 2003a) and the British Educational Communications and Technology Agency (Becta, 2005).
2 See http://www.steinberg.net/983+M52087573ab0.html
3 See http://www.apple.com/logicstudio/logicpro/
4 See http://www.sibelius.com/
5 See http://www.finalemusic.com/
6 See http://www.harmonicvision.com/
7 See http://www.ejay.com/splash/default.htm
8 See http://www.sonycreativesoftware.com/products/acidfamily.asp
9 See http://en.wikipedia.org/wiki/Module_file
10 See http://www.renoise.com/
11 See http://www.harcourt.co.uk/Series/product.aspx?isbn=9780435810917&xmark=gbook
12 See http://links.jstor.org/sici?sici=0027-4380(199403)2%3A50%3A3%3C1048%3AMMI%3E2.0.CO%3B2-9
13 See http://www.naxos.com/naxosbooks/naxosbooks_mto.asp
14 See http://www.musicteachers.co.uk/journal/index.php?issue=2000-07&file=attica-guide
15 See http://www.microsoft.com/products/encarta/default.mspx
16 See http://www.hoddereducation.co.uk/Title/0340886900/The_Hutchinson_Encyclopedia_2005.htm
17 See http://www.digidesign.com/index.cfm?navid=28&langid=51&
18 See http://www.steinberg.net/1409_1.html
19 See http://www.fischertrust.org
20 See http://www.teachernet.gov.uk
21 See http://www.curriculumonline.gov.uk/Subjects/Mu/Subject.htm
22 See http://www.ncaction.org.uk/subjects/music/index.htm

Chapter 3. Pilot Study

3.1 Background

In order to prepare for the main studies, a pilot study was carried out, which resulted in the theoretical framework and research design that were adopted. At the time, this researcher was a member of the InterActive project[1] based at the University of Bristol, whose main aim was to examine ways in which new technologies were used in a range of educational settings to enhance learning. The pilot study selected for this thesis was one of the Subject Design Initiatives (SDIs - see section 3.3 below) of the project. Before presenting the details of the pilot study itself (see section 3.2), sections 3.1.1 to 3.1.4 provide some background to the InterActive project in order to give the context for the study.

3.1.1 The InterActive project

As part of the project, research was carried out across a range of subjects - English, history, geography, mathematics, modern foreign languages, music and science. University and school-based researchers worked together in Subject Design Teams (SDTs) to design 'Subject Design Initiatives' (SDIs), which were a series of lessons using computers that were crafted to investigate a particular area of the curriculum that was considered difficult to teach; the music team decided to focus their research upon composing. SDTs were considered to comprise a 'community of practice' (Wenger, 1998), where its members learn through social participation and collaboration with 'knowledgeable others' (John & Sutherland, 2004: 103); as well as being a community of practice within itself, the music SDT also overlapped with other communities of practice that were involved either directly or indirectly with the project, for example the whole project team, other subject teams, schools and the subject departments within them (Sutherland et al, 2008). A particular concern of the project was to use existing ICT tools and investigate their use in the naturalistic setting of the classroom. The project adopted five interrelated research strands, the middle 3 of which were of direct concern to the music team:

- Educational Policy and Management of ICT in Schools,
- Teaching and Learning,
- The Role of Subject Cultures in Mediating ICT Use,

- Teachers and Professional Development,
- Learners' Out-of-School Uses of Computers.

3.1.2 Theoretical perspectives

The project was underpinned by a socio-cultural perspective, where individual human understanding has its origins in and is shaped by social life; communication in the form of language and other symbolic systems has a crucial role to play in learning (Sutherland et al., 2004: 6; Sutherland, Robertson & John, 2004: 410). The mediation of human action through tools, as discussed in chapter 1, section 1.2.4 is central to this perspective, as is the cultural context that this action takes place within, whether national, for example in responding to the influences of centrally devised curricula, or more local, as in the context of the culture of the classroom. The importance of out-of-school factors was also recognised (Kent & Facer, 2004), particularly where ICT was used. Another aspect of the socio-cultural perspective is the provenance of the cultural tools adopted; for example, the music software Cubasis was based on software used in professional music studios and carried with it echoes of this context; for example, in its use of virtual representations of studio equipment, such as mixers and effects units and use of terms such as 'pre-/post-roll' which refers to older tape-based technologies. Another aspect of this theoretical perspective is that pupils construct their own meanings, building on their existing knowledge, therefore the teacher has an important role to play in creating and organising learning environments that take account of this.

Other adopted theoretical perspectives included the theory of affordances (Gibson, 1979; Norman, 1988):

> The *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill. (Gibson, 1979, 127).

In a music context, a composing package might offer a pupil a certain set of affordances, but these could be quite distinct from another product, or method of composing, for example. The subject culture strand (see section 3.1.1) was informed by the notion of 'pedagogical content knowledge' (Shulman, 1987; Goodson & Mangan, 1995; Gall & Breeze, 2007; John, 2005: 472-3) and led in the case of music to the identification of distinct differences between how primary and secondary colleagues viewed music in their institution, and identified 3 overarching concerns for all teachers: the perceived low status of the subject and the effects on music and ICT provision; a concurrence with a view of

music being for all pupils, and a concern with a need for changes to pedagogy where ICT was employed in the music classroom.

A key text which articulated many of the underpinning beliefs of the project concerning learning was 'Engaging Minds' (Davis, Sumara & Luce-Kapler, 2000). A particular notion that was found to be useful, and one that will illuminate the analyses carried out later in this study was that of 'liberating constraints', which is discussed in some detail below. 'Liberating constraints' can be summed up as...

> ...a phrase that describes the balance between freedom and restraint that creates conditions for learning and creativity (ibid., 2000: 87)

Davis and Simmt (2003: 155), in their discussion of mathematics education and complexity science, provide further detail, describing a continuum between tasks that are too '... narrow to invite much variety of interpretation...' and those that are '... too open to foster focused interpretations ...' and provide a phrase that describes what successful lesson design should aim for, to ...

> ... maintain a delicate balance between sufficient organization to orient agents' actions and sufficient randomness to allow for flexible and varied response. (ibid., 2003: 155)

Further clarification is provided by Bowsfield (2004) who notes that -

> Enabling constraints is finding the space between the extreme alternatives, such as the far too open ... and the far too narrow...(Bowsfield, 2004: 150-1)

(The use of the term 'enabling' by Bowsfield here is interpreted as being equivalent in meaning to 'liberating'). In the context of music education, an example of a composing task that could be too narrow might be:

'Compose an eight-bar piece for piano using the following:

- chords C, G and F for one bar each in the following order:

  C C F G C F G C;

- arpeggios for the left-hand accompaniment;
- the notes E, F and G for the melody;
- a tempo of 92 bpm.'

An example of a task that could be too open might be:

> 'Compose a piece for the piano.'

Davis et al. (2000) suggest that classroom tasks would better be considered as 'structures' which are necessarily complex and organic (in the biological sense, that is evolving over time according to need and opportunity). Their view is that the notion of liberating constraints is built upon a view of learning as...

> ... a complex process of incorporating or embodying a diversity of experiences (ibid., 2000: 87)

Davis et al. provide a metaphor of a football game to illustrate the application of liberating constraints to show that although constraints are necessary to prevent the game quickly evolving into chaos, it is also important to allow for creativity, which should occur...

> ...as a result of - not in spite of - the defining constraints. (ibid., 2000: 88)

Davis and Simmt (2003: 154-5) describe the poles of the liberating constraints continuum as *proscription* (an open and pupil-centred approach) and *prescription* (the expected outcomes can be predicted and the lesson's success can be measured against them). They note that a proscriptive situation does not represent an abandonment of constraints, but a shift in thinking about the sorts of constraint that are necessary for generative activity (ibid., 2003: 155). However, the authors (2003: 155) maintain that it is difficult to plan for the application of liberating constraints in the classroom, and that generally these will be 'refined and negotiated while teaching'.

It should be noted that is not only within music education that liberating constraints have a role to play; professional composers also consider constraints essential and a necessary way of creating the freedom for them to compose (Stravinsky, 1947: 68).

Links to the notion of 'liberating constraints' in English classrooms are made in the 2006 professional development materials for the Key Stage 3 Strategy. This was the first government attempt to provide guidance for practitioners which covered all areas of the mandatory music curriculum for a particular age group and will probably be very influential in planning music curricula in the near future. The theme of freedom and constraint is explored in the Strategy document 'Creative teaching and learning in music' (DfES, 2006b:

18) This document links freedom and constraints to challenge and asks teachers to evaluate these in a provided video and an example of their own work; however it does not explore the notion of 'liberating constraints', instead treating constraints as boundaries that provide limits for pupils' work. However, it does suggest that teachers should create -

> ... an environment which encourages curiosity, enquiry, problem solving (ibid., 2006b: 13)

It goes on to suggest that teachers should identify when risk-taking is pertinent and be prepared to deviate from the lesson plan where appropriate: this tends to suggest that 'going outside' the lesson constraints might be a good idea at times for teachers, and further suggests that pupils should follow -

> ... lines of thought that interest them ... [and have] ... confidence in their own thoughts and ideas

Just when pupils should 'work outside' a lesson's constraints, according to this documentation, is not clear; the table 'Defining musical understanding: six stages of progression' (ibid., 2006a: 15), which it has been suggested corresponds to existing National Curriculum levels 3-8, indicates that pushing against the constraints of the lesson design (only indicated in terms of style here), is appropriate to the top two 'stages' only, stating in the 5th stage, 'Discriminate and Develop' (level 7) that -

> [Pupils should learn] how to refine and / or combine conventional procedures to create new and coherent forms of musical expression that challenge and excite

... and ...

> ... [pupils] can develop interesting music by increasingly pushing the boundaries within one style, or by using ideas from one style when working in another to formulate an emerging 'fusion' style (ibid., 2006a: 15)

In the 6th stage, 'Discriminate and Exploit' (level 8) it states that -

> [Pupils should learn] how to create music that can express and symbolise personal views

... and ...

> Pupils understand how musical starting points can be exploited to go beyond a style, and begin to create a distinctive musical 'voice' (ibid., 2006a: 15)

However, the other lower levels suggest that pupils should work within the conventions of a specified style.

3.1.3 Music subject team organisation

The music subject team comprised two researchers from the University, 3 teachers from 2 primary (ages 4-11) schools and 5 teachers from 3 secondary (ages 11-18) schools. The pupils that took part in the music SDIs in primary schools were aged 10-11 and in secondary schools were aged 11-14. In the case of music, the Subject Design Initiative (SDI) was a 5 or 6 week project that was classroom-based and used computers for composing. The use of the software packages eJay and Evolution Sound Studio were investigated in the primary settings and in the secondary settings, Cubase or Cubasis.

3.1.4 Research methods

The primary data collection tool was digital video, together with teacher and pupil interviews, computer screen grabs, collection of pupil resources used during the SDI and the compositional products in the form of computer files on disk. The placement of the video camera, organisation of sound capture and the means to automatically perform screen grabs without disturbing the pupils were developed over the life course of the InterActive project, including this pilot study. A full explanation of the methods developed can be found in chapter 5, section 5.3.

3.2 The pilot-study

One of the SDIs from the InterActive project was selected for a pilot project for this study, and the data collected and analysed by this researcher. The observations were carried out in a year 9 (ages 13-14) music classroom in an inner-city secondary school. This study lasted for 5 weeks and took place in the second half of the Summer term. Pairs of pupils were provided with a short film clip which ran synchronously within, and was controlled by the music sequencing software Cubase. Their task was to arrange the provided short musical fragments, through moving, copying and pasting them, into a structure that reflected the action in the film clip. Three 'levels' of the task were provided by the teacher so that pupils of all attainment levels could engage with it, the higher attaining pupils being encouraged to delete some of the provided musical fragments and compose their own.

Each lesson was videoed and semi-structured interviews were carried out with the observed pupils and teacher both before and after the SDI. The screengrab program was experimented with during this pilot study, and though initially was only partially successful, the problems were resolved by the completion of the study. The teacher did not use

worksheets for this SDI, choosing instead to write the activity outline on the whiteboard. Composition products in the form of Cubase files were collected.

To analyse the data, an inductive approach was adopted, similar to that embedded within grounded theory (Strauss and Corbin, 1990). The videos were watched many times, from which various categories emerged. A coding frame was then developed and the discourse was then categorised and presented as a time-ordered matrix. The emergent categories were:

- Pupil discourse
- Musical exploration
- Technical exploration
- Teacher help
- Gesture
- Recording
- Off task
- Cross group discourse
- Other

These were printed on A3 sheets as follows and the data transcription added by hand (see fig. 23):

Time	Pupil discourse	Musical exploration	Technical exploration	Teacher help	Gesture	Recording	Off task	Cross group discourse	Other

Figure 18 - Pilot study coding sheet

These sheets were then later used to inform higher levels of analysis involving all the music SDIs. One of main benefits of the sheets was the ability see the categorised data related to one portion of time together, presented horizontally, which provided a rich description of the activity. A problem of the sheet was that the data was not re-usable without further copying and it was relatively difficult to link related data if it occurred in different time portions; for example, when wanting to link related fragments of musical exploration. Repeated watching of the video data also revealed that other categories

could have been added, particularly the visual, for example when the computer screen was used for joint negotiation by pupils in the group. However, the sheets were found to be useful in providing the basis for future discussions upon specific aspects of the music team's work.

3.3 The emerging theoretical perspective

3.3.1 Classroom observations

The repeated watching of the pilot study video and the breadth of the emergent categories provided the impetus to consider a theoretical perspective that was able to embrace the variety of data that the observation of classroom composing had produced. Additionally, the pilot study had shown that there were many factors that were contributing to the process that studies of the use of language and the music alone could not reveal. In the music classroom where computers were used, I had previously observed that pupil conversation was only part of pupils' inter-personal discourse and did not appear to be the dominant form of communication; the visual nature of the computer screen, the use of gesture and the sound of the music, both played by pupils on the music keyboard and played back from the computer, seemed to have equally important parts to play in their discourse. It seemed that the meaning of the whole activity for the pupils was distributed amongst these various ways of communicating. The need for a theory that considered all forms of communication with the same level of potential was thus important. From my own experience in music classrooms, I had observed that much composing work seemed to be strongly based on existing musical ideas, some of which could be attributed to the classroom context, but other seemed to be imported into the classroom; what these imported musical ideas brought with them in terms of connotations and meanings for pupils was unclear to me. There was therefore a need for an adopted theoretical perspective to embrace this transformation of already existing musical material and provide a framework to consider its origins.

3.3.2 Theoretical requirements

An adopted theoretical frame would need to not only embrace the various types of communication noted in the classroom observations on an equal basis but would also need to allow for their social functions (in this case, in the context of the classroom) to be accounted for. It would need to provide a framework for a consideration of the origins of

the musical elements used for pupils' composing and allow for the individual interpretation of meaning to be made of these musical elements and their transformation in during the process of composing. In particular, it would need to allow for the presentation of data as already trialled in the time-ordered matrices of the pilot study (see fig. 18) so that discourse contained in a variety of communicational forms could be tracked and linked in order to facilitate its analysis.

3.3.3 Identification of a theoretical framework

A theoretical framework that meets the above requirements and is particularly well suited to a consideration of classroom phenomena, as demonstrated in its application in science and English classrooms (Kress et al., 2001; Kress et al., 2005), is Multimodality, itself based on the social semiotic principles of Halliday (1978). One particular aspect, Design and Transformation (Kress, 2000b) was found to be especially useful, both as a frame to consider the re-working of previously existing musical ideas when composing, and as a structure to allow for a consideration of their origins. This is further explained in the next chapter.

3.4 Review

In this chapter, the pilot study was described and how it led to the adoption of the theoretical framework and the development of the research design, as well as providing the opportunity to trial the methods adopted in the main studies. In the next chapter,the theoretical framework itself is explained, together with its application in researching the music classroom.

1 See http://www.interactiveeducation.ac.uk

Chapter 4. Multimodality and music

4.1 Mutimodality

4.1.1 Introduction

In chapter 2, it was explained that the increased adoption of technological tools into the music classroom has resulted in the need for a reassessment of composing and performing in the curriculum as well as a consideration of a new theoretical approach to apply to the investigation of the use of these tools by pupils in music classrooms. In chapter 3, following a description of the pilot project, the case was made for the adoption of multimodality theory, which as Jewitt (2006: 3) points out, is still an emerging theory but has nevertheless proved popular with educational researchers (Kress, et al., 2001, Jewitt, 2006, Norris, 2004, Kress, et al., 2005). Multimodal theory is explored in this chapter in section 4.1.2 and the inherently multimodal nature of music classrooms is investigated in section 4.1.3. In section 4.2, there is a separate discussion of an area of multimodality theory that is particularly pertinent to this thesis, Design and Transformation, followed by an investigation of two related aspects, the role of the composer in section 4.2.1 and notions of 'creativity' in section 4.2.2. Conclusions are drawn in section 4.3.

4.1.2 Multimodal theory

At its core, multimodality embraces the notion that there are various distinct 'modes' of communication where any one mode is not privileged over others, which combine to produce a 'semiotic product or event' that 'is both articulated and produced *and* interpreted or used' (Kress & van Leeuwen, 2001: 20): these 'modes' include linguistic (written and spoken), visual, music, gesture and gaze. Modal categorisation is not universally consistent, for example, alternative examples are provided by Norris (2004), who suggests spoken language, proxemics ('the distance that individuals take up with respect to others and relevant objects' (p.19)), posture, gesture, head movement, gaze, music, print, layout and the interconnection of modes as category descriptions. Before the advent of multimodality, semiotic theory (on which it is based) favoured language as the dominant mode, a form of 'monomodality' (Kress & van Leeuwen, 2001:1); for example, written text on a page without illustrations. Since the development of formal linguistic theories, and the establishment of terms that have become an integral part of semiotics such as 'sign', 'signifier' and 'signified', semioticians have further broadened and developed the field, the

most useful developments for multimodal theory being the social semiotic theories of Halliday (1978) and the theories of Peirce (1868). Two important elements of Peirce's theories of semiosis are the use of the terms 'referent' - the relation of the 'sigifier' (in linguistics, the word) to what it represents in the real world (Scholes, 1980) and 'interpretant' - its mediation by a reader (Peirce, 1868). The use of the term 'referent' is significant as it links the use of language to the world at large, extending theory which is wholly linguistically-based (Scholes, 1980: 205). Halliday's theory challenges notions of language as a fixed 'grammar' bound by a set of rules based on logic and removed from its social context; he views language as embedded in social life, where meanings are exchanged, and where '...language is one symbolic resource ... among others' (1978: 4); he looks at the functions of language from the outside in, rather than the other way round.

The world of communication has been transformed by the cheap availability of computers, the accessibility of the internet, interactivity, high speed connections and the simultaneous transmission of multiple modes of communication (for example, visual, aural, written, spoken and gestural, as exemplified by television, video and the computer). No longer is language considered the primary or even the best mode of public communication; the development of communications technology, such as, the computer, has resulted in other modes, such as visual and aural, assuming a greater, if not equal importance (Kress, 2000a).

The mode of music, if viewed from the height of the profession (for example, western art music where serious music is played in a concert situation) could be said to be in many ways 'monomodal'. It is characterized by agreed commonalities, for example, dress, performance etiquette and the role of the audience. These serve to take the emphasis away from the other modes, allowing the listener to focus on the music; when the music is playing, there should be no other sound, movement or visual intrusions. Additionally, there are disciplines that have developed, such as musicology, where a specialized, and for the most part, exclusive language is used to talk about the art form, removed from its context. Nattiez (1975; Monelle, 2000: 5), describes a form of musical monomodality when discussing the three categories, or aspects, of a musical 'fact'; he considers that only focusing on one of these, the neutral or immanent level, does not allow the essence of a work to be described. He notes that conventional musical analysis, undertaken from a structuralist perspective, may view music only in terms of these immanent properties, (which is the position taken by many musicologists and music theorists), but this removes

the work from the composer's intentions and the listener's interpretations; the true essence of a work lies in a tripartite consideration of its genesis, its organization and the way it is perceived. The 'musicologist' perspective that Nattiez describes assumes the existence and primacy of the musical score, making this form of analysis only possible with notated music. Of course, many other examples of music performance are not monomodal, opera and musical theatre being two examples, but there are still agreed conventions (lowering of audience lighting, expectation of audience silence, for example) that urge the audience to concentrate on the modes that are meant to be attended to.

However illuminating they might be, monomodal linguistic and music approaches focus on just that one mode and so are unable to account for the multimodal compositions that surround us in contemporary society (Kress, 2000a). They assume that their elements are arranged in fixed and stable systems with their own sets of 'rules', and are unable to accommodate contemporary systems of communication where change is perpetual and the constituent elements are constantly in a state of flux through the ...

> ... 'interested action' of socially located, culturally and historically formed individuals, as the remakers, the transformers, and the re-shapers of the representational resources available to them. (Kress, 2000b: 155).

Throughout the twentieth and the present centuries, monomodal views of music have been challenged, most notably in the realm of popular culture. Some examples of this are the identification of clothing fashions with musical style and the rise of the pop video; however, it is also exemplified in more 'serious' artistic endeavours such as in performance art and music for film. Modern computer systems are inherently multimodal, combining the visual and aural, as well as providing for interactivity, allowing the user to look at and respond to static and moving images, written and spoken text, diagrams and other sounds, including music. As Kress (2000a:184) points out, the human body is constructed to respond to multimodal input, through its multi-sensory organs, so this shift towards multimodal communication is perhaps not surprising.

Much research into composing music in classrooms has been undertaken from a somewhat limited perspective in terms of the modes considered during data collection and analysis (see chapter 2). Some researchers have considered the talk and non-verbal actions of young composers (Dillon, 2003), others have considered recordings of compositions (Swanwick, 1988), whereas others have considered a broader range of data, such as cumulatively collected computer files, and interviews (Folkestad, 1998). It is

argued here that it is necessary to explore composing in the classroom with computers through the fullest range of modes possible in order to be able to consider the broadest range of modes of interaction; it is considered that only through a multimodal appraisal of the composing process that the full panoply of interactions between pupils and their surround (including computers) in the classroom can be investigated. It is also important to note that this thesis is concerned with the *process* of composing with computers in the classroom, of which compositional products are a part; therefore, it is considered necessary to consider the multimodal nature of the complete activity of the group as they engage in this process in order to facilitate as full an understanding of as many aspects of the composing as possible.

4.1.3 The multimodal nature of music classrooms where computers are used for sequencing

In this section, the case is made for the inherently multimodal nature of music classrooms where music computer workstations are used for sequencing activities. This is discussed from three distinct perspectives: the software, the classroom environment and the teacher.

Software

This thesis centres around an investigation of composing using Cubasis, a 'lite' version of the program Cubase[1], which is commonly used in English music classrooms for composing. This is discussed here from a multimodal perspective as the visual nature of the program is considered key in understanding its operation and potentials. Cubase was one of the first sequencing programs to be developed, initially just for MIDI and later incorporating audio, and has a long history. In short, it allows users to enter music data either through a peripheral MIDI device, such as a music keyboard, entered in step-time using a mixture of a music and computer keyboards, or entered solely with the mouse. This data is then stored as MIDI information that can be played back, manipulated and viewed in various different 'editors'. The top-level view is the Arrange page (see fig. 19):

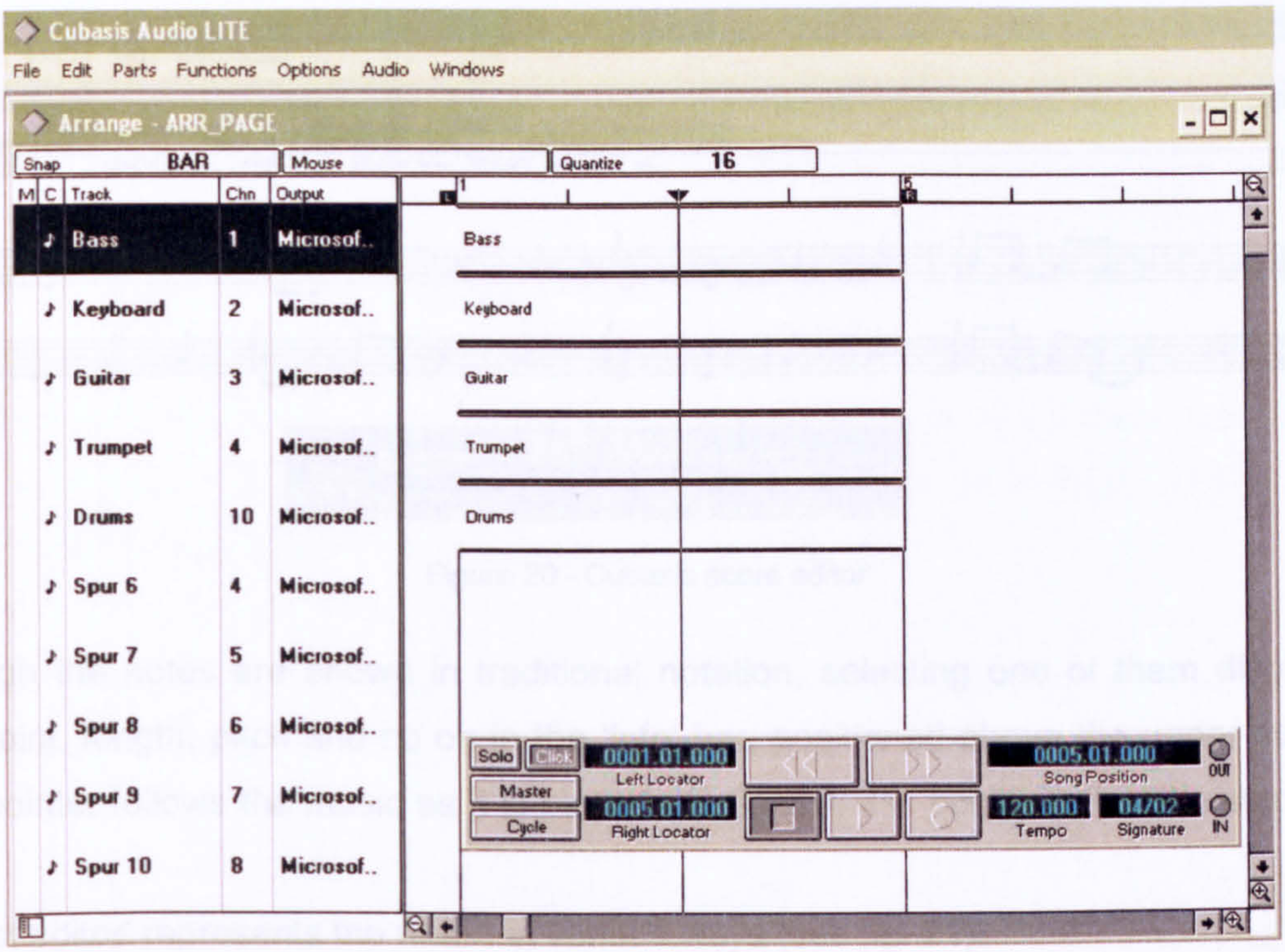


Figure 19 - Cubasis arrange page

In fig. 19, various musical attributes are shown in visual form:

- Bars and beats are shown in a horizontal ruler at the top of the screen
- The 'instruments' are given their own tracks in the left vertical pane
- Each instrument's recorded portion is shown by a horizontal bar containing its name
- The 'transport bar' (the predominantly grey bar at the foot of the screen) contains VCR-style controls to move to the required place in the music
- The transport bar contains the tempo and time signature

At another level, musical data is represented in one of three principal ways: here is the 'score' editor, showing the music in traditional western notation (see fig. 20):

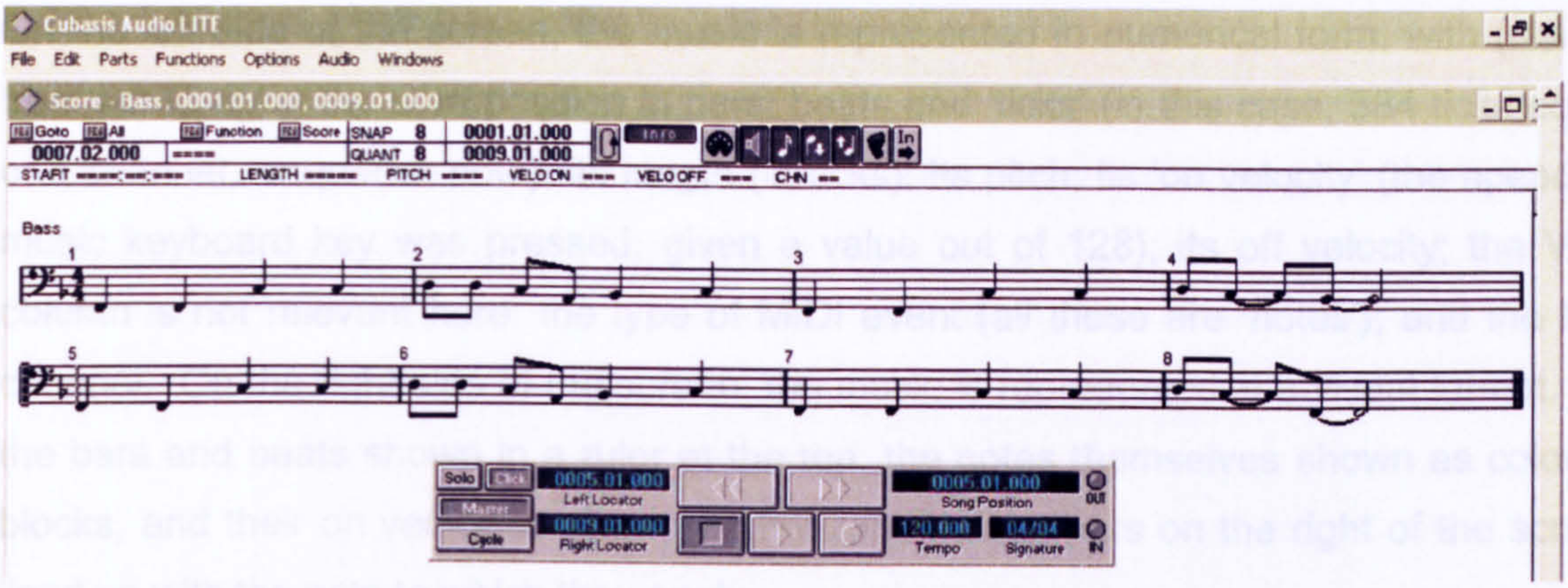


Figure 20 - Cubasis score editor

Although the notes are shown in traditional notation, selecting one of them displays its start point, length, pitch and so on in the 'info' bar, positioned above the upper stave. A song pointer follows the music as it is played - in fig. 20, it is positioned at the start of bar 5.

The 'list editor' represents the music in various ways (see fig. 21):

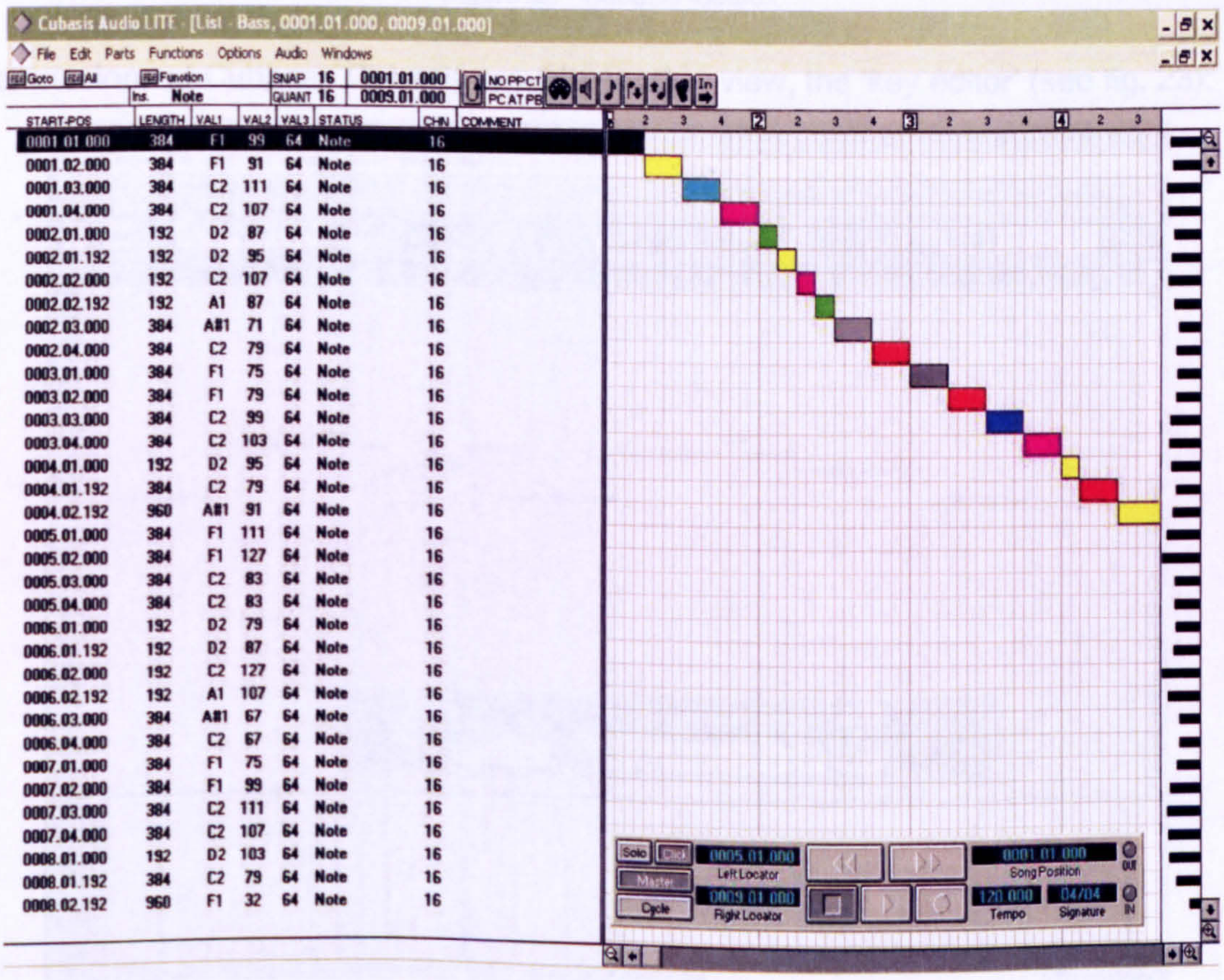


Figure 21 - Cubasis list editor

On the left side of the screen, the music is represented in numerical form, with (reading from left to right) the start position in bars, beats and 'ticks' (in this case, 384 ticks equals one crotchet, or quarter note); its length (in ticks); its pitch; its 'on velocity' (the speed the music keyboard key was pressed, given a value out of 128); its off velocity; the VAL3 column is not relevant here; the type of MIDI event (all these are 'notes'); and the MIDI channel. On the right side of the screen, the music is represented in a visual format, with the bars and beats shown in a ruler at the top, the notes themselves shown as coloured blocks, and their on velocities shown as horizontal black bars on the right of the screen, lined up with the note to which they apply.

Editing tools are available in all windows, such as the pencil and glue that allows editing to be carried out on notes and other MIDI events (see fig. 22):

Figure 22 - Cubasis toolbox

Other versions of Cubase / Cubasis provide another view, the 'key editor' (see fig. 23):

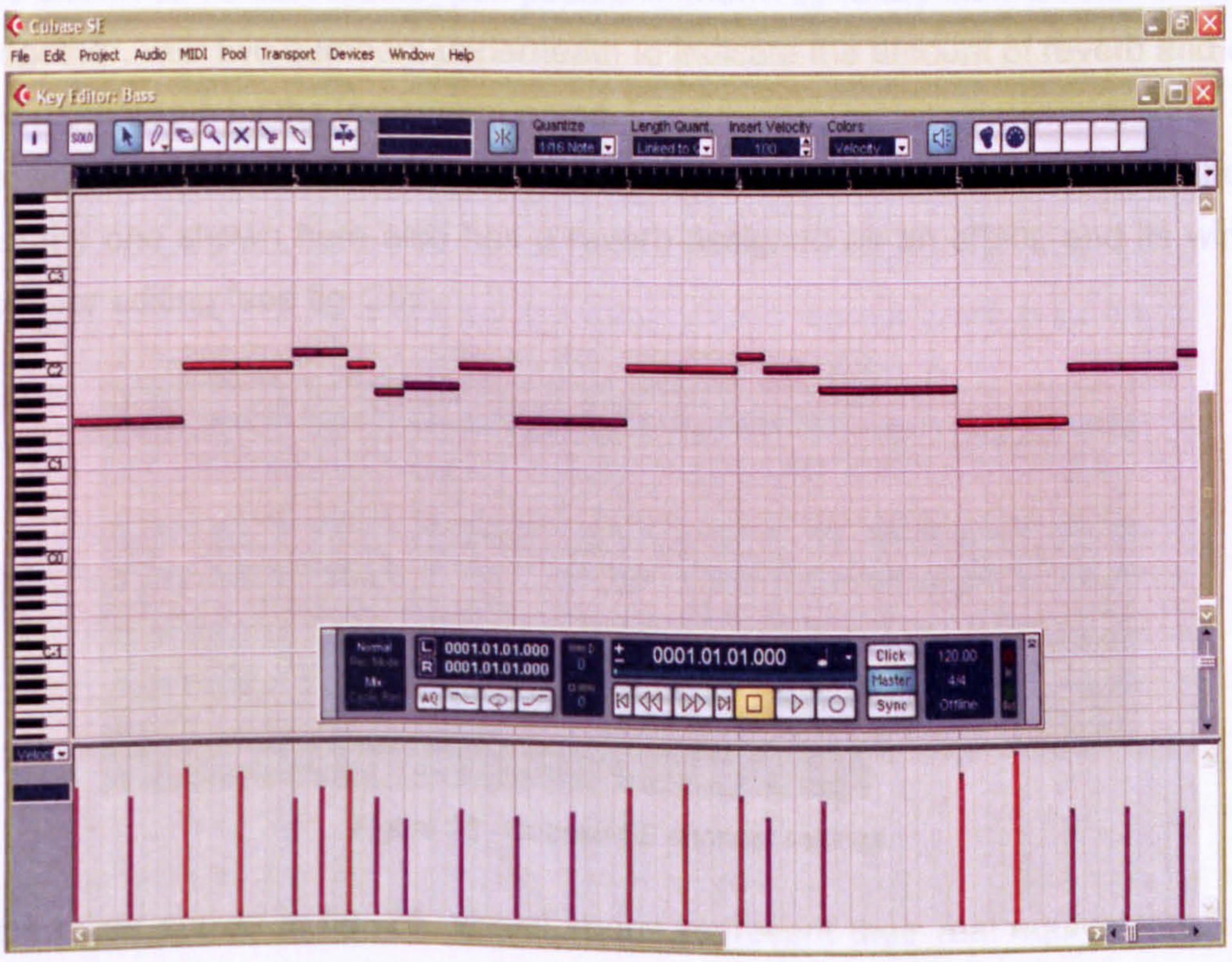


Figure 23 - Cubase SE key editor

The representation in fig. 23 is similar to the right-hand side of the list editor shown above, but turned on its side. Additions are the lining up of the notes with the vertical piano keyboard to indicate their pitch, and the precise length of each note represented as a variable length horizontal bar.

Other notable visual elements of Cubasis are the mixer (referred to as the 'GM / GS / XG editor' in this version of Cubasis - see fig. 24):

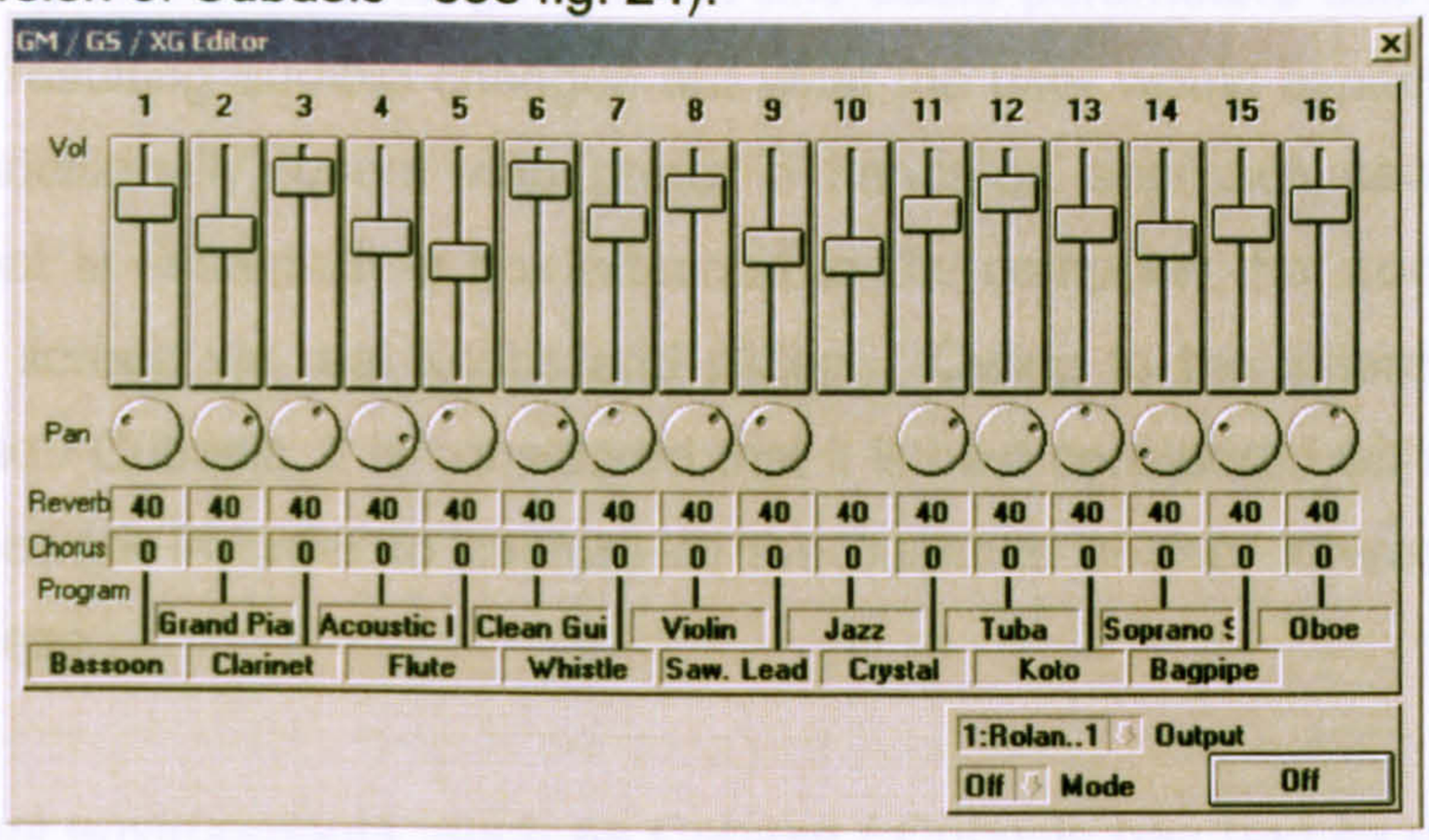


Figure 24 - Cubasis GM / GS / XG editor

Fig. 24 shows a virtual representation of a real sound mixer, with the individual track volumes shown as vertical sliders, pan positions shown by rotary dials located under each slider together, with two numbers underneath to indicate the amount of reverb and chorus, followed underneath by the instrument name.

In other versions of Cubasis / Cubase, each audio track has a window for its individual settings; the one shown here also has a reverb assigned as an effect, and its window is also open for editing (see fig. 25):

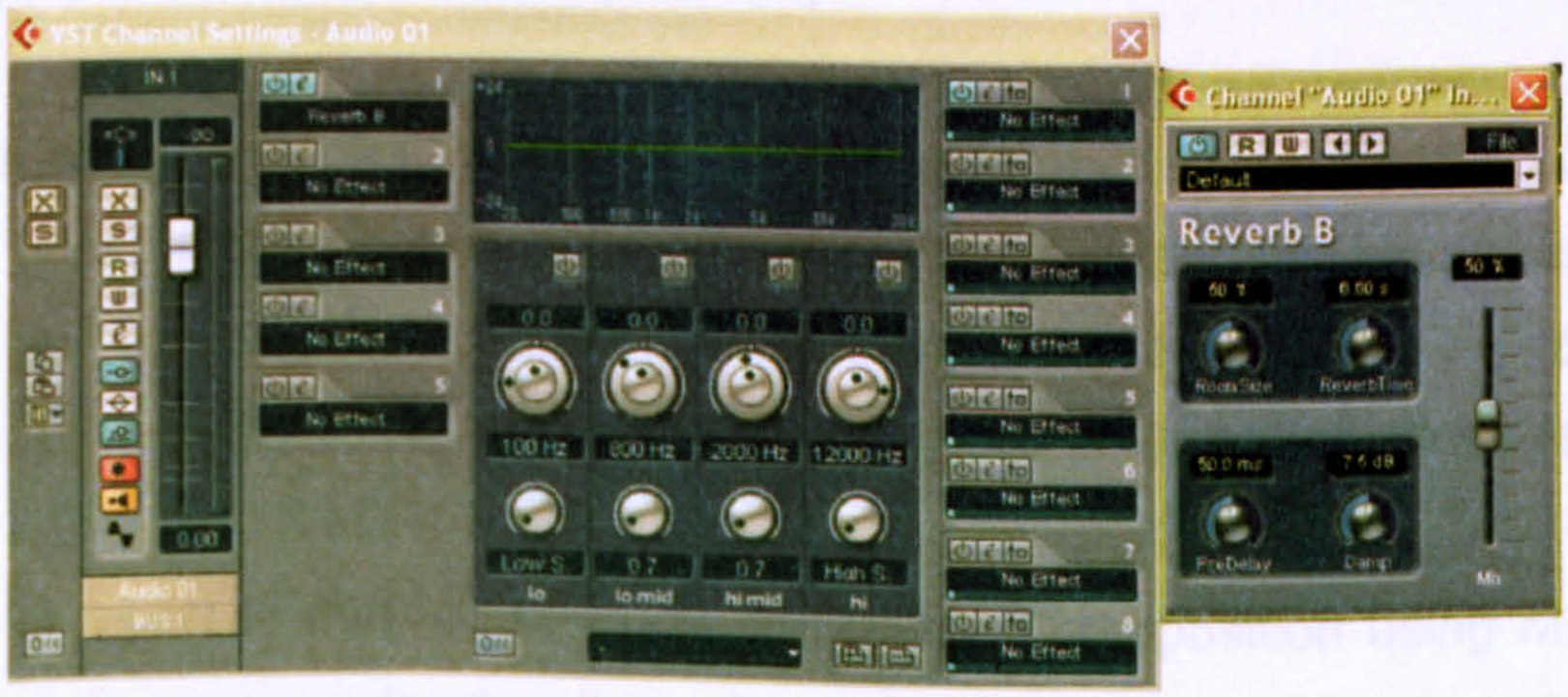


Figure 25 - Cubase SE channel settings

As in the mixer shown in fig. 24, virtual knobs represent their real equivalents, and are provided to change the EQ settings, together with a graph provided above to indicate how

the frequency changes will look in graphical form. The reverb-editing window (to the right) also features virtual knobs and a slider, much like their real-world equivalents.

Programs such as this provide a virtual multimodal representation of many aspects of musical performance in the editing windows as well as many representations of real items found in recording studios. Although musical and audio parameters can be edited using the mouse, the resulting audible changes are what the user would expect from their real equivalents. Additionally, users who prefer a hands-on approach can buy a human interface unit that is essentially a box attached to the computer that controls the virtual controls on the screen via real knobs and sliders. Owing to the inherently multimodal nature of Cubase / Cubasis, it is considered that it is best considered within a multimodal theoretical framework in order to capture all the nuances of user interaction during the composing process.

The use of virtual environments, such as Cubase / Cubasis has had its critics; one chief reservation is summed up by Turkle:

> The computer has become the new cultural symbol of the things that Rousseau feared from the pen: loss of direct contact with other people, the construction of a private world, a flight from real things to their representations. (1984: 95)

This issue has also been presented by Selwyn (1999) in his investigation of the differences between school subject cultures in their educational computer use, where the computer was viewed by an art teacher as clashing with her own pedagogy:

> ... your mind and your hand are divorced as it's going through the screen. When you're doing it physically you're more on tune with it. (1999: 36)

Selwyn notes that to allow for the successful adoption of computers within subject areas, there should be a balance between its effectiveness as a learning tool, which should be *visible*, and its role 'as a mediating technology', which should *invisible*. Where departments are resistant to IT, 'the role of transparency is reversed' (1999: 45).

Folkestad et al report in their 1998 study into musical composition using MIDI-equipped computers that the concern for the distancing from 'real things' that Turkle notes was not observed, maintaining that the computer tool was 'more or less transparent in the creative process', reflecting Selwyn's ideal role for technology. They point out that Turkle's observations seemed not to be the case, noting:

> ... it seems to be the reverse: as Odman (1992) points out, computerised tools involve a shift from representations of the music to the music itself (1998: 95)

Classroom environment

The classroom environment itself is multimodal; it has many aspects - its spatial organization of furniture and equipment, displays on its walls, the availability and direction of light, and so on (Kress et al., 2005: 37). The way the music classroom is laid out reflects the values of those who have designed it, whether they are teachers, school departments, or school management. Kress et al. (2001: 38) also note that the space is transformed as it is used by those within it - in this case, teachers and pupils.

The layout of furniture in the classroom was discussed in chapter 2 in connection with three typical arrangements of computers in music classrooms and how these reflected the values of the teachers, for example, to minimize disruption from other pupils, or to facilitate collaboration. The organisation of furniture and computers may also reflect the teacher's consideration of roles undertaken by pupils, particularly whether their rotation is part of the lesson design.

Classroom wall displays also act as multimodal signs. The choice of material to place on the wall can contain many messages, some tacit, others more explicit, about the values held by the teacher, department or school, depending upon whether the classroom is the teacher's own, or used by a variety of colleagues. Daniels (1989) explored this theme in terms of relaying pedagogic practice; although unrealised by the teachers in his study, he found that their...

> ...production, selection and combination of children's painting was shown to act as a relay of the deep structure of the pedagogic practice of particular schools... (1989: 138)

... or it acted ...

> ... as relays of the fundamental regulatory principles that govern the schools ... (ibid., 2001: 169)

Brock Johnson explored the theme of classroom wall displays from a different perspective, investigating how classroom decoration and artefacts support the integration of local schools into American national culture, claiming that...

> This 'hidden curriculum' is ever present. Classroom decoration and display reinforce sociocultural traditions and orientations when there is no manifest effort to teach them. (1980:177)

In the music classroom, wall displays can take various forms: they can consist of music 'time-lines', showing composers and musical traditions and genres; they can be commercially produced pictures of instruments, both from the western classical tradition as well as from the rest of the world; they might show how the orchestra is set up, indicating the relative positions of the instrumentalists; they might have National Curriculum information, some showing the Programmes of Study for each key stage (in the English secondary school, key stage 3 consists of pupils aged 11-14 and key stage 4 consists of pupils aged 14-16) and others showing national 'level' criteria that will be used for pupil assessment; others might have displays of pupils' work in the form of scores. Each of these different display components could be said to transmit to the reader a sense of the values of the person or persons that put them there. Some observers have noted that the choice of, and the ways in which communication materials are organised in educational institutions, is a way of exercising power relations (Foucault, 1982: 787). In the music classroom, this could be reflected in the display of National Curriculum requirements and assessment criteria, perhaps in the hope of inculcating pupils with the motivation to aspire to meet or exceed national standards and norms, as well as demonstrating what is expected of them. Posters of instrumental ensembles could illustrate the designer's interest in certain types of music - for example, for music from certain countries, or orchestral music. Time-lines of musical traditions and composers could aim to reinforce the importance of music as a unique and important discourse of its own. The display of pupils' work might have the aim of providing engagement in the subject area as well as giving them a sense of achievement when seeing their work used as a model for others.

Multimodal discourse views these aspects as part of a whole design for the teaching of (in this case) music and are considered as being ...

> ... activated, or reactivated, by classroom pedagogy. In this respect, the teacher's role is central: the teacher mediates what is displayed and what is enacted in the classroom ... (Kress et al., 2005:39)

As the teacher is central to this process, I will now give consideration to the role of the teacher as contributing to the multimodal nature of music classrooms.

The teacher

Teachers can also be considered to be multimodal resources in terms of how they orchestrate the learning for pupils. One of these is the making of texts, which Kress et al. (2005) describe as...

> ... multimodal combinations of communicatively orientated utterances and actions. (p.19)

The linguistic elements of these 'texts' consist of the teacher's spoken words (not only the actual words but the intonation and tone of voice as well), writing on the board, projected computer-based text (for example, PowerPoint presentations), handouts and wall displays. However, there are much more to these texts than their linguistic elements - there are visual and gestural components to the teacher's modelling and explanation as well as the focus of the teacher's gaze, the orchestration of space in the room and the timing of the lesson. In the music classroom, additions to these multimodal elements of the teacher's texts could include modelling and orchestrating group or whole-class performing using instruments and / or voices. The use of listening material on CD or computer file can also be considered to be part of the teacher's 'texts'.

This section has argued that the multimodal nature of the music classroom is multi-faceted and complex. Although the focus of the empirical work in this thesis will be on the process of pupils' composing using computers, an understanding of the multimodal aspects of the whole learning environment, including the music software, physical classroom environment and teacher are necessary if as full a range as possible of multimodal influences that the environment has on their work are to be accounted for.

4.2 Multimodality: Design and Transformation

Having discussed why the phenomenon of composing in the music classroom with computers is to be investigated from a multimodal perspective, a key aspect of the theory, Design and Transformation, will be investigated in some depth, as it is to be adopted to illuminate the processes of classroom composing. Two of multimodality's chief proponents, Kress and van Leeuwen discuss the four domains of practice, or strata in which multimodal meanings are made (Kress & van Leeuwen, 2001: 4): Discourse, Design, Production and Distribution. The authors describe Design as:

> ... (uses of) semiotic resources, in all semiotic modes and combinations of semiotic modes. (Kress & van Leeuwen, 2001: 5)

... or

> ... the organisation of what is to be articulated into a blueprint for production. (ibid., 2001: 50)

... and Production as:

> ... the organisation of the expression, to the actual material articulation of the semiotic event or the actual material production of the semiotic artifact. (ibid., 2001: 6)

For the purposes of this study I am going to be focusing on the Design and Production strata, since it is considered that composing using a tool such as a computer-based sequencer merges these two strata into one; Design describes the composing process, where musical ideas are input via the methods of data entry and manipulated using the editing tools described in section 4.1.3, and Production describes the articulation of the composition facilitated by the music computer workstation, providing a medium through which the composition is realised. In other words, the software allows simultaneous detailed control over both its creation and realisation. This is very different from 'traditional' methods of composing, where a written score would be prepared, with the composer supposedly 'hearing' it in their head as they write, or at best, realising parts of it on a piano (Design). The realisation of a score prepared in this way occurs when it is performed (Production) which might be followed in turn by further editing of the score. However, the previous boundaries of work (where music is composed by composers, newspapers are edited by editors and so on) have become unstable in recent years as the computer gives not only easy access to a previously inaccessible range of activities, but also provides the tools to realise them (Kress & van Leeuwen, 2001: 46-47). In other words, a person might make decisions about animated or graphical aspects of a multimedia production as well as textual and musical decisions. In the music domain, software programs such as eJay and Acid provide easy access to composing through the provision of pre-recorded musical samples that can be sequenced in a wide variety of ways by anyone without any formal musical skills.

A key aspect of Design is the 'available resources' for design, which are inevitably domain-specific and linked to their 'histories of social use' (Kress & van Leeuwen 2001: 62). These are referred to in this thesis as 'available designs'. Design is shaped by the tension created by these histories, their stability and constraints on one side and creativity and the ability to be transformative on the other. Another key aspect of Design is that designs are inevitably produced in different contexts (no two places and times can be identical), ensuring there is always something different about each transformation (ibid., 2001: 64).

Kress et al. describe their approach to the process of transformation in the science classroom as:

> ... every sign is the production of a new metaphor brought about through the process of analogy (2001: 6)

... which is another way of describing this transformative process.

In the present multimodal environment where television, computers and mobile technologies (such as 'phones) are common, meaning is distributed amongst various modes - linguistic (for example, written and spoken text), spatial (movement and position within a space), gestural (hand signs, facial expressions, body language) audio (music, sound effects, tone of voice) and visual (animated images, pictures, diagrams, video); any changes in the use or balance of modes to communicate meaning will also result in transformation. A key theme of multimodal theory is 'synaesthesia' - 'the transduction of meaning from one mode to another' (Kress, 2000b: 159). This is likely to become more common in the future as technology develops to allow the greater interaction of modes, particularly in web-based environments; this can already be seen to some extent in the continuing development of Skype[2], which currently offers 3 distinct simultaneous modes of communication - text (instant messaging), audio (spoken word or other sounds) and video.

Another key aspect of this transformative process is that of the 'interested action' (Kress, 2000b: 156) of the individual. Kress links 'interest' to a choice of resources that an individual can make to effectively communicate what they want to. This results in guided ...

> ... action on and with existing semiotic (cultural) resources (2000: 156)

When pupils compose in the classroom, as described in chapter 2, section 2.3, they have many music available designs upon which to draw. The designs provided by the teacher only form part of these; others could originate from a wide variety of sources (North, Hargreaves and O'Neill, 2000; Lamont, Hargreaves, Marshall and Tarrant, 2003). These could include:

- The home (for example: radio, television, computer games, downloads, CDs, DVDs, instruments played by siblings or parents);
- Outside the home and school (for example: shops, concerts, social occasions);
- Elsewhere in school (for example: assemblies, instruments played by pupils and staff, music used in other lesson contexts).

The available designs can be considered as being wider than just those connected with music as there are many physical and cultural influences upon pupils which affect their composing work in the music classroom, many of which are not readily observable and remain tacit. These could be considered negative influences (for example, not enough time) as well as positive ones (for example, working with others); These include:

- The constraints of the lesson and its organisation in terms of time;
- Pupil grouping;
- Physical arrangement of pupils in relation to each other, position in the room and the arrangement of the physical resources such as furniture and computer systems;
- Behavioural expectations of the pupils;
- Values of the subject in terms if pupil expectation of standard of work and its presentation;
- The value placed on the subject within the school context.

Because pupils are always working with the products of prior designs, such as the available sounds on a keyboard, music previously heard, learnt keyboard techniques, and so on to create or re-shape a piece of music, the composing process will always be transformative. Jewitt (ibid., 2006) in focusing the concept of 'interested action' on the classroom, points out that it will also be influenced by the possible social interactions brought about by the re-arrangement of the classroom necessitated by the introduction of new technologies. The re-arrangements of music classrooms brought about by the adoption of computers was discussed in chapter 2, section 2.4.3 but its effect upon pupil interaction is currently under researched.

Kress notes that the more encultured the individual is in the culture they find themselves in (in this case, the culture of a particular style, genre or tradition of music), the more these cultural forces will impact upon the remade resources - however, transformation is always part of the process. Furthermore, because individuals are 'always working with the products of prior design' (Kress, 2000b: 158) this reshaping of resources can be considered 'redesign' and will inevitably reflect others' prior designs to some extent. This is particularly true in popular music where styles and genres are often well established, themselves based on previous styles and genres. For example, heavy metal was established as a genre in the late 1960s and 70s and out of it many sub-genres developed, such as thrash metal, speed metal, goth metal and so on, which continue to this day. Additionally, songs need to be closely related to their precedents in order to

remain recognisably related to the style or genre from which they have emanated; for example, for a song to be considered from the hip-hop genre it needs to exhibit certain features (for example, rapping and DJing) to be recognisable as part of the genre at all; if the work strays too far from these, or uses too many novel devices, it will not be recognisable as part of that style or genre. Humphreys confirms this view:

> ...true composition (or improvisation) must occur within a musical tradition ... [this] is necessary due to the nature of humans' ability to perceive and enjoy (some would say 'derive meaning from') music. (2006: 353)

To sum up, music in popular styles is always based on previous material to some extent and the notion of Design places agency firmly with the individual (Kress et al., 2001: 7).

The second stratum of multimodal theory I wish to examine is Production. Production is sometimes viewed as simply the realisation of Design but it is considered to be rather more than this; its role is certainly to articulate (in this case) the music, but also to *interpret* it. Kress and van Leeuwen describe how in music, the score has previously been considered by semioticians as ...

> ... constituting the identity of musical ... works, rather than the sounds ... which actually materialize the works... (2001: 70)

Certainly in the realm of popular music, this is *not* the case, as much music is not notated at all - it is perhaps the recordings that now hold this 'identity'.

A common notion amongst musicians, from my own experience, who may have had limited exposure to computer music workstations, is that once the music data has been entered into the system it is only necessary to press the 'play' button to hear a performance. Although this is technically possible, the result may not be what most people would consider to be music, as, for example, notes and chords are likely to be lacking in their shaping of articulation and phrasing, the tempo will be the same throughout, the various instrumental parts may be unbalanced in terms of volume and will probably not be panned in such a way so as to present a satisfactory stereo field to the listener. To make the piece suitable for someone else to listen to, editing will be required, or in multimodal terms, the Production will need to be considered. This is not to say that there is one 'correct' way of editing the music; in order to make the performance expressive, and able to communicate more than just the bare bones of notes and rhythm,

there will be many personal choices to be made and the intended audience will need to be borne in mind.

There is a particular area concerning the semiotics of Production that I will now examine: Provenance. Kress and van Leeuwen describe their notion of provenance (2001: 23 & 72) as the use of signs in a new context in order to import the 'ideas and values' (2001: 23) identified with the original context into the new. The authors discuss Barthes' notion of 'myth' in this context, pointing out that these imported meanings may be mythical, vague, confused and unsystematic. They use the example of an advertisement to show how imported values can be understood by contemporary culture in a particular way and how the importer uses this knowledge to promote a product (ibid., 2001: 72). The understanding of the importer could be somewhat vague and confused but will be strongly felt; however, it will generally be unsystematic and each case of this importing will be unique. This notion has strong resonances with many sampling practices in popular music, where sounds associated with a previous context (for example, when classical music is used, such as by Coolio in his track 'C U When U Get There' in which he quotes Pachelbel's Canon in D) are used in a new context, in this case, a piece of dance music. Although Kress and van Leeuwen consider provenance in relation to the Production stratum, I also consider it to be part of Design, where previous musical elements can be utilised for their provenant properties during the process of music composing whilst a composition's elements are created and assembled, rather than only being considered a part of the work's articulation.

I have separated out the Design & Production strata in my discussion above for the purposes of clarity but when a computer system is used for the composing and performance of music they become part of the same process and may occur either together or separately at any point.

'Design and Transformation' is central to a multimodal view of learning, which considers a key part of learning to be the active process of the re-design of available designs. In a music composing context, the available designs (or semiotic material) could originate from a wide variety of sources: those provided by the teacher; those taken from music heard by pupils in out-of-school contexts, such as music listened to on personal music players, radio, internet, television, or music groups attended, such as bands, orchestras and choirs; or perhaps school instrumental lessons. The re-designing or transformation of

these designs into new designs is what Kress et al. term 'a dynamic process of sign-making' (2001: 27). The activity is motivated by the pupil's interest, which is expressed in their choice and transformation of the material to express their intentions, or meanings. This semiotic change...

> ...always reflects and tracks the values, structures and meanings of the social and cultural world of the meaning-maker and of the socio-cultural group in which they are. (Kress, 2003: 40)

This process of re-design inevitably always produces a new design - it can never be simply a *repetition* of prior design. Therefore, 'learning' is viewed as impossible to see in a physical sense, but able to be evidenced in the observation of the process of re-design as well as in the outcomes produced, in this case, musical compositions. For the purposes of this thesis, this makes the process of composing just as important as the outcome; in order to better understand the 'learning' that is taking or has taken place, it will be necessary to scrutinize pupils' engagement with this process of musical meaning-making from the perspectives of as many of the modes (linguistic, musical, spatial, gestural and visual) as is practical, given the limitations of the classroom environment (space, time and auditory 'interference' from pupils who are not the focus of the investigation). What will be necessary is a way of analysing the 'traces' of the composing activity so that the...

> ...choices made by them from the resources which were available to them, which they saw as pertinent at the moment of choice, in conformity with their interest vis-à-vis the topic (Kress et al., 2001: 129).

... can be articulated.

There now follows discussion of two issues that have arisen as a result of the adoption of multimodality as a prism through which to investigate the music classroom composing phenomena and which both have an influence upon the theoretical issues underpinning this study; the role of the composer(s) whose work is being transformed and how existing views of creativity interface with multimodal theory, particularly the aspect of redesigning.

4.2.1 The death of the composer?

> Music has no past; it exists only at the moment when it happens, and no two performances are identical ... it evokes the essential 'now' without implications of a past and of a potential future (Paynter, 2002: 216-7).

Barthes (1977) wrote in 1968 about 'The Death of the Author' and shortly after in 1969 Foucault (1977) published an essay entitled 'What is an Author?' Although there are important differences expressed in these two works, they both prompt a re-assessment of

the role of the composer in the light of composing in the classroom with computers. Furthermore, the issue of copyright in music is bound up with the issues raised in them, and so it will be woven into the following discussion.

Foucault and Barthes begin their discussions by outlining the current cultural status of the 'author'; Foucault describes the current 'solid and fundamental role of the author and his works' in our present society and claims that authorship has become 'individualized' (1977: 115); he notes that we tend to view authors as hero figures, but in fact their names often tend to serve to classify works rather than necessarily refer to an individual. He refers to Barthes' (then) recently written essay, which also maintains that the author is a 'modern figure, a product of our society' (1977: 142), accorded a prestigious position, with explanations of his (*sic*) work sought by readers in the details of his life and personal preferences. He maintains that the tool of analysis afforded by linguistics had shown that ...

> ... the whole of the enunciation is an empty process, functioning perfectly without there being any need for it to be filled with the person of the interlocutors. (1977: 145)

The result of this, Barthes maintains, is that the author function has now disappeared, the term 'scriptor' (1977: 145) being more appropriate. As a result, the modern text has become transformed because ...

> ... the enunciation has no other content ... than the act by which it is uttered' (1977: 145-6).

As a result of this, Foucault points out that writing has now freed itself from the need to be concerned with expression but rather refers to itself (1977: 116). He explores the aspect of death, noting that in previous cultures writing had been considered a '...protection against death...' (1977: 117), offering the author immortality through their work, whereas now, this has been reversed, being replaced by a '...a voluntary obliteration of the self...' where the work could '...become the murderer of its author.' (1977: 117).

Barthes expands upon the potentials for the new role of scriptor, noting that rather than '...passions, humours, feelings, impressions...', the person can draw upon '... this immense dictionary from which he draws a writing that can know no halt' (1977:147). He notes that a text actually consists of the previous multiple works of many cultures, and the reader, or listener, has now become the central figure:

> ...a text's unity lies not in its origin but in its destination. (1977:148).

This has many resonances with contemporary composing, especially of popular music. Owing to the advent of sampling in the 1970s, musicians have frequently taken samples of others' work to include in their own, whether whole sections of music, a single bar of drum rhythm, string lines or a vocal 'hook'. In a multimodal context, this can be considered an example of prior work (an available design) being redesigned. The status of the copyright owner is high in western culture; 'clearing' a sample for use in a commercial recording is a costly and time-consuming business, as there are two copyrights to clear - the publishing and the recording. Contacting owners is easy for the recording copyright, as the Mechanical Copyright Protection Society (MCPS) keeps records of all recordings released in the UK but publishing copyrights can be held by companies or individual artists; sometimes several people can be involved in the ownership of one sample. Costs for using samples in recordings are expensive - £500 is considered cheap. Large companies usually take a royalty which can be 90% of the sales of the work in which the sample is used. Musicians using samples that are not cleared are breaking the law and have been sued, often for very large sums.

This strict enforcement of copyright law might seem fair in our present culture of ownership and possession, but when consideration is given to the design and transformation process described earlier, tensions emerge, since every musician's work is based on that of others, and to be recognisably part of a style, needs to be closely based on that socially and historically evolved style, inevitably re-using much of what others have previously produced. Wertsch expresses concern about our society's tendency to concentrate on what an individual does by themselves to the exclusion of a consideration of 'mediational means', resulting in what he terms the...

> ...false assumptions of the copyright age (1998: 19)

Some observers feel that the current copyright laws operate more in favour of large companies rather than the artists themselves (Boynton, 2004) and some feel that our current system is not fit for the modern age:

> Today's copyright laws and traditions are dissonant with modern culture and technology, and the dissonance has become more and more apparent in the past few years. (Ewing, 2003)

Creative commons (http://www.creativecommons.org.uk/) perhaps provides a more equitable and realistic way of protecting artists' work. Founded in 2001, their vision is to

re-create a better balance between the strictly controlled copyright system we have today and the anarchy that it is assumed would ensue if no controls were in place:

> We use private rights to create public goods: creative works set free for certain uses (Creative Commons, 2007)

Juxtaposing these two issues (the role of the author, or composer, in contemporary music, together with concerns about copyright) creates a potential tension for the composer in the classroom using a computer system. Compositions not destined for commercial release generally do not have their samples cleared (if they contain any) but because the issue of copyright is well embedded in our culture and hence is a concern for composers, the ownership of work can present a problem for some (Crow, 2006). This situation can have an impact on work presented for examination and thus upon teachers' perceptions concerning authenticity (ibid., 2006). Yet, the names of the composers of much popular music are often not well-known known (unless they happen to be the performing artist, with whom the actual composer is sometimes confused), nor the 'owner' of the sample in the case of re-sampled work. It is the sound of the sample that matters and the contemporary (reshaping) resonances it brings to the music being composed. And yet, the original composer, composers or publishing company matter very much potentially, since without their permission, the work can never be made publicly available for others outside the composer's immediate social circle to hear.

Bringing the previously discussed issues together, there is a potential tension concerning composing in the classroom as the recognisability of musical styles requires work to be closely based on pre-existing work, yet literally quoting it (as in the use of a sample) is illegal unless it is cleared. This seems to accord the original creator much credit for their pre-existing work yet their name is often not in the forefront of public consciousness and their work was based on others' pre-existing work in any case. This tension continues with the teacher being unsure about 'authenticity' of pupils' work particularly where examinations are concerned. Indeed, part of the work of examination boards has become concerned with deciding whether disputed examination entries are fraudulent or not.

The copyright of music has been challenged in recent years, facilitated by efficient music file compression technology, illegal download services and peer-to-peer file sharing. The music industry has fought hard against this, using the law on many occasions, but some

observers have questioned whether a 're-conceptualization of copyright in society' (Green, 2002: 1) is now necessary.

The notion of 'the death of the composer' could be viewed as conflicting with Kress and van Leeuwen's (2001: 23 & 72) notion of 'provenance', in that this construct embodies the principle of the importation of signs into a new context specifically for their ability to signify their past connotations within this new context. Barthes discussed this in 1964, in the article 'Rhetoric of the Image' (1977: 32-51), calling this importing of 'the signifieds of connotation' (which are inevitably specific to a given culture and time), 'ideology' (1977: 48); he terms a set of 'connotators', 'rhetoric'. In musical terms, referring to the previously mentioned song 'C U When U Get There' by Coolio, the connotators could be said to be the baroque era, orchestral music, the chord sequence (D, A, Bminor, F#minor, G, D, G, A), the bass line, the use of the piece for weddings; perhaps some, all, none or others are imported into the new context. Whatever they amount to when interpreted by the listener is termed 'rhetoric'.

It is not considered here that there is a conflict with the notion of the 'death of the composer' because it is the 'connotators' that are imported, not necessarily aspects of the composer directly, unless they form part of the connotators. For example, Orff's *Carmina Burana'* is frequently used in connection with television advertising; however, it is questionable whether knowledge of the composer, his life and times play any part in the rhetoric perceived by the viewer - the connotators lie elsewhere.

4.2.2 'Creativity' in the multimodal context

Creativity is considered a synonym for 'redesigning' in the multimodal context that is being adopted in this thesis, as it is recognised (as was demonstrated in section 4.2) that particularly in the popular music field, composers are always working with prior compositional designs and when transforming these available designs, will inevitably be creating in some way. An examination now follows of the existing links of music with 'creativity'.

'Music' and 'creativity' are words often seen together; for example, music is generally considered a 'creative' school subject (Loveless, 2003: 6, Staines, 1999: 133, Barnes, 2001: 92) and the issue of creativity is often to the fore in discussions concerning pupils'

composing work in music classrooms. The National Curriculum for Music (DfEE and QCA 1999: 3) states that one of the main foci is 'to foster creativity' and mentions it in connection with improvisation and composing at key stage 2 (1999: 18) (though, notably, not in connection with key stage 3) and in connection with the development of thinking skills generally (1999: 9). In the most recent National Curriculum document, to be introduced in schools in September 2008, 'Creativity' is given greater prominence, being listed as one of the 'Key concepts' (QCA, 2007a: 181). However, creativity seems to be more widely valued (NACCCE, 1999), for example, it is a particularly highly regarded attribute in the business world (De Bono, 2007). Nevertheless, there is some disagreement about whether human beings are innately creative at all; De Bono claims:

> We are genetically programmed to be non-creative. The brain is hard-wired to establish routines for dealing with a stable world (2007)

However, within a multimodal context, creativity is viewed as:

> ... ordinary, normal; it is the everyday process of semiotic work as making meaning (Kress, 2003: 40)

... and...

> Innovation is the normal condition of all human meaning-making. (Kress et al., 2001: 8)

In the structuralist view of semiotics, where constituent elements (for example, as in formal linguistic theories) operate in a fixed and stable system, creativity tends to be viewed as something only to be associated with those of exceptional ability who have mastered the 'system', for example, individuals who specialise in a field. In the case of music, professional composers are examples (ibid., 2003). This is considered to be a common view, as confirmed by Sawyer:

> We think that most artists work alone. They're blessed with a special gift or genius. (2006:12)

Wertsch adds to this notion, extending it by including the role played by convention, previously mentioned in connection with Barthes (1977: 148), saying that in identifying the creative act with an individual...

> ...we often lose perspective about the centrality of convention in the creative process, and we view the individual artist as the main, if not sole, source of a text or other aesthetic object (1998: 18)

John-Steiner, in her book 'Notebooks of the mind', explores the creative thinking of many well-known musicians, such as Copland, Shostakovich and Casals (1997: 141-158). She quotes Gardner (ibid., 1997: 141) maintaining the case for 'core abilities', one of these

being music, but does not elaborate on the case for music being a universal human feature, concentrating instead on the histories of famous musicians to illuminate aspects of professional creativity. In her later work, 'Creative Collaboration', she follows a similar path, studying famous artistic partnerships with the goal of teasing out the nature of the creativity that these partnerships exhibit.

Csikszentmihalyi, in 'Creativity' provides insights into the process in much the same manner as John-Steiner, through interviews with individuals considered exceptionally creative. He confirms the multimodal view of design and transformation concerning building upon the work of others:

> ...an idea or product that deserves the label 'creative' arises from the synergy of many sources and not only from the mind of a single person. (1996: 1)

... and concerning the context:

> [Creativity happens]...in the interactions between a person's thoughts and a sociocultural context. (1996: 23)

He views the creative system as consisting of three main parts, the *domain*, ('...a set of symbolic rules and procedures.' (ibid., 1996: 27), for example, music), the *field* ('...the individuals who act as gatekeepers to the domain.' (ibid., 1996: 28), for example, music teachers, professional musicians, music academics) and the *person*, whose novel application of the symbols of the domain (such as musical elements) will result in creativity (in the case of music) if the work is accepted by the field as worthy of being considered an extension of the pre-existing musical canon.

Csikszentmihalyi sums up this process as follows:

> ...creativity results from the interaction of a system composed of three elements: a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognise and validate the innovation. (1996: 6)

He explains a notion that concords well with multimodality theory when he describes how future creative people will consider a previously created novel product to be part of the current domain and in turn may 'change it further' (Csikszentmihalyi, 1996: 28); this is very similar to the multimodal process of redesign, which is always working with the products of prior design.

Although the work of the previously mentioned two authors is illuminative concerning the work of professional creative people, this view of Creativity tends to support former views

of stable and fixed symbolic systems (such as formal linguistics), as well as requiring validation from 'a field of experts'. A helpful distinction (building on the work of Csikszentmihalyi) is provided by Sawyer (2006: 27), who delineates two views of creativity: 'big C' and 'little c': Creativity is something exhibited by gifted people who produce something culturally significant whereas creativity encompasses all works, including those of novices, even if nothing of social value is produced. The 1999 National Advisory Committee on Creative and Cultural Education (NACCCE) report tended towards the latter view:

> Creativity is possible in all areas of human activity, including the arts, sciences, at work at play and in all other areas of daily life. All people have creative abilities and we all have them differently. (1999)

Although it is considered important to understand the various types of creativity that observers have delineated, the view that this thesis takes is congruent with that expressed by Kress (2003: 40), of creativity with a small 'c'. That is, creativity is an everyday occurrence, common to all people, and in keeping with multimodal theory, is referred to as 'redesigning'.

4.3 Conclusions

The adoption of theories of multimodality with which to examine the composing process with computers, itself prompted by the inherently multimodal nature of music classrooms as well as contemporary communicational media, has important implications for the approaches taken to the consideration of composing phenomena. To use a 'monomodal' frame with which to examine contemporary composing would be inappropriate, not only for its lack of breadth in its consideration of communicational modes, but also because of the associated structuralist assumptions that underpin it; modern media are constantly remaking and restructuring the semiotic systems that they use to create meaning. Music classrooms have been shown to be places where available designs are themselves multimodal as are the processes employed by pupils when composing in groups, necessitating the adoption of a multimodal frame with which to consider as wide a range as possible of influencing factors upon the composing process itself.

Kress and van Leeuwen (2001) provide a useful division of the communicational process into four strata, of which Design and Production are considered to be combined when composing with computers. Within a context where 'creativity' or 'redesigning' is considered not only for those with a particular talent, but rather an everyday process

engaged in by all, the twin notions of 'provenance' and 'available designs' are useful in unpicking the origins of the resources used by pupils in their composing. The demands of musical style and genre, that in order for music to be recognisably a part of a style and genre it needs to be based on previous work, or 'prior design', inevitably results in a high degree of appropriation of previous work. However, there are tensions in this process of the development of style and genre in that the notion of copyright resides with individuals rather than within a whole developmental process of redesign, and has resulted in calls for a reassessment of copyright itself. The current situation has resulted in a tortuous process of 'clearing' samples for commercial work and prompted questions of authenticity to be raised in connection with composition work presented for music examinations, resulting in subsequent uncertainty concerning the music composing curriculum and the software chosen for composing activities. These tensions are further added to by the 'death of the composer' in contemporary popular music and the increased significance attached to the role of the listener in the communication of an artistic work.

The multimodal prism provides a contemporary theoretical framework which is adopted in order to provide insights into composing with computers in music classrooms; it takes into account the normal, everyday creative potential of pupils, their working with the products of prior design, the means to consider the origins of these prior designs and the the multimodal, multi-faceted nature of these classrooms and their group composing interactions.

In the next chapter, I will discuss the methodological implications that the adoption of multimodality had for this study in terms of the research design and the methods employed.

1 See http://en.wikipedia.org/wiki/Cubase
2 See http://www.skype.com

Chapter 5. Methodology

5.1 Multimodal theory and research design

5.1.1 Introduction

Before embarking on the methodological design of this study, its aims are revisited here in the light of the multimodal theoretical perspective outlined in the previous chapter in order to refocus on its main purposes. The overall aim of this study is 'to investigate the process of composing with computers in the music classroom focusing on the use of MIDI sequencing'. The three subsidiary aims are firstly, to investigate how the whole learning environment (for example, the lesson design, teacher, computer system, the physical organisation of the classroom, equipment and pupils) mediates the transformation of previously existing musical ideas, or in the language of multimodality, the process of *redesigning;* secondly, to investigate the origins and transformation of pupils' selected pre-existing musical ideas, or *available designs*, and thirdly, to produce findings of value to practitioners, to inform their design of composing activities and hence enhance the learning opportunities of pupils.

Chapters 1 and 2 were concerned with the contextual background to this study and explained why I have chosen to focus upon the process of composing with computers in the classroom in a naturalistic setting. Chapter 3 described the pilot study and explained the background to the decision to adopt multimodality as the theoretical framework. Chapter 4 investigated theories of multimodality, focusing particularly on those most applicable to researching composing in the music classroom and set the background for the methodological design which is explained in this chapter. Before describing the methodological design of the study, there follows explanations of how multimodality theories were adopted in its design.

5.1.2 Research strategy

The multimodal theoretical perspective suggested an in-depth, fine grained approach, which would involve a micro-level, detailed exploration of pupil interactions; this would provide rich, detailed descriptions of the complex classroom phenomena from the required multiple perspectives. It was expected that this would allow the composing process to be

examined in detail, aiming to collect as much information about the actual manipulation of musical elements and pupil interactions as possible, as well as to be able to consider the wider contextual influences of the learning environment. This requirement suggested the adoption of a case study methodology for the collection of the data and its analysis. The amount of data collected in such depth would be overwhelming if large numbers of schools and participants were involved, so a decision was made that two studies, each of a single group of pupils at two schools would provide an appropriately high level of detail. There follows an explanation of the term 'case study'.

Case study

Case study has emerged as a research methodology since the mid 1970s, one of its formative proponents being Lawrence Stenhouse, who viewed it as a reaction to existing research paradigms:

> The recoil from the statistical-experimental paradigm has been towards the qualitative and towards the idea of case study. (1978:21)

He characterised its ascendency as being due to the limitations of experimental designs in educational research:

> This experimental procedure was adapted to education, sometimes with good results. But there were always limitations. (1980:2)

However, he also believed that both quantitative and qualitative approaches were not only complementary, but necessary (1980:4). He provides a useful description of the case study:

> The Case Study is an interpretive presentation and discussion of the case, resting upon, quoting and citing the case record for its justification. It will most probably be written by the field worker who compiled the record. (1978:37)

The 'case record' mentioned here is defined as ...

> ... a theoretically parsimonious condensation of the case data, produced by selective editing without explicit comment (except perhaps about editing dilemmas). (1978:37)

The 'case record' in this study was contained within the computer tool that was developed; this is discussed in further detail in section 5.4. Stenhouse is somewhat general in his consideration of what could be considered a 'case':

> All study is the study of cases. All study of cases implies classes, because to name a case is to make it an instance of a class. That is to say: to speak of a particular school is to designate a case of the class, school. (1979: 9)

Greater focus is provided by Stake:

> A child may be a case. A teacher may be a case. But her teaching lacks the specificity, the boundedness to be called a case. An innovative program may be a case. All the schools in

> Sweden may be a case. But a relationship among schools, the reasons for innovative teaching, or the policies of school reform are less commonly considered a case. These topics are generalities rather than specifics. The case is a specific, a complex, functioning thing. (1995: 2)

In this study, the two cases concord with this description; they were the two groups of pupils, one at each school, each considered to be a specific bounded entity, or case. Eisenhardt provides a useful summing up of the case study approach:

> ... a research strategy that focuses on understanding the dynamics present within single settings. (2002:8)

This is echoed by Stake:

> Case study is the study of the particularity and complexity of a single case, coming to understand its activity within important circumstances. (1995: xi)

These descriptions encapsulate well the intentions of this study, of developing a better understanding of the complexity of the composing process in the classroom with computers.

'Case study' and 'qualitative' are two terms often found together (Huberman and Miles, 2002:14; Hammersley, 1992:183) and indeed, the phenomena under scrutiny in the case studies presented here was qualitative in nature - that is, concerned with words (rather than numbers), with description, with taking a holistic perspective, acknowledging researcher involvement and with an emergent research design (Denscombe, 1998:174-176).

Denscombe (1998:30-32) outlines five key characteristics of the case study approach:
Firstly, there should be a 'focus on one instance (or a few instances)'; the studies here were focused in this manner: following the pilot study, two main studies were undertaken at different schools. The aim was to understand these particular cases well, rather than use them to draw generalisations; Stake notes that ...

> The real business of case study is particularization, not generalization. (1995:8)

Stenhouse uses the term 'representative' to draw out this distinction:

> ... a case may be regarded as representative of a class or as exemplary, but not representative, of a class. (1979: 9)

Secondly, Denscombe (ibid.) states the study should be 'in-depth'. Stenhouse notes that this should be ...

> ... sufficiently rich to support the kind of discussion from which judgements can be made as conjectures and then subjected to refutation or confirmation in the light of evidence ... (1980: 3)

It is believed that the multimodal theoretical framework adopted in these studies necessitated a very detailed approach to data collection and the use of several distinct methods which allowed not only for the collection of 'in-depth' data, but also for the phenomena to be viewed from differing perspectives.

Thirdly, Denscombe notes that there should be a ...

> 'focus on relationships and processes' (ibid.)

... which Stake expands upon:

> ... episodes of nuance, the sequentiality of happenings in context, the wholeness of the individual. (1995:xii)

In the two studies described in this thesis, there was a particular concern to capture these 'relationships and processes' through employing methods that allowed both the visual and aural observation of the action of the participants throughout the whole composition process.

Fourthly, the next characteristic noted by Denscombe (ibid.) is a 'natural setting'; all the data collection in the two observed studies took place in the classroom during the school day. Stake widens this to include the placing of...

> ... an interpreter in the field to observe the workings of the case, one who records objectively what is happening, but simultaneously examines its meaning and redirects observation to refine or substantiate those meanings. (1995:8-9)

In the two studies, I was the 'interpreter' who aimed to objectively record the pupil action; my role is discussed further in section 5.2.2.

Finally, the last characteristic Denscombe (ibid.) delineates is 'multiple sources and multiple methods'; a variety of methods were employed in the two studies, informed by the need to capture participant action from various modal viewpoints as required through the adoption of the multimodal perspective; these are described later in this chapter in section 5.3.

5.1.3 A consideration of modes

One particular aspect of this design was the need to consider the observed activity from the perspectives of the various communicational modes. As discussed in chapter 4, these are not universally agreed, so a decision needed to be taken concerning which ones to adopt. In the light of experience gained in the pilot study, particularly in identifying the emerging categories leading to the construction of the time-ordered matrix (see section 3.2), and with reference to those suggested by Kress and van Leeuwen (2001) and to examples of previous multimodally-based classroom research (Kress et al., 2001; Kress et

al., 2005), the following basic categories were chosen: linguistic, spatial, gestural, aural and visual. These would inform both the data collection, in terms of ensuring that the methods used could collect the data required, and also the analysis of the data, in terms of its categorisation, linking and presentation. Further detail is provided concerning the application of the modes in this study in section 5.4.1.

5.1.4 Data collection instruments

The multimodal perspective, as described in the preceding two sections, suggested fine-grained data collection. As had been trialled in the pilot study, it was decided to employ digital video as this had been seen to provide a highly level of detail; this is considered in greater detail in section 5.3.1. To supplement this, semi-structured interviews were to be held with pupils and teachers before and after the series of lesson observations. The questions asked can be seen in appendices 1 and 2 and more detail concerning the interviews can be found in section 5.3.5. The multimodal notion of the transformation of available designs required that the composing process was traced in detail; to back this up, two further data collection methods were employed: screengrabs and the collection of Cubasis files. These are described in detail in sections 5.3.2 and 5.3.3.

5.2 The research design

5.2.1 The main studies

Two schools were selected for this study - one secondary (school A) and one primary (school B). Composition was embedded into the existing curriculum at both schools, although computers for music were new to school B and had only been in use for a year at school A.

School A was a 11-18 mixed community comprehensive school situated on the outskirts of Bristol with nearly 1300 pupils. It was described by Ofsted (2003) overall, and for music specifically, as 'very good' and the standards in music were considered to be 'above average'. Class sizes were about 30 at key stage 3 and music lessons were an hour in length. The music classroom was designed so that part of it was sectioned off for computer use and several practice rooms opened off the main room, with one accessible from a raised balcony (see fig. 26).

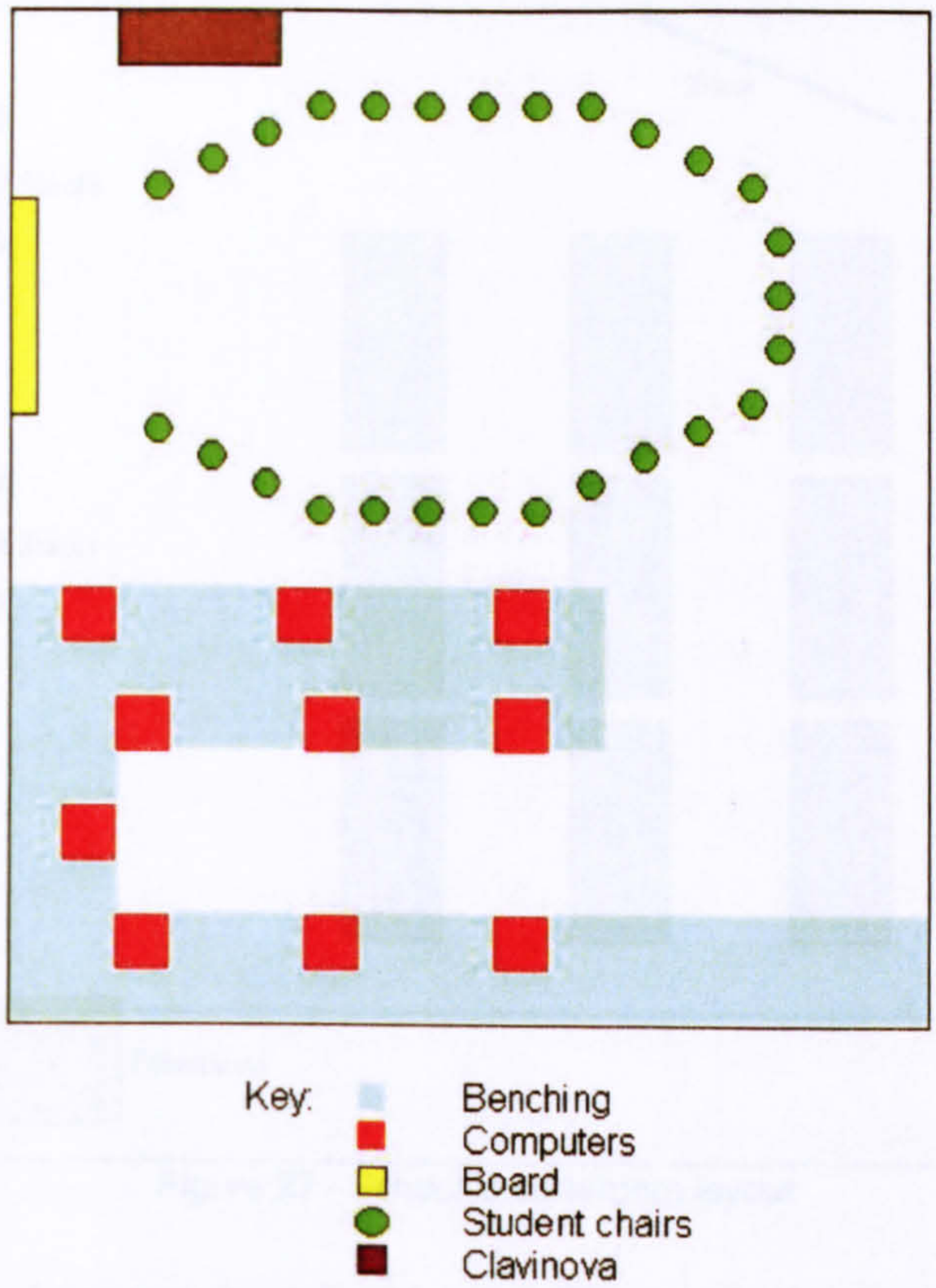


Figure 26 - School A classroom layout

School B was a 4-11 mixed voluntary controlled primary school situated on the outskirts of Bristol with about 265 pupils. Ofsted (2006) described the area as 'economically advantaged' and although music was not mentioned in the most recent report, the school was classed as 'good'. Class sizes were generally over 30 and music was taught for approximately an hour each week. The school had a 'resources' room which was set aside for a range of uses; this was where the 2 computers for music composition were set up (see fig. 27).

