The Music of Sound: A Constructivist Approach to the Comprehension of Electroacoustic Music, through the Composition of Musique Concrète, at Post-Primary School Level

Anna-Marie Higgins

A dissertation submitted to the University of Dublin, in partial fulfilment of the requirements for the degree of Master of Science in I.T. in Education

Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

Anna-Marie Higgins B.A. (NUI), B.Mus. (NUI), H. Dip. Ed. (NUI), M.A. (DIT)

July 2004

Acknowledgments

I would like to express my appreciation to a number of people for their help and assistance to me in the course of my research. I am indebted to Kevin Jennings, my supervisor, for his guidance. His ability to focus on the important issues was a godsend and he patiently helped me to stay on track when I risked digressing from my stated aims. I am grateful to Brendan Tangney and his team at the Centre for Research in I.T. in Education, particularly Tim Savage and Inmaculado Arnedillo Sánchez. They have been a wonderful source of ideas and reassurance and their generosity with their time went beyond the call of duty. Experts from other departments in the University of Dublin to whom I owe a debt of gratitude include Martin Adams (School of Music), Roger Doyle (Music and Media Technologies), Ann Fitzgibbon (Teacher Education) and Gabrielle McCann (Music Education). Their interest in my work was positive and heartening. Students from Manor House School in Dublin tested the artefact and made an important contribution to this research. They approached the tasks in a professional manner and their comments and suggestions were invaluable. I am grateful to my classmates in MITE 02 for their morale-boosting prowess. Finally, I wish to offer my sincere thanks to my family for their support during every stage of this course.

Permission to lend and /or copy

I agree that Trinity College Library may lend or copy this dissertation upon request.

Anna-Marie Higgins

Abstract

The term *electroacoustic* embraces two categories of music – *musique concrète* and electronic music. In the former, the source material is derived from recorded acoustic sounds; in the latter, the sounds are synthesized, usually by means of electronic oscillators. Advances in technology since the 1940s have enabled composers of contemporary art music to generate and use sound in ways that were not previously possible with standard musical instruments. Their music poses great challenges for the listener. In an electroacoustic sound world there are often no conventionally recognisable traits, therefore our traditionally taught music students do not know how to listen purposefully to it. This dissertation investigates the hypothesis that by engaging in the composition of musique concrète, students will have a better understanding of electroacoustic music in general. The author considers the role that Information and Communication Technology can play in giving young listeners more control over their aural experiences. A CD-ROM containing an audio editor, sound files and acoustical information allows direct access to recorded sound and the means to transform it. The study explores how this artefact is used in a Constructivist Learning Environment. The students work collaboratively to produce their own electroacoustic music, thereby developing higher order thinking skills in relation to it. A teacher and ten music students in their fifth year in post-primary school participate in the formative research. During several rounds of testing and refining, the author collects and examines data about the implementation of her theory. Analysis of the results indicates clearly that having experienced the creative process, the participants have a greater understanding of the artistic possibilities of sound materials. The study concludes that by constructing musique concrète with the help of certain support mechanisms, a student can acquire the critical tools necessary for deconstructing electroacoustic music in an informed way.

Table of Contents

Section One Introduction	1
Section Two Literature Review	4
2.1 Introduction2.2 What Do Composers Want Us To Hear?2.3 Compute, Compose And Comprehend	
2.4 Action Learning In A Constructivist Learning Environment.2.5 Formative Research2.6 Summary	
Section Three Design of the Artefact	11
 3.1 Introduction 3.2 The Music Of Sound 3.2.1 Development Of The Artefact 3.2.2 Contents 	
3.3 Summary	
Section Four Implementation and Analysis	14
 4.1 Introduction 4.2 Trial A 4.2.1 Discussion 4.2.2 Rationale For Trial B 	
4.3 Trial B 4.3.1 Part One - Investigating Timbres 4.3.2 Part Two - Investigating Structure	
4.3.3 Discussion4.3.4 Rationale For Trial C4.4 Trial C	
4.4.1 Discussion	
Section Five Findings and Discussion	24
 5.1 Introduction 5.2 Learning Outcomes 5.2 1 Objective Musical Concepts 	
 5.2.2 Composing Procedures 5.3 The Role Of The Teacher 5.4 L Trul Definition 	
5.3.1 Task Definition 5.3.2 Teaching Strategies 5.3.3 Scaffolding	
5.4 Summary	
Appendices for Trial A	
Appendices for Trial A	۱۵
Appendices for Trial B	
Appendices for Trial C	67
Appendices for the Artefact	
References	

Section One Introduction

The technology of recording has played a major role in the evolution of electroacoustic music

(*Manning*, 2003)

Schaeffer coined the term *musique concrète* in the 1940s. He recorded real world or concrete sounds, then looped and reversed them with a tape recorder with a view to creating rhythmic and metric patterns. Stockhausen experimented with purely electronic music, synthesizing sounds from sine waves, then stretching or compressing them to create different timbres. Varèse spoke of "organizing sound" (Varèse, 1962). As they explore new resources, composers find novel ways of thinking about music and by presenting us with their work they invite us, the listeners, to do likewise. Post-primary teachers may wonder how their music students could ever assimilate these ideas within their existing formal training.

In a conventional music lesson, students are expected to delve more deeply than the naïve listener into concepts such as pulse, rhythm, melody and instrumental techniques in order to strengthen their understanding of conventional genres. They listen to, compose and perform music that is grounded in, and comprehensible through, a grasp of these rudiments. How can these students become as knowledgeable about sound waves and timbres as they are already about pitch, dynamics and orchestral colour? Learning by performing is not an option when composers record directly onto hard disk. Learning by listening is not an option when the vocabulary needed to explain the concepts is alien to the learner. Before the advent of the computer, music rooms were not equipped to replicate or explore technologically produced soundworks. It is now possible to do so. This project enables the participating students to acquire and use the cognitive tools provided by ICT to learn about electroacoustic music through an authentic domain activity. As we have immediate access to existing real world sounds we simply need an audio editor to transform them as we wish. In doing so, we are able, for example, to experience at first hand the sound transformations that Schaeffer achieved. We can even examine and use Stockhausen's four criteria for composing music by filtering out harmonics, using a multitrack facility, stretching sounds and finding useable material within noise (Stockhausen, 1989: pp. 88-111).

A Constructivist Learning Environment makes this whole process possible. Jonassen, Peck and Wilson (1999: p. 200) suggest that learning occurs most naturally when teams of people work together to solve problems. In this project, music students are given a real-world task – to

compose a piece of electroacoustic music. The ten students chosen for the project have had almost five years of music learning at post-primary level and have displayed an ability to judge the music they hear (Appendices A2 and A3). Working collaboratively, they will learn fundamental concepts about electroacoustic music and will externalise their understanding by reflecting on the composing task and by articulating their views on other electroacoustic works. This points towards an enrichment of their future listening.

The composing tool that facilitates their learning is a CD-ROM containing an audio editor, sound files and tasks for students with acoustical information for teachers. Since both the artefact and its application would be tested and updated systematically over several iterations, the author adopts a formative research methodology. Various data collection processes document the usability of the given elements as well as the stance assumed by the teacher in each trial.

By encouraging a hands-on approach the *Music of Sound* project aims to make the electroacoustic music genre more accessible to young listeners. According to the findings, post-primary music students can gain an insight into the genre when they compose some musique concrète provided they have a focused assignment, potentially creative musical material and most importantly, a suitable support system. The rest of the paper breaks down as follows:

Section Two: Literature Review

In order to devise an effective learning strategy, views about musical content and pedagogical approaches were sought. The paper notes opinions from Sessions (on listening); Swanwick, Paynter and Elliott (on composing); Hargreaves (on our age-related musical development); Schaeffer, Stockhausen, Varèse and Russcol (on sound); Babbitt, Dennehy and Lansky (on composing electroacoustic music); White (on music analysis); Truax and Webster (on computers and music); Herschbach (on scaffolding); Regelski (on Action Learning) and Jonassen (on the Constructivist Learning Environment).

The literature underpins the hypothesis expressed in the paper: that electroacoustic music can be better understood when approached through composition. It puts forward the notion that this is best achieved in a Constructivist Learning Environment.

Section Three: Design of the Artefact

The rationale for needing a one-stop resource leads into this section, which describes the

artefact. It is a CD-ROM offering the materials needed for composing electroacoustic music. Section Three describes the contents and their relevance to the project.

Section Four: Implementation and Analysis

In order to test both an educational theory and a design package, the author chose a formative research methodology, as outlined by Bresler as well as Reigeluth and Frick. Trials were undertaken over a period of several months and the revised steps taken in each of the trials are enumerated and acted upon.

Section Five: Findings and Discussion

The evaluation is based on video and personal observation, recorded interviews, student questionnaires, written journals, interaction with non-participating peers, analysis of the compositions and reflections by the teacher on the process. The strengths and weaknesses of the artefact and the teaching methods are discussed.

Section Six: Conclusion

This section highlights the key findings and makes recommendations by recalling how the intended learning outcomes were achieved through the application of the artefact.

Section Two Literature Review

Aural perception is central to all our musical experiences

(NCCA, 1993)

2.1 Introduction

Post-primary textbooks in Ireland do not deal with electroacoustic music, probably because it is not examined in either Junior or Leaving Certificate. The author has previously attempted to introduce the genre to her senior music students with the help of two British textbooks (Bennett, 2001; Bowman and Cole, 1989). This conventional approach (– playing short musical excerpts, demonstrating graphic notation and administering multiple-choice questions –) merely acknowledged the existence of the genre and provided a superficial introduction to it. The students resisted the notion that this was music and could not understand either the verbal or written explanations of how the taped electronic sounds were manufactured. Swanwick observes that music alienates people when they perceive its sound materials as strange or threatening (Swanwick, 1988). The aim of this paper is not to question or defend the validity of this sonic art form but to devise a strategy for coping with it at post-primary level.

Non-tonal sound worlds using studio-fabricated timbres are difficult to assimilate. We are even surprised when we hear unfamiliar sounds from acoustic instruments. Bennett gives instructions on how to produce new sounds with existing instruments e.g. different bowing techniques on strings, flutter tonguing and key clicking on woodwind, pitch bending on brass and direct playing on the strings of a piano (Bennett, 2001). By experimenting with these instruments, students can experience at first hand the tone colours they will later hear in recorded music. Such exposure to a range of instrumental possibilities removes, or at least lessens, the "impediment of new sounds" (Swanwick, 1988).

The author of this paper suggests a similar approach be adopted in the treatment of electroacoustic music. Students should work directly with sounds instead of hearing *about* the transformations. Smalley asserts that "listeners can only apprehend music if they discover a perceptual affinity with its materials and structure" (Smalley, 1986: p. 61). The role of ICT here is crucial, as real audio cannot be digitally manipulated in a school context except at the computer. This paper does not deal with Musical Instrument Digital Interface (MIDI) technology, because to make a sound transformation, MIDI technology "lacks sufficient sophistication" and can "only be used to play back sound transformations through a sampler" (Landy, 1991). In any case, it is not a primary element in the genre, which is a world of

waveforms, processing and manipulation of real or freshly generated signals. According to White, we must analyse sound through "a systematic separation" of its components (White, 1984: p. 202). This makes sense, although it is an approach that Sessions derides as it tells us "little or nothing about the character or the intent of the music itself" (Sessions, 1970: p. 41). With this in mind, the paper proposes that the students, having explored and transformed some sounds, should continue working with them and construct a piece of music, thus learning for themselves how and why they find certain structures aesthetically pleasing.

White refers to "the cooperative roles" of the components of sound in the aesthetic experience (White, 1984: p. 202). The views of composers and educationalists are sought in an endeavour to discover if a constructivist approach to music comprehension through composition makes sense. Can we learn how to listen better if we've experienced the composing process? Age profiles are considered and learning strategies are compared. These findings act as the foundation for the design and implementation of an electroacoustic composition project, which promotes aural discrimination among students. This will hopefully lead to confident listening in the area of electroacoustic music. But first of all we must return to the source of the music and ask one very obvious question.

2.2 What Do Composers Want Us To Hear?

For centuries, composers have relied on notation to enable them construct long and complex pieces that did not rely on the performers' memory. However, the composers' intentions may not ever have been properly realised, since the interpretation of their music depends on the ability of the performers, on the quality of their instruments and on the local acoustics. In the digital domain composers have almost total control over their sounds and adopt the role of quasiperformer, especially if their work is recorded directly onto hard disk. With most other music a listener compares different performances or uses the musical score as a visual aid. In their absence, traditional methods of following the music are no longer helpful. Are programmers, technicians, engineers and scientists meant to be the only knowledgeable audience?