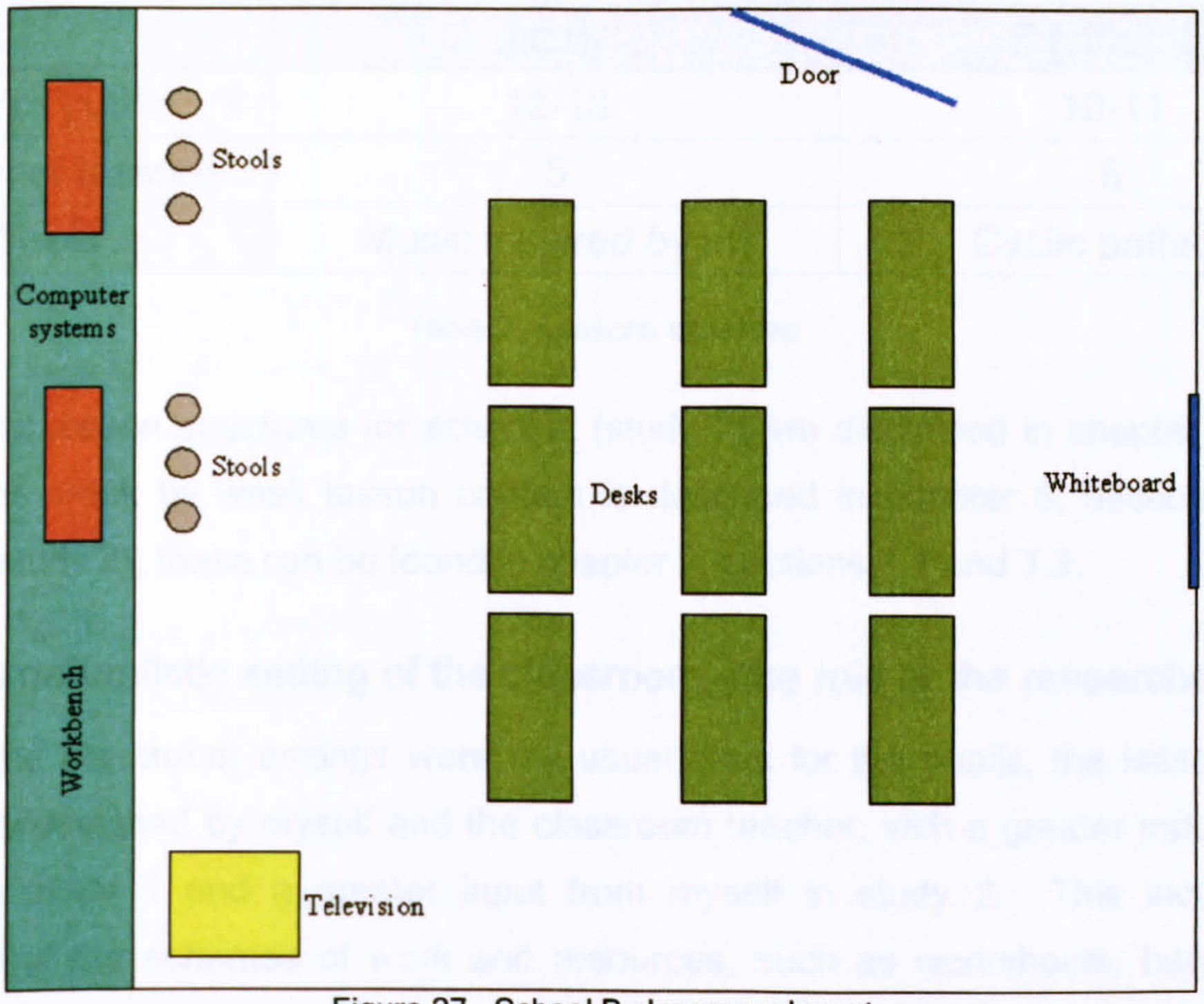


Figure 27 - School B classroom layout

The teachers' choice of composition focus was different in the two schools; in school A it was based on an existing scheme of work entitled 'Music Inspired by Art'; in school B, it was based on a unit from a commercially produced scheme of work entitled 'Cyclic Patterns'.

The teachers selected the pupils for the study; following discussions, it was suggested that in order to provide a form of cross-section of pupils, the groups should contain a mixture of pupils with varying backgrounds and abilities. In the case of school A, two groups were selected for observation, one high-attaining, consisting of two pupils and the other low attaining, consisting of three pupils; however, owing to absence and changes in the members of the second group, it was the first group of two pupils that formed the focus of this study. In school B, two mixed ability groups were selected, each consisting of three pupils and one of these was selected at random as the focus for this study. Table 2 summarises the lessons observed:

School:	A (study 1)	B (study 2)
Age of pupils	12-13	10-11
Number of lessons	5	5
Topic	Music inspired by art	Cyclic patterns

Table 2 - Lessons observed

The general lesson structures for school A (study 1) are discussed in chapter 6, section 6.1 and the week by week lesson content is described in chapter 6, section 6.4. For school B (study 2), these can be found in chapter 7, sections 7.1 and 7.3.

5.2.2 The naturalistic setting of the classroom - the role of the researcher

Although the classroom settings were the usual ones for the pupils, the lesson designs were jointly designed by myself and the classroom teacher, with a greater input from the teacher in study 1 and a greater input from myself in study 2. This included joint production of the schemes of work and resources, such as worksheets, handouts and sequencing templates. Furthermore, composing with computers was new in both of the contexts under examination, although music and composing were well developed activities at both of the schools (see section 5.2.4 for a description of the two contexts). As well as the introduction of a new composing tool (the computer), pupils also worked in a slightly different way to that to which they were accustomed, in that they worked in smaller groups than usual, in pairs or groups of 3; in their usual composing activities, they were used to working, as is typical of composing activities for this age range, in groups of 4 or 5, as explained in chapter 2, section 2.3. However, the use of computers generally was well embedded at both schools and pupils commonly worked in pairs or threes when using computers in other areas of the curriculum.

My own role in the observed classroom activity also varied between the two studies; in study 1, this was chiefly concerned with data collection during lessons, giving occasional technical help to pupils when their music computer workstations failed to function as expected. However, I provided a greater input to the setting up of the equipment before the start of the lessons, such as re-configuring software. In study 2, my input during lessons was greater, as they took place in an additional room to the teacher's classroom; after introducing the composing task, the teacher moved between this room and the main classroom. Technical and musical help was given to both groups by myself in the absence of the teacher, although the pupils worked for the most part by themselves.

Configuration of equipment prior to lessons during study 2 was not required other than to start the screen grab utility.

5.3 Data Collection

In the following sections there follows a description of each of the various tools employed for data collection, the reason for its choice, its adoption in the classroom setting, constraints upon its use in practice and any further remedial action that was necessary.

5.3.1 Video

The adopted multimodal approach required that as many aspects of participant behaviour were captured as possible; one of the most useful tools for this purpose is video. I had gained a good deal of experience in its use in music classrooms during the pilot study, especially through experimenting with the positioning of the camera (see chapter 3, sections 3.1.4 and 3.2). Roschelle notes that:

> Videotape can preserve more aspects of interaction including talking, gesture, eye, gaze, manipulatives and computer displays. Moreover, video allows repeated observation of the same event and supports microanalysis and multidisciplinary analysis (2000: 709).

In particular, the use of digital video (in this case, MiniDV[1]) allowed data to be downloaded to a computer with no loss of quality, which permitted frame by frame viewing, the embedding of video in other applications and the ability to utilise more advanced functionality, such as slowing down the playback and being able to select start and end points for looping. In the pilot study it had been found that the video could provide a record of pupils' conversations, their physical positioning in relation to each other and the computer, their gesture and gaze, the computer screen, as well as their interactions with the computer and music keyboards; however, the positioning of the camera had been found to be crucial (Heath and Hindmarsh, 2002: 107-8). The camera was placed at the side of each group, with the aim of framing the computer system and the pupils (see fig. 28).

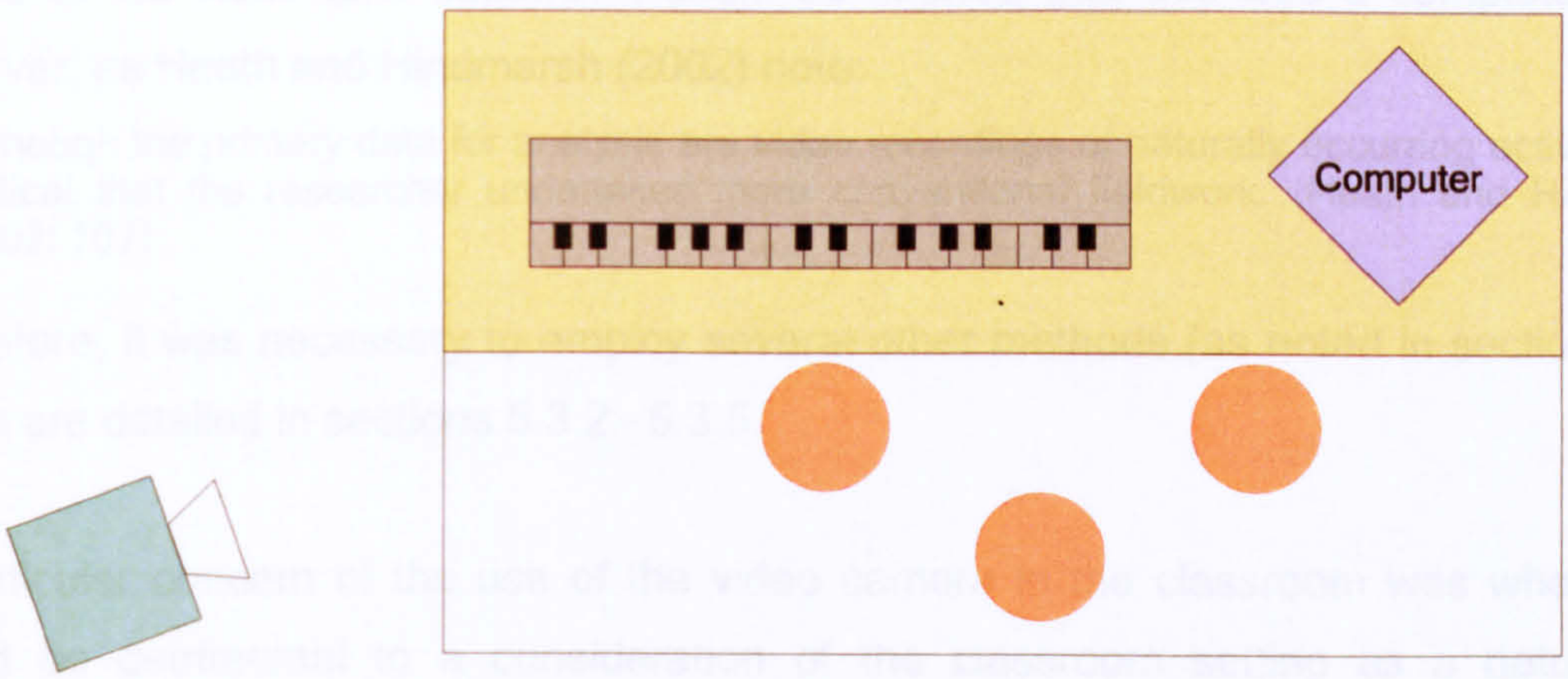


Figure 28 - The camera position

It had been found that the camera's sound recording system was not capable of focusing aurally sufficiently on pupil conversation, so additionally, a sound mixer and a microphone was used. Additionally, it had also been noted that the playing of the music keyboard by the pupils and by the computer's MIDI system was also indistinct, so the keyboard was also routed to the mixer (see fig. 29):

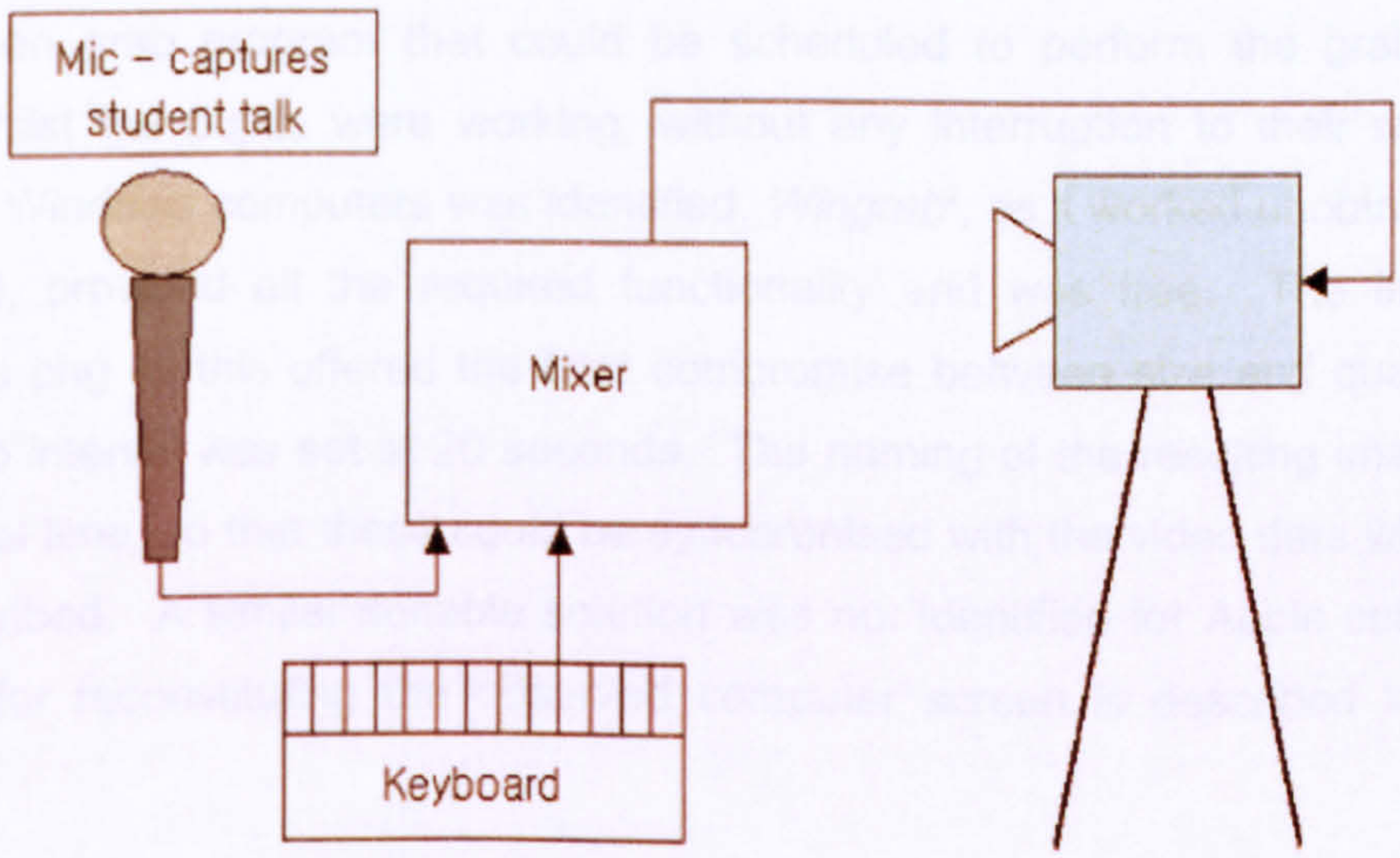


Figure 29 - The connection of the mixer to the camera

This produced an acceptable record of the interactions in most ways but was deficient in capturing the computer screen owing to the inability to synchronise of the refresh rates of the computer system's CRT and video camera, resulting in a continuously moving horizontal band on the video of the computer screen. Therefore, another method of capturing this data was employed (see section 4.3.2). Owing to the seemingly all inclusive

nature of the video data capture, it could be inferred that this was a complete record; however, as Heath and Hindmarsh (2002) note:

> Although the primary data for analysis are video recordings of naturally occurring activities, it is critical that the researcher undertakes more conventional fieldwork. (Heath and Hindmarsh, 2002: 107)

Therefore, it was necessary to employ several other methods (as noted in section 5.1.4), which are detailed in sections 5.3.2 - 5.3.5.

A particular concern of the use of the video camera in the classroom was whether this would be detrimental to a consideration of the classroom setting as a natural one, particularly whether its presence would affect pupils' behaviour. However, I considered that as the filming of lessons had followed interviews with the pupils, I had got to know them to some extent and owing to the filming being of a series of lessons, the pupils would gradually notice the equipment less and less and therefore be progressively less affected by it.

5.3.2 Recording the computer screen

Because of the video recording problems related to the computer screen, it was decided to use a screen grab program that could be scheduled to perform the grabs at preset intervals whilst the pupils were working, without any interruption to their work flow. A solution for Windows computers was identified, *Wingrab*[2], as it worked unobtrusively in the background, provided all the required functionality and was free. The image format chosen was png as this offered the best compromise between size and quality, and the screen grab interval was set at 20 seconds. The naming of the resulting image files was linked to real time, so that these could be synchronised with the video data when this was later transcribed. A similar suitable solution was not identified for Apple computers; the procedure for reconstituting the observed computer screen is described in chapter 6, section 6.1.

5.3.3 Computer files of pupils' compositions

In order to provide as little interruption to the pupils as they worked, it was decided not to ask them to perform multiple saves of their work, in a similar manner to that described by Folkestad (1998: 85), particularly as audio recordings of the lessons would also be available from the video data, and therefore the sequencing work in progress would be

sufficiently documented. However, Cubasis sequencing files (in the .arr format) were saved at the end of each session onto disk and archived.

5.3.4 Field notes

It was realised that although video recording is a useful data collection tool, it is necessarily partial owing to a less than complete field of vision, the decisions taken by the observer concerning what to record and its technical limitations (Roschelle, 2000: 721). For these reasons, it was decided to make field notes as the composing activities progressed to add context and detail to the other data collection methods, to act as ...

> ...an alternative way of capturing a secondary record of the stream of events (ibid., 2000: 725)

In particular, this method was used to note more about the physical background classroom context and any external interactions with the members of the observed group.

5.3.5 Interviews

The process of composing by the group of pupils using the computer was the focus of the observations; this process involved many facets - the grouping of the pupils, the physical positions they adopted, the roles they undertook, what was played on the music keyboard and how it related to the playing that had preceded it and to what was to follow, the group's joint negotiation of tasks, the amount of time allocated to these tasks, the manipulation of the computer as a tool for recording, editing and playing back, the negotiatory potential of the computer for the group, as well as the formation of the compositional outcome. However, owing to the fine-grained data collection required following the adoption of the multimodal theoretical prism, certain aspects required an understanding of the context of the musical activities, both from the pupils' and teachers' perspectives. Therefore, before and after each series of observed lessons, interviews were carried out both with pupils and teachers; the questions asked during these can be seen in appendices 1 and 2. The 'before' interviews with the pupils helped me to get to know them as well as discover something of their musical preferences, musical experiences they had had inside and outside of school, participation in group work in school music, experiences with computers and their attitudes to school music. The 'before' interviews with the teachers were aimed at gaining information about their teaching background, the place of music within the school, the resourcing of the subject, especially with regard to computer provision, their own experiences of computers and their music teaching philosophies. The 'after' pupil interviews were primarily aimed at gaining information about the source of the musical material that had been selected to transform,

and hence the origins of the available designs, particularly where these had been from outside the classroom. The 'after' teacher interviews sought to allow them to reflect on the series of lessons, particularly on whether they had met their expectations, the role of the learning design and what they would change if they were to repeat them.

5.3.6 Other data

To enhance the understanding of context, worksheets and sequencing templates were collected and other useful materials connected to related parts of the music curriculum, such as schemes of work. Table 3 provides the detail of the data collection process:

Before the series of lessons	During the series of lessons	After the series of lessons
Pupil and teacher interviews undertaken Worksheets, computer templates and other relevant documentation collected	Lessons videoed	Pupil and teacher interviews undertaken
	Screengrabs performed every 20 seconds (study 2)	
	Field notes made	
	Computer files collected at the and of each lesson	

Table 3 - The data collection process

Table 4 summarises the data collected for each study:

	Study 1	Study 2
Number of lessons observed	5	5
Pupil interviews	Carried out before and after the series of observed lessons in 2 groups, one of 2 and one of 3 pupils; 4 interview sessions in total	Carried out before and after the series of observed lessons in 2 groups of 3 pupils; 4 interview sessions in total
Teacher interviews	Before and after the series of observed lessons; 2 in total	Before and after the series of observed lessons; 2 in total
Worksheets / computer templates	3 worksheets 1 computer template	5 worksheets 5 computer templates
Lesson video data	5 x 1 hour of each of two groups	5 x 45 minutes of each of two groups
Screengrabs	Not applicable	675
Field notes	All lessons	All lessons
Computer files	5 for each group; 10 in total	5 for each group; 10 in total

Table 4 - The data collected for each study

5.4 Data transcription, categorisation, storage and presentation

5.4.1 Overview

The transcription and analysis of the data is founded upon the theoretical arguments that have been presented in the two preceding chapters, which discussed the background and the reasons for the adoption of the theoretical framework and how theories of multimodality have been adapted to the context of researching composing with computers in the music classroom.

Multimodal transcription and analysis is necessarily complex and it should be noted that there is no one accepted method, as an agreed format has yet to emerge. A key organising element is the *unit of analysis;* Norris (2004) defines the unit of analysis as 'mediated action' (Norris, 2004: 13), although she notes this is inherently problematic as this will depend whether lower level (possibly a word or a small group of related words) or higher level (possibly a conversation) actions are considered. The unit of analysis chosen here is that of higher level actions, or ...

> ... a sum of fluidly performed chains of lower level actions (ibid., 2004: 14)

... which are ...

> ... bracketed by social openings and closings that are at least in part ritualized (ibid., 2004: 14)

In the observed composing in the music classroom undertaken for this study, the unit of analysis was, for example, a conversation about who is to play the music keyboard for the next recording; or the period of time bracketed by the start and end of a music recording; or a series of actions that together can be considered the editing of a particular section of music data, for example, correcting a 'wrong' note. This is directly linked in this study to the notion of 'time-frame' (see section 5.4.3).

All action is necessarily temporally related and related to other actions; Artale and Franconi define actions as...

> ... represented through temporal constraints on world states, which pertain to the action itself. (1998: 464)

Therefore, it was decided to represent the observed actions in the form of a temporally ordered list, in much the same manner as the time-ordered matrix developed in the pilot study (see chapter 3, section 3.2). The choice of categories for this representation was

informed by the multimodal construct of communicational mode (see section 5.1.3 above), '... an organised set of resources for making meaning with' (Jewitt, 2006: 17). As noted previously, it was decided to utilise the following 5 categories:

- *Linguistic* (spoken and written communication);
- *Spatial* (the spatial organisation and movement of pupils and artifacts);
- *Gestural* (gestures used by pupils for the purposes of communication);
- *Visual* (images and diagrams);
- *Aural* (music and other non-verbal sound), subdivided into explanation (textual), western music notation (where something has been played) and a sound recording of the playing.

To illustrate what this temporally ordered, categorised data looks like when represented in this manner (see fig. 30), which presents one of the data views facilitated by the computer tool, which is discussed later in this chapter in section 5.4.2:

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 32 00:12:21 - 00:12:34	AT42, L105, L106 then L107, G63, L107, G64 then L108, L109, L110, L111, L112 S36 & G65 on-going throughout the time frame	**L105** C: Two **L106** A: No, court her in **L107** Researcher: So, are you going to do the third section now? **L108** C: Ready? **L109** B: Set it [smooth] **L110** Researcher: So where's your left locator need to be? **L111** C: Ah.. **L112** A: Nine	**S36** B tries out ideas at the keyboard; A & C sit at the computer; researcher speaks from behind and points at computer screen with a pencil	**G63** C indicates with his left hand that B should stop playing the keyboard **G64** B looks around at researcher when he speaks **G65** A & C look at computer screen apart from when C looks at A to speak.		**AT42** B tries out ideas at keyboard	

Figure 30 - Representation of the multimodal data

Other researchers of classroom interaction have used less than these, such as 'Speech/writing', 'Action' and 'Visual' (Kress et al., 2001: 45) whereas others have sub-divided categories, such as separating out colour from a consideration of the visual mode and gaze from the gestural mode. This would seem to have been dependent upon the

subject domain being studied and the focus of the investigation. The selection of categories for this study was discussed in section 5.1.3 above and it was subsequently found that they did allow for the data to be all accounted for and aligned well with those suggested by Kress and van Leeuwen (2001).

5.4.2 Transcription

Multimodal data is large and detailed and an initial problem to be overcome was that of its effective and pragmatic transcription. As described in chapter 3, section 3.2, during the pilot study a time-ordered matrix had been developed where hand-written notes were made within each of the identified categories whilst viewing the video, which at that time were not specifically related to theories of multimodality. This was extremely time consuming and the data was 'static' in that it could not easily be used in other situations without copying it again. It was realised that a more holistic computer environment would solve many of these problems and present more potential, particularly for streamlining the transcription process as well as the representation and linking of data; it could contain the raw video data therefore removing the need to show the DV tape on a separate machine; it could show just the sections of the video required, looping between start and end points, therefore obviating the need for constant rewinding; video time-code could be foregrounded, thereby easing the transcription process itself; the transcription could be undertaken directly onto the system, so the same data could be used in different situations; it could provide for the linking of data, thereby allowing phenomena to be grouped; it could provide whole or selective representations of the data; it could provide the means to store photographic stills and music transcriptions, and it would be easy to store and back up the data, and link it to time.

The next series of tasks were to collate all the various multimodal files that would be needed to represent the various aspects of observation, such as movie files, stills, sound clips, music notation and screen grabs. The first of these tasks was to download the MiniDV video content and save it as a QuickTime[3] movie using iMovie[4] running on a Apple Macintosh computer. Connected musical fragments were then recorded, edited, saved in mp3 format using Audacity[5] running on a PC and then transcribed using standard western musical notation with Sibelius[6] and exported out as monochrome bitmap files. This transcription of music is a theme explored by Sloboda (2005: 71-2) where he considers the notations of songs to be more problematic than those of language owing to them being '... not bound by practical constraints in the way that they usually are in language.' (ibid.,

2005: 71). However, the notes are played in this study on a classroom music keyboard, which *is* bound by practical constraints and as Sloboda notes 'There is evidence that children immersed in a musical culture (such as our own) internalize the structures that are implicit in the bulk of music they hear ... we therefore, feel that most adults, conceive of music in terms of these enculturated structures' (ibid., 2005: 72). Therefore, it was considered that the musical transcription is accurate enough for the purposes of this study. Also, the screen grabs (created by Wingrab in png format) and series of still pictures (in jpg format) taken from the QuickTime videos depicting spatial changes, were collated.

5.4.3 The transcription tool

To provide the holistic computer environment that was needed, a search was made for a suitable tool that could provide all the required functionality and many options were initially considered. There are several multimodal annotation tools available, six of which have been reviewed by Rohlfing et al. (2006). All of these (except those in the first of their categories, 'media and text editors', or in other words, pre-existing word-processing and video playback tools) took a similar approach to the representation of the data, the 'musical score' approach (Rohlfing et al., 2006:104; Rose et al., 2004: 260), using a horizontal time-line with temporally-aligned blocks representing 'annotations', or periods of linked action. I particularly wanted to show the data in the manner represented by Kress et al. (2001: pp. 45, 50 & 91), that is, with time running vertically and each mode represented horizontally, as an extension of how discourse focused on language has often been presented (Gee and Green, 1998:138; Roth and Lucas, 1997:152; Luke, 1995-1996:23). This was partly because this form of representation was similar to the time-ordered matrix transcriptions I had carried out previously as part of the pilot project, where following the watching of the video data many times, emerging categories were teased out and paper-based templates produced for the actual transcription process, with time indicated vertically down the left-hand side of the sheets (see chapter 3, section 3.2). However, it was mainly due to my need to be able to easily compare distinct multimodal areas with each other, for example, the stream of music experimentation fragments, or to see the verbal interactions placed alongside each other that led me to reject these options; this data could be entered and stored within these systems, but it was not represented in the way that I would need for my further analysis. However, I did investigate another similarly organised ('musical score') tool in more detail (StudioCode[7]) that is discussed further below in this section.

Three software packages were selected to explore in depth to ascertain if they provided the necessary functionality, would run on the required computer platform and be available at an affordable price. The first two of these were not 'musical score' based - Nvivo[8] and Atlas.ti[9].

NVivo (version 2.0.161d) is a qualitative analysis tool that stores data in projects, that contain all the files relating to that project (see fig. 31):

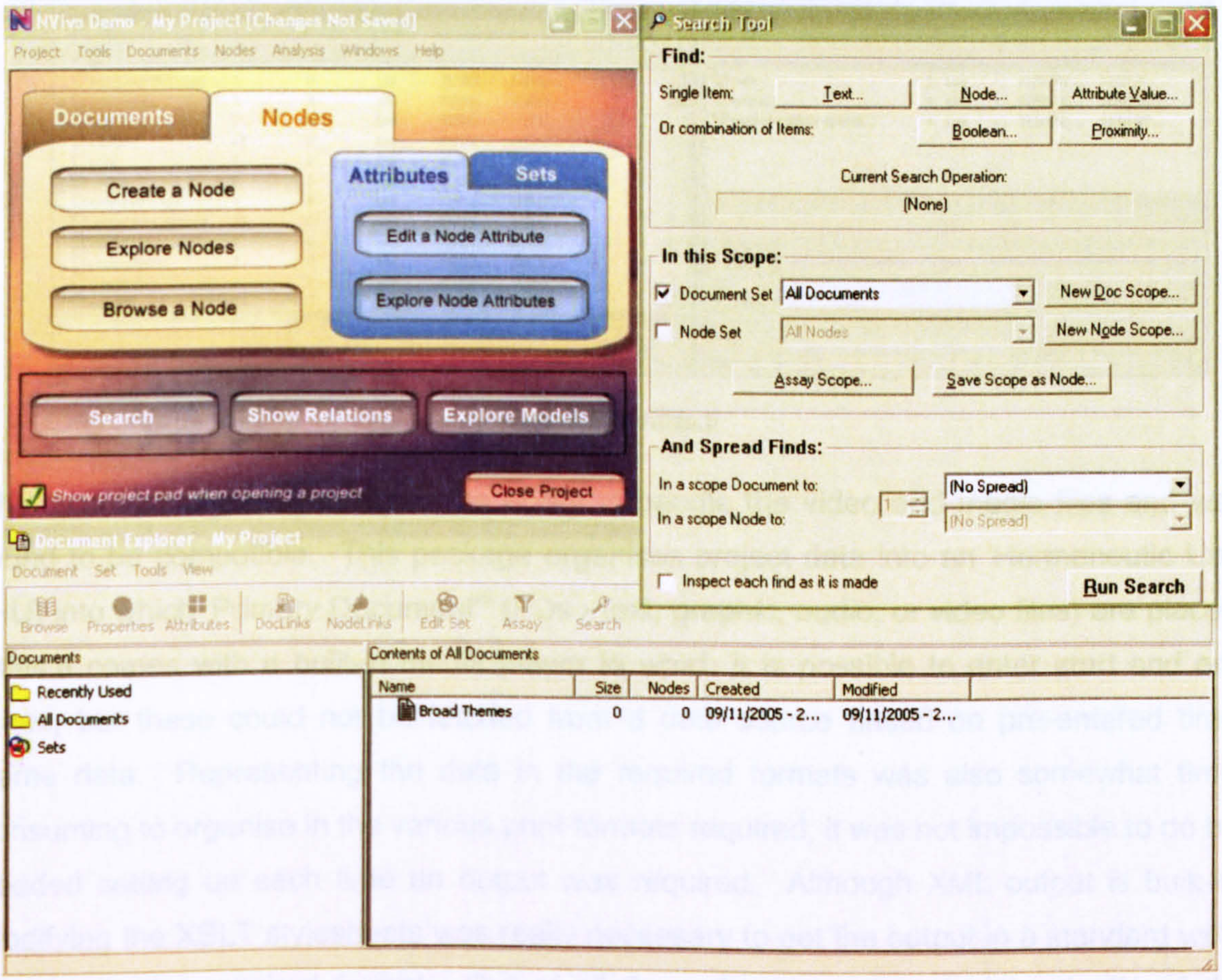


Figure 31 - Nvivo

The software contains numerous features but was unable to handle the video data and other media files in the ways required, so this option was rejected. The next software package to be considered was Atlas.ti (version WIN 5.0 build 66), another package aimed at qualitative data analysis (see fig. 32):

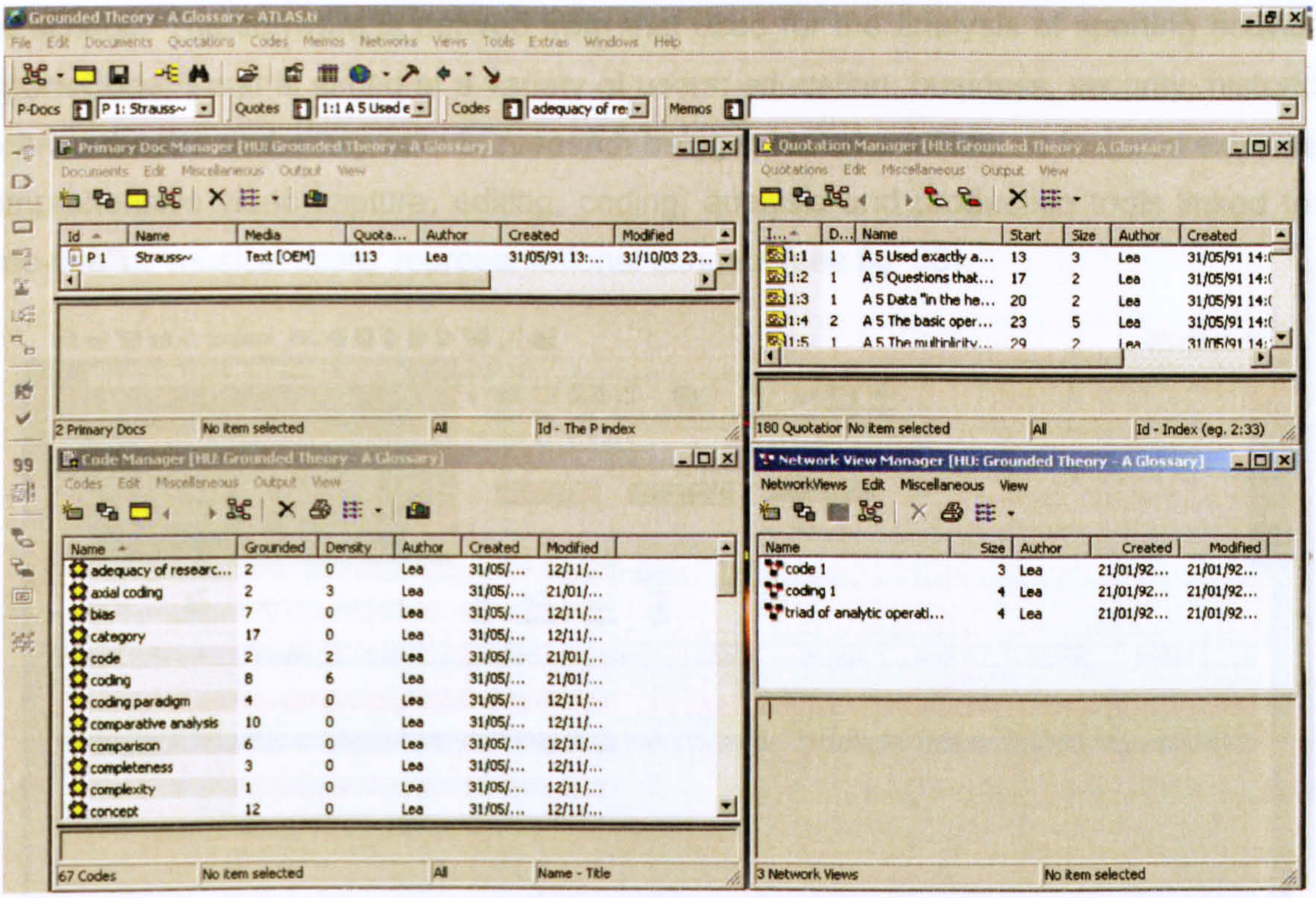


Figure 32 - Atlas.ti

This was investigated initially for its ability to handle the video and media files and was found to be compatible. This package organises project data into an 'Hermeneutic Unit' (HU) into which 'Primary Document'" (PDs - text, graphic, audio, or video files) are placed. Atlas.ti comes with a built-in media player in which it is possible to enter start and end times, but these could not be fetched from a data source based on pre-entered time-frame data. Representing the data in the required formats was also somewhat time-consuming to organise in the various print formats required; it was not impossible to do but needed setting up each time an output was required. Although XML output is built-in, modifying the XSLT stylesheets was really necessary to get the output in a standard web-browser in the required format. Out of all the software packages, Atlas.ti offered the closest solution, but was rejected owing to the reasons already given, the perceived learning curve to enable the required output to be generated and the cost (at the time, €390 educational price).

StudioCode[7] (see fig. 33) was the next package to be considered, although as this only ran on a static well-equipped Mac (situated within the Graduate School of Education), it was not immediately seen as a practical proposition, as a portable solution had the advantage that time could be spent working on the transcription and analysis away from

the school. The software is derived from that used for the analysis of sporting activities (SportsCode[10]) and is aimed at a variety of users: education, business, security, historical archive, theatre and many others, research being a recent addition. It features extremely comprehensive video capture, editing, coding, analysis and production tools linked to a 'time-line' or 'musical score' representational concept (see fig. 33).

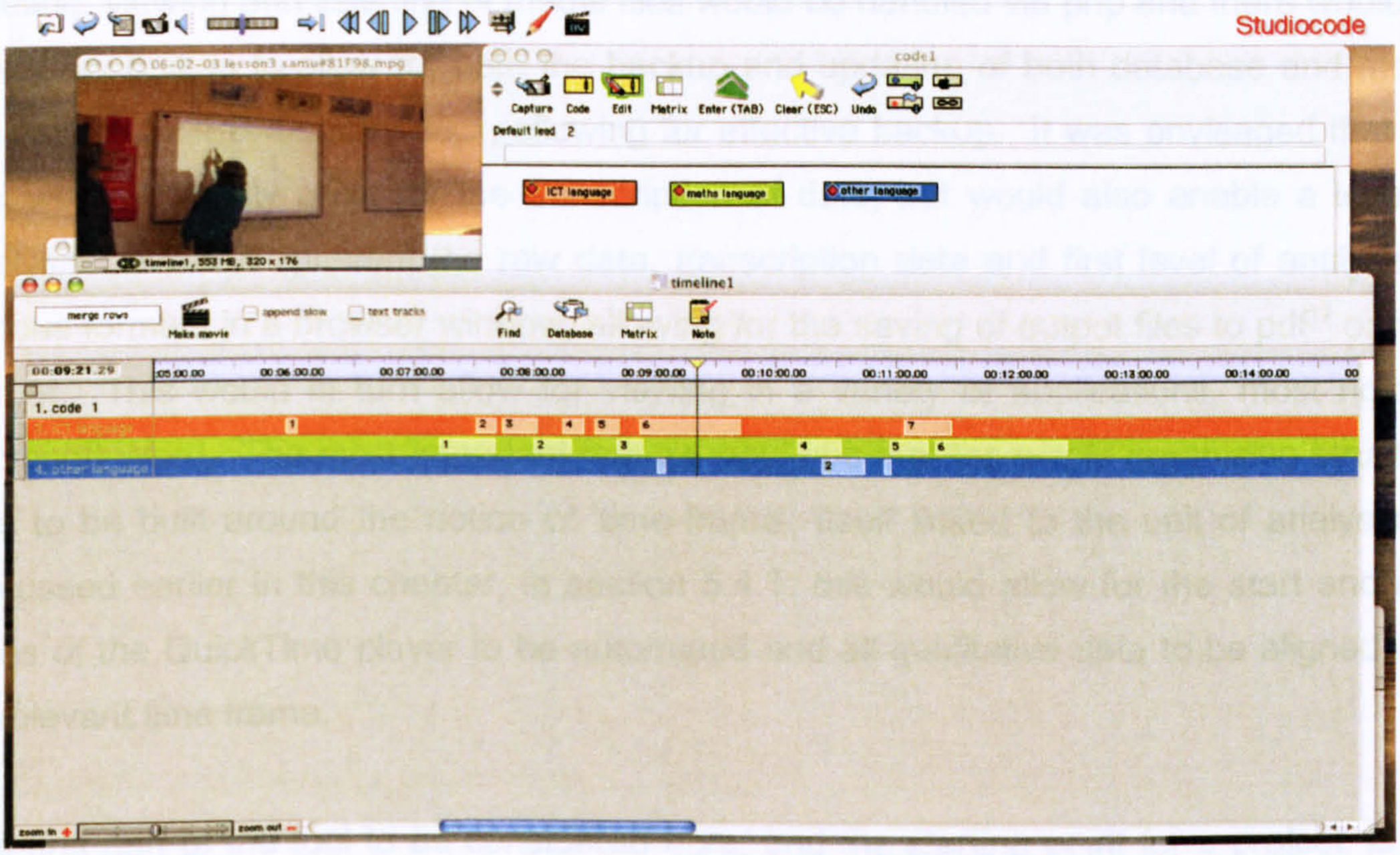


Figure 33 - StudioCode

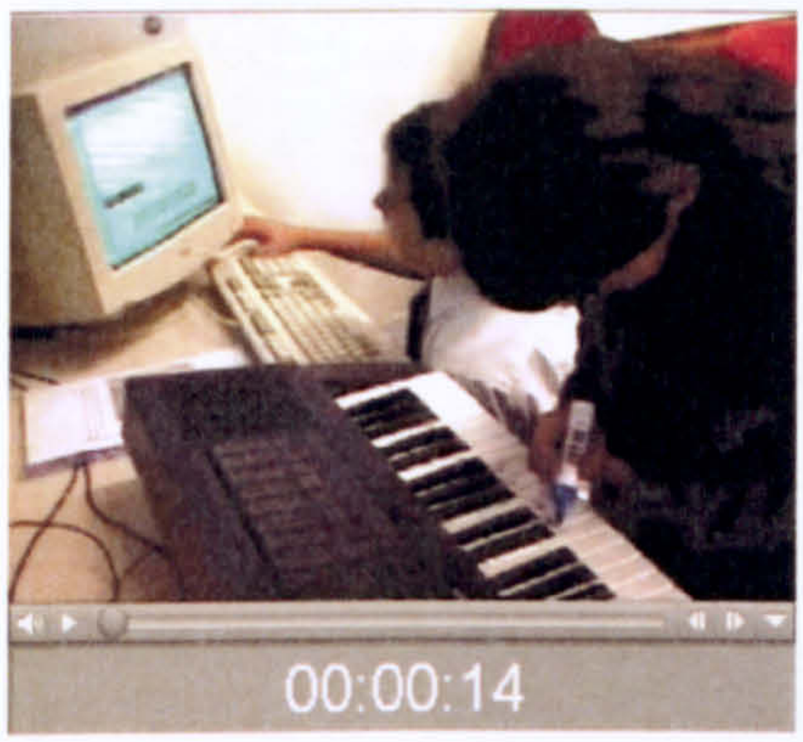
For research purposes, a coding system is initially created, and then the video to be used in the project is captured into the program and coded. The video can then be transcribed with respect to the developed coding system and a timeline of coded events created. It seemed particularly user-friendly, and the learning curve appeared less than in the two previously described products. However, it did not handle audio files, and the varied forms of data representation required were not easily achievable.

Following the appraisal of these products, a decision was made to develop a software solution. In addition to the constraints already noted, it was decided to use Open Source software for two reasons: cost, and the ability to run on any platform. The key technologies employed were DHTML[11] coding for display in standard browsers, the php[12] scripting language to connect the DHTML pages to a MySQL[13] database (and to provide other functionality) all running on an Apache[14] web server and viewable through a standard browser, such as Firefox[15]. The Apple QuickTime player would be embedded in

the system and used to play the movie files previously downloaded from the MiniDV tapes. Use would be made of its configurable JavaScript[16] Application Programming Interface (API) to re-size the player window, start and stop playing from any point in the file, recognize different video formats (adjusting the time display appropriately), looping the playback as required as well as handle the playing of the audio files. All the uploading, deleting, viewing and listening of media files would be handled via php and there would be the ability built-in to allow for both the backup and updating of both database and media file data to a USB memory stick, allowing for effective backup. It was envisaged that the tool would not only allow for the transcription of data, but would also enable a level of analysis. It would present the raw data, transcription data and first level of analysis in various formats in a browser window, allowing for the saving of output files to pdf[17] or html format. This would in turn allow for viewing in a variety of applications, most notably Microsoft Word. The most important feature would be that the whole organising structure was to be built around the notion of 'time-frame', itself linked to the unit of analysis as discussed earlier in this chapter, in section 5.4.1: this would allow for the start and end times of the QuickTime player to be automated and all qualitative data to be aligned with its relevant time frame.

The first part of the tool to be considered here, and the starting point for a project, is the time-frame entry page where decisions concerning the length of the time-frames are made. The time-frame is considered synonymous with the 'unit of analysis' - see section 5.4.1. Start and end points are entered by watching the video - the software forces them to line up with previous time-frame decisions so that the time-frames are contiguous (see fig. 34):

Create Time Frame



Enter start and end times in the format HH:MM:SS for project 1:

Set start time:	00:00:56	Select, then click to add end time to new start time:	Enter a time or use 'Add time' to enter a movie start time in the box below, then press 'Set movie start time':
Set end time:	00:01:05	00:00:16 00:00:36 00:00:44	00:00:16
Create Time Frame		Add time	Set movie start time

Show all time frames for project 1 Go

Delete time frame and all data

Select the start time for project 1:

Select start time:	00:00:00 00:00:16 00:00:36
Delete Time Frame	

Figure 34 - The time-frame entry page

The next task is to use the uploading pages to upload the various media files associated with the project - audio (mp3 files), still pictures (jpg files), video (QuickTime movie or mpeg files), screen grabs (png files) and music transcriptions (jpg files). The next part of the process is to enter data using the data entry page (see fig. 35), where the video portion is looped to aid transcription and the multimodal data can be entered into discrete text boxes and saved relative to the selected time-frame. Data to be linked together (which can be taken from different time-frames or projects) can also be selected and linked on this page:

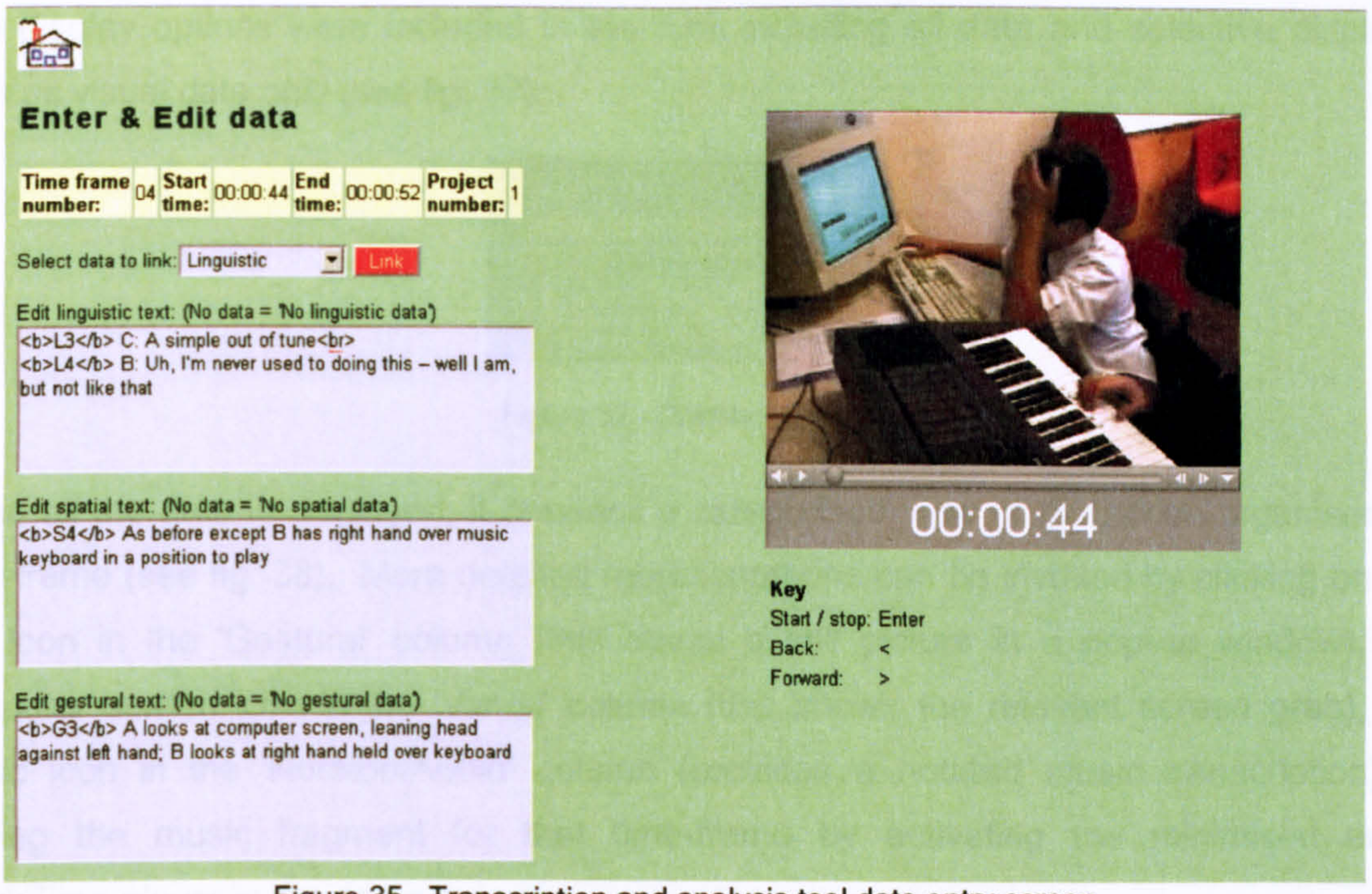


Figure 35 - Transcription and analysis tool data entry screen

Lower down this page there is the ability to link the previously uploaded media files to this time-frame. All of these individual linguistic phrases or musical extracts were sequentially labelled; for example L1 for a linguistic event, or S1 for a spatial event and so on. A further screen displays the entered data and allows the ability to add notes to each of these separate multimodal elements (see figure 36):

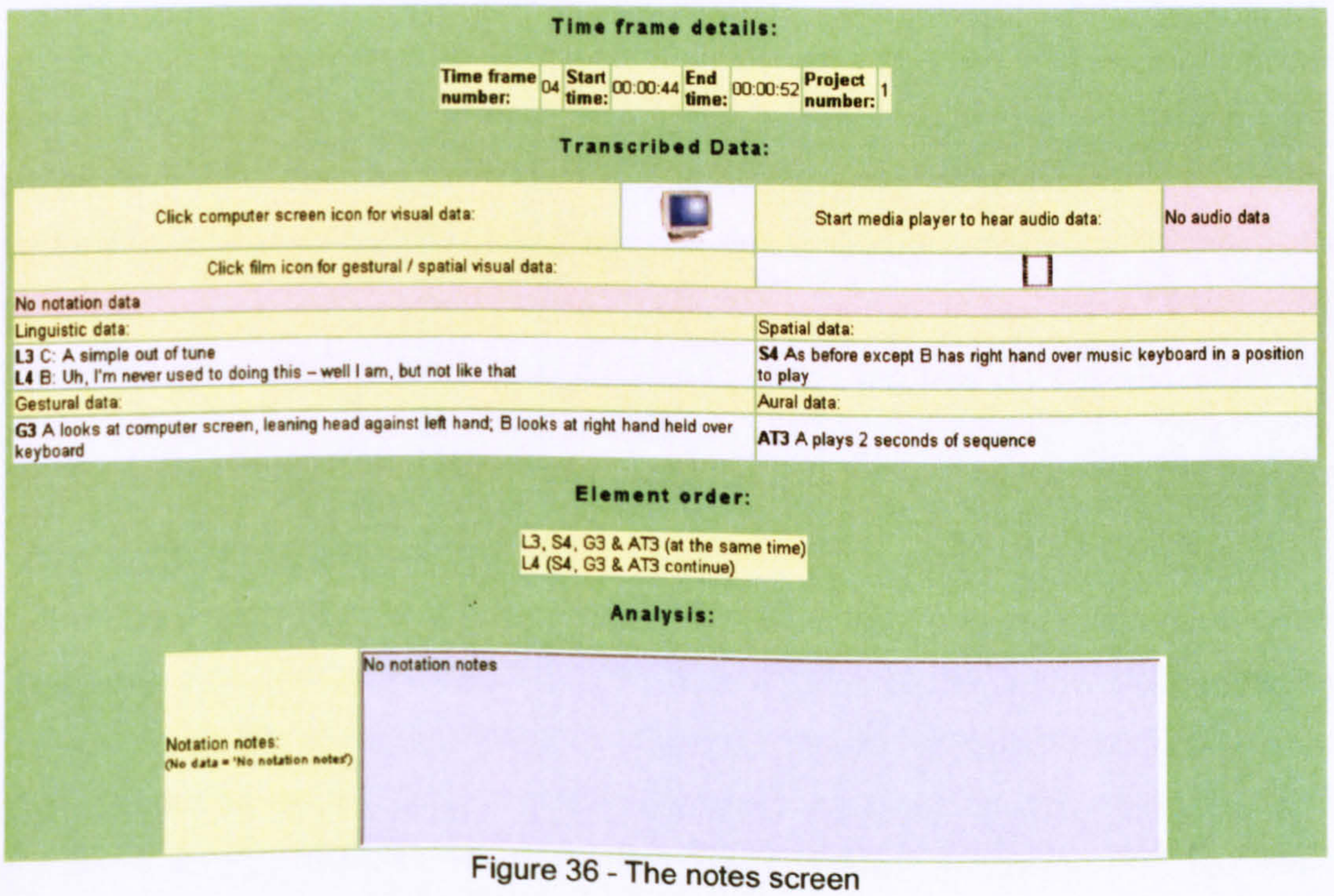


Figure 36 - The notes screen

Five display options were included in the tool, including all data and selective displays, such as visual data only (see fig. 37):

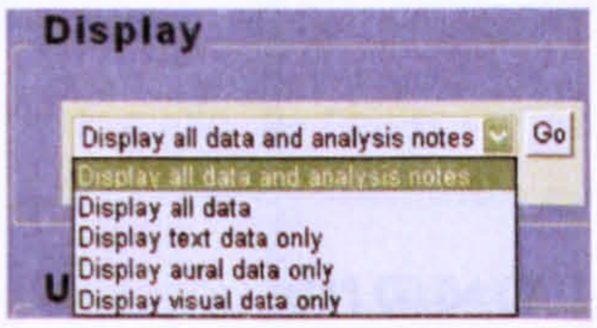


Figure 37 - Display options

When all the data is displayed, it provides a categorised view of the action organised by time-frame (see fig. 38). More detailed representations can be invoked by clicking on the film icon in the 'Gestural' column (this opens a still picture in a pop-up window), the computer screen icon in the 'Visual' column (this shows the relevant screen grab), the music icon in the 'Notaton/Audio' column (provides a notated music transcription) or playing the music fragment for that time-frame by activating the minimised audio QuickTime player in the same column.

Although the transcription and analysis tool took time to code and test, I consider that it saved a good deal of time over the course of the project and allowed me to organise, view and analyse the data in ways that would have been difficult and time-consuming without it.

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation/ Audio
Time frame 5 00:04:07 - 00:04:37	S5, G11then L38-L43, then G12, then L44-45, then S6, then L46-47, then G13.	**L38** B: Well look down the bottom then. **L39** A: Yeah. **L40** B: There it is. **L41** A: We need to put that (points to the screen with right hand).. **L42** B: Before.. **L43** A: Before the (pointing to screen with right hand) ..that one (points to worksheet with right hand). **L44** B: Ain't it all around there. **L45** A: I don't know .. I haven't done anything to it .. shall we ask sir? There's a split in .. **L46** B: Just move all this (points to screen with right hand) .. ow! **L47** A: Er..	**S5** Both pupils look at the computer screen apart from... **S6** ...when pupil A turns around to look for help.	**G11** 00:04:07 pupil B leans with head on left hand. **G12** 00:04:15 pupil B places hands together in front of his mouth. **G13** Pupil A operates the mouse with his right hand.  Displays a still image of the time-frame	 Displays the computer screen image seen by the pupils	**AT9** At 00:04:31 pupil A plays part of 'The Old Castle' section (2 seconds - Ex203)	Displays the music notation of the pupils' composing   Plays an audio clip of the pupils' composing

Figure 38 - Multimodal categorised view

5.5 Analysis of data

The analysis of the data was informed by the adoption of a multimodal perspective as described in chapter 4. The key element of this at the core of the analysis was Design and Transformation (Kress, 2000b) - how available designs are transformed by the pupils to create new meanings. The central mode of this inquiry is necessarily music, but the data linked to each mode was considered to have equal status in terms of its potential for interrogation.

Firstly, a consideration was made of the available designs - the signs made available by the school context to the pupils for them to transform, whether originating from the teacher, other pupils, the wider classroom or school environment. The transformation of these designs was charted through a close examination of the compositional fragments with reference to the available designs, providing detailed information about how each pupil redesigned the material, the musical resources they employed to do so and the final compositional products. Next, a multimodal consideration of the musical transformations

was made, focusing on how the non-musical modes influenced the transformations noted in the previous section. Then, the origins of the transformations were explored, particularly whether they emanated from the classroom context or not. This investigation informed my understanding of the composing process and allowed me to make comparisons between a) the group members and b) the groups in the primary and secondary schools. This process is illustrated by the analyses presented in chapters 6, 7 and 8.

5.5.1 Analysing the transformations - chapters 6 and 7

The transformations contained in the two main studies were considered on a lesson-by-lesson basis; firstly, a consideration of the formal and non-formal signs presented by the classroom environment was made, together with a consideration of the constraints and freedoms that were afforded the groups in the two teachers' lesson designs. This was then followed by an appraisal of all the compositional fragments produced by the pupil(s) playing the music keyboard, grouping them (where possible) into what I term 'transformatory units' - that is, fragments that showed a development of the preceding fragment, or in other words, were built upon each other; the appraisal of these revealed *what* had been transformed. Through an examination of the influence of the non-musical modes upon these transformations in the following sections, for example, the physical arrangement of pupils and equipment, the use of the computer's visual representations, the pupils' verbal dialogue, gesture and gaze, information gained through analysis of the data concerning the *how* could be explored. It is important to note that in study 2, owing to the organisation of the lessons, the 'transformatory units' were linked to the playing (musical keyboard experimentation and recording) of one pupil, so that if three pupils took it in turns to play the music keyboard, then the lesson was considered in three sections, or possibly more if they each had more than one period of playing the keyboard.

Following the lesson-by-lesson discussions, and the general themes raised in each of the two studies, the transformation of the available designs was considered, utilising the themes of lesson design constraint, and the origins of the designs, both those that originated outside of the classroom context and those within it. A general multimodal analysis was then made of the transformations of the available designs in terms of seating position, the potentials of the visual representation of the music, the synchronisation of the playing (in study 1), the use of fingering, movement to the music and time (study 2) and

socially embedded roles and expectations. It is important to note that much of the music that is discussed did not appear in the final product as the composing process was observed to be characterised by much discarding of material.

5.5.2 Comparing the two groups of pupils - chapter 8

In the analysis which forms the basis for this chapter, the processes employed by the two groups were scrutinised to provide insights into the similarities and differences between them through the elaboration of key themes. Although it is acknowledged that the two musical environments were different and the backgrounds and out-of-school experiences of the pupils may have been quite distinct, this comparison revealed useful information about how groups of differently aged pupils are able to transform available musical designs.

5.6 Reliability and Validity

Denscombe provides a useful definition of reliability in qualitative research:

> If someone else did the research would he or she have got the same results and arrived at the same conclusions (Denscombe, 1998: 213)

In the computer tools' various forms of data presentation, the aim was to keep the presentation grounded in the raw observational data by situating the 'original' video and audio data alongside its transcription. This, it was hoped, would reduce the threats to validity (Maxwell, 2002: 48). Maxwell states validity:

> ... pertains to this relationship between an account and something outside of that account, whether this something is construed as objective reality, the constructions of actors, or a variety of other possible interpretations (ibid., 2002: 41)

Qualitative studies have often been criticised for their lack of validity; he suggests that existing definitions of validity might be replaced by a conception of its quality as...

> ... its relationship to those things that it is intended to be an account *of* (ibid., 2002: 39)

In other words, it is not worthwhile asking whether the 'account' (not simply data or methods) is 'true', because there will be different, but equally valid accounts. The relationship between an account and its 'object' can be thought of as depending on its 'contiguity', or ...

> ... the implications and consequences of adopting and acting on a particular account (ibid., 2002: 58)

Concerning this study, a key aim was that the account was *descriptively* valid; it was considered that the very detailed transcriptions of the 'original' data (video, audio),

constant references to its sources, and the keeping of them present in representations alongside the transcribed data, helped to maintain this view of the validity. Another key aim was to maintain high *interpretive* validity; it was considered that this was maintained owing to the adoption of multimodal approaches (themselves based on social semiotic theories), where the sign is the central focus of observation - in other words, it was activity that was noted and recorded, and the interpretations were produced on the basis of what was actually seen. I admit a possible 'bias' owing to my experience as a classroom teacher, but I believe that the adoption of multimodal approaches helps to keep this in the background. The final type of validity I wish to address is *theoretical* validity; Maxwell separates this into two components:

> ... the validity of the blocks from which the researcher builds a model, as these are applied to the setting of phenomenon being studied; the second refers to the validity of the way the blocks are put together, as a theory of this setting or phenomenon. (ibid., 2002: 51)

In adopting a multimodal approach to the observation of classroom phenomena, this study builds on the work of others, notably Kress et al. (2001), Kress et al. (2005) and Jewitt (2006) and it is believed that the adoption of their methods provides a warrant to employ the adopted data collection and transcription methods. Regarding the second theoretical validity component, it should be noted that there are no direct forerunners of the methods that have been employed to tease out pupils' musical transformations of the available designs in studies adopting multimodal approaches. However, they are based on established musical analytical procedures, such as those employed in the analysis of well-known composers' sketchbooks (for example, Beethoven, Stravinsky and Frank Loesser) (Drabkin, 1979; Griffiths, 2005; Block, 1989). In this study, composer's sketchbooks have been replaced by audio extracts that have been transcribed into standard western music notation. Although there are issues surrounding this transcription, which have been discussed in section 4.4.2, it is considered that that the transcriptions provide an appropriately accurate account and to increase validity, are presented alongside the original audio data. The interpretations that have been drawn from the analyses of the pupils' transformations are modelled on those exemplified by leading scholars in the multimodal field, such as those noted above.

5.7 Ethical Issues

Within this study, two particular ethical issues needed to be addressed: the first of these concerned the rights of the participants during the data collection stage and the second related to my use of the data following this phase of the study. To address these issues,

having secured the headteacher's and class teacher's interest and consent, a letter was sent to the parents/carers of all those participating in the studies indicating that the school had agreed to take part in the study and explained its overall aims. The length and timing of the project was presented together with the data collection methods that were to be used in the classroom: video and interview. Assurances were provided concerning the use of the data after the collection phase was complete; participants' anonymity was ensured through not identifying them by name, and to ensure the security of the data, parents/carers were informed that the video and sound recordings would be treated with total confidentiality, the only purpose for which they would be used would be for my research and they would be kept securely at the University.

A University telephone number was given for any further questions. An important part of this process was to assure parents/carers that they could withdraw their son/daughter at any point; this could be at the outset or during the study, without there being any necessity to provide a reason. A reply slip was provided to return to the school to indicate that agreement to take part in the study had been given.

During the interviews with the pupils, their right to withdraw from the study was also explained to them as well as the purposes of the study, the confidentiality of their identity and the measures to be taken to ensure the security of the data. All of the parents/carers and participants agreed to take part in the study and none of the pupils withdrew during its course.

5.8 Research design of the main studies: conclusions

In the introduction to this chapter, a summary of the aims of this study were given together with an explanation of how its design was underpinned by the adoption of multimodality theory and the context of the music classroom.

The main research question precipitated the discussion in chapter 2 concerning the current need for new ways of researching music classrooms where computers are used for composition, particularly ways that are able to account for the use of new technologies. In chapter 3, the pilot study was described and how it had led to the adoption of the multimodal theoretical framework, which was described in chapter 4. In particular, the aspect of Design and Transformation was highlighted as a particularly useful construct to inform the investigation into the composing process. Together, these provided the basis

for the design decisions of the main studies: the adoption of a case-study approach and the application of multimodal theories. The envisaged multiplicity and wide range of multimodal data engendered two important decisions: the multimodal categories to be employed for its organisation and the range of data collection methods to be used for its collection. The breadth of the multimodal observations necessitated the use of data collection instruments able to gather large quantities of fine-grained detail from various perspectives; the amount of this data, its categorisation (following the multimodal adaption of the time-ordered matrix in the pilot study) and the need to be able to view it in particular ways necessitated the development of a transcription and analytical computer-based tool that could sufficiently collate, link and represent this data. In particular, the developed tool facilitated:

- the effective transcription of data;
- the ability to 'see' data in terms of its 'horizontal' time-frame alignment permitting the viewing of simultaneously occurring multimodally categorised data;
- the ability to show data connected, or linked thematically, for example, the 'transformatory units', or otherwise time-separated phenomena, such as the use of particular potentials of the music keyboard, for example, 2-handed playing.

It is believed that the reliability and validity of this study were enhanced through the use of this tool, as the 'filtered' data transcription (such as written explanations of phenomena, for example, gestural) can be presented alongside the 'raw' data; for example, the presentation of a written description of a gestural event alongside a still taken from the video data, or the presentation of an original audio data fragment of music keyboard experimentation alongside its notated transcription. However, it is also admitted that this segmentation, for example the production of an audio-only segment or a still image from a continual video data stream is in itself a form of data filtering, in that it places an emphasis on this selected event, or events.

The choice of the two schools from distinct phases of education for the main studies was significant, not only for allowing analysis of processes utilised by pupils themselves, but also for permitting within-group and between-study comparisons to be made.

Although this is the first study to extend theories of multimodality into empirical music classroom enquiry, it drew upon preceding educational enquiries in other subject domains, principally the previous empirical work and multimodal analyses carried out in English and

science classrooms (Kress et al., 2001; Kress et al., 2005), which have provided some models and tools to inform the design of the methodological aspects of this study.

The following three chapters (6, 7 and 8) focus upon analysis of the data; chapter 6 deals with that from study 1, chapter 7 with that of study 2 and chapter 8 brings together the analyses of the two studies.

[1] See http://www.wisegeek.com/what-is-minidv.htm
[2] See http://www.andras.net/wg.html
[3] See http://www.apple.com/quicktime/
[4] See http://www.apple.com/ilife/imovie/
[5] See http://audacity.sourceforge.net/
[6] See http://www.sibelius.com
[7] See http://www.studiocodegroup.com/
[8] See http://www.qsrinternational.com/
[9] See http://www.atlasti.com/index.html
[10] See http://www.sportstec.com/Products%20Sportscode.htm
[11] See http://www.w3schools.com/dhtml/default.asp
[12] See http://www.php.net/
[13] See http://www.mysql.com/
[14] See http://www.apache.org/
[15] See http://www.mozilla-europe.org/en/products/firefox/
[16] See http://developer.mozilla.org/en/docs/About_JavaScript
[17] See http://www.adobe.com/products/acrobat/

Chapter 6 - Study 1 analysis

6. Introduction

In this chapter, the first of the two empirical studies, which took place in the secondary school (school A) described in chapter 5, section 5.2.1, is analysed. Firstly, a holistic description of the available designs provide by the school and classroom environment is provided followed by a lesson-by-lesson presentation of the designs provided by the teacher, to include the physical arrangement of pupils, the worksheets, descriptions and models given of the composing work and the lesson structure. There then follows a chronological discussion which investigates how the pupils transformed these designs and considers the musical transformations from a multimodal perspective, discussing the links between the musical and non-musical action before finally debating the origins of the available designs, in particular whether they originated in the school context or were external to it. Conclusions are then made, drawing out key points from the investigation.

6.1 Data sources

The sources of the data that form the basis of the analyses in this and the following chapters are the synthesis of the video, interview, field note and composition computer file data, presented multimodally categorised and temporally aligned in the computer tool, as described in chapter 5, section 5.4. As such, the individual sources are not necessarily specifically stated in relation to the presented analyses. This school used Apple computers for music (see section 6.2) for which a timed screengrab capture utility had not been identified (see chapter 5, section 5.3.2). Therefore, the computer screen was reconstituted using the video and computer file data and a Windows-based version of Cubasis. All the multimodally categorised data from lesson 4, as represented by the computer tool, can be found in appendix 4.

6.2 The learning environment - study 1

This study (introduced in chapter 4) took place at an 11-18 mixed comprehensive school where small group-work is currently a feature of composition lessons. A pair of Year 8 (ages 12-13) pupils formed the basis of this study, 5 lessons being observed, a typical length for a composition 'project' at Key Stage 3 (ages 11-14). Information and communications technology (ICT) was used as an integral part of the learning, the school music department having recently taken delivery of 10 Apple computers. In order to

observe a range of learners, data was gathered from two groups: the first of 'higher-attaining' and the second of 'lower-attaining' pupils[1], each selected and grouped by the teacher. In order to focus the observations below, it was decided to concentrate upon the higher-attaining group, mainly because there had been absences from some of the lessons in the other group. This consisted of two male pupils, who have been named for the purposes of this study pupil A and pupil B.

The 'before' interviews with these two pupils revealed that pupil B had lessons on the trumpet and pupil A played had lessons on the piano and also played the guitar. Both of their mothers played the piano. Pupil A liked listening to rock music and pupil B preferred listening to pop. When talking about their ways of working in music lessons, they described how they improvised on the keyboard at first, how this evolved into a tune and then how this was added to other tunes. They worked in friendship groups, and were used to working together. Pupil B described how pupil A was good at the piano, and the tunes they developed were usually based on his work. They confirmed that this was the first time that they had worked with computers in music lessons in school, although they both used them frequently at home for a variety of non-musical tasks. They had not used computers for music at all apart from pupil A having briefly tried some recording software on a friend's computer. They both said that they found composing easy.

The music facilities at the school consisted of a large teaching room sectioned into two areas - a slightly larger space for whole-class teaching and a separate area dedicated to the music computers. Larger instruments, such as the Clavinova (electronic piano) were situated on the periphery of the larger area (see fig. 39):

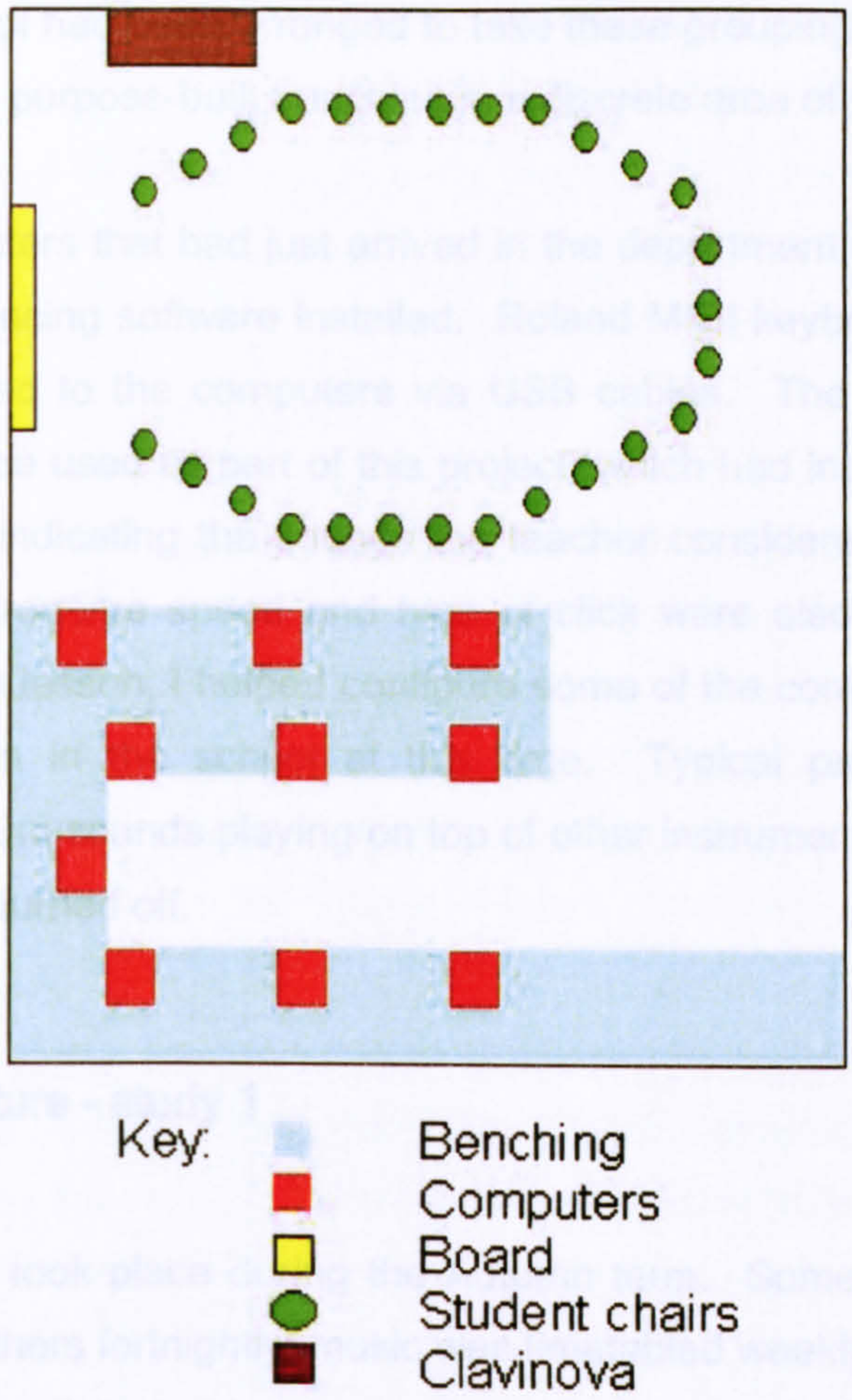


Figure 39 - Study 1: the room layout

At the ground floor level there were two small practice rooms attached to this main room and, at a mezzanine level above, there was a larger practice room. Pupils used these other rooms for their class performance and composition activities when they were not being used by instrumental teachers. This allowed for better acoustic shielding from others' activities.

In the lessons observed, the class could choose whether they used the new computers for their composition work or carried out the task in a more 'traditional' manner, using acoustic and electronic instruments in the usual group sizes of 3-6; this resulted in about half of the class choosing to use ICT. Those who chose to undertake their work using 'traditional' musical instruments arranged themselves in groups of between three and six pupils; however, those using ICT, worked in twos and threes. The seating and positioning of the

computers at the school had been arranged to take these groupings into account, with the machines arranged on purpose-built benching in a discrete area of the room (see fig. 39).

The new Apple computers that had just arrived in the department had Steinberg Cubasis MIDI and audio sequencing software installed. Roland MIDI keyboards with good quality sounds were connected to the computers via USB cables. The teacher had prepared Cubasis templates to be used as part of this project, which had instruments pre-assigned to the various tracks, indicating the sounds the teacher considered most appropriate for this project. The metronome speed and type of click were also stored as part of this template. Before each lesson, I helped configure some of the computers, there not being a dedicated technician in the school at this time. Typical problems were no MIDI communication and drum sounds playing on top of other instrumental sounds owing to the local control not being turned off.

6.3 The lesson structure - study 1

This five-week project took place during the Autumn term. Some lessons took place at weekly intervals and others fortnightly; music was timetabled weekly for one hour but other activities intervened to disrupt this arrangement. As suggested by the Key Stage 3 National Strategy for the foundation subjects (DfES, 2003b), music lessons were structured by dividing them into three sections; launch, main body and plenary.

The launch took place with the pupils sitting in a large circle facing the board, in front of which the teacher sat, with easy access to sound and other equipment that might be needed (see fig. 39). During the launch, the teacher explained the purposes of the lesson, recapped previous work, outlined what various groups of pupils had already achieved, gave out worksheets if applicable, provided a description and models, where appropriate, of the intended activities for the main body of the lesson as well as elucidating what the expected outcomes were. These were to be performed in the plenary session, when pupil work would be peer and teacher-appraised.

The main body of the lesson consisted of pupils working in groups on their compositions. The teacher visited these groups, monitoring, assessing and feeding back to them as needed. This was observed to be both reactive (to pupil requests) and proactive

(providing ideas to help further their compositions). Timing information was given to the pupils at regular intervals in order to help keep them on task and to enable them to finish their tasks by the end of the main body of the lesson. This section of the lesson was characterised by much movement of pupils, mainly to obtain equipment, as well as high sound levels.

The plenary took between 10 and 15 minutes and consisted of the pupils returning to the seated positions they had occupied during the launch and listening to other groups' performances as selected by the teacher. Following each performance, the teacher targeted other pupils, asking for positive comments, prompting the performing group for theirs, and adding his own, recording the assessment information as it was presented. After the performances, he gave an outline of next week's work and dismissed the class.

6.4 Available designs and their origins - study 1

In the following lesson-by-lesson analysis, I will examine the compositional transformations made by the pupils in each lesson using the following process:

- A description of the available designs provided by the teacher and the learning environment
- An analysis of how the observed group transformed the musical designs
- A consideration of these musical transformations from a multimodal perspective
- A consideration of the origin of the transformations, whether from the lesson itself or from an external source

6.5 An analysis of each lesson - study 1

6.5.1 Study 1, lesson 1

The teacher's available designs - study 1, lesson 1

Following the taking of the register, the following worksheet was given out (see fig. 40):

MUSIC INSPIRED BY ART

Pictures At An Exhibition

Romantic and Nationalist composers in the 19th Century were often influenced by other art forms such as literature, poetry and art.

The Russian composer Modest Mussorgsky (1839 – 1881) composed **Pictures At An Exhibition** in 1873. This piece was based on his personal favourite sketches and paintings and paintings by the artist Victor Hartmann.

Mussorgsky had the idea of linking the musical pictures with a PROMENADE theme. This represented the viewer (Mussorgsky) walking from picture to picture. Mussorgsky conceived the music in terms of piano only. However in 1922 the French composer Ravel arranged the work for orchestra.

PROMENADE

Listen to different versions of the Promenade. What do you notice?

TASK

1. Individually play through the promenade theme
2. As a group play the theme together

Now try to make up your own version(s) of the promenade theme

3. Add a drone and / or a beat
4. Add a chord sequence
5. Experiment with the tune. Add notes or take some notes away
6. Change the feel / mood of the original tune
7. Think of your own ideas

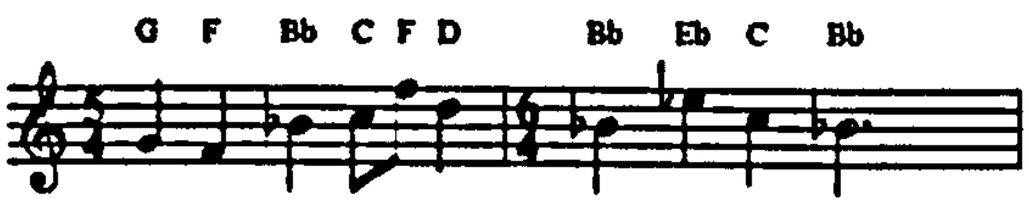


Figure 40 - Study 1: worksheet 1 'The Promenade Theme'

The teacher gave an historical background to the piece and listed the various well-known arrangements that had been made of it since it had been composed, including those by Ravel (for orchestra), Elgar Howarth (for brass) and Emerson, Lake and Palmer (for rock band). The first piece of music played to the class occurred when, asking them to look at the theme on the sheet, the teacher played it to them using the Clavinova. The class then listened to 3 different excerpts from the orchestral version by Ravel featuring the Promenade theme and were asked to focus upon the similarities and differences between these excerpts. These were:

- 1st version - brass (full tune on trumpet)
- 2nd version - euphonium + woodwind (slower)
- 3rd version - trumpet tune accompanied by full orchestra

These initial available designs, presented by the teacher, provided 'holistic' versions of the Promenade theme. The class were then asked questions about the features of each version in terms of their instrumentation and tempo. General instructions for the pupils' practical work were then given: they should firstly play the Promenade theme and then add some changes of their own.

The teacher then broke down the theme into its basic musical elements: rhythm and melody, instructing the class to look at the theme on the worksheet previously handed out. The rhythm was modelled by the teacher by clapping it and the class were asked to copy. They were then asked a question about the shape of the tune which was answered to the teacher's satisfaction by one pupil. The teacher asked them to note the Bb, shown on the worksheet (see fig. 40) and said that cards (indicating the note names) were available for the music keyboards if they were needed. These took the form of long folded pieces of cardboard that could be stood up and aligned with the keys, indicating the note names, which were also written above the standard music notation on the worksheet (see fig. 40).

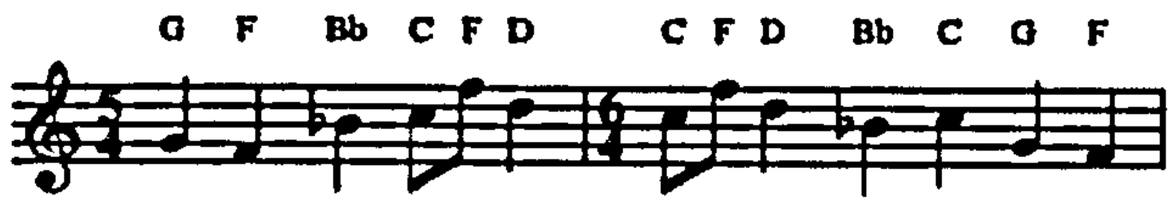
Each of the following steps to be subsequently undertaken by the class was then modelled by the teacher using the Clavinova:

- The whole group to play the theme in full;
- Pupils to make up their own version;
- Pupils then to play with a rhythmic drone (he noted that pupils should use channel 10 for drums if using computers);
- A chord sequence to be added;
- Experiment with the tune (possibly adding some notes or taking some away);
- Change the feel or mood of the original tune;
- Pupils to think of their own ideas.

The teacher noted that this Promenade tune should be used as a linking theme within the structure of the whole piece. The instructions for the lesson having been given, the teacher then told the class that his expectation was that they would play the main theme in their groups with at least one variation, or two if possible in the plenary at the end of the lesson. Pupils then composed for about half-an-hour before taking part in a twelve-minute plenary, when four different Promenades were heard and assessed.

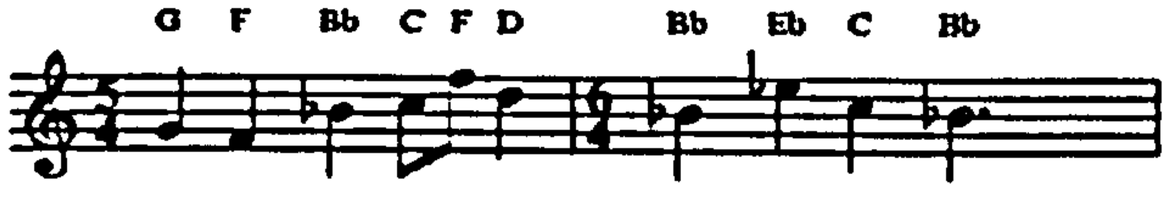
Analysis of how the observed group transformed these designs - study 1, lesson 1

The practical composing section of the lesson began with pupil A practising the Promenade melody line on the worksheet using the 'synth' sound (this sound having been previously selected by the teacher through the setting up of the sequencer template - see music example 1):



Music example 1 - Promenade theme, part 1

... and which ended (see music example 2):



Music example 2 - Promenade theme, part 2

This was performed with Pupil A looking at the worksheet. Pupil B then practised this using the 'synth' sound 2 octaves lower than pupil A. The two pupils decided to change this to a piano sound later on in the lesson.

Both pupils then practised the theme 2 octaves apart, the rhythm gradually becoming synchronised as they played. They recorded this and then listened to their work. Pupil A then experimented with chords as shown by the teacher, initially using the 'synth' sound and then experimented using the string sound. To do this, he selected the different tracks on the teacher-prepared sequence template, which were labelled (see fig. 41).

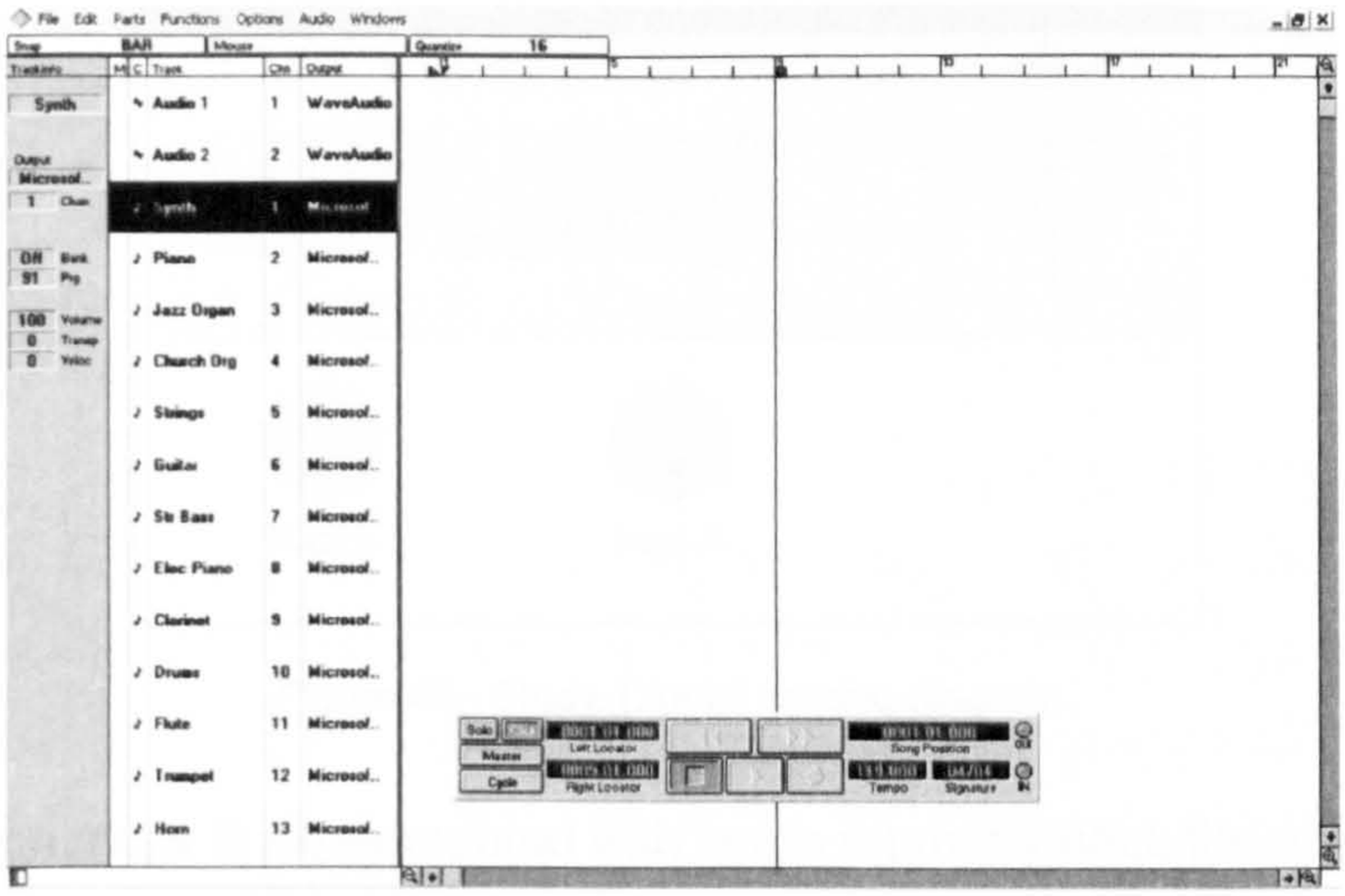
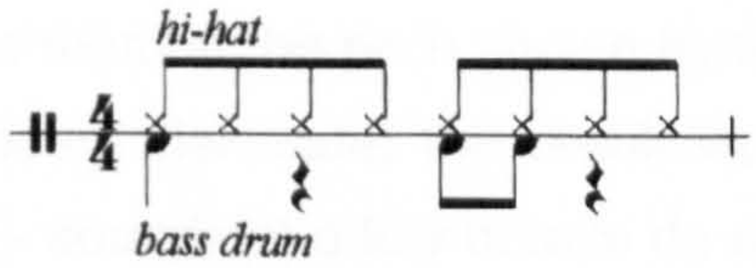


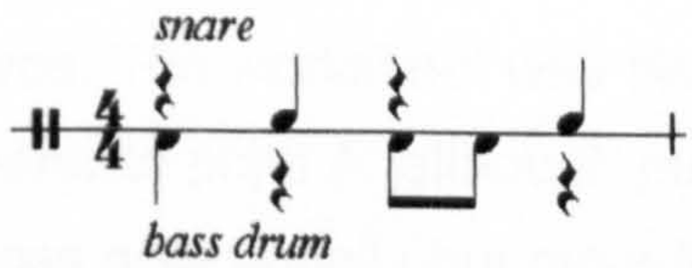
Figure 41 - Study 1: the sequencer template

Pupil B then tried out various rhythms using the drum sounds (see section 6.6.3 for a further explanation of keyboard-based drum sounds) on the music keyboard (see music example 3):



Music example 3 - lesson 1, pupil B, drum rhythm 1

... and then added the snare (see music example 4):



Music example 4 - lesson 1, pupil B, drum rhythm 2

Both pupils then both experimented with different voices , such as gunshot, helicopter and so on before being called back by the teacher to the plenary session.

A multimodal consideration of the musical transformations - study 1, lesson 1

The seating position of the two members of this group, one to the right of the music keyboard (pupil A) and one to the left (pupil B) appeared to influence what they played on the keyboard - the pupil on the right played the tune at its written octave, and the pupil on the left played it 2 octaves lower, both with their right hands (see fig. 42).