Understandably, the technology available to composers has partially dictated their compositional procedures, aesthetics and theories (Schrader, 1981). One of the earliest pioneers, Schaeffer, realised that the expanded musical sound world needed a sense of order, so he devised thirty-three categories of sound objects containing 54,000 different combinations of sonological characteristics. This was meant to be a reference, but was incomplete and, at times, vague (Schaeffer, 1966). Stockhausen made "a scale of thirty-six steps from the darkest and lowest sounds to the brightest and highest" (Stockhausen, 1989: p. 82). This, he hoped, would enable

others to recreate his works, despite possibly imprecise verbal descriptions. Smalley tried to help the listener with another analytical method called *spectromorphology*. This concentrated on the components of the sound spectrum and how they change shape in time. It used words like onset, continuant and termination to describe "temporal gestures" (Smalley, 1986). Wishart divided sounds into groups according to their envelopes, their frequency modulation, their formant characteristics and their spatial location (Wishart, 1985). Teachers may wonder if they should try to adopt one or more of these analytical strategies in order to clarify the works they are playing in class. Unfortunately, composers do not all use the same sound transforming equipment. Some synthesize their sounds. Others record and alter sounds in the studio. Complicated algorithms abound. Composers use very specific jargon to describe their own particular methods. Linear Predictive Coding and granular synthesis are just two of the terms used by Paul Lansky on the cover of his More Than Idle Chatter CD (Lansky, 1994) to explain the techniques he used to create those six pieces. It is hard not to agree with Sessions when he states that he "can imagine no duller reading than someone else's technical analysis of a piece of music" (Sessions, 1970: p. 41). Since all of these composers' efforts at giving some insight into their work are couched in obscure vocabulary, how can we prepare the potential listeners among our post-primary music students for their first foray into an electroacoustic auditorium?

At least one composer favoured a discriminatory policy. Babbitt notoriously refused to accept that any "lay listener" could have the right to express an opinion about this music at all. He also felt that a non-expert, unable to understand the music, could only be puzzled and bored by it – "like all communication, this music presupposes a suitably equipped receptor" (Babbitt, 1958). This paper refutes Babbitt's suggestion that we should listen to something "easier." Dennehy finds the idea of a specialised audience repugnant. He feels that the music can have meaning for a listener, even one who is unaware of how it was built, for "after all, that's all we're interested in: sound" (Dennehy, 2003: p. 11).

We must also consider structure. As sound design moves increasingly towards micro-level control, Truax observes that sound and structure have become increasingly inseparable (Truax, 2000). Paynter says that the unique skill of the composer is in being able to judge precisely when things should happen in the timescape (Paynter, 1992). Critically reflective listeners wish to know how and why composers make those aural judgments "for the first step to understanding a new art is to try to imagine why the maker wants it the way it is" (Russcol, 1972: Preface). Apart from asking them, there is only one way to find out.

2.3 Compute, Compose And Comprehend

Standard classroom practice ensures that students listen to and perform music at an early age. Composing may come later. However, the opportunities to work with sound within the electroacoustic medium have no precise parallels to conventional music making. As the soundproducing agents have changed, so too must our approach (Manning, 1999). The author of this paper proposes that the emphasis should be placed on composing the music in order to enhance the students' ability to listen.

If receptivity is determined by the listener's insight into creative and interpretative processes, as Brocklehurst suggests, we should give students a hands-on experience of composing He feels that "imitation involving visual, tactile and kinaesthetic senses clarify and reinforce auditory impressions" (Brocklehurst, 1971: p. 77). Murail, a specialist in spectral composition, concludes that "we must investigate the world of sounds with tools that we have at our disposition and for this we use computers" (Murail, 2001). Webster describes the music workstation as a learning environment in which all aspects of the musical world are available to study, to manipulate and to use creatively, at least in simulated form. A recent study shows that secondary school teachers in England are already making use of ICT creatively to raise their pupils' performance in composing tasks using MIDI (Pitts and Mawuena Kwami, 2002). Webster agrees that the computer is a powerful tool for giving us insight into a child's cognitive processing (Webster, 2002).

In music composition it develops higher-order thinking skills that can be transferred into the listening arena. Gardner agrees that production ought to lie at the centre of any artistic experience for "understanding involves a mastery of the productive practices" (Gardner, 1991: p. 239). Guidance is necessary, however. Swanwick scorns Schafer's belief that a sheet of paper can become a musical instrument (Schafer, 1979) and reminds us that "it is possible to have organization of sounds without music" (Swanwick, 1979: p. 9). This is why the teachers must be musically competent themselves, according to Elliott. It is his view that children develop musicianship "through action, transactions and interactions with musically proficient teachers" (Elliott, 1995). According to Schon, these latter must be willing to "enter into new confusion and uncertainties" (Schon, 1991: p. 164). What we need is the right setting.

2.4 Action Learning In A Constructivist Learning Environment

The students embarking on this project will have had some experience of composing, albeit limited to reinforcement exercises i.e. writing four-part chorales or bass lines for pop songs. This

follows Swanwick's dictum that we are "not able to deviate from norms unless we actually work from them" (Swanwick, 1988). Regelski denounces this Activities Approach because students must have a musical purpose for doing assignments (Regelski, 1992: p 123). There must be a personal musical goal. He feels that accidental discoveries do not help students see the relationship between cause and effect. He favours experimental experience through Action Learning as it makes the student conscious of the relationship between actions and some valued consequences. Intentionality is the key word in Regelski's argument. The strategies employed in Action Learning tie in with the aims of this paper. The students are presented with certain choices (– sound files and transforming possibilities). They have to negotiate obstacles (for example, unpleasing sounds or rambling ideas) to reach their personal goal (– their own composition). The task involves a real musical action. The software is found in real studios. The students must make creative decisions like real composers.

This personal use for music learning is its action value. Jonassen et al. also feel that knowledge is situated in authentic experience (Jonassen et al, 1999: p. 9). The learning is "ill structured" unlike in traditional scenarios where the teacher simplifies and organizes everything. The technology facilitates exploration. In a Constructivist Learning Environment many perspectives are found, so the learner has to reflect and then articulate ideas. The students do not work in isolation in this project. They collaborate with each other and "socially negotiate the meanings they have constructed" (Jonassen et al, p. 218).

The author considered advising the participants, from the very start, to construct a piece of absolute or pure music, so that they would not merely use the sounds as elements in a story. While not condemning outright the notion of programme music, Paynter dislikes the idea of music being used to illustrate historical, literary or visual ideas "that can be better expressed in another medium" (Paynter, 1992: p. 19). Hodges suggests the adoption of a "soundscape approach" as the extra-musical dimension provided by a text or story can serve as a "stimulus for creativity" (Hodges, 1996: p. 90). However, it was decided not to issue instructions regarding title, theme or content, at least in the early stages of this experiment. To do so would negate the personal choices that are at the core of Action Learning.

Finally, Swanwick's eight developmental modes are consulted in order to choose the most suitable age group for this project (Swanwick, 1988: p. 72). The first four modes – sensory, manipulative, personally expressive and the vernacular – are the phases that children pass through up to the age of 8. Then they are concerned with the speculative (ages 9 to 11), the idiomatic (ages 13 and 14) and the symbolic (at 15) after which they have the ability to organize their musical thoughts in a mature and reasoned fashion. Hargreaves calls this the "professional"

phase and cites as one of its main features "the ability to work at a higher-order, reflective level" (Hargreaves, 1996: p. 167). Bearing this in mind, the thesis proposed by this paper – that comprehension of and focused listening to electroacoustic music can be better achieved through composing – will be tested on fifth year students, aged 16 and 17 years of age. To discover if this aim is achieved, the focus of the investigation will be on both the participating teacher's perceptions and the students' experiences with the materials (Bresler, 1996: p. 8).

2.5 Formative Research

The author's theory and its supporting composing tool will be put to the test during several rounds of trials. Formative research demands a close observation of student interaction with the tool and a willingness to act on weaknesses and strengths discovered during the trials. As it is a "disciplined inquiry" (Bresler, 1996: p. 8) data will be collected through observation, documents and interviews (Reigeluth and Frick, 1999).

2.6 Summary

Man's listening process over the millennia has progressed from orality through print to audio (Truax, 2000). Electroacoustic music has forced us to abandon our usual props of written score and performers' interpretations, obliging us to concentrate on the essence of the music itself. We must really listen. The question that sparked off this paper was *how*? The challenge for the music teacher is to make sense of an apparently random set of sounds and to enable students to do likewise. The author tried to find out how composers produced their sounds to see if they had devised strategies which might help with the difficult act of listening and was surprised at the number of classification systems in existence. Dennehy assured us that we would be able to find meaning in the music. It was decided to reverse the usual listen-perform-compose plan and ask the students to compose in order to *be able* to listen. Music educationalists agreed with R. M. Schafer, when he wrote, "one learns practically nothing about the actual functioning of music by sitting in mute surrender before it" (Schafer, 1967). Webster and others extolled the versatility of ICT in expanding our musical experiences and Jonassen outlined the many types of meaningful learning made possible by technology.

For this project a Constructivist Learning Environment allowing students to explore this music will be adopted and Regelski's Action Learning pragmatism will underscore the task at hand. The students will be 16 and 17 years of age, following Swanwick's age profiles. Guided

by the literature relating to formative research, the author will be an active participant, hoping to play "a central role in shaping the educational setting and the materials" (Bresler, 1996: p. 13).

Section Three Design of the Artefact

When all is said and done, music is an aural art, and if it satisfies us at all it does so through our sense of hearing

(Paynter, 1992)

3.1 Introduction

To describe what we hear as musical we must perceive the sounds as being "aesthetically organized" (Reimer, 1970). Electroacoustic music makes heavy demands on our listening skills because conventional music training does not show us how to appreciate its artistry or find meaning in it. This paper tests the hypothesis that to be able to respond to electroacoustic music, our students need to learn how to speak its language and that in order to do this they need to *compose* electroacoustic music.

3.2 The Music Of Sound

The artefact is a CD-ROM aimed at music teachers and their senior students at post-primary level. It contains the material and software needed to compose electroacoustic music. It embodies a pedagogic approach that has been validated in trials. It is recommended that the composing tool be used not as a stand-alone resource but rather as a facilitating medium for an integrated approach to the teaching and learning of electroacoustic music.

The artefact that supports the thesis has two intended learning outcomes: to add value to the participating students' aural judgment by giving them direct access to the tools for creating electroacoustic music and to enable them to reflect on and discuss their actual experience with it.

3.2.1 Development Of The Artefact

A real-life electroacoustic composer requires timbre-generating equipment and some means of shaping a piece of music. With this in mind, the author began the project by restricting the contents of the artefact to the bare essentials for composing – audio files and a sound editor. The earliest deployment of the artefact was informed by Regelski's Action Learning paradigm, which says that instruction should "approximate the anticipated real-life use – as closely as the formal conditions of school allow" (Regelski, 1992: p 110). Trial A would see if the simple provision of software and sound materials with little or no teacher guidance could encourage the students to compose a piece of musique concrète that would ultimately lead them to an understanding of electroacoustic music. Having put the author's thesis to the test under these

extreme conditions, the first trial was followed by two others where the purpose was to retain, develop or exclude different facets of the artefact while investigating the most effective means for applying its principles. This iterative design process has resulted in a pedagogical tool whose path to realisation will be described more fully in Section Four and whose contents will now be summarized.

3.2.2 Contents

The audio editor chosen for this project is *Cool Edit Pro* (now called *Adobe Audition* and found at <u>http://www.adobe.com/</u>). The *.exe* file may be saved to the user's hard drive from the CD-ROM. It works with any Windows-compatible sound card. *Cool Edit Pro* may be used for viewing waveforms and spectral content, for recording, playing audio files and for editing sounds. This version supports files in *wav* format. The multitrack window allows wav files to be placed on different tracks creating a layered texture before being mixed down (Appendix <u>Art1</u>). A link to an online *mp3* converter is provided.

Throughout the artefact, screen shots are used to demonstrate certain details and short *Flash*driven screen recordings provide a tutorial for areas found difficult by the students for example selecting, trimming, labelling, saving and retrieving sounds (Appendix <u>Art2</u>). These videos were captured through *Camtasia Studio* (found at <u>http://www.techsmith.com</u>).

Navigation to the main sections occurs through the five *Flash*-generated buttons on the left side; a sub-navigation bar on the top of every page affords access to the *Opening Screen, Sound bank, Resources* and *Composers*. The sound bank includes composing materials such as bowed, plucked, blown and struck notes in wav format. Diverse timbres were chosen for their transforming potential and usability within a musical piece. Non-instrumental sound files that do not have strong programmatic affiliations are also provided. There are also listening materials including extracts from the repertoire in *mp3* format (Appendix <u>Art3</u>). These have tonal and non-tonal origins and act as a reference area. They illustrate the development of sounds over a short time span and demonstrate how these sounds relate to one other during that time. Internet links to the websites of some significant composers are included, as the genre cannot be satisfactorily studied out of context. Teacher guidelines clarify the process to be undertaken (Appendix <u>Art4</u>).