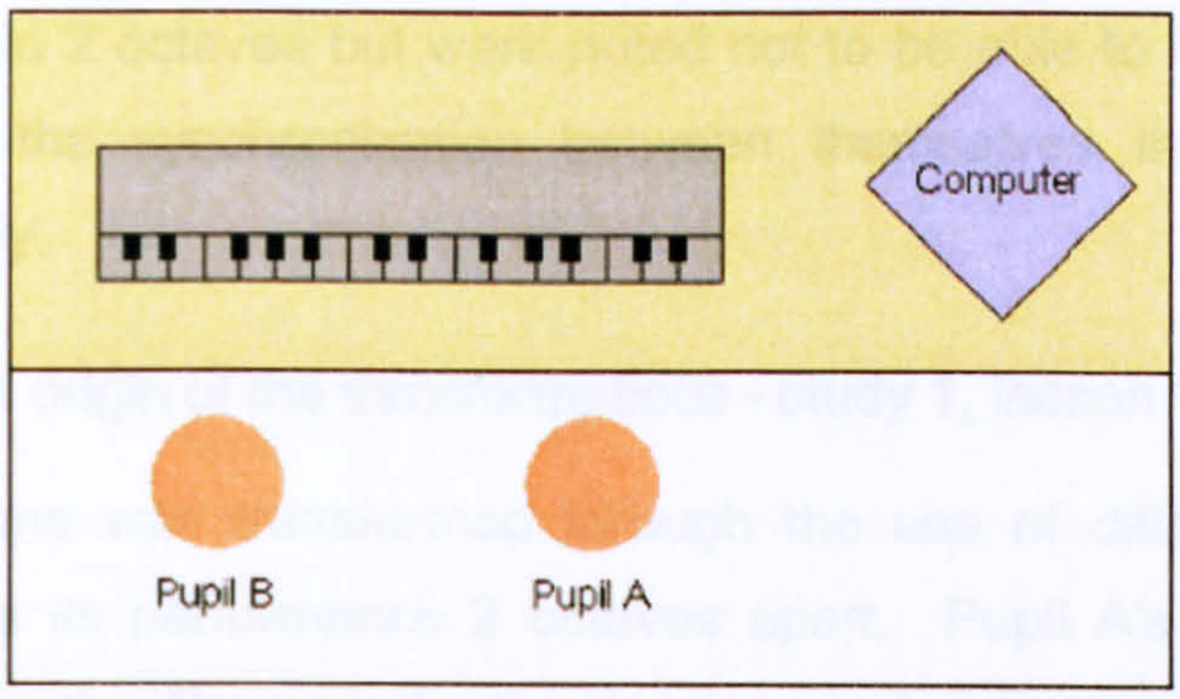


Figure 42 - Study 1: pupil seating diagram

Later in the lesson, pupil B experimented with some drum rhythms, the notes for the snare and bass drum sounds also being located conveniently at the left side of the keyboard (C1[2] and D1). The experimentation with chords (following the demonstration provided by the teacher during a visit to their group) was exemplified by pupil A; he was seated at the right side of the keyboard, the same side used by the teacher when he demonstrated them and pupil A copied. Pupil B did not appear to be able to reach this side of the keyboard and so was not able to practise them at the pitch shown by the teacher; if he had practised them on his side of the keyboard (left side) the result would not have been musically satisfactory owing to the pitch - sounds at a low octave do not sound good in combination with close intervals, which were used in the chordal demonstration of the theme.

Pupil A, being seated to the right of the keyboard was also able to control the computer with his right hand and therefore appeared to control when and what was recorded - in this lesson, the main theme in octaves. The worksheet was placed on the desktop behind the keys on the music keyboard nearer to pupil A, although pupil B had good sight of it. The pupils looked at each others' faces occasionally but more frequently followed each others' hands, especially pupil B, who watched pupil A's hands when playing the tune 2 octaves below his, and pupil A who watched what pupil B was playing when he was playing by himself. This watching each others' hands appeared to help them play in synchronisation with each other. They spoke infrequently, generally in short phrases and not using complete sentences.

The visual representation of the software on the screen was nearer to pupil A but pupil B also used it to talk about the music. The labelling of the instruments in the track list allowed them to not only see what instruments were available but also to choose different instruments, such as the 'synth' sound and the piano with which to experiment. They appeared to try hard to follow the metronome click produced by the computer when

recording the theme in 2 octaves but were noted not to be able to keep in time with this, instead maintaining the synchronization between themselves though watching each others' hands carefully.

A consideration of the origin of the transformations - study 1, lesson 1

The Promenade theme was transformed through the use of different sounds ('synth', piano, strings) and in its performance 2 octaves apart. Pupil A's experimentation with adding the chords to the Promenade theme was exploratory and was not recorded; however, this featured strongly later in the project and so could be considered an early experimentation with the potentialities offered by this technique. The experimentation observed in this lesson was strongly based on the models provided by the teacher, as embodied in the information provided on the worksheet. The transformations of the pupils here could be considered transformations of the *performance* of the theme rather than the theme itself, as the rhythm and melody were not changed. The playing in two octaves by both pupils can also be considered a transformation, perhaps made possible through their seating positions at the music keyboard.

Pupil B's experimentation with the drum sounds is significant as these were not present in any of the teacher models or listening examples. They are rhythms that commonly feature in various styles of popular music but it is their playing in this context that is notable, when all the listening models provided had been in the western classical style and did not include a rhythmic drum part. Pupil B's work is not recorded at this point but the style that the patterns evoke is used again later in the project.

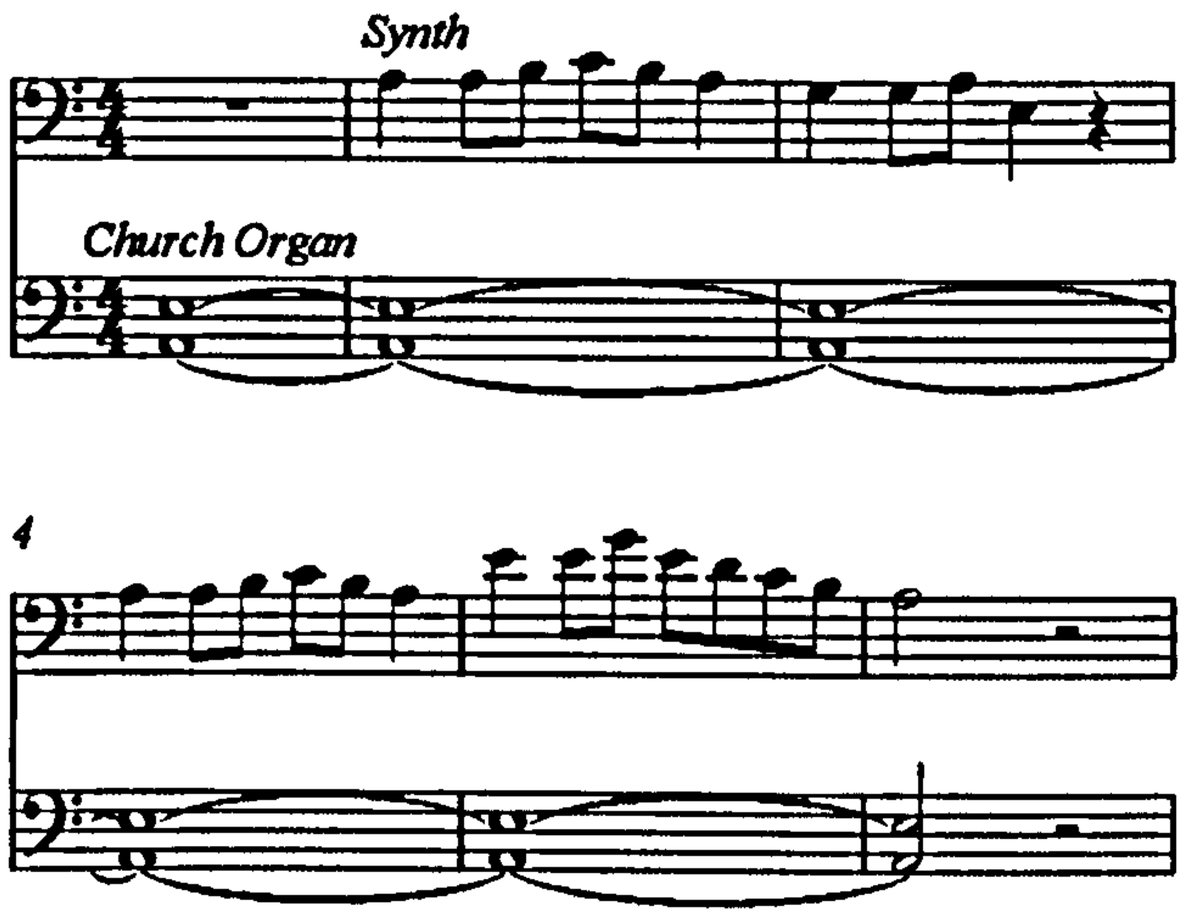
The final experimentation of both pupils with the sound effects on the keyboard (gunshot, helicopter) would appear to be unrelated to the teacher's intentions for this lesson and could be considered as experimentation with the new equipment to explore what sounds it was capable of producing.

6.5.2 Study 1, lesson 2

The teacher's available designs - study 1, lesson 2

Lesson 2 began with a spoken recapitulation of the project so far by the teacher, together with questioning of the class, about the work that had been done two weeks previously. The central idea of the Promenade representing a person walking from picture to picture was reinforced. The teacher played the Promenade tune again on a keyboard and noted

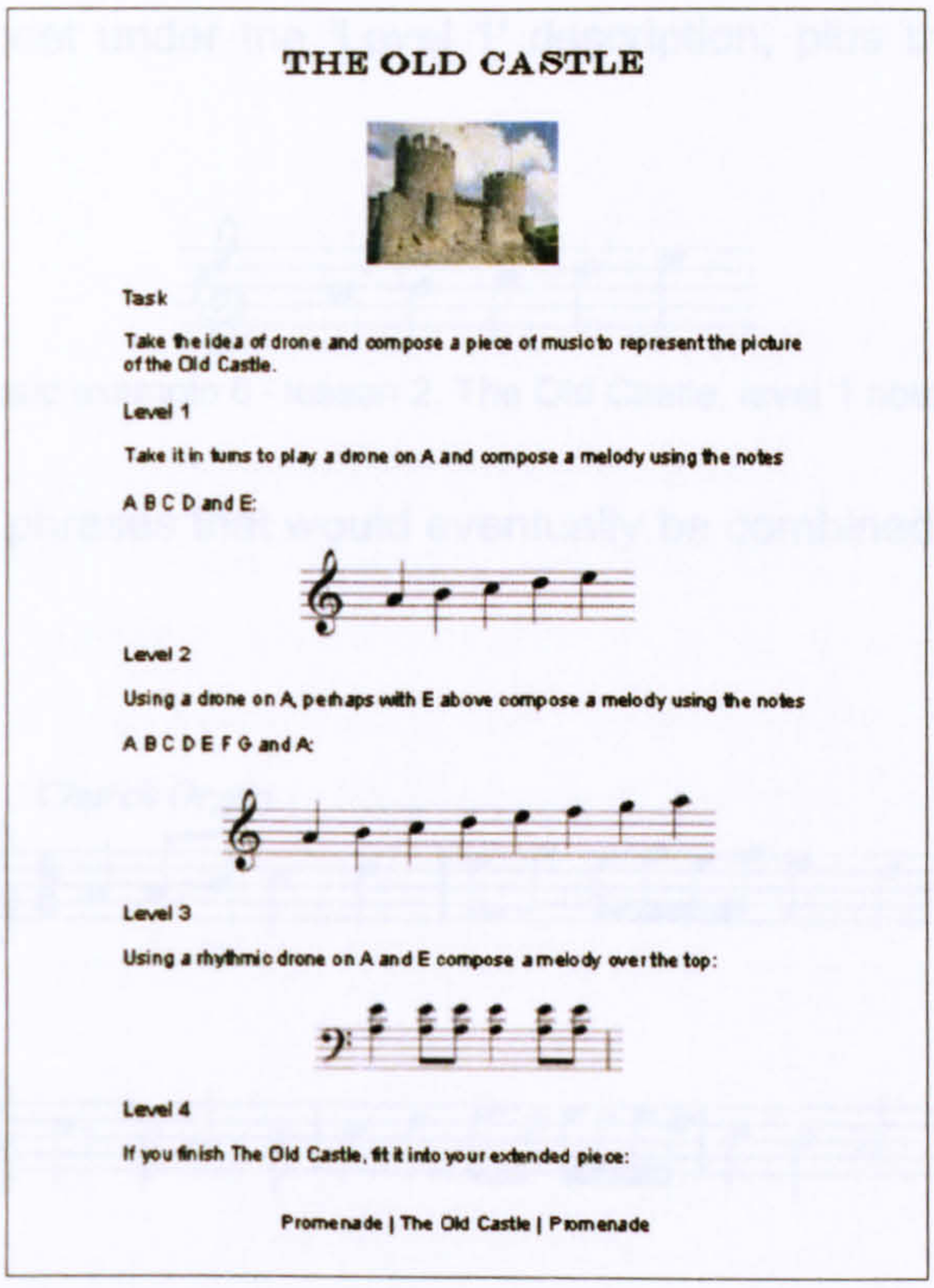
that some pupils had got further than the first task of playing the theme and had gone on to compose their own music for a different Promenade. The overall structure of the evolving piece was then outlined and he asked them to consider the idea of an Old Castle whilst holding up a picture and asking what musical elements might be used to best represent this image? 'What about tempo?' ('It will probably be slow' was given as an answer). He suggested that a drone would be a good device to use (this musical device seemed to be generally well understood by the class, perhaps as the result of previous work), and advised them that they should use this in their pieces. He then gave them a musical demonstration on the keyboard (see music example 5):



Music example 5 - lesson 2, The Old Castle teacher demonstration

Worksheets were then given out (see fig. 43). The teacher outlined what using an 'A' drone meant. He then pointed to the different levels on the sheet, explaining that they got progressively harder:

- Level 1: take it in turns to play a drone on A and play a melody using notes A, B, C, D & E.
- Level 2: Using a drone on A, perhaps with E above, compose a melody using the notes A, B, C, D, E, F, G, and A.
- Level 3: Using a rhythmic drone on A & E compose a melody over the top.
- Level 4: (especially for computer users) If you finish The Old Castle section, fit it into your extended piece (i.e. Promenade, Old Castle, Promenade). The second Promenade could be a different version.



THE OLD CASTLE

Task

Take the idea of drone and compose a piece of music to represent the picture of the Old Castle.

Level 1

Take it in turns to play a drone on A and compose a melody using the notes

A B C D and E:

Level 2

Using a drone on A, perhaps with E above compose a melody using the notes

A B C D E F G and A:

Level 3

Using a rhythmic drone on A and E compose a melody over the top:

Level 4

If you finish The Old Castle, fit it into your extended piece:

Promenade | The Old Castle | Promenade

Figure 43 - Worksheet 2 "The Old Castle"

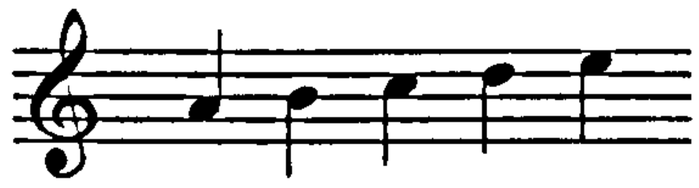
He then gave a listening example from the original piano version by Mussorgsky, playing the first Promenade, The Old Castle and the following Promenade. He briefly mentioned that the piecing together of the three sections so far considered (Promenade - The Old Castle - Promenade) could be considered an example of 'ABA' form. Finally, he grouped and moved the pupils so that they could start their work.

Of particular note, was the playing of the listening example, which was a MIDI file played on the teacher's laptop computer through the classroom hi-fi system. This provided a visible and audible link between the new technology used for composition and the original music. Pupils then composed for about 25 minutes before being called back to their whole-class seated positions. Three 'Old Castle' compositions were then heard and appraised.

Analysis of how the observed group transformed these designs - study 1, lesson 2

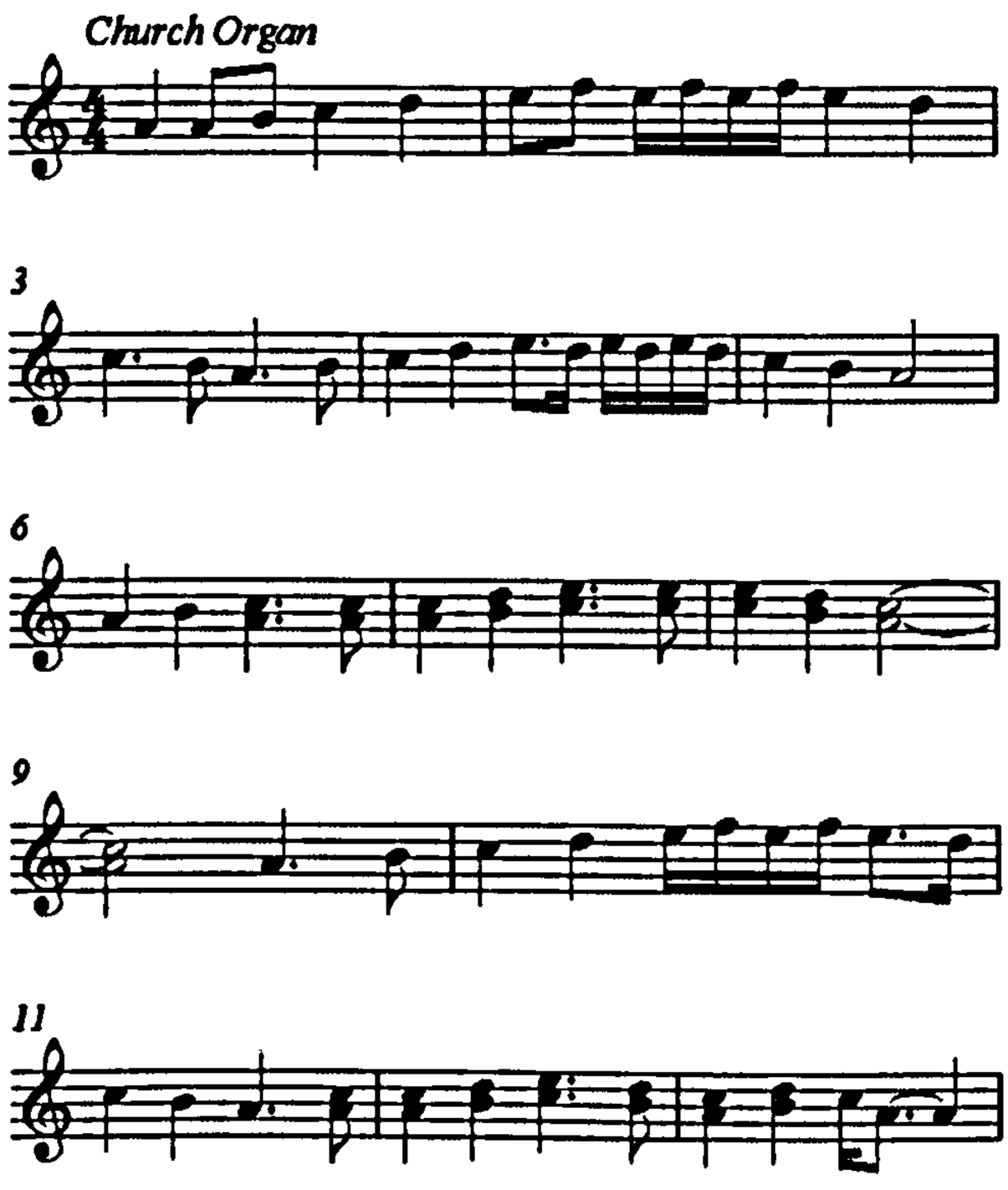
Initially, pupil A tried out various sounds - church organ, guitar, string bass, jazz organ before finally selecting the church organ. To do this, he selected the different tracks on the teacher-prepared sequenced template, as described in lesson one (see section 6.5.1 and fig. 41). He then experimented with the A minor modal tune using the following notes,

as listed on the worksheet under the 'Level 1' description, plus the upper F (see music example 6):



Music example 6 - lesson 2, The Old Castle, level 1 notes

He then played parts of phrases that would eventually be combined into the final recording (see music example 7):



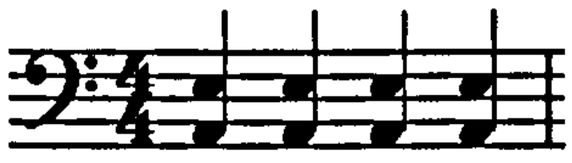
Music example 7 - lesson 2, The Old Castle, pupil A final performance

... while pupil B experimented with the rhythmic drone suggested by the teacher in his level 3 description (see music example 8):

Music example 8 - lesson 2, The Old Castle, pupil B, drone 1

Pupil A then changed the track so that he played using the piano voice. The teacher then intervened and slowed down the click for them so that they would find it easier to record their work at the tempo used in the models. Pupil A chose the 'synth' sound, then went

back to the piano. Pupil B then played a rhythmically modified drone (see music example 9):



Music example 9 - lesson 2, The Old Castle, pupil B, drone 2

The pupils then tried this drone (transposed to G & D) with pupil A playing the Promenade theme on top, placing elements from lessons 1 and 2 together.

Pupil B then played the Promenade theme in a low octave. The teacher then intervened again and gave them some advice on saving and choosing tracks; he suggested recording the drone on one track and then adding the melody on another. He suggested the church organ as a suitable sound.

Pupil B then played the (rhythmically modified again) drone several times (see music example 10):

Music example 10 - lesson 2, The Old Castle, pupil B, drone 3

... while A tried out some melodic ideas using the A minor mode as before.

They then recorded, and then deleted this attempt. Pupil B eventually recorded the 3rd drone (as in musical example 5.10) and then pupil A added a 'synth' melody above this.

The teacher then intervened again and suggested quantizing their work even though it was noted to have not been played in time with the click.

Both pupils then played a drone in 2 octaves apart (see music example 11):

Music example 11 - lesson 2, The Old Castle, pupil B, drone 4

... and recorded several of these, each time waiting for the 8-beat 'count-in' of the click. They appeared not to be happy with the result, however, and deleted their recordings. The teacher then intervened again and told them to do 'The Old Castle' now, perhaps becoming concerned that they were not addressing the central task of this lesson. Pupil B tried out a new drone rhythm (see music example 12):

Music example 12 - lesson 2, The Old Castle, pupil B, drone 5

... and several of these were recorded. Both pupils then experimented briefly with drone 3 (as above transposed to G & D) and the Promenade tune again. Pupil A then showed B the following drone rhythm (see music example 13):

Music example 13 - lesson 2, The Old Castle, pupil B, drone 6

... using the guitar sound and this was recorded several times. Pupil A then added a melody using the 'synth' sound, but time ran out of time as the teacher called the groups to meet again for the plenary session. Pupil A stayed at the computer and attempted to re-record the drone, but did not have enough time and left the workstation with the work incomplete.

A multimodal consideration of the musical transformations - study 1, lesson 2

The transformations of the modal theme initially modelled by the teacher were imitated by pupil A - pupil B did not attempt to try this for himself - it appeared to be tacitly understood that pupil A would tackle this melodic transformation while pupil B would address other areas of the task. This could also have been reinforced by their seating position, with pupil B not having easy access to the right, higher-pitched side of the music keyboard. Pupil B initially experimented with the drone as demonstrated by the teacher, but changed this as the lesson progressed, partly owing to an intervention from pupil A. Not only was the rhythm changed from crotchet and quavers to straight crotchets, then to dotted and tied notes, it was also transposed from A-E down to G-D on occasions.

As in lesson 1, the sequencer template was observed to have provided the opportunity for the pupils to experiment with a range of sounds, set up by the teacher, such as church organ, guitar, string bass and jazz organ. When the pupils (tentatively) recorded their 'Old Castle' section, they were observed to be able to use the visual layout of the screen to position their recorded section after the previous session's Promenade theme recording, thus using the software's potential to allow them to organise and visualize their developing work. However, they demonstrated that, as in the previous session, they were not able to

play in time with the click, although this did not appear to concern them. Playing in time with the metronome click was not demonstrated by the teacher previously and perhaps they were unaware of the importance of this. The teacher suggested they quantize their music after they had recorded the drone, although it was noted that they were not shown how to select just this element of the music. Although quantization of a rhythmic element of a piece of music is a common device used to 'tidy up' rhythmically loose playing, if the music is not played sufficiently in time with the metronome initially, the quantization process will have unpredictable results, possibly resulting in an even more inaccurate rhythm.

Pupil B was observed to be leaning his head on his left hand for some of the lesson, appearing disconnected with the process, especially when pupil A was trying out some new ideas. He did not make any attempt to sit at the other side of the keyboard, the seating arrangement appearing to be tacitly understood by both pupils. The pupils rarely looked at each others' faces, but looked at each others' hands when playing the keyboard, especially when the other was trying out a new idea.

A consideration of the origin of the transformations - study 1, lesson 2

The transformations that will be considered in this section are:

1. the transformations of the A minor modal melody;
2. the transformations of the drone;
3. the placing together of elements from lessons 1 and 2.

1 - the transformations of the A minor modal melody

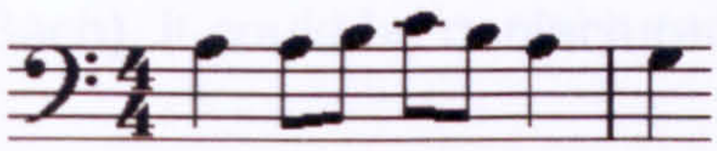
Pupil A's experimentation with the A minor modal melody remains quite close to the model given by the teacher, particularly in two respects:

- the similarity of the opening phrase:

Pupil A (see music example 14):

Music example 14 - lesson 2, The Old Castle, pupil A, opening phrase

Teacher (see music example 15):

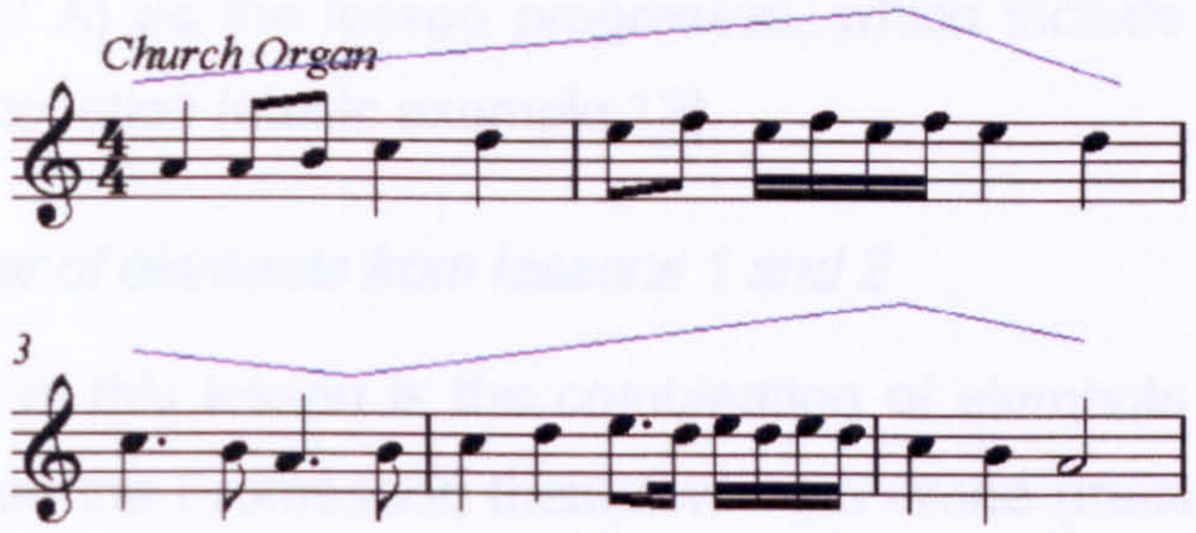


Music example 15 - lesson 2, The Old Castle, teacher, opening phrase

and ...

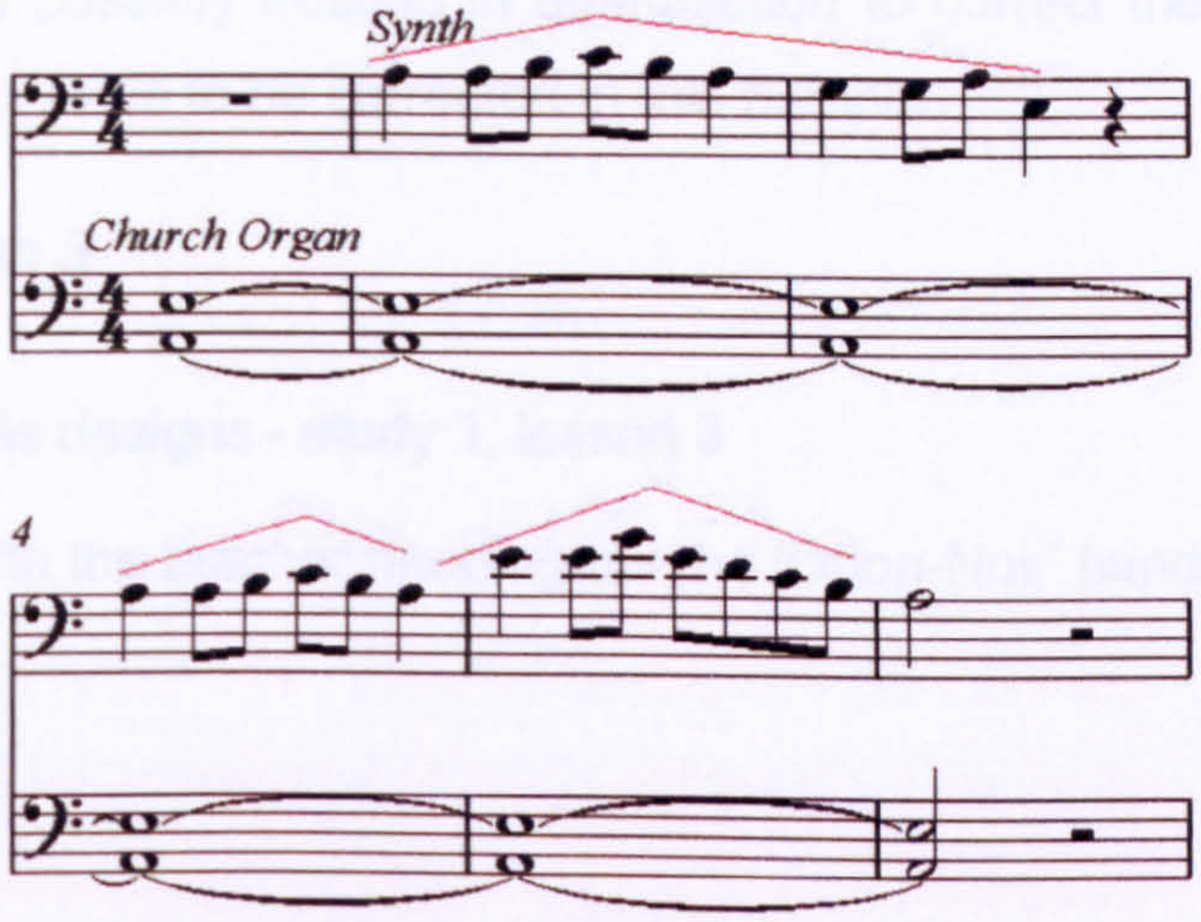
- the overall melodic shape:

Pupil A (see music example 16):



Music example 16 - lesson 2, The Old Castle, pupil A, melodic shape

Teacher (see music example 17):



Music example 17 - lesson 2, The Old Castle, teacher, melodic shape

They both feature an up-down melodic contour and also both finish on the tonic (A). The teacher suggested to the group that church organ might be a good choice for the tune. Pupil A has adopted quite closely what the teacher suggests in terms of the elements of this section of the composition but has used these elements to transform them into something quite new. Perhaps the most striking feature of his evolving melody is the trill-like decoration in bars 2 & 4; to give a definitive origin for this is not possible, but as he had piano lessons out of school, and this form of decoration forms an important part of much baroque music that is studied in the early stages of learning the piano (such as the 2

and 3 part inventions of J. S. Bach), it could be conjectured that this may have originated from this source.

2 - the transformations of the drone

The drone goes through many transformations (see musical examples 8 - 13) by pupil B. He initially follows the example given on the worksheet but then changes the rhythm (with some input from pupil A) as the lesson progresses, which include dotted notes (music example 11) and syncopation (music example 12).

3 - the placing together of elements from lessons 1 and 2

A noteworthy feature of this lesson is the combination of elements from lessons 1 & 2, where the pupils united the Promenade theme with the drone (transposed down a tone). This was suggested by the teacher on the worksheet given out in lesson 1 and was included in the final composition at the beginning. It should be noted that although the elements are combined, they are not played in time, probably owing to a lack of performance skill and possibly trusting in quantisation to correct the errors, when in this case, they were too extreme to be corrected in this manner.

6.5.3 Study 1, lesson 3

The teacher's available designs - study 1, lesson 3

This lesson started with the teacher handing out the 'Orion-Noir' handout (see fig. 44):

Orion-Noir

Task

To compose a piece of music to fit with the picture 'Orion-Noir' by Victor Vasarely.

Level 1:

- Select a preset rhythm on the keyboard and set the required tempo
- Compose two ostinatos on **C** and **G**

Level 2:

- Play the rhythm below and compose two different ostinatos using the notes:

C E G

1	2	3	4	5	6	7	8
X	XX	X	X	X	XX	XX	X

Level 3:

- Play the rhythm below and compose three ostinatos using the notes:-

C D E F G

1	2	3	4	5	6	7	8
X	XX	X	XX	X	XX	XX	X
XX		X	X	XX		X	X

Level 4:

- If you finish you composition for 'Orion-Noir', fit it into your extended piece:-

Promenade, 'The Old Castle', Promenade 2, 'Orion-Noir', Promenade 3

Figure 44 - Worksheet 3 - "Orion-Noir"

and showing a large copy of the original 1963 Orion-Noir picture by Vasarely (See fig. 45):

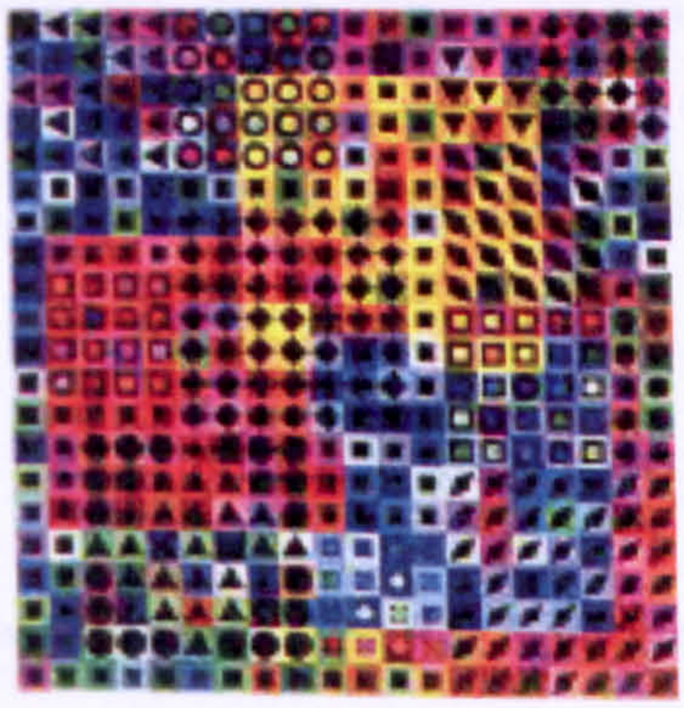


Figure 45 - Orion-Noir (Vasarely)

The teacher then gave a brief explanation about minimalism and how it applied to both art and music, playing a musical example by Steve Reich[3]. He then explained the different levels on the worksheet, showing how to select a rhythm on a keyboard, how to set the tempo and how to make up an ostinato on C and G.

The rhythm grids (shown in the lower half of the worksheet) were then modelled (by clapping) and then copied by the class. They were then shown how to use rhythm grid 1 and the notes C, E and G on a keyboard to compose an initial ostinato and to use rhythm grid 2 and the notes C, D, E, F and G to compose a second ostinato. Finally, he explained that those that had finished this should then fit this new "minimalist" section into their other previously composed sections to make up the whole composition, using the structure illustrated at the foot of the worksheet Promenade, 'The Old Castle', Promenade, 'Orion-Noir', Promenade. Pupils then moved to their composition groups where they worked for about 30 minutes. Following this, they returned to their initial seated positions for the plenary session and four 'Orion-Noir' compositions were appraised.

Analysis of how the observed group transformed these designs - study 1, lesson 3

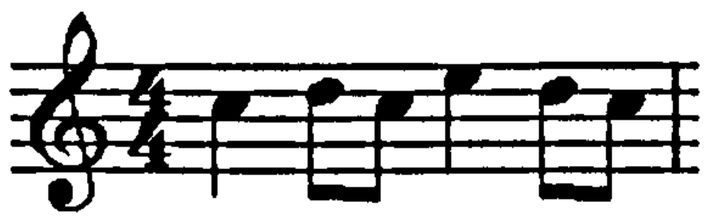
The first part of this lesson seemed primarily concerned with finding out where the pair had got to in the last session, and trying out new ideas. They began by playing back part of the drone from The Old Castle recorded during the previous session (see music example 18):

Music example 18 - lesson 3, The Old Castle drone

Next, pupil B experimented with some drum voices on the keyboard and pupil A played a blues riff in C using the piano sound. Pupil B then played C major backing chords while A played some riffs using C, D, E. Pupil B recorded his chordal pattern (see music example 19):

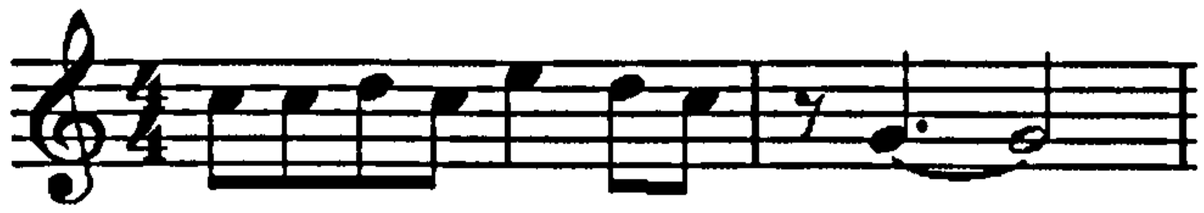
Music example 19 - lesson 3, pupil B, C major backing chords

... playing this for several bars. Pupil A then experimented using the C scale using the piano sound, playing phrases with jazz overtones (see music example 20):



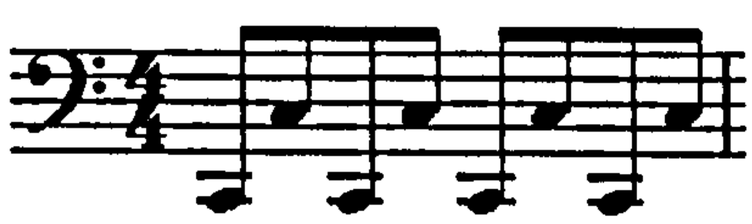
Music example 20 - lesson 3, pupil A, C major experimentation 1

He then tried a similar idea using the string voice which was recorded (see music example 21):



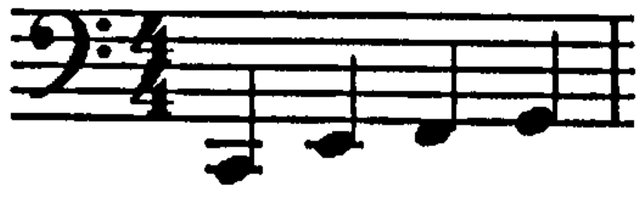
Music example 21 - lesson 3, pupil A, C major experimentation 2

The teacher then intervened, suggesting that they quantise this. Pupil B then experimented with a new idea, arpeggiating the C-E-G, following on with Dm, Em, F & G. Pupil A then recorded his tune (without backing chords). The teacher then suggested that pupil B added a bass part to this, and leant over pupil pupil B's shoulder to play this C octave bass figure (see music example 22):



Music example 22 - lesson 3, teacher, C octave example

However, this was not adopted by the pupils. After the teacher had left, pupil A then showed pupil B a new riff (see music example 23):

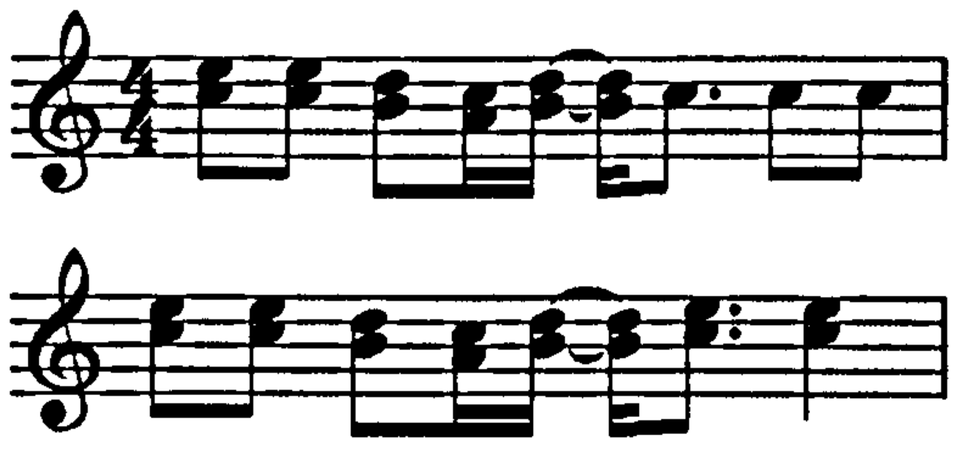


Music example 23 - lesson 3, pupil A, bass riff

Pupil B copied this and played it several times. Pupil A then added an improvisation to this as pupil B played the bass riff, based on this figure (see music example 24):

Music example 24 - lesson 3, pupil A, improvisation 1

Pupil B then recorded the bass riff several times and pupil A then practised an improvisation over the top of this (the one that was kept for the final recording) which developed the initial 'jazz' idea (see music example 25):



Music example 25 - lesson 3, pupil A, improvisation 2

Pupil B then experimented with the rising arpeggios as described previously, before both pupils were called back to join the plenary session.

A multimodal consideration of the musical transformations - study 1, lesson 3

The start of this lesson was characterised by the use of the computer screen as a means for the pupils to negotiate their current position with regards to the progress of the whole composition. They used the screen to point to in order to indicate the various sections as well as to discuss where this week's work was going to be placed. Also, they listened to the various sections to remind them of their previous work. Their seating positions were maintained from the previous 2 sessions with pupil A taking charge of the computer's operation, although pupil B offered his opinion freely about this, suggesting what pupil A should do with the computer. The repeated quaver chordal pattern played by pupil B was his own, but the ascending C-E-F-G bass line that was adopted and recorded by pupil B was shown and initiated by pupil A, through leaning over to the lower end of the keyboard and playing it for pupil B to copy. Pupil B copied this, adapting the fingering so that he didn't need to use his right-hand thumb to play it. This was recorded many times, followed by much of the remainder of the lesson (the largest portion of it overall) being used for pupil A to devise a suitable melodic passage over the two backings, seemingly based on a series of pre-learnt riffs. For much of this section of the lesson, pupil B (as in the previous lesson) leaned his head on his left hand and watched.

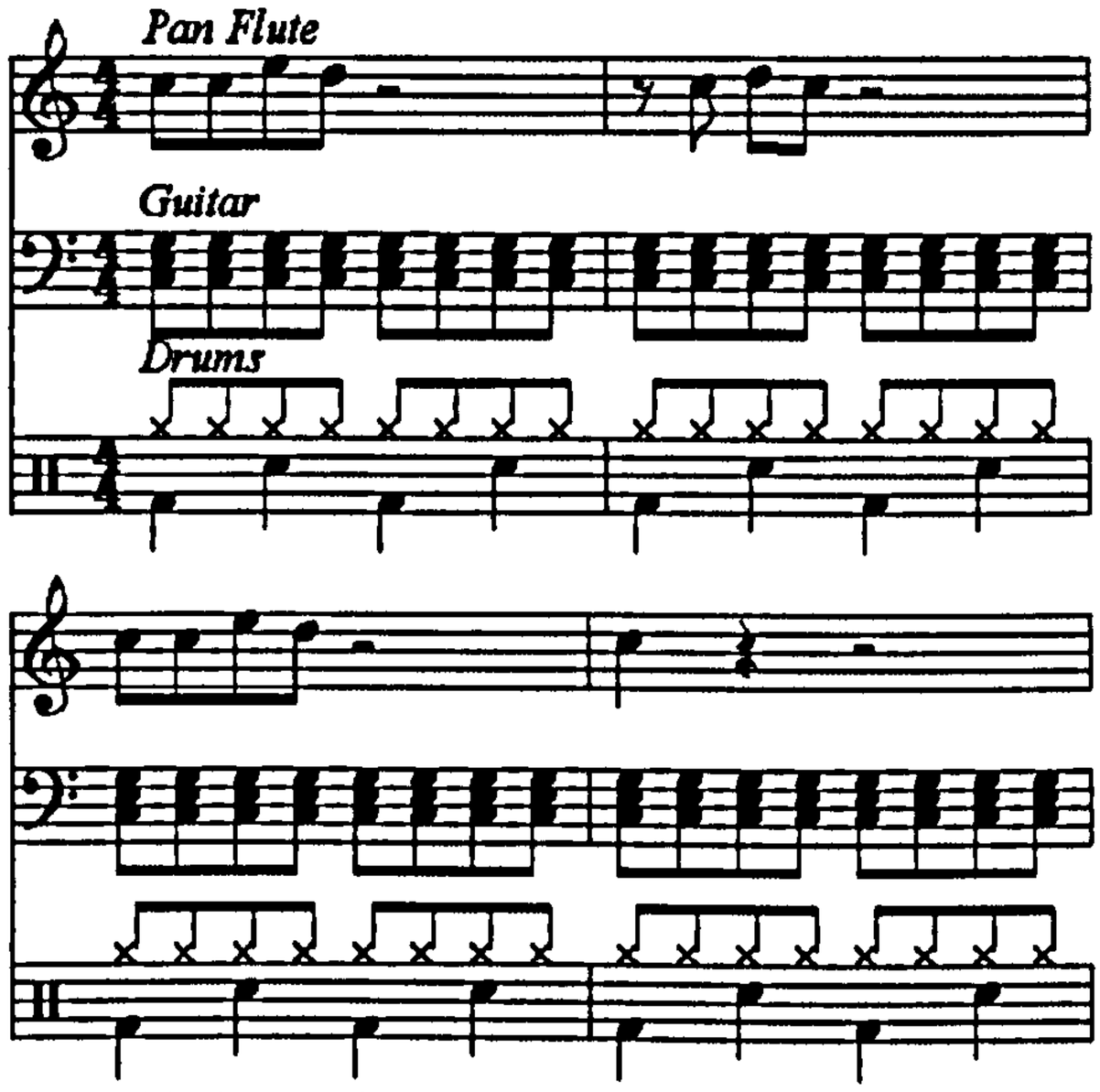
A consideration of the origin of the transformations - study 1, lesson 3

In this lesson, the observed pair of pupils appeared to disregard the detail of the designs provided by the teacher completely; however, two important general features of the introductory session were adopted by the pupils and developed:

- the idea of short repeated patterns, exemplified by the Steve Reich example and the 'box and cross' notation which was itself a repeated pattern

- the possible inclusion of elements taken from popular music, perhaps through the playing of the Steve Reich listening example

The repeated quaver chordal pattern initially experimented with by pupil B seemed to set the tone for the rest of this practical experimentation session. This provided a basis for pupil A to experiment with his ideas based upon the chord of C. These contained some syncopated and tied rhythms and it was not clear from where they originated - it was seemingly not from the lesson itself. After this lesson a drum beat was added to this, based on the patterns first experimented with in lesson 1 and the melody sound changed to 'pan flute' (see music example 26):



Music example 26 - lesson 3, group A, development of Orion-Noir initial idea

Pupil B experimented at 2 points during the lesson with rising arpeggiated chordal figures but these were not recorded nor developed further.

The teacher's demonstration of a possible octave bass part to accompany pupil A's recorded tune was not taken up by the pupils, but did seem to enable the development of their own, which pupil A initially showed to pupil B (the rising C-E-F-G bass riff figure - see music example 23). As with pupil B's former repeated quaver chordal figure (see music example 19), this bass riff seemed to allow pupil A the freedom to experiment and he produced quicker, more complex syncopated rhythms, based around the C chord. The fluency with which he played these, the range of the melodic ideas and the lack of experimentation in this lesson with the individual riffs that go together to make up the

extended phrases, would tend to suggest that they were based on previously learnt patterns, possibly during out of school piano lessons, or through experience of improvising himself.

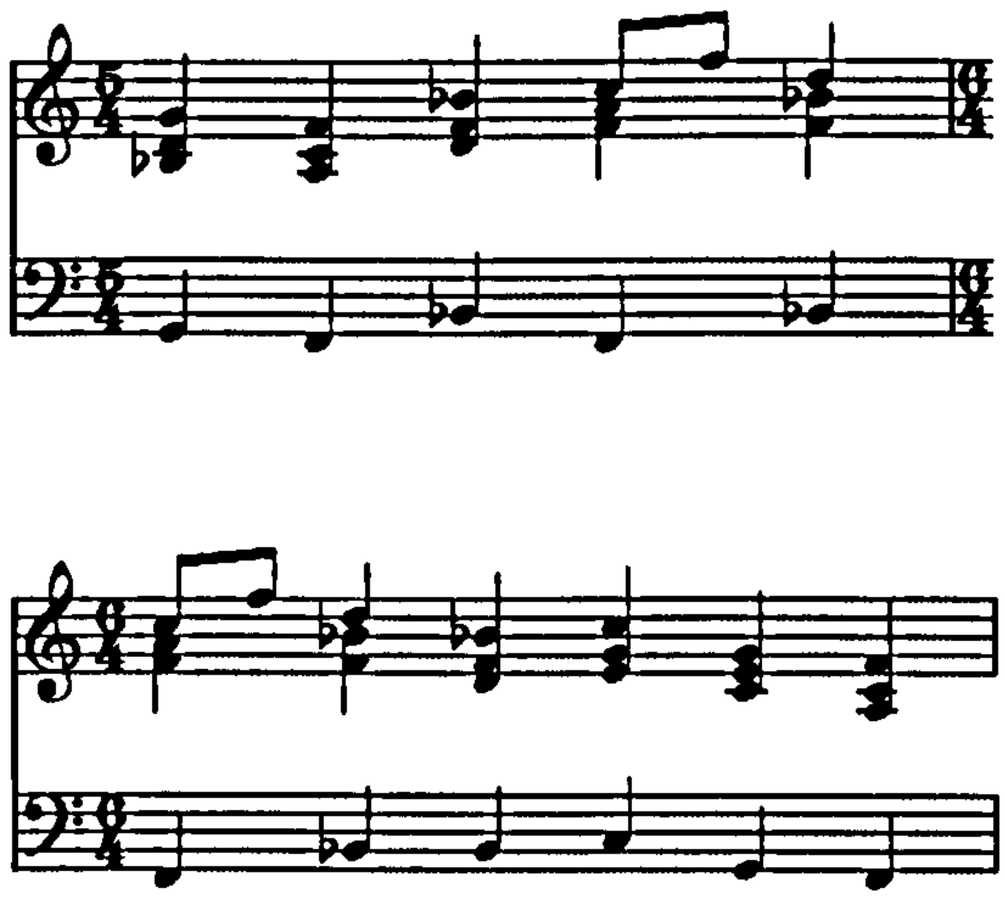
At the end of this practical session, the pupils had taken some of the teacher's designs but developed them in very different ways from that suggested by the lesson's 'minimalist' descriptive title. They would appear to have gained little in terms of stylistic awareness of minimalism if the final output of their work alone is taken into account (this was also evidenced in their replies to the final question of the post-study interview), but have added much from their own experience to the basic guidelines given by the teacher and developed the general themes of the lesson in their own way.

6.5.4 Study 1, lesson 4

The teacher's available designs - study 1, lesson 4

The teacher began the lesson by outlining its aim: to compose the final version of the Promenade theme using block chords with a sense of climax and excitement. Next week, they would be assessed and recorded, and the piece had to be played in its entirety. He questioned the class about the overall structure and recapped what was expected in each section.

Worksheets were then given out (the same as those from week 1) as a prompt. He then reminded them that today's session was to compose a final variation of the Promenade theme using block chords. He then unpacked the term 'block chords', and suggested a rule to help play a chord; play one, miss one, play one, miss one, play one (3 notes in total). They should take the melody and try to add block chords that change every note. He gave a demonstration at the keyboard (see music example 27):



Music example 27- lesson 4, Promenade theme, teacher example

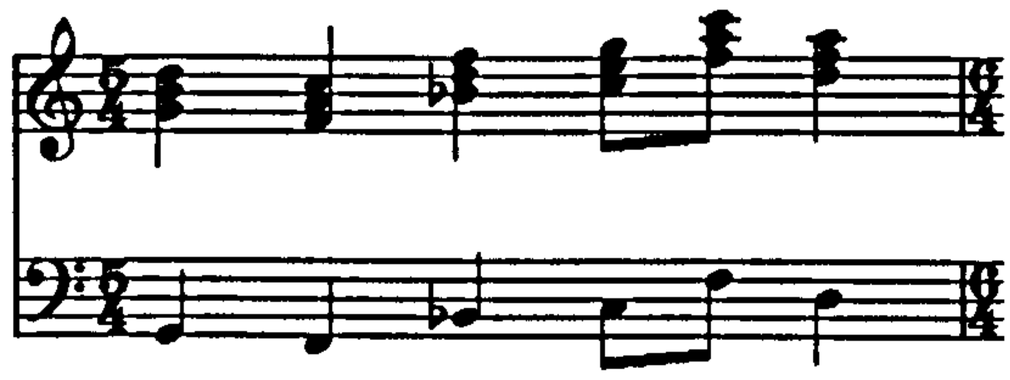
He then pointed out that as this was to be the last version, it would need a sense of climax or excitement, and asked a question about how to end the Promenade: pupils answered that it could be louder, slow down, or they could add a drum beat and aim for a triumphant ending.

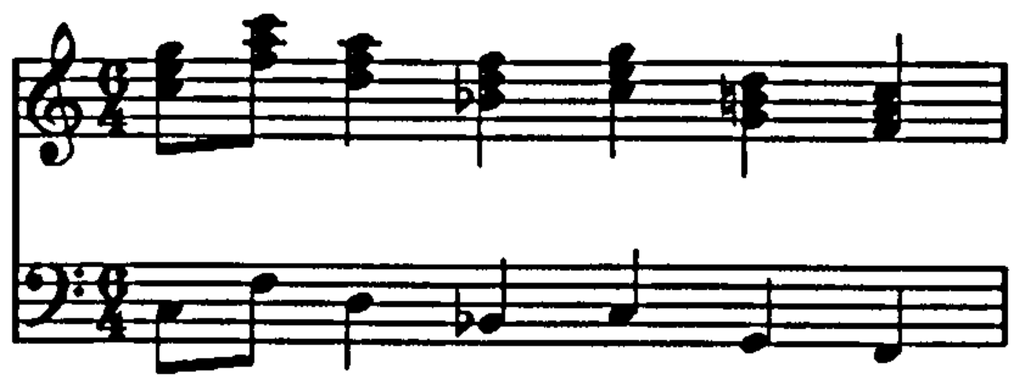
The teacher then played the rock version of Pictures at an Exhibition (by Emerson, Lake and Palmer[4]) recorded in 1971. He asked the pupils a question about the instruments used, and they identified them all. He then asked what the drums were doing to make it more exciting, and suggested that the pupils might think about adding a beat to their final Promenades. He repeated his explanation about chords, explained the use of the term 'Rondo form' and went over the overall structure again. He reiterated his expectation that by the end of the lesson, the pupils would be able to perform a minimum of Promenade, the Old Castle and the second Promenade. Pupils then moved to their composition groups and began work. After about 35 minutes, the teacher called them back to their seated positions for the plenary session. Two pieces were then appraised (one by a group using an electronic keyboard and the other using by a group using a music computer workstation).

Analysis of how the observed group transformed these designs - study 1, lesson 4

Both pupils started by experimenting with the Promenade theme; pupil B with a single line in the bass, and pupil A with 3-note right-hand chords. They joined together rhythmically briefly at the end of pupil B's third playing. They practised this again several times before

they were satisfied enough with their performance to record it. It was eventually played as in the following example (see music example 28):





Music example 28 - lesson 4, group A, Promenade theme with chords

Much of the rest of this lesson was taken up by the pupils with reviewing their previous work and re-ordering the various sections of it on the Cubasis arrange page in order to create the whole composition in the form required. The only musical contribution that had been added since the last lesson was a drum beat to the 'minimalist' (Orion Noir) section, as described in lesson 3, sub-section 6.5.3 (see music example 26).

A multimodal consideration of the musical transformations - study 1, lesson 4

The continuing negotiation of the piece using the Cubasis arrange page as a shared space was observed for much of the lesson. Through moving the 'parts' on the Cubase arrange page, the pupils could see the emerging structure of their piece. Both pupils were fully involved in this process and spoke almost continually to each other throughout this process, in contrast to their earlier work in the project. They used their fingers to point at the screen and listened to each part before discussing where to place it. All the time they were doing this, they had the worksheet in front of them and referred to it occasionally, particularly with reference to the structure of the piece.

The practical part of the lesson was taken up almost entirely with practising the chordal version of the Promenade theme, pupil A looking at his hands, probably to check his fingers were correctly placed for the chords and pupil B initially at his own but after a few iterations of the theme, at pupil A's hands, probably to match the timing of the melody. At one point they were disturbed by a loud sound from a neighbouring group, it being relayed

through a hi-fi system. However, apart from the time taken for this interruption, it did not seem to alter the flow of their practice of the theme.

A consideration of the origin of the transformations - study 1, lesson 4

In this lesson, the teacher provided only partial information concerning adding chords to the Promenade theme. This was perhaps intentional, to encourage the pupils to experiment with their own ideas. He did not adopt his own instruction to 'play one, miss one, play one, miss one, play one' literally (see music example 27), as his version of the piece involved a musical inversion of this pattern, placing the bottom note of the right-hand chord on the top, or in the melody, as in the original score; consequently, his model sounded close to the original Promenade. However, the advice was adopted literally by pupil A, who added the notes *above* those of the melody. Because pupil A did not carry the Bb right through the piece, he created a false-relation between the Bb on beat 3 of both bars and the B natural on beat 5 of bar 2 (possibly created by considering mainly white-note chords where possible). The ordering of the parts on the screen was not directly modelled by the teacher in a computer context; however, the pupils were able to translate the ordering of the sections on the worksheet into something that was meaningful for them on the computer screen. The teacher had not shown them previously how to name the parts, so each one (or connected ones) had to be listened to, a decision made on which section the part belonged to and then it was placed (through dragging using the mouse by pupil A) on to an appropriate track so that it was played by the correct 'voice', or keyboard sound. Both pupils then discussed this, deciding whether it was now acceptable or whether more changes were necessary.

6.5.5 Study 1, lesson 5

The teacher's available designs - study 1, lesson 5

The aim of this lesson was for the class to finish practising their pieces in order that they could be performed, recorded and assessed at the end of the lesson. The teacher went over the structure again and questioned the pupils to ensure that they understood it should be Promenade - The Old Castle - Promenade 2 - Orion-Noir - Promenade 3. The key features of each section were recapped. The practical session was timed to last about 10 minutes with the rest of the lesson concerned with listening to each groups' work in turn followed by a brief appraisal and a summative comment by the teacher.

An analysis of how the observed group transformed these designs - study 1, lesson 5

At the start of this session, pupil B played the Promenade theme at a low pitch. The overall sound of the whole piece at this point was similar to the finished product (as it was at the end of the previous session). The pupils had not yet recorded their final Promenade theme with the chords (as practised in session 4); this occupied the first part of the practical session. Pupil A started by playing the Promenade theme in both hands using chords (6 notes), then both pupils played the Promenade theme (pupil A playing 6 notes, pupil B playing 1) slowly, using an 'ethereal 'synth" sound. Pupil A then decided to practise his chordal section again. They both then played again, this time recording. At the end of the theme, the teacher had requested that they add an ending; pupil A played a 'coda' section consisting of major arpeggios in the following sequence of major chords:

Bb - C - G - F - Bb - F

This recording was then deleted. Pupil A then practised again and they then both recorded the theme again, with pupil A playing the ending arpeggiated chords in the following revised sequence:

Bb - G - F - Bb - C - G - F - Bb - C - F

Again, this recording was deleted. The pupils then played the Old Castle recording back, seemingly to check it. Both pupils then recorded the final Promenade again, right through - this recording was kept; all pupils were then called to perform their pieces to each other in the plenary session. The final sequence of major chords played by pupil A was:

Bb - G - F - Bb - C - G - F

...followed by a brief unison restatement of the final part of the Promenade culminating in a single bass echo finishing on an F.

The final playing of the composition is presented in table 5. For a full score of the piece, see appendix 3.

Section	Bars	Description
Opening Promenade	1-6	Promenade Theme ('synth' Sound - RH starts on G3) Rhythmic drone accompaniment on G1 & D2 ('synth')
Old Castle	7-20	Aoelian melody (Organ sound - RH starts on A3) Rhythmic drone accompaniment on A1 and E2 (organ
Promenade (2)	21-24	Tune in block chords (RH - piano sound) as in example above Tune also in bass (piano) as above
Orion-Noir (1)	25-38	High Pan-flute melody (off-beat, starts on C4, E4, D4) - C major / Steady drum beat / Quaver chords in middle of texture - chord of C (C2, E2, G2)
Orion-Noir (2)	39-50	Tune based on melodic patterns as above ('synth' Sound) / drum beat continues from previous section / 1-bar bass riff as above
Final Promenade (1)	51-52	Single tune without accompaniment starting on G1 (piano)
Final Promenade (2)	53-54	Low Promenade tune continues in bass plus RH chords (piano) an octave lower than before (starts on G2, B2, D3)
Coda	55-63	Piano arpeggios (LH sustained triad plus figure in RH) - Bb major; G major; F major; Bb major; C major; G major; F major; unison echo of final part of Promenade; single bass echo finishing on F1

Table 5 - Overall plan of group A's 'Music Inspired By Art' composition

A multimodal consideration of the musical transformations - study 1, lesson 5

Apart from the recording of the final section of the piece, some of the practical part of the lesson was used to review the piece as a whole. The pupils did not alter very much of their previous work on the screen at this stage, apart from repositioning the section they had just recorded on the arrange page, and talking to each other for a good deal of the time the music was playing about things that were good about it, and some things that could have been improved.

A consideration of the origin of the transformations - study 1, lesson 5

The playing of the Promenade theme in block chords was carried over from the previous lesson, except that it was played in both hands, using 6-note chords by pupil A, with pupil B playing the single note version.. The transformation that was made of this was the coda

section added by pupil A, following the request from the teacher that they ensure their pieces had definite endings. It is not clear where the idea for the arpeggiated chords originated, but it may possibly have been from pupil B, following his earlier two experimental sessions in lesson 3. As playing chords in this way is a common feature of many piano pieces, it is possible that it was a design brought in from pupil A's piano lessons taken outside school. However, it is unlikely that these would have used the chordal progression played here as it featured some unusual harmony and a false relation. Further evidence of pupil A having adapted this technique to a new situation was seen when he played the sequence differently each time, although he retained the same elements, themselves based on the chords that he had just used to harmonize the 3rd Promenade theme. Additionally, there were 2 echoes of the theme that were played at successively lower octaves in addition to being played quieter, the second being played by pupil B; this quiet form of ending was not modelled in the classroom. The idea for it may have originated in his piano lessons, or perhaps listening to pieces where this musical idea was used. Some time was spent reviewing the whole piece - the drone, originally intended for the 'Old Castle' section, was added to the first Promenade - a use of the potential of the computer system to try out possibilities through combining elements in novel ways.

6.6 General discussion of the transformation of the available designs - study 1

6.6.1 Constraints

The teacher in this school was very open to the pupils trying out their own ideas, so when the observed group did something different to what had been suggested (as in lesson 3 - see section 6.5.3 - where the teacher demonstrated a quaver octave bass figure (see music example 22) which the pupils did not use, instead employing their own crotchet rising bass pattern (music example 23)), the teacher did not comment negatively on this but encouraged them to make more of the work they had produced, through additional suggestions made during plenary sessions and further practical demonstrations given of techniques they might consider trying. Table 6 provides a summary of the tasks required of the pupils in each of the activities and a list of the constraints that were placed upon them (see table 6):

Lesson	Activity	Constraints
1	• Play Promenade theme • Make up own version • Play a rhythmic drone • Add a chord sequence • Experiment with the tune (possibly add some notes or take some away) • Change the feel or mood of the original tune • Think of your own ideas	• Play as written on the worksheet • Needs to be based on the original • Needs to fit the new version of the Promenade • Needs to fit the new version of the Promenade • Open-ended • Open-ended • Open-ended
2	• Use drone (A or A & E) • Use A minor for melody notes (2 levels) • Put sections in ABA structure	• Notes given but rhythm open-ended, although modelled using fixed 4/4 rhythm • Notes given, rhythm open-ended but needs to fit drone rhythm (if there is one) • Structure given
3	• Create accompanying ostinatos (2) using C & G • Use rhythm grid 1 and notes C, E & G to form melodic ostinato 1 • Use rhythm grid 2 and notes C, D, E, F & G to form melodic ostinato 2 • Fit into overall ABACA structure of piece	• Notes given but rhythm open-ended, although modelled using fixed 4/4 rhythm • Both notes and rhythm given • Both notes and rhythm given • Structure given
4	• Add block chords to Promenade theme • Add sense of climax or excitement as it comes to a conclusion - possibly add drums? • Overall structure of piece reiterated	• Promenade theme fixed and way to form chords modelled. Changes in notes within chords acceptable • Open-ended • Structure given
5	• Structure reiterated • Key features recapped	• Structure given • Mixture of level of constraint

Table 6 - Lesson activities and constraints

The level of constraint placed upon the pupils varied, appearing to be dependent upon two key aspects:

- the musical element, such as drone, ostinato, scalic pattern, structure or chord
- the focus of the lesson, whether performing or composing

In **lesson 1**, the focus in the first part of the lesson was on performing the Promenade theme accurately and was therefore relatively constrained; the melody, rhythm and tempo were therefore initially prescribed (see fig. 40). However, as the lesson progressed, these constraints were relaxed in the second part of the worksheet and the pupils were encouraged to experiment more with adding the suggested ideas: rhythmic drone, chord sequence and altering the melody. The observed pupils did what was required of them with regard to performing the given Promenade theme, with little transformation of the available designs, limiting their transformations to choice of sound and octave. Pupil B did experiment with rhythm in this lesson (see section 6.5.1), and although not featuring in the product from this lesson, it impacted upon a future lesson.

Lesson 2 was seemingly not so constrained as lesson 1 as the focus was upon composing a section of music to echo the mood of the Old Castle picture. Small building blocks were provided for the pupils to build their Old Castle section from, such as the notes of the drone and the the melody, but not the rhythm, tempo or meter (see fig. 43). The structure of the piece (ABA) is indicated but the lack of provision of a rhythmic frame and a wide range of notes provides a good degree of freedom. The observed pupils were able to transform the given elements to create their musical response to the Old Castle picture, however, as shown in section 6.5.2, both the melody and drone were closely modelled on the example provided by the teacher.

Lesson 3 appeared at first sight to be highly constrained, as the notes, rhythms and structure were prescribed by the teacher in the worksheet using the box-and-cross notation as well as the given notes for the ostinatos (see fig. 44). However, in practice, the observed group used these elements in novel ways to produce something very different to the expected minimalist ideas, extending what the teacher would appear to have anticipated in the lesson design. Although the lesson appeared to be highly constrained, the culture of the music classroom was observed to be one of encouraging experimentation, and the observed pupils 'played' with ideas that were related to the principles of minimalism (see musical examples 19-25), in that they were based on small cells of music, but used a different musical style, rhythms and notes to those suggested by the teacher in the launch of the lesson and on the worksheet, to produce a jazz-rock-pop

inspired section. Related to this style of music, the conversation during the pre-study interview is notable:

Interviewer:	OK. What sort of music would you listen to if you were at home now and you had a free choice of anything to put on - what sort of things would you put on?
Pupil A:	Electric guitar and, like, drum and that sort of music
Interviewer:	... so rock music, or pop music or ...
Pupil A:	... rock music
Interviewer:	Yeah, are there any particular bands or anything you like?
Pupil A:	No, not really.
Interviewer:	No? What about you (looking at B), what would you listen to?
Pupil B:	Pop music
Interviewer:	Pop music - any particular artists?
Pupil B:	No

As their musical preferences were rock and pop, it is notable that they were able to work in these ideas into their composition, even within the framework given by the teacher, which although it did not rule out the use of these styles, it didn't promote them either, especially in the technical details of how to construct the composition, as embodied in the worksheet (see fig. 44).

Lesson 4 focused on adding chords to the Promenade theme which, like lesson 3, appeared to be a constrained activity especially as the method of adding the chords was given. However, the pupils spent nearly all of their time practising the theme with the addition of chords, adding them in a different way to that anticipated by the teacher model, but in line with his explanation, producing an interesting harmonic result through the occurrence of the false relation (although the pupils' playing of this was not recorded using he computer in this lesson). Again, as in lesson 3, the seemingly constrained activity resulted in a novel outcome.

Lesson 5 was characterised by the creation of an ending for the piece and a final structuring of the various sections into a whole (see Appendix 1). Although the structure was prescribed, the ending was unconstrained, being left up to the pupils to experiment with; the result was a novel outcome through the use of arpeggios and a quiet ending

involving repetition of part of the theme, in contrast to the teacher's suggestion of a sense of climax for the ending. Also in this lesson, both pupils worked together to order on screen the recordings they had made into a successful whole, based on the plan of the structure provided by the teacher. However, they went beyond the basic requirements of the required five section piece (Promenade - The Old Castle - Promenade 2 - Orion-Noir - Final Promenade), providing two sections to the Orion-Noir stimulus (the first based on the repeated C chord and the other based on the C-E-F-G bass riff) as well as a Coda, using the part of the Promenade theme in a low octave to finish the piece.

6.6.2 The possible origins of the available designs selected for transformation

The secondary classroom context offered many available designs for the pupils to transform; however, the pupils brought more to the composition process than that provided by this context alone. I will now bring together the points made in my previous examinations of the possible origins of these designs as seen transformed by the pupils in the observed lessons.

Potentials

A potential of the music computer workstation was seen to be its ability to provide opportunities for pupils to experiment with various elements of the music that would have been much more difficult to realise using other means, such as the more 'traditional' classroom composing groups using musical instruments. One of these was its ability to allow them to experiment with different timbres. The teacher had set up the sequencer template with a wide variety of sounds, made available through the selection of different tracks (see fig. 46):

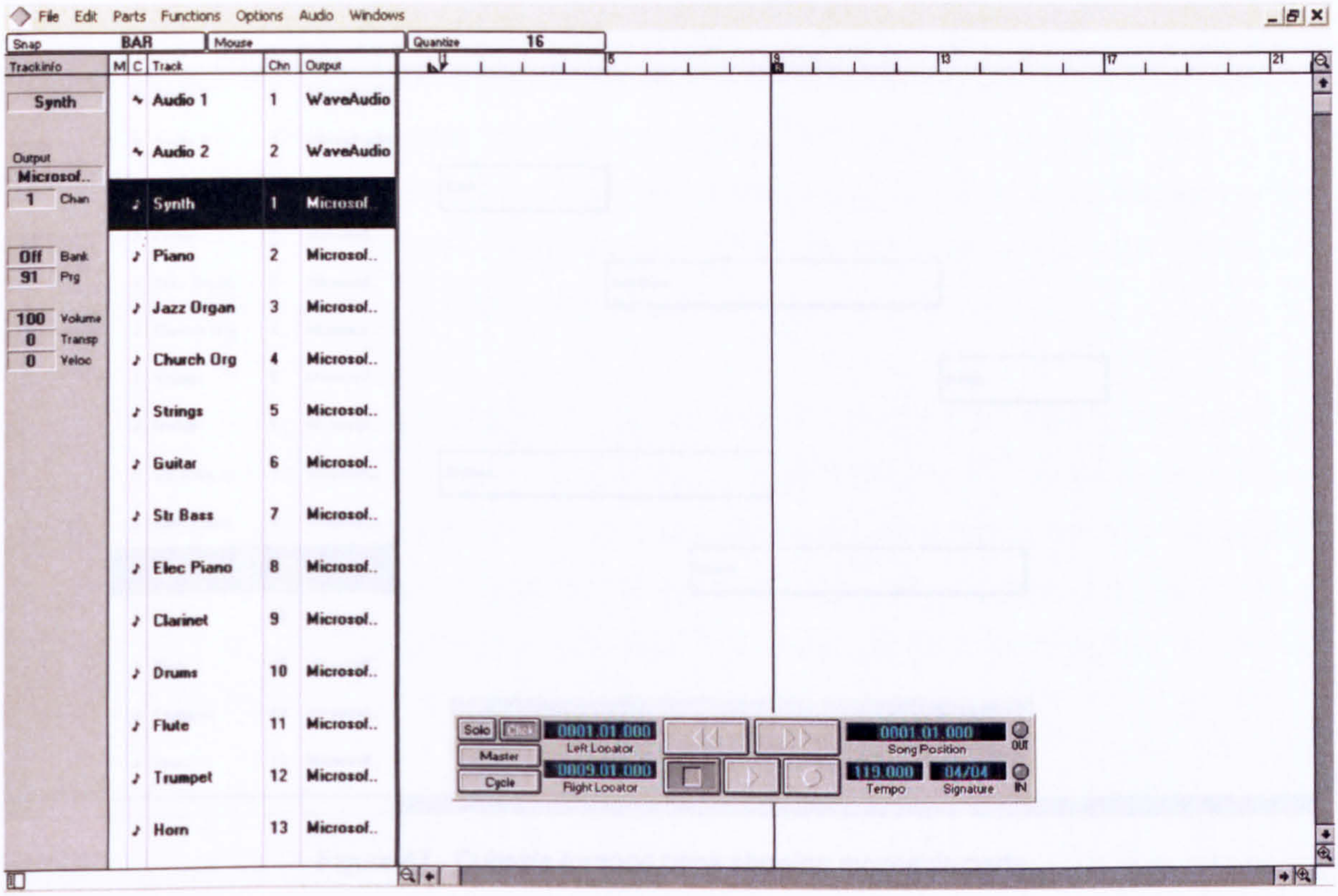


Figure 46 - Cubasis arrange page showing the selection of different sounds

Not only did this template enable the pupils to select different tracks and try the sounds out on the keyboards, but it also allowed them to move sections of previously recorded material on to different tracks to hear how they might sound with different timbres. The pupils used this potential of the sequencer in every lesson.

Another potential of the software was its ability to show sections of the music clearly, which seemed, through its ability to represent the aural process visually, to make structuring the music an intuitive process for the group. Figure 47 shows a typical Cubasis arrange page with various parts appropriately named (they can be renamed, if desired), that can be moved at will onto any other track or time in the music:

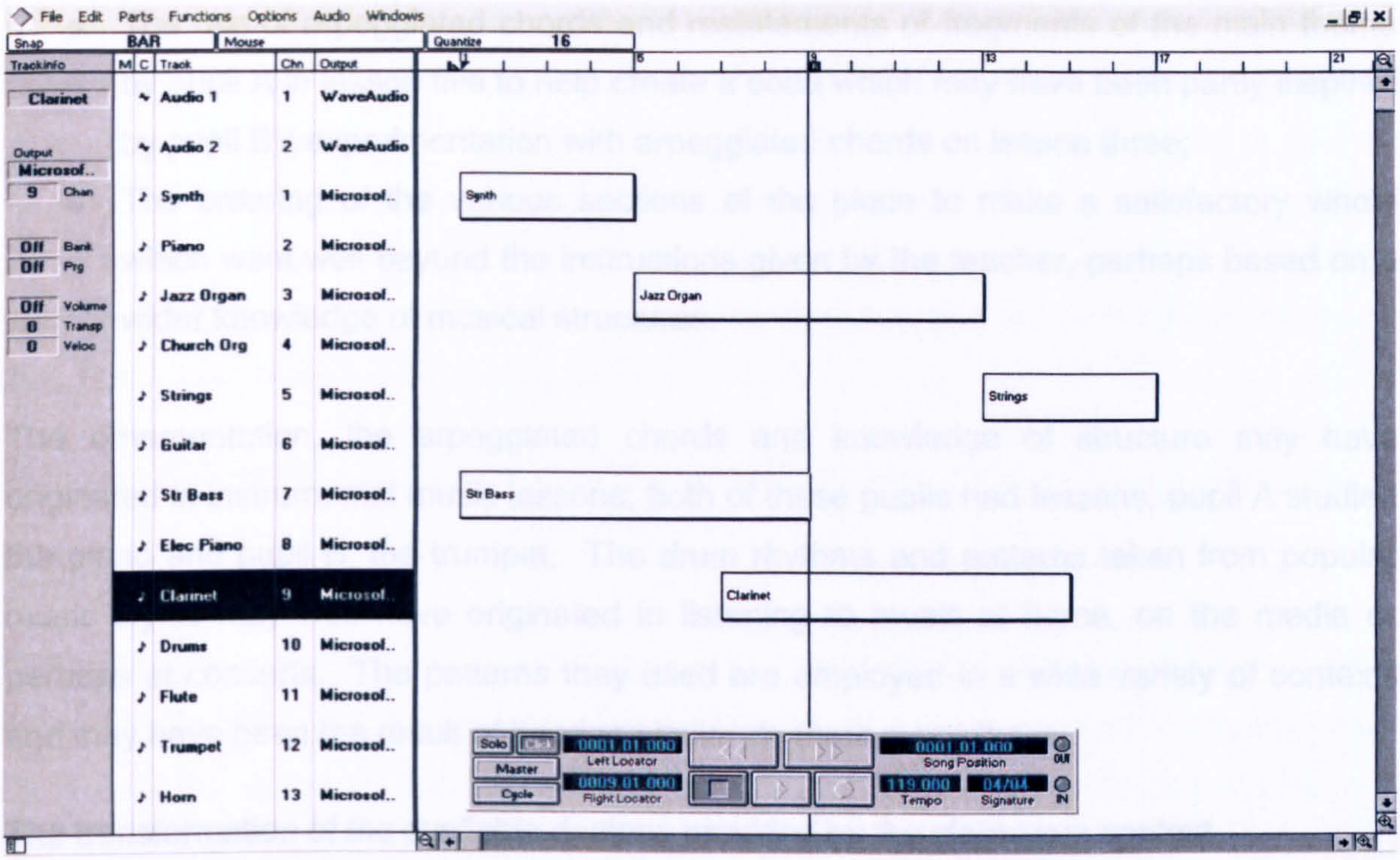


Figure 47 - Cubasis arrange page showing moveable parts

When the teacher asked the pupils to structure their music, the observed group moved the parts around in lessons 4 and 5, and were able to hear the effects of this instantly. This potential also presented a good space for negotiation, as ideas trialled could readily be seen and form the basis for discussion (see section 6.5.4). An example of this was the using of the rhythmic drone, originally intended to accompany the 'Old Castle' section, but subsequently used to accompany the first Promenade theme.

The possible origins of the available designs from outside the classroom context

The pupils brought more to the composition process than a re-design of the designs made available by the teacher; the transformation of some elements and the addition of others appear to originate from contexts outside the classroom. For example:

- The drum rhythms experimented with by pupil B in lesson one;
- The ornamentation to the melody and the development of the drone rhythm in the "The Old Castle" in lesson two;
- The rhythms borrowed from popular music styles in lesson three - the repeated chords, the bass riff, the drum rhythms and the jazz-inspired complex rhythmic and melodic figures used by pupil A;

- The use of arpeggiated chords and restatements of fragments of the main theme by pupil A in lesson five to help create a coda which may have been partly inspired by pupil B's experimentation with arpeggiated chords on lesson three;
- The ordering of the various sections of the piece to make a satisfactory whole which went well beyond the instructions given by the teacher, perhaps based on a wider knowledge of musical structures.

The ornamentation, the arpeggiated chords and knowledge of structure may have originated in instrumental music lessons; both of these pupils had lessons, pupil A studied the piano and pupil B, the trumpet. The drum rhythms and patterns taken from popular music styles may well have originated in listening to music at home, on the media or perhaps at concerts. The patterns they used are employed in a wide variety of contexts and may have been the result of hearing similar rhythms many times.

The transformation of the available designs provided by the classroom context

The observed group transformed the available designs from the classroom context in many novel ways; some of these were envisaged by the teacher (based on the advice given in the lesson introductions) and some were not (see the lesson descriptions in section 6.6.1). The pupils transformed the Promenade melody through different choices of timbre and octave, and the addition of a rhythmic drone. They also transformed it through the addition of chords in a rather different way to the teacher model in lesson 4, by adding the notes on top of the melody rather than below it, and extending the suggested 3-note chords to 6. When presented with the drone and A minor notes to form a melody (lesson 2), they used the techniques provided by the teacher to transform them into a section of music in much the same way as outlined by the teacher in the introduction to the lesson, using the rhythmic drone, A minor melody (in a similar way to the model) and the same church organ sound. However, in lesson 3, they used elements that bore a small resemblance to those designs provided by the teacher (they used two ostinati and similar series of notes) to create a section of music based upon a popular music style. In lesson 4, they added chords to the Promenade theme, but added them above the melody notes, rather than below them. Lesson 5 produced some novel solutions to the ending suggested by the teacher; they chose not only to end in a 'down-beat' mood, but took sections of previous Promenades (2 bars of the low octave only, 2 bars of the version with added chords but pitched an octave lower) and followed them with arpeggios in 7/8 and 4/4 time, based on the chords used in the Promenade theme, and ended the whole piece

on a unison echo of the main theme that finishes on the dominant (F) note, finishing in a somewhat ambiguous manner (i.e. not on the tonic). There seemed an appropriate amount of constraint built into the lesson design for these pupils, allowing them to adopt a mixture of following the suggested transformations of the teacher and using novel solutions of their own devising. This appeared to provide them with boundaries which they could push against and yet experiment freely within, when and where they felt able to do so. This is discussed further in chapter 8.

6.6.3 A multimodal consideration of the transformation of the available designs

Seating position

The seating position adopted by the pupils in the practical part of the lesson appeared to influence the roles and musical possibilities they were able to engage in. Pupil A took control of the computer for the whole series of lessons, having both the mouse and keyboard near to hand. Although pupil B had a verbal input into the ordering of the parts on the arrange page, the 'power' to operationalize these lay with with pupil A.

The seating position also appeared to influence what was played by each pupil: pupil A played the upper part of the keyboard and pupil B, the lower. In much music, the melodic line is uppermost in the musical texture, and so is played with the right hand, whereas lower pitched notes, played with the left hand, are frequently used for accompaniment purposes. Pupil B therefore, owing to his seating position at the keyboard, played an accompanying, non-melodic role, whereas pupil A played the melodic material. Furthermore, many of the most frequently used drum sounds (bass drum, snare, hi-hat, ride cymbal etc. - see fig. 48) are situated towards the lower, left-hand octaves of the keyboard (the 'C1' in the diagram is the lowest, left-most note on the keyboard):

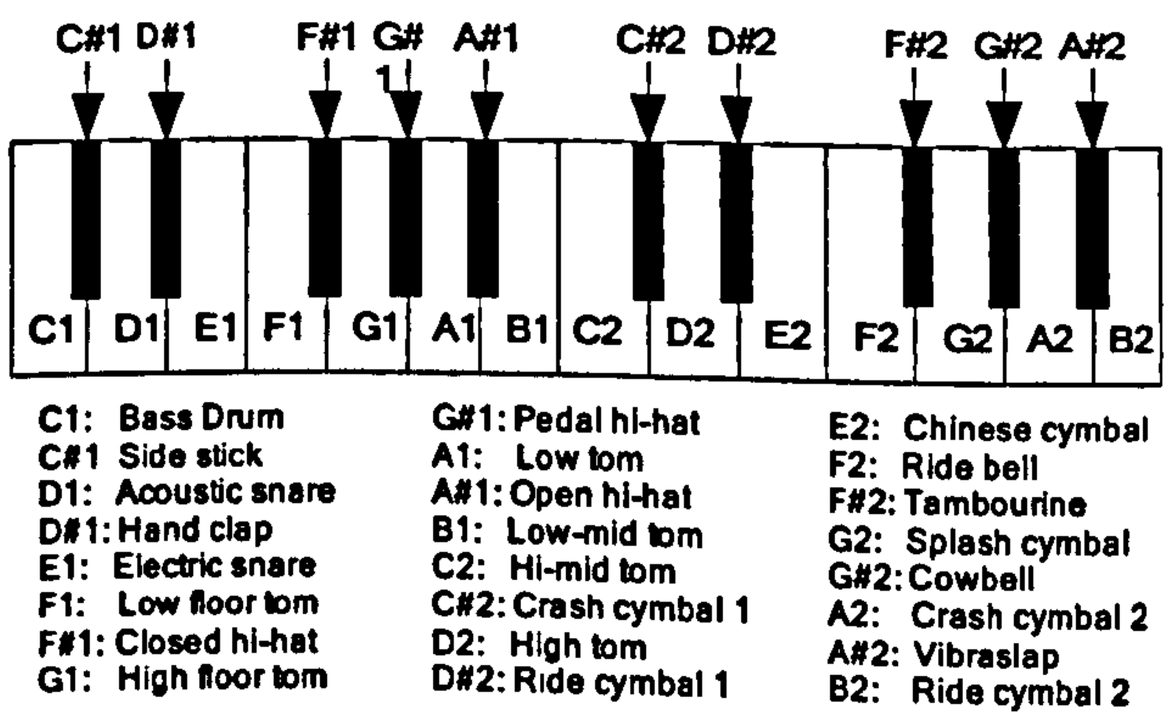


Figure 48 - MIDI drum key assignments

Pupil B's seating position therefore resulted in his taking the role of providing the drum rhythms - both in terms of their composition and when they were recorded.

Potentials of the visual representation of the music

The musical potentials of the visual representation provided by the computer have been discussed in section 6.6.2. In addition, the visual representation provided a constantly available diagram of the structure of the piece, showing progress so far and how the various recorded sections related to each other. Pupil conversation focused on this representation for at least one extended period in each lesson:

L38 B: Well look down the bottom then.
L39 A: Yeah.
L40 B: There it is.
L41 A: We need to put that (points to the screen with right hand)..
L42 B: Before..
L43 A: Before the (pointing to screen with right hand) ..that one (points to worksheet with right hand).
L44 B: Ain't it all around there.
L45 A: I don't know .. I haven't done anything to it .. shall we ask sir? There's a split in ..
L46 B: Just move all this (points to screen with right hand)

This linking of the sound of the music to its visual representation seemed to be a key element in allowing the pupils to organise their work. Two potentials that were not exploited were the ability to use colour to differentiate the parts and the ability to name them; the tracks had already been named in the template provided by the teacher, but the parts could also have been named individually, making their identification quicker. The worksheet provided by the teacher took on the role of providing information about the task and serving as a reference point, for example, about the structure of the piece. The pupils were observed to have no problem linking the teacher's expectations as embodied in the worksheet with the developing visual representation on the screen.

Synchronization of playing

It was observed that the pupils watched each other's hands when playing the music keyboard together, as in the playing of the Promenade theme. Although they could hear their playing clearly, the watching seemed to be important. It was noticeable that they did not play in time with the metronome click, so the visual linking of the performance in this way seemed key to maintaining their synchronisation.

Socially embedded roles and expectations

The pupils were not seen to discuss their roles at the keyboard - it seemed to be taken for granted that they would sit where they did and take on the computer and musical roles observed. It is somewhat difficult to probe these expectations of the pupils to ascertain the reasons why they might have these seemingly ingrained roles. From the pre-study interview data, it was noted that both of their mothers played the piano, they both improvised a lot in school music lessons (both on the keyboard), they usually worked in groups of 3-4 and they chose their own groups, based on friendship. When asked about role taking they said:

Interviewer: Now when you work in your group, do you tend to work in a certain way - I mean does someone always tend to take the lead, does someone tell you what to do or do you work more sort of together, would you say?

Pupil A: Together

Pupil B: Yeah - he's (pointing to A) he's good at piano so we usually take tunes from what he plays and add on to it

From these comments it could be inferred that it had become accepted practice that pupil A took the musical lead in lessons, and pupil B was quite happy with this situation. In the pre-study interview, both of the pupils had plenty of general experience of using computers:

Interviewer: OK. Do you use computers outside school?

Pupil B: Yeah

Pupil A: Yeah

Interviewer: And where would that be - at home?

Pupil B:	Yeah at home
Pupil A:	Home
Interviewer:	And what sort of things would you ...
Pupil B:	Homework usually, or going on the Internet
Interviewer:	Right, so if you're using it for your homework, which sort of application would you use on the computer?
Pupil B:	Word mainly
Interviewer:	Yeah - anything else you use
Pupil A:	Just the Internet
Interviewer:	Do you use CD-ROMS to look things up?
Pupil B:	Sometimes there's an encyclopaedia I use
Pupil A:	Encarta

From this excerpt, it appeared that both pupils were equally experienced with computers; however, pupil A took the lead in the observed lessons, perhaps indicating that they viewed the computer in the music classroom as an extension of the music work, rather than a computer in the general sense. As it appeared to have become accepted that pupil A would take the musical lead, this seemed to have also been extended to the use of the computer.

6.7 Conclusions

The nature and extent of the constraints embodied within the lesson designs appear to be important in allowing pupils the freedom to experiment with ideas drawn from both within and outside the learning environment. Linked to this, it seems to be important to create a classroom culture where pupils are free to experiment and 'go outside' the constraints laid out by the teacher, using material and styles that they like and find motivating, and may be influenced by out-of-classroom musical experiences but may not have been envisaged in the lesson design. This is not to say that pupils were observed to always go beyond the limits of the constraints laid out in the lesson design: for example in lessons 1 & 2 they mainly 'stayed within', experimenting with other ideas, such as drum parts by pupil B in lesson 1, but 'staying within' regarding the composition product. However, in lessons 3, 4 and 5 they were observed to be able to use the lesson design's boundaries to create new ideas of their own, based on those laid out in the worksheets, for example the jazz-pop-rock rhythmic and melodic material used in lesson 3 (Orion-Noir), the novel adaption of the

chords in lesson 4 and the distinctive ending that they created in lesson 5. This 'staying within' and 'going beyond' can be linked to elements of the lesson designs, some of which require the pupils to produce predicted outcomes (such as re-articulating the Promenade theme) whereas others allow them to engage in generative activity, where tasks are more open and the outcomes cannot be predicted. However, this study has indicated that these two aspects of lesson design do not necessarily result in these predicted or non-predicted outcomes, because the classroom culture also needs to be taken into account. A lesson design that appears to require pupils to produce a predictable outcome could be interpreted by them with a degree of freedom not seemingly anticipated in the lesson design, as in lesson 3. This is discussed in further detail in chapter 8 with reference to *prescription* and *proscription*.

The precise origins of the available designs selected for transformation where they emanate from outside the lesson design may be at best difficult or even impossible to identify; however, two aspects of this are significant, that that they do not appear to originate from the lesson design itself and that pupils are motivated to use them in their composing. Some of the available designs that appeared to originate in the classroom may not necessarily have been envisaged by the teacher, such as those offered by equipment or collaboration with others. Examples of this are the potentials of the music keyboard and the computer workstation, which are necessarily complex and have much musical 'intelligence' embedded within them. In the case of the computer system, examples of this are the musical representation of the music data in both graphical and score form and the virtual representations of real-world equipment, such as mixers and effects units (see chapter 3, section 3.1.3). Pea describes this phenomenon:

> These tools literally carry intelligence *in* them, in that they represent some individual's or some community's decision that the means thus offered should be reified, made stable, as a quasi-permanent form, for use by others (1993: 53)

This was exemplified when it was observed that the two pupils in this study appeared to require almost no help to use the music computer despite their lack of experience in its use owing to its recent arrival in the department. Pupils are generally surrounded by music from birth, so their experiences of music outside the classroom will inevitably be greater than those within it; therefore the incorporation of their musical preferences into their classroom work is to be expected and in this classroom, was encouraged. This was confirmed in this study, where several musical ideas were identified as originating outside

the classroom context (see section 5.5.2), appearing to have their origins in various other contexts, such as instrumental skills and experiences, and stylistic music preferences.

The multimodal observations revealed that the process of musical composition in this study appeared to be additionally mediated by several other seemingly non-musical issues. The issue of role was observed to be central to the activities the pupils engaged in, exemplified by their fixed seating positions and how they 'saw' their roles, as articulated in the pre-study interview. The pupils did not appear to be concerned by this issue but it was observed each of their individual inputs into the activities were very different and seemed to have been formed into an expectation, perhaps as a result of their previous experiences of working together. The use of the computer screen as a shared space for the negotiation of musical outcomes, in this case mainly the structure of the music and instrumental timbres, was observed to be backed up by spoken dialogue and pointing. Visual contact between pupils was observed to also have an important role to play, especially when synchronising the keyboard playing of both pupils, particularly noticeable because the sequencer's metronome click was not used for this purpose, although it could be heard when the pupils were recording.

In chapter 7, I will consider the second study, which took place with a group of year 6 pupils in a primary school, utilising a similar framework to this chapter.

1 The terms 'higher-attaining' and 'lower-attaining' refer to the teacher's judgements of the selected pupils' attainment in music.
2 The '1' refers to the first, or leftmost C on the keyboard.
3 An American composer associated with minimalist music, which is characterised by being composed of short reiterated musical phrases, a steady pulse and static consonant harmony. See http://www.stevereich.com/
4 An English progressive rock band formed in 1970, consisting of Keith Emerson (keyboards), Greg Lake (bass, guitar and vocals) and Carl Palmer (drums).

Chapter 7 - Study 2 analysis

7. Introduction

In this chapter, the second of the two empirical studies is described, which took place in the primary school described in chapter 5, section 5.2.1. As in chapter 6, a holistic description of the available designs provided by the school and classroom environment is presented, followed by lesson-by-lesson descriptions of the available designs, the musical transformations from musical and then multimodal perspectives, followed by a discussion surrounding the possible origins of the available designs used in the lessons. Conclusions are then made, drawing out key points from the study.

7.1 Data sources

The sources of data that form the basis of the analyses in this chapter are the same as before (see chapter 6, section 6.1), except that Wingrab was able to be used in this study, (see chapter 5, section 5.3.2) enabling an automated series of computer screengrabs to be considered alongside the other data. All the multimodally categorised data from lesson 4, as represented by the computer tool, can be found in appendix 5.

7.2 The learning environment - study 2

Music lessons took place in a 'resources' room which was situated close to other classrooms; this room had a variety of uses, one of which was for music teaching. Two music computer workstations were set up on a workbench along one side of the room (see fig. 49). During practical work, the two groups worked alongside each other, not using headphones. The decision not to use headphones was taken after discussion with the teacher, in order to facilitate the sharing of ideas between the two groups. Only the two groups involved in the project were present in this resources room, as well as the teacher and the researcher.

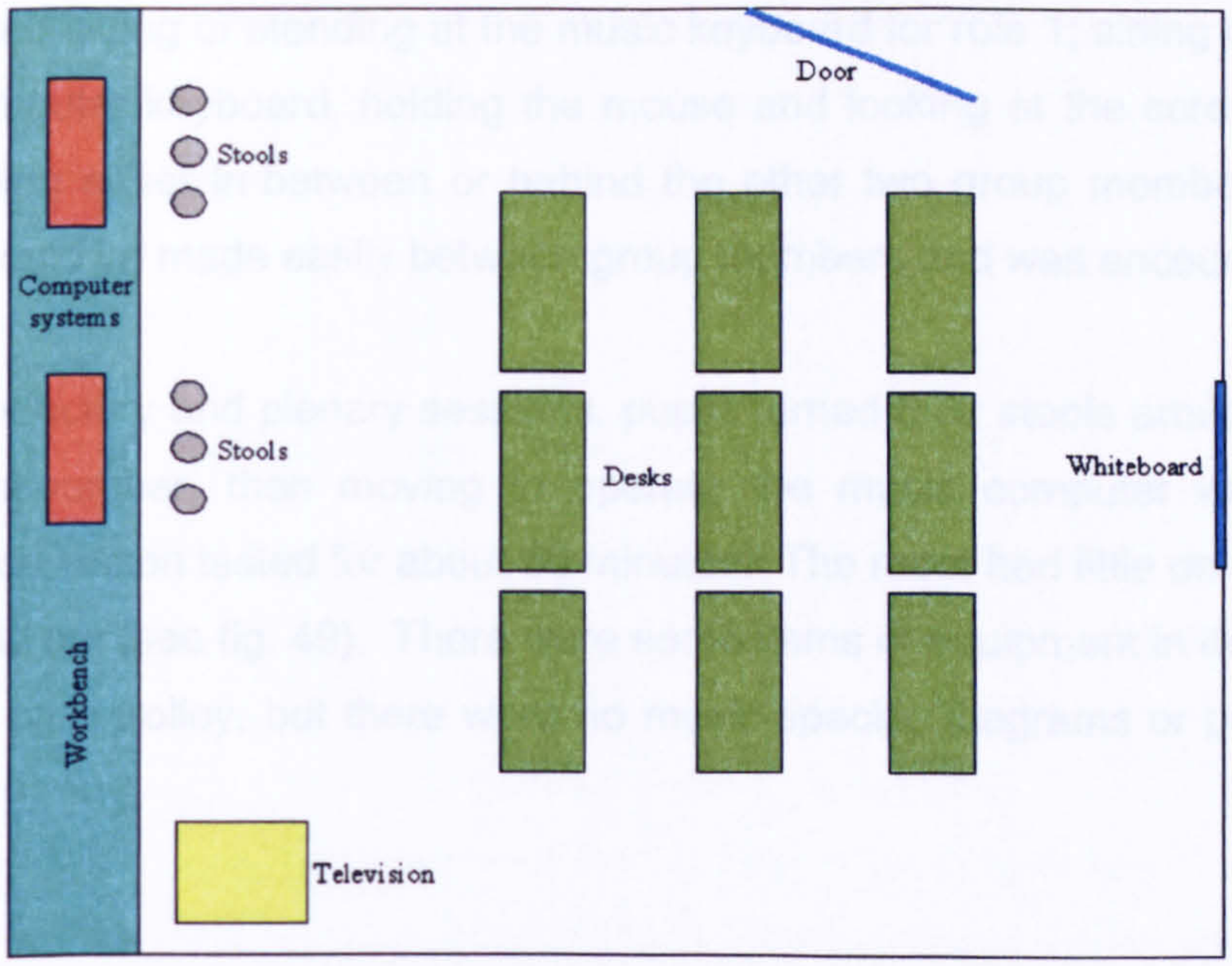


Figure 49 - Study 2: classroom layout

The set up of the computer workstation for MIDI sequencing is illustrated in fig. 50:

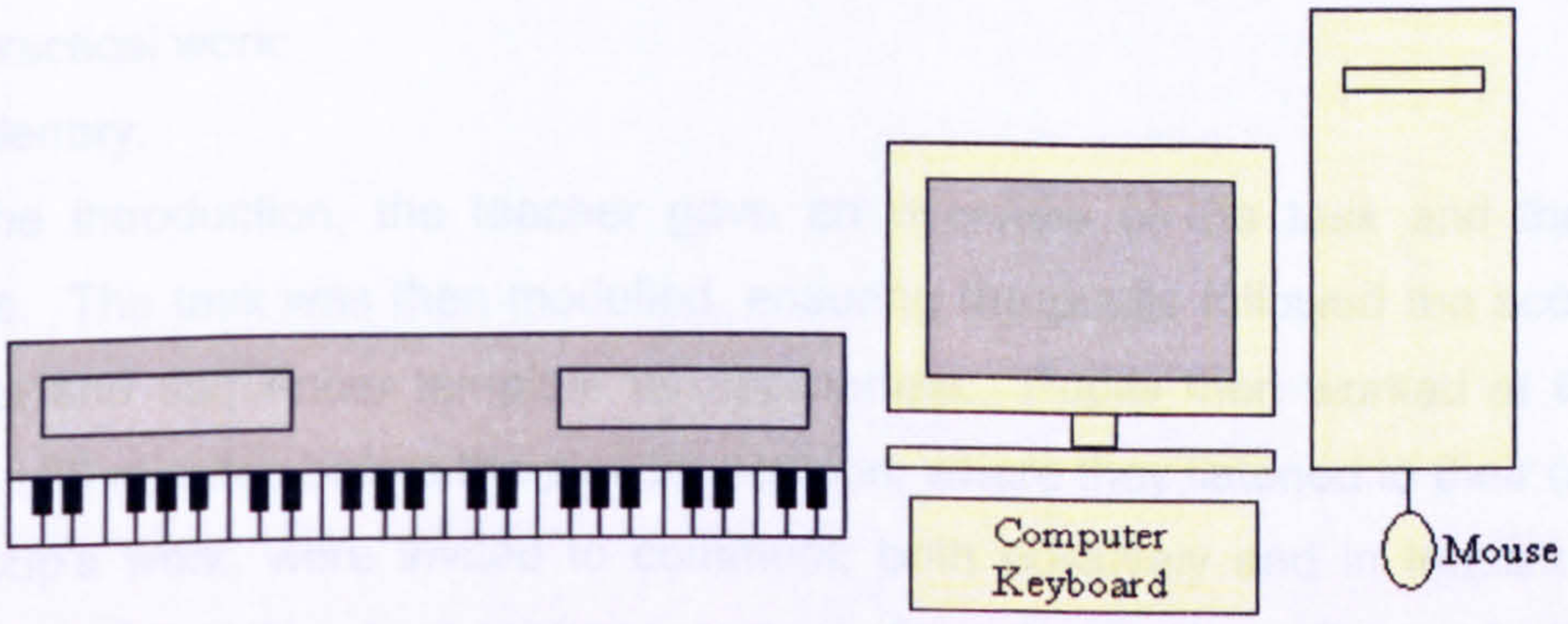


Figure 50 - Study 2: the music workstation

The sound was produced through stereo speakers, built into the keyboards. Following planning discussions with the teacher, a decision was taken to organise the space and tasks in such a way so as to allow the pupils in each group to undertake all three of the following roles during the lesson:

1. Keyboard
2. Computer
3. Advisor

This necessitated sitting or standing at the music keyboard for role 1; sitting or standing in front of the computer keyboard, holding the mouse and looking at the screen for role 2; sitting or standing either in-between or behind the other two group members for role 3. Conversation could be made easily between group members and was encouraged.

During the introductory and plenary sessions, pupils turned their stools around to face the teacher and researcher, then moving to operate the music computer workstation as necessary. Each lesson lasted for about 50 minutes. The room had little on the walls and was formally laid out (see fig. 49). There were some items of equipment in the room, such as a television on a trolley, but there were no music-specific diagrams or posters on the walls.

7.3 The lesson structure - study 2

Each lesson consisted of a similar format:

- Introduction;
- Practical work;
- Plenary.

During the introduction, the teacher gave an overview of the task and the expected outcomes. The task was then modelled, ensuring the pupils followed the accompanying worksheet and sequencer template as appropriate. Pupils then worked at the task for about 20 - 30 minutes before the plenary session, where they listened to their own and the other group's work, were invited to comment, both positively and in terms of ideas for improvement, in addition to receiving comments from the teacher. This typically lasted for about 15 minutes.

7.4 An analysis of each lesson - study 2

As in the previous chapter, it is considered that the available designs upon which pupils draw originate from a wide variety of sources. In the following lesson-by-lesson analysis, I examine the compositional transformations made by the pupils in each lesson using the following process:

- A description of the available designs provided by the teacher and the learning environment
- An analysis of how the observed group transformed the musical designs

- A consideration of these musical transformations from a multimodal perspective
- A consideration of the origin of the transformations, whether from the lesson itself or from an external source

7.4.1 Study 2, lesson 1

The teacher's available designs - study 2, lesson 1

This lesson began with the teacher handing out the worksheet (see figs. 51 and 52):

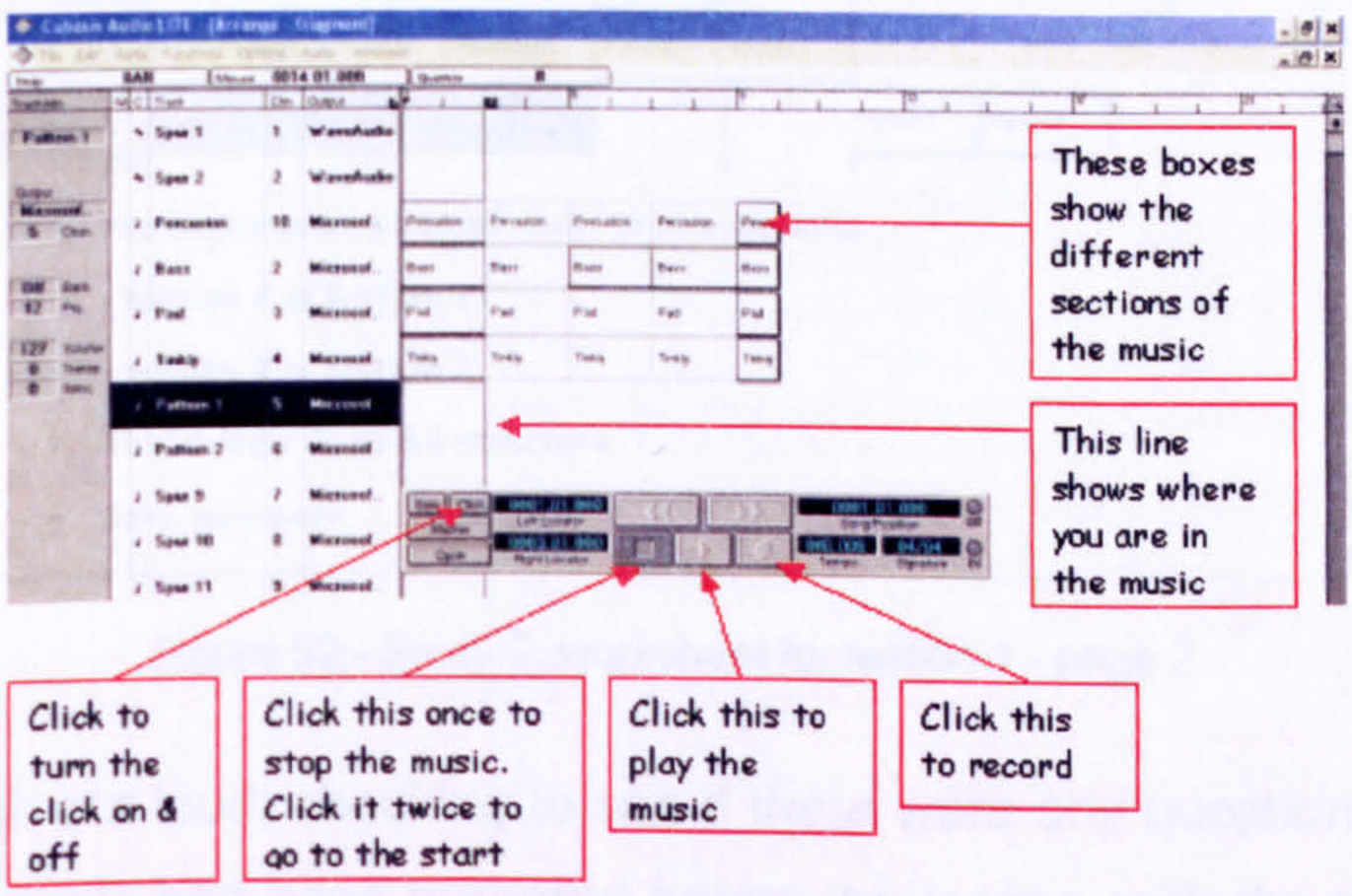
Cyclic Patterns

15th September

WORKSHEET

You are to compose at the computer 2 short musical patterns, copy them and move them into position to form a short piece with AB structure.

The Cubasis file 'fragment .all' should already be loaded on your computer. The screen should look like this:

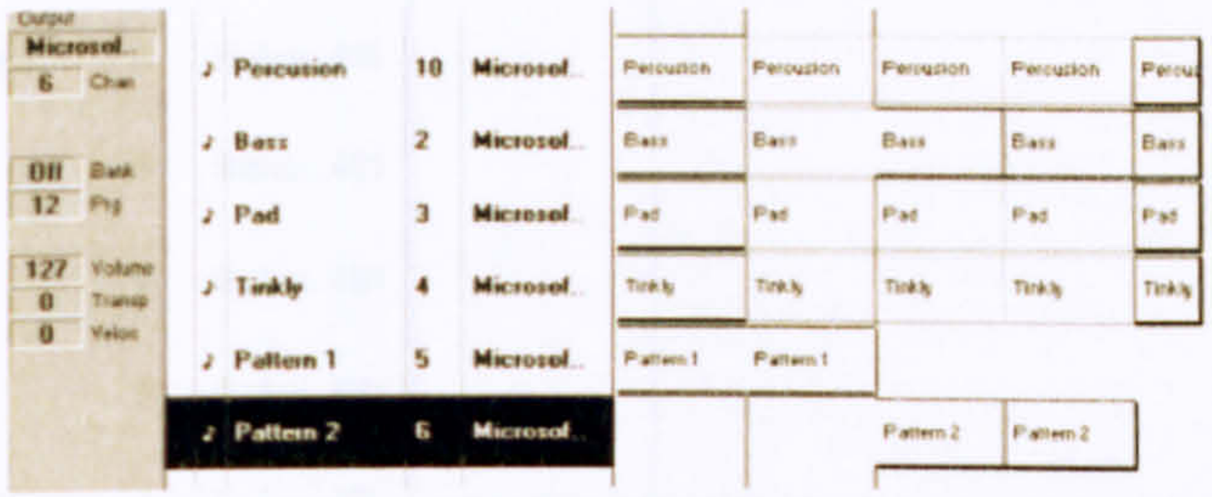


- Check the track 'Pattern 1' is selected (coloured black) and the click is on
- Click the play button to listen to all the music. Listen out for the clicks
- You are to record two patterns each lasting for 8 clicks. They will both use the notes C, D, F & G. These are marked on the keyboard.
- Play these notes and make up a tune that lasts for 8 clicks
- When you are ready to record your tune, go to the start by clicking this button  twice

Figure 51 - Study 2: worksheet for lesson 1 - page 1

- Click record  You will hear 8 clicks. Play your tune. Click on stop  when you have finished
- Play back your tune. Was it good? If not, select it by clicking on it and press 'Delete' on your computer keyboard and record it again
- If it was good, mute this track by clicking here in the 'M' column. A dot will appear: 

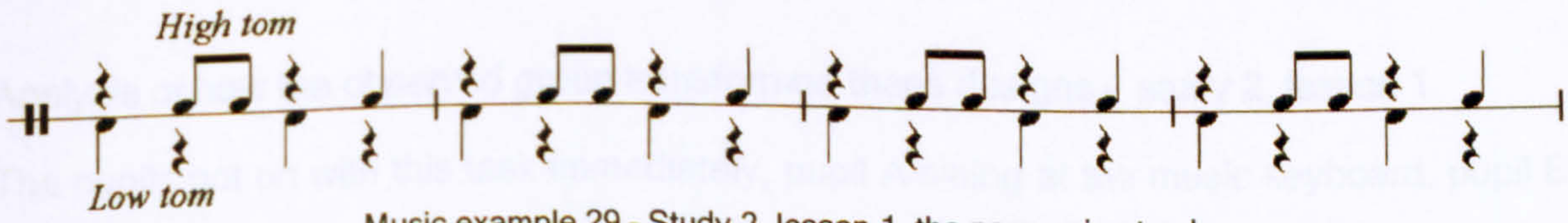
- Select 'Pattern 2' and record a different tune lasting 8 clicks
- If it is good, keep it, otherwise, delete it and record another tune
- Copy Pattern 1 by selecting it (it will turn black). Go to the 'Edit' menu and select 'Copy'
- Make a copy by selecting 'Paste' from the Edit menu
- Make a copy of Pattern 2 as well in the same way
- Click and drag Pattern 2 into place on the screen so it looks like this:



- You have made a piece of music in two sections:
  - section A is Pattern 1
  - section B is Pattern 2
- This is know as an AB structure
- Save your work

Figure 52 - Study 2: worksheet for lesson 1 - page 2

It was read through out loud, checking to see if there were any questions from the pupils. The 2 music keyboards had been prepared before the lesson, with the note names (C, D, F, G & A) written on the keys with a blue whiteboard pen. The sequencer template differed slightly from that on the worksheet in that there were three 'Your tune' tracks. A percussion track was also provided, which provided a rhythmic framework (see music example 29):



Music example 29 - Study 2, lesson 1, the percussion track

Each of the 'Your tune' tracks was set up to produce a glockenspiel sound. A 4-bar recording was then made, using the notes previously marked on the keyboard to model the task (see fig. 53):

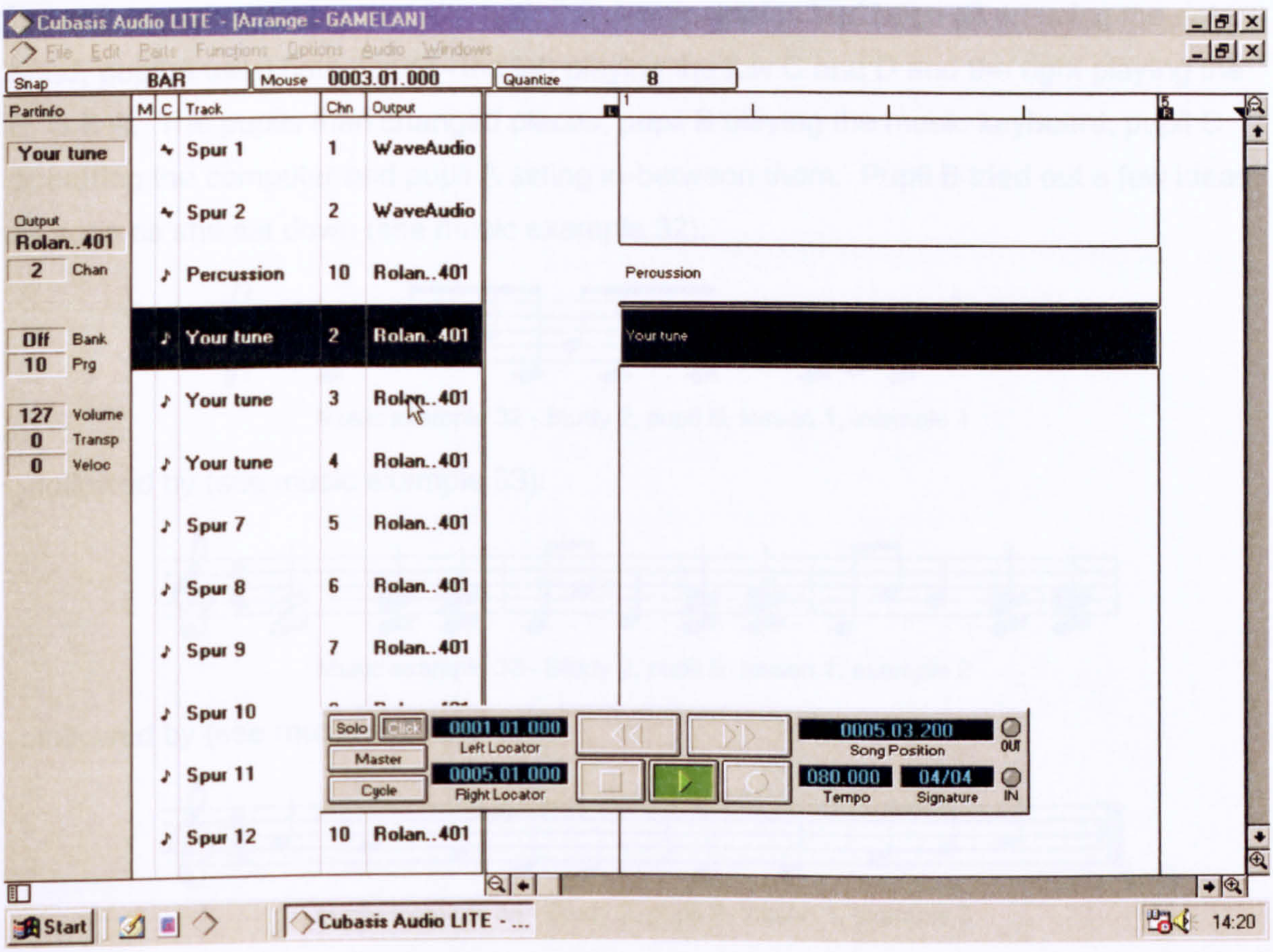


Figure 53 - Study 2, lesson 1, sequencer template

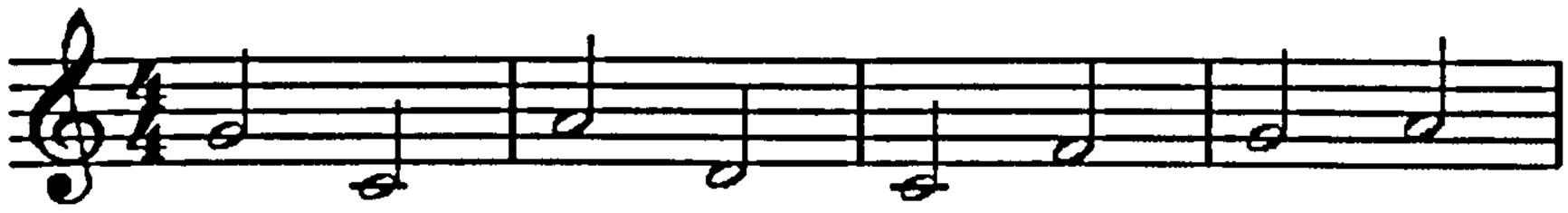
The music played in the model is notated below (see music example 30):

Music example 30 - Study 2, lesson 1, the provided model

After checking there were no more questions, the pupils then continued with their practical work.

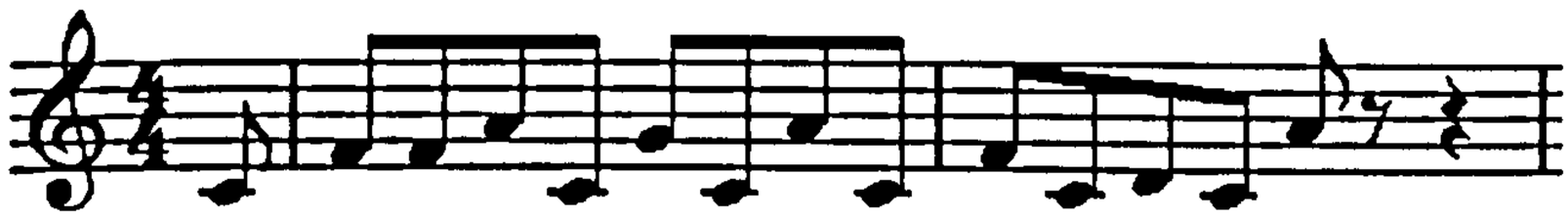
Analysis of how the observed group transformed these designs - study 2, lesson 1

The pupils got on with this task immediately, pupil A sitting at the music keyboard, pupil B sitting in the middle and pupil C operating the computer. Pupil A was the first to experiment with a 4-bar phrase at the music keyboard (see music example 31):



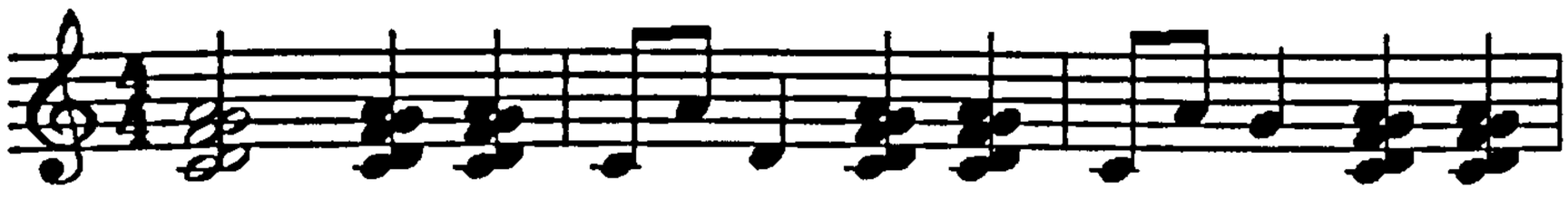
Music example 31 - Study 2, pupil A, lesson 1, example 1

It was interesting to note that although the demonstration had been given using the right hand, pupil A used both hands - the left playing the low C and D and the right playing the F, G & A. The pupils then changed places, pupil B playing the music keyboard, pupil C operating the computer and pupil A sitting in-between them. Pupil B tried out a few ideas as soon as she sat down (see music example 32):



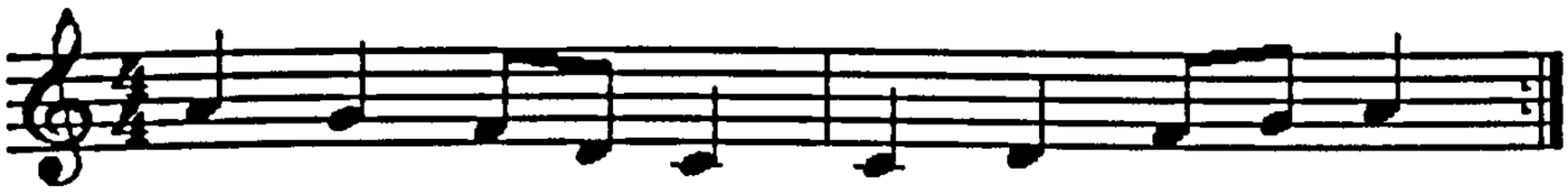
Music example 32 - Study 2, pupil B, lesson 1, example 1

...followed by (see music example 33):



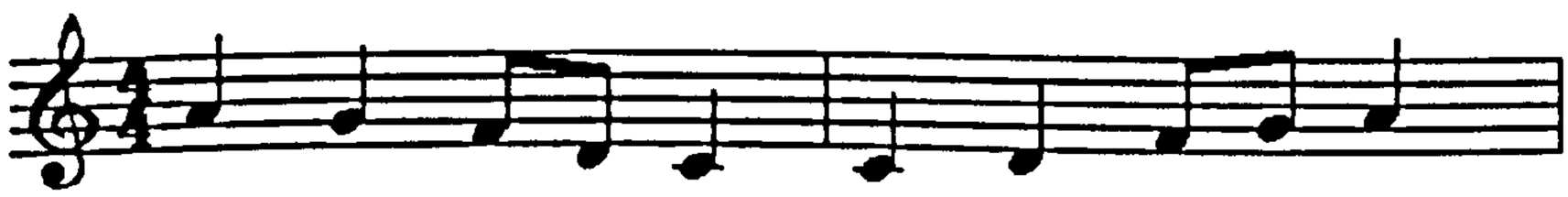
Music example 33 - Study 2, pupil B, lesson 1, example 2

...followed by (see music example 34):



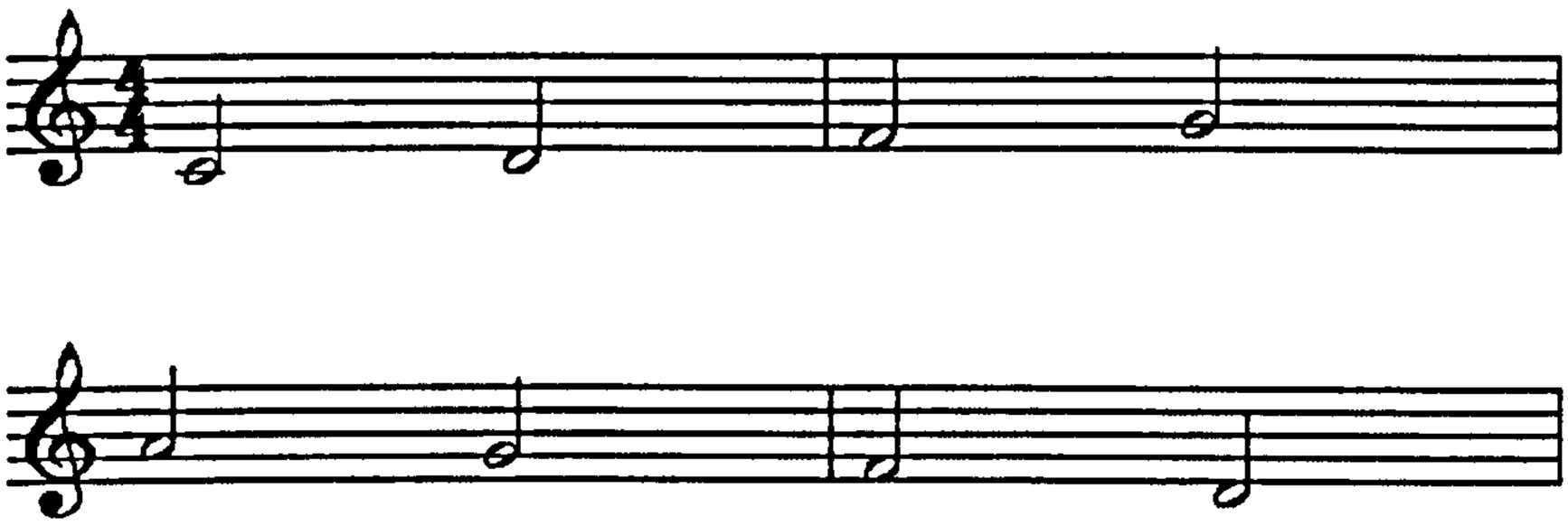
Music example 34 - Study 2, pupil B, lesson 1, example 3

Pupil B then asked pupil A to play the backing track while she practised and then asked him to record her playing (see music example 35):



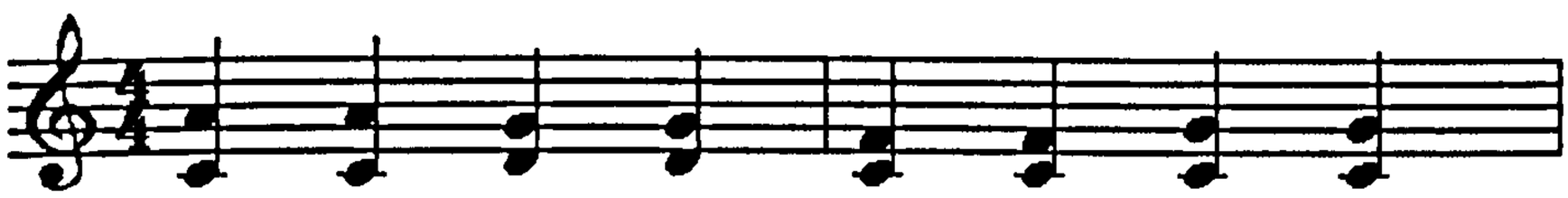
Music example 35 - Study 2, pupil B, lesson 1, example 4

She is then reminded by pupil C that there ought to be 2 beats to each note. She then recorded the following (see music example 36):



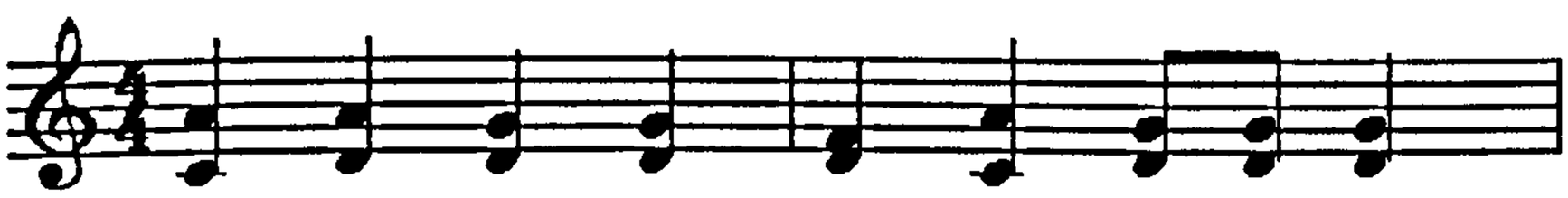
Music example 36 - Study 2, pupil B, lesson 1, example 5

Pupils B and C then changed places, so that pupil C could play the music keyboard. Pupil C initially experimented with a two note phrase (see music example 37):



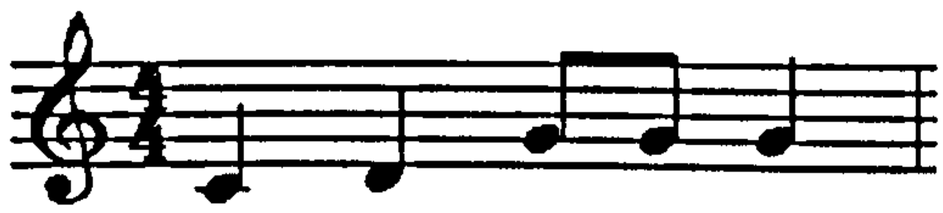
Music example 37 - Study 2, pupil C, lesson 1, example 1

...and then with a modified version (see music example 38):



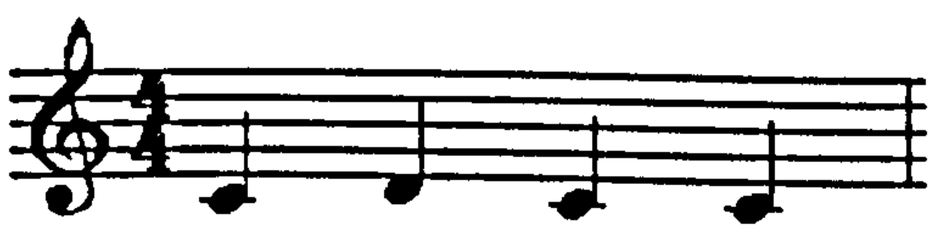
Music example 38 - Study 2, pupil C, lesson 1, example 2

She started to record (see music example 39):



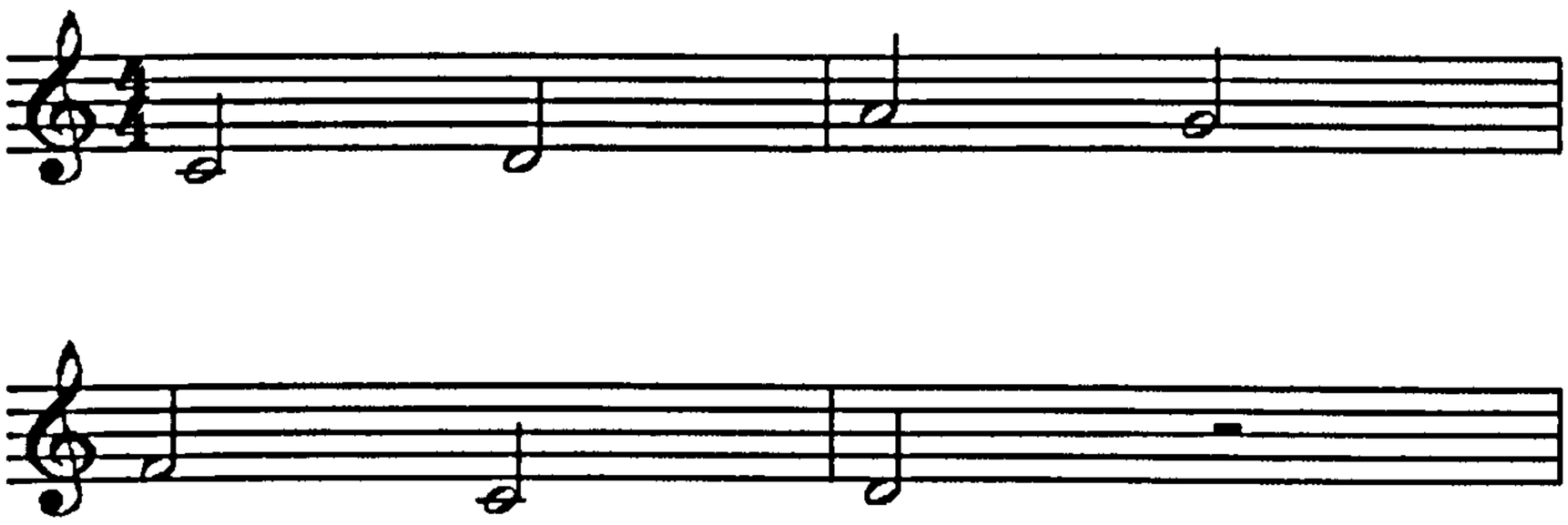
Music example 39 - Study 2, pupil C, lesson 1, example 3

She was stopped by the other two pupils in her group who explained that each note should be two beats long. She then played the following (see music example 40):



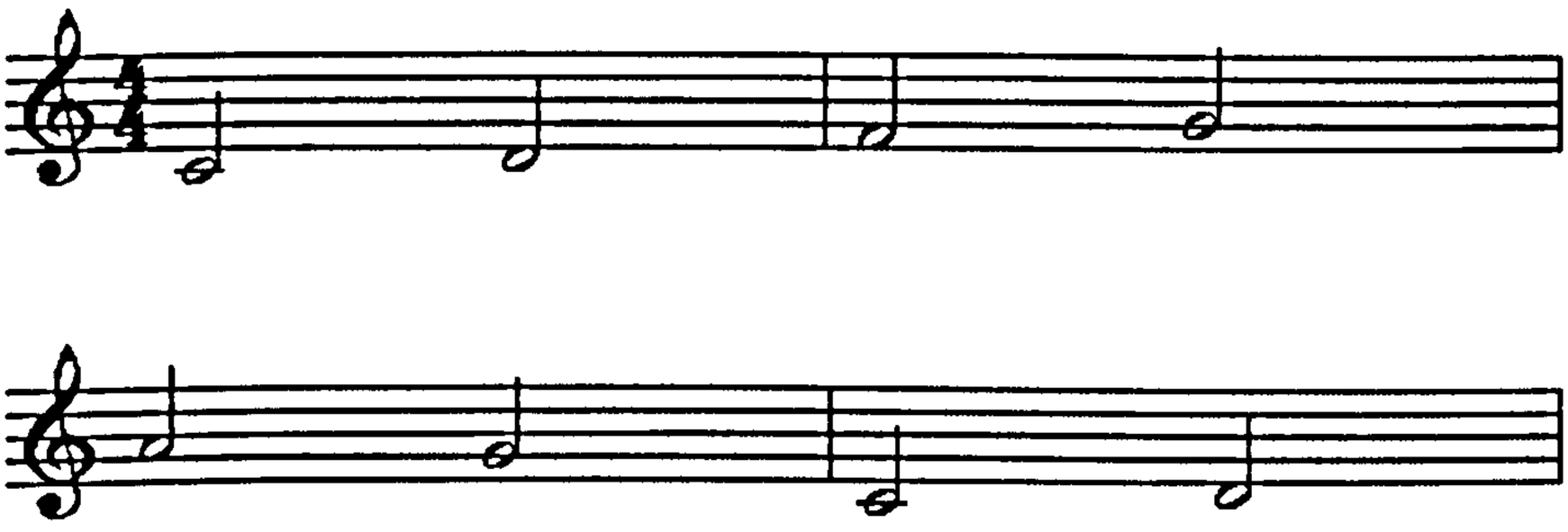
Music example 40 - Study 2, pupil C, lesson 1, example 4

She then practised (with pupil B counting the two-beat notes for her - see music example 41):



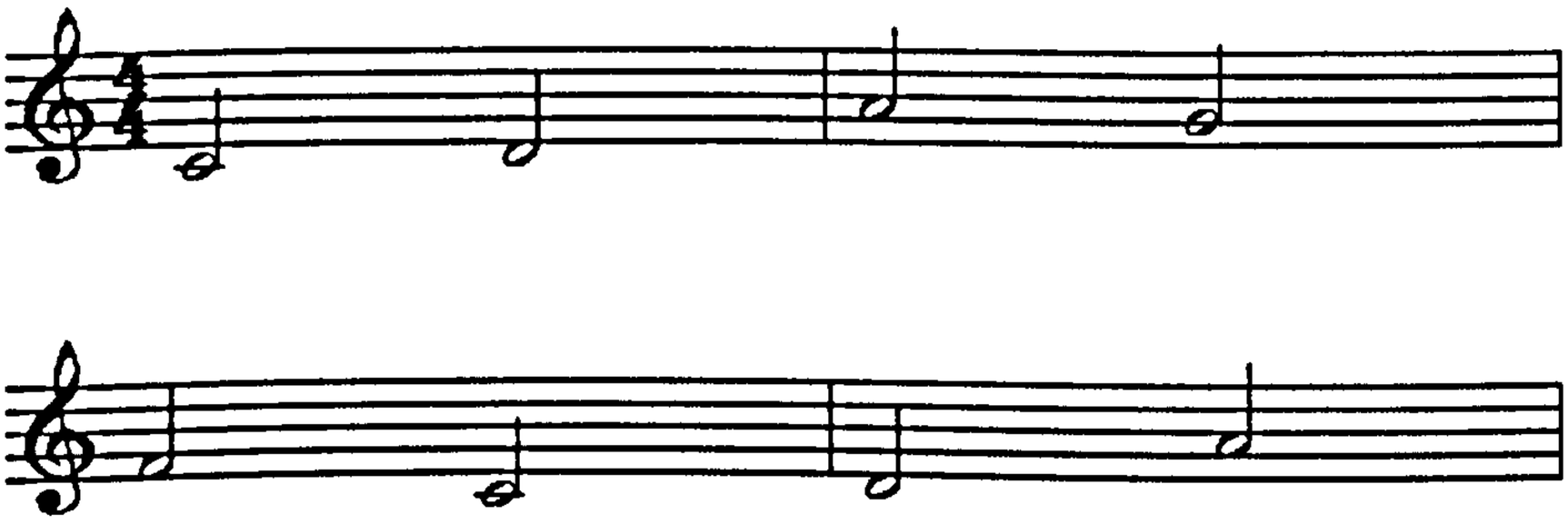
Music example 41 - Study 2, pupil C, lesson 1, example 5

After 3 false starts, she recorded the following (see music example 42):



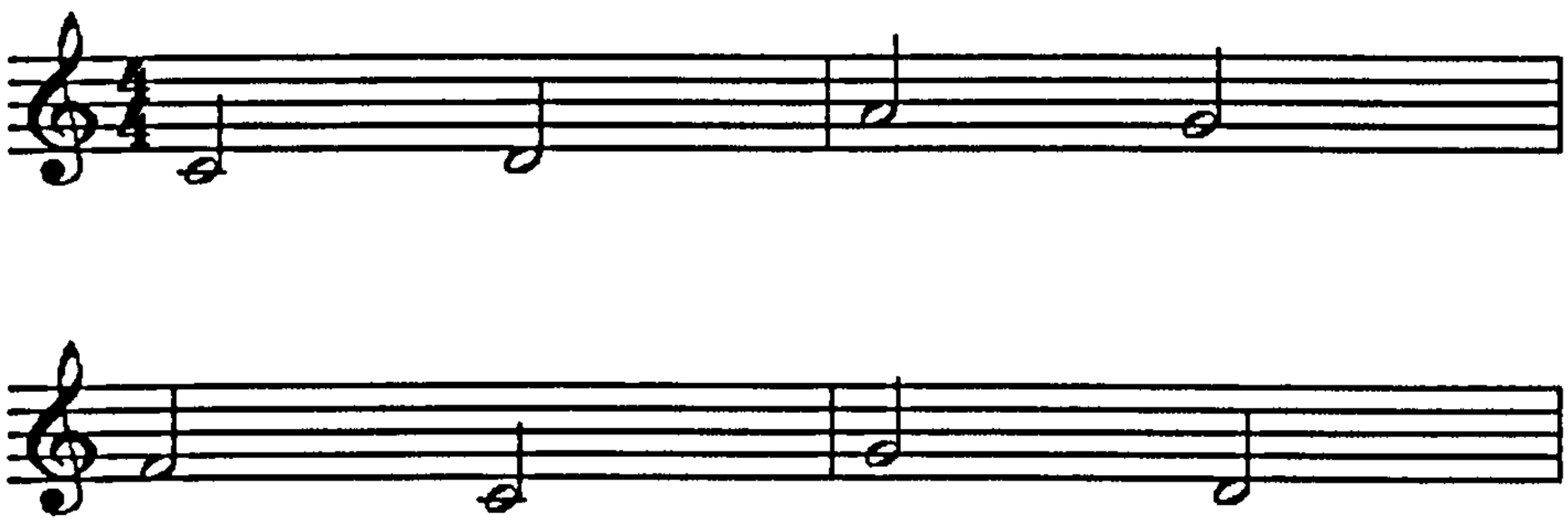
Music example 42 - Study 2, pupil C, lesson 1, example 6

She was seemingly not happy with this, so she then recorded the following, erasing the previous recording (see music example 43):



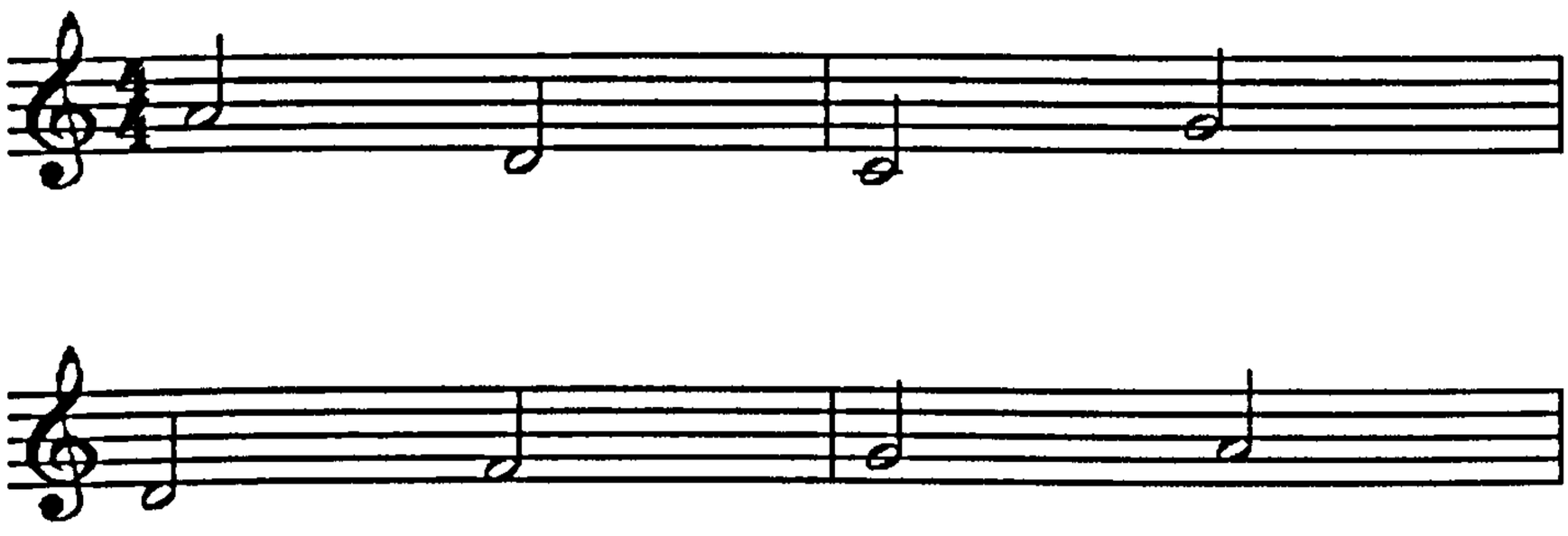
Music example 43 - Study 2, pupil C, lesson 1, example 7

Again, she was not happy when it was played back, so she then recorded the following (see music example 44):



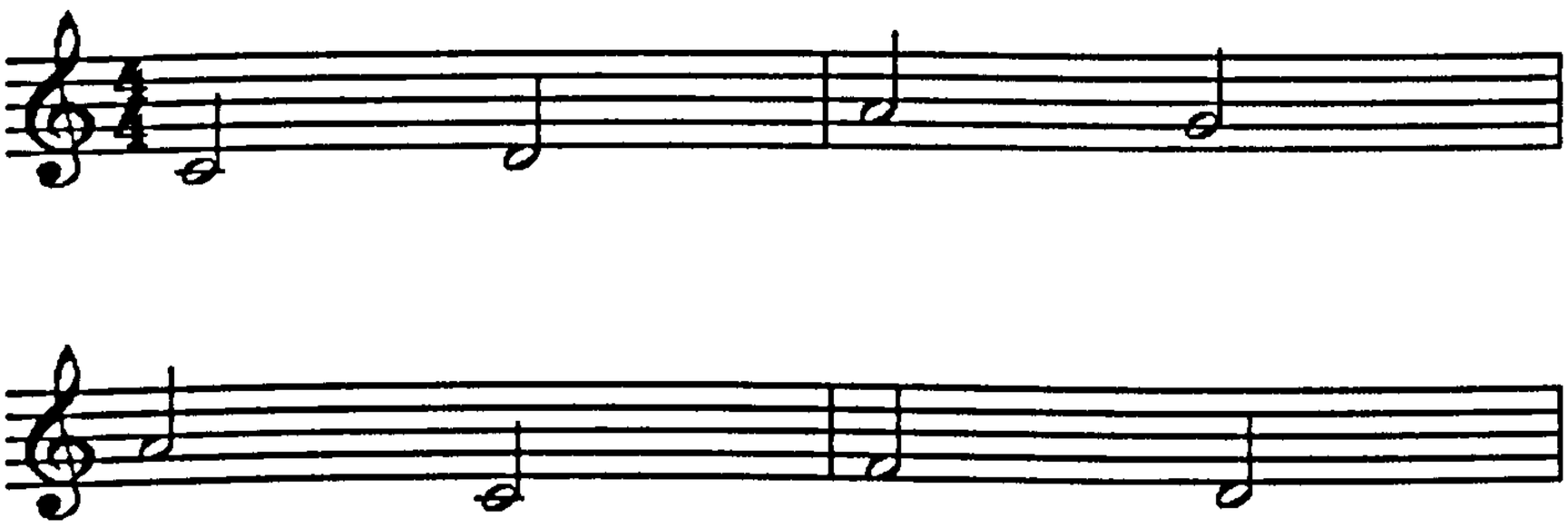
Music example 44 - Study 2, pupil C, lesson 1, example 8

Pupil A then sat in the music keyboard seat, pupil C stood up behind the other two pupils and pupil B operated the computer. Pupil A experimented with the following (see music example 45):



Music example 45 - Study 2, pupil A, lesson 1, example 2

... before recording this (see music example 46):



Music example 46 - Study 2, pupil A, lesson 1, example 3

This was the last recording made in this lesson by this group.

A multimodal consideration of the musical transformations - study 2, lesson 1

The seating positions of the pupils is shown here related to their roles as described in section 7.1 (see fig. 54):

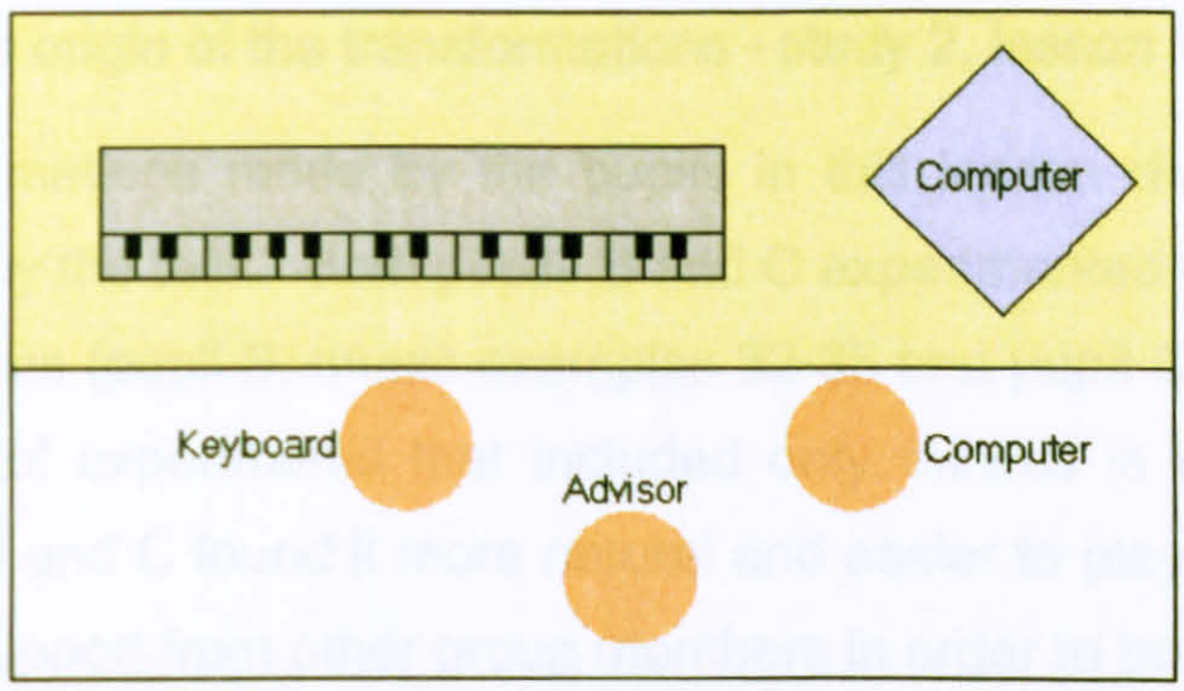


Figure 54 - Study 2, pupil seating diagram

The roles of the pupils had been considered at the time of the lesson design and ran through the design of the whole project and its associated resources. Consequently, the sequencer template had 3 tracks labelled - one for each pupil, so that they they were all required to compose using the music keyboard. Also, all had to operate the computer, with the aim of giving them experience in manipulating musical data with this tool, as well as acting in the role of a 'musical advisor', taking an overview of the process and giving suggestions as needed. The concern in this analysis is to ascertain how equitably these roles were distributed in practice; the following table lists how many times pupils experimented at the music keyboard before recording and the overall time taken by each (see table 7):

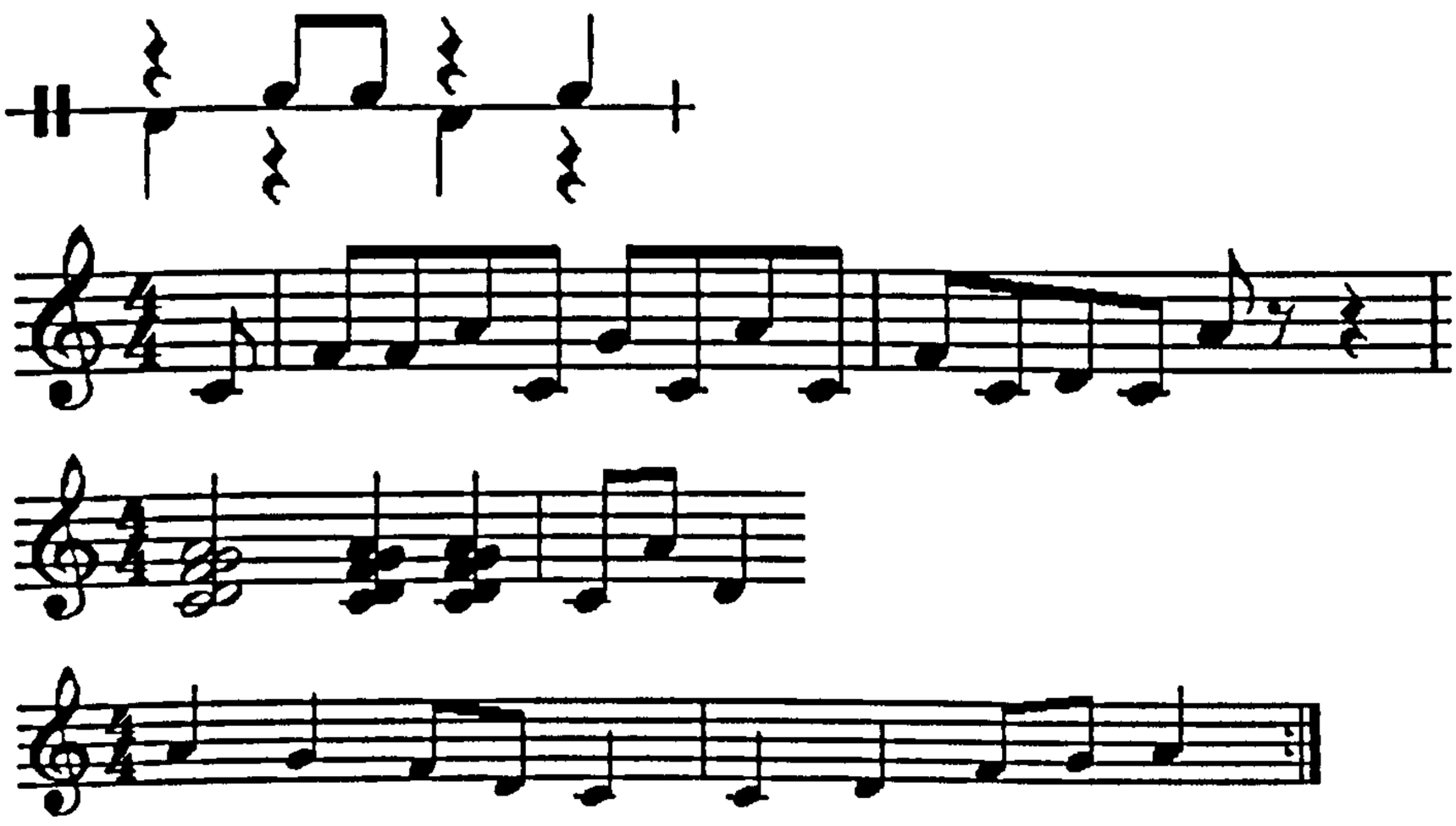
Pupil	Total time spent at the music keyboard	Experiments	Recordings
A	5 mins 16 secs	2	1
B	2 mins 51secs	3	2
C	4 mins 36 secs	4	4

Table 7 - Study 2, total time and number of experiments and recordings (lesson 1)

This table shows that there was no connection in this lesson between the overall time spent at the music keyboard and the number of experiments and recordings. It is also noteworthy that the pupils spoke to each other almost continuously, except when one of the pupils was playing the keyboard for a recording, and was focused on this task; the other pupils appeared to realise that the pupil playing would need to concentrate on their recording and did not interrupt them.

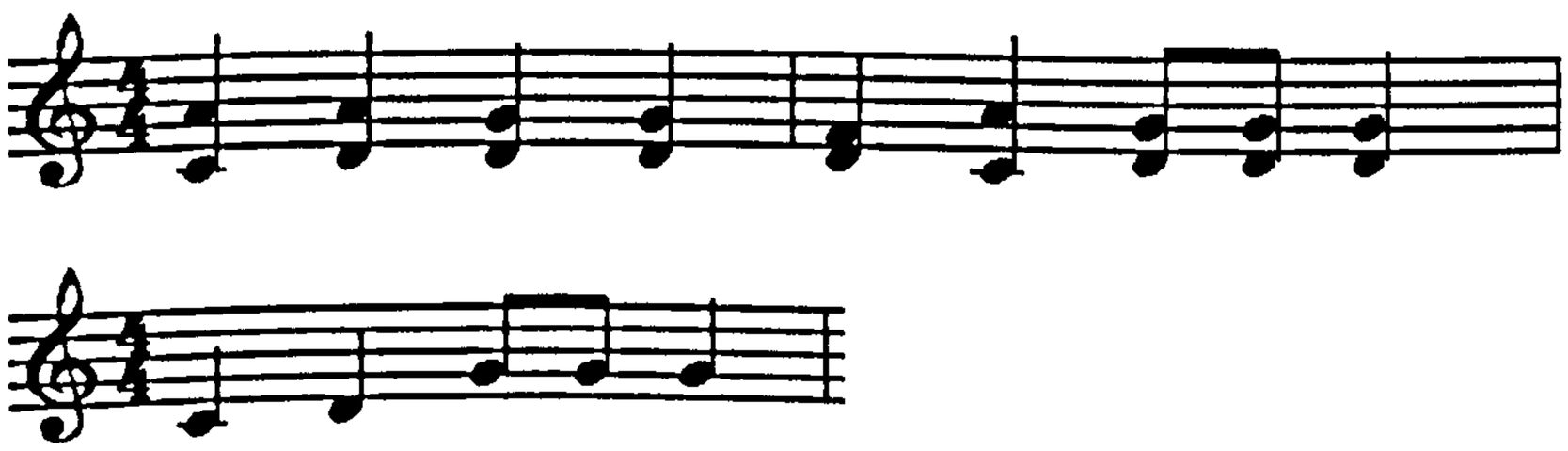
A consideration of the origin of the transformations - study 2, lesson 1

Many of the transformations made by the pupils in this lesson did not use exclusively minims, as required by the task. Both pupils B and C experimented with ideas that used a variety of other rhythms (pupil B, music examples 32-35 and pupil C, music examples 37-40). If the number of experiments that included only minims is taken into account, it appears that pupils B and C found it more natural and easier to play their own rhythms as they often required support from other group members in order to be able to play melodies consisting of minims only. They played a variety of rhythms that did not originate from the written or modelled (played) elements provided by the teacher, but could perhaps have been influenced by the backing drum rhythm (see music example 29) where quavers were used on the 2nd beat. To illustrate this possible link, the next music example shows the drum rhythm and the quaver rhythms used by pupil B together (see music example 47):



Music example 47 - Study 2, lesson 1, the accompanying percussion rhythm and quaver development by pupil B

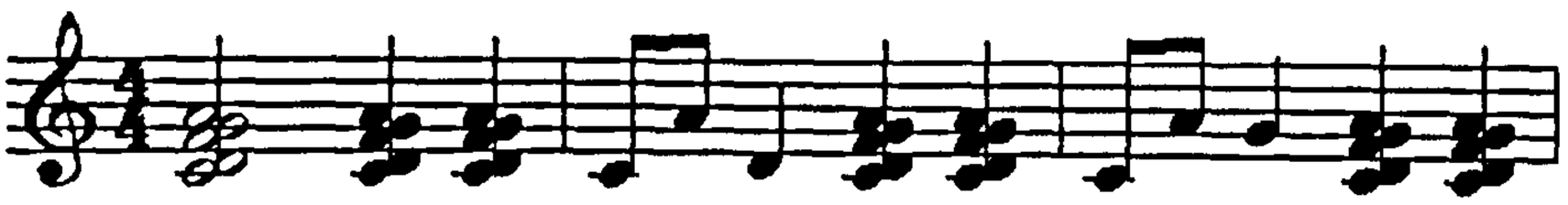
Pupil C also developed the quaver rhythm (see music example 48):

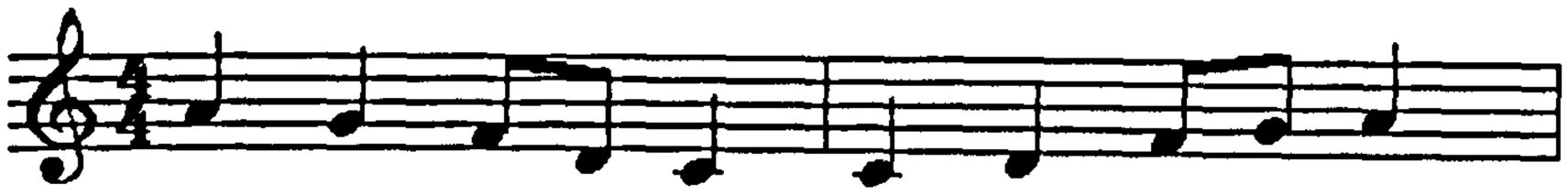


Music example 48 - Study 2, lesson 1, quaver development by pupil C

Another aspect of development of the music perhaps not planned for in the lesson design was the use of more than one note at a time (or chords). Both pupils B and C demonstrated this during their experimentation (see music examples 49 & 50):

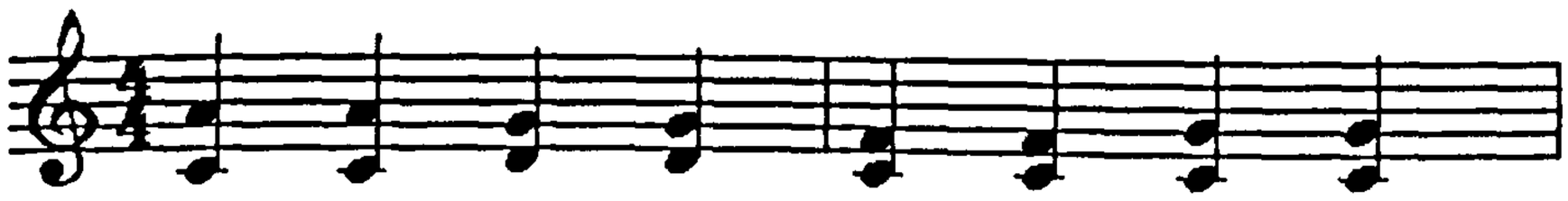
Pupil B:

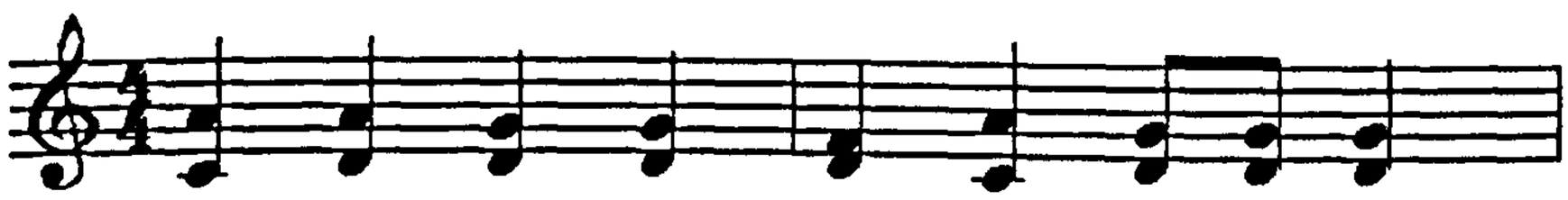




Music example 49 - Study 2, lesson 1, use of chords by pupil B

Pupil C:





Music example 50 - Study 2, lesson 1, use of chords by pupil C

The melodic shape of the minim melodies varied widely, from those that progressed by step (see music example 36, pupil B), to those that progress almost by step (music example 42, pupil C) and those that feature leaps of a 5th (see music example 45, pupil A). No particular shape is adopted completely by any specific pupil; they all use elements of 'step' and 'leap' melodic contours. However, it was noted that pupil A used both hands to play the three examples, which might account for the greater use of leaps in the playing (see examples 31, 45 and 46).

7.4.2 Study 2, lesson 2

The teacher's available designs - study 2, lesson 2

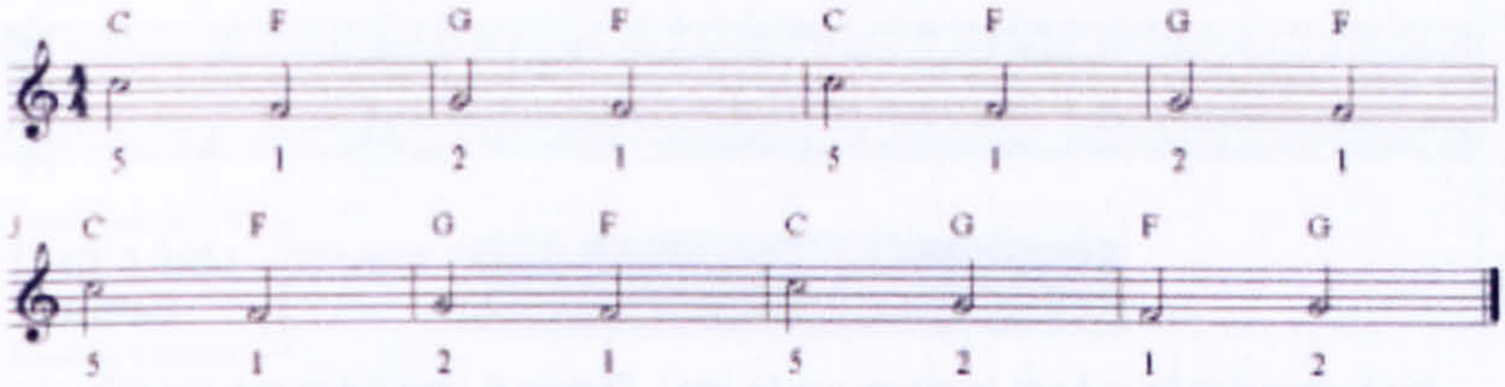
Initially, the worksheets were given out (see figs.55 & 56), the notes having been written on the keys of the music keyboard as in lesson 1.

Cyclic Patterns

29th September

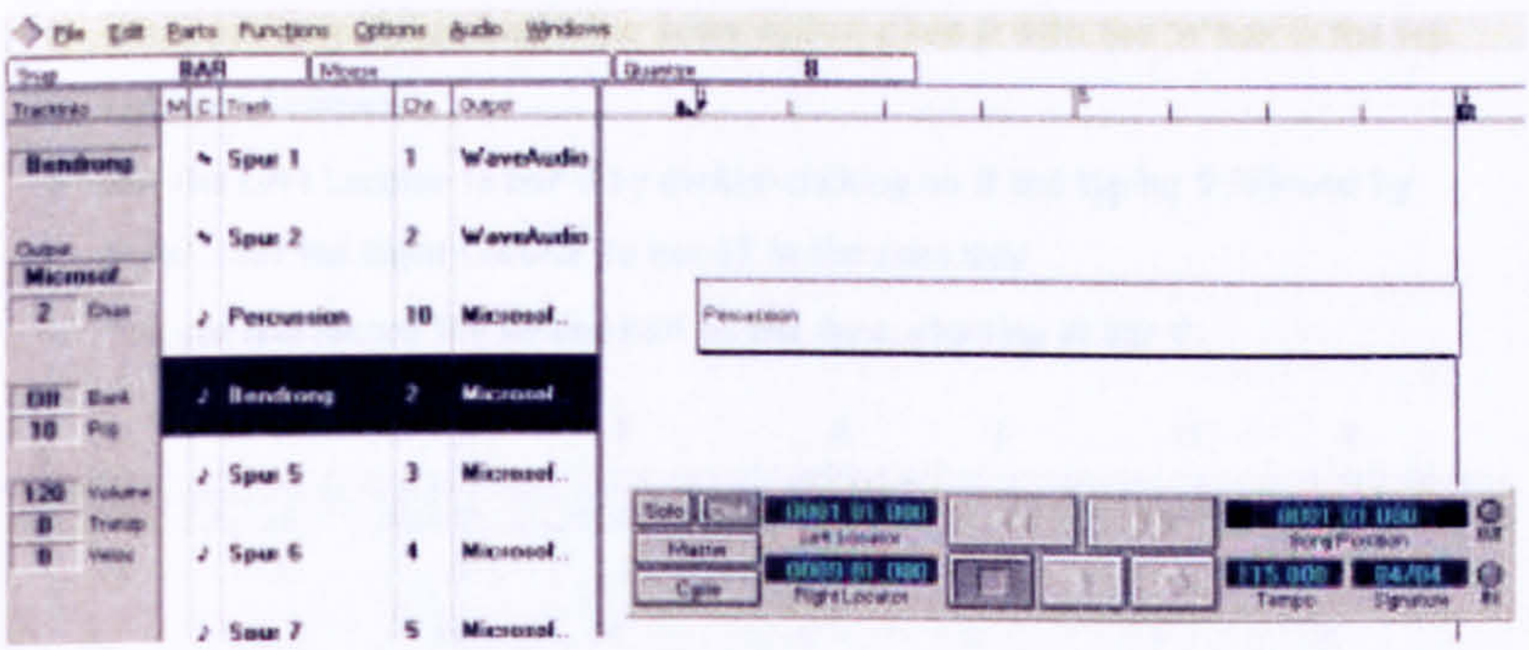
WORKSHEET

You are to play and record the Melody for the Gamelan tune 'Bendrong'. The notes you will need are marked on the keyboard. Here is the music for the first half:



What is the name of the note that lasts for 2 clicks?

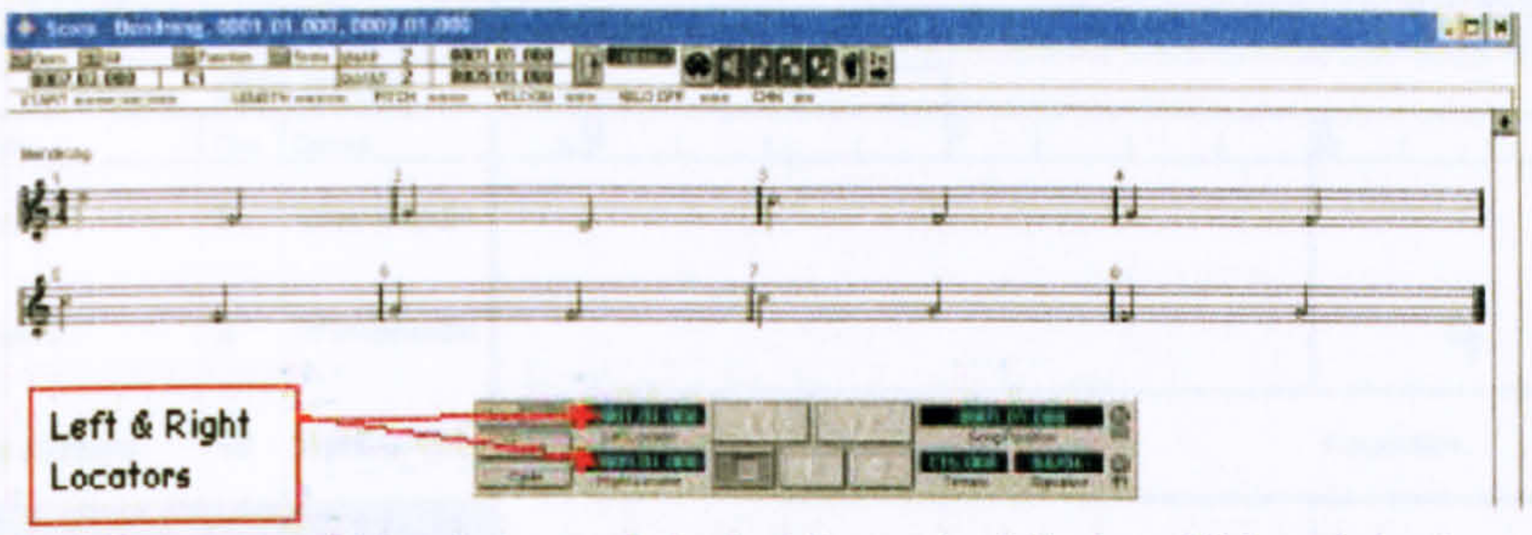
The file 'bendrong.all' should be already loaded onto your computer:



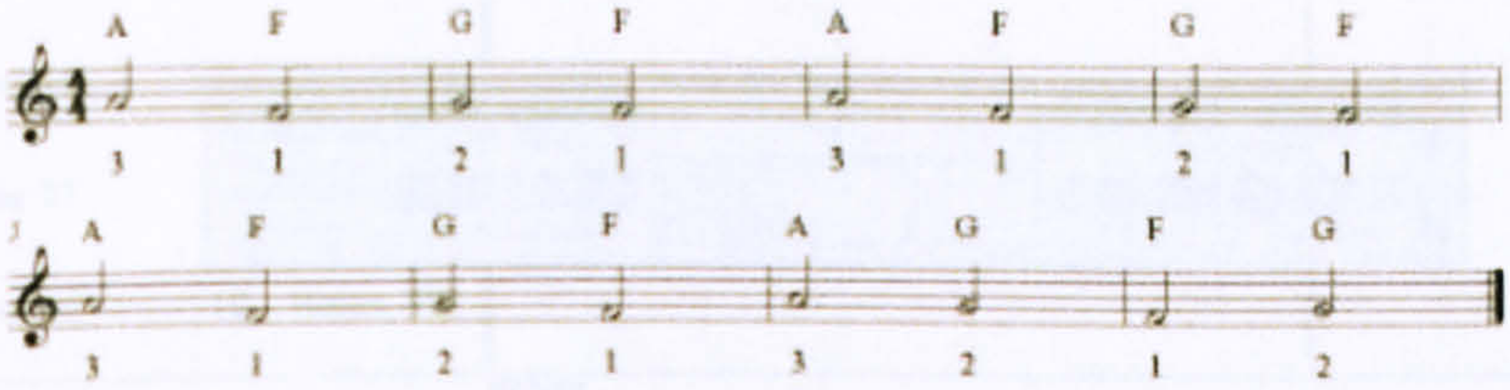
- Select the track 'Bendrong' (it will go black). Check the click is on
- Practise the tune on the keyboard
- When you are happy with it, click 'record'. You will hear 8 clicks and then you should play the tune
- Go back to the start of the music and listen to the tune. Is it in time? Do all the notes last for 2 clicks? Are all the notes correct?

Figure 55 - Study 2, lesson 2, worksheet page 1

- Go back to the start of the music and listen to the tune. Is it in time? Do all the notes last for 2 clicks? Are all the notes correct?
- If one or two notes are wrong, go to the Edit menu and select 'Score'. A screen like this will appear:



- Can you see which note is wrong? Look at the music at the top of this worksheet carefully to see which one it is
- To change a note, click and hold on it. Drag it up or down to change its pitch.
- When you have finished with the score editor, close it with the 'x' box in the top right-hand corner.
- Set the Left Locator to bar 9 by double-clicking on it and typing 9 followed by Enter. Set the Right Locator to bar 17 in the same way
- You can now record the second half of the tune, starting at bar 9:



Play the second half of the tune to listen to. Do you need to edit it?

- Save your work

Figure 56 - Study 2, lesson 2, worksheet page 2

This lesson linked directly with the commercial music unit of work currently being studied[1], from which this gamelan tune was taken. The task was concerned with playing the two tunes accurately and using the technology to edit any incorrect notes, thereby negating the need to re-record the whole tune again. The introduction to this lesson followed the same pattern as lesson 1; teacher read-through and questions on the worksheet; demonstration of the task using the computer music workstation; any final questions before practical work begins. Each tune was modelled in turn, as well as the computer-related technical skill of re-setting the left and right locators in order to record the second tune. The score editor was used (the template was set up so that double-clicking on a part invoked this editor) to correct the pitches of notes, but a demonstration was not provided

that showed how to correct rhythmic inaccuracies, possibly owing to the inherent complexity of this.

As illustrated in the worksheet, the sequencer template was already set up on the computer workstations (see fig. 57):

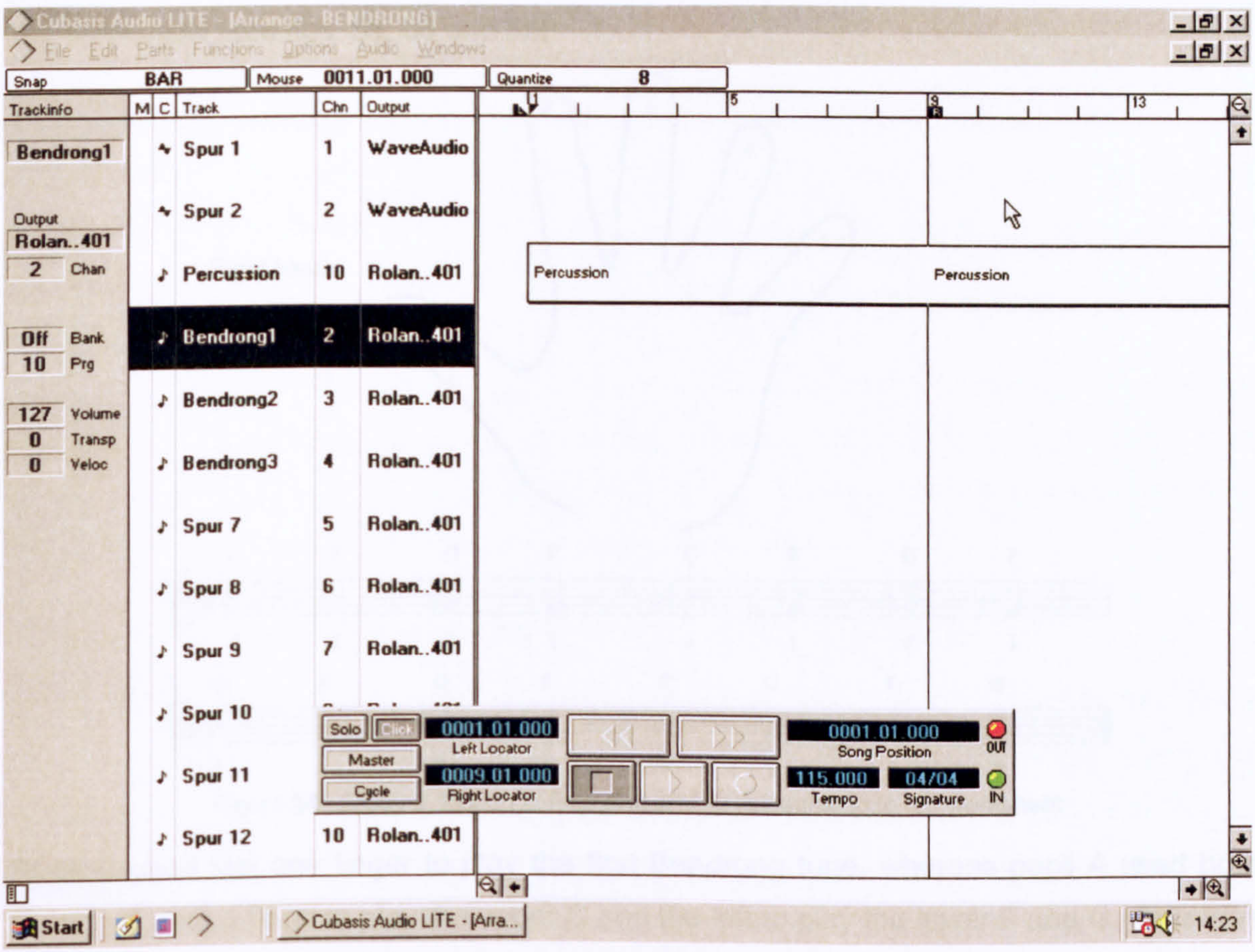


Figure 57 - Study 2, sequencer template for lesson 2

As in lesson 1, there was a percussion part provided (see music example 29) in addition to three labelled tracks, one for each pupil labelled 'Bendrong1', 'Bendrong2' and 'Bendrong3'. The left and right locators were set up in readiness to record the first tune (Bars 1 and 9). The three tracks have also been set up in the template to play the glockenspiel sound, appropriate to the gamelan genre.

Analysis of how the observed group transformed these designs - study 2, lesson 2

There was no required transformation by the pupils of the rhythmic or melodic material in this lesson, and the activities were constrained in order to prevent the pupils experimenting with new musical material in order to focus their attention on the performing aspects. In terms of the pupils realising the Bendrong tune as the teacher had intended, all pupils achieved the aim of the lesson.

A multimodal consideration of the musical transformations - study 2, lesson 2

An interesting aspect of this lesson was the keyboard fingering adopted by the pupils, in that it did not follow the model provided by the teacher earlier in the lesson. The model was provided using traditional keyboard fingering, and this was written under the notes on the worksheet (see figs. 55, 56 and 58):

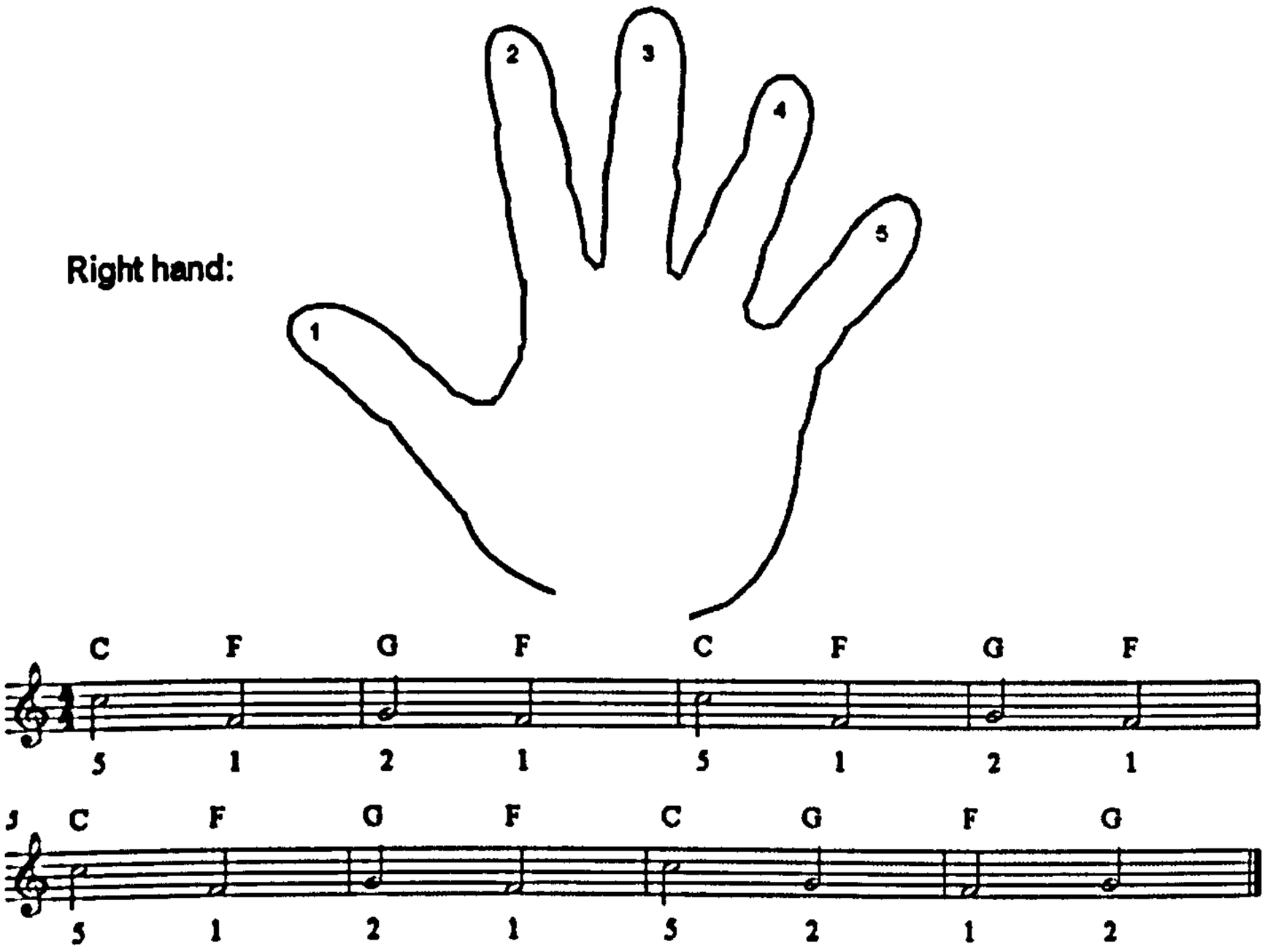


Figure 58 - Study 2, lesson 2, fingering and its relationship to the worksheet

Pupil C used just one finger to play the first Bendrong tune, whereas pupil A used both hands - the right hand to play the upper C and the left to play the lower F and G. This was noted by pupil B, sitting to his left, who showed him briefly how to spread the right hand and use the fingers independently to play the various notes, even though she did not do this herself. When pupil B played the tune, she followed pupil A's example using both hands. This transformation of the model given into a method of playing of their own design through the adoption of alternative fingering patterns is notable in connection with later lessons where this appeared to have a direct impact on the composing itself.