The *Home* page presents a sketch of the lesson plan. To engage the student's interest, a series of instructions are given rather than a list of nouns, for example, "Create Space." In the *Introduction* the student discovers the origins of Musique concrète and learns how to use the Audio Editor. Clearly, electroacoustic music promotes the creation of new tone colours, often

through the manipulation of *found* sounds. Therefore, essential composing tools are explored in the *Sound* section – how to apply basic effects, create a sense of space, alter pitch, stretch time, investigate harmonics and modify sound envelopes. The *Structure* section stresses the connection between the *gestures* in a piece. Finding contrasting elements, placing aural events in time, incorporating silence, releasing tension and building texture are the organisational devices that help the listener recognise such relationships. In the *Composition* section a distinction is made between programmatic and absolute music. The composing task is revealed, accompanied by a list of reminders for the composer. It is envisaged that this checklist, together with some probing questions (Appendix <u>Art5</u>) will hone the student's critical skills and act as an aid to future purposeful listening.

3.3 Summary

The artefact in Trial A concentrates on non-instrumental real-world sounds (Appendix $\underline{A5}$) and the listening references illustrate the use of sound sources whose origins are still recognisable. For Trial B the listening section is expanded to include instrumentally based pieces (Appendix <u>B1</u>). Non-tonal sound files (Appendix <u>B3</u>) are later replaced by a clarinet tune whose rhythmic and melodic motives act as the basis for composition. The artefact for Trial C contains predominantly tonal sound sources, some from extreme instrumental registers (Appendix <u>C1</u>). However, sound transformation is not treated in isolation. Structural techniques are practised and applied in an artistic and meaningful way. The historical and acoustical contexts, ignored in previous trials, are embraced because they aid the student in making creative and scientific aural decisions. Questions posed by the Trials A and B participants warrant the inclusion of certain elements on the most recent version of the CD-ROM, for example, a short essay explaining how the term electroacoustic does not refer to a *style* of music. Similarly, the Trial C results will have a bearing on future updates.

Having evolved into its current state the artefact has pared away all but the essential elements needed for composing, listening to and understanding musique concrète.

Section Four Implementation and Analysis

The immediate purpose is toward the improvement of the materials and local practices of the specific teachers

(Bresler, 1996)

4.1 Introduction

Since the learning outcomes from this paper were going to help the author to improve both the design and pedagogical value of the artefact, formative research methodology was considered to be the best method for testing it. Three trials took place, all preceded by preparatory work and ending with a discussion and all centred on composition.

4.2 Trial A

The first trial took place over two two-hour sessions. Four fifth year students were invited to participate. Preliminary tasks established the students' level of response to different types of music (Appendices A1 to A4). The students worked in pairs in two separate rooms and had one hour to explore the fifty-six sounds using the software. The teacher was at hand to answer questions and to bring other sound transformations to their attention.

Each pair of students was asked to compose a piece lasting thirty seconds using the provided sound files as source material (Appendix <u>A5</u>). They would have one hour to complete the assignment. No other parameters were set. The composing was captured on digital video with a view to gaining an insight into the student's critical thinking. The two resultant pieces <u>Battle of</u> <u>the Elements</u> and <u>Frog's Day Out</u> are described in Appendices <u>A7</u> and <u>A8</u>

After the composing session their immediate reactions were recorded in a video conversation (Appendix <u>A11</u>). Then, having listened to two full electroacoustic works they made their individual observations on paper (Appendices <u>A9</u> and <u>A10</u>). A short final session allowed the composers explain how they had created their pieces to music students who had not undertaken the project (Appendix <u>A12</u>). This discussion was recorded on minidisk. The composers filled out a final questionnaire detailing how they would continue with their pieces and saying what they felt they had learned (Appendix <u>A6</u>).

4.2.1 Discussion

Trial A had several objectives. It set out (a) to see if students could explore sound by using an audio editor; (b) to find out if, with a peer and without teacher intervention, they could construct a piece of musique concrète and (c) to discover if they could listen purposefully to electroacoustic works having had this first-hand experience of constructing their own piece. The participants would rely on themselves and their partner and would learn by trial and error.

Analysis of the compositions, the responses given in the follow-up questionnaires, the postcomposing conversation and their handling of peer questioning indicate that the objectives outlined here were only partially realised. This was chiefly because there were too many sound files and possible transformations at the students' disposal. One girl said, "I think if we had more time to go through them and listen to all of them and try to think our ideas through, it would have been easier." (Appendix <u>A11</u>)

The type of manipulations in which the students engaged were limited to pitch shifting and time stretching possibly because of their lack of prior formal knowledge of the available range of effects. They later admitted to having seen the terms *filter*, *envelope* and *flange* but could not say what these meant. Despite the fact that technology is supposed to facilitate exploratory and experiential learning, the students did not investigate these other options presented to them and did not construct any meaning for these menu terms.

The teacher observed that, while they were composing, no discussion was made about the harmonic potential of individual sounds. These were treated in a superficial manner, their only purpose being to fulfil an illustrative role in the story, because "making it kind of programmatic was easier". Apart from its narrative role, the students did not seem to know how to structure a piece. While they realised that contrast would be an important way of "keeping it from being samey and boring" the idea of developing a motif or working towards a focal point did not feature in their conversations. After forty minutes the teacher felt obliged to depart from the stated model and ask each pair where they intended to place the climax. As they looked puzzled, she made an analogy: "In an hour-long television drama, at what point does the most critical moment or action-packed sequence occur? And then what happens?" They then became more aware of the form of their piece and began working on dynamics, fade-ins and fade-outs.

One of the most important aims of the project was to prepare the participants for future listening. In one respect this goal was achieved as their curiosity about this type of music had been awakened: "you're kind of looking out for things now as opposed to just kind of listening to it."

However, despite their genuine attempts to understand the genre and to articulate their knowledge, it is clear from their responses that Trial A had not met all of its objectives: "You can say what the electroacoustic music sounds like, but [...] it's more difficult to say why." One of the composers tried to explain the music to her non-participating peers but the most important feature of electroacoustic music – the manipulation of the gathered or synthesised sounds – was not mentioned. Having encountered no real tools for analysis they continually referred to the moods behind their pieces: "music is kind of a sound that evokes a reaction… you either love it or hate it…"

The students felt that they had not been trained adequately in the use of the software. This was a valid complaint as they had obvious problems with selecting, trimming and saving sound files: "There's an awful lot to do and you're kind of lost sometimes [...] looking for things." Although they initially expressed misgivings about it, they later admitted that the audio editor was intuitive, once they'd mastered the saving and retrieving process.

Some other positive outcomes were noted and would influence the planning of Trial B. Asked how she would justify the labelling of their two works as *music*, one girl replied: "You have to have a theme or something going through it". This shows an awareness of something fundamental in music – the need for a unifying feature in a piece. All agreed that working in pairs was more beneficial to their learning than tackling the project as individuals: "you're learning from the other person as well as learning yourself".

Elements from Trial A would be retained in the next trial as learning did occur. The students had to assess their decisions, test the correctness of their choices, recognise errors in their reasoning, revise and make priorities (Video clip: *Teamwork*). They now had experimented with composing and their experience had given them more of an insight into electroacoustic music than their non-participating peers. When asked if they thought that it was real music, the group of peers felt that it was "perfectly suitable as background music in films and television." One of the composers disagreed and argued her point well: "Perhaps ours didn't but [...] if it's done properly it can convey an emotion [...] that's a fundamental idea of music."

4.2.2 Rationale For Trial B

The learning that took place in trial A did not include higher-level principles of electroacoustic composition such as how to remove the original source of a sound to render it acousmatic or how to structure sounds non-programmatically. An attempt would be made to find a more effective balance between scaffolding and "the pleasure of discovery" (Papert, 1996).

Support would be provided to help students learn how to use the software, listen effectively and construct a non-illustrative piece. They would still remain autonomous in their composing work, however.

4.3 Trial B

Six different fifth year students participated in Trial B. Before embarking on the composing process they agreed to listen to three short works at least once every day for five days and to note their thoughts in a journal (Appendices <u>B1</u>and <u>B2</u>). The three works were based on real world sounds – a falling drop of water (*Dripsody*), clocks (*Chronometer*) and trains (*Etude aux Chemins de Fer*) – and each lasted less than three minutes. There were also two instrumental tunes, in their original and digitally manipulated forms, which would give the girls an idea of how to work with the material. Then they spent two four-hour sessions working with the artefact, this time with only twenty sound files (Appendix <u>B3</u>). It was hoped that this would encourage them to spend more of their time on the structuring of their compositions rather than on exploring gimmicky timbral effects. After an informal discussion about programmatic and absolute music, they learned how to use the audio editor, spent an hour exploring the sounds and transformations and found out how to save files. The sound bank had been updated since the previous trial.

4.3.1 Part One - Investigating Timbres

In order to investigate if the students could create any interesting timbres from the existing sounds and if they could construct a piece from them, they were set a task: to compose a piece of music that they liked, lasting between thirty and sixty seconds. They were instructed to choose two contrasting sounds, to use repetition and variation, to include a climax and not to write a programmatic piece (Appendix <u>B4</u>). They worked in pairs in three separate rooms. The sound files contained non-tonal sounds only and were selected for their transforming potential. The composing process was again recorded on video. The teacher moved from room to room to check on the composers' progress and to ask them to verbalise their plan for the piece, but did not offer any suggestions. All requested and were given another hour to complete their work; in fact they did not complete their pieces on the first day. Despite having been asked to limit themselves, if possible, to two sound sources, all three compositions used more. One girl said that she did not think it would be possible to compose a piece of electroacoustic music with just two sounds as "it would be too hard to keep someone's attention for thirty seconds" no matter

how the sounds were treated. She was reminded that one of the pieces on the preparatory CD had only one sound source – a drop of water.

On the second day they listened to their three pieces, *The Flight of the Gunmen, Jungle Bells* and *ETM*, and heard why certain sounds had been chosen and processed by the others. This discussion was recorded (Appendices <u>B8</u>, <u>B9</u> and <u>B10</u>). No group had succeeded in creating an absolute or abstract piece. "We found it easier to make a piece based on a story and it just ended up like that." This pointed to an obvious flaw in the choice of sound materials in the artefact. The author realised at this point that the students were unable to divorce sounds from their real world sources. This was impeding their ability to examine the non-programmatic potential of sound. This would be remedied in Part Two. The author also noticed that two of the students did not work well together and remembering a similar scenario in Trial A decided to split all six girls up for the next stage, to see if "working on your own is easier."

4.3.2 Part Two - Investigating Structure

Three new strategies were adopted, as a result of the previous day's observations. The sound set was revised, the teacher modelled a piece and the social context was changed (Appendix <u>B6</u>). Some non-programmatic electroacoustic pieces were played, in an effort to steer the composers away from the notion of music as a storytelling medium. Then the short clarinet piece, <u>*FADE*</u> was played for them while the students examined the notated score (Appendix <u>B5</u>). The score would focus their attention on rhythmic and melodic motives. For their next assignment they were asked to construct a piece lasting between thirty and sixty seconds using *FADE* as their sound source. The teacher explained how this tune could provide material for a brand new piece. Suspecting that they might not know how to proceed without a story, she decided to model a piece of music using the same guidelines that they were now being given. It was called <u>*MH311203*</u> and was her attempt at capturing a mood: being in school on New Year's Eve (Appendix <u>B5A</u>). No further analysis was made of this piece lest it would overly influence their composing. It was obvious from the students' reactions that they were surprised by *MH311203*. This may have been due to the absence of a beat and the prevalence of dissonant harmonies; these students had not come across any twentieth century works in class at that point.

The latest version of the artefact included *FADE* in the collection of sound sources and one further piece in the listening area - *idlechatterjunior*. The girls worked in six separate rooms for one hour. The teacher visited them to answer questions. There were problems with both the technology and the creativity. A recurring comment was that "the saving was the hardest part of the whole thing." Noticing the difficulty they were having in completing the task to their own

satisfaction and feeling their level of frustration with it, she called a halt at the allotted time. Nobody had chosen a title for their abstract piece, nobody liked their own work and nobody wanted it to be played for the others. The teacher complied with their wishes. It was time to find out what they had learnt.

A questionnaire was completed (Appendix <u>B7</u>) to give the author an indication of what the students felt they had learned about sound, signal processing and electroacoustic composition. Then, an interview with all six composers took place. This was videoed. A few weeks later, the group went to a lunchtime concert featuring live electronics and tape music (Appendix <u>B11</u>). They wrote down their impressions and afterwards, discussed informally what they had heard.

4.3.3 Discussion

Contradicting the thesis put forward by this paper, they were unable to comment in an informed way on the concert pieces. Oral and written feedback showed that they remained cynical and uncomprehending about the genre. If given the opportunity to ask a question of any composer, what would they like to know? One girl wondered, "what happened him as a child? Was he dropped on his head?" In spite of the extra scaffolding and the doubling of the time spent on both preparation and composing, the six Trial B students gave the impression that they had learnt *less*, not more, than the four Trial A people. There were six main outcomes.