One problem that occurred during this lesson was that the pupils needed to look at the worksheet as they were playing rather than try to remember the 8-bar pattern; there was no music stand on the keyboard, so this presented a problem. One way they got around this was for the pupil currently in the role of advisor to hold the music up for the performing pupil to see; another was for this pupil to call out the note names. It was noted, however,

that the pupils eventually needed to have committed the 8 bars to memory before they could record it without any errors.

During the practical part of this lesson, the pupils' gaze followed similar patterns; the pupil at the computer looked at the screen at the start of the recording and then at the hands of the pupil that was playing, only stopping the recording when the pupil stopped playing. This shows the seeming importance of the visual connection with the actual performance, when, instead, the end of the recording could have been ascertained by listening or continuing to look at the computer screen and stopping the recording when the right locator position had been reached. The pupils playing the keyboard and in the advisor role also both watched the playing hands during the recording.
No editing was considered by the pupils; they preferred to play the 8 bars until they had performed it correctly in one go. It is perhaps notable that this took much longer than editing would have done as, in general, only 1 or 2 incorrect notes were played; perhaps the editing as demonstrated looked too complex to engage in.

A consideration of the origin of the transformations - study 2, lesson 2

In this lesson, the only observed available musical designs that were transformed were those provided by the classroom context. The pupils used the music computer workstation to achieve the required lesson outcomes but did not use the score editor as demonstrated by the teacher. The method of playing the keyboard was transformed into something that appeared to be manageable by the pupils, although it is not clear from where the observed techniques originated. It is particularly notable that although one group member demonstrated that she understood traditional fingering (the pre-study interview had revealed that she took piano lessons outside of school), she did not use it herself. The reason for this is not clear; perhaps she was unwilling to 'stand out' from her peers.

7.4.3 Study 2, lesson 3

The teacher's available designs- study 2, lesson 3

The worksheets were handed out at the start of the lesson (see figs. 59 & 60), the note names having been written on the keys of the music keyboards.

Cyclic Patterns

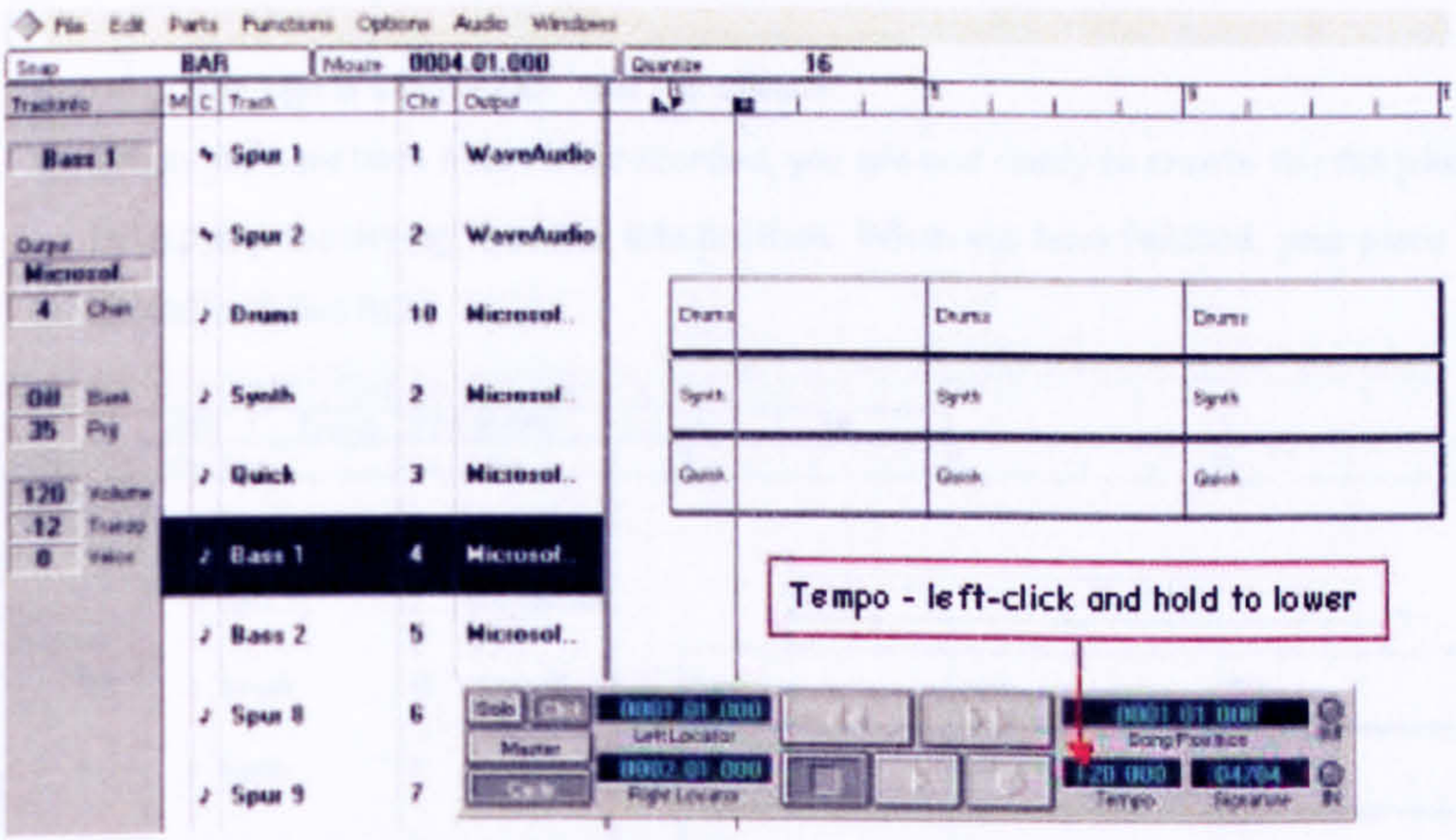
6th October

WORKSHEET

You are to play and record two short patterns of music that will form a bass part (this is the lowest part of the music). The notes you will need are A, G, E & D which are marked on the keyboard. Here is the music for the first pattern, or 'riff':

You will notice that the notes are joined with a line at the top - this tells you that they are quavers - this means they are worth half a click each. We will call this 'bass riff 1'

The file 'synth.all' should be already loaded onto your computer:



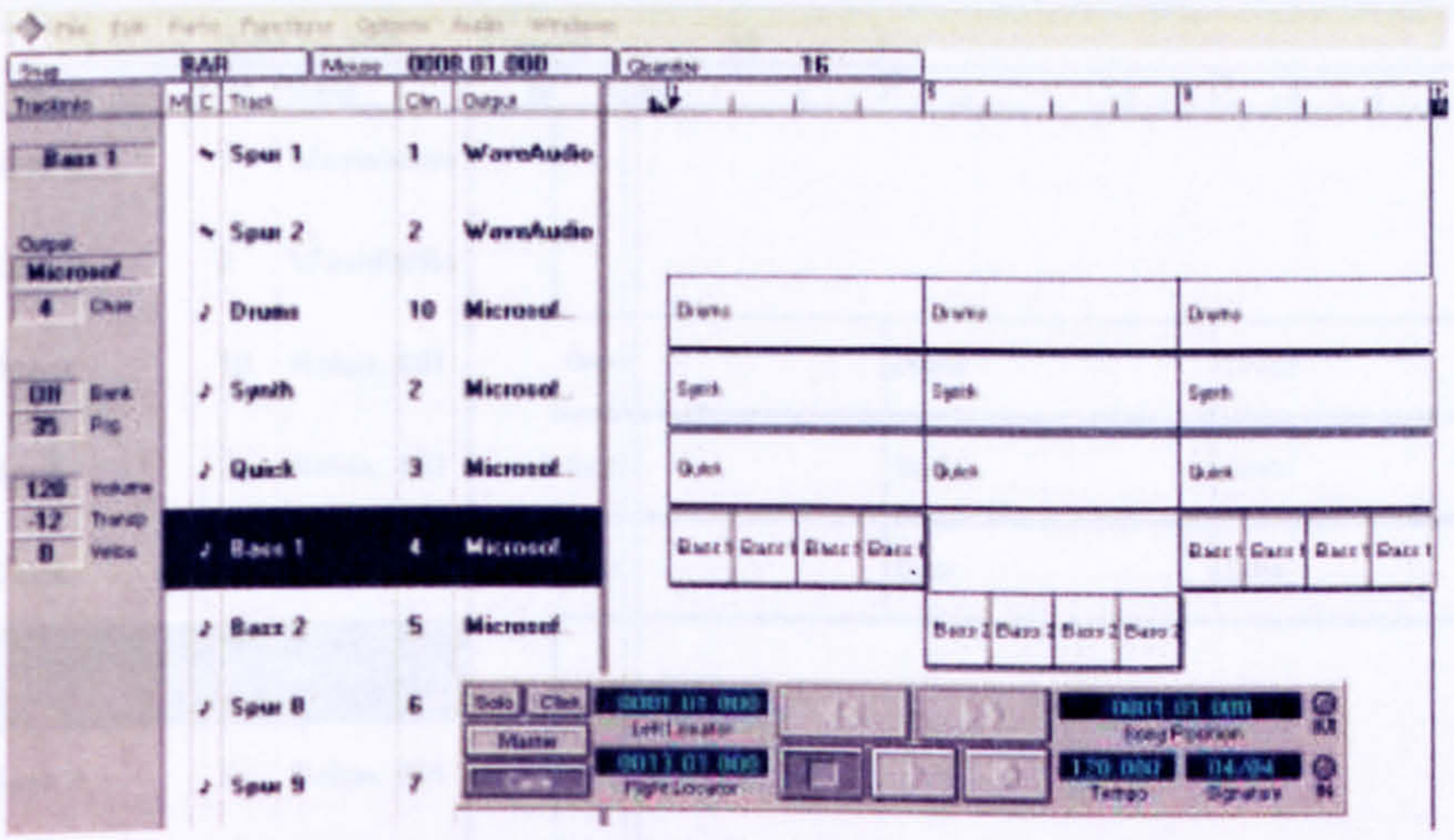
- Select the track 'Bass 1' (it will go black). Check the click is on
- Practise bass riff 1 on the keyboard
- To record it, you will need to lower the tempo, or slow down the speed of the music. To do this, left-click and hold on the green numbers just above the word 'Tempo'

Figure 59 - Study 2, lesson 3 worksheet page 1

(see the diagram above). Let the number go down to 80. You can also double-click the number, enter the new tempo and then press Enter

- When you are ready click 'record'. You will hear 8 clicks and then you should play the riff
- Go back to the start of the music and listen to the tune. Is it in time? Are all the notes correct?
- If one or two notes are wrong, you can edit them in the score editor, or delete the track and record it again
- When bass riff 1 is done, select the track labelled 'Bass 2' and record bass riff 2:

- 𝄾 - this sign is a half-click 'rest', or silence
- When you have both bass riffs recorded, you are now ready to create the full piece by copying and moving the riffs into position. When you have finished, your piece should look like this:



- This piece is an ABA structure - Bass 1 is the 'A' section and Bass 2 is the 'B' section
- Put the tempo back up to 120, & play the piece. Save your work

Figure 60 - Study 2, lesson 3, worksheet page 2

This lesson was the first of a series of three that used a backing track in a popular music style as the basis of an exploration of its various musical aspects. The particular aspect to be explored in this lesson was the bass part which would involve the groups in performing one bar of each 4-bar pattern followed by using the computer's copy and paste[2] function to create the whole pattern. The teacher explained this to the pupils and then showed the link between the first pattern (written on the worksheet on page 1 using note letter names - see figs. 59 and 60) and the notes on the keyboard, which had been written on the keys using a board marker. The rhythm was clapped by the pupils, modelled on the keyboard

by the teacher and then recorded, the teacher showing the pupils how to slow down the tempo to 80 bpm (beats per minute) to make playing in time to the backing track easier. The pupils were then shown how to copy and paste this one-bar pattern, or riff, to form the complete 4 bars. The first riff having been muted, the rhythm of the second bass riff was then clapped by the pupils, modelled by the teacher, recorded, moved into position and then copied and pasted by the teacher to form the second 4-bar pattern. The pupils were then shown how to create the third pattern by copying and pasting the first and finally the whole piece was played. The pupils were then asked if there were any questions and then the practical session started.

The sequencer template prepared for this lesson by the teacher had three tracks prepared: 'Drums', 'Synth' and 'Quick', with two labelled tracks for the pupils' bass parts (see fig. 61):

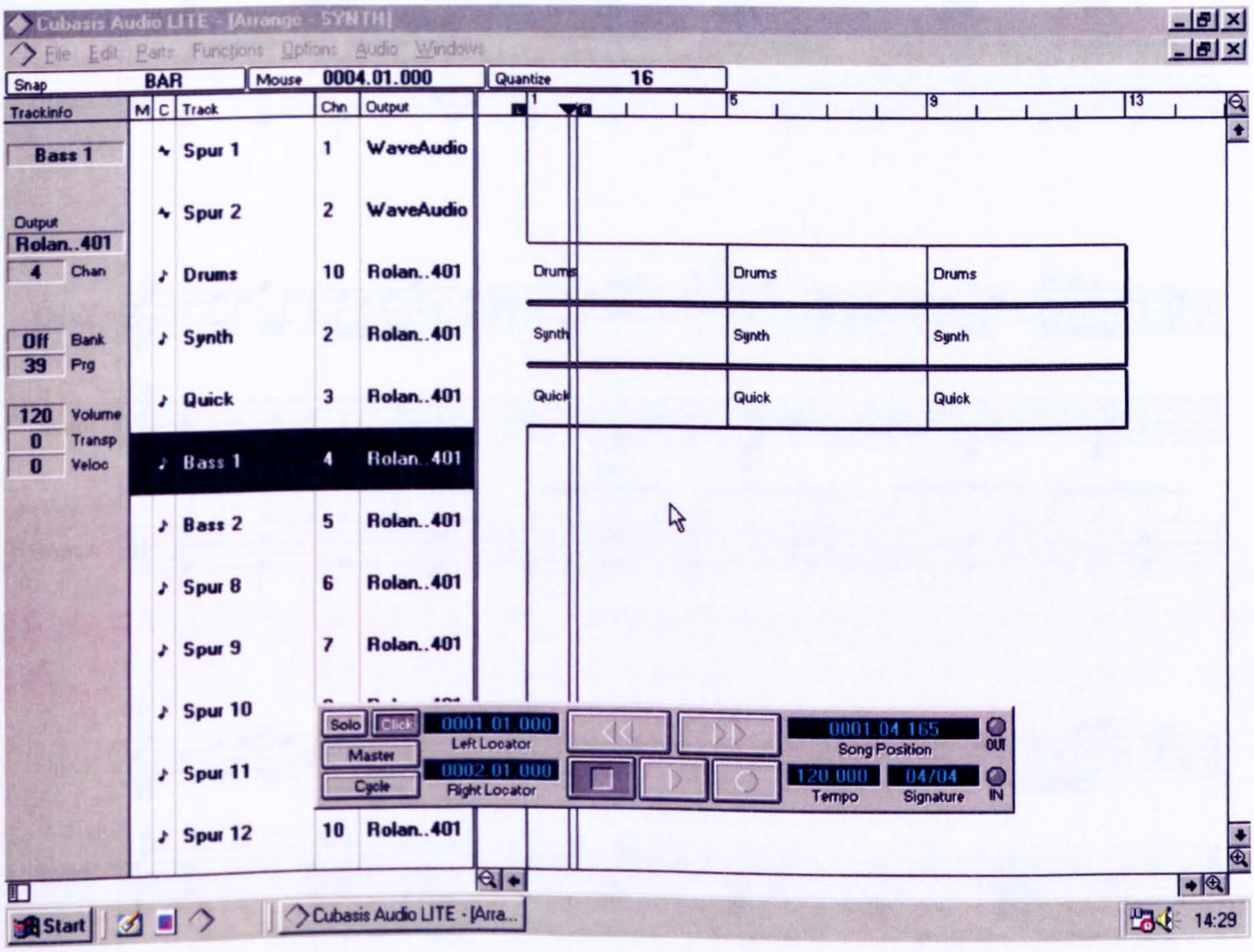


Figure 61 - Study 2, the sequencer template for lesson 3

Figure 62 is a notated score of the 'Drums', 'Synth' and 'Quick' tracks:

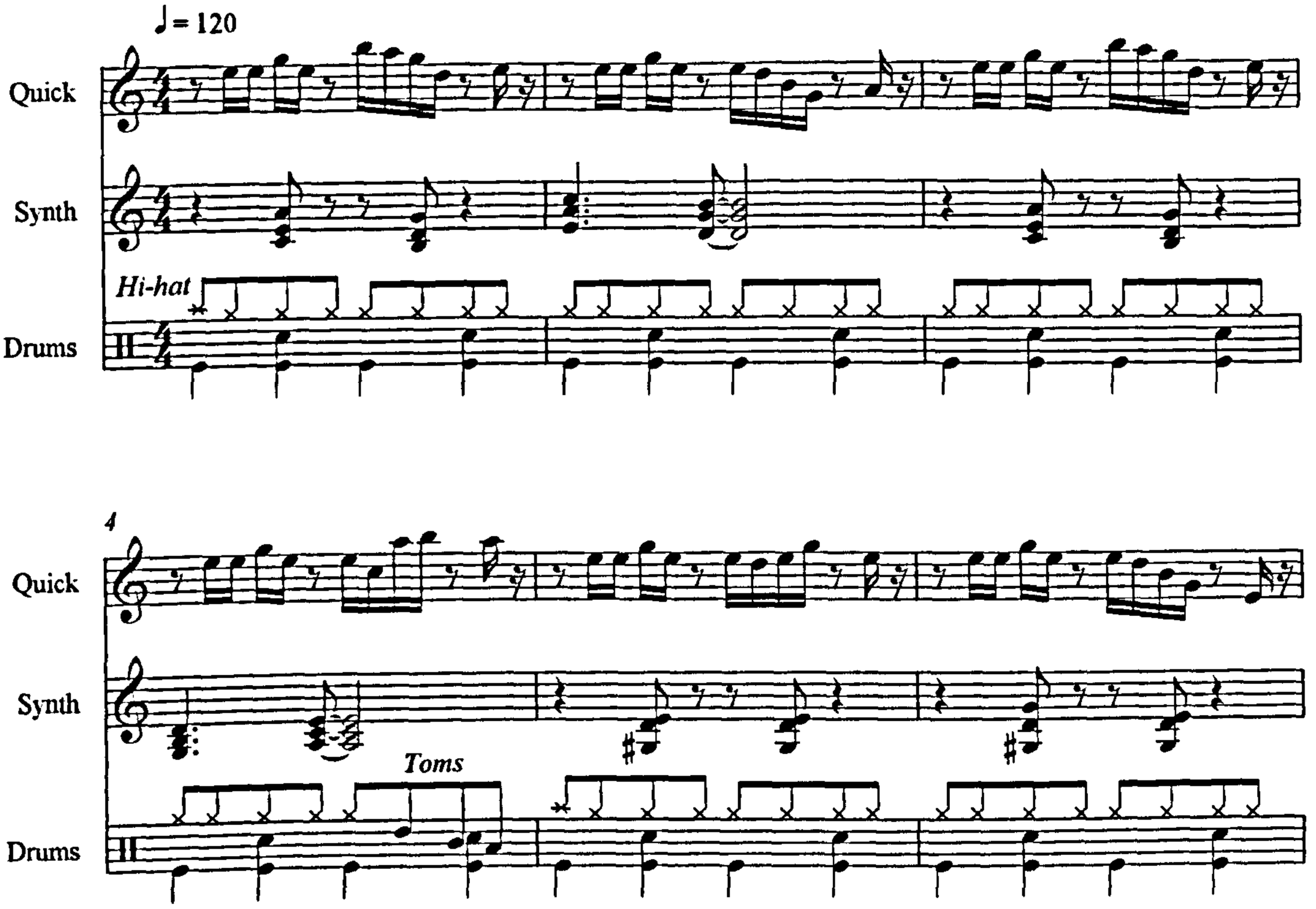
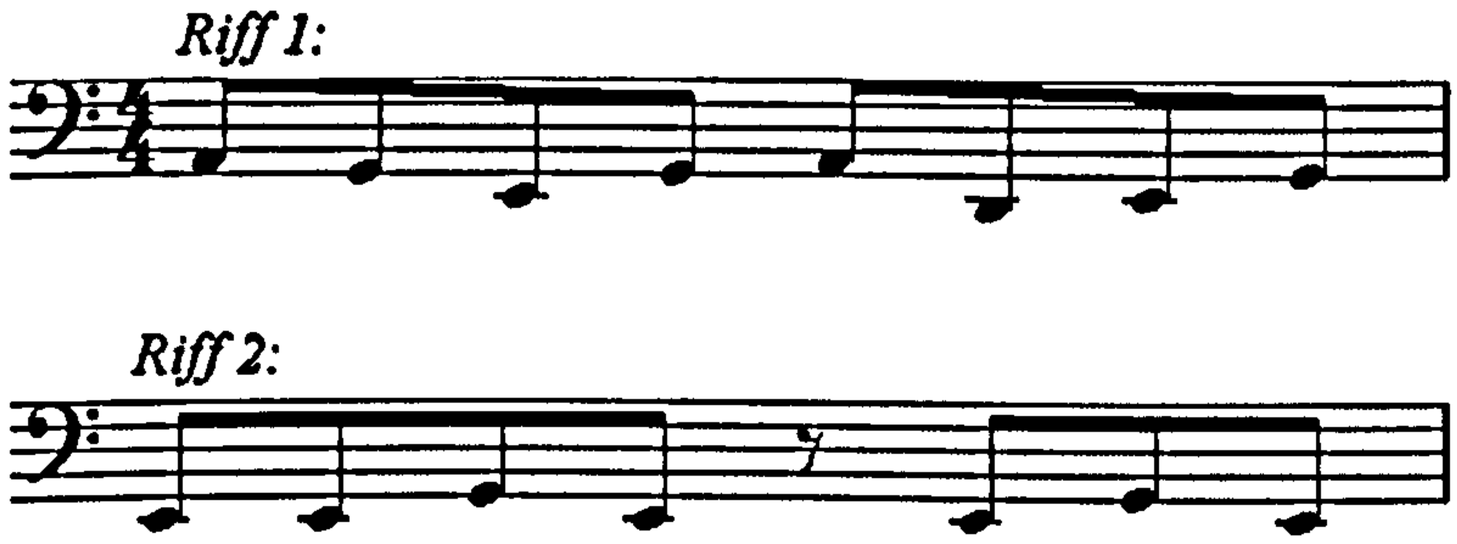


Figure 62 - Study 2, lesson 3, score of the sequenced tracks

The following features of the prepared backing track are notable, particularly for their possible influence on the pupils' later composing of melodic material in lesson 4 and drum parts in lesson 5:

- the quick decorative synth. part (top stave) is mixed well back in the backing track and so is not prominent as a melodic line. It consists entirely of semiquavers.
- the 'Synth' part (2nd stave) serves to establish the harmony. The odd-numbered bars are characterised by 2 chords that provide a 'punctuating' rhythm, the 2nd chord being syncopated. The even-numbered bars again contain a syncopated 2nd chord, the first being on the beat.
- The drum part (bottom stave) provides a steady 4/4 beat, with the snare on beats 2 and 4 and a quaver hi-hat rhythm with a tom fill at the end of each 4-bar phrase.

The bass riffs that the pupils played in this lesson can be seen notated in music example 51:



Music example 51 - Study 2, lesson 3, the 2 bass riffs to be played by the pupils

Analysis of how the observed group transformed these designs - study 2, lesson 3

Owing to absence from school, there were only two members of the observed group present for lesson 3. The opening of this lesson was concerned with pupil B practising riff 1 slowly on the keyboard. Pupil A, situated at the computer, played the backing track and danced to it and then slowed it down to the suggested 80 bpm (beats per minute). He then spent some time helping pupil B to make the link between the notes written on the worksheet and those written on the keyboard. After 3 minutes, pupil B demonstrated that he could play riff 1 at about 64 bpm: another ½ minute later and he could play it at 80 bpm. However, pupil A did not record pupil B's performance but instead suggested that he (pupil A) should try it on the music keyboard instead. He tried it for a short while and then moved back to the computer while pupil B resumed practising riff 1. At 5 minutes into the lesson, pupil A decided to "...see how fast I can make it". A pupil from the other group then joined pupil B at the keyboard and danced as pupil B played back the sequence at

250 bpm. Pupil B then started practising riff 1 again, as pupil A replayed the sequence at 250 bpm and danced to it himself. He then slowed the tempo down to 30 bpm and played back the sequence at this tempo while pupil B attempted to play the riff to the backing; however he appeared to find this too slow and stopped before he had finished it. There then ensued a discussion between pupils A and B about the merits of recording slowly and then playing back at the intended speed. As pupil A then tried to record pupil B's performance, he realised that '... it's not counting me in', indicating that the metronome click was not activated on the transport bar (see fig. 63):

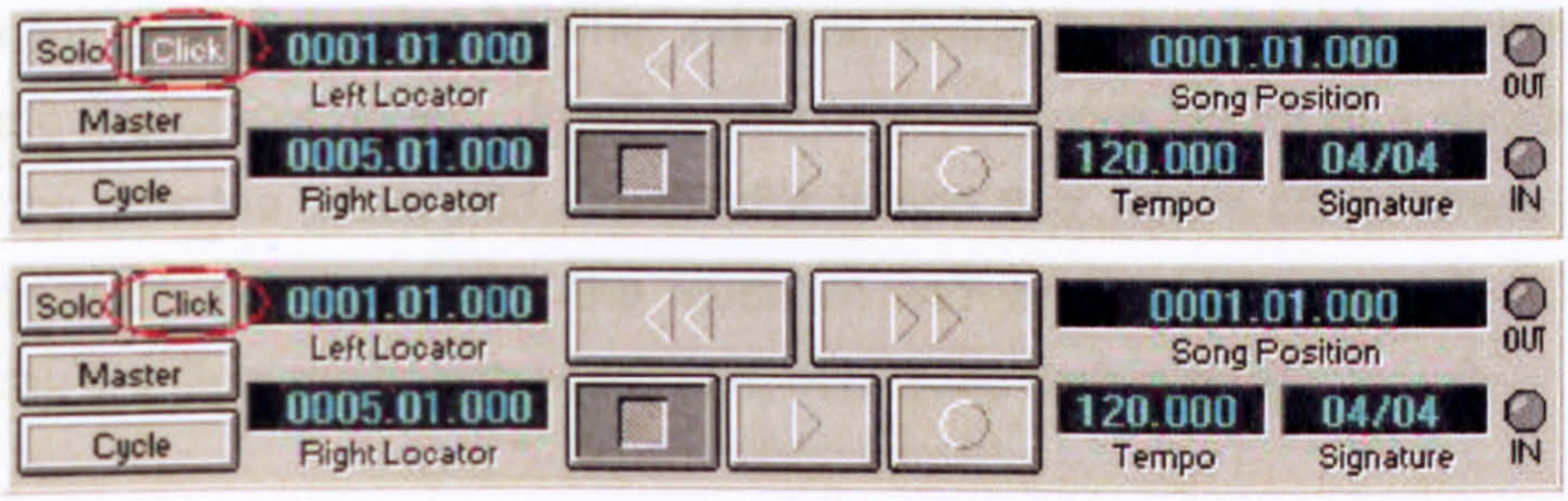


Figure 63 - Study 2, lesson 3, two views of the transport bar, the upper one showing the click activated, the lower de-activated

Pupil A then listened to pupil B practising riff 1 and increased the tempo to about the same as pupil B's tempo (now around 70 bpm). The researcher (myself - see chapter 5, section 5.2.2) then checked the metronome setting and activated the click. Several recordings were then tried and deleted. At 15 minutes, pupil A checked the latest recoding in the score editor, and possibly considering it not accurate enough, deleted it. A while was then spent attempting to record the riff at 30 bpm but, as before, pupil B was unable to play it at this tempo. Pupil A then increased the tempo again to 80 bpm and with some help from the researcher, pupil B played the riff in time, which was then copied 3 times by pupil A to form the first 4-bar pattern.

To record riff 2, pupils A and B changed positions. Pupil A practised riff 2 many times. The tempo was not changed again and after another 5 minutes of practising, pupil A recorded riff 2. Both pupils then worked at the computer to copy and paste their riffs into the correct order (as on the worksheet) to create the whole 12 bar 'song'.

A multimodal consideration of the musical transformations - study 2, lesson 3

An interesting feature of this lesson was that as soon as pupil A played the backing track, he danced to it, perhaps indicating that the adopted musical style held a particular

meaning for him (i.e. dance music). When the tempo was increased to 250 bpm, not only did pupil A dance to it, but was joined by a pupil from the other group. However, as the focus of the work moved to playing the 2 riffs correctly, the dancing stopped.

Whereas in the previous two lessons, the group had adopted the structure suggested by the teacher with regard to the process of their work, in this lesson it was much more disorganised, with many interruptions to the flow of the work caused by the use of the tempo feature, which resulted in pupil B being unable to record the bass part until later in the lesson owing to the choice of an inappropriately slow or fast tempo, either of which makes accurate recording difficult. Notably, slowing the music to 30 bpm made it impossible for pupil B to play in time, perhaps owing to the difficulty of being able to identify the pulse at this speed. Pupil A was able to record his riff in a shorter space of time since by now the group had identified a tempo that was a compromise between a tempo they could technically play the music at and yet was fast enough to be able to recognise the principal beats with which to synchronise their playing.

The pupils stood for most of this lesson, moving about more than in the previous 2 lessons, with pupil A moving between the computer, advising pupil B, pointing to the notes on the worksheet and playing the music keyboard, whilst pupil B recorded the first riff. After the tempo had become more established, the movement of the pupils became much less, with a stronger focus on their individual roles - using the computer and playing the music keyboard.

The copying and pasting of the sections of music was accomplished quickly, especially in comparison with the time taken to record the 2 riffs. This could have been due to the pupils' familiarity with these techniques through their engagement with computers elsewhere in the curriculum.

A consideration of the origin of the transformations - study 2, lesson 3

There were limited musical transformations in this lesson as in lesson 2, perhaps because it was focussed upon performing and recording sections of music accurately, all of which the pupils were able to do. Elements that were new to this lesson were the copying and pasting of sections of the music to form longer patterns, introducing the role of the bass part in music and the slowing down of the music to make recording more accessible.

The chief musical element that was transformed during this lesson was tempo, one of the available designs provided by the teacher; although the pitch and rhythm were not altered at all, pupils experimented with tempo to create different musical effects, observed to be somewhat detrimental to the progress of the lesson as envisaged by the teacher. The piece was originally set to play on the provided template at 120 bpm, with the teacher modelling the slowing of the tempo to 80 bpm in the introduction to the lesson in order to make the recording process easier. However, the pupils experimented with extending the range of tempo to the minimum this version of Cubasis supports (30 bpm) and the maximum (250 bpm).

7.4.4 Study 2, lesson 4

The teacher's available designs - study 2, lesson 4

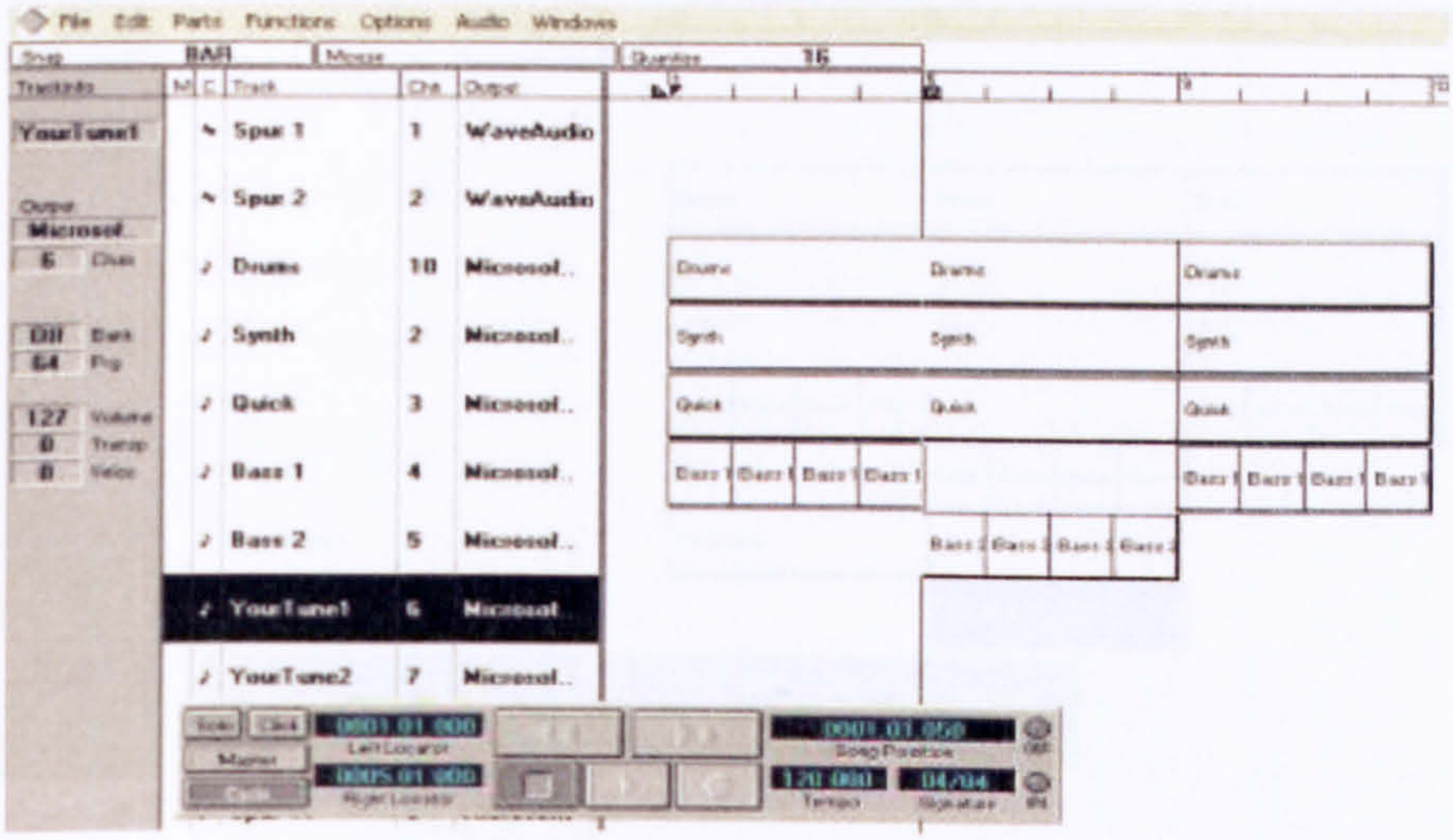
At the start of lesson 4, the worksheets were handed out (see figs. 64 and 65):

Cyclic Patterns

13th October

WORKSHEET

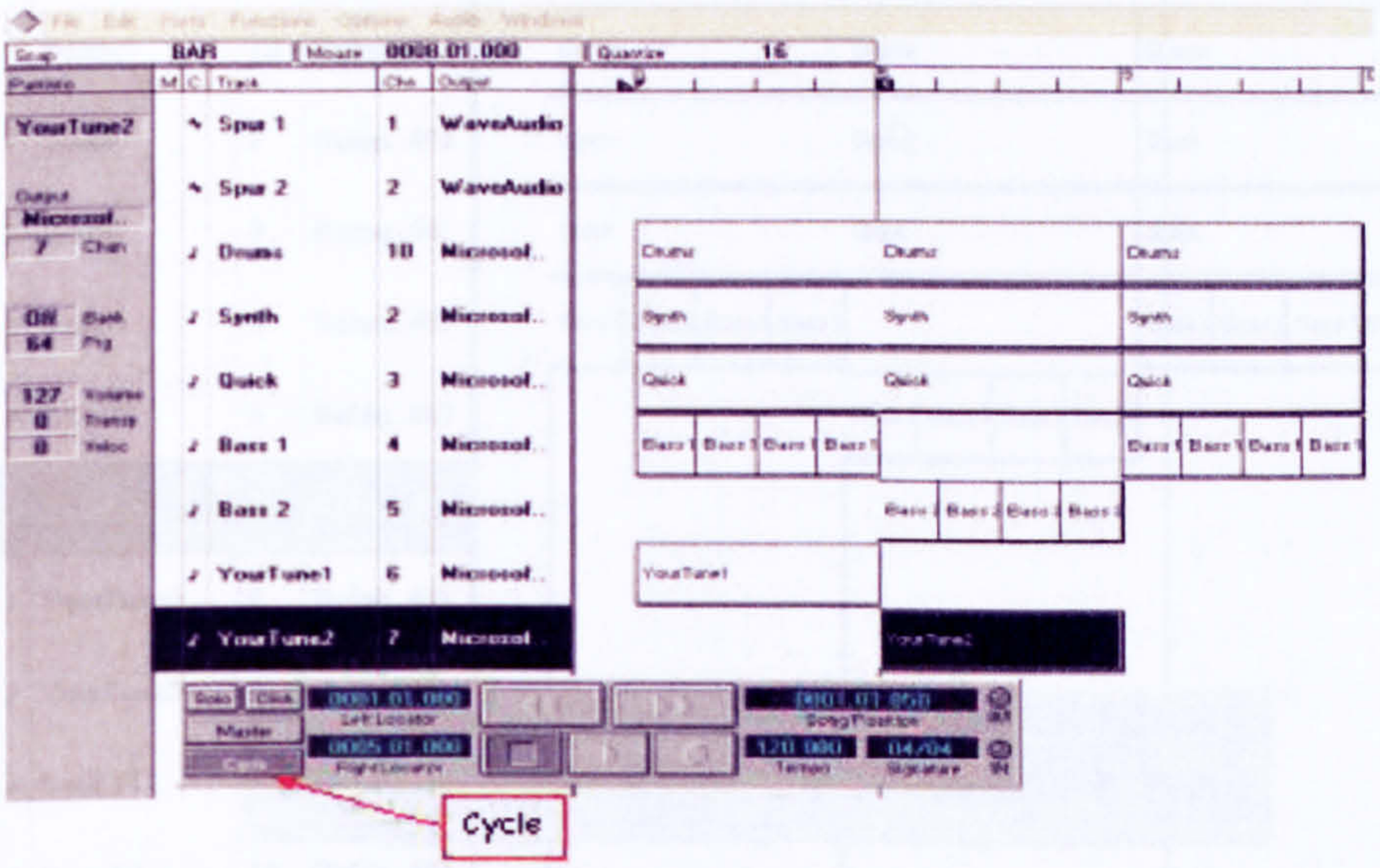
You are to improvise three sections of music that will be added to the piece you worked on last week. The notes you will need are A, G, E, D & C, which are marked on the keyboard. The file you saved last week should be already loaded onto your computer:



- You will notice there are 3 more tracks added - YourTune1, YourTune2 and YourTune3
- You are to improvise a tune using the notes marked on the keyboard - practise your tune now - it will last for 16 clicks, or 4 bars. You can practise it with the backing music - just click on 'Play' rather than 'Record'
- When you are ready to record it, check the track 'YourTune1' is selected and the click is on. Click record, wait for 8 clicks and then play your tune
- When you have finished, listen to it to check it is correct. If you need to change any notes, you can either edit it, or delete it and record it again

Figure 64 - Study 2, lesson 4, worksheet page 1

- When you have finished 'YourTune1', you are ready to record 'YourTune2'. Put the Left Locator to bar 5 and the Right Locator to bar 9
- Practise 'YourTune2' on the keyboard with the backing music and then record it when you are ready
- Listen to 'YourTune2' to check it is correct, then either edit it or record it again
- Your screen should now look like this:



- Repeat the previous steps for "YourTune3", setting the locators to bars 9 and 13
- When "YourTune3" is correct, set the Left Locator to bar 1 and the Right Locator to bar 13. Click 'Cycle' so that it is highlighted, and the piece will repeat many times. Listen to the music and then save your work

Figure 65 - Study 2, lesson 4, worksheet page 2

The teacher had prepared the music keyboards by writing in the note names C, D, E, G & A with a board marker on the keys. The sequencer template file provided was that worked on during the previous lesson by the pupils, with the addition of three 'YourTune' tracks (see fig. 66):

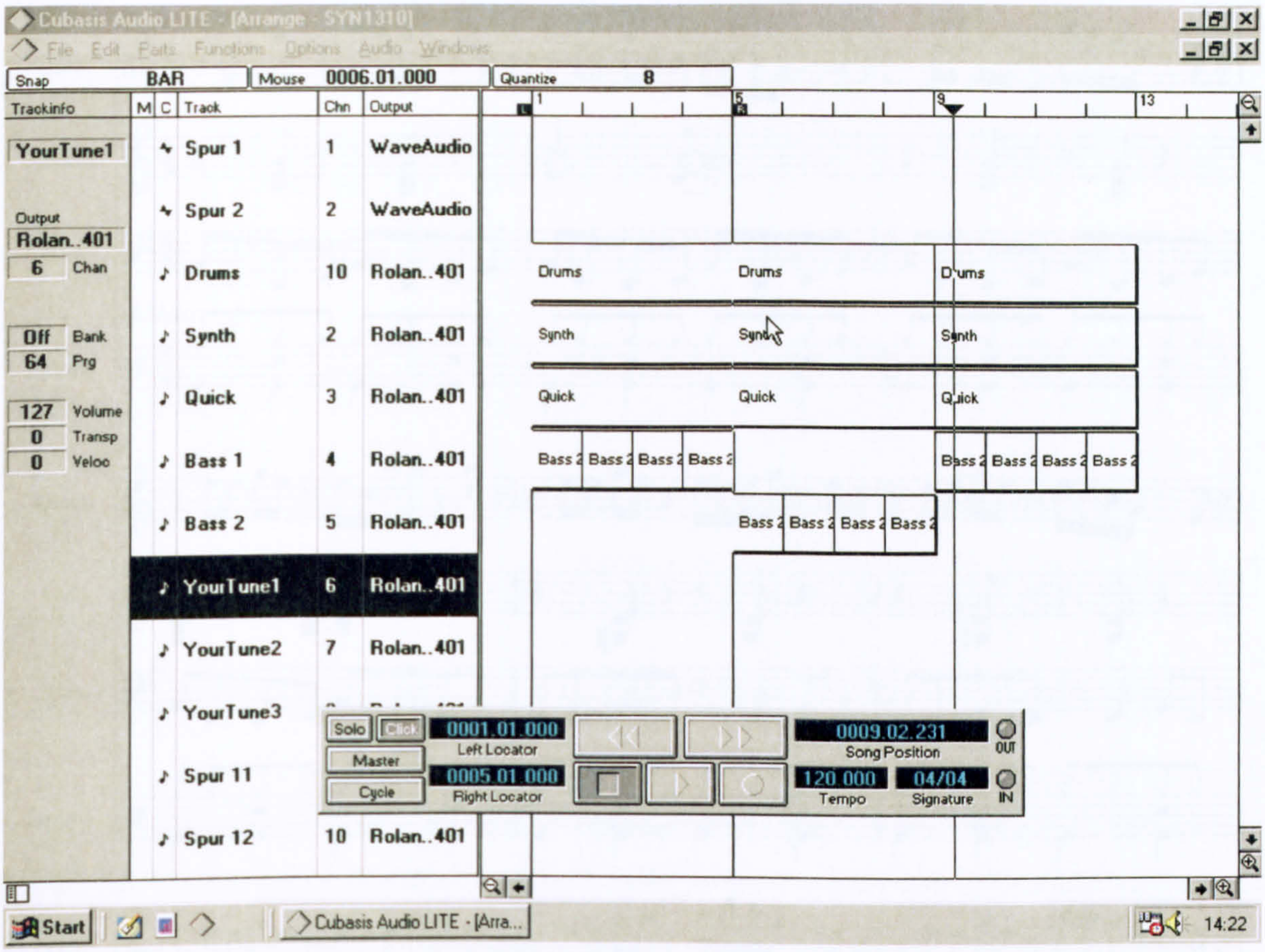


Figure 66 - Study 2, sequencer template for lesson 4

The full notated score of this backing track can be seen in fig. 67:

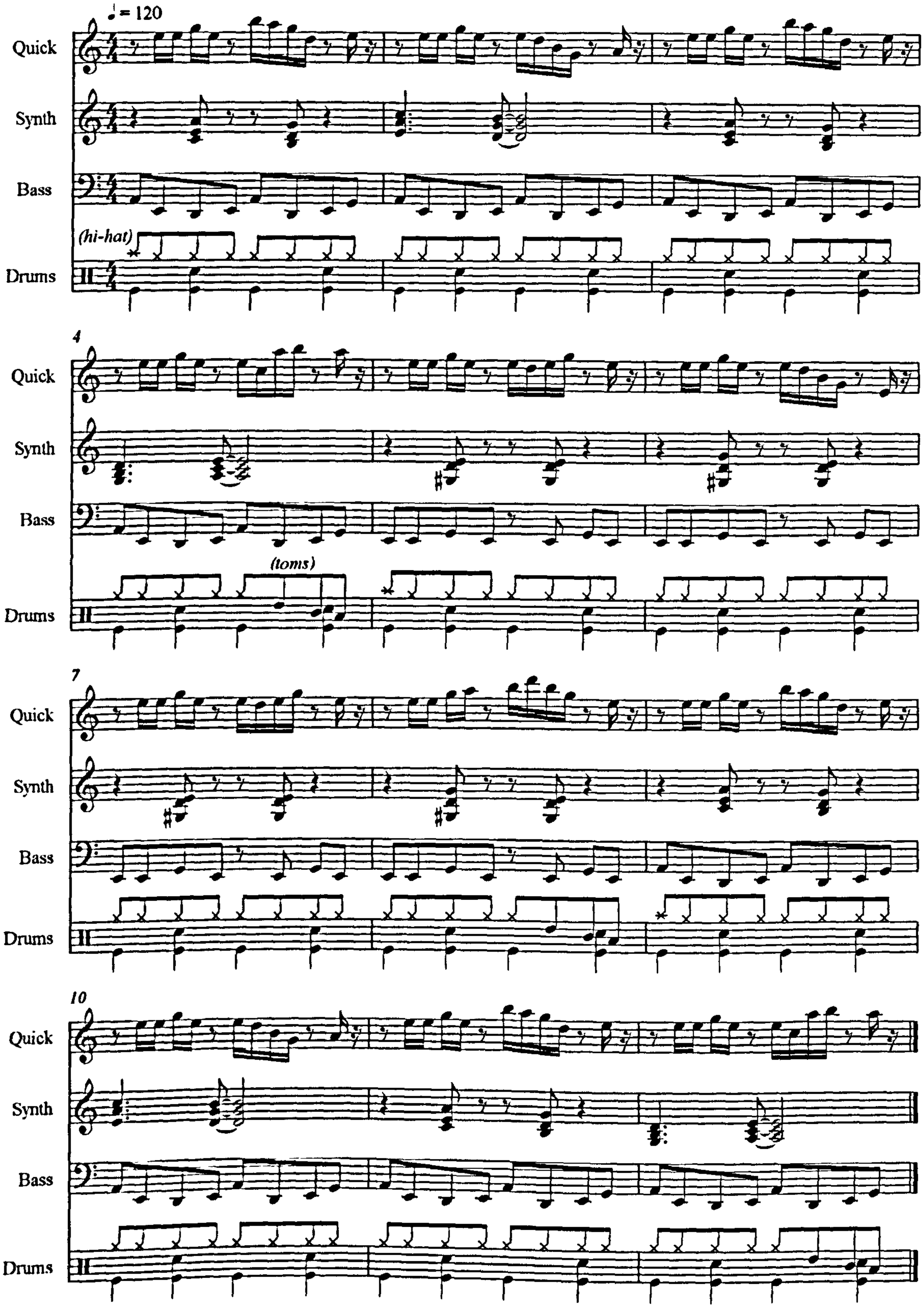


Figure 67 - Study 2, lesson 4, score of the sequenced tracks

The worksheet was explained and pupils asked if there were any questions. One pupil asked about setting the locators and the teacher replied that it would be covered in the practical demonstration. A performance was then modelled, recorded from bars 1 - 5 on the 'YourTune1' track (see music example 52):

Music example 52 - Study 2, lesson 4, model

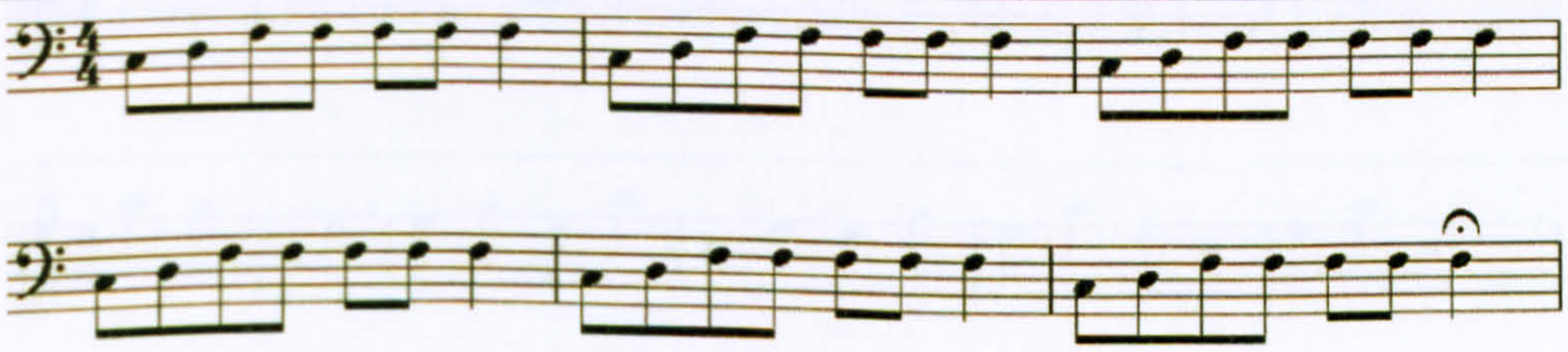
Having deleted the track, it was explained how the left and right locators should be set to perform recordings 2 and 3 and how the pupils should organise themselves so that they all had a turn at playing, operating the computer and listening and commenting on the others' work. She then asked if there were any more questions before allowing the pupils to start the practical work.

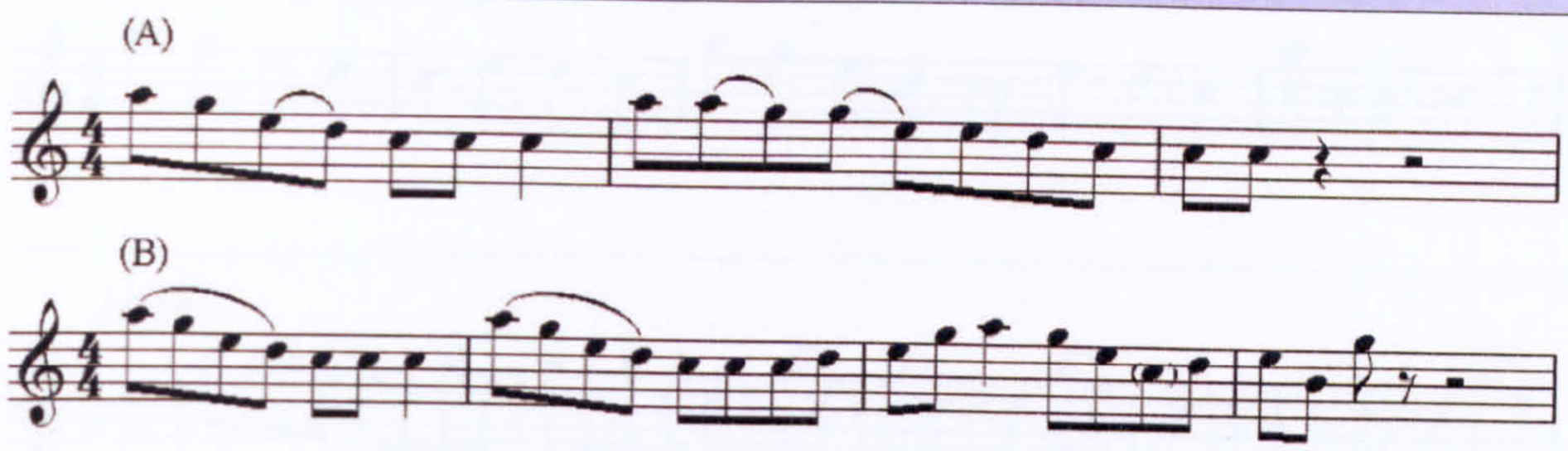
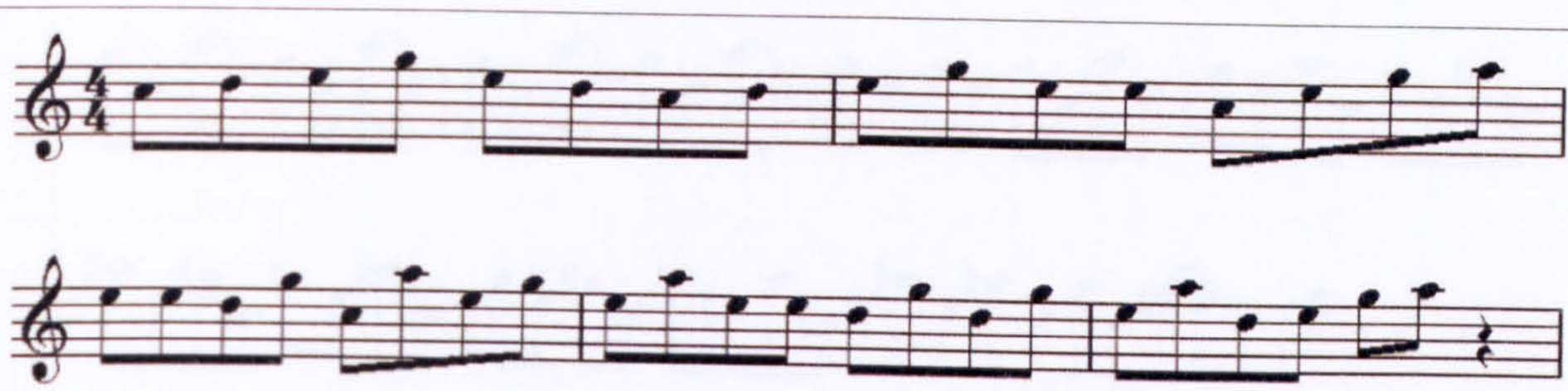
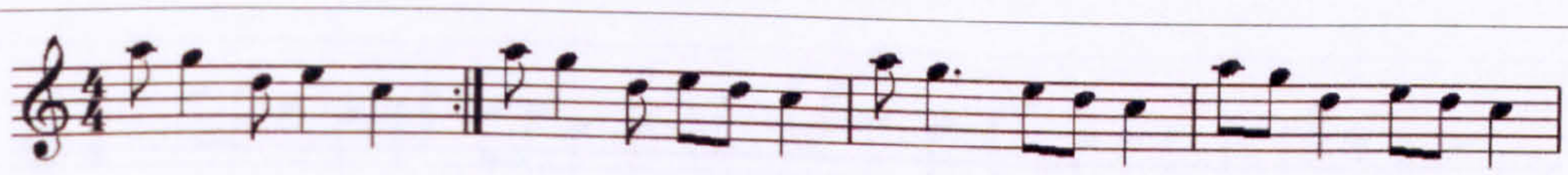
Introduction to the transformations of the available designs by the two groups

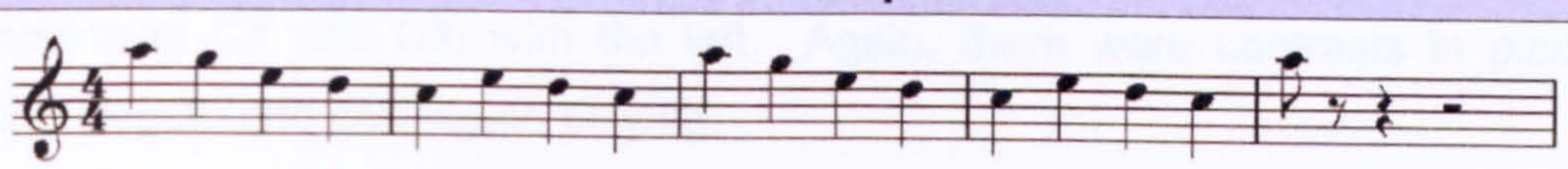
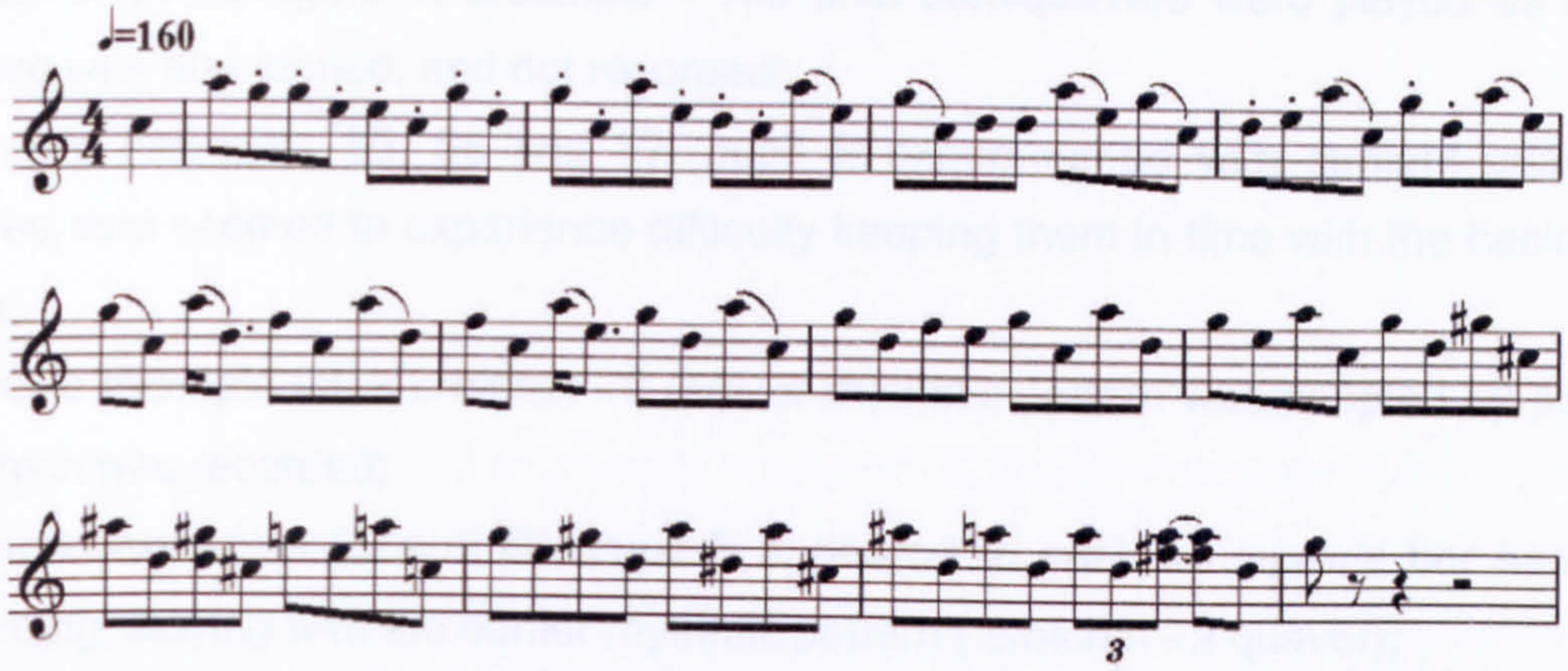
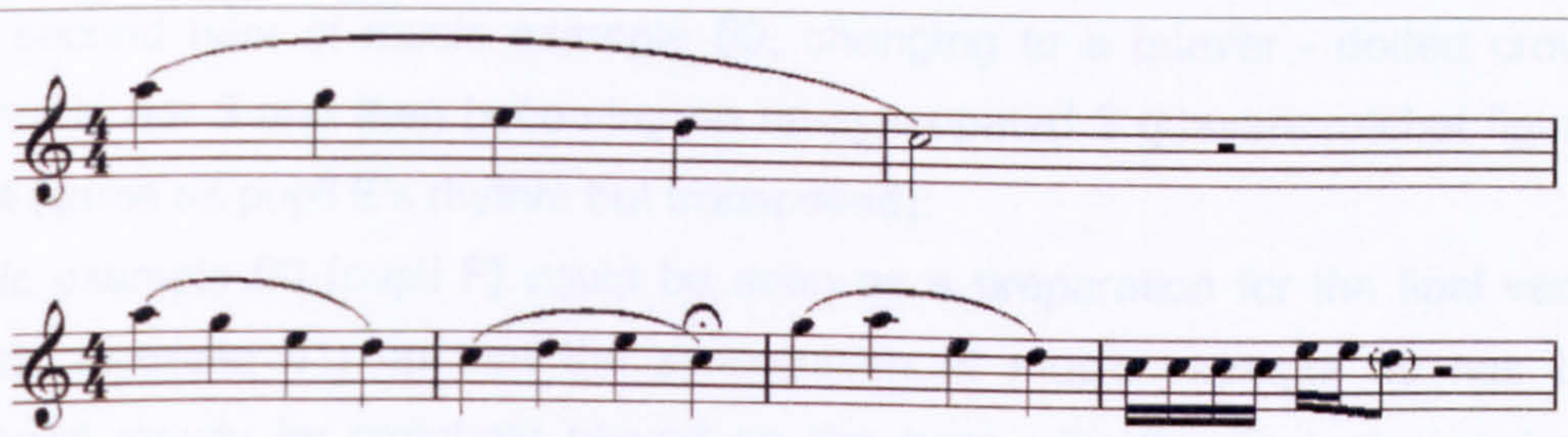
Owing to the high degree of transformation of the available designs in this lesson by group A (the group referred to previously), a description is also provided here of the work of group B. This is given in order that the impact it has on the work of group A (described later) can be referred to.

Analysis of how group B transformed these designs - study 2, lesson 4

The musical experimentations of group B are listed by example (see musical examples 53-66) in the order in which they occurred. Each example is the complete connected musical experimentation performed by a pupil until they are interrupted by another event, when a significant gap in the experimentation occurs. Each 'example' is referenced by pupil (the pupils in group B are named 'D', 'E' & 'F') as well as by musical example number.

Pupil	Music example
D Music example 53	

Pupil	Music example
D Music example 54	
E Music example 55	
E Music example 56	
E Music example 57	
E Music example 58	
F Music example 59	
F Music example 60	
F Music example 61	

Pupil	Music example
D Music example 62	
D Music example 63	
D Music example 64	
E Music example 65	
E Music example 66	

There were many features worthy of note in these examples; some of the principal ones are presented here, taking the work of each pupil in turn:

- The experimentation of pupil D was characterised in music examples 53, 54 and 62 by even crotchet - quaver figures and some contrast between legato and non-legato playing;
- In music example 63, pupil D tried out many ideas (not accompanied by the backing track), exploiting the left / right-hand possibilities of playing the upper

notes (A and G, moving to A# and G#) with the right and the lower notes (C, D and E, moving to C# and D#) with the left. Again, there were contrasts in places between legato and non-legato playing;

- In music example 64, pupil D experimented with a different musical idea, a legato, mainly stepwise figure in crotchets. The final semiquavers were played as the phrase was abandoned, and not recorded;
- In music examples 55, 56 and 57, pupil E experimented with straight quaver figures, and seemed to experience difficulty keeping them in time with the backing track;
- In music example 58, a crotchet - 2 quaver rhythmic pattern was adopted by pupil E, which was recorded;
- In music examples 65 and 66, pupil E appeared to seek to improve her earlier recording, staying with the earlier rhythmic pattern (crotchet - 2 quaver);
- Pupil F experimented without the backing track with a syncopated idea in the first and second bars of music example 59, changing to a quaver - dotted crotchet rhythm in bar 3 and then becoming an un-syncopated 2 quaver-crotchet figure in bar 4 (same as pupil E's rhythm but transposed);
- Music example 60 (pupil F) could be seen as a preparation for the final version (music example 61), in that the syncopation of music example 59 has been replaced mainly by crotchets played on the beat. By the final version (music example 61), the rhythm has become crotchets only. There is one example of a syncopated note in bar 4 of music example 60 however, but when the video was observed carefully, this appeared to be an 'accident', the penultimate E occurring either too early or too late. Music example 61 is notable for its angular melodic line, only occasional notes being in stepwise motion.

Analysis of how group A transformed these designs - study 2, lesson 4

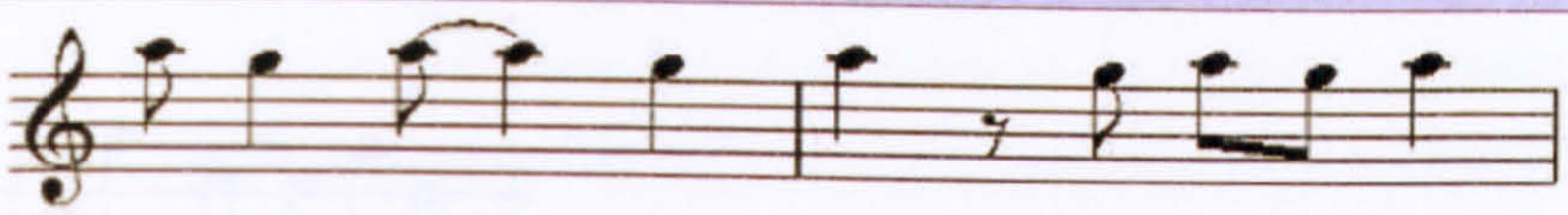
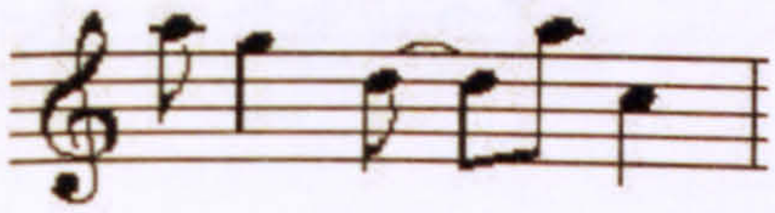
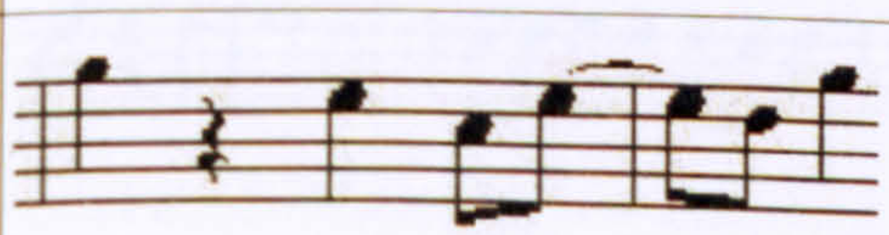
Before discussing how the designs were transformed by group A, the order of performance of the 3 pupils should be noted. Pupil B played the music keyboard at first, but was unwilling to continue, so pupil C played next, and was recorded first. Pupil A went next, followed by pupil B, who recorded on this second occasion. The amount of transformation of the available designs was far more extensive than in earlier lessons in this project. In order to organise the transformations into musically related coherent sections, I have chosen to use the following subsections:

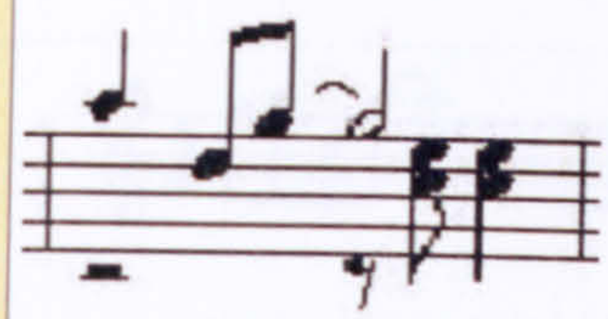
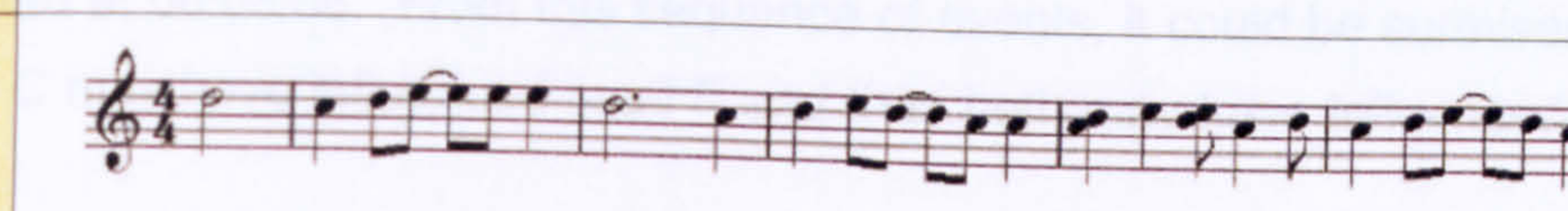
- the use of syncopation;
- the use of two hands;
- the use of 'doubled' and 'held' notes;
- the use of legato / staccato;
- the use of space in the music, or rests;
- other available designs that were exploited.

These are discussed in turn below.

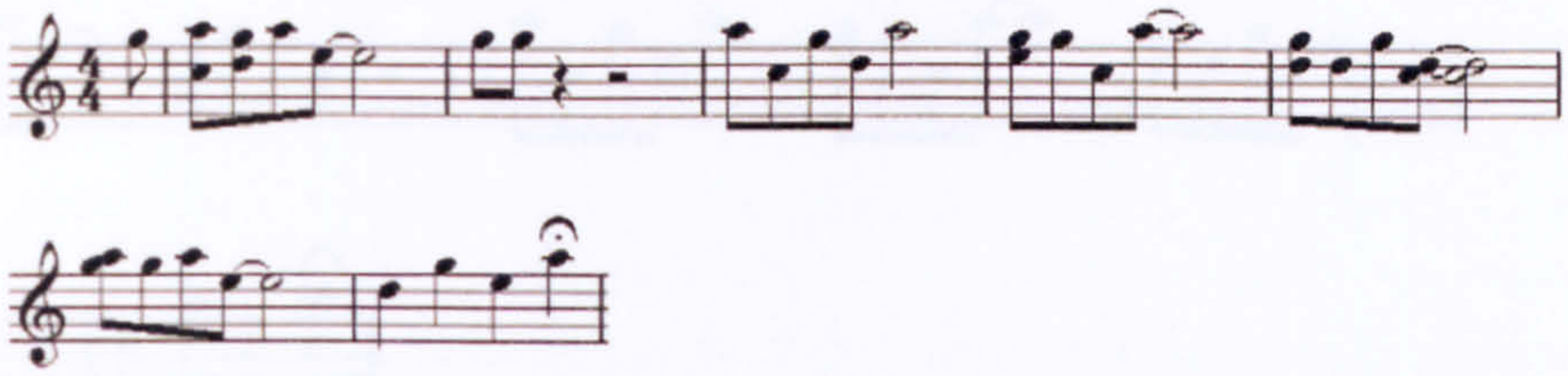
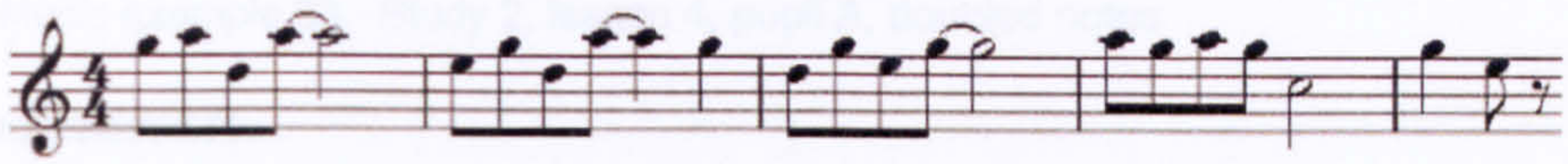
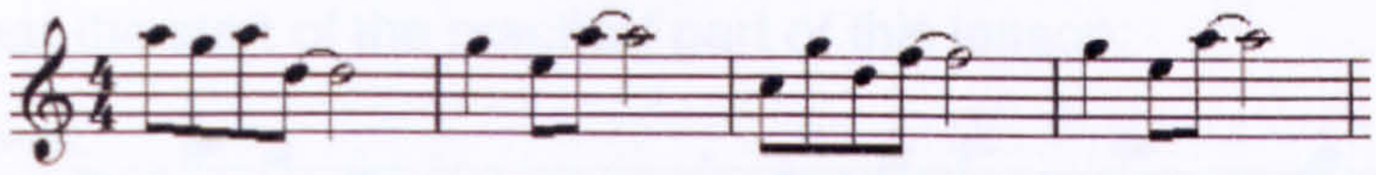
Syncopation

The syncopated phrases produced by pupil C during his experimentation went through the following transformations (see music examples 67-78):

Pupil	Music example
C Music example 67	
C Music example 68	
C Music example 69	
C Music example 70	
C Music example 71	

Pupil	Music example
C Music example 72	
C Music example 73	
C Music example 74	
C Music example 75	
C Music example 76	 
C Music example 77	
C Music example 78 (final recorded version)	

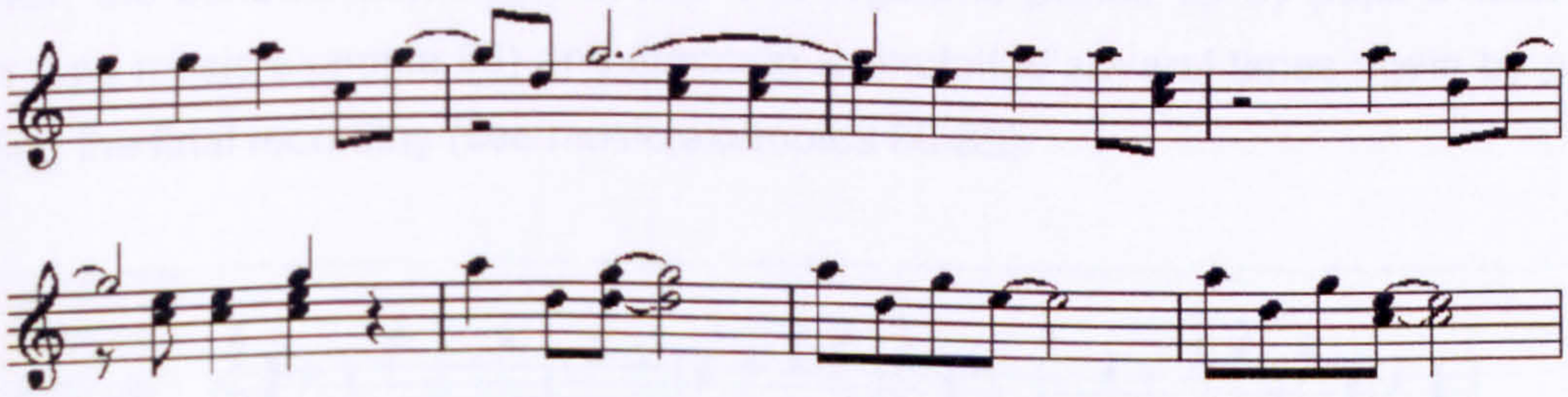
Syncopation featured in pupil A's work as well, illustrated in the following examples (see music examples 79-81):

A Music example 79	
A Music example 80	
A Music example 81	

The work of group B also featured some syncopation, as demonstrated in the experimentation of pupil F in musical example 59 and perhaps 60. However, it should be noted that this occurred at the film time of 00:05:39 onwards, whereas, the syncopated experimental patterns produced by pupil C started at 0:01:22 and the syncopated patterns work of pupil A start at 00:08:56. From this sequence of events, it could be surmised that the work of pupil C may have influenced pupil F and they both may have influenced pupil A.

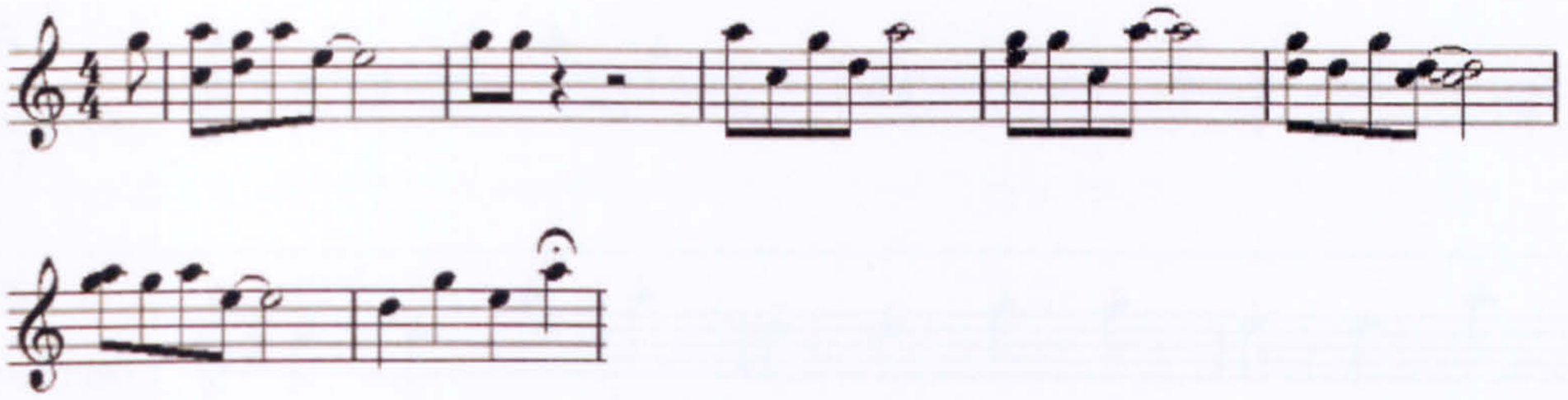
The use of two hands and the use of 'doubled' and 'held' notes

The use of two hands appears in the experimentation of pupils C and A. In the case of pupil C, it appears as the right hand holding a higher note while the left plays underneath or as two held notes, one in each hand (see music example 82):



Music example 82 - Study 2, lesson 4, pupil C, held notes

In the case of pupil A, this use of two hands takes the form of adding 'doubled' notes with both hands in certain places (see music example 83):



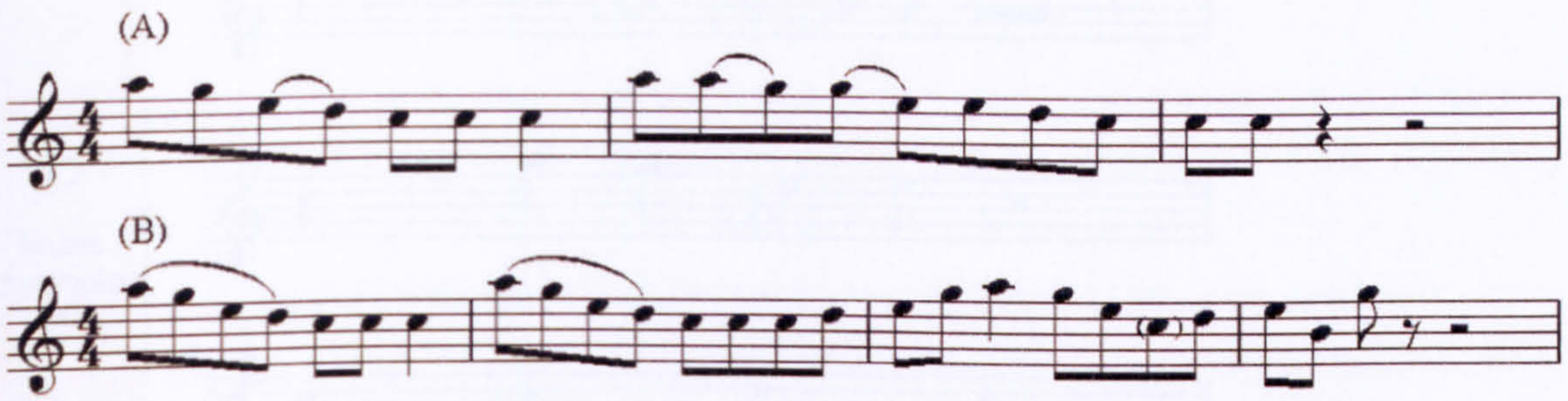
Music example 83 - Study 2, lesson 4, pupil A, doubled notes

The use of legato and staccato

The contrast between legato and staccato is most pronounced in music example 84, played by pupil B near the start of the practical part of this lesson:

Music example 84 - Study 2, lesson 4, pupil B, staccato and legato

Very shortly after this, pupil D in group B also experiments with this feature (see music example 85):

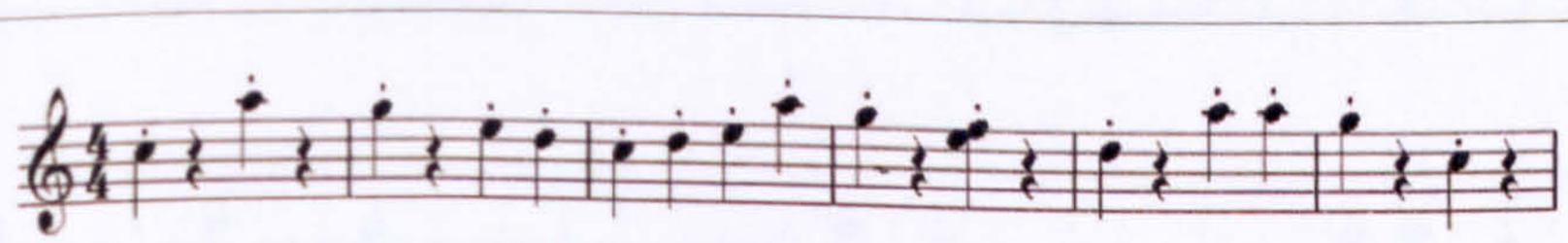


Music example 85 - Study 2, lesson 4, pupil D, staccato and legato

Pupil B does not use legato again in her experimentation, choosing to play staccato. However, the contrast between staccato and legato is picked up by pupil D later in the lesson (see music example 63) and staccato is exploited several times again by pupil B, including the final recording (see music examples 86-89).

B

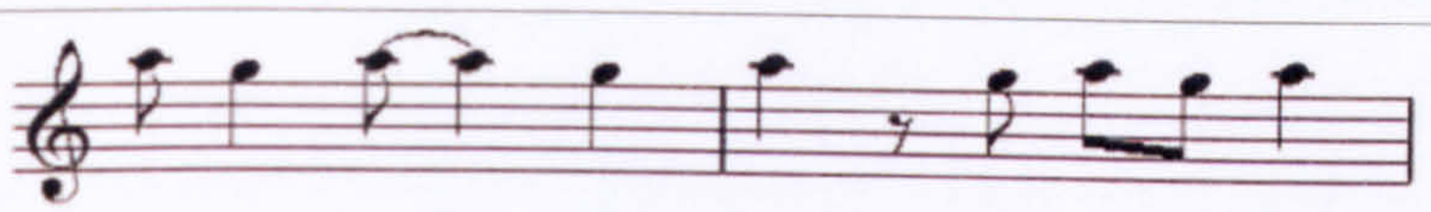
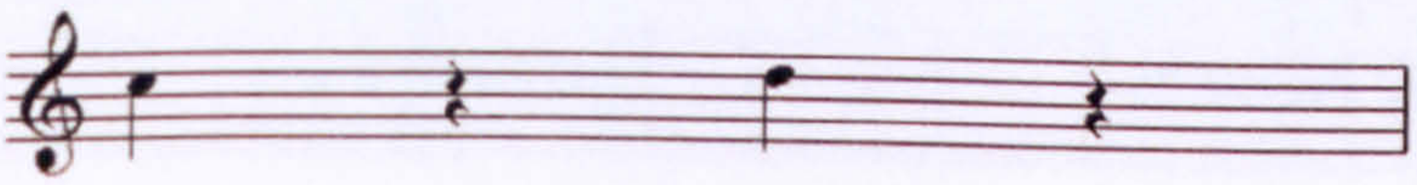
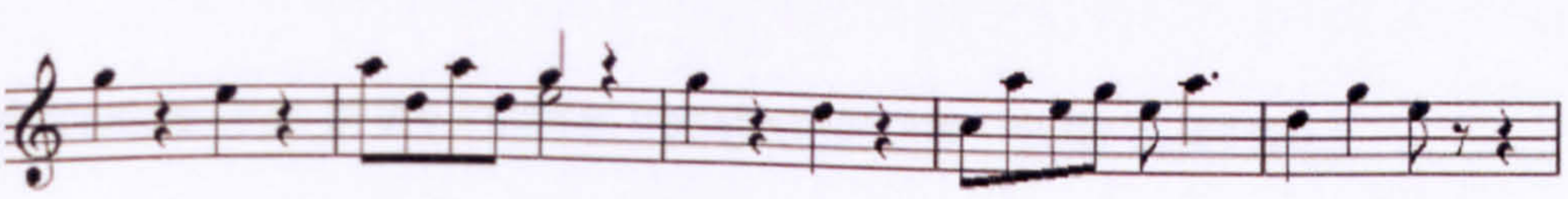
Music example 86



B Music example 87	
B Music example 88	
B Music example 89	

The use of space in the music, or rests

Rests are used in some form by all three pupils in group A. Here are some examples see music examples 90-92):

C Music example 90	  
A Music example 91	 
C Music example 92	

Two points are worthy of note in relation to the use of rests in pupils' experimentations: they tend to be varied in length, and rests do not appear in the work of group B at all, apart from at the ends of their excerpts, where rests have been added in the notational representations to make the bars complete.

Other available designs that were exploited

As well as the development of the musical designs, the technology was used in this lesson in two additional ways, both of which had been observed in previous lessons:

- the use of the score editor
- the use of tempo to enable a piece to sound radically different

Although it was not initially intended that the pupils could edit their work in the score editor in this lesson, the pupils had previously seen its use modelled in lesson 2, and there are two examples of the use of this editor by pupils C and A from group A by and also by group B.

The use of the tempo facility to radically speed up and thus alter the character of the piece appeared to be an 'accident', although it had featured in lesson 3 and it was clearly labelled on the transport bar (see fig. 68):

Figure 68 - The transport bar with the tempo set at 250 bpm

The pupils were observed to be excited about the effect it had on their music and shared this with group B.

A multimodal consideration of the musical transformations - study 2, lesson 4

In comparison with the previous 3 lessons, the pace of musical events was much quicker. It is particularly noticeable in this lesson that none of the modes (linguistic, spatial, gestural, visual and aural) makes 'sense' in a linear fashion by themselves (see appendix 5), they are all interdependent. In this section I will explore the following themes:

- Time - how it was apportioned between the 3 pupils in group A and and how much experimentation / recording each pupil engaged in
- The interdependence of the modes - the case for a multimodal analysis
- The degree to which the Cubasis visual representation formed a basis for shared negotiation

Time

The data for the time spent at the music keyboard by each pupil in group A and the number of experiments and recordings is summarised in table 8 below:

Pupil	Total time spent at the music keyboard	Number of experiments	Number of recordings
A	3 mins 45 secs	4	2
B	4 mins 44 secs	8	1
C	5 mins 10 secs	11	3

Table 8 - Time spent at keyboard and numbers of experiments / recordings

From table 8 it can be seen that although the teacher had tried hard to change the roles equitably in order to try to provide all the pupils with a fair opportunity to experience all of them equally, and although the actual time spent was reasonably apportioned, the actual number of individual experiments and recordings did vary, pupil C taking more time and having more experimental and recording opportunities than the other two pupils. The other two roles were also similarly distributed, with pupil A spending most time at the computer and pupil B spending most time acting as advisor.

The interdependence of the modes - the case for a multimodal analysis

The musical fragments played by the pupils, as categorised and represented above, can be shown to tell a musical 'story'. In this particular classroom situation, this seems to be the only mode that can stand alone in this way, perhaps because music is the focus of lesson. None of the other modes tells a 'story' by itself; for example, if the following linguistic example taken from two time frames (00:08:14-00:08:28 and 00:08:29-00:08:55) is considered alone, it appears disconnected from the musical action that is happening at the same time:

L59 B: Which one do I press, that one?

L60 A: Ah, I can't get to play

L61 B: How do I stop it?

L62 C: Press that one twice to stop it. There

L63 B: I want it back to the beginning

L64 A: That one

L65 B: Put it down

L66 B: Which one do you press to record then?

L67 C: Press record

L68 B: No, I didn't say record it!

L69 C: Yes you did, you said record it.

L70 B: No, I said how do you record it

Similarly, if the following gestural example (from the same two time-frames) is considered alone, it too appears disconnected:

G36 B's gaze varies between screen, A & C; A looks at keyboard; C watches screen

G37 A leans across from keyboard to press a computer keyboard key at 00:08:30

G38 C conducts from 00:08:33 to 00:08:36

G39 C leans over B's right shoulder to press computer keyboard keys at 00:08:47

G40 C leans over B's right shoulder to press computer keyboard keys at 00:08:50

G41 A leans across from keyboard to press a computer keyboard key at 00:08:54

G42 B looks between screen, A & B

However, a study of the musical data alone does seem to reveal a 'story'; this is investigated in the next chapter in some detail through a note-level study of what is played on the music keyboard (see chapter 8, section 8.3). Because the pupils are only using the arrange page during these time frames, and not any of the lower level editors, such as the score editor, the two following visual representations of the computer screen do not show their musical progress in terms of what notes or musical phrases have been experimented with (compare figs. 69a and 69b):

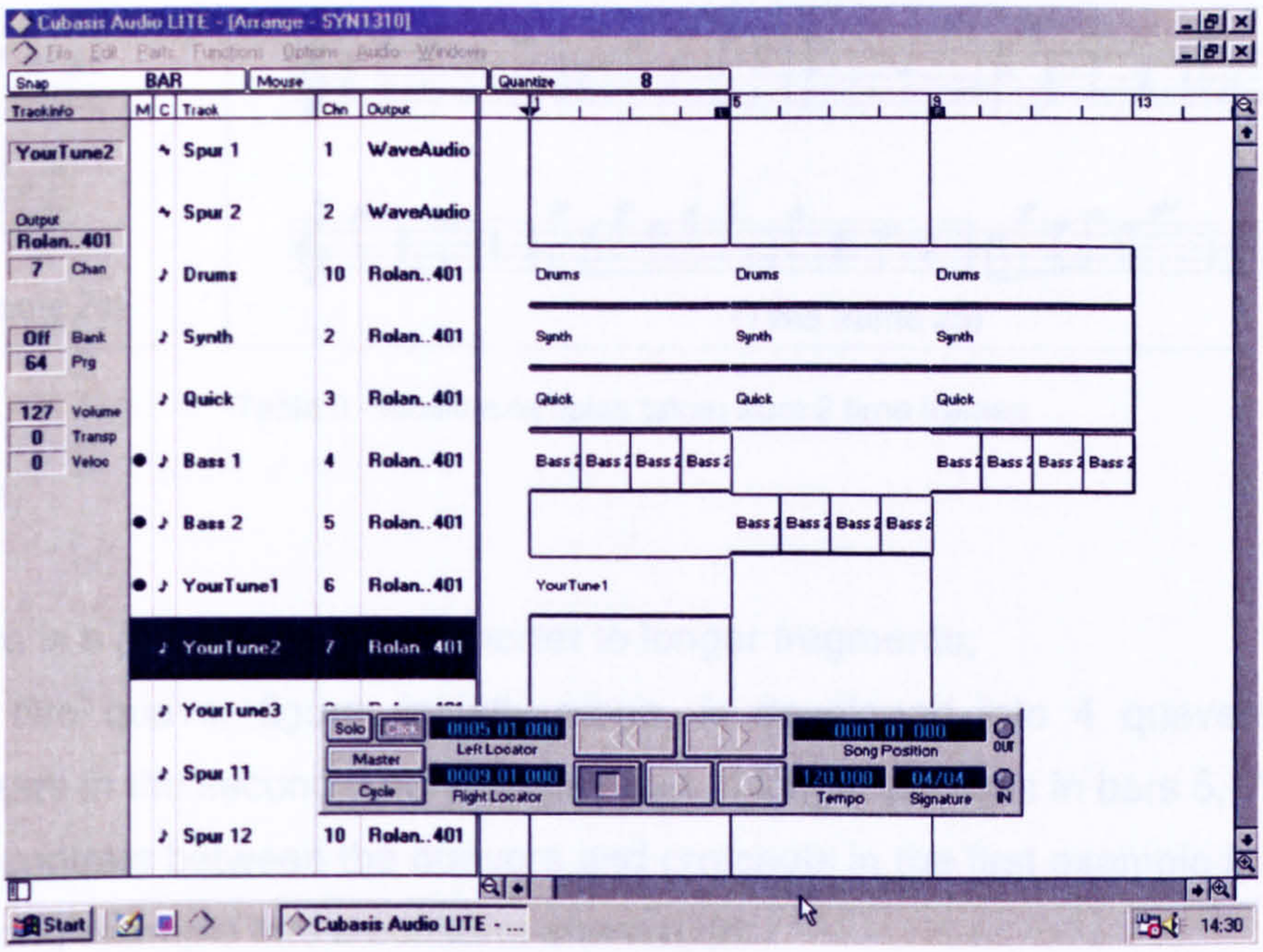


Figure 69a - Study 2, lesson 4, arrange page 1

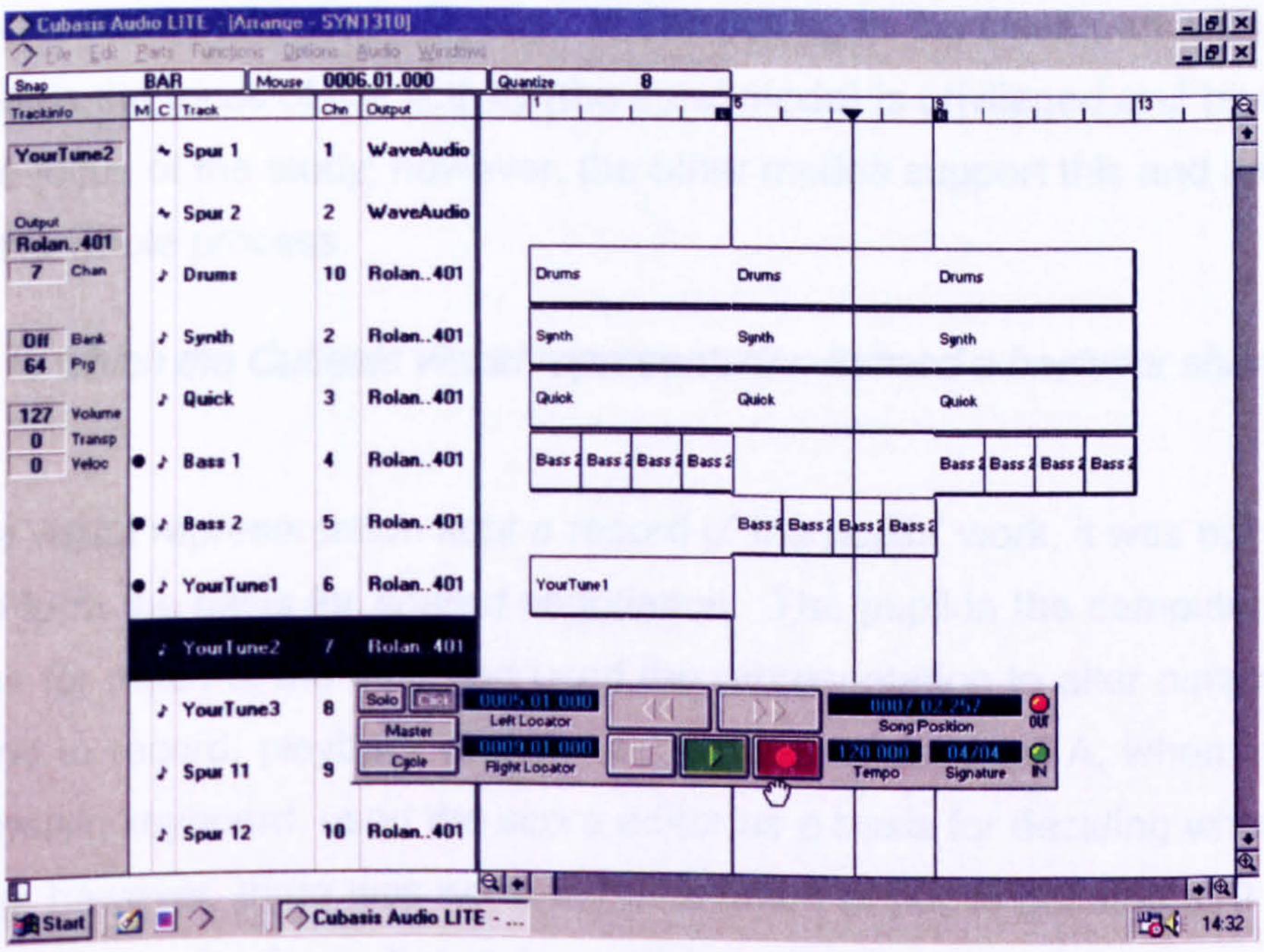


Figure 69b - Study 2, lesson 4, arrange page 2

However, an examination of the music at note level experimented with by pupil A during these 2 frames demonstrates a greater developmental connection (see table 9):

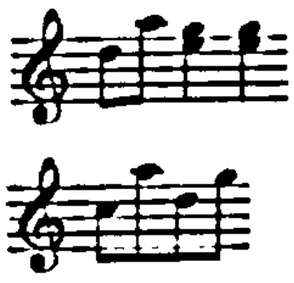
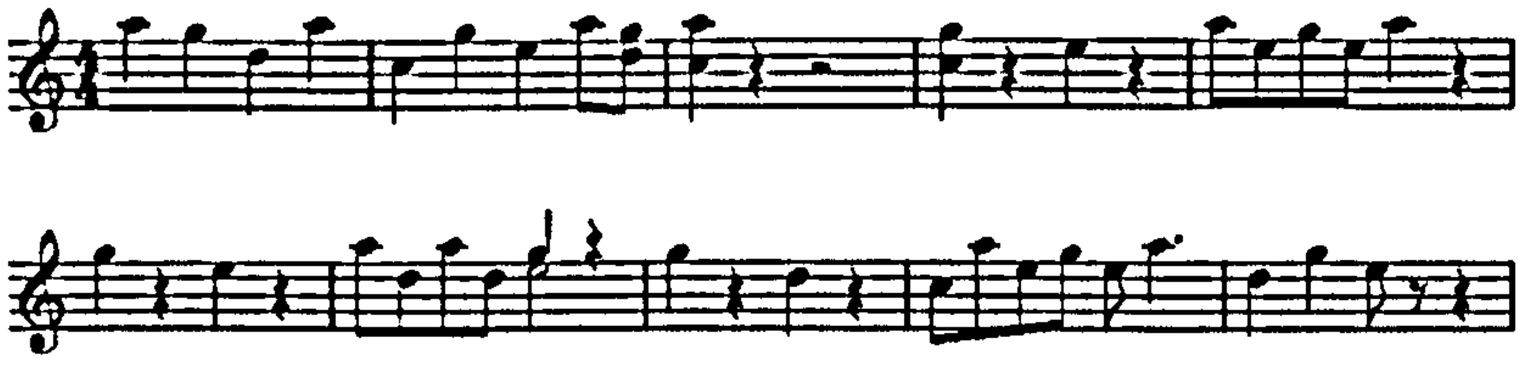
 (Time frame 24)	 (Time frame 25)

Table 9 - Music examples taken from 2 time frames

For example,

- There is a progression from shorter to longer fragments;
- The two quaver figure, initially alone, is developed into 4 quavers, and then appears in the second time-frame as part of longer phrases in bars 5, 7 and 9;
- The contrast between the quavers and crotchets in the first example is extended in the long example into a constant alternation.

The outcome is that in this observed case of composing in the classroom with computers, the mode that is the focus of the activity (the aural mode) is privileged and by virtue of this becomes the focus of the study; however, the other modes support this and are necessary to describe the whole process.

The degree to which the Cubasis visual representation formed a basis for shared negotiation

Although the visual representation kept a record of the pupils' work, it was not observed in this study to form the basis for *shared* negotiation. The pupil in the computer role looked at the screen for much of the time and used the representation to alter parameters, such as tempo and to record, playback and delete performances; pupil A, when in the role of playing the music keyboard, used the score editor as a basis for deciding whether to keep his recording; however, there was not one observation of pupils pointing at it together, or using it as a focus for joint discussion. Other visual representations, such as the worksheet and the keyboard were observed to occasionally form a focus for shared discussion, but this always occurred over a short space of time, for example, to clarify a single issue, such as which notes to use.

A consideration of the origin of the transformations - study 2, lesson 4

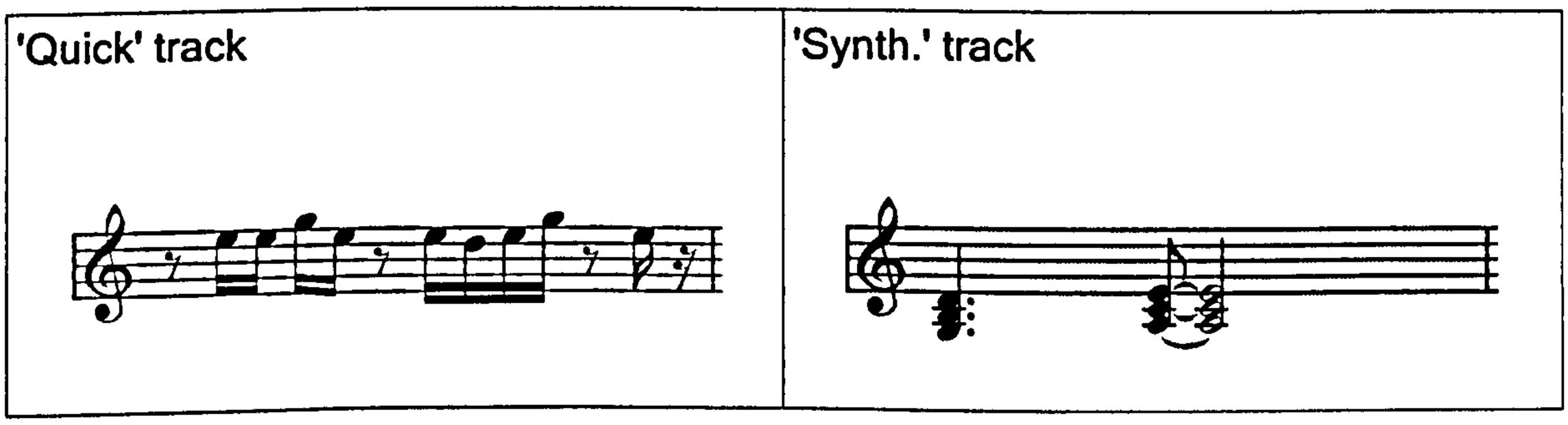
The music produced by the pupils employed many initial musical signs that were further transformed by them in different ways; however, they did not necessarily have clear

origins in the available designs provided by the classroom context. I will now discuss the origin of the transformations using the same headings to describe them as in the earlier musical analysis of how group A transformed the designs:

- the use of syncopation;
- the use of two hands;
- the use of 'doubled' and 'held' notes;
- the use of legato / staccato;
- the use of space in the music, or rests;
- other available designs that were exploited.

Syncopation

Syncopation was present in the sequenced backing track but not quite in the ways used by the pupils; for example, the sequenced backing track contained these two rhythmic examples (see music example 93):



Music example 93 - syncopation present in the backing track, lesson 4

The backing track may have provided the source for the addition of syncopation in the pupils' work; however none of the models presented to the pupils by the teacher contained this rhythmic feature. It seems from this brief survey of available designs that although the identified syncopated ideas from the backing track may account for the source of the rhythms experimented with by pupils C and A, it is also appears that they brought transformations of their own to this rhythmic figure, possibly of their own novel invention, or from outside the lesson context.

The 'Synth' syncopated example from the sequencer template had syncopation on the 2nd half of the 2nd beat. Pupil C's music examples 67, 68, 69, 70, 72, 73, 74, 75 and the final version, 76 (see music examples in section 7.3.4) all featured syncopation at this point in

the bar. However, the 'Synth' sequenced example started the bar with a long dotted crotchet, something that none of pupil C's transformations adopted. The quicker semiquaver syncopation of the 'Quick' track was not echoed in pupil C's work at all. Therefore, the link between the syncopation in the sequenced backing track and pupil C's work was perhaps only dependent on this placement on the 2nd half of the 2nd beat, which may possibly have stimulated this pupil's further transformations of the syncopation.

Turning to the syncopated experimentation of pupil A, as in pupil C's work, the placement on the 2nd half of the 2nd beat was repeated three times (see music examples 79, 80 & 81 in section 7.3.4). However, these three examples all started with 3 quavers and not with a dotted crotchet as in the sequenced backing track. There are 2 examples of pupil C's work that feature the 3 quaver figure before the first syncopated note (see music example 69 and the final version, music example 76 - bar 2), so these could equally have been a possible available design for pupil A's syncopated experimentation.

The use of two hands and the use of 'doubled' and 'held' notes

Playing with two hands was not modelled by the teacher, although this would probably have been commonly seen previously in school as many pupils and the teacher played the piano, as well as on television and in various other contexts. Pupil C's holding of a higher note with the right hand while the left played other notes underneath as well as the two held notes (one in each hand) techniques may have been observed by pupil A and adapted by him for his own use. It should be noted that none of the 3 pupils who used this technique had piano or keyboard lessons. In this lesson, the use of two hands would seem to have originated from outside the lesson, although pragmatically, the use of two hands does make playing the pentatonic scale on the keyboard easier (see fig.70).

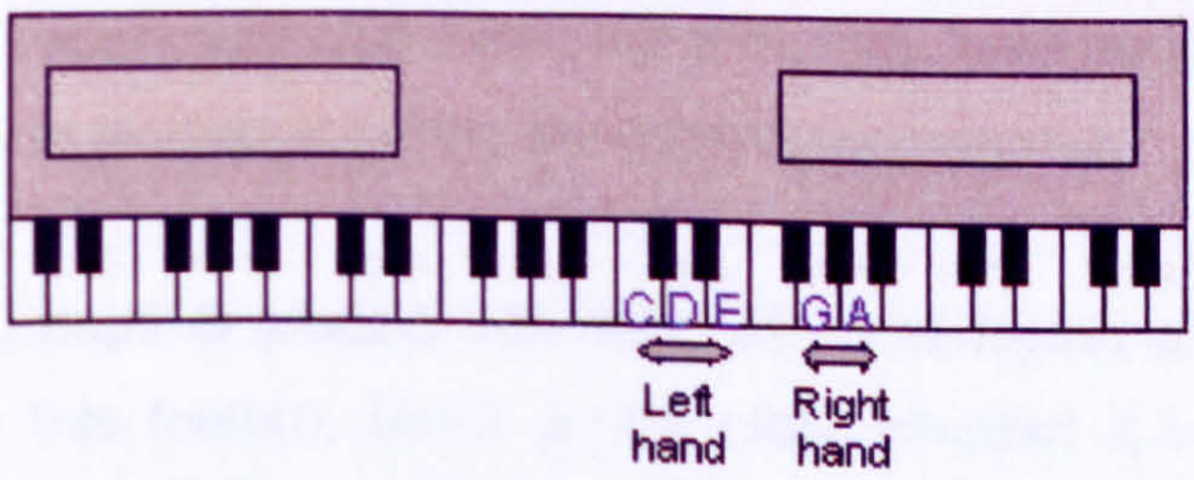


Figure 70 - Hand positions at the keyboard

Possibly, the use of two hands could be viewed as a potential of the music keyboard that is signalled in its design, in that all the notes are available to be played - as many at one time as the player desires; this notion of intelligence embedded in tools was discussed more fully in the conclusion to chapter 6. However, to play certain combinations of notes,

two hands need to be used. It should also be noted that although the playing of two notes at one time was also not modelled by the teacher, there were 3-note chords in the backing track in all of the 'synth' track and this would have been presented to the pupils as an aural available design, although not one modelled, written down or viewed on the computer screen.

An example of the use of two hands is found in the experimentation of pupil D in group B in music example 63; although doubled notes are not present here, the use of the two hands enables the playing to be faster and concentrates on the rapid opposition of the two groups of notes identified in fig. 64, as well as other notes when the right hand moves slightly, to the black notes on the right. As this experimentation by pupil D followed the work of the two pupils in group A, it could be inferred that pupil D was influenced by both or either of pupils C and A.

As well as a purely musical consideration of this available design, it was observed that there appeared to be a gestural link; the use of both hands is perhaps more apparent to the eye than to the ear and it is possible that the technique could be copied visually rather than aurally. If the set of notes identified for the pupils to experiment with had been of a wider pitch range, then the use of two hands would have been easier to hear; however, with only 5 notes to choose from, the use of both hands is harder to identify aurally.

The use of legato and staccato

There was no particular use of contrast between legato and staccato in the model provided by the teacher. However, the 'Quick' track in the sequenced backing did contain short notes, owing to the use of semiquavers. These were not played as detached as the crotchets in pupil B's experimentation were, but they may have suggested the application of this particular musical technique during the composing process.

As previously noted, pupil D played with staccato and legato shortly after pupil B's experimentation with this feature, but it is not clear whether it was presented as an available design by pupil B initially or whether this was exploited co-incidentally by the two pupils, perhaps as an potential of the keyboard. This potential could be viewed (as with the use of two hands) as a natural outcome of the keyboard's design, through the possibility of joining the releasing of one key to the depression of another (legato) or

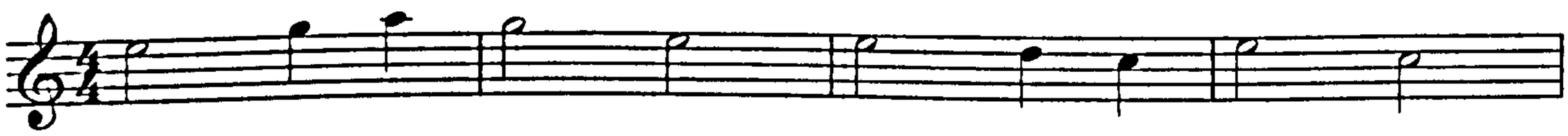
through the possibility of pressing a key for a short duration and leaving a 'space' before depressing another (staccato).

The possibility for transformation using this particular available design could have been transferred from one group to another, either aurally or gesturally, as demonstrated in the case of playing with two hands. The gestural possibility of transference requires some further explanation: when notes are played in a legato manner, the hand will remain close to the keys and the fingers will need to be used individually in order for one finger to press a note as another is released. Staccato playing, by contrast can be achieved through a variety of means; pupil A chose to use only the straightened index finger of her right hand to play the notes using a 'pecking' movement; more conventional means would involve an increased use of the wrist. As such, the visual contrast between the two modes of playing were clearly observed and could well have been transferred through gestural imitation.

It is interesting to note that when pupil B was questioned about this particular feature of her playing during the post-project interview she said that she had recently been playing a piano piece that was staccato. In this case, this piece would appear to have been the main source of this particular feature of her playing. Whether she then passed this technique on to pupil D can only be surmised; what can be said however, is that this was a possibility.

The use of space in the music, or rests

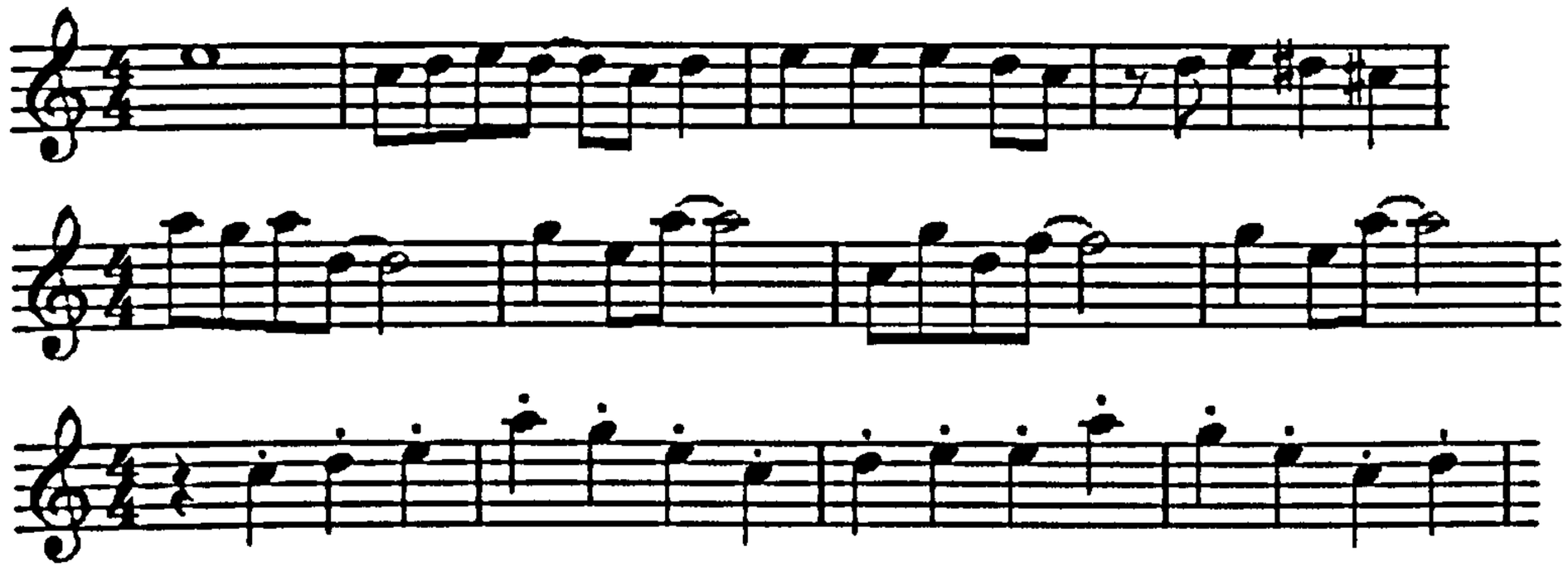
In the example provided by the teacher, rests, or spaces in the music do not feature at all (see music example 94):



Music example 94 - Study 2, lesson 4, the model provided by the teacher

In the sequenced backing track, there are rests necessarily used throughout consistently in all parts to provide the rhythmic definition required for it to fulfil its purpose (see fig. 67). However, none of the parts fulfil a melodic role, so it is problematic to ascertain how influential these rests may have been to pupils experimenting with melody. It is particularly interesting to note that rests did not feature in the work of group B at all, other than after their last note(s), which have been added during the transcription process to maintain the rhythmic integrity of the transcription itself.

The first use of rests is by pupil C in music example 84, and this may well have influenced both pupils A and B whose experimentations followed those of pupil C. However, it could be argued that the rests that occurred during this experimentation could have served to allow the pupils 'thinking time'; there is certainly support for this when the final products of all pupils are considered (see music example 95), where only two rests occur; in the work of pupil C (top line - last bar) and of pupil B (bottom line - 1st bar):



Music example 95 - Study 2, lesson 4, the final product of group A

It should be noted that the rest at the start of pupil B's work may have been due to an uncertain start to her recording; she later asked if she could re-record it, but was refused by the other members of her group. However, rests form such a consistent part of the experimentation, it appears that their use could be considered a conscious one by the pupils of this musical device.

Other available designs that were exploited

The Score Editor

Although this potential of the software was used by the pupils in this lesson, the reason for its use appears to be of their design, in that they used it to 'check' their recorded work and often used its representation as a basis for individually deciding whether to re-record or keep the existing recording; this use was not modelled by the teacher. The traditional score representation seems to have held some authority for them, perhaps through seeing the use of printed music within the school for performances by instrumentalists. It could also possibly be because siblings or parents play an instrument and use written music (two pupils in group A did not have instrumental lessons).

Tempo

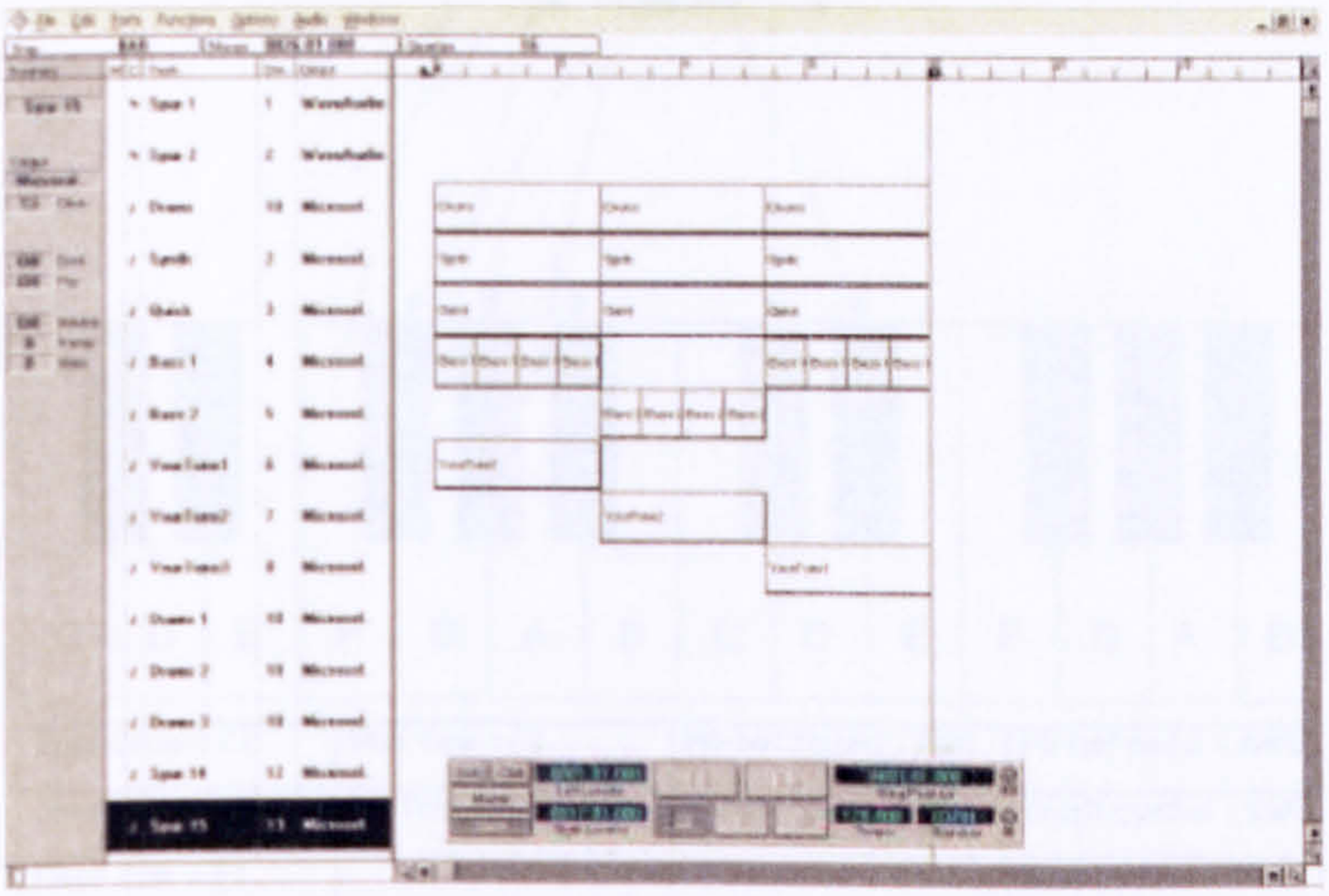
Although the origin of this available design cannot be seen in the active composing part of the lesson, the pupils had experimented with this extensively in lesson 3, and in any case, are familiar with the use of computers within the school (and at home in these two cases) and didn't appear to have any inhibitions about experimenting freely with the software.

7.4.5 Study 2, lesson 5

The teacher's available designs - study 2, lesson 5

The worksheets were handed out at the start of the lesson (see figs. 71 and 72):

The file you saved last week should be already loaded onto your computer:



- You will notice there are 3 extra tracks labelled 'Drums 1', 'Drums 2' & 'Drums 3' - these are where you will record your drum parts. Each one will last for 12 bars.
- Each member of the group is to practise their 'drumming' on the keyboard with the backing tune playing at the same time, and then record their work on one of the 'Drums' tracks
- When you are ready to record, check the correct track is selected and the click is on. Click record, wait for 8 clicks and then play your drum track
- When you have finished, listen to it to check it is correct. If you need to change any notes, you can either edit them, or delete the track and record it again
- When you have finished your drum part, let the other group members record theirs, muting all 'Drums' tracks that have already been recorded
- When your group has recorded all the drum tracks, listen to the music and then save your work
- Play your work, one drum track at a time to the other group

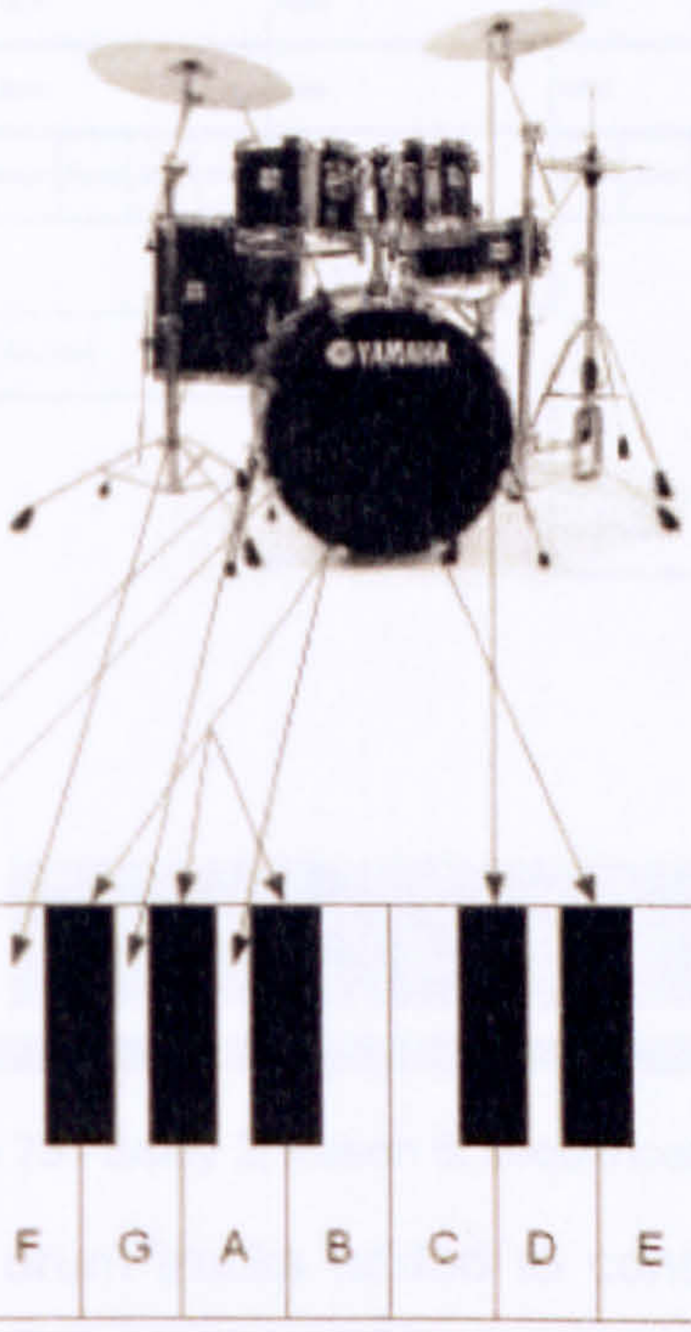
Figure 71 - Study 2, lesson 5, worksheet page 1

Cyclic Patterns

20th October

WORKSHEET

Each member of the group is to improvise (this means composing the music as you play it) a drum part that will be added to the piece you have been working on for the past two weeks. The notes used for each of the drum sounds are shown below:



Bass Drum = C1	Mid Tom = G1	Hi-hat closed = F#1	Hi-hat pedal = A#1
Snare Drum = D1	Hi Tom = A1	Hi-hat open = G#1	Crash cymbal = C#2
Floor Tom = F1			Ride cymbal = D#2

Figure 72 - Study 2, lesson 5, worksheet page 2

The teacher had again prepared the music keyboards by marking the required note names on the keys with a board marker. The sequencer file containing the work the group had been engaged with for the previous two weeks was loaded onto the music workstations (see fig. 73):

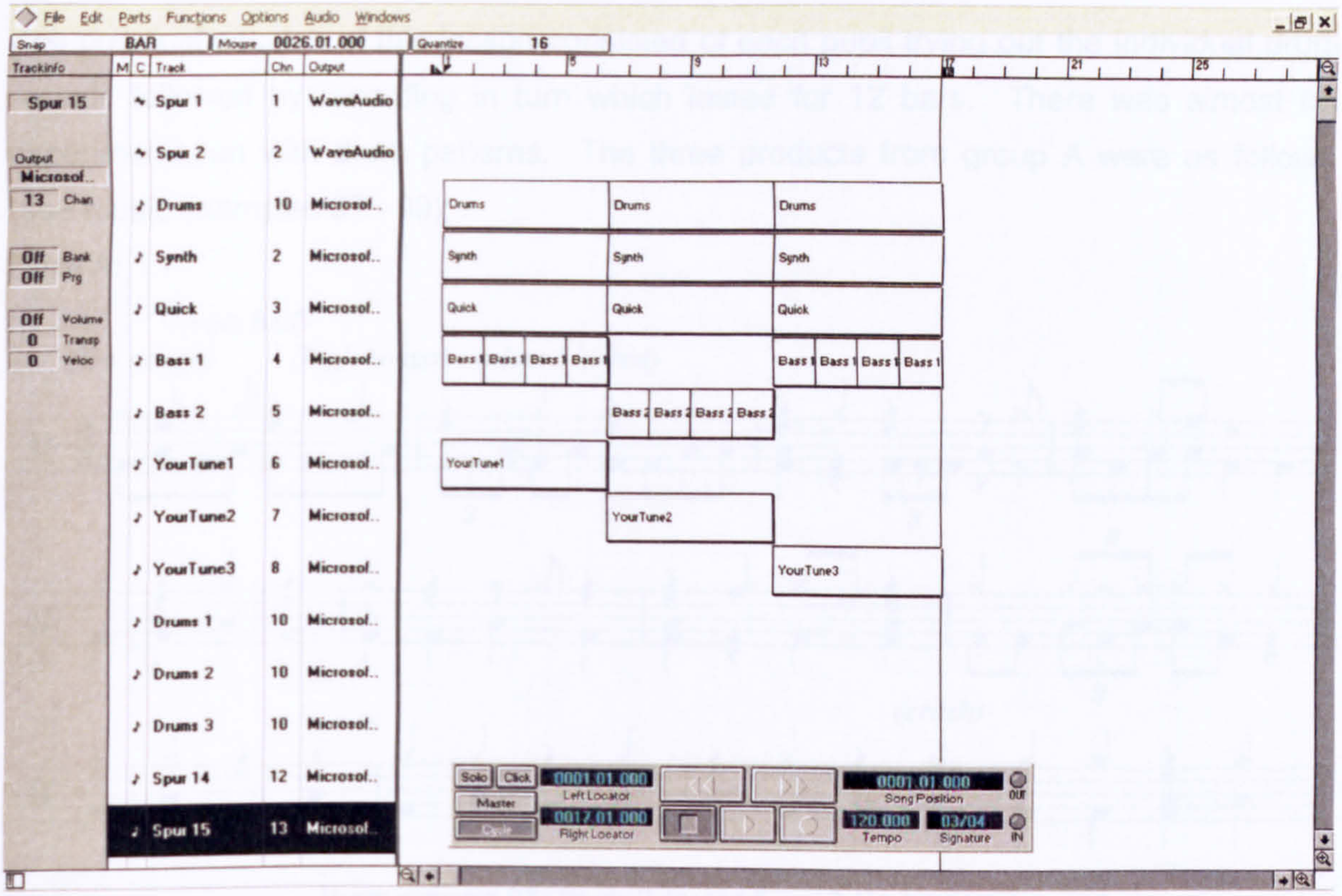
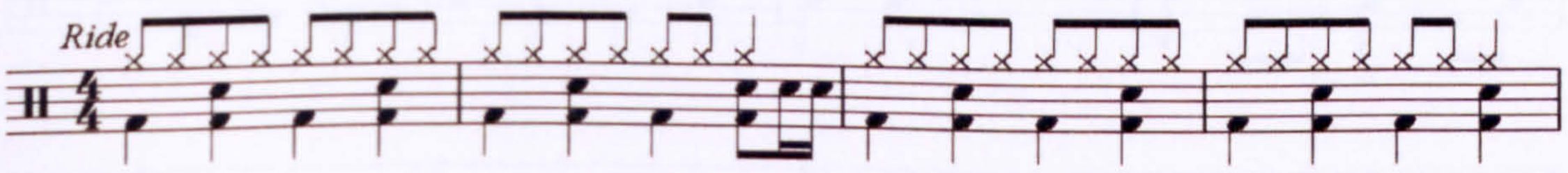


Figure 73 - Study 2, lesson 5, sequencer template

The template had had three drum tracks added to contain the pupils' recordings made during this lesson ('Drums 1', 'Drums 2' and 'Drums 3'). The worksheet was read through and explained, followed by a provided model of the drum part, which was played on a music workstation; this only lasted for 4 bars, not the 12 bars required of the pupils (see fig. 96) :



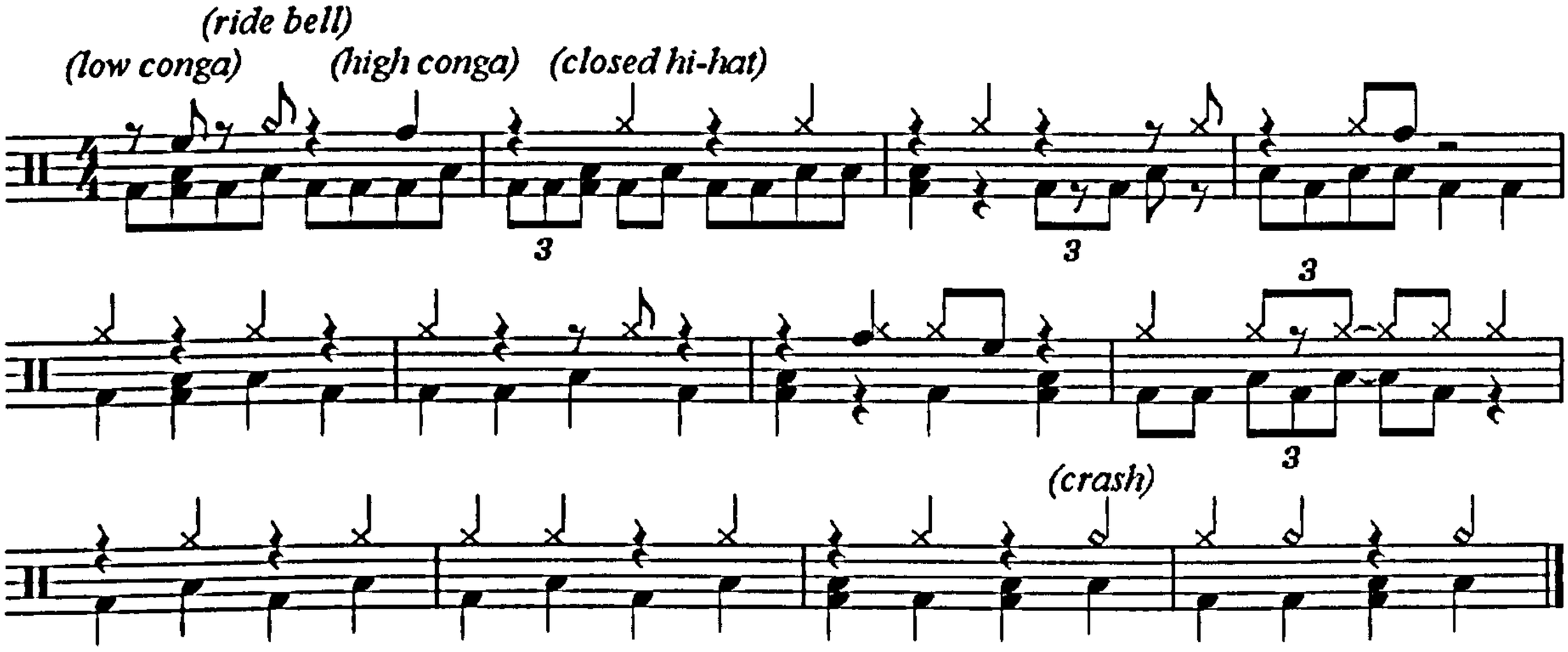
Music example 96 - Study 2, lesson 5, teacher model

It was explained that each pupil should take it in turns to play and record a drum part that lasted for 12 bars, muting the original and others' drum parts when recording and playing back theirs. They would then all play their compositions to each other during the plenary session at the end of the lesson. The pupils then began their practical work. It should be noted that there had already been a drum part included as part of this sequence, which the pupils had heard many times. The teacher made it clear that they were not to copy it and to mute it when recording or playing their own.

Analysis of how the observed group transformed these designs - study 2, lesson 5

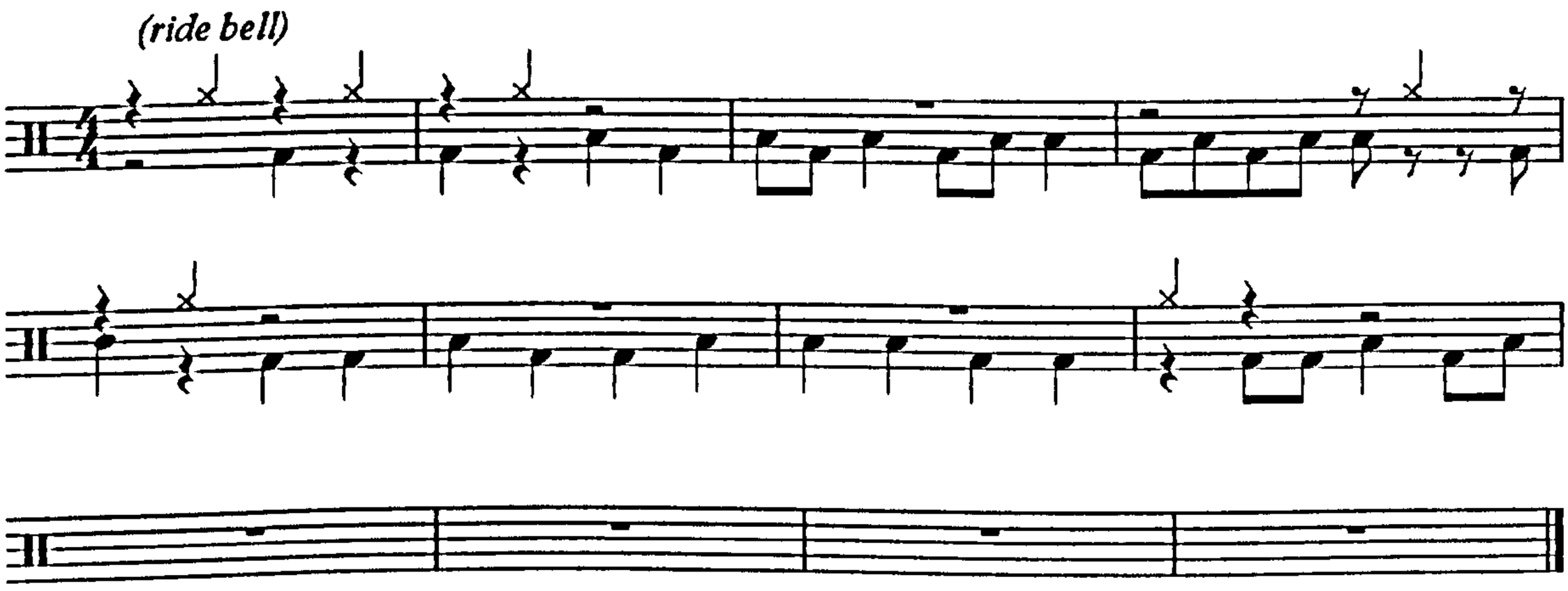
The practical session of this lesson consisted of each pupil trying out the individual drum sounds followed by recording in turn which lasted for 12 bars. There was almost no experimentation with drum patterns. The three products from group A were as follows (see music examples 97 - 99):

Pupil A:



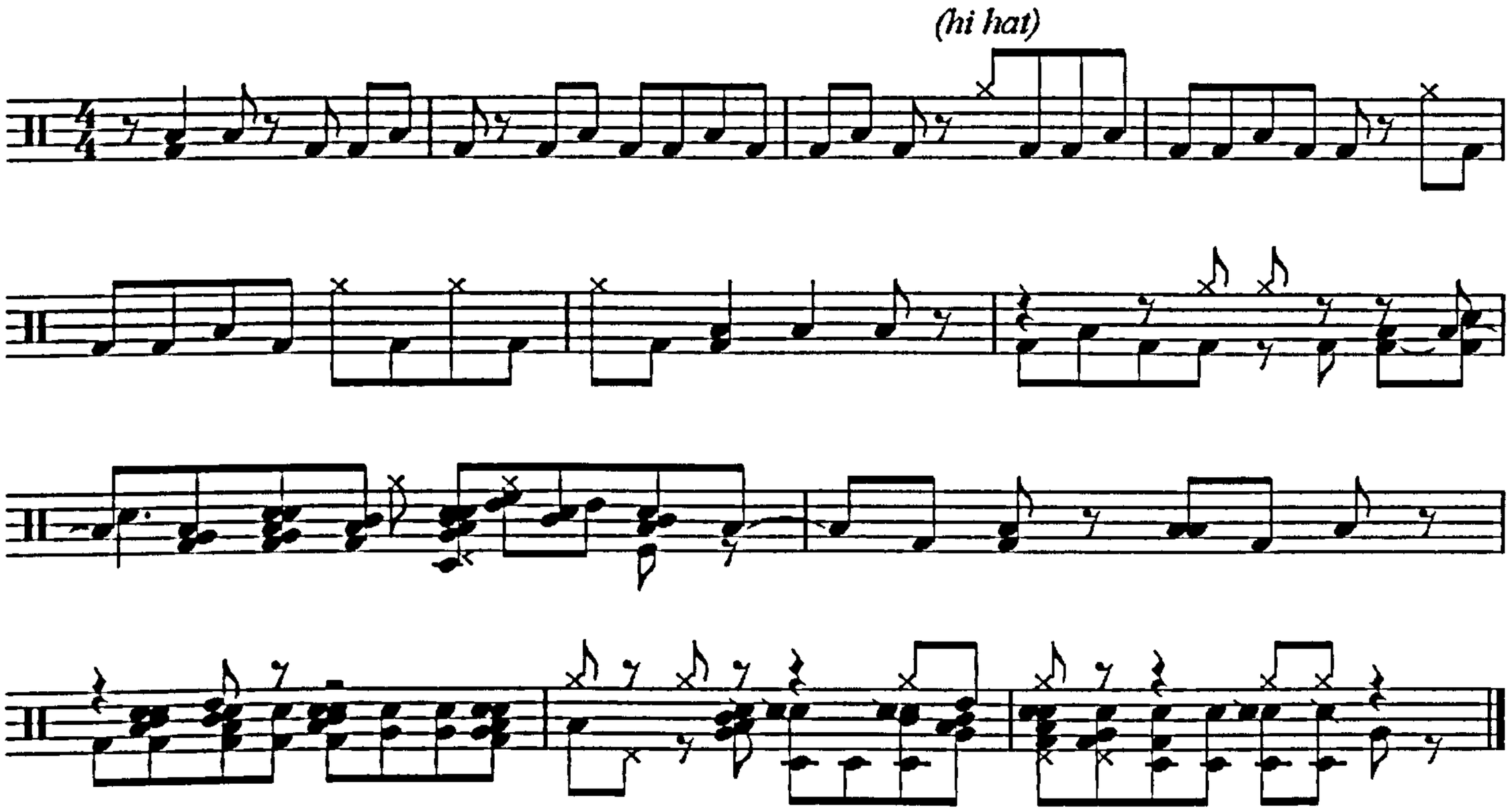
Music example 97 - Study 2, lesson 5, pupil A's drum track

Pupil B:



Music example 98 - Study 2, lesson 5, pupil B's drum track

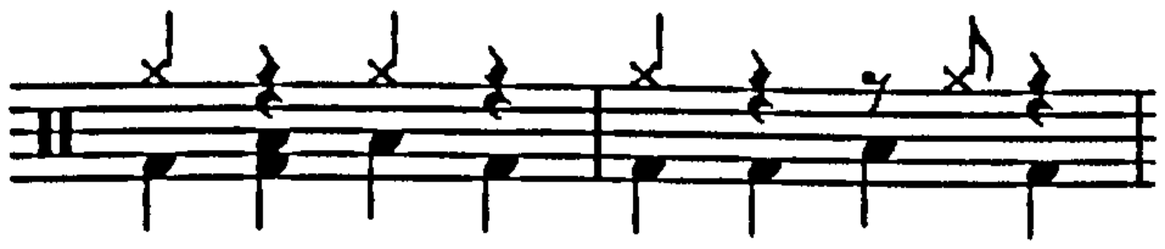
Pupil C:



Music example 99 - Study 2, lesson 5, pupil C's drum track

It was observed that each pupil adopted an individual approach to this task:

Pupil A placed the bass drum on the first beat wherever possible and it could be inferred from music example 97, and from video observation data, that he was copying the teacher's (and that of the drum part in the sequence) drum performance arrangement of left hand playing the drums (primarily bass and snare), and right hand playing the cymbal sounds. This particularly comes into focus on lines 2 and 3 of music example 97, where the closed hi-hat sound is produced by the right hand, and the bass and snare drum by the left hand (see music example 100):

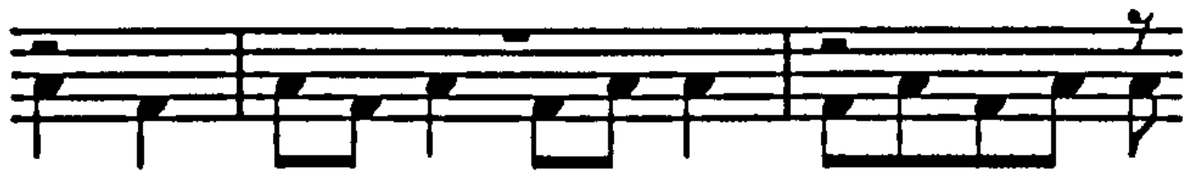


Music example 100 - Study 2, lesson 5, pupil A drum fragment

It would appear that during line 1, pupil A is coming to terms with the rhythm as it is far less repetitive and ordered, with some sounds seemingly out of time.

Pupil B does not play more than one drum sound at a time, unlike pupil A. In pupil B's drum part (music example 98), the ride bell sound was used initially as an off-beat sound (the teacher had shown how the snare was generally used for this purpose) but by bar 8, this had moved on to the beat. Another feature of pupil B's drum track is the alternation

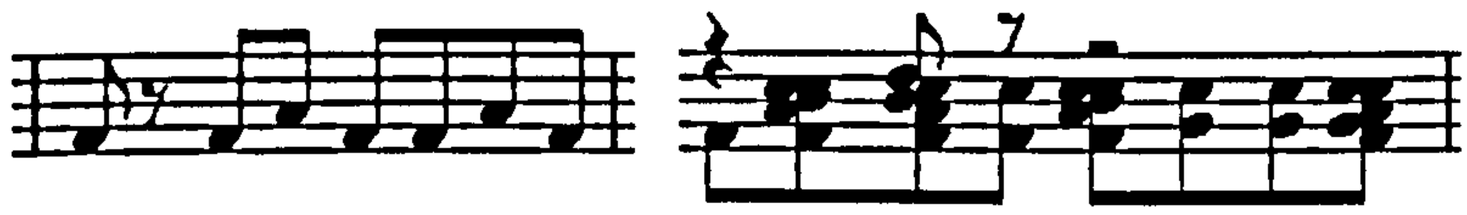
between the bass and snare drums, modelled by the teacher and also present in the original drum track (see music example 101):



Music example 101- Study 5, lesson 5, pupil B drum fragment

However, the bass drum is not on the beat and the snare off the beat as presented in the two available designs of this feature. Pupil B stopped playing at the end of bar 9 and there was no time left in the lesson for the track to be revisited and finished.

Pupil C's drum track provides a steady beat for most of the track in a similar manner to both the teacher model and the original track. It features the bass drum and snare alternation that was an aspect of pupil B's performance, with the bass drum generally placed on the beat. Another notable facet is that the texture builds up as the track progresses; see music example 102, which illustrates bars 2 and 10 of pupil C's drum track, providing a bar near the beginning and one near the end of the track for the purpose of comparison:



Music example 102 - Study 2, lesson 5, pupil C drum fragment comparison

Perhaps because pupil C's drum track was played after those of the other two pupils, it uses more drum sounds and is more experimental in general.

A multimodal consideration of the musical transformations - study 2, lesson 5

In comparison with the previous lesson, the pupils' physical positions were much more static. There was also less time allowed for this activity than there had been in previous lessons - only about 15 minutes - and as a consequence, there was only enough time for each pupil to experiment with the drum sounds and record their pattern once. The pupil playing the music keyboard stood while the pupils at the computer and advising sat. Conversation related only to the activity, such as when to start the recording and whose turn it was next.

A consideration of the origin of the transformations - study 2, lesson 5

Some elements of the available designs presented within the classroom context by the teacher were exploited by the pupils, notably the bass - snare drum alternation (pupils B

and C) and the drum 'texture' echoed in the apportioning of drum sounds to hands when playing the keyboard (drums with the left and cymbals with the right). Pupil C built the drum texture as the track progressed, which was not a feature of the classroom-based available designs, but is a common feature of popular music, both in sections of the music (such as the introduction) and in songs as a whole. Other features of the designs made available to the pupils that were not transformed, such as the repetitive regularity of drum parts (the pupils' drum parts all featured variety), and the marking of the 4-bar sections, which is realised in the original drum part of the sequenced backing track by short tom-tom fills.

7.5 General discussion of the transformation of the available designs - study 2

7.5.1 Constraints

The transformations displayed in each lesson varied greatly, lesson 4 demonstrating by far the most. Perhaps not surprisingly, a greater amount of pupil experimentation with a range of musical elements, particularly pitch, rhythm and texture, was observed when the constraints imposed by the lesson design encouraged it. The individual lesson designs aimed to promote a range of musical activities with varying levels of constraint; the following table (see table 10) provides a summary of the constraints present in each designed activity:

Lesson	Activity	Constraints
1	Compose minim tune to prepared backing track consisting of a drum pattern	Use only notes C, D, F, G & A monophonically Minim note lengths only 4 bars long Use only pre-prepared glockenspiel sound
2	Perform two 8-bar gamelan-based minim tunes to prepared backing track consisting of a drum pattern	Play only what is written on worksheets Use only pre-prepared glockenspiel sound Use fingering on worksheets
3	Play two 1-bar bass riffs in time to prepared dance-orientated backing track. Copy and paste them to produce three 4-bar patterns	Only play what is written on worksheets Use only pre-prepared synth. bass sound Must be copied and pasted to form three 4-bar patterns as demonstrated
4	Compose three 4-bar tunes in time to prepared dance-orientated backing track.	Use only notes C, D, E, G & A Any rhythm 4 bars long Use only pre-prepared lead synth, sound
5	Compose three 12-bar drum parts to prepared dance-orientated backing track.	Use any rhythm or drum sound 12 bars long

Table 10 - Study 2, the constraints placed on each activity

From table 10 it can be seen that lessons 2 and 3 were focused on performing, and asked the pupils to play only what is written on the worksheets using a pre-defined keyboard sound. The outcome was therefore able to be measured in terms of how close to the anticipated ideal it came. These lessons could be described as highly constrained. Lesson 1 imposed some constraints on the activity, such as length of tune, rhythmic value to be used, monophonic tune and keyboard sound to be used, but allowed the pupils to choose from a range of notes based on the F pentatonic. Lessons 4 and 5 were less constrained: lesson 4 imposed the length of the tune and the keyboard sound to be used but allowed pupils to choose the the notes to be used (C pentatonic), the rhythm and how many notes were to be played at any one time; lesson 5 imposed the constraint of length (12 bars) and keyboard sound (drums) but allowed any rhythm or combination of drum sounds. When these levels of constraint are examined, it might be expected that lessons 4 and 5 would yield the most in terms of transformations of the available designs, which they do.

There were many examples of pupils' creative attempts to experiment with ideas that lay outside the constraints placed upon the activities:

- lesson 1, where the pupils, tasked with producing a tune of monophonic minims; experimented with quaver and crotchet melodies as well as with chords;
- lesson 2, where the suggested keyboard fingerings were modified;
- lesson 3, where tempo was used creatively to create certain effects;
- lesson 4, where unexpected devices were used such as syncopation, polyphonic; lines, the use of two hands, articulation (legato & staccato) and the use of rests.

However, it should be noted that although many varieties of experimentation took place that lay outside the prescribed constraints of the lesson designs, all the pupils produced outcomes that fitted within these levels of constraint.

7.5.2 The possible origins of the available designs selected for transformation

The classroom context offered many available designs for the pupils to transform. However, when this range of available designs was examined and then compared with the range of designs that the pupils actually used, it was realised that they brought more to the composing process than those provided by the classroom context alone. In the following

sub-sections I examine the possible origins of these designs as seen transformed by the pupils in the observed lessons.

Potentials

The pupils transformed the designs made available and intended by the teacher; however, many of the designs they experimented with appear to originate from outside this immediate context. In the cases of playing more than one note at one time (where they were tasked with playing just one, such as in lesson 1) and playing with two hands (such as demonstrated in lesson 4) it could be argued that both of these are potentials of the music keyboard that are signalled in its very design; in other words, the presentation of the keys in a horizontal line from left to right presents the possibility of them being pressed in any combination. However, to press the keys that the player desires, two hands may well be needed; likewise, if any combination of keys can be pressed, why not press two or more of them at any one time? Also, if it can be seen from this design that some keys can be held down while others are played (in other words, polyphonic playing), why shouldn't the player do this? The players do not necessarily need to have experienced someone else performing on the keyboard in this way to realise the possibilities, it is presented as a possibility in its very design.

Another example of potential signalled through design was presented in the music software interface. In lessons 3 and 4, pupils experimented with tempo in a way not envisaged by the teacher, by speeding the sequencer tempo up to its maximum (250 bpm) and demonstrated through their body movements that they considered that this held meaning for them in that music played at this fast tempo was suitable for dancing to. They also experimented with slowing it down to its minimum (30 bpm). The possibility of changing the tempo to facilitate recording was only visited in passing by the teacher, but this was only to slow it down relatively slightly, from 120 to 80 bpm. The potential of using it to change the character of the music through radically altering it was not envisaged, but was strongly signalled in the design of the interface, where it was clearly marked on the transport bar (see fig. 74):

Figure 74 - The transport bar showing the tempo control

The possible origins of available designs from outside the classroom context

Through a consideration of the transformations by the pupils, it is possible to trace the origins of some of them to the classroom context and to the potentials of the equipment they are using and collaborative working. However, many seem to originate from other contexts. Some examples are:

- methods of keyboard fingering, as demonstrated in lesson 2;
- some aspects of the syncopation used in lesson 4;
- the use of legato and staccato in lesson 4;
- the use of rests in lesson 4.

What these other contexts might be can only be conjectured. Music was valued in this particular school and was frequently heard and seen by all pupils, as described earlier, so some or all of these examples may have originated in the wider school environment. Other possible places include the home, media, social and public events, or maybe a combination of these. During the post-project interviews, the pupils were shown extracts from the videos of the lessons which had been chosen to highlight some of these occasions when the origin of a design was not clear. The pupils appeared vague about these possible origins; only pupil B (from group A), who had used legato and staccato in her playing, was able to say that she had recently been playing a piano piece in her lessons outside of school that had featured staccato as a central feature.

The transformation of the available designs provided by the classroom context

All of the available designs provided by the teacher and the wider classroom context were able to be transformed by the pupils. Perhaps this was because many of the necessary underlying musical skills had been part of the curriculum for many years for these pupils and the teacher had a very good knowledge of the attainment levels of the two particular groups. If the pupils had a problem with the tasks set, it was that they appeared to find it difficult at times to stay within the constraints imposed by the activity. This was seen in lesson 1, where the pupils demonstrated that they could play rhythms that were much more varied than the minim tune asked for by the task and that they could also use chords, where the task asked for a monophonic tune. It was also seen in lesson 2, where pupils did not use the fingering indicated and in lesson 3 where they demonstrated that they would like to use tempo more creatively than the task required.

As well as demonstrating that staying within the task parameters at times was problematic, the pupils also showed that they could bring more to the task than its basic requirements - in other words, they could add value and extend the possibilities. This was clearly demonstrated in lesson 4, where features such as syncopation, articulation and the use of space in the music were observed.

The only lesson in which pupils transformed some of the designs provided by the classroom context without exploiting all of them was in lesson 5 where some of the possibilities of adding the drum rhythm to the previously sequenced tracks were employed, but others were ignored, or perhaps found too difficult in terms of the playing skill needed to realise them. It may also have been because of the lack of time in this lesson.

7.5.3 A multimodal consideration of the transformation of the available designs

Role and seating position

Role and seating position were linked through the lesson design; the teacher had organised the lessons so that all pupils were required to take a turn at each of the three roles and had designed the sequencer template accordingly, with a track for each pupil's work, as well as organising the layout of the equipment, furniture and the seating positions to be used by the pupils. The computer music workstation and furniture were arranged so that once seated, pupils could not easily reach others' equipment; however, pupils sitting at the computer were observed to lean over to play the music keyboard and pupils whose role was playing the keyboard were observed to stand on occasions and reach over to the computer mouse and keyboard. The pupil in the 'advisor' role (see section 7.2) seemed less involved with the lesson and it was noted that some pupils contributed more in this role than others.

Roles and Time

The teacher made no mention of the time each pupil should spend in a particular role and the times spent by pupils and the amount of experimentation at the music keyboard was variable. Examples were provided in the discussion above from lessons 1 and 4. See table 11 for a comparison of these:

Pupil	Total time spent at the music keyboard - lesson 1	Total time spent at the music keyboard - lesson 4	Experiments - lesson 1	Experiments - lesson 4	Recordings - lesson 1	Recordings - lesson 1
A	5 mins 16 secs	3 mins 45 secs	2	4	1	2
B	2 mins 51 secs	4 mins 44 secs	3	8	2	1
C	4 mins 36 secs	5 mins 10 secs	4	11	4	3

Table 11 - Study 2, comparison of lessons 1 & 4 timings of pupils' music keyboard experiments and recordings

These vary in perhaps unexpected ways: pupils A and C did not play a musical instrument at all, whereas pupil B had piano lessons out of school, yet pupil C had a longer time at the keyboard (total for both lessons of 9 mins 46 secs compared to pupil B's 7 mins 35 secs) and undertook more experiments (15 compared to 11) and recordings (7 compared to 3). This signals potential inequalities in the opportunities for composing in the lesson, even though the teacher had tried in the lesson's design to eradicate these. In a 'traditional' composing group using musical instruments, all the pupils potentially have a similar role, in that they all have the opportunity to contribute to the composing through playing an instrument; however, it should be admitted that this will not necessarily result in equality as far as the composing process is concerned, owing to the different personalities and levels of achievement of the pupils. In a composing group where computers are used, the issue of role adds an additional layer to the consideration of equality of opportunity, as there are distinct roles for pupils to occupy; this part of the study has demonstrated that pupils will not necessarily arrange the adoption of roles equitably throughout the group in terms of time.

Potentials of the visual representation of the music

Although the potential for shared negotiation of musical outcomes through the use of the visual representation of the computer has been observed in key stage 2 classrooms (Gall and Breeze, 2005) it was not in evidence in this study. The worksheet was used jointly on occasions when pupils were checking details such as musical pitches or what activity to do next, but the computer screen was used by the pupil in the computer role mainly, and occasionally by the pupil in the keyboard playing role in order to check their work

individually, but not to discuss this with the others in the group. This might have been due to various issues: perhaps the teacher's definition of role had not encouraged this sharing; perhaps the physical arrangement of the furniture and equipment had precluded this; perhaps this was not encouraged elsewhere in the curriculum. However, the observations here suggest that it needs to be planned for carefully, perhaps building it into the lesson design.

Keyboard fingering and its effect upon the transformations

Keyboard fingering was noted to have an effect on the musical outcomes in two lessons in this study - lessons 2 and 4. In lesson 2, pupils A and B used two hands to play the tune that the teacher had intended they play with one hand. This technique was further developed in lesson 4, where possibilities such as two or more notes played at once, and the rapid alternation of notes from each hand were trialled. As pointed out in section 7.3.4, this may have been picked up visually up by the pupils in the observed group (A) from pupils in the other group (B). This transformation of the fingering is an example of a design being presented by the teacher (the minim tune with the fingering indicated) and then being adopted by the pupils in unexpected ways (in two hands, with specific notes taken by each hand). The adoption and adaption of this technique enabled the pupils to transform the music in lesson 4, through the playing of more than one note at one time and the use of rapid note alternations.

Movement to the music

Moving to the music, as observed in lesson 3, was not anticipated and perhaps indicated a possible connection between the musical style chosen as a backing track and music the pupils identified with. Another interesting aspect was that when the tempo was increased to 250bpm, a pupil from the other group joined in the dancing. The adoption of this style was observed to be motivational for the pupils in that it kept them on task for the three lessons in which it was used. The transformation of this particular musical design for something extra-musical perhaps indicates that it could be a good idea to look beyond the immediate musical transformation of designs to connected creative areas - in this case dance - for other, perhaps equally worthwhile transformations.

7.6 Conclusions

The lesson design appears to be important in providing the conditions so that pupils have sufficient freedom and are able to experiment with the musical ideas that they select and are motivated to transform. Although all the composition products met the requirements of the lesson designs, exemplified by the worksheets and the teacher model, much of the experimentation engaged in by the pupils went beyond these requirements. In this study, lessons 2 and 3 focused entirely on performing, and although lesson 1 contained a composing element, it was limited to a choice of notes to fit a given rhythm. The lessons containing the most scope for composing were 4 and 5 and these were observed to be where the widest range of experimentation took place that did not appear to be based on classroom designs. Many musical devices, such as the use of syncopation, the use of doubled and held notes, the use of chords, varied articulations and the use of rests, or space, in the music were observed. Additionally, some playing techniques were seen that had not been demonstrated or suggested, such as the use of two hands, the adoption of particular fingering patterns and the use of tempo. Not all of these were found by the pupils to be musically useful, and were abandoned: an example is the use of tempo. Additionally, most of the experimentations by pupils were observed to follow a developmental trajectory, in that an initial idea was played and then worked on in subsequent experimental fragments until it had been recorded by the software and the pupil satisfied with the result. A feature of the experimentation for lesson 1 was that some of the pupils found it difficult to play a melody consisting only of minims and produced many interesting ideas before eventually limiting them to fit the task requirement. Although the lesson design did limit the outcomes produced by the pupils in the first lesson, it did not preclude them experimenting with many interesting ideas and engaging with generative activity. It may be that the limiting of outcomes in the lesson designs did not prevent pupils from experimenting with 'going beyond' the requirements of the composition product because they were part of a school music culture that encouraged them to do this.

The possible origins of the ideas selected for transformation in study 2 can be grouped into those embedded in the equipment being used for composing, instrumentally-specific techniques and those enabled through the use of group working and influences from the other composing group. Those embedded in the equipment include the various keyboard techniques, such as the use of held notes, the software interface and possible influences

contained in the backing track used in lessons 3, 4 and 5. Specific instrumental techniques that may have been influential include the use of staccato and legato and the use of two hands at the keyboard. The influences from other group members as well as pupils in the other group are difficult to pinpoint, but a consideration of the order of occurrence of certain events, such as the possible transference of the staccato technique in lesson 4 demonstrates that this was at least possible. These origins are discussed further in chapter 8, section 8.2. Although the origins of the ideas transformed by the pupils in this study do not seem related to style or genres of music that pupils may engage with outside the classroom, as they did in study 1, the pupils were observed to be motivated by the style of pop music used in the backing track for lessons 3, 4 and 5, perhaps indicating that the use of this familiar context helps pupils to experiment more freely than perhaps they might otherwise have done.

The multimodal analysis indicated that there were other important mediating influences upon the composing process in addition to the musical ones just described. A key influence in this study was the issue of role: this had been planned into the lesson design, and was reflected in the design of the worksheets and sequencer template. It was observed to give all pupils experience of each of the three identified roles, and although some pupils tended to dominate, taking more time than others, it did result in all pupils composing with the music keyboard in each lesson. However, the lack of negotiation between group members concerning the whole composing task was observed to indicate that perhaps instead of one single group composition, the lesson design had resulted in three separate compositions, with each performer on the music keyboard taking responsibility for whether their recorded work was good enough to keep, or needed playing and recording again. Another important observed influence was the importance of visual and gestural communication between pupils: this was exemplified in the watching of hands playing the keyboard by the pupil at the computer to ascertain when recording had ended and also in the possible passing on of keyboard techniques, such as playing with two hands and the use of various articulations such as staccato and legato.

The analysis of the two studies in this and the previous chapter has raised many issues concerning the composing process as observed in the classroom that will be considered further in the next chapter. This will use the notion of 'liberating constraints' to frame a consideration of the relationship between the learning environment and the composing (or redesigning) process. The possible origins of the available designs will again be

considered taking into account the two studies, identifying key similarities and differences between them. The evidence for creativity in the observed studies will be examined and a micro level examination of composing traces made to support this investigation. Finally, a comparison will be made between the two settings and the key issues arising from this identified.

1 This was 'Cyclic patterns' from 'Music Express' published by A&C Black.
2 Just as in a word processor, sections of music can be cut, copied and pasted.

Chapter 8. Similarities and differences between the transformations in the two studies

8. Introduction

In this chapter, the two studies are examined in greater detail in order to understand in more depth the composing processes with computers employed by the two groups of pupils in the two age ranges (10-11 and 12-13). The first subsidiary aim was 'to investigate the mediating influence of the learning environment upon the transformation of previously existing musical ideas'; in order to address this aim more fully, an examination of the processes investigated in the previous two chapters is made through an exploration and comparison of the liberating constraints in each of the two classroom composing environments. The second subsidiary aim, 'to investigate the origins and transformation of selected pre-existing musical ideas' is investigated through a consideration and comparison of the origins of the available designs that are transformed by the pupils as detailed in the two studies. Following this, there is a focus upon the redesigning of available designs by the two groups of pupils as evidence for how the two settings promoted creativity, through a micro level examination and comparison of how a subset of pupils transformed the available designs. The third subsidiary aim, 'to produce outcomes of use to classroom practitioners' is contingent upon the outcomes of the first two subsidiary aims, and is discussed in chapter 9. Conclusions are drawn at the end of this chapter concerning the key similarities and differences between the two settings.

8.1 Constraints upon the composing process

In order to understand better the constraints of the two learning environments upon the two composing contexts the notion of 'liberating constraints' has been adopted, as discussed in chapter 3, section 3.1.2. This notion of 'liberating constraints' provides a useful means with which to consider the whole learning environment, and especially the composing activities observed in the two studies designed by the two teachers. It will form an additional theoretical lens through which to view the influence the learning environment has upon pupils' redesigning of the available designs, which will now be considered in four sections. These are:

- The planning of lesson activities
- The physical layout of the equipment and furniture

- The roles undertaken by the pupils
- The sequencer templates

8.1.1 The planning of lesson activities

As examined in the two previous chapters, in sections 6.6.1 and 7.5.1, the teachers' planning of the lessons was observed to have an effect on the amount of composing activity engaged in by the pupils and the scope of the transformations made by them. Therefore, it is considered that although (particularly in study 1) the culture of the music classroom was such that pupils were observed to move beyond the constraints provided by the teacher, the lesson design nevertheless had a direct impact upon the composing itself. In the two sections mentioned above, tables were provided (see tables 6 and 10) to show the intended activities for each lesson matched to the constraints these imposed. Table 12 extrapolates the information from tables 6 and 10 to show the opportunities for, and the scope of the composing within each lesson in both of the studies.

There now follows an exploration of the liberating constraints in each of the two contexts.

Study 1

In study 1 (unlike in study 2), the teacher had designed the activities at various 'levels'; for example, in lesson 2, where a picture of an old castle was the stimulus for a section of the music of the same name, there were three[1] 'levels' (as defined by the teacher):

1. Pupils to take it in turns to play a drone on a single note A while others compose a melody using the notes A-B-C-D-E only.
2. The drone to be a single A, or perhaps with an E above with a melody using 8 notes: A-B-C-D-E-F-G-A.
3. A rhythmic drone (the crotchet 2-quaver rhythm is provided) to be used for a melody to be composed over the top. The choice of notes is unlimited.

The amount of constraint is presented in table 13 with reference to the teacher's 3 'levels', through splitting the composing task into two parts (drone and melody).

Study 1	Opportunities for composing in lesson	Scope of composing opportunities	Study 2	Opportunities for composing in lesson	Scope of composing opportunities
Lesson 1	Take existing tune (Promenade) and change some elements, (e.g. notes, feel or mood).	Change of single elements.	Lesson 1	Compose 4-bar minim tune using notes C-D-F-G-A, timbre pre-selected by teacher.	Choice of note from 5 given, no choice of rhythm or timbre.
Lesson 2	Compose drone with modal melody - task provided at 3 'levels'. (notes given for 'levels' 1 & 2 - free choice for level 3).	Rhythm and tempo of melody suggested through teacher model, but free to compose any melody using provided notes (level 1: A-B-C-D-E; level 2: A-B-C-D-E-F-G-A; level 3: free choice).	Lesson 2	None (performing-based).	None
Lesson 3	Create melodic and rhythmic ostinato from rhythm grids using provided notes given at 3 'levels'.	Using given notes at one of 3 'levels' (C-G / C-E-G / C-D-E-F-G) to compose ostinatos to provided rhythms.	Lesson 3	None (performing-based).	None
Lesson 4	Add block chords to Promenade theme and add suitable ending.	Adding chords using method modelled by teacher. Freedom to compose own ending - only the addition of drums was suggested.	Lesson 4	Compose 4-bar tune using notes C-D-F-G-A, any rhythm, timbre pre-selected by teacher.	Any rhythm but note range limited to 5 provided notes; no choice of timbre.
Lesson 5	Lesson mainly concerned with structuring piece and tidying up ready for assessment following a performance.	Structuring composed elements into form provided by teacher.	Lesson 5	Compose 12-bar drum part.	Use any drum sound and rhythm.

Table 12 - The opportunities for and scope of composing opportunities in the two studies

Level	Drone	Melody
1	Single A	5 notes
2	Single A or A & E	8 notes
3	Rhythmic drone using A & E	Unlimited

Table 13 - Study 1: the 3 'levels' of lesson 2 and their constraints

This levelling of the range of technical demand is, in my experience, a typical technique used by secondary music teachers to engage the diverse range of learners in their classrooms; it was noted during the observations that all pupils *did* engage with the tasks, perhaps indicating that the teacher knew these pupils well and had planned accordingly.

The pair of observed pupils, both higher-attaining, sometimes followed the designed composing activities, but on occasions moved outside their constraints. Table 14 charts this 'staying within' and 'moving outside':

Lesson	Task	What was observed that 'stayed within'	What was observed that 'moved outside'
1	Take existing tune (Promenade) and change some elements, (e.g. notes, feel or mood).	Promenade tune played in 2 octaves.	Rhythmic drone (as demonstrated in lesson 2) added later.
2	Drone with modal melody (notes given for levels 1 & 2). Task provided at various levels.	A & E rhythmic drone used with modal tune using notes A-B-C-D-E-F.	Use of 3rds, dotted rhythms and semiquavers (see music example 7).
3	Create melodic and rhythmic ostinato from rhythm grids and provided notes.	Two ostinatos are used (repeated quaver C-E-G chord and C-E-F-G bass line).	Ostinatos used extend scope of what was suggested by teacher. Rock style adopted. Syncopated melody with a range of a 10th. Use of drum accompaniment rhythm (the teacher didn't introduce the idea of adding drums until lesson 4). (See music examples 19-25.)
4	Add block chords to Promenade theme and add suitable ending.	Pupils add block chords to the tune.	Pupils play the tune in octaves. Notes added to form the chords are added on top of the melody notes, not below as in the original listening example and the teacher's model; however, this followed the verbal explanation given by the teacher (see music example 28).
5	Lesson mainly concerned with structuring piece and tidying up ready for assessment following a performance.	Suitable ending composed and elements structured into the form required by the task.	Ending based on a series of broken chords plus a restatement of the theme in the bass; piece comes to a quiet conclusion (see chapter 5, section 6.5.5).

Table 14 - Study 1: 'staying within' and 'moving outside' the lesson designs

The teacher's lesson designs in study 1 can be considered to have provided an appropriate amount of constraint for the observed pupils to engage in 'generative' activity, that is, they could move outside the constraints of the composing task (if a strict interpretation of the worksheet and teacher explanation is made), to capitalise upon the classroom culture encouraged by the teacher, that of the freedom to experiment, where nothing is considered 'wrong'. I will consider the fuller multimodal aspects of these constraints in sections 8.1.2, 8.1.3 and 8.1.4.

Study 2

The design of the lessons at the primary school in study 2 took a different approach to that of the secondary school in study 1 in that the lesson activities did not contain 'levels' aimed at different pupils, but aimed to provide enough scope within the designed activities to enable all the pupils to engage with them. It will be noted from table 10 in chapter 7, section 7.5.1 that lessons 2 and 3 of the primary study were performing-based, thereby not featuring any composition; these will be not be considered in the following discussion. In table 15, the composing activities in lessons 1, 4 and 5 are mapped together with the observed pupil composing that 'stayed within' the scope of the teacher's tasks and that which was observed to have 'moved outside':

Lesson	Task	What was observed that 'stayed within'	What was observed that 'moved outside'
1	Compose 4-bar minim tune using notes C-D-F-G-A, timbre pre-selected by teacher.	All the pupils' outcomes were a minim tune, with the notes chosen from the provided note-range.	The experimentations by the pupils featured a wide range of rhythms and textures, from quaver patterns (see music example 32), chords (see music examples 33 & 35) and a mixture of rhythms (music examples 34 & 35).
4	Compose 4-bar tune using notes C-D-F-G-A, any rhythm, timbre pre-selected by teacher.	All pupils produced work which matched the task's requirements.	All three pupils extended the scope of the model presented by the teacher (see music examples 67-81) significantly, through the use of syncopation, doubled and held notes, varied articulations, the use of rests as well as the use of two hands.
5	Compose 12-bar drum part.	All pupils sequenced a 12-bar drum part.	The teacher model was of a typical drum part found in this style of music; the pupils were all able to produce their own novel parts, partly based on that of the teacher (see music examples 97-99).

Table 15 - Study 2: 'staying within' and 'moving outside' the lesson designs

As in study 1, pupils were able to exceed the task requirements, indicating that it was not only well-matched to their attainment levels, but that it enabled them to be able to engage in 'generative' activity.

A comparison of the liberating constraints of the design of the composing activities

In a direct comparison of the level of constraint upon the scope for composing (see table 12) between the two studies, although the constraints apply in both studies to the same musical elements, pitch, rhythm, timbre and texture, the tasks set in study 2 appear to contain a more restricted set of possibilities for composing. These differences in constraint are discussed here under each of the musical element headings:

Pitch

Restrictions on the number of differently pitched notes to be used were applied in both studies. In study 2, the actual notes to be used sometimes covered a smaller note range than in study 1 (always 5 in study 2, compared to a greater range in study 1 in the higher 'levels', particularly in lessons 2 and 3). Additionally, note restrictions in study 1 were not always applied in this way (for example, the possibility was given of changing notes in the Promenade theme and creating one's own ending). The teacher's models in study 1 were observed to include the greatest range of notes suggested to the pupils, whereas in study 2, as there were no 'levels' in the task, the maximum number of notes were employed in the teacher's model.

Rhythm

Sometimes the rhythm was dictated, as in study 2 lesson 1, where minims only were used and in study 1 lesson 3 where the 'box and cross' notation was used; however, at other times it was left completely open to the choice of the pupils, such as in study 1 lesson 2 (the Old Castle) and in study 2 lesson 4, where the 4-bar tunes were composed. However, the rhythm of the teacher's model was observed to have a strong influence in some cases, such as in the study 1 'Old Castle' lesson.

Timbre

The timbre to be used was always prescribed in study 2 in the teacher's sequenced template, where each pupil's track was set up in advance with a preset sound. In study 1, pupils had more choice, as they were not restricted to recording on any particular track,

and the teacher had set up the template so that there were a range of sounds available on the different tracks (see fig. 41, chapter 6, section 6.5.1).

Texture

There were some lessons where the teachers had indicated that single notes should be used, such as in the minim tune in study 2 lesson 1 and the melodic ostinatos of the 'Orion-Noir' lesson in study 2. However, on other occasions, this restriction was not indicated but perhaps implied, through the provision of the teacher model, where single notes only were used, such as in study 2 lesson 4, when the 4-bar melodies were composed.

It is not the actual constraint placed upon the composing that is considered important, but informed by the notion of 'liberating constraints', it is the possibilities that it provides for pupil composing and whether the constraints can be 'moved outside'; in other words, does the task provide enough boundaries for pupils to be able to form initial ideas yet allow the freedom for experimentation and expression and hence to be creative? Both studies showed similarities in the ways the pupils could move outside the boundaries of the lesson designs. This was not only evidenced through the extension of musical elements, such as rhythm (for example, the use of syncopation) or texture (the use of 2 or more notes) but also in the appropriation of other styles of music, although this was only noted in study 1 (secondary), where pupil A brought in elements of jazz, rock and pop, both in the syncopated melody and in the choice of bass-line in the pair's interpretation of the Orion-Noir picture. In terms of the more general adoption of musical techniques, examples are the staccato playing of pupil B in lesson 4 of study 2 and the use of broken chords and the use of the quiet, somewhat 'downbeat' ending in lesson 5 of study 1. The possible origins of these are discussed below in section 8.2.

Observations

The observation and analysis of all the pupils' experimentation in both studies demonstrated that they investigated many musical possibilities that lay outside the constraints of the lesson designs, even though their recorded outcomes did not always mirror the breadth of these. They were also able to import designs from other musical contexts. Both of these aspects of their work indicates that the level of constraint in the lesson designs seemed to be appropriate for the musical backgrounds and attainment levels of the pupils and indicated that the teachers had taken this into account when

planning the tasks and had thus provided a suitable opportunity for pupil composing and 'generative' activity.

8.1.2 The physical layout of the equipment and furniture

As well as the musical constraints contained within the learning designs, the adoption of the multimodal prism has allowed other important aspects of the designs to be taken into account. The first of these to be examined is how the layout of the room in terms of the arrangement of furniture and equipment was observed to constrain the composing activity. As these studies were necessarily at the micro level, this will be considered in terms of the micro-system of the computer music workstation, or in other words, in terms of the immediate composing group. For reference, see the layouts of each of the two studies in figs. 75 and 76 below:

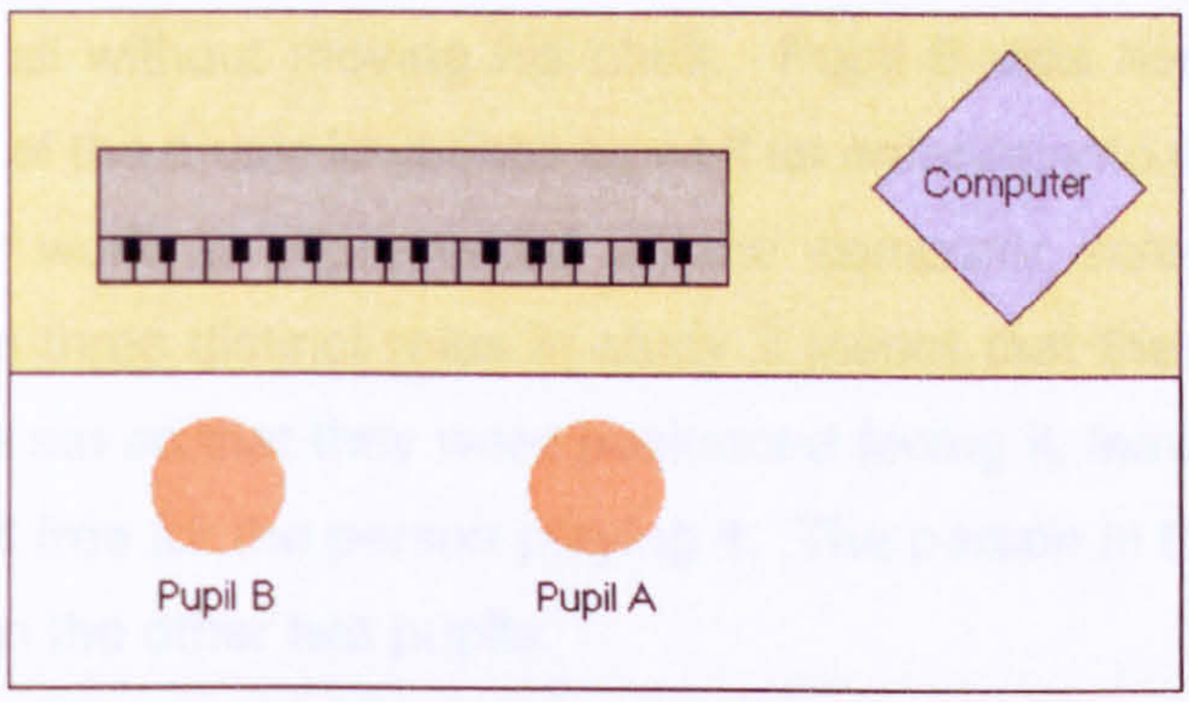


Figure 75 - Study 1 physical layout

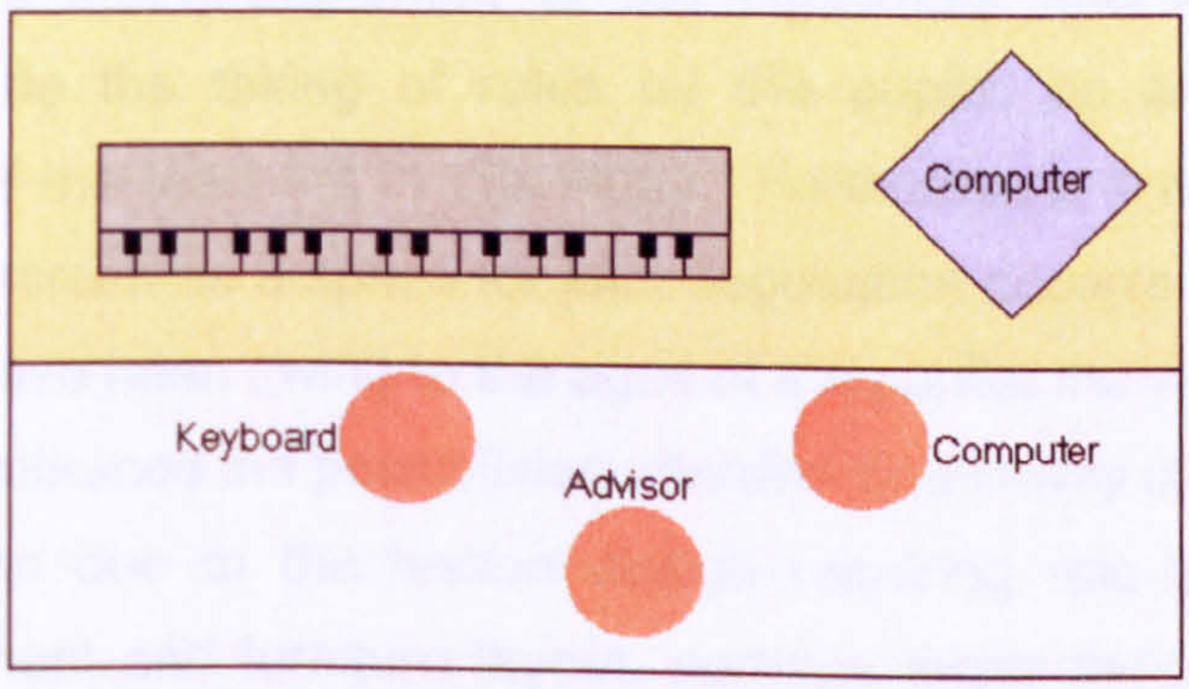


Figure 76 - Study 2 physical layout

The constraint noted to have been the most restrictive in terms of the multiplicity of activities engaged in by each pupil in study 1 was that the pupils remained in these positions for the whole of the course of the study, whereas in study 2, the teacher had planned for each pupil to undertake a specific activity in turn.

The MIDI computer music workstation is necessarily split into 2 main sections: the computer system and the music keyboard. For semi-professional and much professional use, this system would be used by one person; however, for a single person to be able to manage the demands of the computer recording and editing as well as playing the music keyboard requires a high level of familiarisation with these processes in order to be able to perform them for effective creative musical ends; therefore, these tasks are generally split for the purposes of key stage 2 and 3 (ages 7 to 14) composing, so that they are separately undertaken by different pupils.

In study 1, it was observed that pupil A was familiar enough with the computer music workstation to be able to perform these tasks by himself. This resulted in the physical arrangement of the equipment so that he could reach it all himself from a seated position and could operate it all without moving his chair. Pupil B was necessarily restricted to playing the lower half of the music keyboard as well as entering into discussion concerning the progress of their work as represented on the computer screen. In contrast, the planned need to have three distinct roles in study 2 meant that the person operating the computer system was sat so that they were positioned facing it, leaving the space in front of the music keyboard free for the person playing it. The person in the 'advisor' role stood behind and in-between the other two pupils.

It was observed that the arrangement of the equipment and furniture could either encourage or preclude the taking of roles by the pupils, an aspect that had been considered by both of the teachers in this study. Furthermore, it was observed that the use of the computer screen as a space for joint negotiation occurred in study 1 but not in study 2. This could have been owing to the ages of the pupils; the younger pupils of study 2 may not yet have embraced the possibilities afforded by this way of working. However, it could also have been due to the lesson design requiring role-taking, leading to the differences in equipment and furniture layout, perhaps tacitly indicating to the pupils in study 2 that the focus of their activity (for example, playing the keyboard) meant that they were not required to involve themselves with the computer.

There were examples of pupils 'encroaching' into others' allocated roles in study 2; for example the pupil operating the computer sometimes stretched their left hand over to the music keyboard to play a few quick notes - this was quickly rebuffed by the person playing the keyboard. Also, on one occasion, when having recorded a 4-bar tune, the pupil having

just played it on the keyboard was observed to then monopolise the computer system while he played it back several times to check he was happy with it; this was not a task shared amongst the group - it seemed that he considered it his own responsibility to check the quality of his work before the group could move on to the next change in roles in order for another pupil to record their own tune. However, these were relatively uncommon events and in general terms the pupils stayed in the roles and positions envisaged in the lesson design.