Firstly, the participants were not convinced that this sonic art could be classified as music: "because it's not, technically music...it's not ... well, I know it *is* but..." Asked how someone might describe her composition one girl replied, "I think people would see it as a big mix of sound effects, cause that's what it is. That's how it ended up."

Secondly, the pre-project training in music analysis, undertaken during their normal music class, may have over-influenced their thinking in relation to musique concrète as they continued to apply non-electroacoustic principles to these works: "To me, music has to have some sort of rhythm or beat." Thirdly, the students did not know how to create a piece that developed and used the sounds for their own sakes. Instead, they used the sounds as a medium to communicate a narrative. Fourthly, their knowledge of the transformations themselves remained sketchy, at best. In the group interview they were able to describe some terminology but reverted to their pre-project vocabulary when discussing the works: "It was kind of eerie." Fifthly, the six students were unable to manage their files and often labelled them incorrectly or lost them. Finally, they did not like working alone (Video clip: *Friction*).

4.3.4 Rationale For Trial C

The author proposed some remedies for these problems. None of the six Trial B participants could accept that they were dealing with music in this project. The two Trial C students would try to discover its meaning. Stockhausen said it could be "the composition or decomposition of a sound" so they would examine the components of individual sounds. He described it as "the passing of a sound through different time layers" and consequently "the behaviour or life of the sound" became its theme (Stockhausen, 1989: p. 98). The Trial C compositions would concentrate on the inner components of sound and the relationships of events to each other within a given timeframe. They would focus on timbre and structure. This approach would solve the first four problems outlined in the last paragraph. The teacher would also spend more time on the practical problem of file management and the next trial would revert back to composing in pairs.

4.4 Trial C

In considering the best way to proceed with the testing, the author made a decision that would slightly bend the rules of formative research. She asked two of the Trial B composers to continue with the project. Unlike newcomers these would bring to Trial C some familiarity with the genre and some experience with the software and so their feedback would highlight positive and negative aspects of the evolving artefact from a student's point of view. They would be novices, however, in the Trial C approach to the thesis.

The artefact now presented twenty sound sources that had rich harmonic potential (Appendix C1) and offered ideas on how to explore them. Three sessions were spent on sound enquiry before the composing stage was reached. Guided by the teacher, the students engaged with harmonics, filters, envelope, time stretching, echo and spatial effects (Appendices C2 and C3). They wrote down in a journal any timbres that they found interesting and successfully identified these processes in two pieces modelled by the teacher, indicating they had achieved a level of understanding that prepared them to embark on their own work.

The final composing task was to "fill sixty seconds with sound or sounds" in a manner that made sense to them. Their main aim would be to make a piece that they liked, themselves. Each girl would be in charge of one piece and would be the final decision-maker while her colleague would act as support. This would allow each of them to have autonomous control while ensuring feedback from a partner. The composers were advised to restrict themselves to as few sounds as possible. The teacher modelled one extreme example before they started - a bassoon note made

to last sixty seconds. This, they decided, lacked movement, development and any sense of resolution. They were given no time constraints and were allowed to work at their compositions for several forty-minute sessions over a period of two weeks.

A digital video camera was used to capture some of the composing process. Afterwards the students were interviewed together, completed a questionnaire and explained their compositions to the students in their music class.

4.4.1 Discussion

Several new elements characterized the implementation of the artefact in this round and each had a significant impact on the learning outcomes. The teacher had a more active role in the initial stages; the concept of sound became central; there was more focus on the structuring of the pieces; the composers had greater autonomy without losing peer support; finally, the students had more time to compose their pieces.

The teacher led the investigation into sound with the help of visual, aural and kinaesthetic props. Specific instrumental sounds were examined and modified in the spectral window. Particular signal processing effects were practised. Each step was carried out by the students themselves, prompted by the teacher's "try this and see what happens" style. The students were guided along a path of discovery already worked out by the teacher and containing elements that she considered to be relevant, thus experiencing a level of scaffolding which was not available to students in previous trials.

Aware of the difficulties that they had experienced with file management in Trial B, the teacher modelled the process. She chose and trimmed a rhythmic figure from *FADE* and wondered aloud how she would label it. All agreed that the name <u>fluttery</u> best described the sound. When the waveform was split in two, the first half of *fluttery* became <u>flut</u> which, when reversed, became <u>tulf</u>. The new attack portion, the students now concurred, could be saved as <u>tu</u>. When effects were added, new labels such as <u>flutterychorus</u> and <u>tulfstretch</u> were used. It was remarkable how easy they found saving and retrieving after this simple demonstration and a cursory look at their final folders shows that they grasped the idea well.

The composing process had been left in the students' own hands, for the most part, during Trials A and B. This time, while they were working on sound exploration together, the teacher drew their attention to certain motives, contrasting timbres and interesting effects. They recalled developmental and structural devices they had learned in melody-writing classes.

The two resultant compositions use sound in an organized and meaningful way. The restrained nature of the opening in <u>S v L</u> displays several noteworthy ideas: repetition, use of

silences, rhythmic development and reversal of a melodic figure (Appendix <u>C17</u>). The notions of contrast, unity and a coda contribute to a satisfying, well-structured whole. The student has achieved what she set out to do – fill sixty seconds aurally, in a manner that pleased her and made sense to the listener.

Her own analysis of the piece is related with apt vocabulary and refers to compositional technique. She chose a sound –"just noise, filtered" - and used this several times "to give continuity to the piece, just to show you that it's one piece." Eschewing a story line, she applied dynamic contrast to the carefully chosen sounds to strengthen the structure: "I've used water sounds just to make it more fluid. You know, it's coming to and end... I faded it out.... soft, soft, soft" (Appendix <u>C15</u>).

Her perception of silence and loudness had been altered by her experience here and will surely add to her store of analytical skills in her future listening: "People would say they don't go together; [...] but when you put them in the right kind of way they do fit."

This and other reflections point to a new found confidence in articulating her impressions: "The dynamics getting louder and then, crazy stuff, which I think worked well."

The composer of <u>Alien Complete</u> gives a detached, though insightful, account of her own piece, comparing it accurately with *S v L*: "I think mine is more kind of raw [...] even though I did use recurring bass notes..." Her description of the construction process is sprinkled instinctively with terminology such as loop duplicate, trimming, stretching, reversing, filtering, fading in and adding an effect. Working with another person made a big difference to this composer: "I kind of got influences off her to have a structure and to organise my sounds better."

This peer interaction had positive results for both parties. The clever heartbeat idea going through the *Alien Complete* piece is reminiscent of the other girl's unifying noise motif. The girls constantly referred to each other's work when discussing their own, thereby having a safe platform for testing their ideas about electroacoustic works in general (Video clip: <u>*Abstract*</u>).

Finally and perhaps, most importantly, the students were permitted to spend several hours working on their pieces. During some of these sessions the teacher was not present. The students admitted later that they preferred working unsupervised as they could experiment more.

In the follow-up questionnaires the students wrote down many of the things they had learnt by taking part in Trial C. The quantitative assessment, however, threw up a less fulsome result. Of the twelve terms and their associative words that they were asked to link, each girl scored only four correct answers (Appendix <u>C5</u>). This demonstrated the need for a follow-up session where remaining problems, if any, could be solved.

4.5 Summary

From its skeletal incarnation, the CD-ROM has evolved into a quasi-library of tried and tested sound sources, aural reference material and animated demonstrations. While the design of the artefact was in a constant state of development, so too was the associated teaching approach. From the position of onlooker adopted in the earliest stage, the teacher gradually assumed a more supportive role, while allowing the student composers to make creative discoveries for themselves. It is suggested that the use of the artefact alone, without teacher guidance, could not elicit such a positive outcome.

Section Five Findings and Discussion

The few analytical studies of electroacoustic music that exist have been carried out by those who are electroacoustic composers themselves

(Norris, 1999)

5.1 Introduction

Section One explained how electroacoustic music defies a conventional teaching approach. A thesis was proposed: that students could learn to listen more purposefully to this music if they had some experience of composing musique concrète.

The Literature Review in Section Two revealed the complexity of sound creation. It suggested that composing with technology, in a Constructivist Learning Environment, would foster an understanding of the genre.

A basic composing tool was introduced in Section Three. Composing and listening materials on the CD-ROM would be field-tested on the target age group and the teacher's role would be established. A more effective version of the artefact would emerge from these tests.

Section Four discussed the methodology used in the process. Formative research allowed both artefact and teaching approach to be refined over several iterations and data from each trial was disclosed.

Section Five will report on the most significant findings. By analysing these results, the author will extract evidence to support her thesis. An assessment of the learning outcomes will disclose the impact of the project on the students and the role of the teacher will be considered.

5.2 Learning Outcomes

When dealing with electroacoustic music there are two decisive ways of showing that learning has occurred. Informed listeners have a grasp of "non-subjective data" (Norris, 1999) and a capacity to interpret such features in the context of a musical work. The author will now recall some instances where the students demonstrated said learning skills. These examples are derived from direct and recorded observation of the composing process, comments made during interviews and discussions, responses given in comparative questionnaires and written tests, verbal explanations, reflections in listening journals and an analysis of the students' compositions.

5.2.1 Objective Musical Concepts

Varèse stated that composers must know "just as much as possible about acoustics" (Varèse, 1939). Certainly, all ten participants showed an awareness of frequency and amplitude in their use of pitch-related transformations. They also employed some obvious manipulations, such as looping and reversing. However while the Trial C participants were able to use the vocabulary correctly in their descriptions of pieces (Appendices <u>C14</u> to <u>C16</u>), the girls from the earlier rounds favoured non-technical terms such as "tinkly" and "eerie." In a "True or False" type question about composing devices, four of the six Trial B composers did not acknowledge the importance of choosing "timbres with useful harmonic content" (Appendix <u>B7</u>, Q4). Like their Trial A predecessors their compositions were populated with sound effects whose purpose was to fulfil a narrative role (Video clip: *Programmatic*).

The Trial C girls, on the other hand, had discovered some higher-level principles of electroacoustic music. Not only did they use a fade-in to obtain "an envelope effect" (Appendix C8) they tended to check the spectral view often to visually confirm the harmonic content of the sounds they were processing. One of the girls filtered noise in her piece (Appendix C15); the use of subtractive synthesis in works by Stockhausen and Xenakis will make more sense to her now. These and many other examples (presented in tabular form in Appendix C10) prove that the project has enabled learning to occur in relation to important objective concepts found in electroacoustic music. But could they recognise the "temporal relationships between events" in an electroacoustic work (Norris, 1999)? In other words, did their composing experience give them an understanding of structure?

5.2.2 Composing Procedures

In order for a perceptive listener to notice how events relate to each other in a piece of music, the composer must set up these relationships in the first place, then express them clearly through repetition and variation, for example. This is a feature of both Trial C compositions.

One girl explained, "repetition is essential so you're not confused." She also felt it necessary to include a recurring motif "to have an idea running through it, not just one sound here and one sound there", thereby unifying the piece. Now that she has used these ideas in practice, she is in a better position to acknowledge their presence in the works of others.

Varèse said, "Take away form, and there is no content" (Varèse, 1959). The author hoped that by experiencing this concept as composers, the students would listen out for organized or

predictable gestures in any electroacoustic music they would come across in the future. This is exactly what happened in the case of the other Trial C girl.

Her piece, <u>Alien Complete</u>, was quite difficult to follow and despite having some interesting timbres and a heartbeat-like pedal, it had no obvious pattern of events. From their facial expressions it was clear that her non-participating classmates did not warm to it, either, as readily as they later did to her partner's piece. The composer herself made a very interesting observation:

I didn't really notice not having a structure cause I knew what was coming next. [...] But since I stopped doing the project and I got the CD last week and I listened to it for the first time, I noticed just how unstructured it was. [...] I didn't feel that it wasn't structured at the time (Appendix <u>C8</u>).

The compositions themselves were merely conduits for learning. This girl's insightful appraisal shows that she has had a significant learning experience, regardless of how she constructed the piece in the first place. She has been able to judge the work objectively – an important listening skill for a music student and surely one of the aims of this project.

In quantitative terms, three of the six Trial B students rated structure as only seventh in importance in a list of ten elements (the others placing it third, fourth or fifth) while the Trial C people felt that it was the second or third most important element. These in particular had learned through the project that a clear plan aided the communication of musical ideas.

5.3 The Role Of The Teacher

The positive outcomes brought about by Trial C may be explained by the small changes in the nature of the task and the big changes in the level of teacher support, mediated by a validated artefact. The role of the teacher was three-fold: to define the task, to develop strategies and to measure, through ongoing observation, the most appropriate level of scaffolding for each situation.

5.3.1 Task Definition

One constant in all of the trials was the students' goal – to put together a piece of music of up to a minute's duration. As the testing progressed it became clear that certain parameters associated with the task had to become stricter to focus the composers' attention on specific aspects of the work at hand. Evidence cited earlier shows that a limited set of acousmatic and

tonal sounds made the structuring of an abstract piece more possible. It was also apparent that the students who were allowed to spend more time completing the task fared better than those who were rushed. Finally, the author noticed that working on the task with a peer proved to be more successful than working alone. The partnership that had most value for the participants was the one where each had ultimate control of their own composition.

5.3.2 Teaching Strategies

Part of the teacher's contribution has been related already, so a general point about the strategies that impacted on the learning in each trial will now be made.

In Trial A, apart from making the students work in pairs, the teacher tried to adopt a stance of non-intrusion, as advocated by Regelski in his theory of Action Learning (Regelski, 1992). Her sole intervention was unplanned but led to a useful exchange about the need for a climax and was a turning point for the students involved. By deliberately not interrupting the rest of their work or commenting on their decisions she was able to witness their modus operandi, gaining a valuable insight into hitherto unpredictable thought processes.

Spanning two long sessions, the role of Trial B in the formative research was to tweak the Trial A methodology. This included some "reflection-on-action" as well as "reflection-in-action" by the teacher (Schon, 1991). Modifying certain situational aspects, such as the timing of the test to coincide with lessons on conventional music analysis, prolonging the duration of the test and providing a different sound set all arose from the Trial A experience. Adopting a new scenario for the second part of Trial B had not been on the original agenda. The teacher felt obliged to model a work, to offer different sound sources and to see how the students would manage without a partner. This tinkering with the materials, the activities and the social context were part of the research process and were the spontaneous reaction of a practitioner to what she had seen and heard in each trial.

To ensure that the instructional sessions preceding Trial C would not revert to chalk-and-talk presentations, a variety of props were used to help the learners assimilate the static knowledge. The overtone series was represented in notation format and examined visually. Its individual partials were produced aurally both at the piano and the computer and a kinaesthetic demonstration occurred when the teacher played a fundamental note and the girls depressed certain piano keys to allow the relevant harmonics to resonate.

5.3.3 Scaffolding

Trial C promoted learning because the students had a stronger support system than their predecessors, for example the teacher modelled a solution on a couple of occasions. She acted out a scenario for the Trial C girls, by pretending to *be* them, allowing them to see "the complete application of the strategy" (Herschbach, 1998). This meant working through a musical composition and correcting errors while expressing her thoughts aloud.

It was important not to dominate the proceedings so the teacher stepped into the background as soon as the Trial C girls felt confident enough to work without help. In the author's view, meaningful learning took place as a result. Students had to monitor their own progress. Keeping a note of developments in a notebook gave them a crutch and enabled reflection to take place between sessions. They referred to their notes and were able to guide one another constructively.

5.4 Summary

The thirteen compositions, although not an end in themselves, objectively demonstrate the level of learning achieved at each stage of the project, the earlier ones resembling no more than cartoon soundtracks, the final ones showing a genuine understanding of the composing process and the impact it has on the listener. After Trial B one of the students remarked that "it would be too hard to keep someone's attention for thirty seconds with just two sounds." Later the same girl announced, "one sound, one note can be stretched or change pitch and that could make a whole song on one note if you re-arrange it all" (Video clip: <u>One sound</u>). This particular u-turn had been provoked by her intervening Trial C experience.

Section Six Conclusion

Music is not a communication code between composer and listener... There is no real certainty that the message the listener received is the intended one.

(Swanwick, 1979)

On the basis of the evidence gathered during this project it is possible to make some general observations about introducing electroacoustic music to post-primary music students.

The findings clearly show that students can assimilate and put into practice the thinking processes necessary for producing a piece of musique concrète. It also demonstrates that possession of these skills equips them to relate in a more informed and meaningful way to electroacoustic music in general. Certain key factors contribute to this positive outcome. These include flexible teaching strategies, careful task framing, strong support systems and well-chosen materials accessed through the appropriate mediating technology.

The research indicates that without advance preparation in the following areas, the students do not achieve the desired learning outcome: an adequate technical facility; prior knowledge of the working materials including the attributes of the sound materials and the ways in which they may be transformed; familiarity with the musical context and background; an awareness of their own intuitive perceptions of higher level ideas that may inform the work for example time, pitch, change, structure and balance.

In teaching electroacoustic composition certain types of scaffolding have been shown to be effective. These include carrying out the preparatory work listed above; asking leading questions at crucial moments; modelling solutions; making analogies to clarify certain points; demonstrating difficult points visually, kinaesthetically and aurally; stepping back when the students are ready to work independently; being available but not intrusive and focusing their attention by making appropriate comments.

An assessment of the outcomes indicates that it may be beneficial to begin electroacoustic work after other aspects of the music curriculum have been dealt with previously, so that concepts like dissonance, that are not specific to this genre, may not preoccupy the student composers.

This study provides evidence that students who work collaboratively gain a greater insight into the task at hand than those working alone. By articulating and exchanging views they hone their perceptual skills, thereby laying the foundation for future listening. The study also shows that there is a very positive outcome when each group member has autonomy over her own composition while enjoying the peer support from the group.

A computer-mediated Constructivist Learning Environment, such as that exemplified in this project is essential in approaching the domain of electroacoustic music. It is important that the artefact provided is deployed in a holistic way, taking account of the implications for task definition, teacher strategy and scaffolding. Arising out of the study, the following principles underlie the design of the artefact, a CD-ROM containing the material needed for composing musique concrète. An audio editor is included together with links to sites where other sound editors may be downloaded. The choice of sound sources is precise and favours tonal over nontonal sounds. Each has rich harmonic potential and is capable of dramatic aural transformation. Acoustical information is given using non-technical vocabulary and is supported by *Flash*-driven screen recordings. The interface is simple in order to focus the user's attention on the task at hand. Screen shots accompanied by short, direct instructions are provided so that time is not wasted trying to solve problems with the technology. The task is worded carefully and typical solutions are available. There are examples of electroacoustic works and links to related Internet sites.

Electroacoustic music is fundamentally different in its materials and structures from other musical genres. Most music students have little intuitive or encultured knowledge that they can bring to bear on the problems it poses. Tackling these problems requires an integrated and clearly structured approach such as that described.

The current study specifically explores electroacoustic composition. Its findings may be relevant to other types of music composition but further research would be necessary in order to validate this. This dissertation argues that electroacoustic music is a domain worthy of study on its own merits. It outlines both a philosophical and a methodological approach for successfully approaching this domain and, it is hoped, represents a step towards integrating electroacoustic music into the mainstream of music education.
Appendices for Trial A

Appendix A1

Here is a list of composers' names in alphabetical order. Please place a tick (\checkmark) in the box beside the name of any composer you've *heard of*. (You do not have to remember or name any of their compositions or give any other information.)

Benjamin Britten
John Cage
Raymond Deane
Claude Debussy
Donnacha Dennehy
Roger Doyle
Bob Dylan
Duke Ellington
George Gershwin
Franz Haydn
Elton John
Ronan Keating
Paul Lansky
Tod Machover
Freddie Mercury
Wolfgang Amadeus Mozart
Turlough O'Carolan
Dolly Parton
Steve Reich
Pierre Schaeffer
Paul Simon
Stephen Sondheim
Karlheinz Stockhausen
Morton Subotnick
Brian McFadden
Peter Ilyich Tchaikowsky
Edgar Varèse
Guiseppe Verdi
Andrew Lloyd Webber
Trevor Wishart

Total known

Please listen to and comment on the music

Piece number 1

Piece number 2

This is one of eight similar worksheets

Pre-composition listening: list of extracts

	Title of piece	Points to note	Salient features
1.	<i>Fugue no 9 in D minor -</i> Bach	Swingle Singers	Timbre: a cappella voices Texture: polyphonic
2.	Arrival of the Queen of Sheba - Handel	Strings and flute	Style: Baroque Pulse: Steady
3.	Arrival of the Queen of Sheba - Handel	Dé Danann: traditional Irish group	Timbre: Irish instrunents
4.	<i>Flute Concerto (3rd movement)</i> – Mozart	Flute + orchestra	Structure: Rondo in a Concerto
5.	Pictures at an Exhibition – (Bydlo) Mussorgsky	Huge swell and ebb in volume: programmatic	Dynamics, Pitch: Deep register, Timbre: double bassoon
6.	Waltz - Tchaikowsky	Theremin	Timbre, Pulse
7.	Lady Madonna - Beatles	Rajaton: sounds like Anúna	Timbre: vocal ensemble
8.	<i>Under the Green Time</i> – Roger Doyle	Pipes and typewriter: Electroacoustic	Timbre, Texture
9.	An tIolrach Mór - trad	Irish sean-nós, ornamented, slow, no feeling of beat	Tempo, Pulse, Pitch
10	Sonata: Unaccompanied Violin - Buckley	Playing techniques	Pitch, Duration, Pulse, Timbre
11	<i>Recitative 1 from Cantata</i> <i>BWV 78</i> - Bach	Awkward intervals, no sense of tonality, monophonic	Timbre, Pulse (none), Pitch, Texture
12	<i>Adam lay i-bounden –</i> Brittten	SSA + harp	Tempo, Timbre, Style
13	<i>Hibiki-Hana-Ma -</i> Xenakis	Electroacoustic	Timbre
14	<i>Etudes aux chemins de fer</i> - Pierre Schaeffer	Musique Concrète	Timbre, Structure
15	<i>métro-boulot-dodo:</i> AMH	Musique Concrète	Timbre, Structure

(This page was not give to the student participants)

Please listen to and comment on the music on the worksheets you were given.

You may refer to some or all of these points if you wish.

Beat
Duration
Tempo
Pitch
Dynamics
Structure
Timbre
Texture
Style
Title/ Mood
Historical period
General comments

Sound files available to the students in Trial A

Strings	1	Violin scale
Strings	1	Double Bass scale
Woodwind	2	Oboe tunes
Brass	11	Brass instruments – a major scale on each instrument
Percussion	15	Timpani and African drums
Real world	23	Sound magic files e.g. rock fall, fire, hiss, clang, pop (These are on a demo CD issued by MIT)
Real world	3	Train sounds: train arriving, departing; on the train
Total	56	30 tonal and 26 non-tonal sounds

	Your first name
Questionnaire about The	<i>Music of Sound</i> project
Title of your piece	Length
Describe the structure or story of the piece	
What sound files did you choose and why? How	did you transform them?
What is the most musical feature of your piece?	
Did you achieve the aims you set out for yoursel	ves?

What did you like the least about your piece, if anything?

If you could continue to work on it what would be your plan for the piece?

Did you learn anything from doing this project?

Have you any other comments?

Thank you for taking part. AMH May 2003

Commentary on Trial A Composition 1

Battle of the Elements

This piece lasts 41 seconds and portrays the battle for supremacy between the four elements earth, air, fire and water. A bell-like clang indicates the start and end of the fight and is reminiscent of that heard at a boxing match. Ten wavs (sounds in audio format) were constructed from various sounds and used in the final mix. Three tracks (or layers of sound) were used.

This composition did not require a strict sequence of events so the notion of structure did not become important for the students until half way through. They concentrated on the sounds and transformations before discussing the placing of the climax or the inclusion of a pause. Pitch bend was their favourite transformation and they reversed or inverted sounds as well. There was some rhythm in the piece and they wanted to add a melodic ostinato but ran out of time. They each made intelligent suggestions that were willingly tried by the other.

Commentary on Trial A, Composition 2

Frog's Day Out

This piece is illustrative and lasts 26 seconds. It describes a frog jumping in and out of a pond, skipping along to the sound of bees before coming into contact with a tiger.

They had a little scene to play out so, from the outset, these students used the multitrack view and worked on structure. Eight wavs were used in the final mix to illustrate the frog, a submarine, the hopping, the bees, the tiger and the cadence-like rhythmic section on timpani at the end. These were achieved mainly through time stretching, reversing, flange and multitap delay. One girl was domineering and often ignored or dismissed the excellent suggestions made by the other. The pair lost some opportunities to create worthwhile effects as a result.

The piece ends with an implied perfect cadence (dominant note to tonic note) on timpani.

Your first name _____

<u>métro-boulot-dodo</u>

- 1. How many different ideas can you hear?
- 2. What are those ideas?
- 3. How do the ideas relate to one other?
- 4. Are there any surprises? Where?
- 5. Can you hear any 'classic' structural techniques?
- 6. Is there a beat?
- 7. Are there any silences between the ideas?
- 8. What is the overall duration of the piece?
- 9. Where do the important things happen for example, changes in texture, dynamics in relation to the beginning, middle and end of the piece?
- 10. Does the piece have a climax? If so, how is it made and when does it occur?

Observations:

Your first name _____

Under the Green Time

- 1. How many different ideas can you hear?
- 2. What are those ideas?
- 3. How do the ideas relate to one other?
- 4. Are there any surprises? Where?
- 5. Can you hear any 'classic' structural techniques?
- 6. Is there a beat?
- 7. Are there any silences between the ideas?
- 8. What is the overall duration of the piece?
- 9. Where do the important things happen for example, changes in texture, dynamics in relation to the beginning, middle and end of the piece?
- 10. Does the piece have a climax? If so, how is it made and when does it occur?