Another aspect of the physical layout of the furniture and equipment is the opportunities it provides for pupils to act on visual clues provided by other pupils. This was observed -

- in study 2 lesson 4, where pupil D may have picked up pupil B's use of staccato playing in study 2, lesson 4 (see chapter 7, section 7.3.4);
- in study 2, lesson 4, where pupil A may have adopted pupil C's use of two hands (see chapter 7, section 7.3.4);
- in study 1, lesson 1, where pupil B follows pupil A's hand carefully in order to synchronize his playing of the Promenade theme 2 octaves lower (see chapter 6, section 6.5.1).

These responses to visual stimuli are important as they add to the designs available to the pupils for transformation and illustrate the opportunities there are for music learning through visual means.

8.1.3 The roles undertaken by the pupils

Although there have been many studies of collaborative and co-operative group work, examinations of the roles undertaken by pupils when composing in groups with computers in the classroom are almost non-existent, as noted by Gall and Breeze (2007: 53) who call for a 'reconceptualisation of existing pedagogy' in this respect. Government advice is available for practitioners in the form of the volume 'Group Work' as part of the Pedagogy and Practice series of support and guidance materials (DfES, 2004b). The issue of role is investigated in this volume, but advice for teachers is limited to dividing up roles within groups and changing roles for the next group discussion (ibid., 2004b: 15) or the provided strategy of rotating roles as part of the development of social skills (ibid., 2004b: 18).

Specific advice for music has also been published as part of the music key stage 3 strategy 'Creative teaching and learning in music' document; however, this focuses on the identification of roles in non-computer music groupings (e.g. leader, creator, conductor, decision maker) (DfES, 2006b: 10) and applying the linguistically-focused well-tested techniques, such as 'listening triads' and 'Jigsaw'.

The roles observed to be undertaken by pupils and the time they spent in each of them was seen to be particularly crucial to their composing in terms of their -

- opportunities for experimentation at the music keyboard;
- the sharing and negotiation of outcomes.

Opportunities for experimentation

Musical experimentation in the two studies was characterised by time spent exploring possibilities at the music keyboard. Time in the computer role was largely spent putting into operation the recording process, especially in study 2; in other circumstances, where pupils might use the editing features of the computer for experimentation, then this would need to form part of this consideration too - however, that was not the case in these studies. This opportunity for experimentation or exploration is generally considered to be important in classroom composition (Westerveld, 1974: 41; Jennings, 2005: 235; Fautley, 2005: 48) and in the two studies observed here, it was noted to be a constant feature. However, the nature of the experimentation was observed to be different in each of the studies.

For each pupil to be able to have the opportunity to develop their ideas, it would seem that the time for this should be equitably shared. However, this was not observed to be necessarily the case, as was shown in study 2, chapter 7, section 7.4.3 and the number of experimental fragments consequently varied.

The experimentation in study 1 was less characterised by its occupation of a section of time preceding a performance but was more interwoven into the whole activity. Owing to the seating positions and the role relationships that had developed between them (see section 6.5.3), the nature of the experimentation was very different for each of the pupils. Pupil B, sat to the left of the keyboard, experimented with drum patterns, the bottom

octave of melodies played in unison with pupil A and with accompaniment and bass patterns; pupil A experimented with melodic patterns and often told pupil B what to do for the various accompaniments. The pupils tended to experiment at the same time, so the time taken by each of them was approximately equal; however the nature of it was quite different.

In study 1, the opportunity to experiment with a range of musical ideas was mediated by the static seating position and role relationships, whereas in study 2, although the roles were rotated, the time available for each pupil was not equal, providing different opportunities for experimentation.

The sharing and negotiation of outcomes

The sharing and negotiation of outcomes took on different forms in each of the two studies. In study 2 there appeared to be no sharing of issues concerning the composing process using the computer screen, but rather through verbal means; the following is an example from lesson 4 (see chapter 7, section 7.3.4):

L34 C: I had the beginning right, it was like...(plays)

L35 A: It's about right

L36 C: Aah, I'm gonna start again. There are too much [..] I've lost it now

L37 C: Done now, it's best

L38 C: Listen to it?

L39 A: Happy with that?

L40 C: Yeah

L41 A: My go now

In study 1, the pupils used the Cubasis arrange page frequently as a joint negotiation space; the following is an excerpt from a conversation which took place during lesson 4 (see chapter 6, section 6.5.4) as they both looked at the screen and intermittently pointed to it:

L75 B: Yeah, so you've got to move all that underneath ..

L76 ... underneath it was a above it..

L77 ... it was the start of that first one's got to be under that.

L78 A: We've run out of space to put it. Now we'll put it..

L79 B: ..over..

L80 A: .. after that (points to worksheet). So we'll put you upstairs ..

L81 B: ..in the middle..

L82 A: ..there. And then (points to computer screen) we've got to have ..

L83 ... and then we'll start recording here for the .. that bit ..

L84 ... and then we'll bring them in (turns to face pupil B).

L85 B: Umm .. what are we going to do for that then - do the Chorus and the Promenade tune? ..

L86 We're going to have to go slow tempo because .. the chords aren't we?

It is possible that the lesson design in study 2 encouraged the pupils to consider the whole process in terms of three separate recordings and therefore three separate compositions, rather than the whole composition being a single outcome of their joint effort. Study 1, by contrast, did not divide the work up into separate roles that each pupil must adopt, but rather treated the whole composition as a joint activity and outcome. Perhaps because of this, both pupils felt they should both have an input into its creation and development irrespective of who played the keyboard for a particular section. This difference between the two studies is further discussed in the concluding observations at the end of this chapter.

8.1.4 The sequencer templates

The sequencer templates are an important aspect of the lesson design as all the pupil composing work is focused upon them. They can convey much more to the pupil than simply presenting a computer interface with all MIDI connections and sounds set up; they can be an embodiment of the activity itself. The arrange page from the template prepared for lesson 4 from study 2 is shown below (see fig. 77):

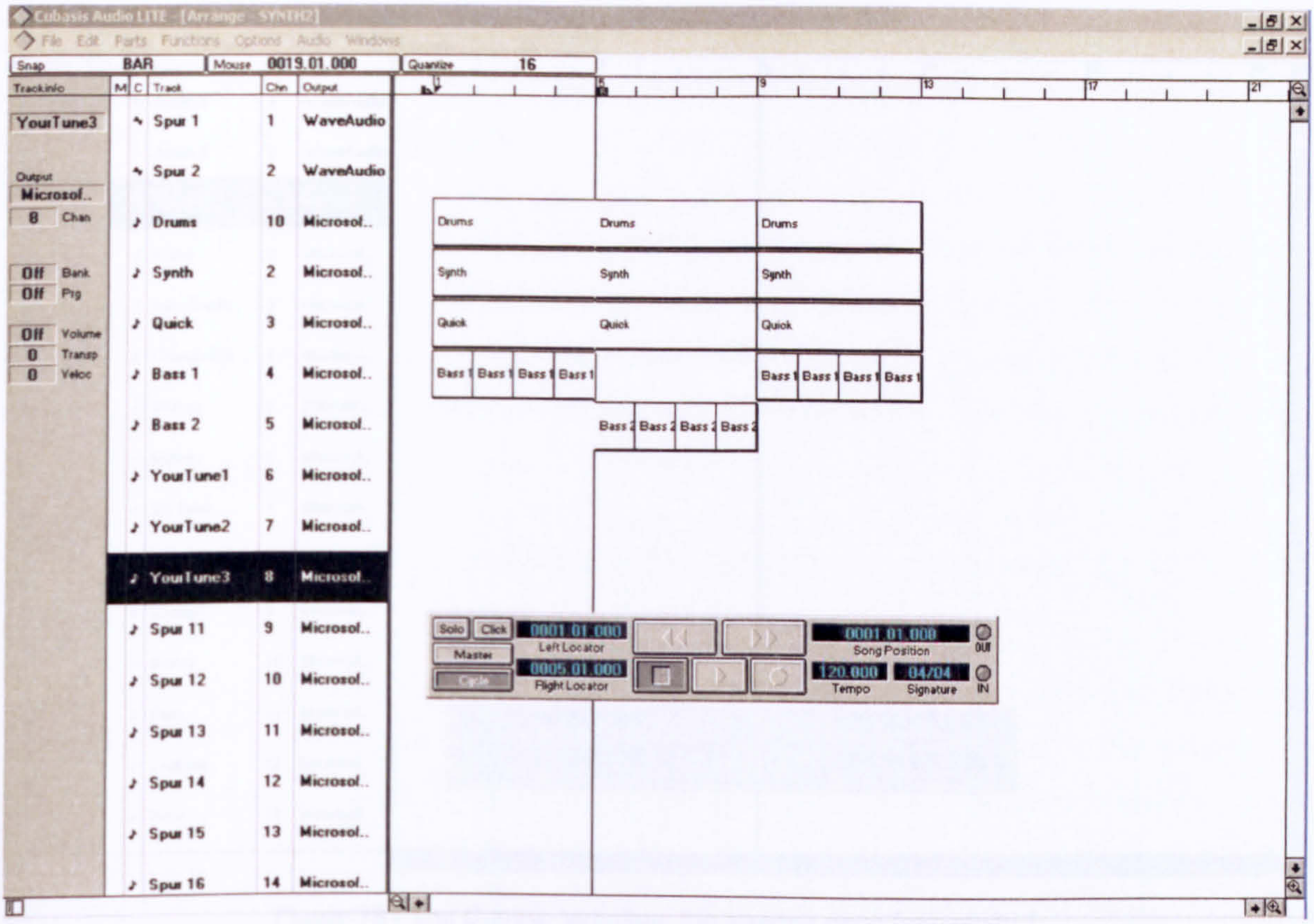


Figure 77 - The Cubase template: the arrange page from study 2 lesson 4

The scope of the work in terms of bars and beats was laid out across the page and the tracks for the pupils to record onto were indicated in the track list. The backing was laid out above the pupils' tracks and its texture and instrumentation can be seen represented by the parts and by the names in the track list. The transport bar had the initial start and end locator points for the first pupil's recording already entered and the tempo was set to that suggested and modelled by the teacher. This representation can be considered to serve as a blueprint and it was noted that it was able to be used by the pupils with only the occasional technical question, such as how to change the locator positions.

The template prepared by the teacher for use in study 1 was used from lesson one onwards. The pupils' composition work was added to it during each lesson and it was subsequently saved using their own file name. It can be seen below (see fig. 78):

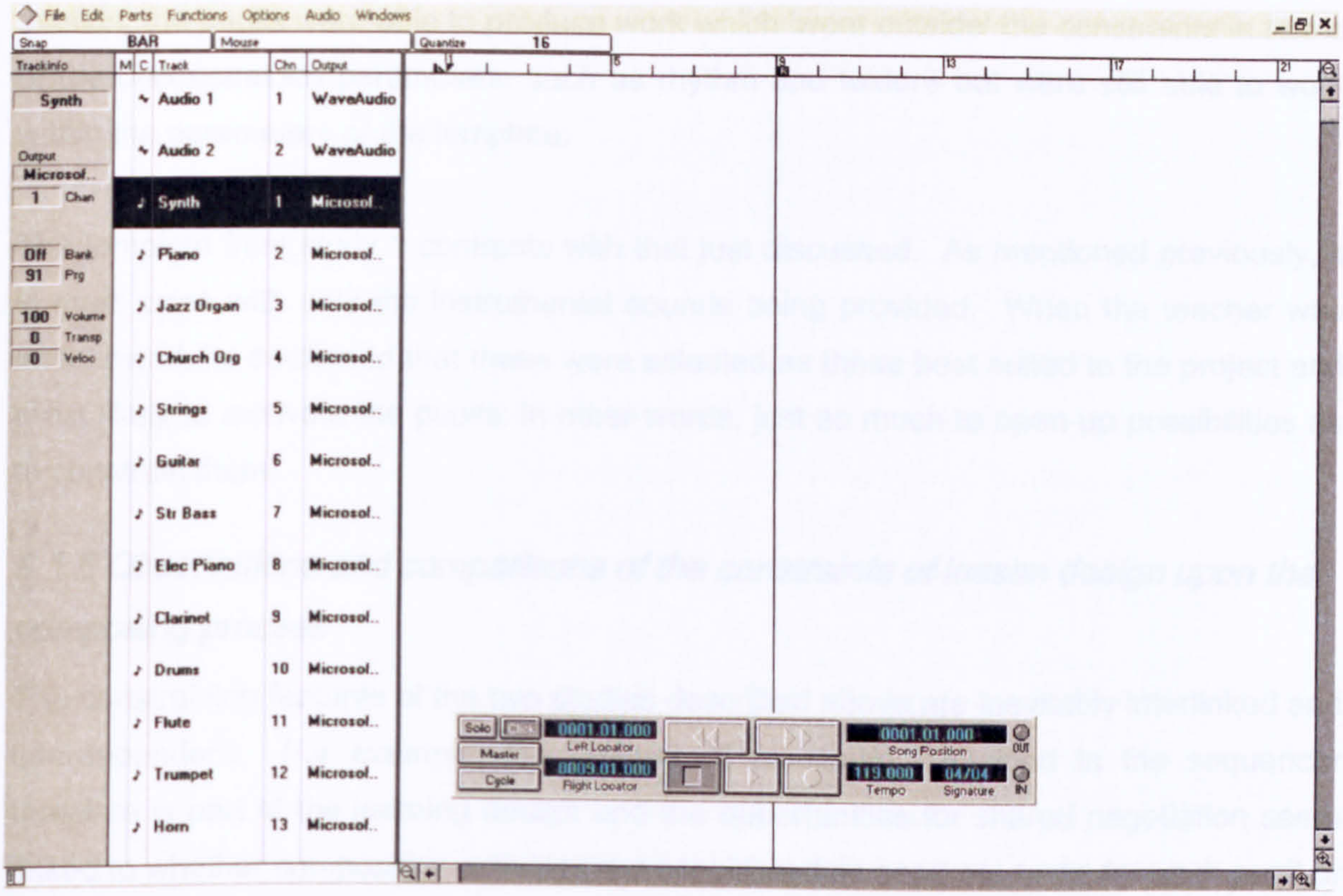


Figure 78 - The Cubase template: the arrange page from study 1

This template was much more 'open' in that it contained no pre-recorded backing tracks and following teacher guidance, the pupils set the start and end points for recording using the locators on the transport bar, as well as the tempo. However, the instrumental sounds together with the MIDI inputs and outputs had been set by the teacher so that the pupils could start work straight away.

The templates contained varying amounts of constraint within them. If the template from study 2, lesson 4 is considered (see fig. 77), it will be noted that the following parameters are set:

- the length of the recording;
- the timbre to be used;
- the tempo;
- the style of the backing track.

Taken together with the note constraints from the worksheet, the activity could be considered to be highly constrained; however, as was demonstrated in the previous

section, the pupils were able to produce work which 'went outside' the constraints in terms of the unconstrained parameters, such as rhythm and texture but were still able to work within the parameters of the template.

The template from study 1 contrasts with that just discussed. As mentioned previously, it is more open with only the instrumental sounds being provided. When the teacher was interviewed, he confirmed that these were selected as those best suited to the project and most likely to motivate the pupils; in other words, just as much to open up possibilities as to constrain them.

8.1.5 Observations and comparisons of the constraints of lesson design upon the composing process

The constraining features of the two studies described above are inevitably interlinked and interdependent. For example, the amount of constraint contained in the sequencer template is part of the learning design and the opportunities for shared negotiation seem linked to whether composition activities are considered as separate tasks for each pupil or as a group task. As well as this interlinking, there seem to be some dichotomies, as it was observed that where there was less constraint in the planning of the composing activities, pupils' roles were less equal and balanced. The following diagram (see fig. 79) sums up these key differences:

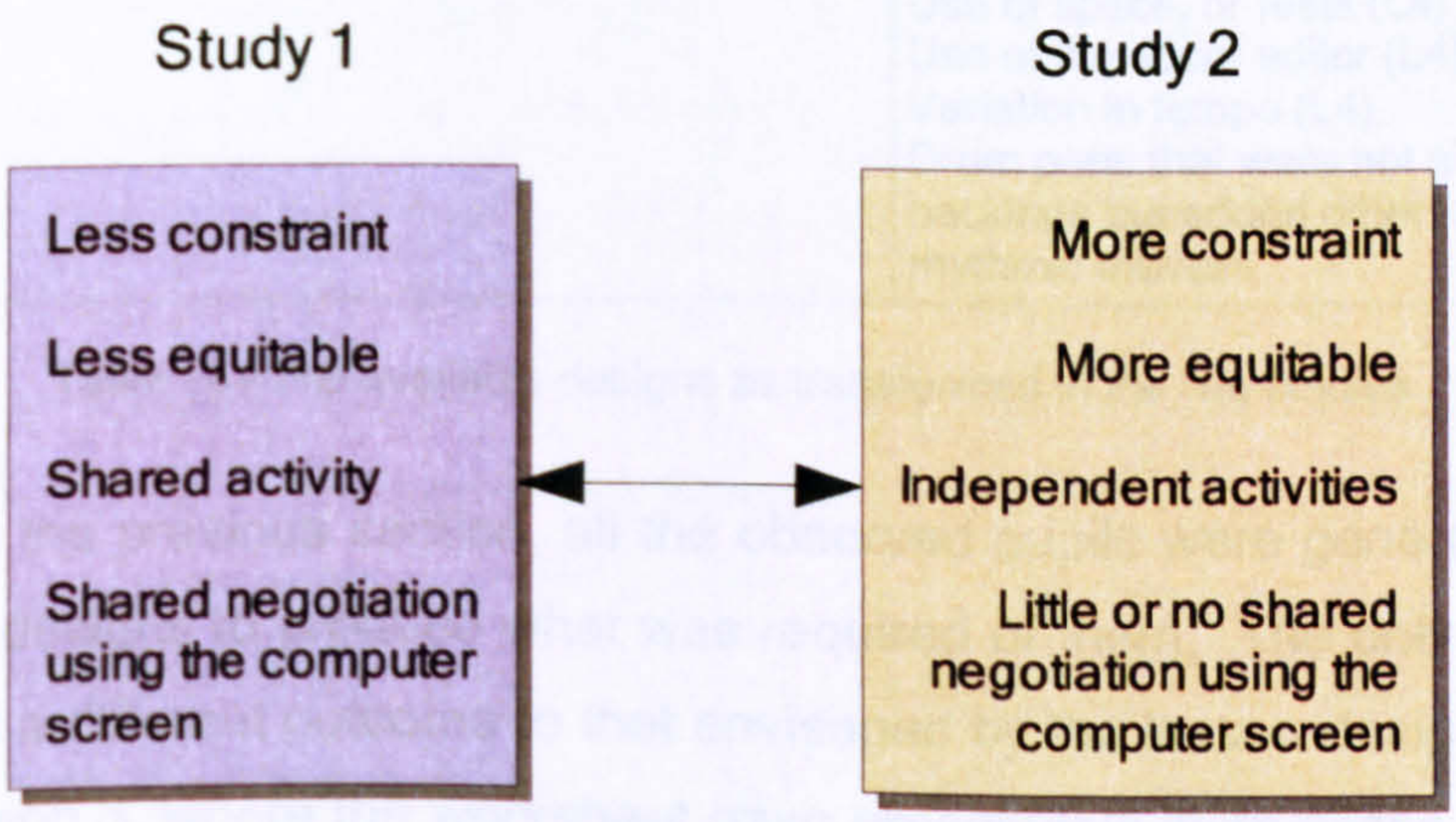


Figure 79 - The key distinctions between the two studies

8.2 The origins of the transformed available designs

In this section I investigate and compare the origins of the available designs that were transformed by the pupils. The following table summarises the origins of the available

designs used for the composing, placing them into two groups as previously presented in chapters 6 and 7 (see table 16):

	Available designs originating from the classroom context	Available designs originating from outside the classroom context
Study 1 (secondary)	Promenade Theme (L1) A minor modal melody and drone (L2) Placing together of drone and Promenade theme (L2) Short repeated patterns (L3) Suggestion of adding elements from popular music (L3) Chordal version of Promenade theme (L4) Ordering of sections of previously recorded music (L4)	Playing of Promenade theme in octaves (L1) Drum experimentation (L1) Rhythmic experiments with drone (L2) Melodic ornamentation of the Old Castle melody (L2) Repeated quaver accompanying C major chords (L3) The use of elements from popular music (L3) Jazz-influenced syncopated right-hand melodies (L3) C-E-F-G bass figure (L3) The ordering of sections of previously recorded music that went beyond that required by the lesson design (L5) Playing of Promenade theme with chords and in octaves (L5) Arpeggiated chords (L5) Two final echoes of main theme to form an ending (L5)
Study 2 (primary)	Use of the suggested notes (C-D-F-G-A) to form minim melody (L1) Use of suggested notes (C-D-E-G-A) to compose 4-bar melody (L4) Use of keyboard as a drum set to compose 12-bar accompanying pattern (L5)	Rhythmic variation - including quavers and crotchets (L1) Textural variation - including note clusters and 2 notes played at one time (L1 & L4) and 'held' notes (L4) Two-handed playing (L1 & L4) Syncopation (L4) Variation in articulation (L4) Use of space, or rests (L4) Use of the score editor (L4) Variation in tempo (L4) Drum parts that were not simply repetitive backings but added other elements of rhythmic interest.

Table 16 - The available designs as transformed in the two studies

As discussed in the previous section, all the observed pupils were generally able to work with the lesson designs to produce what was required of them. The only example where pupils produced a different outcome to that envisaged by the lesson design was in study 1 (secondary) lesson 3, where the worksheet gave prescriptive instructions concerning how to compose this minimalist section of the composition and the pupils composed a jazz-rock influenced piece of music instead. There now follows a discussion of the possible origins of the available designs from outside the classroom context under the following headings:

- Instrumentally-specific techniques that may have originated in instrumental lessons;
- Musical styles;
- Potentials of the equipment;
- Other pupils in the classroom;
- Observations upon the origins of the transformed available designs.

8.2.1 Instrumentally-specific techniques that may have originated in instrumental lessons

Most MIDI equipment in schools is keyboard-based; there are many other MIDI controllers that can be used to input data, such as MIDI guitars, drum pads, wind synthesisers and so on, but perhaps owing to its usefulness as a stand-alone instrument and its familiarity to teachers, it is the keyboard that is almost ubiquitous in classrooms. The piano and keyboard are popular instruments for pupils to learn both in and outside of school, so perhaps it is to be expected that specific keyboard techniques, perhaps learnt in these lessons, will be employed for pupils' composing in the classroom. This was observed in both studies, the more advanced techniques (such as ornamentation) being seen used by the older pupils in the secondary study. In study 2 (primary), the only firm piece of evidence that a technique had originated from an instrumental lesson was the use of staccato by pupil B in lesson 4 (see chapter 7, section 7.3.4) and her confirmation in the post-study interview that she had recently been studying a piece of piano music which featured staccato. On occasions, the scope of this appropriation of techniques appeared to be widened to include whole phrases of music, as was observed in study 1 (secondary) in lesson 3 (see chapter 6, section 6.5.3) where the minimalist lesson design was interpreted by the pupils in a different way to include riffs and phrases borrowed from jazz-influenced music which relied on keyboard-specific techniques for their realisation. Additionally, instrumentally-based techniques were applied to material originating in the classroom, such as in study 1 lesson 5 (see chapter 6, section 6.5.5) where pupil A created an arpeggio-based section based on the chords used in the harmonisation of the Promenade theme in lessons 4 and 5, arpeggios played in this particular manner being a keyboard-specific technique.

8.2.2 Musical styles

Various musical styles were represented in the pupils' composing that were not made available to them in the observed series of lessons. Music plays an important part in the daily lives and identities of young people (Lamont et al., 2003: 229; North et al., 2000: 255) and its potential influence upon their work in school is high. The origins of the musical styles observed in these two studies is hard to pinpoint as their influence could originate from a wide variety and combination of sources, for example:

- Listening at home and school to varied kinds of media, for example CDs, television and radio;
- The study of music in the classroom and in instrumental lessons;
- Going to concerts, gigs and other events where live music is present;
- Hearing family members and friends playing instruments.

It is thus important to note that pupils bring a stylistic awareness into the classroom that goes beyond that which is experienced in the school environment. Popular music styles were frequently observed, as in the experiments with drum rhythms (pupil B in study 1, lesson 1 - see chapter 6, section 6.5.1) and the jazz-rock-pop-influenced music (pupil A in study 1, lesson 3 - see chapter 6, section 6.5.3). The ending of the composition in study 1 seems to indicate that there was an awareness of the Romantic western art music period from the 19th century, as the piece ends in a somewhat quiet manner with fragmentary restatements of the main theme, each an octave apart - a device reminiscent of this style. The use of ornamentation by pupil A in study 1 (secondary) in lesson 2 (see chapter 6, section 6.5.2) could not only indicate the importing of an instrumental technique as previously noted, but could also signal an allusion to baroque / enlightenment western art music styles.

8.2.3 Potentials of the equipment

The physical layout of the keyboard has been refined over many hundreds of years and it was observed in these studies that pupils were not provided with any help in playing it, other than the note names being written onto the keys in study 2. Perhaps it was considered that pupils' previous keyboard experience was sufficient to cope with the proposed composition tasks, but it may also have been because it was thought that its purpose was made clear though its very design (Norman, 1988). Put another way, it might have been that the design of the keyboard's black and white keys, with the lower notes to

the left and the higher to the right was judged to be so common in contemporary society, that this aspect of the instrument did not need explaining and would be quickly understood by the pupils. There were two playing-related techniques observed that did not appear related to instrumental techniques encountered in instrumental lessons; these were:

- the use of two hands to play what had been envisaged in the lesson design (as exemplified in the worksheet and teacher model) as playable by one hand (see chapter 7, section 7.3.4);
- the use of sustained notes in one hand while the other played more quickly moving notes (see chapter 7, section 7.3.4).

There were also aspects of computer use that were observed not to need explaining to the pupils in study 2, such as the use of the tempo facility (through changing the tempo bpm number on the transport bar) and the use of the score editor (invoked by double-clicking on a part). Both of these could have been accidental discoveries, but nevertheless, they are potentials of the equipment that are immediately available for pupil use and did not need previously explaining or pointing out in these studies.

8.2.4 Other pupils in the classroom

Another origin of available designs is other pupils in the classroom; in these studies, various techniques appeared to have been appropriated by pupils from others in the classroom, not necessarily members of their group. These could have been passed on by various means, including aural, visual and gestural. This was particularly noticeable in lesson 4 of the primary study (see chapter 7, section 7.3.4) where it was observed:

- the use of 2 hands and staccato could have been copied by pupil D
- the alteration of the tempo was copied by group B
- the movement to the music (dancing) observed in group A when the tempo was increased was also observed in group B

This is an advantage of classrooms where pupils do not wear headphones, in that they can not only hear other groups, but can link sounds that interest them to visual and gestural clues, making the copying of techniques and ideas easier. From my own classroom experience, I know that wearing headphones has the advantage of minimising

audible interference from other groups' music, but it also makes interaction between groups less likely.

8.2.5 Observations upon the origins of the transformed available designs

Although it is hard to pinpoint the exact source of most of the available designs, this attempt to categorize them has shown that they have multiple sources that are essentially drawn from the sum of the pupil's lived experience (see fig. 80).

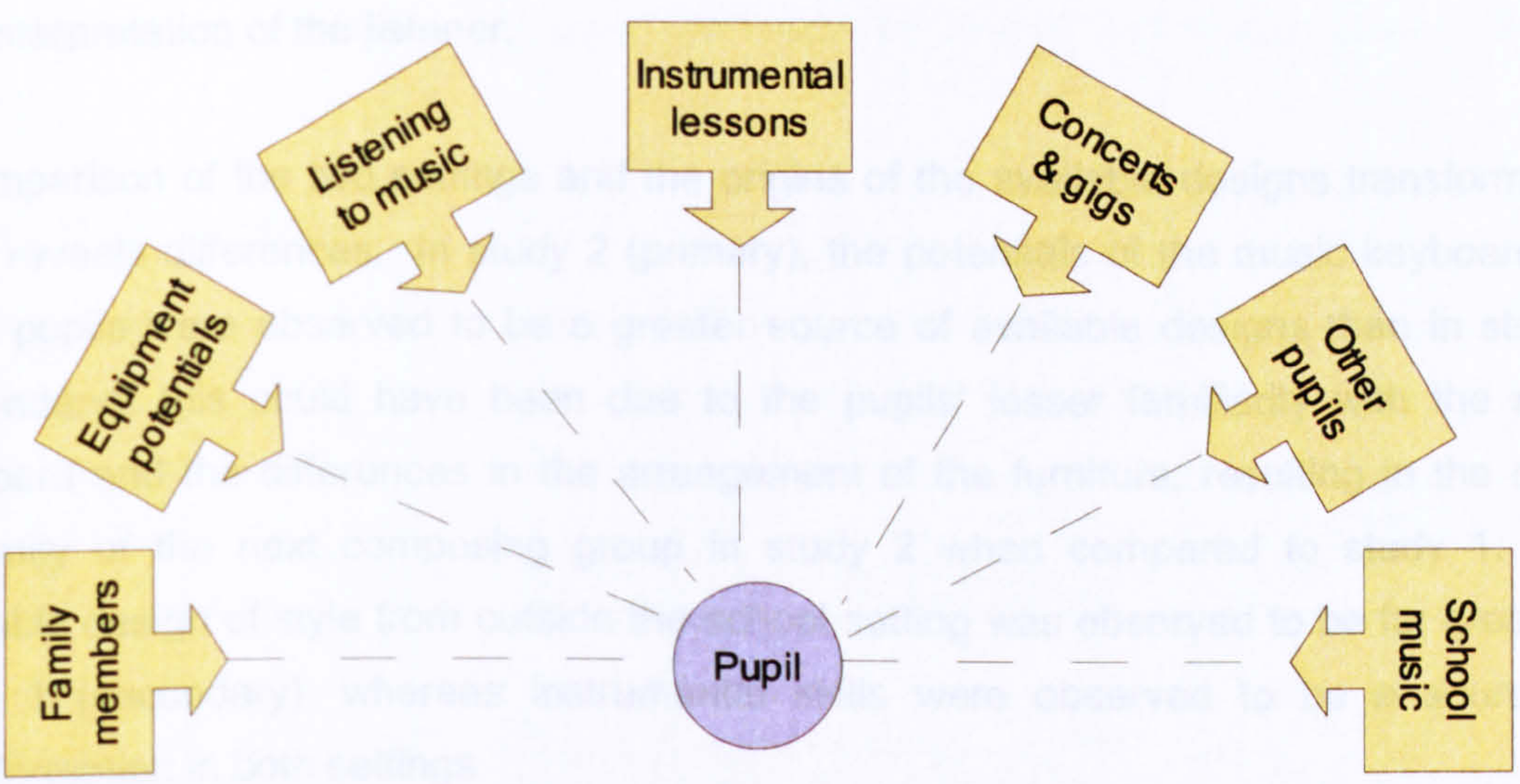


Figure 80 - Musical influences upon pupils

This is important for teachers since acknowledging these influences provides the potential for links to be made between lesson designs and pupils' own musical worlds. Composing can provide the opportunity for classroom music to be directly relevant and appropriately challenging for learners since it allows them to use the musical experiences and skills they already have and focus on musical styles they find motivating.

A key aspect of multimodal theory that I wish to explore here in the context of the two studies is the value of the notion of 'provenance' in the music classroom, as discussed in chapter 4, section 4.2. In particular, did the pupils import the 'ideas and values' of the original culture when using the fragments in their own compositions? When questioned about fragments they had experimented with that seemed to originate in other styles, the pupils did not seem to be able to make a link to a style, a composer or a time. For example, when pupil A from study 1 was questioned about the music he had played in a jazz-rock-pop style, he was not able to link it specifically to a specific style or performer by name or description; however, in the pre-study interviews, he had said that this style of music was one that he liked. It would appear that the pupils used the fragments for their

sound rather than for the cultural associations that they brought with them, perhaps concurring with Barthes' view of the 'death of the author' (Barthes, 1977) where the 'text' (in this case, composition) actually consists of the previous work of many cultures and the 'reader' (listener) has now become the key figure in its interpretation. In other words, the 'ideas and values' of the original culture *may* be imported into the new musical setting but this is not dependant upon the composer necessarily understanding this at the time of the act of appropriation of the elements of the imported culture, but upon the cultural location and interpretation of the listener.

A comparison of the two settings and the origins of the available designs transformed in each reveals differences. In study 2 (primary), the potentials of the music keyboard and other pupils were observed to be a greater source of available designs than in study 1 (secondary): this could have been due to the pupils' lesser familiarity with the music keyboard and the differences in the arrangement of the furniture, resulting in the closer proximity of the next composing group in study 2 when compared to study 1. The available design of style from outside the school setting was observed to be far greater in study 1 (secondary), whereas instrumental skills were observed to be a source for transformation in both settings.

8.3 Creativity

As described in chapter 4 (section 4.2.2), the multimodal view of creativity is that it is everyday and a normal function of human beings. In this section, the aim is to show how the pupils in these two studies were able to be musically creative, and comparisons will be made between the two studies. The notion of 'liberating constraints' and the origins of the transformed designs will be drawn upon and explored in this context.

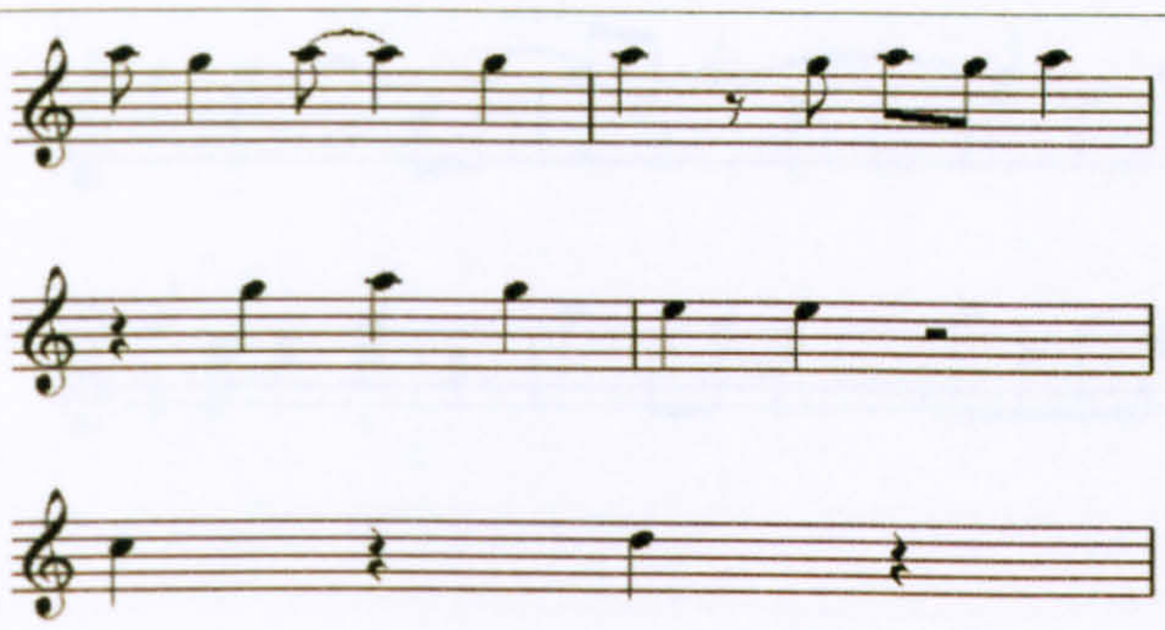
As discussed in section 8.1, the lesson design is crucial if it is to promote 'generative' or creative activity and in sub-section 8.1.1 it was demonstrated that owing to the design of many aspects of the lessons, that all the pupils in these studies were able to demonstrate this. In section 8.2 the possible origins of the transformations were surveyed and a case made for their origins in the pupils' complete life experiences. Therefore, to create a classroom environment where pupils are motivated to create generative work (or be 'creative' when redesigning the selected prior designs - see chapter 4, section 4.2.2), account should be taken of both effective lesson design framed by the notion of liberating constraints and pupils' prior musical experiences. Drawing on this, there now follows an

exploration at the micro level of the musical aspects of three examples of a connected series of musical fragments played by four individual pupils, two from each study. The work of the two pupils from study 2 is presented separately, as the pupils in this study composed individually. However, the work of the two pupils in study 1 is presented as one series of musical fragments owing to their way of working as a pair, the interconnected nature of their work and because their composing fragments occurred either simultaneously or very close to each other. There then follows an examination of how the pupils redesigned the available designs and then comparisons are drawn between the two studies.

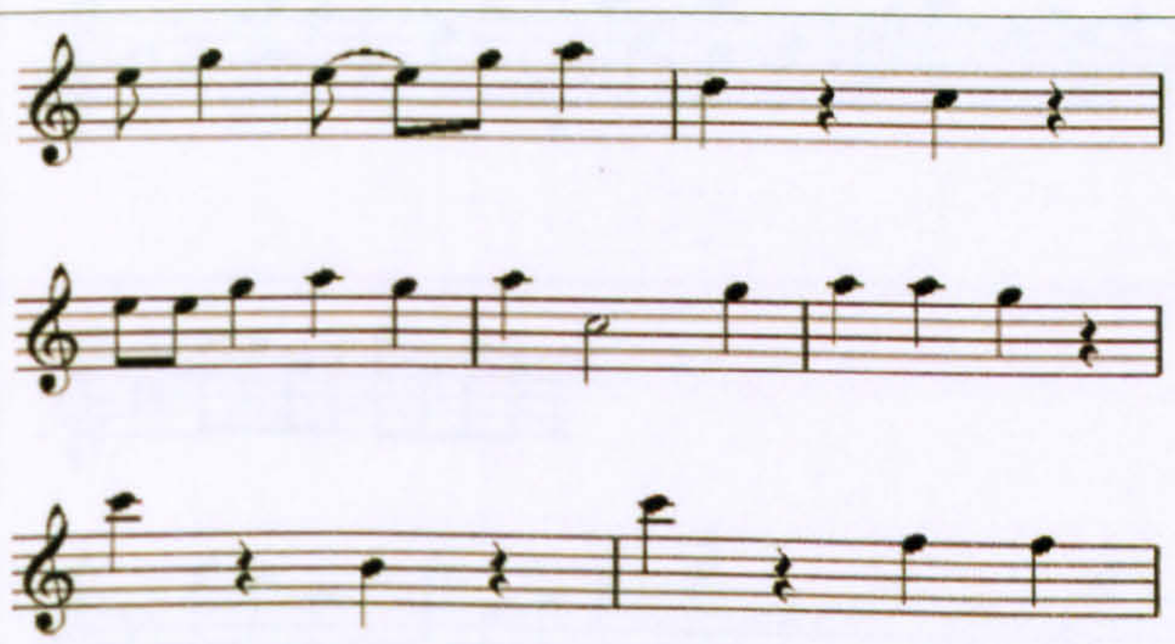
Pupil C, study 2, lesson 4

The first pupil's work to be examined is that of pupil C in study 2 lesson 4 (see music examples 103-112); the music examples illustrate everything that pupil C played at the keyboard during this lesson, including the experimentations and final recording:

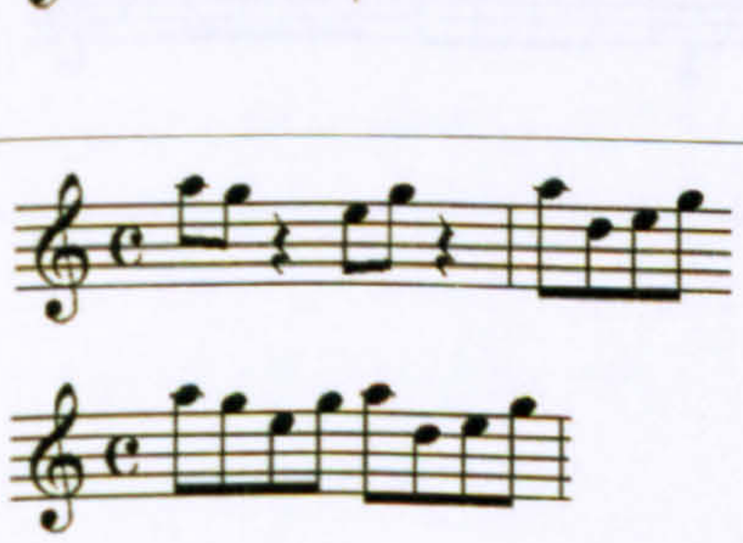
Music example 103



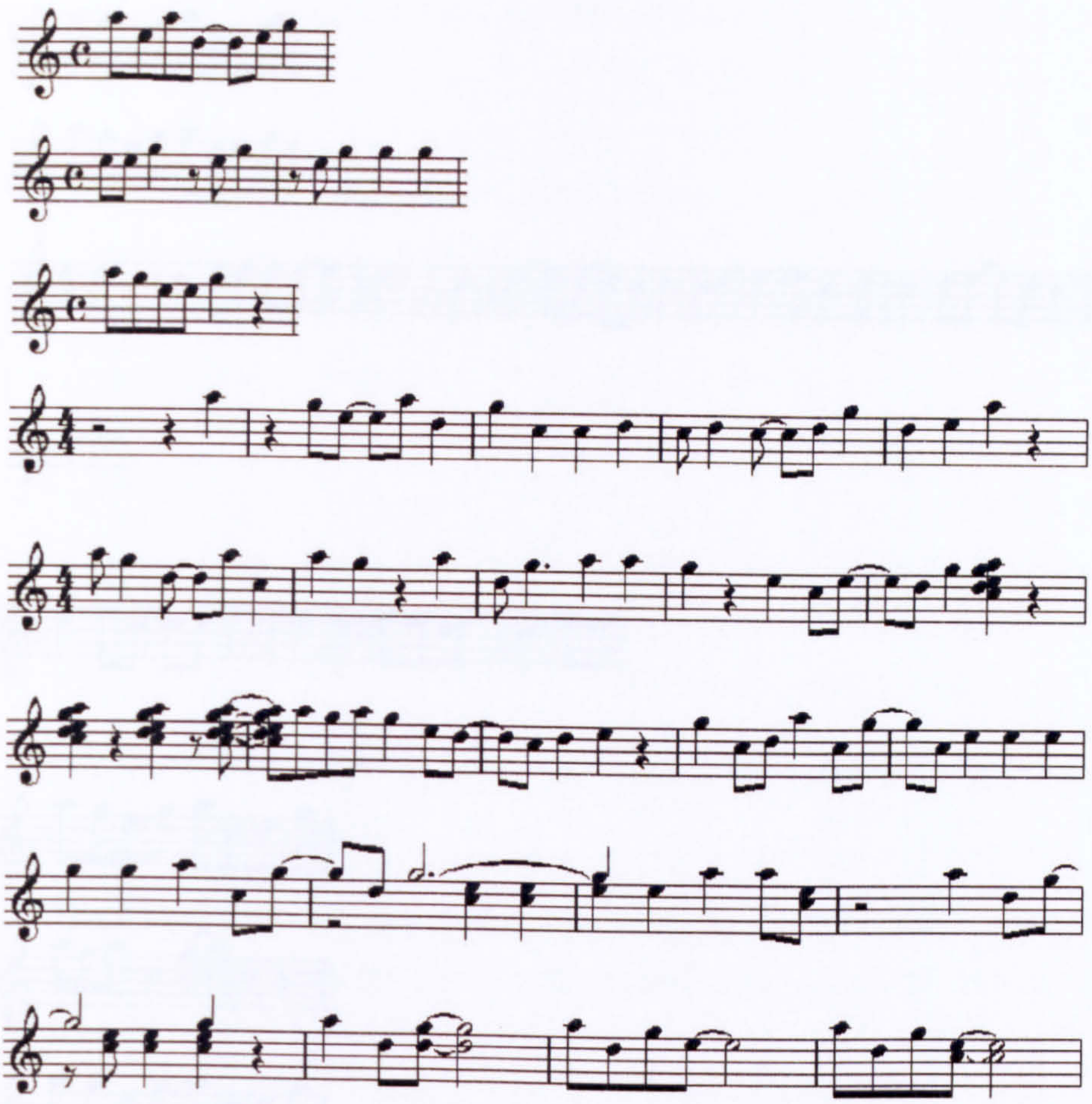
Music example 104



Music example 105

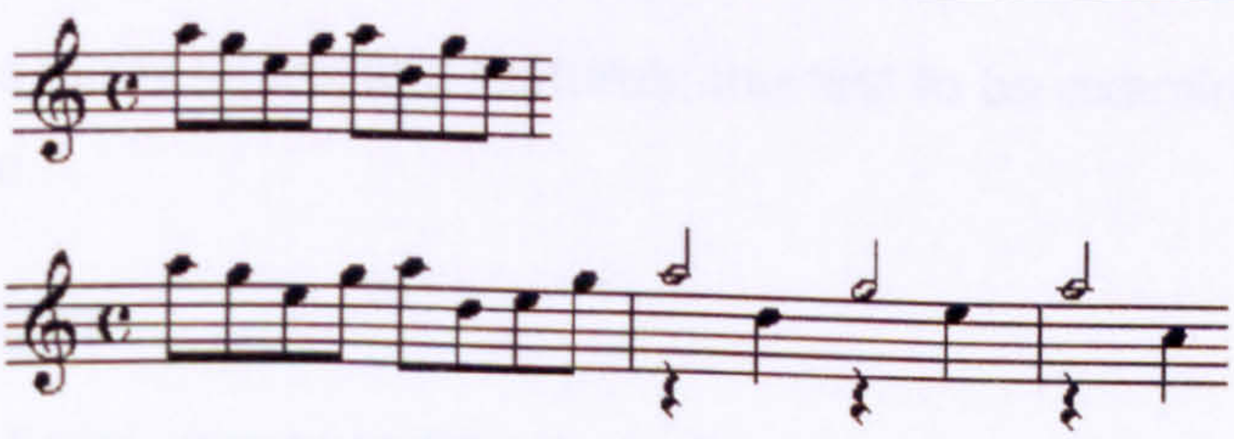


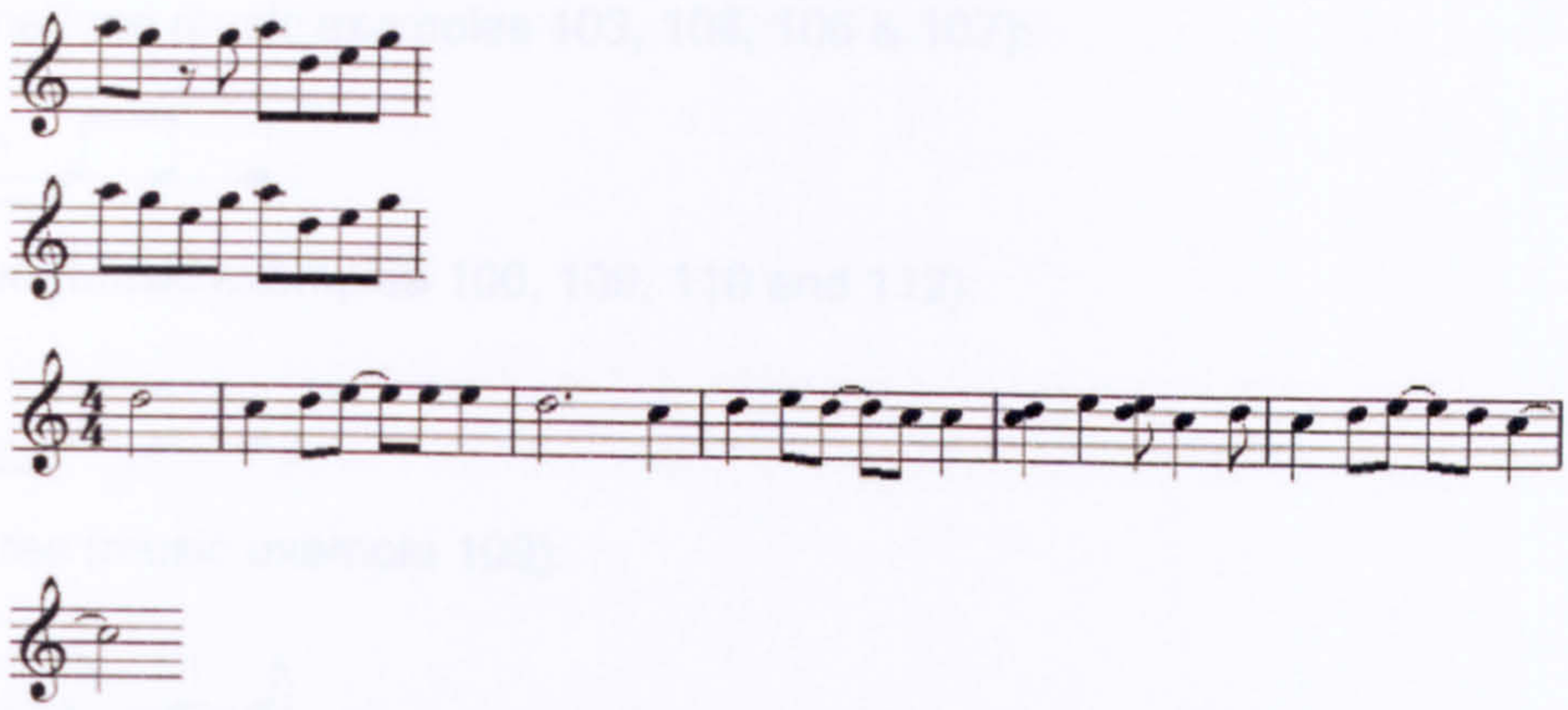
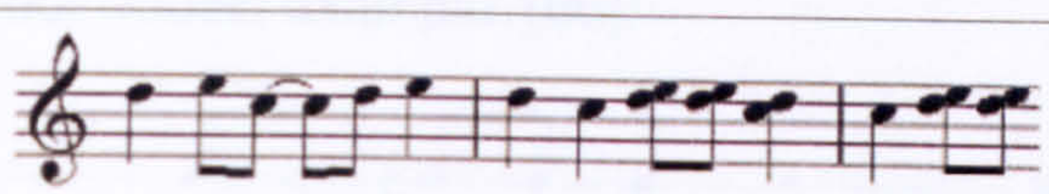
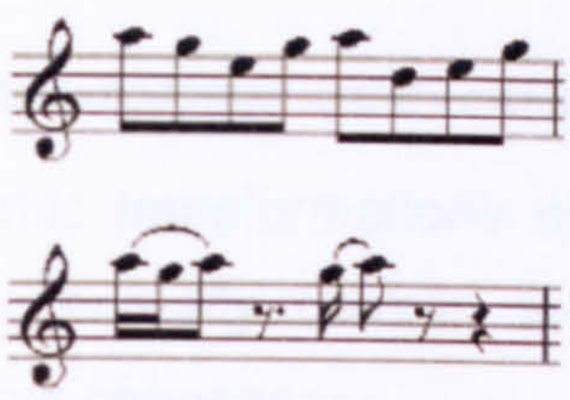
Music example 106



Music example 107

Music example 108



Music example 109	
Music example 110	
Music example 111	
Music example 112 (final recording)	

Pupil C's work has many interesting features; the first to be examined here is the recurring 'syncopated' figure.

The syncopated figure

The 'syncopated' figure was experimented with in many varied rhythmic and melodically-shaped guises which demonstrate a wide breadth of transformation.

Transformations of the syncopated figure - rhythmic

The rhythmic transformations consist of:

Quaver on beat one (see music examples 103, 104, 106 & 107):

Quaver on beat two (music examples 106, 109, 110 and 112):

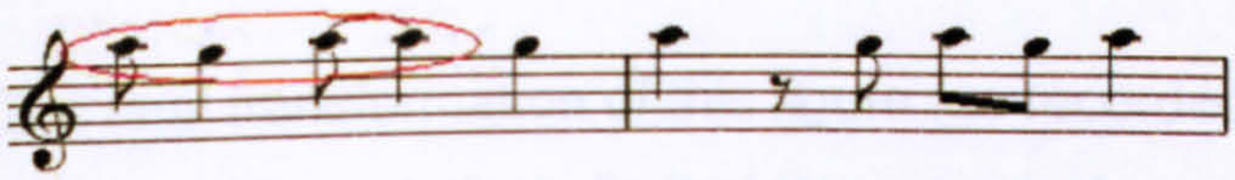
Quaver on beat three (music example 109):

Quaver on beat four (music example 106):

Transformations of the syncopated figure - melodic

As well as rhythmic transformations of the syncopated figure, pupil C also varies the melodic shapes, generally centred around a consideration of 3 intervals which are employed in various sequences:

Down then up a major 2nd (music example 103):



Up then down then up a minor 3rd (music example 104):

Down a 5th, up a major 2nd then a minor 3rd (music example 106):

Down a minor 3rd, up a 4th then down a 5th (a continuation of music example 106):

Down a 2nd then down a 4th (music example 106):

Up a major 3rd, down 2nd then up a 4th (music example 106):

Up a 5th, down a 4th then up a 4th (music example 106):

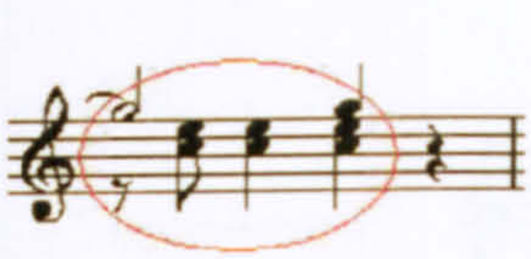
Up a 2nd, down a 4th then up a minor 3rd (music example 107):

The final transformation of this figure (as recorded in the final product - see music example 112, bar 2) is relatively limited in scope and uses only the three lower notes, C, D and E. In music example 110 pupil C experimented with this more restricted rhythmic device within the more limited melodic framework, and he played a figure that is based upon the syncopation starting on beat 2, using the intervals up a 2nd, down a 3rd then up a 2nd (see music example 110):

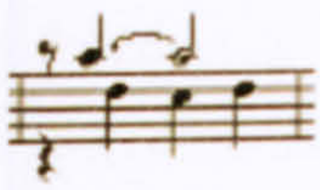
When the final recording was made, syncopation appears only in bar 2:

'Held' notes

These occur where pupil C holds upper notes with the right hand (A or G) and plays other notes with the left hand (C, D or E). This potential of the keyboard is exploited twice in music example 106, as shown in bars 2 and 5 of the following fragment:



...in music example 107:



... and in music example 108:

Although this potential is explored and developed, it does not appear in the final recording (see music example 112).

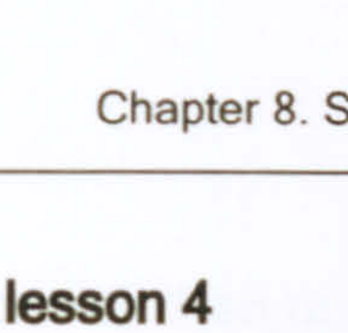
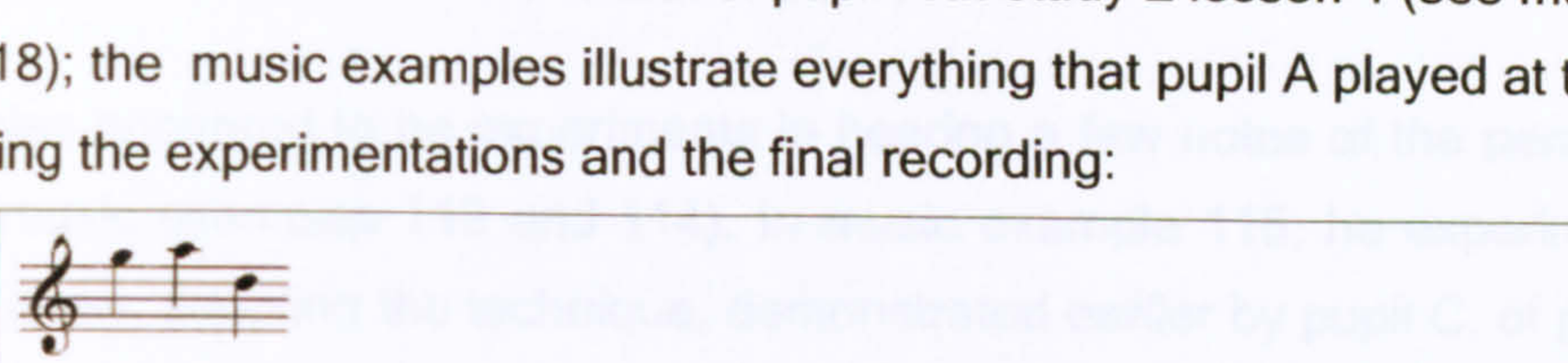
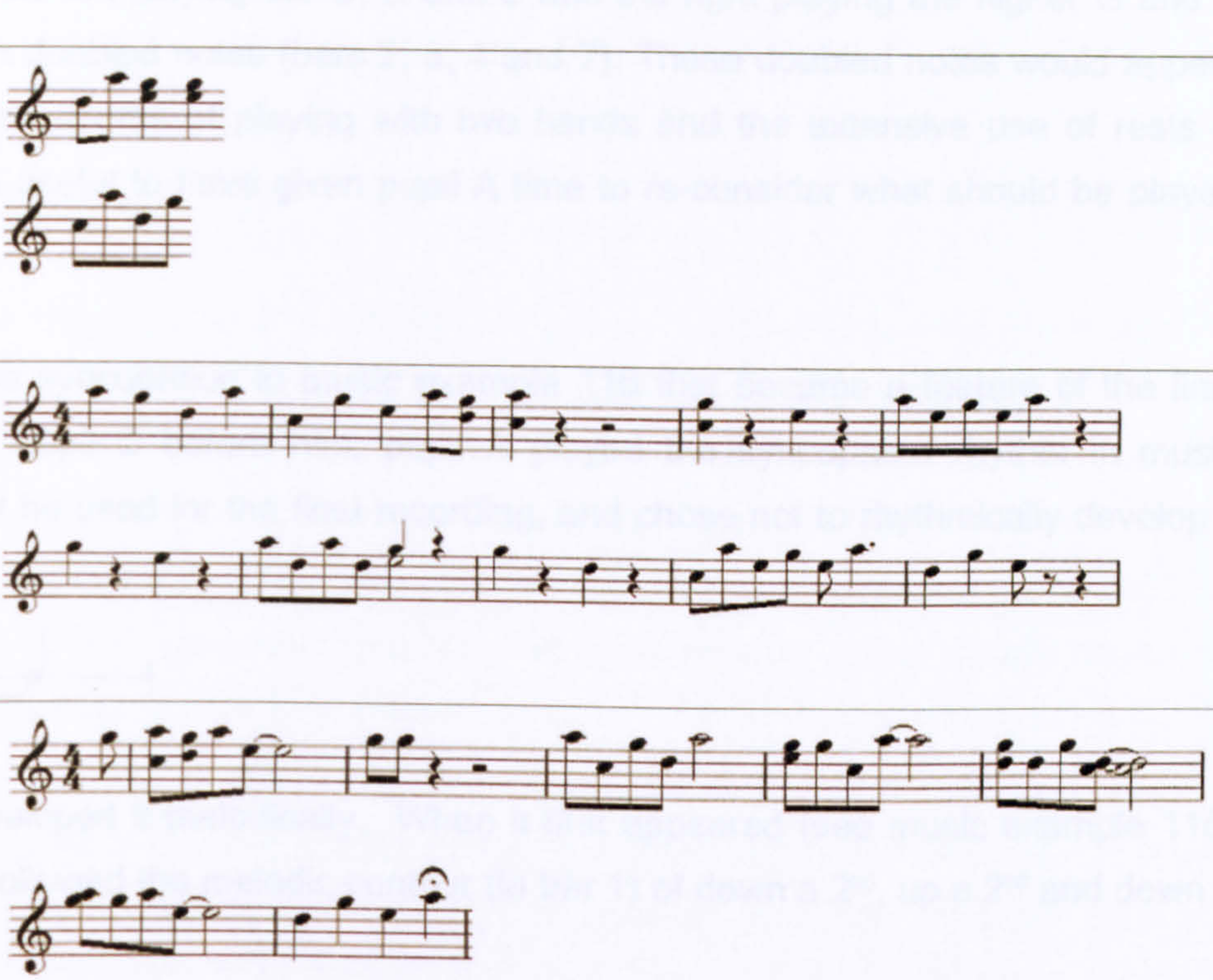
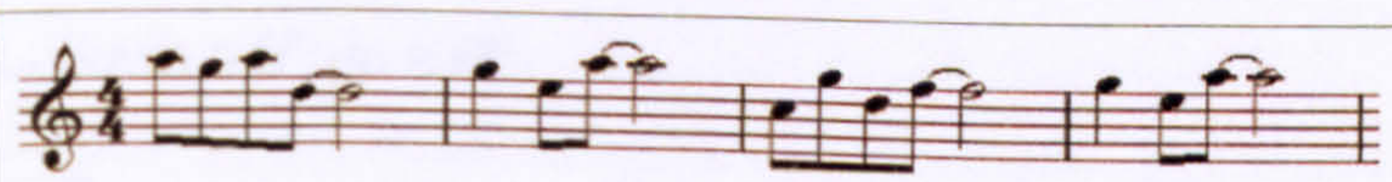
Chords

Cluster chords, using all 5 of the available notes are used twice by pupil C in music example 106 only:

However, these do not appear in the final recording.

Pupil A, study 2, lesson 4

The second pupil's work to be examined is that of pupil A in study 2 lesson 4 (see music examples 113-118); the music examples illustrate everything that pupil A played at the keyboard, including the experimentations and the final recording:

Music example 113	
Music example 114	
Music example 115	
Music example 116	
Music example 117	
Music example 118 (final recording)	

Pupil A's experimentation takes on a somewhat different form to pupil C: he did not develop musical ideas (such as syncopation) as separately identifiable entities, but instead appeared to develop his extended musical ideas sequentially, each complete example building on the last. He seemed to be working with a more holistic notion of the 4

bars he was preparing than pupil A. Owing to this, there follows a consideration of each of the fragments sequentially.

His initial examples appeared to be experiments in hearing a few notes of the pentatonic in combination (music examples 113 and 114). In music example 115, he experimented with a stream of ideas, adopting the technique, demonstrated earlier by pupil C, of playing with two hands, the left playing the C, D and E and the right playing the higher G and A (see fig. 64), with doubled notes (bars 2, 3, 4 and 7). These doubled notes would appear to have been an outcome of playing with two hands and the extensive use of rests is notable, perhaps useful to have given pupil A time to re-consider what should be played next.

He introduced the syncopation in music example 116 that became a feature of the final product. Unlike pupil C before him, pupil A played the syncopated rhythm in music example 116 that he used for the final recording, and chose not to rhythmically develop it further:

However, he developed it melodically. When it first appeared (see music example 116) the upper notes followed the melodic contour (in bar 1) of down a 2nd, up a 2nd and down a 4th:

However, this contour was transformed again in bars 4 and 5:

Bar 4: no interval - down a 5th up a 6th:

Bar 5: down a 4th - up a 4th - down a 4th:

Bar 6 was the same as bar 1.

In music example 117 it can be seen that pupil A transformed this figure again (in bars 1, 2 and 3), this time starting with upward rather than downward intervals. The final recorded version (music example 118) used a mixture of the downward (music example 116) and upward (music example 117) melodic contours from the previous two music examples:

Bar 1: down a 2nd, up a 2nd, down a 5th

Bar 2: down a 3rd, up a 4th

Bar 3: up a 5th, down a 4th, up a 3rd

Bar 4: down a 3rd, up a 4th

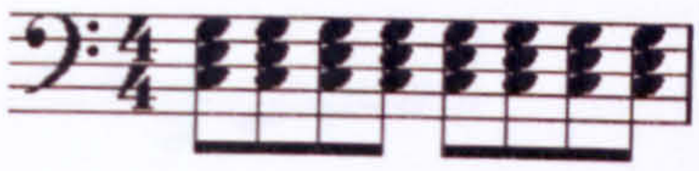
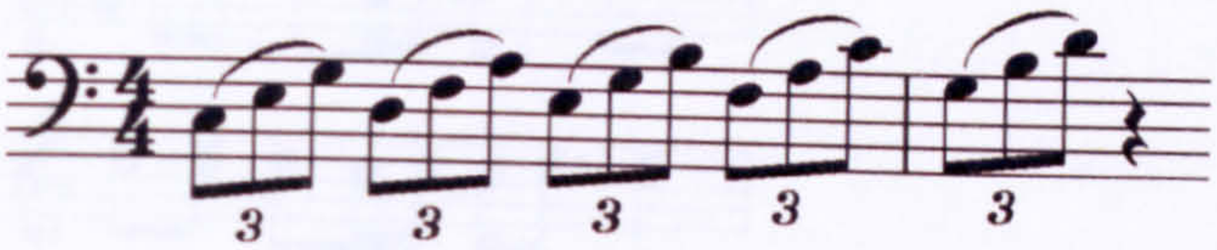
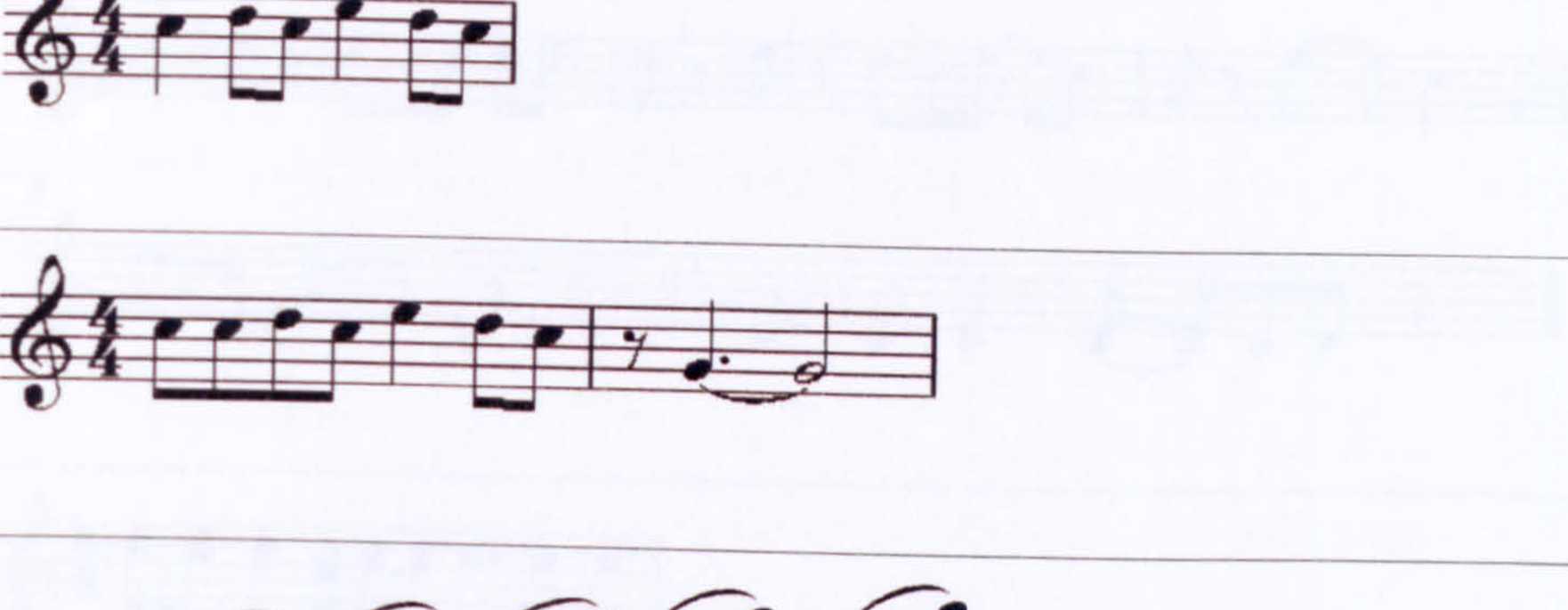
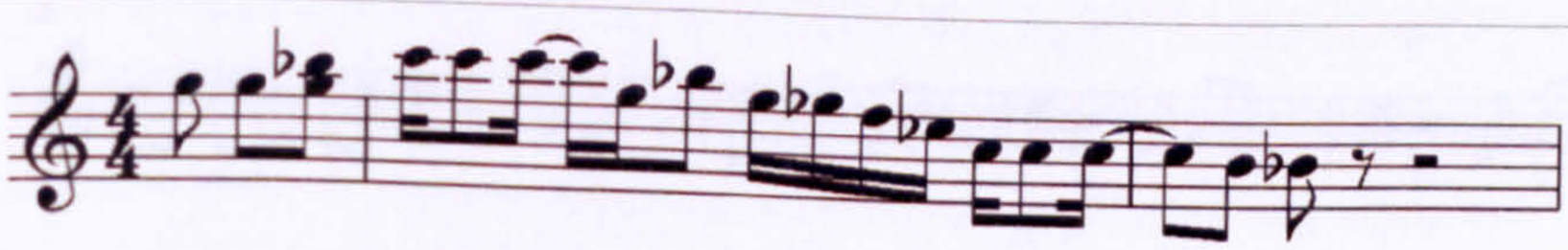
The use of doubled notes is notable, particularly in bar 1 of music example 116 where the two hands moved in contrary motion. The later doubled notes (in bars 5 and 6) would appear to have been fingering 'accidents' as they are major 2nds and the video showed them being played by a single finger. These do not appear in music examples 117 or 118 and the rhythm was more consistent, almost repeated in the first 3 bars, perhaps indicating that pupil A was developing his two-handed technique so that he only need play single notes, as modelled earlier in the lesson.

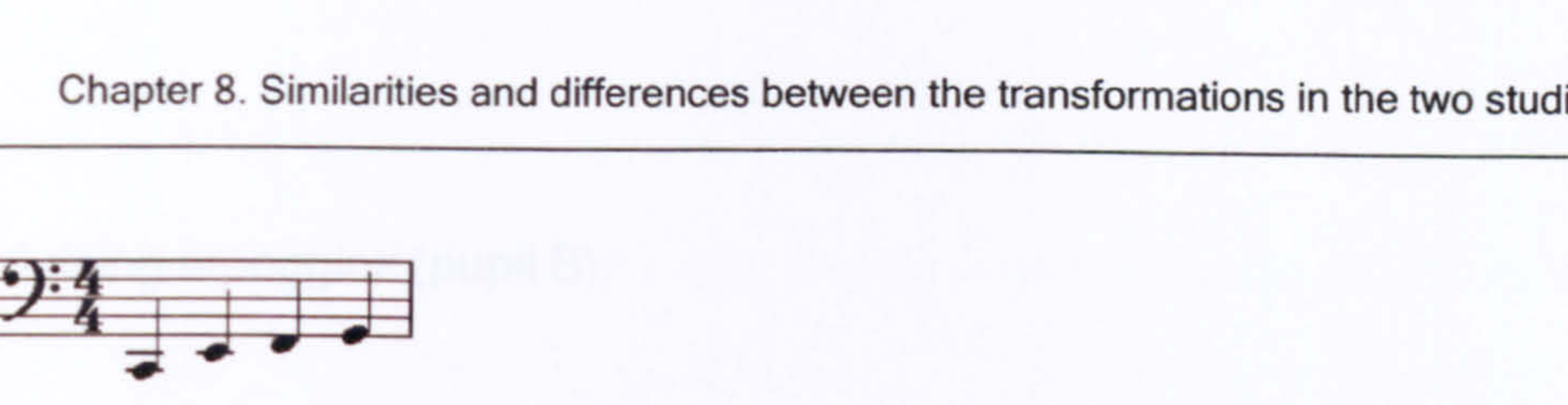
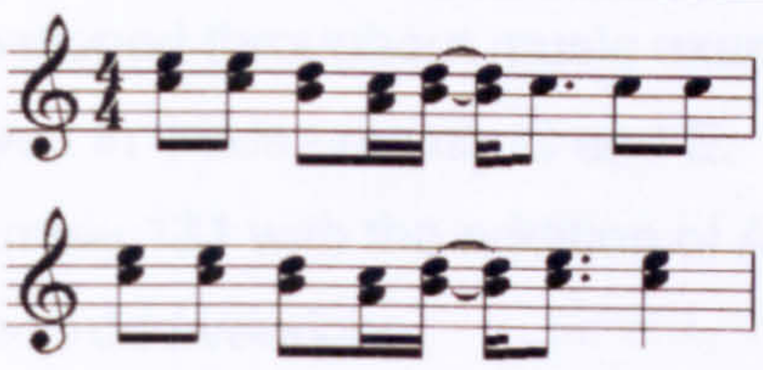
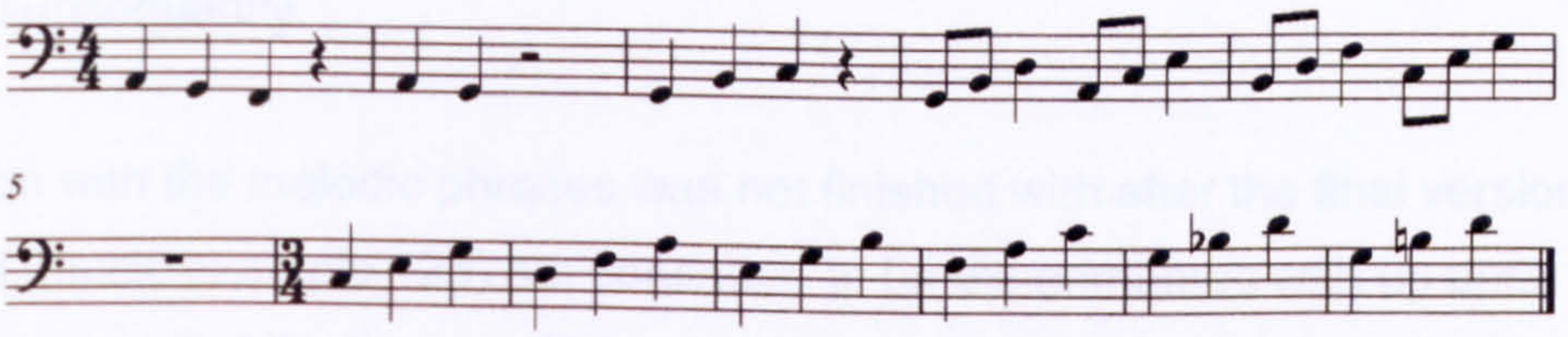
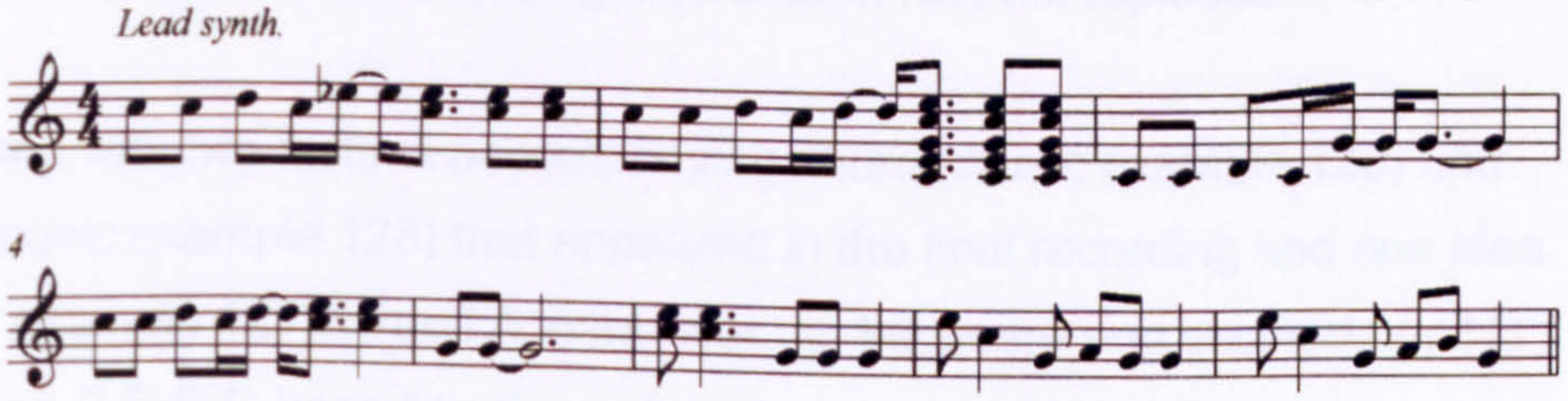
The note A appeared to act as a tonic throughout this fragment, particularly in music examples 116 and 118 where (apart from the up-beat to music example 116) the fragments started and ended on this note.

Pupils A and B, study 1, lesson 3

The work that to be examined thirdly is that of pupils A and B in study 1 lesson 3 (see chapter 6, section 6.5.3), the 'Orion Noir' lesson (see music examples 119 - 133). These music examples illustrate what the pupils played at the keyboard, omitting their 'trying out' of sounds (such as pupil B trying out the drum sounds near the start of the lesson), but including their experimentations and the final recordings:

Music example 119 (pupil A)	

Music example 120 (pupil B)	
Music example 121 (pupil A)	
Music example 122 (pupil A)	
Music example 123 (pupil A)	
Music example 124 (pupil B)	
Music example 125 (pupil A)	
Music example 126 (pupil A)	
Music example 127 (pupil B)	

Music example 128 (pupil A - then B)	*(played many times)*
Music example 129 (pupil A)	
Music example 130 (pupil A)	
Music example 131 (pupil A)	
Music example 132 (pupil B)	
Music example 133 (pupil A)	

There are three key strands that were developed in this series of fragments:

- The jazz-rock-pop-influenced melodies in C major (pupil A);
- The accompanying chords and bass-lines (pupil B);

- The upward rising arpeggios (pupil B).

The development of the jazz-influenced melodies took up most of the experimentation time and can be seen in music examples 119, 121, 122, 123, 125, 126, 129, 130, 131 and 133. They were generally quite similar and because they were played fluently from the outset, it seems that they may have been brought into the lesson from elsewhere. However, there were some features of them that were developed during the experimentations notated here:

- Flattened 3rds and 5ths were experimented with in music examples 119, 126 and 133 but these were eventually left out of the final recording;
- The semiquaver syncopated rhythm:

... was developed throughout music examples 121, 125, 130, 131 and 133;

- Notes played in thirds - mainly C and E. This was particularly well developed in music example 131 with the addition of A/C and B/D, but only C/E were played in the final recorded version;
- Grace notes were experimented with in music examples 129 and 130 but were not developed subsequently.

The experimentation with the melodic phrases was not finished with after the final version had been recorded (music example 125) but continued to be experimented with up until the end of the practical part of the lesson. This seemed to indicate that pupil A thought it might be possible to improve on his recording; however, it was not replaced.

Pupil B experimented with two distinct accompanying chord (music example 120) and bass-line figures (music example 128) that appeared in the final recording and one idea that did not (music example 127). Pupil A leant over the keyboard and showed pupil B how to play the rising C-E-F-G bass-line figure (music example 128), effectively dismissing the dotted quaver - semiquaver figure that pupil B was experimenting with (music example 127). These figures were not developed any further than their original playing, but were practised by pupil B so that they were ready to be recorded.

Pupil B also experimented with upward rising arpeggio figures (music examples 124 and 132) but these were not developed any further in this lesson and did not appear in this

section of the original recording. Arpeggios did appear in the ending, however, played by pupil A in the final section of the piece.

The creative transformations (redesigns) observed in the two studies

This micro level examination and linear study of the two observed lessons selected from the two studies has shown the incremental development of the experimental musical fragments of the pupils, and hence has demonstrated their ability to redesign and be creative. All the pupils' work investigated here provides evidence of the transformation of the available musical designs and the creation of new compositional products. This supports the view expressed in chapter 3 that creativity is something that is '... ordinary, normal ... the everyday process of semiotic work as making meaning (Kress, 2003:40) and that 'Innovation is the normal condition of all human meaning-making.' (Kress et al., 2001:8).

Liberating constraints and creativity

This examination of the work of 4 pupils demonstrates the breadth of redesigning (creativity) that results from the lesson designs (see table 17):

	Constraints	Breadth of redesigns
Study 1 (lesson 3)	**Task:** Create melodic and rhythmic ostinato from rhythm grids using provided notes given at 3 'levels'. **Scope for composing:** Using given notes at one of the 3 'levels' (C-G / C-E-G / C-D-E-F-G) to compose ostinatos to provided rhythms.	Jazz-rock-pop style used; tonality centres around that suggested (C major) but uses flattened 3rds; semiquaver syncopated rhythms, 3rds; grace notes; repeated C major quaver chord accompaniment; rising bass line; arpeggio figures.
Study 2 (lesson 4)	**Task:** Compose 4-bar tune to provided template using notes C-D-F-G-A, any rhythm, timbre pre-selected by teacher. **Scope for composing:** Any rhythm but note range limited to 5 provided notes; no choice of timbre.	Syncopation - development of rhythm and melody; 'Held' notes explored; Cluster chords explored; Doubled notes explored; Use of rests explored.

Table 17 - Lesson constraints and breadth of redesigns

Table 17 demonstrates that although the degree of constraint for the two lessons that have been musically analysed at the micro level might be considered quite high, the pupils were

able to use this to explore a wide range of musical possibilities, in the case of study 1, going outside the limit of the constraint and in study two, using many varied ways of redesigning but staying within the limit. Most of the ideas experimented with in study 1 were heard in the final recording (with the exception of pupil B's rising arpeggio figures), whereas many in study 2 were not (the 'held' notes, cluster chords, doubled notes and rests).

8.4 Conclusions

The two studies were of differently aged pupils with distinct experiences of music making, yet there were many similarities in the way that they transformed the musical material:

- Pupils demonstrated that they were able to work with the 'liberating constraints' of the lesson designs to compose music that was deemed successful by the teachers;
- Pupils transformed their selected available designs in musically creative ways, for example, experimenting with rhythm and pitch and the different ways of organising these elements, and were able to select those configurations most appropriate for their final compositions;
- The processes of composition, in 'staying within' or 'going outside' the requirements of the lesson design, resulted in much discarded musical material generated while experimenting that was not recorded and hence did not appear in the final compositional product;
- Pupils were able not only to respond to the available designs from the classroom context but were also able to import into their work designs from outside of this context, from their lived experiences;
- Pupils were all able to use the music computer workstation, which was new to most of them, to be musically creative;
- Pupils were all able to work in groups for composing.

However, there were some key differences noted, which are categorised and discussed here under the following sub-headings:

- Musical style;
- Innovation and repetition;
- Scope;
- Practical and theoretical skill.

Musical style

'Musical style' refers here to music linked by the consistent use of musical conventions relating to the use of melody, rhythm, harmony and instrumentation, as discussed in chapter 2, section 2.2. The transformations in study 1 demonstrated an awareness of different musical styles, in that the work undertaken in each lesson was related to and maintained that particular style. For example, in lesson 1 of study 1, the changes made to the Promenade theme were in the style of the given model, by Mussorgsky; in lesson 2, when responding to the 'Old Castle' picture, the pupils followed the style modelled by the teacher with the rhythmic drone and modal melody played on the organ; in lesson 3, the pupils chose not to follow the minimalist intentions of the teacher but created their own jazz-rock-pop-influenced piece with appropriate bass-line, drum part and syncopated melody; in lesson 4, the pupils added chords to the Promenade theme, again maintaining the style of the original; in lesson 5, in creating the ending, they made it stylistically cohesive in that they chose a romantic-era inspired quiet ending which featured stylistically appropriate techniques. The transformations in study 2 did not generally demonstrate this awareness of musical style, with the pupils' transformations tending to focus upon the musical elements of pitch and rhythm.

Innovation and repetition

The examination of the experimentations in study 2 revealed a steady process of innovation and there were no examples of repetition, even where recordings were deleted and new ones made. However, in study 1, there was repetition and pupils were observed to practise a particular figure many times, seemingly to get it to an acceptable standard so that it could be recorded. This had the inevitable outcome that not all the lesson was devoted to composing, but a certain amount to performing.

Scope

Study 2 focused on one musical aspect in a particular lesson; melody in lessons 1 and two; bass part in lesson 3; melody in lesson 4 and drum part in lesson 5. In study 1, the musical scope was wider, with melody and drone accompaniment being considered in lesson 2 and melody, bass-line and accompanying chords being considered in lesson 3, for example. This assumed that the pupils were able to 'see' this holistic musical picture and be aware of how the part they were currently working on would fit in. This inevitably affected the transformations themselves, because whereas the primary pupils worked on one aspect of the music at a time, with a backing track providing the rest of the musical

context as they composed, the secondary pupils needed to bear in mind what the other elements of their composition might be, and so adapt their composing as they went along, sometimes to elements that had yet to appear in the music.

Practical and theoretical skill

Perhaps the main difference between the two studies was the degree of musical skill acquisition, both demonstrated by and expected from the two groups of observed pupils, which were not only of different ages but also in different phases of their education. For example, there was no apparent awareness observed in study 2 of chord and scale knowledge, whereas this was in evidence in most lessons in study 1, the pupils being asked to compose a melody using a certain mode and to add chords to the Promenade theme. Also linked to the awareness of style, there was an understanding shown by pupil B in study 1 about the function of drum parts in popular music when he composed a part to fit the 'Orion-Noir' section; this was almost absent in study 2, demonstrated by the variety of approaches taken in lesson to the composition of the 12-bar drum part. The teacher in study 1 assumed terms like 'drone' and 'ostinato' would be understood by the pupils and their use was demonstrated by the observed pupils without any further explanation. This had a direct effect on the observed transformations of the pupils, some being structured around these musical devices (such as chords or ostinati) in study 1, whereas this was not the case in study 2.

These differences are grouped here into two areas; those that are considered due to the different ages of the pupils (see table 18) and those that are considered due to lesson design and school environment (see table 19), although there is some inevitable overlap between these where the lesson design is differentiated owing to the ages of the pupils. The terms 'equality' and 'equitable' refer to the pupils' experience of the different roles whilst composing, such as playing the music keyboard or using the computer.

Difference	Study 1 (secondary)	Study 2 (primary)
Style	Greater awareness with observed effects on the transformations of available designs	Rarely has an impact
Innovation and repetition	As well as composition, pupil were observed to spend some time practising the performance of their work	No repetition of composed fragments - the process is one of a steady process of innovation
Scope	Several 'layers' of the music were composed at one time	Focus on one 'layer' at a time
Skill	Greater skill level	Lesser skill level

Table 18 - Differences between the two studies (age related)

Difference	Study 1 (secondary)	Study 2 (primary)
Constraint of lesson design	Less constrained	More constrained
Equality of role for group members	Less equitable	More equitable
Nature of activity (group or independent)	Single group activity	Independent activities for group members while working as a group on defined roles
Negotiation using computer screen	Yes	No

Table 19 - Differences between the two studies (lesson design and school environment)

There is no intention that by presenting the differences as a set of oppositions that there is any notion of 'better'; the two studies were just different. Different phases in schooling have different pressures, the National Curriculum foci, resources, and support for music in the school being just three.

Some of the differences between the two studies, not related to lesson constraints, could perhaps be better viewed as a series of interrelated continua, as discussed in section 8.1.5 (see fig.81):

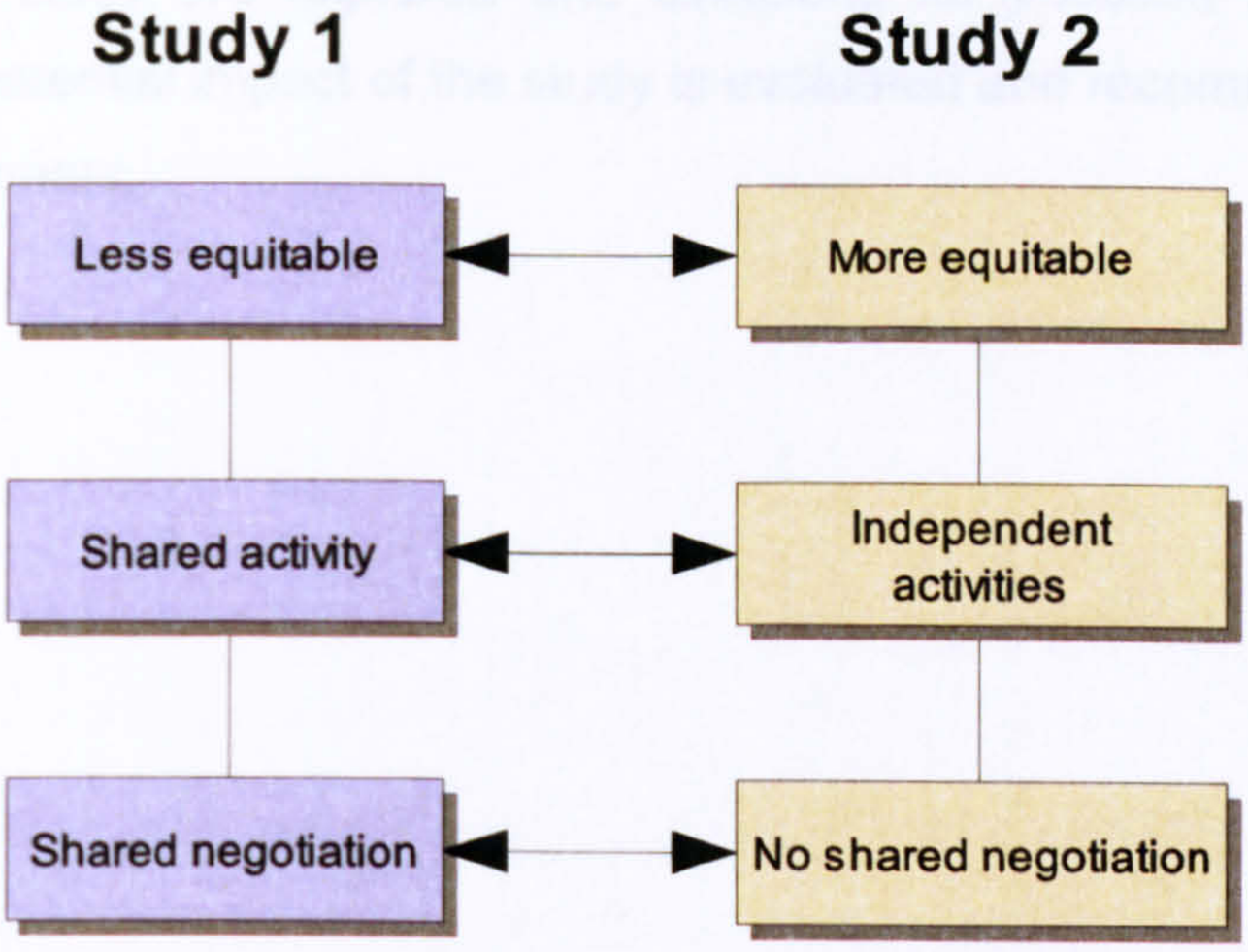


Figure 81 - Three continua

In study 1, the fixed roles resulted in a less equitable sharing of the group composing with computer roles, however, this did result in the composition being a single product of both pupils, whereas in study 2, the sharing out of the roles resulted in essentially 3 separate compositions contained within one activity. This in turn impacted upon the third continuum presented here, using the computer for shared negotiation of the composing task, which seemed to be a natural outcome of the observed composing of the pupils in study 1, whereas owing to the separated, more individualised process of study 2, was not present. This is considered to be characterised as a possible tension of the group composing process which needs to be addressed through lesson design; ideally, there would be an equitable distribution of composing tasks, but with the composing becoming one joint group activity, characterised by the sharing and negotiation of processes and outcomes, (which study 1 demonstrated to be a useful potential of the computer music workstation), tasks were not equitably distributed, and the pupils tended to adopt one fixed role. This tension is discussed further in chapter 9, section 9.2.1.