Observations:

Trial A Video Transcript

Post-composing conversation with Aoife, Cliodhna, Carolyn and Sophie on 15/05/03

AMH: General comments about the process, working together, the music... your thoughts?

AOL: The process is... really annoying cause it's just so frustrating. And the music... it's.... it's.... There's an awful lot to do and if you're kinda lost sometimes, trying...looking for things... but you find them in the end, but all in all, it is worth it 'cause I thought it sounded very good.

AMH: But you only spent... you learnt the stuff and did it today all in an hour (AOL: Yeah) and a composer doesn't do that – learn how to play an instrument and then go and write for it in an hour... Aoife said earlier on that it was the most stressful thing she did all day and that included an *ECDL* exam. Sophie, what do you think?

SD: Yeah, I'd have liked if there was a touch screen. (All laugh)

AMH: I know you had trouble with the laptop mouse. Apart from all that, Aoife used the word 'music'. People who hadn't done music and who had no experience of this, would they quibble with you for calling it music?

SD: (unsure) Probably, yeah.

AMH: How would you justify it?

SD: I dunno. You kind of have to have a theme or something going through it, I dunno and *(makes a face)* it's like noises and different effects...

AMH: Had yours any element of music in it?

SD: Yeah, it had, like, different instruments in it... the timpani and... (reflects)

AMH: You know the list you had yesterday? Were you able to use any of those points on that list? Do you remember the list? The beat and duration...

SD: Well it had the... the insects were the beat. They were keeping, like, the 'da, da-da, da, da-da'. I dunno.

AMH: Would you say your music was programmatic or pure?

SD: Programmatic.

AMH: Yeah, telling a little story. Carolyn, what are your thoughts?

CP: I'm really glad I did it, because I didn't know anything about it and now... I do! You see there's a lot of potential to make something, like, really great so you're always trying to realise this sound you hear in your head and make it come out of the computer, which doesn't always

happen, but, I would call it music because I think that music is kind of a sound that evokes a reaction, which it does, you know; you either love it or you hate it or you think 'oh that's interesting', so I would call it music. It's hard to try and find a kind of a tonality so you have to kind of judge more like 'does it sound more like upbeat or sad or happy?' as opposed to 'does it sound like a major key?' So, in that way it's different from conventional music. But, I'm really glad I did it. I think it's brilliant.

AMH: Cliodhna you listened to some music, yesterday that you may not have heard before, or even a type of music that you may not have heard before. Now, did anything you did today coincide with anything you heard yesterday or has it shed light on any of those composers or their work?

CB: It has. You can kind of understand a bit more now where they are trying to go with it. But it's more difficult to kind of... it's probably because, you know, as you said, we did it in an hour... but, I mean, if you want to go over to the piano, you know what notes make it sound happy or sound sad or... you can say what the electroacoustic music sounds like, but you can't really... it's more difficult to say why. Like you know, it sounds happy or it sounds sad, but you know, it's harder to know why.

AMH: Well you do realise that what you're doing there all the time is you're inventing the instrument because normally if you're writing for an orchestra, you'll say, 'right I'll give something to violins and I'll give this to flute...' but you were creating the timbre... so you had to actually sit down and figure out what sound you wanted before you figured out how to organise the piece so there was a lot going on for you there as well... Aoife what do you think of the view that music is organized sound?

AOL: No, it's not just organized sound. There has to be a meaning to music. There has to be some feeling and meaning behind it. You can't just say 'I know that IV - V - I... that's a nice chord progression. I'll use that' and you know, that's organizing notes one after the other and it's going to sound OK, but there's no meaning after it. You want your theme to be love or something like that. It's not just organized sound, you know. There's a feeling and an emotion behind it, it's not just a matter of... you can't just say' all these notes go together and they're all in the same key and I can modulate in that bar and sure I'm sticking with the rules of music. Everybody breaks the rules of music.

AMH: I wondered how long these teenagers would stay away from a pop beat. All of you had a beat. Can we hear *Elements* again?

CP: (*Plays the piece and describes it.*) We felt those sounds went well together. We did pitch bending on the tearing paper. We thought it sounded brilliant. We transformed it by using pitchbend but we did it manually.

AMH: You tweaked what was there?

CP: Yeah

AMH: Aoife and Sophie, was there any effect you came across that you liked?

AOL: Mostly just pitch and time changing. We stretched time a lot. Most of the things we couldn't get we changed the pitch on some of them... they sounded lower. We just weren't getting the sounds that we wanted out of what we had so we had to change them.

AMH: Electroacoustic music is not something that is well known by either teachers or students or indeed the Department of Education in Ireland. They've totally ignored it on the syllabi. Have you any comment to make about that?

CB: I think it should be on the syllabus. Because the kind of music you should be learning about shouldn't be just Mozart and you know *Seachanges* and all those works that are on the Leaving Cert course. I think it's important to know what other types of music are out there. You might decide you hate them. But just like some people in our class might decide they hat Mozart, you know they've still learnt about him and taken the time to get to know him before forming an opinion. You know, I knew nothing about this before I started.

AMH: You do realise that this software is used a lot in pop music. Pop musicians have hijacked it brilliantly and use it commercially whereas the contemporary classical people, they're inventing stuff all the time, but it's not as commercially viable and their music isn't listened to as much. Carolyn, have you opinions on any of this?

CP: Well I was going to take up Cliodhna's point about whether it should be taught in schools. I think, yeah it should. There should be modules on it. I know in the Leaving Cert you can do an Elective where you do a project. That might be the best way to examine that because otherwise it might be difficult to examine it conventionally, because with Mozart or something, there are answers you can give and it kind of assesses you but I think with this you would have to do kind of do it in a project based way but I think it should be brought into the course because it's just so interesting and I think it's probably kind of the way technology is going as well. You learn all about the past and the present. You should learn about where the future is going too.

AMH: Sophie, did you need to sit down and try your hand at it?

SD: Yeah, definitely, because I dunno, you kind of learn more things. I didn't know... I hadn't a clue what you were talking about when you said *flange* or any of that when we were starting off... You kind of know it changes it in some way and then you have like this image in your head of what it's going to do

AOL: I'd love to explore all kinds of music, no matter what it is. If you really have a love for it you'll try your hand at everything.... When it comes to that, there, the real sounds especially, the real world sounds, I thought it was brilliant how you could change them so much and you know, make it tell a story. It was very programmatic like, we told a story about a frog's day out *(laughs)*... and if you have a real love for music you really want to learn about music you have to explore all the different areas so I definitely would try it out more, because I really did enjoy it even though it was kind of frustrating some of the time.

AMH: And what about the composing process itself, what did you have to think of? Did you have to make it programmatic? Could it have been pure music?

CB: It could have been but I think especially for us, only starting out, to make it more accessible, making it kind of programmatic was easier. It was easier to kind of have an idea in your head on what sounds you wanted and where you wanted to go with it and the kind of theme. It was easier to have that in your head while you were going on. I think otherwise, starting out, you might just get lost... just trying to make it pure.

AMH: But if you were doing a piece of pure music, what is important in a composition, you know, say a piece of music a minute long. From 0 to 60 seconds, what needs to happen, say?

SD: You need to have a climax, which could be getting loud, I suppose, or I dunno, something that makes it stand out

AMH: Where would that be, say from 0 to 60?

SD: Probably about three-quarters way. Usually. I don't know. Some pieces could end abruptly. There has to be something there.

AMH: And do you need contrasting ideas, Carolyn?

CP: I think you need to keep it interesting and you can't let the audience's mind wander because then they won't really want to listen to it. Contrast is always good, to keep it from being samey and boring. And the contrast just produces different reactions as well.

AMH: Could you consider doing something in Sonata Form there? Do you know Sonata Form? (All: Yes)

CP: I think there's a lot of scope for doing things like that.

AMH: Using real world sounds. (All: Yes)

AMH: So a piece of musique concrète using SI and SII? (All: Mmm)

AMH: Development? (All: Yeah)

AMH: And then come back to them again in more or less their original...? (All: Yeah)

AMH: So that's a plan for the future, possibly, if you got your hands on that software? (All: Yeah)

AMH: Having done the project does it make you appreciate the work that composers have to do?

SD: I think you can appreciate the music more cause it shows that it takes so much time just to like... When you're listening to it at the start, you just think it's sounds, but you realise how much effort is put into it to get those sounds and to kind of feel around and to get those sounds and transform different, like, pieces of music...

AMH: Do you think you'd be able to listen to a piece right through now, because you've only ever heard a couple of minutes. You'd need to listen to it a few times.

CP: I would think you could because from doing that you kind of get a sort of an impression of what their thought process is so you kind of listen to it going 'I wonder where he's going to go now?' or 'I wonder what they're going to do?' – you know, whatever. So you're kind of looking out for things now as opposed to just kind of listening to it.

AMH: Does the title of a piece help, Cliodhna?

CB: Definitely. I think in any kind of a piece, electroacoustic or otherwise, you kind of know what to expect, like for example with Aoife's and Sophie's piece *(Frog's Day Out)*. It put it in a good context.

AOL: Really and truly, I'd have to say I really did enjoy it. It was a bit frustrating but it was so interesting it made up for it.

AMH: Well the frustration came from the fact that you didn't know the software as distinct from the composing.

AOL: Yes, exactly. It was just brilliant.

AMH: Did you think the software was easy to work on? Having got round it. It was sort of intuitive...

CB: I think so, yeah.

AMH: Working on your own and working with someone else, thinking out loud, how did you find that?

SD: I think starting off on something like that it is better to work in groups cause you're learning from the other person as well as learning yourself and you're kind of sharing ideas and I just think it works better.

AMH: You're dying to get working on it on your own, are you Carolyn?

CP: Well I think most of our ideas came up in conversation, so definitely from a development point of view, it was great to work with people. But I think, you see sometimes you disagree on stuff, so if you worked on your own you'd bring in sounds that you'd like, but other people might not necessarily like as much, so there's more scope for kind of personal development. But it's great fun kind of working with other people.

AMH: The raw materials you got, Cliodhna, sort of limited you a bit. Would I have been better off to give you fewer or more, today? Would you have liked other ones or did you have no time anyway?

CB: Yeah, I think if we had more time to kind of go through them and listen to all of them and you know, try to kind of think our ideas through, that sort of way, it would have been easier. But Carolyn and I tended to come up with ideas as we were talking. I think that the sounds we were presented it were good. Enough of them were similar that you could get a theme going.

AMH: And Aoife do you think you have to be good at computers to work on this?

AOL: No, not at all. I'm terrible at them. I failed all my *ECDL* exams. No all you need to know is how to click on a button and listen to a sound. It was very easy, completely user-friendly.

End

Teaching their peers: A short account (May 2003)

The composers played their pieces for students from their music class, first without giving the title. The non-composers gave accounts of what they heard – story lines mainly alluding to science-fiction films, a hospital, *The Matrix* and recycling cans. When told the actual titles, the audience went back over the various episodes in an effort to reconstruct "the story" and make sense of it all during the second hearing. They treated the pieces as simply exercises in sound effects and made no mention of music.

One of the composers was chosen by the others to explain electroacoustic music to the noncomposers. This was her explanation:

With electroacoustic music you have to use more normal sounds... well not normal sounds, but sounds that are not necessarily coming from, like, an instrument or, you know, from the orchestra or something. They could be everyday sounds or something like that. And you have to... or, well, you can... get across a story, which is what we were going for in our piece...

Although she does not mention sound, she evidently knows about it, as can be clearly seen by her response to the next question in which she was asked to describe the piece, which was about nature's elements:

We have the bell at the start to signify the beginning of the battle and the sound we got for getting across the rippling water underneath was the oboe-keys... kind of buttons... just clicking. Then we took the sound of fire that was on the file on the computer and we did a lot of pitch bending which is how we, kind of, got it to go up and down. It really distorts the sound somewhat. Then we used stretch on it as well, I think. We just used different transformations. You can change the pitch and you can delay sounds or have an echo effect. At the beginning we were getting the pitch to go up and at the end we were getting the pitch to go down. And the bell just ends it.

She forgot to mention the clever way they worked on producing a sound from an oboe tune to represent the whooshing of the wind and how they used the sound of falling rocks to represent earth. She and her co-composer had concentrated on getting the sounds right by repeatedly listening to them and by comparing and discussing the sounds before deciding where they belonged in their piece. This caused problems towards the end:

We had it structured but then we realised we didn't have a climax or a pause, so what we kind of did was... (laughing)... just stop the music for a little while then started again which I think... that could have been placed better and thought through better... and then I didn't like the "air-up" thing... the big thing that was supposed to sound like air, but just sounded like a siren, so I think I'd try and find something better for that as well.

When asked if they thought that it was real music, the group of peers felt that it was "perfectly suitable as background music in films and television".

Perhaps ours didn't, but if it's done properly it can convey an emotion or convey an idea or tell a story and that is an element of music... You listen to it and it makes you feel something and it gets across an idea and that's a fundamental idea of music, which is present in electroacoustic music.

This reflection sums up well the most important quality of electroacoustic music. The girl who made the statement has very obviously noted the difference between random sound effects and real music.

Giving their views on electroacoustic music, they lacked specific vocabulary to deal with some points e.g. their use of the term *pitch* was not always accurate in the context. Here are some of the things they learned from doing the project, in their own words:

...the (electroacoustic) music can arouse emotion and create moods... the music is not just thrown together even though it may not be very easy on the ear... I learned how to transform particular sounds into different ones and how to combine various sounds together on a computer to create an electroacoustic piece... I thought that the pitch bend would have the same effect on all the sounds but it didn't... paper is a cool sound... it is a difficult and time-consuming process to compose an electroacoustic piece... the composers have to put a lot of effort into their works... there are loads of different echo effects.... I didn't really understand electroacoustic music before and now I have a better understanding of what is going on when I listen to a piece... electroacoustic music, in my opinion, has to be practised to be learned... some sounds don't do much when you try to change them... that typewriter piece must have taken him (Roger Doyle) ages to do... I'd love to see what my voice would sound like stretched, eek...!

Appendices for Trial B

Appendix B1

Each student participating in **Trial B** was given a CD containing the following works:

Nan	ne of piece and composer	Duration in minutes and seconds
1.	<u>Dripsody</u> (Hugh Le Caine)	01' 28''
2.	Chronometer (Harrison Birtwhistle)	01' 41''
3.	Etude aux Chemins de Fer (Pierre Schaeffer)	02' 52''
4.	Slow Air for oboe (A M Higgins)	01' 01''
5.	Reversed Slow Air	01' 01''
6.	<u>Rial wos</u> (modified Slow Air)	01' 02''
7.	<i>FADE</i> for clarinet (AMH)	00' 50''
8.	Reversed FADE	00' 50''

Daily Listening Journal

Dripsody – First Hearing

Dripsody – Second Hearing

Dripsody – Third Hearing

Dripsody – Fourth Hearing

Dripsody – Fifth Hearing

Dripsody – Final Comment or Summary

(Similar pages were used for Chronometer and Etudes aux Chemins de Fer)

1.	Applause
2.	Birds
3.	Coins falling
4.	Crickets
5.	Door creaking and slamming
6.	Insect noise
7.	Oboe key clicks
8.	Lion roaring
9.	Paper rustling
10.	Paper tearing
11.	Pebbles falling
12.	Pen on railings
13.	Purring cat
14.	Running
15.	Train arriving
16.	Train departing
17.	On the train
18.	Water flowing
19.	Water plopping
20.	Water splashing

Titles of sound files available to the students in Trial B

Day 1: Using non-tonal sounds

Cool Edit Pro is an Audio Editor.

- 1. Find out how to use the Waveform Edit Window.
- 2. Work in pairs and go through the 20 real world sound files for the musique concrète composition. [In rooms G1, G3, MR]
- 3. Trim, reverse, fade in and fade out.
- 4. Add other transformations e.g. echo, multitap delay, pitch shift.
- 5. Take turns using the mouse.
- 6. Write down the effects for later use. [Then return to the Lecture Theatre.]
- 7. You will now be shown how to use the Multitrack Window. This allows you to layer different sound files. Eventually these are mixed down.
- 8. You will organise your folder. Name and save new files correctly.

Composing assignment

Choose two contrasting sounds. Construct / compose a piece that you like, lasting between 30 and 60 seconds. You have an hour to complete the piece. Do not write a programmatic piece. Use repetition, variation and make the piece have a climax.

The camcorders will record your work in progress, especially your conversations about the decisions you reach.

- 1. You will play your pieces for the other students today.
- 2. Later in the term, you will play and <u>explain them</u> to your classmates recorded.

Tomorrow...

... you will listen to some electroacoustic pieces where voices/instruments are used.

... you will be asked to manipulate the clarinet piece on your CD.

FADE





<u>MH311203</u>

This screen shot shows how panning affects the waveform visually as well as aurally. Panning gives a degree of independence to the left and right speakers. The participants in this project did not explore it in their compositions.

This piece is an attempt at creating a feeling of space. There are echo effects, meant to conjure up the sounds heard in school corridors when there are only a few people in the building. The silences followed by sudden bustling moments are typical of the school setting.

This piece was constructed from one long note and one reversed rhythmic figure found in the piece called \underline{FADE} .

Day 2: Using sounds made on an instrument

- Listen to *idlechatterjunior* by Paul Lansky. Fill in the answers on the worksheet.
- □ Then go finish your musique concrète piece. Be prepared to explain it to the others. Know the sound sources you used and how you manipulated the timbres have a list of the transformations you applied.
- Later you will be interviewed individually. Questions are below.
- □ After listening to your pieces, go to the lecture theatre again to hear <u>Under the Green Time</u> by Roger Doyle.
- Then you may split up and work individually on the Clarinet tune <u>FADE</u>.
- □ After lunch we will listen to all the works and then return to the theatre for a follow-up session before heading home.

Composing Assignment (for one hour)

Using FADE as your source, construct a piece you like lasting between 30 and 60 seconds. Choose an appropriate title. You will work on your own, rather than in pairs.

Questions to think about during Day 2

- 1. What have you learned about electroacoustic music from your composing experience?
- 2. What is the name of your first musique concrète piece?
- 3. What is the name of your manipulated Clarinet piece?
- 4. What did you set out to achieve in your pieces? Did you succeed?
- 5. What transformations did you apply? What structure did you use?
- 6. How did you find group work? Was it easy to reach joint decisions?
- 7. Tick the terms you've come across:
 - □ looping
 - □ flange
 - □ invert
 - □ reverse
 - □ panning
 - normalize
 - reverberation
 - □ multitracking
 - □ mixing down
 - □ acousmatic
 - □ 44100, 16-bit, stereo resolution
- 8. Could you explain them to your class later?

A M Higgins, 31st December 2003

What I've learned about Electroacoustic Music

1. Timbre is the term used to distinguish between different sounds. Composers may *record* and manipulate sounds (as did Pierre Schaeffer in "Etude aux Chemins de Fer") or synthesise new sounds from sound waves (as did Karlheinz Stockhausen in "Kontakte"). I understand this now.



2. Electroacoustic music *manipulates not just real world sounds but also sounds from acoustic (non-electric) instruments.* I understand this now.

Yes 🗖	No 🗖	Sort of

3. These are the elements found in music. Rate the ones you think are found in electroacoustic music in order of significance:

Pitch or Melody [Tonality or Key]
Rhythm
Beat or Pulse or Time Signature
Tempo or Speed
Harmony [Dissonance and Consonance]
Texture or Layering
Style
Timbre
Structure or Form
Dynamics or Volume

4. The most important way to make a composition interesting is to choose *timbres with useful harmonic content* and to make the *overall structure* obvious.

T rue	🗖 False	e
--------------	---------	---

5. The way to make the structure obvious is to use *repetition* and *variation* and *contrast*.

True	False
T	F 1
rije	Halse
TTUC	1 4150

6.	Development of an idea or motif works better than just adding more and more sounds.
	Having too many sounds clutters up a piece and makes the ear form too many associations.
	If a real-world sound source is used the end result is probably going to sound
	programmatic. To make an abstract piece it would probably be better to make the sounds
	acousmatic.

	🗖 True 🗖 False 🗖 Maybe	
7.	7. You have to hear the whole piece to get an idea of the climactic po	int.
	True False	
8.	8. There has to be a sense of tension and resolution.	
	True False	
9.	In your opinion, how important is it to have a hands-on experience of this music if you want to get a clearer understanding of electroacoustic music?	
	\square not important \square quite important \square	important
10.	10. <i>The Music of Sound</i> is an appropriate title for this project. True or 1	False?
	True False	

Trial B Questionnaire results

Q1: Composers may record and manipulate or synthesise. 5 said they understand. 1 "sort of"

Q2: Not just real world sounds; also acoustic instruments. 5 said yes. 1 "sort of".

Q3:

Of the 10 elements listed, the Number 1s were:

Dynamics or Volume (3 people) Texture or Layering Rhythm Beat or Pulse or Time Signature

Structure:

3 people placed it 7th out of 10; one placed it 5th; one placed it 4th; one placed it 3rd

Timbre:

5 people placed it 2nd on the list out of 10; one girl placed it 6th on the list

No 10 on the list:

Beat (Time signature); (2 people) Harmony (Consonance, Dissonance); (2 people) Melody (Pitch); Tempo

Q4: *Timbres with useful harmonic content; obvious structure*. 4 said False; 1 said True; 1 no answer

Q5: *Repetition, Variation, Contrast = obvious structure –* All 6

Q6: To make an abstract piece – make the sounds acousmatic – 4 true; 2 maybe

Q7: To hear the climax you must hear whole piece - 1 no answer; 5 true

Q8: Tension and resolution – 2 true; 4 false

Q9: *Hands-on is very important* – all 6 agreed

Trial B: *<u>The Flight of the Gunmen</u>* (40") Helen Devine and Rachel Hynes

RH: It takes place in the jungle and there are birds and insects. They're all talking and then they start screaming. The men get really annoyed. The gunmen shoot them. And then all the birds are gone. Then it's really quiet for a little while. You just hear the wind. *(Pointing to left and right of stereo wave form)*

AMH: Abstract or programmatic?

HD: The piece is programmatic. We didn't intend for it to be programmatic. It's just, we found it easier to make a piece of music based on a story and it just ended up like that.

AMH: Is there any structure in it?

RH: I'd say it's... it starts off quietly with a pen on the railings, which is a tinkly sound. There's a few birds talking as well. It gets louder and louder – here's the climax (*pointing*) where all the birds re screaming at each other and the men are shooting the birds. And then it gets really quiet and a few of the elements come back into it, like the sky and the insects and the birds again. I think it's like ABC because all the bits contrast each other. The contrast is mainly between the dynamics, I think, because it's moderately soft here, really loud here, then it's silent for a few seconds, and then it's kind of louder.

AMH: Are the gunmen fleeing?

They don't really belong to the jungle so they just leave. Their only purpose there is to shoot the birds.

AMH: You started off with a different title.

HD: Yeah, we did. When we found the sound of the birds screeching, we decided to base it on Lord of the Rings but that didn't really work out because we couldn't find sounds we could associate with it. It sort of took its own storyline, really. It kind of wrote itself. *(laughs)*

AMH: Do you think that the choice of sounds was out of your control, because you didn't control the sounds? I mean, the sounds were there for you. Did that dictate what you did?

RH: Yeah, I suppose it did. The sounds on the computer sort of influence your decision. There was a lion, an insect and birds. They're kind of all animals. You think of an animal scene, without meaning to. We tried the birds, first, because it sounded really cool. From there where else can you go except for other animals?

AMH: Did you think that some sounds had more potential than others for transformation?

HD: We were influenced by the sounds that we had on the computer. I think that with the computer we could have changed those sounds into anything we wanted, really.

AMH: What were your favourite transformations?

HD: I think the paper rustling sounded like the wind. I think that was the best one. (plays it)

AMH: What's the significance of the plop at the end?

RH: It's sort of like a twist in the tail. The plop makes it kind of interesting.

AMH: Did you have any favourite effects? Can you remember any of them offhand?

RH: The echo. That was cool. We had a bit of a problem. We put on a robot and we couldn't change it back. That sounded really bad. We used fades as well.

HD: We didn't use many transformations really.

AMH: How can you justify that as a piece of music and not a soundtrack for a cartoon or a set of special effects? You don't *have* to justify it, by the way. Do you think that people would have a point if they said that it's a series of special effects or sound effects?

RH: They'd have a point. I think people would see it as a big mix of sound effects cause that's what it is. That's how it ended up.

Others' reactions:

AMF: I think the gunshots are very good... and the wind. I like the way they transformed that from something else.

HD1: I think the paper rustling into the wind/thunder is really good. I love the water plop at the end. That's deadly.

CMcG: I like the start – the contrast in dynamics from loud to soft and I thought the water plop at the end was just class. It was brilliant.

SW: I liked when the gunshots ended and it became real silent. And then it started back again. The ending is really good too.

Trial B: Jungle Bells (38") – Anne Marie Fenton and Helen Dwyer

AMH: Tell us about your piece.

AMF: We started off with about two sounds – the lion and the key clicks. They feature a lot in the piece. The first time it's the normal one and the second and third time we transformed it to make him sound more aggressive and then he gets shot here. (HD: That's why it's louder there. Then it's softer cause he's dying.) The setting is in the jungle. And the key clicks... there's a woodpecker and then we used that sound *(laughs)* ... we made it higher I think. It sounds like rain falling on the jungle.

HD1: Cause you know in Africa where they have those little shantytowns they have corrugated iron roofs.