It is important to note that this thesis has focused at the micro level on the work of one pair (study 1) and one group of 3 pupils (study 2) and the differences analysed and presented above are not intended to be generalisable to distinct phases of education or pupil ages. In the next chapter, a synthesis of these findings is presented in relation to the aims of study. In particular, the usefulness of the adoption of the multimodal frame for observation and analysis of composing with computers in the music classroom is examined. The

limitations of the study are explored and directions for possible further research are suggested. The potential impact of the study is evaluated and recommendations made for classroom practitioners.

1 It should be noted that there were 4 'levels' provided on the worksheet, but the fourth of these related to fitting this section into the structure of the whole piece, not to the composition of the section itself.

Chapter 9. Synthesis: conclusions and implications

Introduction

The purpose of this chapter is to focus the analyses that were carried out in chapters 6, 7 and 8 in the light of the aims of this study (see chapter 1, section 1.4) in order to synthesize, summarise and discuss the key findings, to consider the efficacy of the adoption of multimodal theories, to consider the possible impact of the study and to highlight areas for further investigation.

9.1 Theoretical frame

The main aim of this study was 'to investigate the process of composing with computers in the music classroom focusing on the use of MIDI sequencing' and an early concern was the identification of a suitable theoretical frame. The adoption of theories of multimodality was partly prompted by a view, shared by other observers (Jewitt, 2006:2; Cain, 2004), that contemporary research in music classrooms where computers are used required a new theory, a new way of considering the data. The introduction of computer tools for composing into the classroom is part of a much longer history of the appropriation of technology in this setting but has necessitated a reappraisal of the process of composing owing to four key issues:

- the accessibility to composing is increased owing to less reliance on traditional music skills, such as reading western music notation and performing;
- an issue of role has arisen within the 'composition-with-computer' group where, in contrast to the preceding one-instrument-per-pupil group composing context, only one musical instrument (usually a keyboard) is used;
- the development of software for music composing is often associated with the ongoing development of popular music and much of the rhetoric concerning interface design and the styles of music associated with computers is influenced by this connection;
- the adoption of computer-based technology facilitates the appropriation of previously created music into pupils' classroom composing.

The adoption of theories of multimodality was also prompted by the multimodal nature of the new technology for composing, the need for a theory that was embedded within the social semiotic nature of human communication, and one that could accommodate the

notion that very little, if anything, in musical composing, especially in popular music styles, is completely new or novel and that new composing is necessarily founded on previous work that composers are motivated to 'redesign'. Kress's construct of 'Design and Transformation' (see chapter 4, section 4.2) fitted this latter requirement well, providing a frame for contextualisation of pupil composing with contemporary tools. The adopted multimodal theories not only enabled, but required composing processes to be viewed from simultaneously occurring, multiple perspectives or communicational modes; this view of classroom phenomena allowed new issues to emerge, highlighting the importance of the influence of lesson design upon pupil creativity and effective group work and confirming the view that the consideration of less than the fullest range of modes possible would result in only partial data being available for consideration.

The case for the adoption of these theories, particularly the notion of Design and Transformation, which underpinned the consideration of the whole learning environment, was made in chapter 4. The means by which the multimodal transcriptions and analyses were carried out was described in chapter 5 and the rationale explained for the development of a computer-based tool to enable the vast amount of data to be collated, categorised, displayed and thematically linked. The analyses of each of the two main studies contained in chapters 6 and 7, together with chapter 8 provided further analysis and comparisons of the two studies. Additional theoretical framing was provided through consideration of the notion of 'liberating constraints' as a means by which to view the learning design aspect of the mediating influence of the learning environment, with the continuum of prescription-proscription utilised to characterise the amount of constraint inherent within a learning design. This was discussed with reference to the liberating constraints identified within the two studies in chapter 8, section 8.1.1 and distinctions between the two studies drawn in section 8.1.5.

9.2 The Aims and Findings

9.2.1 Subsidiary aim 1: the influence of the learning environment

The first subsidiary aim was 'to investigate the mediating influence of the learning environment upon the transformation of previously existing musical ideas'. In the analysis of this mediating influence in the previous 3 chapters (see chapters 6, 7 and 8), the

teacher's learning design was found to be the key influence upon enabling pupils to compose effectively.

The notion of 'liberating constraints', employed in order to consider the influence of the learning design aspect of the learning environment upon the music being transformed by the pupils at the elemental level, particularly in terms of its pitch, rhythm, texture and timbre, focused here on whether the pupils' transformation of these elements 'went outside' the lesson constraints or 'stayed within'. The phenomenon of 'moving outside' the lesson constraints by pupils was observed, both in terms of the materiality of what was composed and in the scope of the transformations. Closely linked to this was a consideration of the influence of the classroom culture, itself part of the larger whole-school culture: the freedom to experiment and 'move outside' was seen to be important in providing pupils with a warrant to go beyond the confines of what had been laid out in the composing brief.

Equipment, such as the computer music workstation (especially the software interface and sequencer template) and music keyboard can also be viewed as 'liberating constraints' in that their physical designs contain 'intelligence' within them. In particular, the computer interface provides virtual representations of objects in the physical world, which were observed to enable pupils to use its potentials without teacher explanation; the music keyboard appeared to invite the use of novel playing techniques which extended the musical possibilities. Both of these, at times, allowed pupils to compose with ideas that lay outside the lesson's constraints.

As a result of this focus upon the influence of the learning environment upon the transformation of musical ideas, the time allowed for pupil experimentation was observed to be important in allowing them to try out their ideas, and it was noted that traces of many of these transformations did not appear in the final compositional products. Without appraisal of this experimentation, teachers were not necessarily aware of the extent and scope of the pupils' transformations, making the final compositional product assessment less useful for formative purposes than it could have been.

One of the chief aspects of the teacher's learning design was the organisation of roles. The use of computers for composing places a new emphasis upon the roles pupils' adopt, since these, in contrast to earlier typical ways of organising of group composing activities,

are not necessarily concerned with playing a musical instrument, one of them being mainly concerned with managing the computer. This was accounted for in one of the teachers' learning designs in this study, but not in the other; however there was observed to be a tension between on the one hand, the work of the group being jointly constructed and negotiated, and on the other, the provision of a framework for equitable role-taking. Where roles were not organised by the teacher to take into account equality of engagement in musical activities, it was observed that pupils stayed in a single role, but where they were allocated on a balanced basis, it was observed that the group composing tended to become separated into a sequence of individualised activities. 'Liberating constraints' was also utilised to consider the influence of the physical classroom environment upon pupils' roles undertaken during the composing activities and both the layout of furniture and equipment and the wearing of headphones was observed to enhance and constrain the ways in which the pupils worked collaboratively.

9.2.2 Subsidiary aim 2: the origins and transformation of selected pre-existing musical ideas

The second subsidiary aim was 'to investigate the origins and transformation of selected pre-existing musical ideas'. This aim has two key parts: firstly, the focus on what was composed, or 'redesigned' by the pupils, with the intention of better understanding the origins of the material that was transformed by them in order to produce their compositions, and secondly, the actual transformations the pupils made of this material. Furthermore, it was linked to Kress and van Leeuwen's notion of 'provenance', or the importing of cultural values associated with a previous context, and to an exploration of the creativity demonstrated by the pupils to ascertain if the observed composing supported Kress' notion of its 'everyday' nature.

It was found in this study that 'moving outside' the lesson's constraints was sometimes linked to the importing of out-of-classroom musical influences by pupils into their observed composing work. An example was the appropriation of instrument-specific techniques and musical styles, and although their exact sources were often difficult to identify, they did not appear to originate in the classroom context.

Influences were also observed that *did* originate in the music classroom, examples being the previously discussed potentials of equipment, such as music keyboards and the music software, and the influence of other pupils. Although no direct examples of 'provenance'

were articulated by pupils, (or the importing of ideas and values associated with previous cultural contexts), they were all able to compose creatively, demonstrating that they could transform the musical ideas, whatever their origins, through the process of re-designing into something new, these transformations themselves becoming 'available designs', or the resources available to the pupils, for future transformation. The tracing of the pupils' transformations at the micro level revealed similarities, but also differences between the two observed phases of education. These were linked to adoption of musical style, how much innovation or repetition the pupils' experimentation demonstrated, the musical scope of the transformations and the practical and theoretical skills that the transforming demonstrated.

9.2.3 Subsidiary aim 3: outcomes of use to practitioners

The third subsidiary aim was 'to produce outcomes of use to classroom practitioners'. This is necessarily linked to the outcomes of the previous two research aims; as a result of the consideration of liberating constraints, learning designs where composing was featured seemed to be most productive in terms of pupils' transforming where they contained an appropriate balance between constraint and freedom in order to promote generative activity. This in turn seemed to be aided by the creation of a music classroom culture where pupils were free to experiment with their own ideas.

The investigation into the origins of the available designs suggested that pupils should be encouraged to bring into the classroom musical ideas from outside it, especially ones that they are motivated to transform. A knowledge of individual pupils' out-of-school musical activities (both formal and informal) would help teachers to encourage their pupils to make the most of their lived musical experiences.

The micro-level tracing of pupils' transformations has suggested that to be able to fully understand pupils' redesigning, and to be informed about their work in order to be able to effectively assess it formatively, it is necessary to engage with their experimentations as well as their compositional products. This is chiefly because much of the experimentation does not appear in the final product, despite it being observed to be focused on meeting the composing task; it frequently appeared not to be included owing to limits of time or space. This is inherently a problem for teachers, as they cannot physically listen to the development of, perhaps 15 compositions at one time. There may be technical computer-based solutions, which together with pupil self-assessment procedures, may be able to

provide teachers with a better view of this process than the current situation is able to. Currently, often only the product is considered, and this has often been observed in this study to be a representation of only a small part of the groups' composing.

The observed case studies have shown that the issue of equity in role-taking needs to be considered if all pupils are to be engaged in music composing activity. However, equal consideration needs to be given to the seemingly conflicting aspects of making the composition a true group outcome and the promotion of the shared negotiation of the task as it progresses. As well as building in to the lesson design the necessity for all pupils to take on all (or both of) the roles, account needs to be taken of the promotion of mutual interest and inter-dependence upon others' work. Perhaps tasks should require pupils to compose sections that cannot 'stand alone', as was the case in study 2, but rather require all the other inputs to make a complete composition. The position of the computer screen in the observed studies as being in front of one pupil perhaps should also be taken into account; a more central placement, equally observable by all the group members, could promote its use as a shared space for negotiation, as seen in study 1.

The setting out of the furniture and equipment in the music classroom was discussed in Chapter 2, in sub-section 2.4.2. The observations in this study focused upon the mediating effects of these arrangements at the group level and it was seen to have had an effect upon the composing, particularly with regard to the ways in which it enabled or precluded pupils from engaging in roles, as discussed in the preceding paragraph. The observations suggest that the arrangement of furniture and equipment should allow pupils to engage in and be a part of others' roles and aim to avoid too much separation, thereby promoting the creation of a group product.

The recommendations for practitioners can be summarised:

- An appropriate balance between constraint and freedom should be maintained in learning designs for composing in order that generative activity is supported; this is linked to a music classroom culture where pupils are free to experiment;
- Pupils should be encouraged to use musical ideas of their own in the classroom, especially ones that they are motivated to transform. Effective composing task design is informed by a knowledge of individual pupils' formal and informal out-of-school musical activities;

- Account needs to be taken by teachers of pupils' experimentation alongside the product in order to provide the fullest information concerning the composing process with the aim of facilitating effective formative assessment;
- Equity in role-taking needs to be balanced against the possible fragmentation of whole-group composing;
- The classroom layout and the wearing of headphones should be considered in order that appropriate opportunities for both within and inter-group collaboration are provided. Of particular concern is the placement of the computer screen so that it can provide a shared space for group negotiation during the composing process.

9.3 Reflections on the study

9.3.1 The research journey

This study has described a research journey which arose out of my own professional concerns about the changes that the use of the computer made to the composing process in the classroom and in particular, a desire to understand better the influences that lesson design, the physical layout of the learning environment, the potentials of the software and pupil's previous musical encounters had on this process.

At the end of the research journey, some of my previously held beliefs have been confirmed and others challenged; this study has revealed partial answers and inevitably posed further questions. The relationship between the physical learning environment and collaborative group working is one that I had believed to be often overlooked in music classrooms; this study confirmed that a full consideration of this aspect is crucial in enabling successful pupil collaboration and setting the framework within which all pupils are able to contribute to a single group product. I was not surprised that transformatory activity, or 'creativity' was exhibited by all pupils nor that the musical ideas originated from a range of origins, both inside and outside the formal learning environment, as this was concordant with what I had suspected was the case in my previous teaching experience. However, I was surprised that the multimodal notion of 'provenance' was not demonstrated in this study as I had encountered this previously in my teaching. Additionally, the scope of pupils transformations and the amount of these that did not

appear in their final composition products was greater than I realised, an aspect of the study that has caused me to re-evaluate my own methods of formative assessment.

In common with my own teaching in secondary schools, it seemed that both of the teachers in this study had adapted their existing composing teaching pedagogy for composing with computers (especially as in both schools the composing with computers took place alongside 'traditionally' organised composing activities), rather than consider it an activity distinct enough to require its own lesson design. Some changes to pedagogy had been made but it appeared, especially considering the implications of the findings of this study, that further changes will be necessary in order for the full scope of the composing potential offered by the technology to be realised.

9.3.2 Data collection and analysis considerations

The adoption of multimodality and the associated requirement to use data collection instruments capable of gathering the breadth of data made the use of video a natural choice. It is admitted that although the aim was to collect as wide a set of data as possible, this was constrained by the nature of perspective; choices were made concerning the direction the video camera should point and and this was considered a form of data 'filter'. Also, its very presence would have some effect upon the pupils. The perspective of the researcher when note taking, or the involvement in the actions of the pupils would also inevitably influence the data. These concerns aside, it is considered that the data collected was nevertheless of a naturalistic classroom environment.

This wealth of data, following categorisation using the multimodal communicational modes in the developed computer-based tool, presented a rich source of data which provided the analytical basis from which to draw out the various emerging aspects. It is considered that the scope of the multimodal data collection is the widest yet undertaken in a study of composing in the music classroom and has revealed many simultaneous mediating influences upon the whole composing process, covering a multitude of perspectives, something that would not have been possible without the adoption of this theoretical frame.

9.3.3 Limitations of the study

The principal way that this study could be improved is the greater involvement of pupils and teachers in viewing and discussing the classroom phenomena. Although they were interviewed at the start and end of the project and their actions viewed throughout, an opportunity taken at the end of study 2 to present some of the video data to the pupils in order to better understand the origins of the designs selected for transformation (see chapter 7, section 7.5.2), suggested that this was potentially a very powerful method of obtaining a greater range of perspectives on the data. In particular, it was realised that the reasons for certain actions and the sources of the material chosen could only be ascertained by asking the participants, through highlighting the action as the video was replayed and targetting questions. A further suggested expansion of this would be to ask the pupil to provide a commentary while the video was replayed, much in the manner of commercial DVDs, where an additional viewing of the film is provided, with the director providing a commentary.

The history of the pupils' learning is also relatively unknown to the researcher but well understood by the teacher. An additional perspective could well be gained by repeating the above video replay to the teacher and asking them to place this in context with previous learning. Involving parents, carers and other music teachers (such as instrumental teachers) could be another extension worthy of consideration.

One constraint of the methodology is the time it takes to sift and record the data, even with the computer tool. Greater automation, such as the use of a camera which did not necessitate the transferring of video data into a computer-based format, or a computer-based video solution would save time. Additionally if the data-collection tool was computer-based, there would also be opportunities for researcher-initiated time-frame stamping on the video data itself and the automatic collation and linking of time-stamped screen grabs to these time frames.

9.4 Directions for future research

This study drew upon a substantial body of data and the analyses were focused through the definition of research questions. However, there are many other questions that remain that could be followed up through further research; these are described below.

How is the process of composing in the classroom with older pupils mediated by computers? This study was restricted to the 10-13 age range but it would be useful to increase the scope of this to older pupils, as composing beyond the age of 14 in English schools is necessarily individualised owing to examination constraints. It is believed that this would add another perspective to the one presented in this study through the greater experience and skill level that pupils of this age would be expected to demonstrate.

How can teachers gain fuller information on the whole composing process with computers as demonstrated in this study in order to better inform their knowledge of pupils' work? In this study it was observed that much of the transformatory work of the pupils at the computer was not appraised by the teacher, yet it was also shown that much of this work was of creative value; being able to engage with this work would provide the teacher with a more complete appreciation of the achievements of pupils, would help plan for their future learning needs and help engage more fully with the demands of the government's recent personalised learning initiative[1]. More research into how this could be accomplished would help teachers balance their focus less on the compositional product and more on the process. For composing with computers, a computer-based technical solution might be appropriate; this could perhaps retain the pupils' experimental work, maybe as a series of aural and / or video snapshots of keyboard playing and editing changes made on the computer that could be listened to and / or viewed later by the teacher.

How do the constraints inherent in lesson designs promote generative activity by pupils? It was notable that it was observed in this study that some of the lesson designs promoted more composing activity that 'went outside' the lesson constraints than others. This was not simply due to the boundaries being broad enough to encompass pupils' work but the constraints of some lesson designs seemed to not only allow, but encourage pupils to 'go outside' these boundaries. Further research is needed to tease out and understand why the elements of these 'generative' lesson designs encouraged pupils' composing work in this way and how this knowledge could be utilised to promote composing in the classroom.

How can the tension identified in this study, between teachers' underpinning aims to promote equality of engagement with the various roles offered by the composing-with-computers context, and the expectation that the group composing outcome will be a single, jointly constructed process and product? Research into resolving this tension

would impact upon lesson design, particularly in terms of room layout, temporal aspects and negotiation skills, and could build upon existing co-operative and collaborative group-working methods.

Is the multimodal notion of 'provenance' present in any of the composing by pupils with computers in music classrooms? This phenomena was not observed in the work of the two groups in this study in the ways that my previous teaching experience had led me to anticipate. However, I have frequently encountered the importing of values from other contexts through the re-use of existing available designs in the composing with computers of pupils older than the participants in this study, particularly with GCSE and A-level music pupils; perhaps this is because musical style and its associated cultural connotations may be more fully embedded in older pupils who have greater life experience of music, both in formal and informal contexts.

9.5 The potential impact of this study

The potential impact of this study is considered from the perspectives of two groups, practitioners and researchers.

9.5.1 Practitioners

This group consists of teachers in schools and those involved in initial and in-service training. The potential impact on this group is to prompt a reconsideration of learning design for the use of ICT for composing in the music classroom. Three strands are discussed here; learning environment, teacher appraisal and constraints.

Learning environment

The first potential impact is to place the whole learning environment at the centre of learning design. Many courses have focused upon the technical issues surrounding the use of technology, but this study has shown that the whole learning environment needs to be considered when designing for composing with ICT. The organisation of group work should be of key concern, embracing the provision of opportunities for effective collaboration through role-taking, a consideration of task equity, together with how to promote shared negotiation and the creation of a single group product. Additionally, the organisation of the physical environment and its effects upon collaboration, both within and inter group should be of equal concern.

Teacher appraisal

The second potential impact upon practitioners is to motivate a reconsideration of teacher appraisal of composing, particularly to balance it more towards the process rather than product. This study has shown that the experimental phase involves much transformatory composing that does not necessarily appear in the final composition product; therefore, if the product alone is considered for assessment, not only is the group not given appropriate credit for creative work in which they may have been involved, for formative purposes, the teacher is not fully informed concerning the scope of the group's potential, which may in turn negatively influence future planning for that group. Some ideas for how this might be achieved were given in sections 9.2.3 and 9.4.

Constraints

The third potential impact concerns a proposal to consider the notion of 'liberating constraints' in lesson design in order to ensure that pupils' motivated interest is maximised and creative work encouraged. The balance between proscription and prescription is a key element of this, as is the adoption of the principle of 'going beyond' the constraints of the activity. Linked to this is making the best use of pupils' lived musical experiences in the classroom through encouraging them to use their own ideas within their compositions, and ensuring that the lesson's constraints allow them to do this.

9.5.2 Researchers

It is expected that the chief potential impact upon the research community will be to add to the currently very under-researched literature on group composing with ICT. Issues have been raised within this study that have not been investigated previously within this domain and it is expected that this will have an impact upon the scope of future enquiries. The impact upon future research is discussed below under two headings; theoretical concerns and data handling.

Theoretical concerns

A potential impact upon researchers is the proposal of appropriate theoretical frameworks with which to consider the contemporary ICT-rich music classroom. It is considered that previous studies have been relatively narrow in scope, particularly those seeking to examine and diagrammatically represent the stages of the composition process; multimodality provides a theoretical perspective that embraces a wide set of mediating

influences, and it is hoped that future research will be able to contribute more effectively to our understanding of the use of ICT in the music classroom through its adoption. The notion of liberating constraints is considered to have much to offer future research into learning design, especially in relation to promoting creativity and 'going outside' lesson constraints. It is expected that studies of the effects of the balance between proscription and prescription in naturalistic settings would be valuable in understanding how best to promote creativity in the music classroom.

Data handling

A further potential impact is the development of the computer tool as means to handle the rich and large volume of data that multimodal enquiry in the music classroom generates. Although there are existing computer-based tools that support multimodal enquiry, none of them were found to be suitable for the music classroom. It is considered that the developed tool not only provides a systematic means of 'seeing' the data, particularly its interconnections, but also allows for a degree of analysis whilst maintaining easy access to the raw data. Without this tool, multimodal enquiry into the music classroom would be difficult to organise and it is expected to be an important part of enabling others to pursue multimodal enquiry in this area. It is hoped that the adoption of the tool is aided by its construction using freely available software components that will run on a wide variety of platforms, including Windows, Mac OS and Linux.

9.6 Concluding remarks

This study has raised many concerns regarding composing in the classroom with computers. The ongoing adoption of technological tools into the music classroom and the maintenance of the central place of composing in the statutory music curriculum when set against a background of little research into the use of ICT for group composing in this setting makes the timing of this research apposite.

This investigation has shown that there are many concerns about learning design that are not currently the focus of practitioners' or researchers' attention and yet have been observed to mediate the composing process, making them worthy of further study. Highlighting the importance of learning design places the agency for change with the classroom practitioner; at the same time, the suggestion that pupils should bring their own musical ideas into their classroom composing places an emphasis upon their own musical creativity. Taking these two aspects into account, the teacher can be viewed as an

orchestrator of creative possibilities, especially through a consideration of how liberating constraints and 'going beyond' can be utilised to make the most of the opportunities offered by the technology.

There are other challenges for practitioners: the suggested realignment of emphasis upon the composing process as a better indicator of pupil transforming suggests practitioners should reconsider their assessment of composing with ICT; issues of pupil role, the creation of single group products, and the collaborative opportunities provided by the technology prompt teachers to reassess the whole learning environment for group composing, particularly room layout and how it mediates pupil interaction.

The adoption of a new theoretical framework for the observation of music classrooms where ICT is used, when considered against a climate of recent calls for new ways of looking at these settings, is also timely. It can be viewed as an extension of the theory into a realm that, through the introduction of technological tools, has itself become an increasingly multimodal one.

This concluding part of this thesis has shown the potential of the study to contribute to further research and the training of music teachers. My intention is that the multimodal theoretical framework will be used and developed in future studies into music classrooms as I believe it has done much to bring to the fore issues that have not been exploited previously. As a teacher, I hope that the impacts described here may influence practice, leading to positive benefits for pupils when composing with computers in music classrooms.

[1] See http://www.standards.dfes.gov.uk/personalisedlearning/about/

Glossary

Musical terms

Arpeggiate (*verb*)	Playing the notes in a chord separately, one after the other, usually in an upwards or downwards direction, sometimes referred to as a 'broken chord'.
Articulation	In basic terms, whether the note is played staccato (short) or legato (smoothly).
Bar (measure)	Regular groupings of beats.
Bass line	The bass is the lowest part in music. The term 'line' refers to the on-going contour of this part.
Beat (pulse)	The underlying 'heartbeat' of music. It can be regular, with the same number and speed of repeated repetitions, or irregular.
Box and cross notation	A method of notating rhythm. The box represents a fixed rhythmic unit, typically 1 or ½ a beat, and the presence of the cross indicates that a clap or note should occur on this rhythmic unit.
Chord	A chord is a combination of (usually) 3 or more differently pitched notes played simultaneously.
Cluster chord	A chord where the notes are close together, more so than in a major or minor chord.
Coda	An ending, or concluding section to a piece of music.

Crotchet (quarter note)	A duration of sound related to a time-signature and tempo. In 4/4 time (4 crotchet beats in a bar) a crotchet will last for one beat at the tempo of the music.
DJ	An acronym for 'Disc Jockey', a term for someone who plays recorded music to an audience.
Drone	In its most simple form, an accompanying single sustained note. It can also be played as a rhythmic repeated pattern, or combined with another notes, such as a 5^{th}, or the note five notes higher.
False relation	This occurs in a harmonic progression where a note in a chord appears in the same chord, next chord or nearby chord chromatically altered. Harmonically, the appearance of one 'contradicts' the other.
Gamelan	A musical genre identified with Java and Bali, notable for its inclusion of instruments such as metallophones, xylophones, drums and gongs.
Graphic scores	A form of music representation where graphical symbols are used to represent musical events. There is no widely accepted standard for these, individual composers indicating what the symbols represent in their particular composition.
Hip-hop	A style of music that originated in New York in the 1970s and that features rap performed over backing music provided by a DJ.
Interval	The distance in pitch between two notes, e.g. the interval between C and D is a 2^{nd} and the interval between C and G is a 5^{th}.

Key	The relationship of pitches to one another , which creates melodically and harmonically functional music. There are 12 major and 12 minor keys in western music, based on each semitone of the keyboard.
Leap	The musical interval (or distance) between a note and another note that is not next to it in pitch.
Legato	A type of articulation where notes are played connected
Minim (half note)	A duration of sound related to a time-signature and tempo. In 4/4 time (4 crotchet beats in a bar) a minim will last for two beats at the tempo of the music.
Mode	A 'mode' is an older kind of 'key'. The 'A minor mode' referred to in this thesis consists of all the white notes from A to A and is known as the Aeolian mode.
Quaver (eighth note)	A duration of sound related to a time-signature and tempo. In 4/4 time (4 crotchet beats in a bar) a quaver will last for half a beat at the tempo of the music.
Octave	The interval of an octave is from one letter-named note up or down in pitch to the next similarly named note (e.g. C to C), or 8 notes.
Ostinato	A regularly repeating rhythmic pattern of notes.
Pentatonic	A 5-note scale, e.g. C, D, E, G & A.
Pitch	The 'highness' or 'lowness' of a sound. High sounds are situated at the right-hand end of the music keyboard, and the low sounds on the left.

Rap	A form of rhythmic, rhyming speaking used in styles of music such as hip hop.
Rest	A space in the music, measured in the same manner as a note, e.g. a crotchet or minim rest.
Rondo form	Rondo form is a musical structure which had its origins in the Baroque era, where a repeated 'A' section is alternated with contrasting sections.
Rhythm	Durations of notes in combination. A rhythm can be repetitive (as in most popular music) or irregular.
Staccato	A type of articulation where note are played detached.
Step	The musical interval (or distance) between a note and the next note to it in pitch.
Syncopation	A type of rhythm with the accent on the off-beat.
Tempo (bpm)	The speed of the beat or pulse: 120 beats per minute (bpm) indicates two beats per second.
Texture	The number of musical sounds playing at one time, which can range from one to many.
Tied	Where 2 or more notes are joined together, to form a longer, single note.
Timbre	The tone quality of a sound, largely determined by the harmonic spectrum it produces.
Time-signature	Two numbers given at the start (and at points where it changes) in notated music. They are represented as a pair: the top number represents the number of beats in a bar

and the lower number the value of one of these beats, '4' indicating a crotchet and '2' a minim.

For example, $\frac{3}{4}$ denotes three crotchet beats in a bar.

Tonic

The tonic is the first, or 'doh' note of a key - in C major, the tonic is a C. It sounds like the 'home' note to listeners used to western tonality. (*see 'key'*).

Trill

A type of ornament. A trill is a rapid alternation of 2 notes.

Technical terms - music technology

Arrange Page	The top-level view in Cubasis, with tracks arranged vertically on the left-hand side of the screen, and the music arranged horizontally, aligned with a time-line.
Audio	Acoustic or electronic sound stored in a digital file, which can be compressed (for example mp3 files) or not compressed (for example Microsoft wav files).
Chord symbols	Where symbols are used to represent the intended harmonic accompaniment, for example, 'C' indicating a C major chord (C, E, G) and 'Em' representing an E minor chord (E, G, B).
Clavinova	An electronic piano made by Yamaha.
Count-in (click)	See 'Metronome'.
EQ	An acronym for Equalisation, the altering of the tonal qualities of a sound through electronic means.
Frequency	The number of oscillations per second of a vibrating object. It is measured in Hertz; 60Hz = 60 oscillations per second. The faster the oscillations, the higher the pitch of any resultant sound.
General MIDI (GM)	An almost universally adopted MIDI specification that indicates how MIDI parameters, such as voice numbers and drum sounds, should be mapped, thus supporting better interoperability between similarly specified MIDI equipment. 'GS' and 'XG' are extended variants of this, promoted by Roland and Yamaha respectively.

Keyboard velocity	The speed at which a key on a music keyboard takes, upon depression, to travel from the top to the bottom sensor. In general, the faster (or 'harder') a key is depressed, the louder the resultant sound will be.
Key Editor	A Cubasis editor where notes are represented as horizontal blocks aligned with a keyboard on the left of the screen and a time-line at the top of the screen. Additional parameters of the notes are shown at the bottom of the screen, indicated by vertical blocks.
List Editor	A Cubasis editor where MIDI events are shown in numerical form on the left of the screen and as coloured blocks on the right.
Local Control	Part of the MIDI specification that allows the sound producing part of a music keyboard to be disconnected from the keyboard; this is typically necessary when a keyboard is used with a computer system.
Locators	In Cubasis, the left and right locators are set in the transport bar; the left indicates where a recording will start and the right (in the versions of Cubasis used in this study), where it will end.
Metronome	MIDI sequencers provide a metronome facility which plays a continuous click in order to facilitate playing in time. The 'count-in' is an introductory number of clicks which help prepare the keyboard player for the start of the recording. They can be set to any number, but are set by default to 2 bars, or 8 clicks.
MIDI	An acronym for 'Musical Instrument Digital Interface', an electronic specification that allows items of musical

	equipment, such as keyboards, drum machines and computers, to communicate with each other.
Mixer	A device capable of receiving multiple types of music input (both analogue and digital), transforming them (principally in terms of tone and volume) and routing them to various destinations, such as master 2-track recording devices (such as CD), multitrack devices, outboard effects units and for monitoring purposes (such as foldback in live performance, and headphone monitoring in studios).
Multitimbral	The ability of a MIDI instrument to play two or more timbres at once.
Mute	The ability on a sequencer to silence a track,in order to hear others more clearly.
Part	A rectangular coloured horizontally orientated block representing a section of music in a sequencer. It can be dragged around the Cubasis arrange page using the mouse.
Quantise	The rhythmic lining up of notes with a pre-defined grid, often used to make real-time playing sound in time with the rest of the music.
Reverb	Short for Reverberation, the sound produced by reflections within an acoustic space following a produced sound, such as a note of music.
Riff	Similar to 'ostinato' but applied to popular music.
Sample	A (usually) short digitised recording.

Score Editor	A western notation score-based editor, which is part of Cubasis, that enables users to view and edit recorded music in score format.
Scorewriter	Software whose product is a musical score and/or parts for program performance. It also typically allows the playback of scores via MIDI as well as containing extensive score editing facilities. Examples are Sibelius and Finale.
Sequencer	Software that combines the input, output and editing of MIDI and audio data. Examples are Cubase, Cubasis and Logic.
Synth.	Short for 'sythesizer' - typically a keyboard-based musical instrument capable of manipulating the timbre of a sound through analogue or digital means.
TAB	Short for 'tablature' - a fretted string instrument-specific notation where each string is represented by a horizontal line and numbers are entered to indicate finger positions on frets.
Tick	The smallest division of time in a MIDI sequencer, often called the 'resolution' of the sequencer. It is often expressed as fractions of a quarter note.
Tracker	A form of software music sequencer, which facilitates the arranging of samples on a timeline using several monophonic channels.
Transport Bar	A floating window in Cubasis which contains the transport functions for the sequencer, such as Play, Stop, Rewind, Tempo and Time-signature.

VCR	An acronym for Video Cassette Recorder, referred to in this study owing to the similarity between the arrangement of the tape transport controls and those of Cubasis' Transport Bar.

Technical terms - computer related

Apache	An open-source web server.
API	An acronym for Application Programming Interface. It provides the interface that allows computer programs to interact with an application.
Audacity	A freely available multi-platform audio editor.
Bitmap	A type of image file format where pictures are stored as mapped spatial arrays of single points
CPU	An acronym for 'Central Processing Unit', often referred to as the brain' of a computer, where programs are executed.
CRT	An acronym for 'Cathode Ray Tube', another name for a type of computer screen that is becoming obsolescent.
CSS	An acronym for Cascading Style Sheets. These are linked to web pages in order to provide a method of styling browser output in order to provide a common look across a site.
DHTML	An acronym for Dynamic Hypertext Markup Language, which is used to create interactive web sites through a combination of technologies, such as HTML, Cascading Style Sheet (CSS) and JavaScript.
Firefox	A multi-platform web browser.

Hard Drive	A high capacity form of permanent data storage found in a computer system based on a magnetic disc.
HTML	An acronym for 'Hypertext Markup Language', a static presentation language used in web pages.
ICT	An acronym for Information and Communications Technology, a general term for information systems such as the computer.
JavaScript	A scripting language, commonly used in client-side web pages to add interactivity.
iMovie	Proprietary film editing software supplied with Apple computers.
Linux	A Unix-based operating system that runs on a variety of hardware platforms.
Mac OS	An operating system for Apple computers.
MiniDV	An abbreviation for 'Mini Digital Video', a tape-based digital format used for video recording, notable for its compact dimensions.
mp3	A compressed music format that can be played by a wide range of devices, including web browsers.
mpeg	An acronym for Moving Pictures Experts Group, it is a common video format.
MySQL	A database management system commonly used in web applications.
pdf	An acronym for Portable Document Format, a proprietary

	format owned by Adobe, typically used for the transmission and reading of web-based documents.
php	An acronym for PHP: Hypertext Preprocessor. It is a server-side scripting language commonly used to provide functionality to a web site, such as the linking of databases.
png / jpg	Compressed picture formats that can be displayed by many applications, including web browsers.
QuickTime	A computer-based film format owned by Apple computer.
RAM	An acronym for 'Random Access Memory', the volatile memory data storage in a computer.
USB	An acronym for Universal Serial Bus, a contemporary interface for connecting peripherals to a computer system.
Windows	A Microsoft operating system that typically runs on Intel x86-based CPUs.
XML	An acronym for Extensible Markup Language, a general purpose language which facilitates the sharing of structured data, particularly in internet applications.
XSLT	An XML-based language which enables XML documents to be displayed in web browsers.

Technical terms - academic

Available designs	Previously existing resources that can be selected for the purposes of redesigning in order to produce new semiotic products.
Design	The second of the four strata of the domains of practice from which multimodal meaning are made: the combination of semiotic resources that are organised into a plan for the following stratum, Production - in the case of music, the composing process.
Design and Transformation	The process by which a semiotic artefact is remade, building on the previous work of others.
GCSE	An examination typically taken in England by pupils in the academic year in which they attain the age of 16. It is a National Qualifications Framework (NQF) level 2 examination.
Interpretant	A term originally used by Peirce to refer to the mediation by a person to a referent, for example, a person making meaning from the reading of a book.
Key stage 2	The stage of English primary education for pupils aged 7-11
Key stage 3	The stage of English secondary education for pupils aged 11-14
Key stage 4	The stage of English secondary eduction for pupils aged 14-16
Mode	A term used in multimodality theory to refer to a distinct form of communication, such as linguistic, musical or visual.

Monomodality	Communication through one mode of communication to the exclusion of others, for example music.
Multimodality	The theory of communication embracing distinct yet interconnected modes and their potential to create meaning. It is based upon theories of social semiotics.
National Curriculum	The statutory curriculum for all pupils in England and Wales aged 5-16, an outcome of the 1988 Education Reform Act.
National Strategy	A series of government initiated national strategies targetted at improving specific areas of the curriculum, such as the literacy and numeracy strategies.
Prescription	An approach to learning design where the activity is highly bounded and framed; the opposite to proscription.
Primary school	School in England for pupils aged 4-11.
Production	The third of the four strata of the domains of practice from which multimodal meaning are made: the actual material articulation of the semiotic work - in the case of music, the performance.
Proscription	The opposite end of a continuum to prescription: the adoption of an open and pupil-centred approach to setting boundaries in learning design that promotes generative activity.
Referent	A term originally used by Peirce to refer to the relationship of a sign to what it represents in the real world.
Secondary school	School in England for pupils aged 11-16 or 11-18

Semiotics	The study of sign systems and their processes, particularly their potential to communicate meaning.
Sign	A term from formal linguistics to indicate a unit of meaning that consists of a signifier and its relationship to something signified.
Signification	The relationship of a signifier to its signified.
Signified	What is represented by a sign such as a word.
Signifier	The form of a sign, for example, a word.
Synaesthesia	The making of meaning through different modes.
Transformation	The changing of a previous design to produce something that is redesigned.
Year 6	Pupils aged 10-11
Year 7	Pupils aged 11-12
Year 8	Pupils aged 12-13
Year 9	Pupils aged 13-14

Appendices

Appendix 1

Questions asked of pupils during 'before' interviews

1. Do you play a musical instrument?
2. If so, do you play music outside music lessons?
   Prompt - school orchestra / ensemble / at home/ in the community / do you have your own instrument?
3. Do any of your family play a musical instrument?
   Prompt - what instrument do they play? Do they play in a band / orchestra?
4. What sort of music do you listen to?
   Prompt - What do you particularly like about it? If you could play / sing any type of music, what would you choose? What do your parents listen to?
   (Optional - if play an instrument) What do you enjoy playing on your instrument?
5. What do you do in music lessons in school?
   Prompt - performing, composing, appraising
6. Tell me about the last thing you did in music lessons
   Extras - What do you like best in Music? What do you find the hardest / easiest?
7. Do you work in groups in music?
   Prompt - If so, who do you usually work with? (friendship groups, whether members have particular musical competences)
8. (Optional - only if they work in groups) Do you work in a certain way in your group i.e. does one person always play the same instrument, does someone lead, what do you do?
9. (Optional - only if they work in groups) Most people have problems working in groups at some time. What sort of problems do you have? What do you do when problems arise?
10. Do you use computers in school? What sort of thing do you use them for?
11. Do you use computers outside school? What do you use them for? Have you done anything with music on your computer at home or at school?
12. (Optional - if they play the keyboard) Ask them to play something.

Questions asked of pupils during 'after' interviews

1. You have just completed ..... project. What did you like about it?
2. Were there any things you didn't like about it?
3. What did you learn? Did you learn any new skills?
   Can you show me? (on keyboard / computer)
4. How did the computer help you do your composition?
5. Did you work together in a certain way?
   Prompt - Did you share the use of the mouse / keyboard? Who chose which sounds you used? Who made up the music?
6. Who chose whom you worked with? Who do you usually work with? Were there any differences working with X than with your usual partner(s)?
7. Do you think it would have been different if you had worked on your own?
8. Did you have any problems?
   Prompt - Working together / Technical / Helping other groups / Did anyone help you?
9. How was composing with the computer different to working without one?
10. (study 1) How did the picture influence your composition?
11. (study 1) Did you think your music reflected the mood of the pictures?
12. Have you done any work towards your composition outside the lesson?
    Lunchtimes / After School?
13. Were you allowed to listen to anyone else's work?
    Prompt - e.g. In lesson informally and outside lesson
14. What did you think about other people's compositions: those who worked at the computer? Those who didn't use the computer?
15. What do you understand by the word 'minimalism'?

Appendix 2

Questions asked of teachers during 'before' interviews

1. Tell me about your history as a teacher, particularly as a music co-ordinator, up to this point.
2. What would you say it was like to be the music co-ordinator at this school?
3. Do you get support from other staff?
4. How do whole-school decisions impact on the teaching of music?
5. Why do you think music is part of the National Curriculum?
6. When you are teaching music, what are you trying to achieve?
7. Which aspects of the subject do you most enjoy teaching, and which aspects do you enjoy the least?
8. Music teaching has changed since you began your career, what's your experience of change?
9. How do see the future of music teaching?
10. When do feel children learn best in music?
11. When you think things have gone well in your lesson, what has happened?
12. Do you use a computer outside school?
13. If so, what do you use it for?
14. What kind of music things do yo use it for?
15. How did you obtain your computer at home?
16. What sort of music software do you have?
17. How do you see ICT fitting in with what you want to achieve in music?
18. Have you used ICT within your music lessons?
19. Do you use ICT for any school purpose?

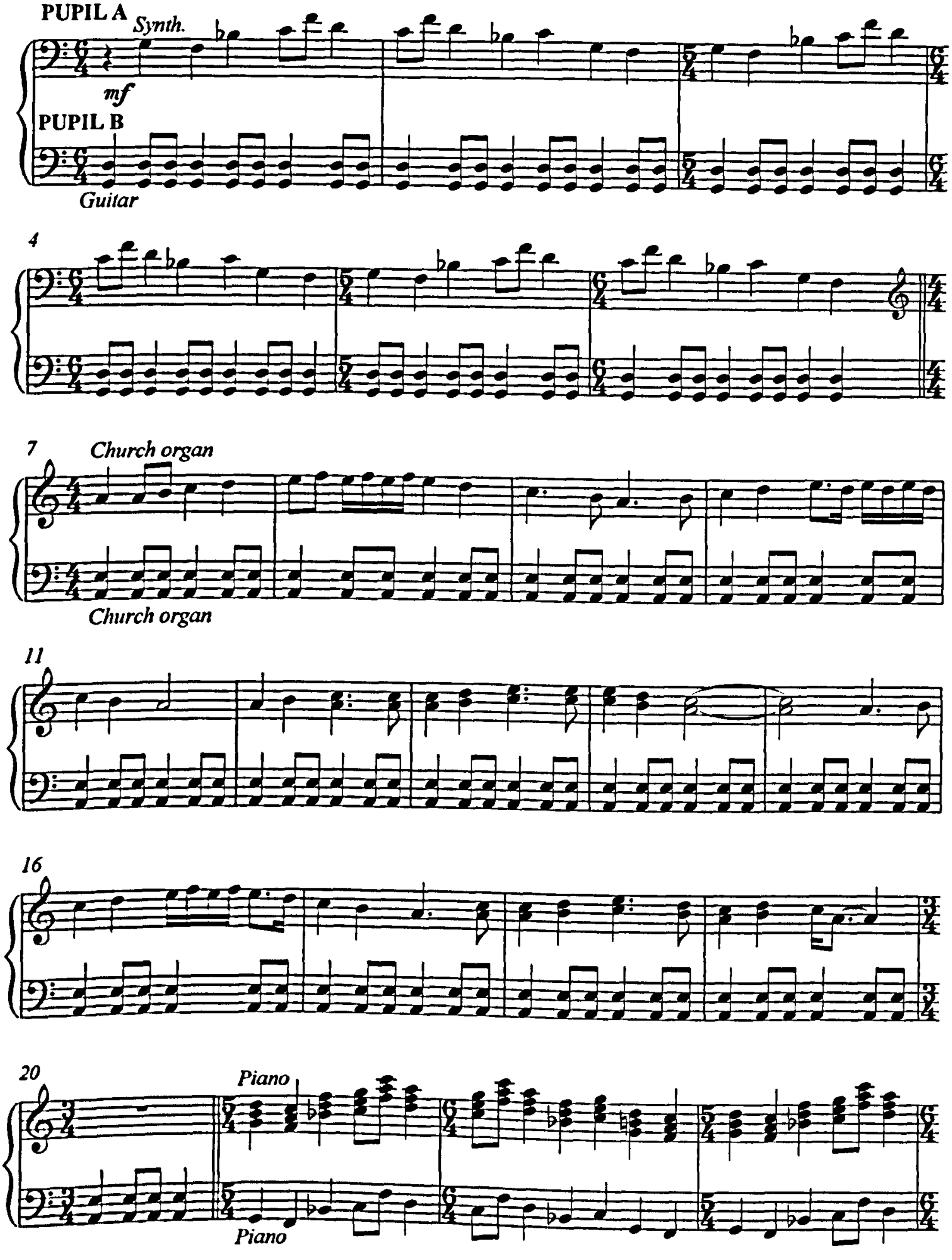
    Prompt - other subjects - administration
20. How do you think your out-of-school use of ICT impacts on your use of computers in school?
21. What do you think is the most important contribution that ICT can make to music in schools?
22. Do you have any concerns about incorporating ICT into music teaching?
23. What do you think pupils are doing with ICT and music outside school?
24. Is there anything else you would like to add?

Questions asked of teachers during 'after' interviews

1. You have just finished the ... project. What do you think went well? What could have been improved?
2. Did the pupils' outcomes meet your expectations?
3. Was there anything notable about the ways the pupils worked together compared to their usual mode of composing?
4. Would you change the layout of the equipment or furniture in the light of your experiences in this project?
5. Do you think the pupils had enough or perhaps too much opportunity to collaborate with each other and with other groups during this project?
6. Do you think the use of headphones helps or impedes this?
7. Did you find any of the pupils' composing exceeded your expectations, especially in the light of your prior knowledge of them? How do you feel about them perhaps not strictly meeting your brief but following their own composing preferences?
8. In the light of this project, how important do you think the pupils' process of composing is compared to the compositional product in terms of their musical development?

Appendix 3

Art and Music Project - full performance



2

24

Pan flute

f

Guitar

Drums

28

32

36

Lead synth.

Bass guitar

40

44

47

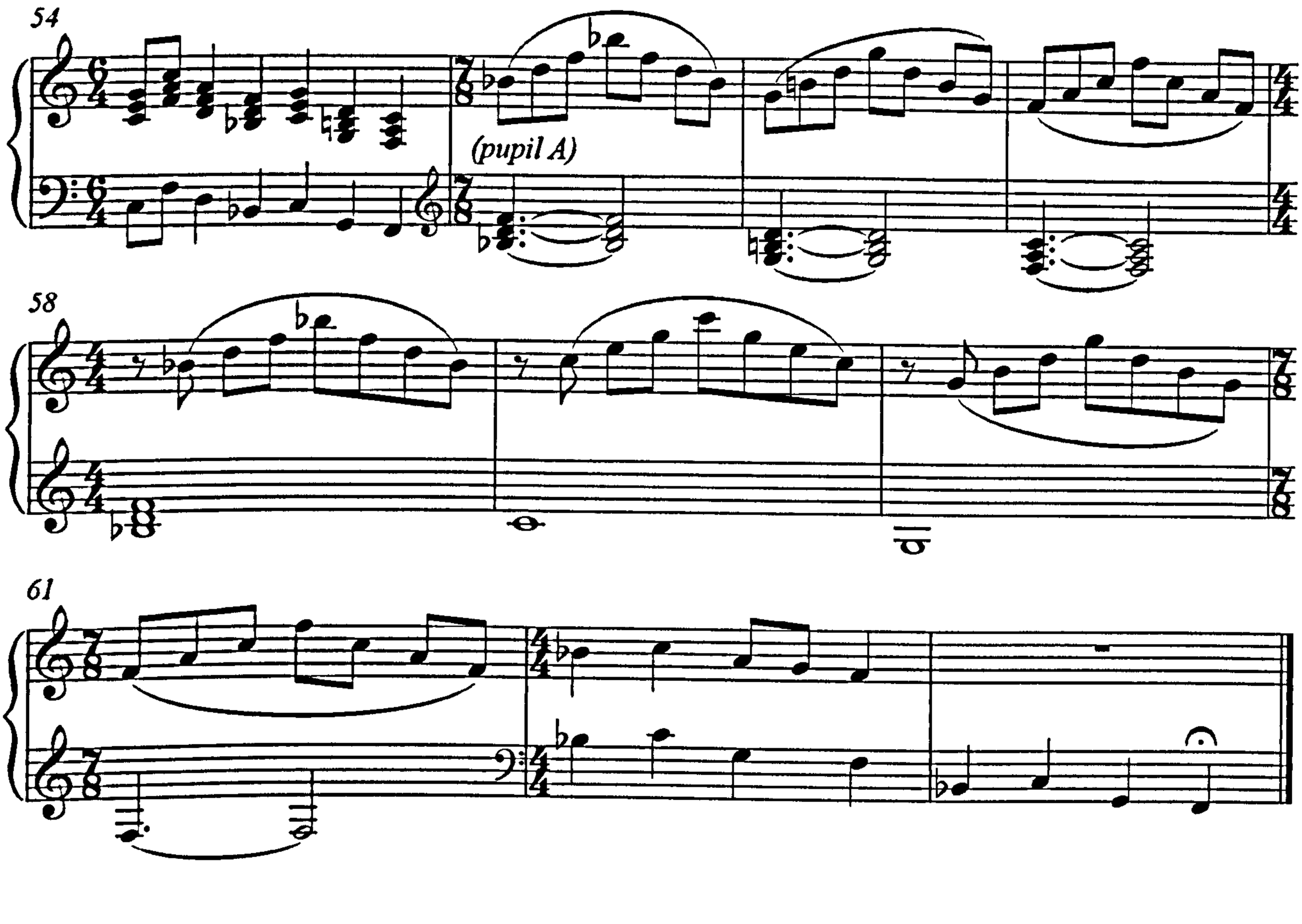
50

Piano

mp

Piano

4



Appendix 4: Full display of multimodal data for study 1, lesson 4

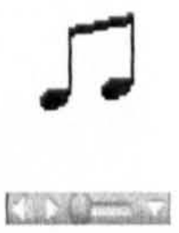
Appendices 4 and 5 contain multimodal data taken from the computer transcription and analysis tool. The icons represented in these appendices are 'clickable' in the computer tool; the film-strip icon in the gestural column opens a window in which the still image/s for that frame are displayed; the computer icon in the visual column opens a window in which the screen grab for that frame is displayed; the musical notes icon in the notation/audio opens a window in which the music notation for that frame is displayed. The QuickTime player icon represented here is a 'live' minimized audio-only version of this application in the computer tool.

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 1 00:00:00 - 00:01:00	S1, then G1, then G2, then G3, then L1–L7, then G4, then L8, then G5, then L9, then AT1, then L10–11, then G6.	**L1** Teacher: What, can't you find it? **L2** What was it called? **L3** A: Uh... New pupil A and pupil B. It's A and B or B and A... **L4** Teacher: A and B? **L5** A: Uh, B and A .. oh no .. **L6** Teacher: That was it, yup ... which one? **L7** That one there. OK. **L8** Can you go on to a new locator and then you can go on to this one. Yup? **L9** Let's see what you've got. Let us just work out where that is, set a locator and can you get on with the next bit, yeh? **L10** OK .. and then you can come back and do that other bit. **L11** A, you know what I mean by block chords?	**S1** Pupil A sat next to computer at right-hand side of music keyboard, pupil B sat at left-hand side of music keyboard.	**G1** Pupil A moves worksheet on top of music keyboard so both can read it. **G2** Pupil A raises hand to call teacher over to help find computer file. **G3**Teacher stands behind both pupils, leans over and operates mouse and computer keyboard. **G4** Teacher points to screen during L7. **G5** Teacher points to worksheet during L8. **G6** Teacher walks away and pupil A takes control of mouse.		**AT1** Teacher plays back start of Promenade theme during L9.	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 2 00:01:00 - 00:02:47	S2, G7, then AT2, then AT3, then AT4, then L12-14, then G8, then L15-19, then AT5.	**L12** Teacher: Yeah. We'll hear those as well. **L13** A: We gotta have chords **L14** B: Let's try having them come in the same time. Oh no, it's gone - the fantasia bit **L15** A: What fantasia bit? **L16** B: Right down the bottom there. **L17** A: Oh, is that what we're playing with it, was it? It wasn't that then? **L18** B: No - it's just the arrow over a bit, isn't it? It's a copy of it. **L19** A: Oh yeah - we did two of them.	**S2** Pupils remain in position and read worksheet / experiment on music keyboard	**G7** Pupils play keyboard with their right hands. No gestural / spatial visual data **G8** Both look at computer screen during L14.		**AT2** 00:01:15 - 00:01:20 some drum sounds tried out on keyboard by pupil B. **AT3** Drum track being currently selected, pupil A changes the selection to a piano track and a few piano notes are played by B (00:01:20 - 00:01:23). **AT4** From 00:00:25 - 00:02:30 both pupils experiment with the Promenade theme - pupil B with a single line in the bass, and pupil A with 3-note right-hand chords. **AT5** They join together rhythmically briefly at the end pupil B's 3rd playing.	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 3 00:02:47 - 00:03:18	S3, G9, L20-28	**L20** B: It's out of tune isn't it. It just doesn't come in at the right time. **L21** A: That looks right. **L22** B: Yeah, but it's the other. **L23** A: There's the other. **L24** B: Don't delete it! Cor, keep your fingers off that delete button! **L25** A: I'll highlight about there? **L26** B: No.. **L27** A:Oh God, look, you can see the line there (points at screen) .. **L28** yeah..that's right....see if that starts at the same time.	**S3** Pupils A & B both face the computer screen.	**G9** Pupil B leans his chin on his right hand apart from when he points at the screen. 		No music is played during this frame.	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 4 00:03:18 - 00:04:07	S4, G10, then AT6, then L29-32, then AT7, then L33-35, AT8, then L36-37.	**L29** A: We need to organise ours .. there we are our Old Castle **L30** B: Start at the beginning. Haven't we done the Old Castle? **L31** A: We have, we've done it all .. but we just need to put.. **L32** B: Where is the Old Castle? **L33** A: That's it isn't it? **L34** B: Don't know. Play it from there. **L35** A: So, I think that's it - not sure. **L36** B: Ow - my ear! Oh no it isn't - we haven't done the Old Castle. **L37** A: Haven't we? We did!	**S4** Both pupils face the computer screen.	**G10** Pupil B leans his chin on his right hand. Pupil A operates the mouse. 		**AT6** From 00:03:22 to 00:03:31 pupil A plays back the section where the drone and Promenade theme sound together. **AT7** At 00:03:41 pupil A plays 4 notes on the music keyboard (Ex202). **AT8** At 00:03:57 pupil A plays back a short section of the 'minimalist' section.	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 5 00:04:07 - 00:04:37	S5, G11then L38-L43, then G12, then L44-45, then S6, then L46-47, then G13.	**L38** B: Well look down the bottom then. **L39** A: Yeah. **L40** B: There it is. **L41** A: We need to put that (points to the screen with right hand).. **L42** B: Before.. **L43** A: Before the (pointing to screen with right hand) ..that one (points to worksheet with right hand). **L44** B: Ain't it all around there. **L45** A: I don't know .. I haven't done anything to it .. shall we ask sir? There's a split in .. **L46** B: Just move all this (points to screen with right hand) .. ow! **L47** A: Er..	**S5** Both pupils look at the computer screen apart from... **S6** ...when pupil A turns around to look for help.	**G11** 00:04:07 pupil B leans with head on left hand. **G12** 00:04:15 pupil B places hands together in front of his mouth. **G13** Pupil A operates the mouse with his right hand.		**AT9** At 00:04:31 pupil A plays part of 'The Old Castle' section (2 seconds – Ex.203)	

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 6 00:04:37 - 00:05:21	G14, then L48-49, then S7, G15 then S8, then L50-L56, then AT10, then G16.	**L48** B: What did he do? **L49** A: You can do it. **L50** B: Phew - can't see anything like that .. move that and I'll .. oh .. **L51** A: That's right at the start .. I've seen that here I think **L52** B: What starts? **L53** A: Move it back to the start a minute..here it is..oh no.. **L54** stop going up with it..stop..look, that is from there.. **L55** play a minute..see what it sounds like. (music) **L56** It's from there..see, you move that one, that one and then put the church organ over..	**S7** Both pupils look at the computer screen. **S8** Pupil A moves back so that pupil B can reach the mouse (00:04:44).	**G14** 00:04:37 Pupil B looks around (2 secs), at a noise from the group on his left. **G15** At 00:04:53 pupil A points to the top of the screen with his right hand. **G16** Pupil A points again at 00:05:06. 		**AT10** Part of 'minimalist' section is played back at 00:05:11 by pupil B (Ex.204)	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 7 00:05:21 - 00:06:03	S9, G17, then L57-L59, then G19, then L60, then G20, then L61-64	**L57** B: Move them all separately, that's what you've got to do..that's the next bit isn't it? **L58** A: Shall we ask him about that? **L59** B: Yeah. He'll probably discuss all of it. **L60** A: Then we've got to fit that Promenade..we've got to fit a Promenade, so really, we should push them all out of the way first. **L61** B: It'll be a wierd order. **L62** A: It'll be a wierd order but.. we'll just sort it out afterwards. **L63** B: Yeah. Try and keep it on the same line! **L64** A: Where is it?..go down a bit..that one sound right?	**S9** Both pupils sit facing the computer.	**G17** Pupil B leans his chin on his left hand (00:05:21) and then his head (00:05:32). **G18** Pupil B leans on chin again at 00:05:53. **G19** Pupil A points to the worksheet at 00:05:36 and looks around at pupil B. **G20** At 00:05:40 pupil A gestures to the computer screen (L60).		No music is played during this time frame.	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 8 00:06:03 - 00:06:49	S10, G21, then L65-73, then AT11, then L74.	**L65** B: Yeah. **L66** A: So that one comes first.. **L67** B: ..and then it's this one .. that on there. **L68** A: That one's the next one isn't it? **L69** B: Yes - you've got to do it behind it. Like overlapping, isn't it? **L70** A: I've got to do this, I wonder what that would sound like? **L71** There, down on top of all the squares. **L72** Right, that one comes first and then that one and there's the drum track isn't it? **L73** Yep? Just click on a bit. **L74** All right, if we.... OK I remember, there's the drums..	**S10** Both pupils sit facing the computer.	**G21** Pupil B leans on hand on chin. Pupil A keeps his right hand on the mouse. 		**AT11** Pupil B plays the keyboard at 00:06:39 to 00:06:48 (Ex.205).	 

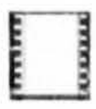
Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 9 00:06:49 - 00:07:33	S11, then L75-79, then G22, then L80, G23, then L81, then L82, G24, then L83-84.	**L75** B: Yeah, so you've got to move all that underneath .. **L76** underneath it was a above it.. **L77** it was the start of that first one's got to be under that. **L78** A: We've run out of space to put it. Now we'll put it.. **L79** B: ..over.. **L80** A: .. after that (points to worksheet). So we'll put you upstairs .. **L81** B: ..in the middle.. **L82** A: ..there. And then (points to computer screen) we've got to have .. **L83** and then we'll start recording here for the .. that bit .. **L84** and then we'll bring them in (turns to face pupil B).	**S11** Both pupils sit facing the computer.	**G22** At 00:07:04 pupil B turns to his left, distracted by some talking fom a member of another group to his left - he turns back at 00:07:08. **G23** At 00:07:19 pupil A points to the worksheet. **G24** At 00:07:27 he points to the computer screen.		No music is played during this time frame.	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 10 00:07:33 - 00:08:27	S12, G25, then L85, then AT12, then L86-L92, then AT13.	**L85** B: Umm .. what are we going to do for that then - do the Chorus and the Promenade tune? .. **L86** We're going to have to go slow tempo because .. the chords aren't we? **L87** Oh God, no! **L88** A: That bit .. go back, go back, go back .. there it is.. **L89** B: Just don't .. just don't. **L90** A: .. bar twenty eight. I've got those at home of yours. **L91** B: You've got everything away at home haven't you? **L92** A: So we're recording from here .. I'll just practise it. OK.	**S12** Both pupils remain seated but face the music keyboard.	**G25** Pupil B leans his head on his left hand and places his right hand on the music keyboard. 		**AT12** Pupil B plays the music keyboard at 00:07:36, has a short break then plays a fragment again (Ex.206). Pupil A interjects, playing two chords near the start of the first section of this. **AT 13** They both start again at 00:08:27 (see next time frame)	 

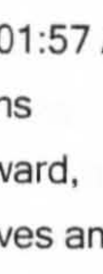
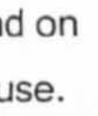
Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 11 00:08:27 - 00:08:56	S13, G26, then L93, then AT14, then L94-96, then AT15.	**L93** Teacher (to whole class): About ten more minutes. **L94** A: Ready?.. Oh dear... look, I've got the 'harmonote' .. ready? **L95** All right .. I just got stuck there. **L96** B: You practise for a while.	**S13** Both play the keyboard.	**G26** Pupil B leans on left arm and plays with right hand. 		**AT14** They play for most of this time frame (Ex207). Pupil A plays the right hand 'chord' part and makes some mistakes as he plays. **AT15** Pupil B suggests that he should leave pupil A to practise alone towards the end of the frame.	 
End of Time Frames		No linguistic data	No spatial data	No gestural data No gestural / spatial visual data	No visual data	No aural text data	No notation data No audio data

Appendix 5: Full display of multimodal data for study 2, lesson 4

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 1 00:00:00 - 00:00:16	S1; G1; L1; AT1	**L1** A: Do we have to have it on like this jazzy stuff?	**S1** A sat at computer, B standing, writing note names on keys with marker pen, C stands behind them	**G1** A looks across to other members of the group when asking question; else looks at computer. B looks at keyboard. 		**AT1** 00:00:11 - 00:00:14 A plays one bar of sequence	No notation data No audio data
Time frame 2 00:00:16 - 00:00:36	AT2 , S2 (at the same time)	No linguistic text	**S2** As before except C leans across keyboard from other side to A and plays 2 notes. B takes C's hand and removes it from the keyboard	No gestural text. 		**AT2** A plays whole of sequence, looping back to start	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 3 00:00:36 - 00:00:44	L2, S3 & G2 (at the same time)	**L2** Some inaudible conversation between B and members of other group	**S3** A sat at computer, B standing initially, then sat at music keyboard. Both look around to talk to other pupils behind them	**G2** A looks round at B while talking to other members of group, then back to computer screen. B turns round to talk to other group. 		No aural text	No notation data No audio data
Time frame 4 00:00:44 - 00:00:52	L3, S4, G3 & AT3 (at the same time) L4 (S4, G3 & AT3 continue)	**L3** C: A simple out of tune **L4** B: Uh, I'm never used to doing this - well I am, but not like that	**S4** As before except B has right hand over music keyboard in a position to play	**G3** A looks at computer screen, leaning head against left hand; B looks at right hand held over keyboard. 		**AT3** A plays 2 seconds of sequence	No notation data No audio data
Time frame 5 00:00:52 - 00:01:01	S5, G4 & AT 4 (at the same time)	No linguistic text	**S5** A sat at computer; B plays the music keyboard; C stands behind them	**G4** A as before, B plays keyboard. 		**AT4** B plays (for the whole time frame) A starts the backing sequence after 2 seconds	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 6 00:01:01 - 00:01:16	L5, S6, G5 & AT5 (at the same time)	**L5** B: I can't do it (then turns round to talk to researcher - inaudible)	**S6** A as before, B turns round to talk to teacher	**G5** A as before, B turns round then turns back to keyboard. 		**AT5** A stops sequence at 00:01:04 then replays it again at 00:01:07 (continues to next box)	No notation data No audio data
Time frame 7 00:01:16 - 00:01:22	S7, G6 & AT6 (at the same time)	No linguistic data	**S7** A sat at computer (head in hand), B playing keyboard	**G6** A has head in left hand, looks at computer screen, B looks at keyboard. 		**AT6** B plays from start of time frame. At 00:01:22 A stops the sequence started in previous box	 
Time frame 8 00:01:22 - 00:01:44	L6 - 14 in order. (L11 overlaps end of L10 and L14 almost overlaps end of L13). Then AT7. S8 & G7 are on-going throughout the time frame	**L6** B: Someone else go first **L7** A: Go on then 'C', you first **L8** B: Will you? **L9** C: Yeah **L10** Teacher: So who's going to record their tune first - that's what you need to decide **L11** B: 'C' **L12** A: Do you want to start recording it I'll press delete **L13** Teacher: I'd practise first **L14** A: Do I just press record - when you're supposed to play then?	**S8** After it has been decided that C is going to play first, C moves to keyboard and sits while B moves to the left and stands	**G7** A puts down left arm and faces rest of group. C faces keyboard and positions hands. C then practises the music keyboard. 		**AT7** Pupil C experiments	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 9 00:01:44 - 00:02:03	S9, G8 & AT8 (at the same time)	No linguistic text	**S9** A at computer, C tries ideas on keyboard, B stands at side of keyboard	**G8** A looks at C while leaning back on chair. At 00:01:57 A leans forward, moves and blows into microphone. C looks at keyboard while trying out ideas. 		**AT8** C tries some ideas on the music keyboard	 
Time frame 10 00:02:03 - 00:02:17	AT9 then G9 (AT9 continues) L16 then L18. S10 is on-going throughout the time frame	**L15** C:Remember it doesn't matter if it's even **L16** A:Shall I record it? **L17** C:No, supposed to play it [to get it right]	**S10** A at computer, C tries ideas on keyboard, B stands at side of keyboard	**G9** A waves to friend in other group keeping right hand on mouse. **G10** A then leans on left arm watching C experiment and lets go of mouse with right hand. **G11** A puts right hand on mouse. 		**AT9** C continues experimenting	 

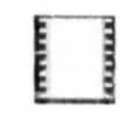
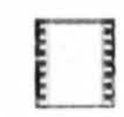
Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 11 00:02:17 - 00:03:25	L18 then AT10 then L19 & AT11 (at the same time) After the first "5" of L19 - G13 AT12 then L20 (AT12 continues - G14 in the middle of this, followed later by G15) then L21 S11 & G10 on-going throughout time frame	**L18** C: OK I'll press record **L19** A: It's over to me I think, I'll count you in - 1. I'll count to five: 1, 2, 3, 4, 5; 1, 2, 3, 4, 5" **L20** A: Shall I record? **L21** 00:03:15 A (to C): Do it again.	**S11** As before	**G12** A watches screen and operates mouse with right hand. C sits to play keyboard **G13** A leans his head on left arm **G14** 00:02:52 A takes head off arm, looks briefly at C and then back to the screen **G15** 00:03:08 A turns to look at C as the keyboard is played then looks back to the screen (this is repeated twice). 		**AT10** A starts sequence by clicking on start button with mouse C plays (not in time - ex.1) **AT11** A stops sequence (C plays while A speaks - exs.2 & 3) **AT12** A starts sequence again C plays an extended passage (ex.4):	 

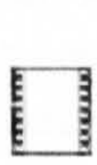
Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 12 00:03:25 - 00:03:57	AT13 then L22 then G16 then AT14 & L23 (at the same time) during which G17 & G18 occur then L24	**L22** C: Play it again - I know what to do now. Delete that. Delete it! **L23** A: Ill play it now - (plays sequence back) Happy with that? **L24** C: No, can you delete that?	**S12** A keeps right hand on mouse and leans head on left hand with elbow on desk. C sits and plays with two hands; right hand playing upper G & A and the left hand playing C, D & E.	**G16** After C has finished playing, he turns and faces A. **G17** At 00:03:48 A is distracted by other group and looks around. **G18** A looks back to computer at 00:03:52 and leans back on chair as the sequence plays.		**AT13** A starts sequenced backing track having pressed "record" 8 clicks are heard -then C plays. **AT14** C plays the first part back briefly before telling A to delete it. A then plays the whole sequence	 

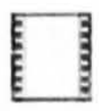
Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 13 00:03:58 - 00:04:42	L25 then AT15, AT16 then L26, L27 then AT17 then L28 then G19 then AT18, AT19 S13 on-going throughout time frame	**L25** C: Yup. Now go back to the beginning. Now record it **L26** C: Start again **L27** C: That's completely wrong .. and .. it .. didn't fit. Beats [..] again. **L28** C: Let's listen to that	**S13** A leans back on chair on occasions as sequence plays. C continues sitting at keyboard.	**G19** C leans over to his right and presses the spacebar twice with his right hand. A presses "Play" and they listen to the recording. 		**AT15** A starts to record immediately . C plays (Not in time) **AT16** A stops recording **AT17** A starts recording. C plays (not in time) **AT18** A plays the sequence (it is not the section that has just been recorded) **AT19** 00:04:41 A stops sequence	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 14 00:04:43 - 00:05:15	AT20, G20 then AT21 L29 then AT21 L30, G21 overlap end of AT21 G22, S14 on-going throughout the time frame	**L29** C: Get this one **L30** A: Mr Breeze - yeah, OK a minute? I don't know [if the] sound [is] right	**S14** A puts knees up against desk whilst leaning back in chair, keeping right hand on mouse. C continues sitting at keyboard	**G20** A looks at screen initially **G21** Later looks around to ask researcher a question **G22** C watches hands whilst playing keyboard, looking to the right when speaking to A.		**AT20** C plays his "techno"ide a twice while A experiments with the score editor **AT21** A plays the previous recording back (starts 00:04:54), not recording as C requests. C listens then plays a new idea as the rest of the backing track continues	 
Time frame 15 00:05:16 - 00:05:48	AT22, L31 (occurs while AT22 is continuing) then L32 then AT23 then L33 S15 & G23 on-going throughout the time frame	**L31** C: I just want a quick try **L32** A: (to researcher)Mr Breeze (to C) C, stop playing (to researcher) Do you think this sounds very right? **L33** Researcher [replies - inaudible]	**S15** A leans back on chair and alternates between looking for the researcher (behind), pupil C and the computer screen, keeping right-hand on the mouse. C sits at keyboard practising in between verbal exchanges	**G23** A looks between the computer screen and looking for the researcher, keeping right-hand on mouse. C looks either at keyboard or at A when speaking.		**AT22** C continues experimenting (a 4-bar section can be heard from the other group at the start of this time frame) **AT23** A plays sequence for the researcher to hear	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 16 00:05:49 - 00:06:19	AT24, G24 then L34, G25 (AT24 continues) L35, S17, G25 then L36 then L37 S16 on-going throughout the time frame	**L34** C: I had the beginning right, it was like...(plays) **L35** A: It's about right **L36** C: Aah, I'm gonna start again. There are too much [..] I've lost it now **L37** C: Done now, it's best	**S16** A leans back on chair as before, C sits at keyboard **S17** They are both distracted at 00:06:07 by a loud count-in from the other group	**G24** A looks at computer screen and C looks at keyboard apart from looking around briefly at the researcher at 00:05:52 **G25** 00:05:54 - 00:05:57 & 00:06:00 - 00:06:02, C looks at computer screen **G26** 00:06:08, both look at other group.		**AT24** C practises in readiness to record	 
Time frame 17 00:06:20 - 00:06:33	AT25, S18, G27 all on-going throughout the time frame	No linguistic text	**S18** A sits with knees raised and resting on edge of tabletop, maintains right hand on mouse and has left arm held up against side of head. C sits and plays keyboard	**G27** A looks at screen and C looks at keyboard throughout. 		**AT25** C plays while A records the performanc e on the computer	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 18 00:06:34 - 00:06:44	L38 then AT26 (G29 occurs towards the end of AT26) S19 & G28 on-going throughout this time frame	**L38** C: Listen to it?	**S19** A sits with knees raised and resting on edge of tabletop, maintains right hand on mouse and has left arm held up against side of head. C sits and plays keyboard	**G28** C looks towards the computer screen **G29** At 00:06:42 A looks around, briefly distracted by the other group. 		**AT26** A plays the previously recorded sequence back following C's request	No notation data No audio data
Time frame 19 00:06:45 - 00:07:04	G30, L39, L40 then L41 & S21 together L42, S22, G31 then L43, L44 S20 on-going throughout the time frame	**L39** A: Happy with that? **L40** C: Yeah **L41** A: My go now **L42** Researcher: Now, what you have to do to record the next track? **L43** A: Um, so ... **L44** Researcher: Select the next track down ...	**S20** A maintains same position as before. **S21** At 00:06:47 C gets up from chair at keyboard and sits at a chair next to A **S22** At 00:06:50 B moves towards, initially stands, then sits at the keyboard	**G30** A initially looks at screen then looks at B & C as they change places **G31** At 00:06:57 A looks back to screen (when responding to requests form the researcher). 		(No sound is played on the keyboard or computer during this time)	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 20 00:07:05 - 00:07:28	L45, S23 (S24 & G32 occur mid-way through these)	**L45** Researcher: OK, now you have to set the right & left locators. Because at the moment - can you both watch ? - can you see the left locator set at bar 1, which is there? And the right locator set at bat 5, that was the beginning and the end of C's tune, OK?	**S23** Researcher speaks from behind initially, but moves forward at 00:07:14 and points to screen & looks at pupils **S24** At 00:07:08, C moves to stand to the right of A and looks at the computer screen. A maintains right hand on mouse and left hand on head	**G32** Researcher points to screen when talking about locators and bars. 		(No sound is played on the keyboard or computer during this time)	No notation data No audio data
Time frame 21 00:07:29 - 00:07:42	L46 then L47 then L48 then L49 then L50 S25 & G33 on-going throghout the time frame	**L46**Researcher: Now, you've got to record the next bit, so which bar do we want to set the left locator to? **L47** A: Uh, six **L48** C: Six **L49** A: Five **L50** Researcher: Five, that's it. So, if you double-click that box, and enter 5. That's it - and 'enter'	**S25** Researcher remains pointing at screen and talking to pupils. A executes keyboard tasks as required	**G33** Researcher stands and points at computer screen. A uses right hand on mouse and left hand to operate computer keyboard. 		(No sound is played on the keyboard or computer during this time)	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 22 00:07:43 - 00:08:02	L51 then L52 then L53 then L54 S26, G34 on-going throughout the time frame	**L51** Researcher: Where do we want to set the right locator? **L52** A: Nine **L53** Researcher: Nine - so you double-click the right box; enter '9'; and then you're ready to record the next part **L54** A: I'll go now	**S26** Researcher remains pointing at screen and talking to pupils. A executes keyboard tasks as required. C moves around the back of A	**G34** Researcher stands and points at computer screen. A uses right hand on mouse and left hand to operate computer keyboard. 		(No sound is played on the keyboard or computer during this time)	No notation data No audio data
Time frame 23 00:08:03 - 00:08:13	L55, S27 starts, then L56, S27 ends, then L57, G35 then AT27 then L58	**L55** B: Can I sit here? **L56** Researcher: I think that's OK **L57** B: Hmm, I'm rubbish at the computer **L58** C, you'll have to help	**S27**A moves into seat at keyboard; B moves into seat at the computer; C sits on chair behind computer	**G35** B looks around at researcher when sitting down, then briefly at the screen and then behind at C. 		**AT27** A tries out a short idea at the keyboard	 
Time frame 24 00:08:14 - 00:08:28	AT28, L59 stops this then L60 then L61 then L62 S28 & G36 ongoing throughout the time frame	**L59** B: Which one do I press, that one? **L60** A: Ah, I can't get to play **L61** B: How do I stop it? **L62** C: Press that one twice to stop it. There	**S28** A sits & plays music keyboard; B sits at computer with right hand on mouse; C sits behind B and leans over to help	**G36** B's gaze varies between screen, A & C; A looks at keyboard; C watches screen. 		**AT28** A tries out 2 ideas; the second is cut short by B playing back a previously recorded sequence	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 25 00:08:29 - 00:08:55	L63 then L64, G37 then AT29, during which G38, L65, L66, (L67 & G39 together), L68 (L69 & G40 together) then L70 then G41 G42 on-going throughout the time frame	**L63** B: I want it back to the beginning **L64** A: That one **L65** B: Put it down **L66** B: Which one do you press to record then? **L67** C: Press record **L68** B: No, I didnt say record it! **L69** C: Yes you did, you said record it **L70** B: No, I said how do you record it	**S29** A sat at music keyboard; B sat at computer; C sat behind A to the right	**G37** A leans across from keyboard to press a computer keyboard key at 00:08:30 **G38** C conducts from 00:08:33 to 00:08:36 **G39** C leans over Bs right shoulder to press computer keyboard keys at 00:08:47 **G40** C leans over Bs right shoulder to press computer keyboard keys at 00:08:50 **G41** A leans across from keyboard to press a computer keyboard key at 00:08:54 **G42** B looks between screen, A & B.		**AT29** A starts playing the music keyboard when the backing track is started and continues experimenting after it has stopped for a short while	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 26 00:08:56 - 00:09:28	L71 then L72 then AT30, during which G44 then L73 then L74 then L75 then L76 G43 on-going throughout the time frame	**L71** A: You actually didn't want that. What, didn't you actually listen to [name] **L72** B: I'm still not very good on the computer **L73** A: Music's good, shift, and I'll use it **L74** B: No, I will **L75** A: Do you wanna know it? **L76** C: Just play it	**S30** A practises keyboard, when not talking to B; B keeps right hand on mouse sat at computer; C sits behind A.	**G43** A looks at keyboard apart from when talking to B. B looks at screen apart from when talking to A, when she turns to her left **G44** C 'draws' in the air whilst turning on chair.		**AT30** A practises keyboard when not talking to B	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 27 00:09:29 - 00:10:09	AT31, during which L77 then AT32, G48, L78 then L79, AT33, near the end of AT33: L80, L81, L82, L83, L84, L85, L86 (AT33 ends)	**L77** A: It's that one **L78** Yeah, your [..] stopped. Stop again. **L79** C: Press play **L80** A: Press delete. Delete. **L81** C: This one? **L82** A: Yeah **L83** C: Sure? **L84** A: Yeah **L85** C: OK **L86** A: Press stop	**S31** A practises keyboard, when not talking to B; B keeps right hand on mouse sat at computer; C sits behind A.	**G45** C moves to music when it is playing, mainly with arms **G46** B keeps right hand on mouse and left hand on left shoulder **G47** A plays music keyboard, turning to face B and the screen when speaking **G48** A uses upturned palm of right hand to show stop recording.		**AT31** 8-beat pre-count **AT32** A's work is recorded while A plays the music keyboard **AT33** A's work is replayed and continues with the rest of the backing track	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 28 00:10:10 - 00:10:31	G49 then L87 then AT34 then AT35 during which G50 then L88 then G5 S32 & G52 on-going throughout the time frame	**L87**A: Start **L88**C: Again. Again	**S32** A seated at keyboard; B keeps right hand on mouse sat at computer; C sits behind	**G49** C leans over B and presses a key on the computer keyboard **G50** C moves about on chair behind B **G51** C leans over to press a key on the computer with left hand **G52** B looks between screen and A. C watches mainly keyboard.		**AT34** 8-beat pre-count **AT35** A's work is recorded (second time)	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 29 00:10:32 - 00:11:03	L89 during which G53 then AT36, G54 then L90 & G55, L91 then G56 then L92 S33 on-going throughout the time frame	**L89** C: And [..] listen to them all **L90** B: OK? **L91** A: It'll do **L92** C: You know what you could do [name] underneath is, um put everything else to see what is sounds like on zoom...	**S33** A seated at keyboard; B keeps right hand on mouse sat at computer; C sits behind	**G53** C leans over B and presses a key on the computer keyboard **G54** A and C are focused on the screen **G55** B looks round to A when asking him if the recording is OK **G56** A leans right over in front of B to listen to the 'take' again and to look at the score edit on the screen.		**AT36** The previously recorded 'take' is auditioned	No notation data No audio data

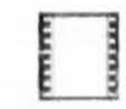
Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 30 00:11:04 - 00:11:54	AT37 then AT38 then AT39, L93 towards end then AT40 L94 during S34 & G57 on-going throughout the time frame	**L93** A: Aah **L94** Yeah, that'll do	**S34** A stands and leans over in front of B for all of this frame, controlling the playback of the computer and selecting the score edit to follow the recording	**G57** A has left hand with palm uppermost on desk for support and right hand controls the mouse. A's body leans against the table top. 		**AT37** A plays the previously recorded sequence himself while leaning over in front of pupil B at 00:11:04 **AT38** A plays the sequence again at 00:11:17 **AT39** A plays the sequence again at 00:11:30 **AT40** A plays the sequence again at 00:11:43	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 31 00:11:55 - 00:12:20	G59 starts L95 & G58 then L96, L97, L98, L99 (G59 ends) then G60, AT41, G61 then L100, L101, L102, L103, L104 S35 & G62 on-going throughout the time frame	**L95** A: My turn **L96** B: C'mon, it's my turn; you've had your turn **L97** C (before B finishes): It's my turn at the computer **L98** A: I'm going on the comfy chair **L99** C: Yeah, I go in [turn] **L100** A: Yeah, 'B' **L101** C: No, I, I **L102** A: Ah, comfiness **L103** C: Go **L104** A: Are you ready to record?	**S35** B moves to music keyboard. A & C initially compete over who is going to control computer. A moves to computer seat and C sits on the right of the screen	**G58** B walks around the back of A & C to stand in front of the music keyboard **G59** A initially puts left arm on desk over computer screen but removes it as A & C change places **G60** A & C change places **G61** B tries out ideas on the keyboard with index finger of right hand **G62** A & C look at each other for most of this frame.		**AT41** B tries out ideas after A & C have changed places	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 32 00:12:21 - 00:12:34	AT42, L105, L106 then L107, G63, L107, G64 then L108, L109, L110, L111, L112 S36 & G65 on-going throughout the time frame	**L105** C: Two **L106** A: No, count her in **L107** Researcher: So, are you going to do the third section now? **L108** C: Ready? **L109** B: Set it [smooth} **L110** Researcher: So where's your left locator need to be? **L111** C: Ah.. **L112** A: Nine	**S36** B tries out ideas at the keyboard; A & C sit at the computer; researcher speaks from behind and points at computer screen with a pencil	**G63** C indicates with his left hand that B should stop playing the keyboard **G64** B looks around at researcher when he speaks **G65** A & C look at computer screen apart from when C looks at A to speak.		**AT42** B tries out ideas at keyboard	 
Time frame 33 00:12:35 - 00:12:52	L113, L114, L115, L116, L117 S37 & G66 on-going throughout the time frame	**L113** Researcher: So, can you set the left locator to bar 9 **L114** C: Magic **L115** Researcher: And where does the right locator.. **L116** C: 13 **L117** Researcher: OK so set it to 13, well done. That's it, well done. Just to save the tune, can you press ctrl & S?	**S37** A & C remain at computer, looking at the screen; C stands at the music keyboard and looks around at the researcher when he speaks.	**G66** A keeps right-hand on the mouse and presses the computer keyboard keys when instructed. C keeps left elbow on the worktop and types on the keyboard with the right hand.		(No playing of music keyboard or computer playback during this frame)	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 34 00:12:53 - 00:13:03	L118, L119, L120 & G67, L121 & G68 S38 on-going throughout the time frame	**L118** C: Turn them on **L119** Researcher: If you press the control key and S at the same time it saves the song **L120** C: Are you ready? On your marks... **L121** B: No, I'm not ready	**S38** A & C sat at the computer with B standing at the music keyboard	**G67** C looks round at B when talking to her; B stays near the keyboard **G68** B points at C when saying "No, I'm not ready'.		(No playing of music keyboard or computer playback during this frame)	No notation data No audio data
Time frame 35 00:13:04 - 00:13:16	AT43, G69 (at start), G70, L122, G71, L123, L124 S39 on-going throughout the time frame	**L122** Researcher: B is going to do a staccato tune.. **L123** B: Yeah **L124** Researcher: ...in this bit? **L125** B: Play	**S39** A & C sat at the computer with B standing at the music keyboard	**G69** As B practises her tune, C moves his head in time **G70** When C plays the sequence, he "drums" in the air **G71** C leans across and plays a few notes on the keyboard with left hand. B lifts his arm off the keys.		**AT43** B starts practising her tune, during which C starts the accompanying sequence. B stops shortly after but sequence continues until end of time frame	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 36 00:13:17 - 00:13:27	S41, L126 L127 L128 G72, L129 L130 S40 & G73 on-going throughout the time frame	**L126** C: Recording **L127** B: Don't actually record it **L128** C: (reply to B) OK. (General) What did he say? How do you record it - can't remember now? **L129** A: Press that (points with mouse) **L130** B: No, whoops	**S40** A & C sat at the computer with B standing at the music keyboard **S41** A swivels on chair	**G72** A takes mouse with right hand to show C which button to press **G73** C changes gaze between B and the computer screen, typing at computer keyboard. B changes gaze between music keyboard and computer screen.		(No playing of music keyboard or computer playback during this frame)	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 37 00:13:28 - 00:13:41	AT44, G74 then AT45, G75 S42 on-going throughout the time frame	No linguistic data in this frame	**S42** A & C sat at the computer with B standing at the music keyboard	**G74** A "drums" on tabletop from 2nd bar of pre-count, while watching computer screen with C, who joins in **G75** B plays tune with index finger of right hand only. 		**AT44** 8-beat pre-count **AT45** B's tune is recorded	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 38 00:13:42 - 00:13:57	G76 then L131, G77 then L132, G78 then L133 S43 on-going throughout the time frame	**L131** B: Get ready to record it **L132** A: Stop it **L133** B: Stop it, C... I said stop it	**S43** A & C sat at the computer with B standing at the music keyboard	**G76** A keeps right hand on mouse; C starts with both hands on computer keyboard **G77** C moves left hand across to the music keyboard to play a few notes. B moves this hand away with own right hand **G78** C moves left hand across to the music keyboard to play a few notes. B moves this hand away with own right hand.		(No playing of music keyboard or computer playback during this frame)	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 39 00:13:58 - 00:14:18	G79, G80, AT46, L134 (music at normal tempo), L135 (music at quick tempo), L136 S44 on-going throughout the time frame	**L134** B: Am I supposed to be playing? **L135** Turn the swift thing down **L136** C: Isn't that quick	**S44** A & C sat at the computer with B standing at the music keyboard	**G79** All look at screen as playback is prepared **G80** As playback is begun at 00:14:09 C speeds up the tempo - looking firstly at C then at A, smiling. As C looks at A, A turns to look at C, then returns to looking at the screen, leaning on left hand.		**AT46** No music is played on the keyboard during this frame, but B's tune is replayed at 250 bpm	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 40 00:14:19 - 00:14:30	G81, L137, AT147, G82, L138 S45 on-going throughout the time frame	**L137** A: D, D, E - listen to this, hey.. **L138** From other group: How did you get it that good?	**S45** A & C sat at the computer with B standing at the music keyboard	**G81** A looks at the other group (along same worktop to his left) **G82** As the speeded up sequence is replayed, A raises his arms in the air and moves them in time to the music. C "drums" with both hands while B looks from the screen to the other group.		**AT47** Speeded up replay of B's recording	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 41 00:14:31 - 00:14:45	L139, G83 then L140 L141 L142 L143, G84 then L144 S46 on-going throughout the time frame	**L139** A: That by us? **L140** From other group: Yeah **L141** A: Don't know [..] **L142** A, B & C: (all laugh) **L143** B: OK if I play now? **L144** A: Let me go back one, um	**S46** A & C sat at the computer with B standing at the music keyboard	**G83** A looks around at B & C at the start of the frame and then they all look at the computer screen **G84** After B's question, C looks at music keyboard then back to the screen. 		**AT48** 5 beats of B's tune are replayed by A on the computer	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 42 00:14:46 - 00:15:03	L145, G85, L146, AT49, L147, AT50, G86, L148, G87 S47 on-going throughout the time frame	**L145** C: Now I have some [ideas to try out] **L146** C: It's really really fast, see **L147** A: Let's go to a hundred. **L148** Mr. Breeze, Mr. Breeze...	**S47** A & C sat at the computer with B standing at the music keyboard	**G85** B moves C's left arm away from the keyboard as he tries to play some keys **G86** C "drums" as the backing track is played **G87** C looks at screen as A speaks. A keeps right hand on mouse and looks at screen.		**AT49** B tries her staccato idea again **AT50** At 00:14:55, A plays back the speeded up version of B's tune again, then turns around to ask for help from the researcher	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 43 00:15:04 - 00:15:22	G88, L149 & AT51 & G90, G89, L150, L151, L152, L153, L154 S48 on-going throughout the time frame	**L149** A: What do we set it at? **L150** C: (picking up then looking at the worksheet) Lets see up [..] its a hundred and twenty **L151** A: Hundred and twenty **L152** C: Yeah **L153** A: Is that OK [..] **L154** C: Lets see .. yeah, thats better	**S48** A & C sat at the computer with B standing at the music keyboard	**G88** A looks at screen throughout **G89** C picks up worksheet to find tempo, then looks at screen after A has reset it **G90** B stands at music keyboard and tries her tune with index finger of right hand.		**AT51** B tries to play the tune she has practised at the new speed	 

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 44 00:15:23 - 00:15:32	L155, AT52, L156, L157, L158 S49 & G91 on-going throughout the time frame	**L155** B: A, tell me when to play **L156** A: Do it, I just see a [..] **L157** B: Yeah, but I haven't played mine yet **L158** A: You have	**S49** A & C sat at the computer with B standing at the music keyboard	**G91** C looks at the worksheet, covers his face with it, puts it on top of his head then uses it as a sun visor. A leans head on left hand and operates computer with his right hand on the mouse. C looks at screen and then at A when talking to him.		**AT52** A stops playback from previous frame at 00:15:24. No other music played during this frame	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 45 00:15:33 - 00:15:42	AT53, L159, L160, L161, L162, L163, L164 S50 & G92 on-going throughout the time frame	**L159** C: What? **L160** A: Cut in, cut in **L161** B: But I haven't played my bit yet **L162** A: Yes, she has, hasn't she? **L163** B: No **L164** C: We recorded it	**S50**A & C sat at the computer with B standing at the music keyboard	**G92** C holds worksheet, turns it around and covers his face with it. A leans on left hand, right hand on the mouse controlling the playback. B looks at A when talking and at the screen the rest of the time.		**AT53** A plays the first 2.5 bars of the whole sequence - no other music played during this frame	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 46 00:15:43 - 00:15:53	L165 then>br> L166 S51 & G93 on-going throughout the time frame	**L165** C: (leaning across) Can you read it? On your marks, get set **L166** A: Go away a minute. I can't see it with this thing in the way. I can't read it either	**S51** A & C sat at the computer with B standing at the music keyboard	**G93** A keeps right hand on the mouse and uses left hand to type as necessary, leaning on left hand the rest of the time. C leans across at the start of the frame to press the 'record' key on the computer keyboard. B waits, standing at the music keyboard. 		(No playing of music keyboard or computer playback during this frame)	No notation data No audio data

Time Frame	Element order	Linguistic	Spatial	Gestural	Visual	Aural Text	Notation / Audio
Time frame 47 00:15:54 - 00:16:14	AT54, AT55, L167, L168 & G95, L169 & G96 S52 on-going throughout the time frme	**L167** A: Yes, so.. **L168** C: I know anything that's wrong 'cos we ain't got something the tune **L169** C: Appears to be one zero five one eight any [..] (pointing) one point zero one, yeah, so those are followed by the zero difficult	**S52** A & C sat at the computer with B standing at the music keyboard	**G94** A keeps right hand on mouse while *leaning on* left hand; C reads the worksheet; B stands at the music keyboard **G95** C points to screen, talking to A at the same time **G96** C reads from worksheet out loud.  		**AT54** *B* practises part of her tune **AT55** B stops when A plays 5 beats of the start of the sequence. She keeps her index finger on the first note of the music keyboard	 
Time frame 48 00:16:15 - 00:16:15	**End of Time Frames**	It was decided after this point that Bs original recording was fine and did not need re-recording. Therefore, transcription ended here as all necessary data was transcribed.	No spatial data.	No gestural data.	No visual data.	No Aural Text data.	No notation data No audio data

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