AMF: And we had normal rainfall as well. So there's like three things going on there.

AMH: What does rain sound like? Maybe you'd tell us.

HD1: Whatever it lands on.

AMH: Have you a structure? Beginning, middle and end?

HD1: ABA. A – the lion setting the scene and then there's all the rain and the water- the jungle. B – the middle – it's all the gunshots. The birds and insects are running and flying away. The water is splashing with animals running through it, trying to get away. And the lion is all 'I'm King of the jungle. I'm going to stand up to them.' Then he gets shot. He's like dying there (in Section A). It's just back to the start. It settles down and it just kind of fades out.

AMH: Did you find it difficult to work in a pair? Were there decisions you found it difficult to agree on?

Both laugh.

AMF: Mostly it was both of our ideas. When you're given the sounds, there are a lot of animal sounds, so a jungle setting is what we came up with, and then we called it *Jungle Bells*.

AMH: Helen, you made this statement to me that everything was easier on your own.

HD1: I think everything is easier on your own cause you've no one to argue with and you can do just what you want, so you can just use your own ideas. I suppose it's a help when other people are there to give you ideas but if you want to finish it yourself, like, and you have an idea and the other person doesn't like it...

AMH: Is there anything you would have changed if you had more time?

AMF: We'd have made it a bit longer.

AMH: Are there any sounds you would have preferred? You had a lot of insect sounds and animal sounds. I agree with you. Is there any sound that you think might have worked well in a different piece altogether that you'd like to try out?

HD1: I don't think so. I think the key clicks can be adapted and changed and manipulated really easily. It can be used for all different things like. I think it's easily manipulated for anything.

AMH: How about the paper? Did you try it at all?

Both: No.

AMH: What transformations did you prefer? Which ones did you seem to favour?

HD1: Just the volume change and the fading in and fading out. We used the person running and we zoomed in and took a really small section if it – where the person's foot just went on the ground. We used that as the gunshot and just turned up the volume. I liked that bit.

AMH: Could you have done that piece without using transformations?

HD1: No. So many of the sounds in it are the one sound, which has been transformed.

AMH: Could you have done that piece without the computer?

HD1: If we went to the jungle we could do the piece without the computer. *(laughs)* We'd have to get all the animals and a corrugated roof and...

Others' reactions:

CMcG: My favourite bit was the lion. It was just so loud. It was kind of shocking really. SW: Yeah the beginning was my favourite bit as well. It really introduced you to the animals. The theme was really apparent from the beginning.

HD2: The bit where he got shot and then the whole thing is just silent. The change of dynamics and the fading out at the end – I really like that.

RH: I thought their manipulation of the sounds was really good – the insects. It sounded like there were loads of animals there. They must have done loads of kind of fadey stuff.

AMH: The title and the word 'programmatic'. Comments?

RH: The title is really important. *Jungle Bells* gives you the idea of a jungle and a melody with bells.

HD2: The title is really important especially for Ciara and Susan's piece where there was no story to it. With the other two pieces you could kind of gather what was going on. With theirs I wouldn't have had a clue what was going on only for it.

SW: I think programmatic is a lot easier to do - with a story – and it's much clearer to the listener, so you don't really need a title for that but if you're talking about something that's abstract and you had to give your opinions of it, having a title gives the listener a bit of information so that they know what to expect. When they hear sounds they know how to interpret them.

CMcG: I think a title is important. It sets the mood. *Jungle Bells* sounds like something fun. You want to listen to it.

Trial B: <u>ETM (Extra-Terrestrial Music)</u> (29") Ciara McGinley and Susan Wilkinson

AMH: What is your piece about?

SW: It's not programmatic. It's all abstract. There are repeated sections. There's no real story to it. We used dynamics and things like that. You work out what you think of it yourself. We went on kind of a spacey theme. We used kind of shrill noises and kind of space ship... I don't know about space ship, but ... just flying. When we heard it we thought of space aliens. We based it around that. You kind of make your own impression of it.

AMH: Ciara you had problems with this right to the end. What were the problems?

CMcG: I think one of the problems was because it wasn't programmatic, it was trying to get everything to fit together, trying to get new ideas...like aliens coming out of space ships and having things go quiet at the end as if they were taking off. They were the type of problems we had.

AMH: Talk us through the sounds you used.

SW: Train departing ... like a space ship. All the clicky shrill noises reminded me of aliens, weird things you find in space. It was pens on railings and things. We changed the pitch all the time, going up and going 'squirrelly' – the pitch bender *(showed different ones)*. That was the one we used most.

AMH: Is there a climax?

CMcG: I think it's the clicky bit with the aliens because it was something different than what we had we hadn't got before to keep the listener interested and keep their attention

AMH: Do you think it would have been possible to keep the listener's attention with two sounds? I asked you all to try to stick to two sounds if possible. No one did. If I'd given you two sounds only would it have been harder or easier?

SW: I don't think it would have been possible to compose a piece of electroacoustic music with just two sounds because although you have loads of options like to reverse or invert or whatever it would be too hard to keep someone's attention for 30 seconds with just two sounds because no matter what you would do with them they would still sound the same. It would just get boring after 15 seconds, maybe.

AMH: Dripsody had only a couple of sounds. How did it keep you interested?

CMcG: The composer of *Dripsody* kept my interest by the dynamics. He started off with one beat which I thought was a metronome giving the beat and then added more and then a climax came and there was an uprising scale and then it quietened down again and had the one beat again at the end. He used a big range of notes. The louds and softs... the dynamics. That kept your attention. He didn't need to use many instruments or sounds.

AMH: What's the most successful thing in your piece?

CMcG: Most successful – the start of it, with the space ship kind of landing and the end of it where it goes from soft to loud as if the space ship is going up into the sky.

SW: Because we didn't really do any story to it, it was important for the listener to realise that it is a kind of a space age theme. It definitely sounds eerie and futuristic. That was probably the most successful part. Maybe some bits stopped. But we couldn't really elaborate on them. We couldn't really fade in and fade out and maybe that was the hardest part.

AMH: If you had loads of time would you make any changes?

CMcG: I'd probably explore the transformations a bit more; try to change some of the sounds, as I wasn't too sure about some of them I was kind of just guessing. I'd probably use more transformations, change the pitch a bit more... dynamics, stuff like that.

SW: I'd try to get it more together. I like the sounds but they are very independent from each other so it might be better to try and mingle them a bit together.

Others' reactions:

HD2: I love the fading in and out.

RH: I liked the banjo sound... was it pebbles or something? (It was key clicks)

AMF: It was really kind of eerie. I liked the train – it got the idea of transport across.

Me: Did you hear the train in the middle of space?

HD1: The title *ETM* showed that it wasn't programmatic and it was left to the imagination.

Concert attended by the Trial B students after they had completed the composing project

Mostly Modern Series
at
The Bank of Ireland Centre, Foster's Place, Dame St, Dublin 2
Thursday, 22 nd January 2004 Lunchtime Concert: 1.15pm
Susan Doyle – Flute and Live Electronics
Kaija Saariaho: <i>Noa Noa</i>
Zack Browning: Network Slammer
Benjamin Dwyer: Crows Echoes
Scott McLoughlin: Excused from the Laws of Gravity
Arild Suarez: Solo No 3: Dolmance
Admission Free

Short analysis of the Trial B works

The Flight of the Gunmen (40")

Evocative of a hunt scene. Intuitive use of solo bird sounds and flocks of birds. Good build up to the gunshots. These were created from the sound of someone running – the impact of the foot on the ground was taken and transformed to give a percussive effect. Climax at 30". Slow wind down. Pen on railings effect at the start and end is chilling – ABA structure. Ends with a 'plop' in water. This was well timed and drew a gasp of praise from the listeners. Probably signifies a dead bird falling into water.

Jungle Bells (38")

Similar theme to the previous piece, even though the composers were working in different rooms.

Lion sounds, oboe key clicks and running water sounds were easily identifiable, as they were not transformed. Climax (shooting) is not as dramatic as in the other piece. The composers had ended with applause (indoor reverberation) but were coaxed to remove it. (It has been tacked on here to show how incongruous it was in every way – indoor reverb in an outdoor scene; making a comment on the piece within the piece; no musical value...)

<u>ETM: Extra-Terrestrial Music</u> (29")

The students were convinced that this was not programmatic as they claimed it had no story. However all the sounds try to relate to space. There is no apparent structure. Some of the sounds are puzzling – birds and train sounds. They explained the train by saying that they wanted to get the idea of transport or movement. However, they hadn't removed the original source well enough. This piece requires a more acousmatic feel.
Appendices for Trial C

Appendix C1

Available sound files for Trial C

- 1. Bassoon: In the Hall of the Mountain King (Grieg) staccato (4")
- 2. Cello scale $\operatorname{arco} C$ to G (12 notes)
- 3. Cello pizzicato one note C
- 4. One clave hit
- 5. Bell
- 6. Female singer
- 7. Wind vibrato
- 8. <u>Noise</u>
- 9. The <u>overtone series</u>
- 10. <u>FADE</u> on clarinet
- 11. <u>Slow Air</u> on oboe
- 12. Dripsody
- 13. All the Piano notes in sequence
- 14. The <u>Spinet</u> notes in sequence
- 15. Vibraphone range
- 16. Violin C to G (12 notes) arco
- 17. Violin C arco
- 18. Violin E' arco
- 19. Violin E' pizzicato
- 20. <u>Violin</u> sounding like a train (scooping and double-stopping notes)



Investigating the sounds and adding effects

- 1. Bassoon tune with <u>pitch bend</u> added
- 2. Bassoon with pitch bend and light echo added
- 3. Full organ range stereo panned Left to Right spectral view
- 4. Organ <u>low notes</u> only
- 5. Low notes with Fast Fourier Transform
- 6. Notch filter As 110Hz 220Hz 440Hz 880Hz 1760Hz Normalized by 70%
- 7. All of these organ sounds (4, 5, 6) -<u>stretched by 10</u>
- 8. Noise amplified: noisier
- 9. Noise with <u>parametric equaliser</u> making the As resonate
- 10. Overtone series Notation (Scorch)
- 11. The overtone series: each individual partial and some combinations to show the <u>differences in timbre</u> when some partials are stronger
- 12. Miscellaneous: bell, speeding up frequencies, plucked string, female singer, wind vibrato
- 13. Manipulated *FADE* on clarinet: <u>MH311203</u> (Manor House, 31st December, 2003)
- 14. Reversed and manipulated <u>Slow Air</u> on oboe: new tune called <u>Rial Wos</u>
- 15. <u>Dripsody</u>
- 16. Crosstalk
- 17. Spinet range with Fast Fourier Transform filter ringing As normalized by 70%
- 18. Violin C arco
- 19. Violin E' arco
- 20. Train-like violin; first part of bluegrass violin double stopping

Pre-composition exploration of sound

This is a brief account of the strategy employed in dealing with sound and sound transformation and may be of interest to anyone who carries out the project in the future.

Guided by the teacher, the students engaged with **harmonics**, which are the inner components of sounds and which govern many aspects of timbre. Notation software was used to demonstrate how the **overtone series** over a fundamental tone looks and sounds. Asking the students to depress the appropriate keys on the piano before the fundamental was played also allowed them hear the relevant strings vibrate. Different **filters** were applied in order to reject or boost specific frequencies. Using the spectral view window on the audio editor (Appendix <u>C3A</u>) the two girls examined notes on bassoon, cello and church organ before and after a Fast Fourier Transform filter was applied.

They also learned about the **envelope** of notes and spent some time removing the attack portion of plucked notes to hear if the steady state of these notes would retain much or any of the character of the original sound. They faded in sounds to hear if this made a difference to blown, bowed and struck notes. They examined **time stretching** to hear how this might alter the pitch of a note and **pitch shifting** to find out if they could maintain the tempo. Many types of **echo** and **delay** were applied to the new wav files. To achieve **spatial effects** the girls tried **reverberation** and noted how sound can be **panned** from one speaker to another.

They wrote down in a journal any sounds and effects that they found interesting. They successfully identified these processes as applied in two pieces modelled by the teacher, indicating they had achieved a satisfactory level of understanding and were ready to embark on their own work.



Church organ: the full range of notes Spectral view

This allows analysis of audio data, to see which frequencies are most prevalent in a sound file. The more abundant a frequency, the brighter the display colour. Dark blue means that next to no frequencies in this range exist whereas bright yellow means that frequencies in this range are very strong. Lower frequencies are displayed near the bottom of the screen.

Dripsody by Hugh Le Caine (1955)

To study this piece in class a teacher will need some background information. This is a summary of notes taken from Schrader, Barry (1981) *Introduction to Electroacoustic Music*, Englewood Cliffs, New Jersey: Prentice-Hall

- This uses speed change as a primary technique in a tape composition.
- The sound source is the sound of the fall of a single drop of water.
- Recorded on a short piece of tape, $\frac{1}{2}$ inch long
- Reproduced and copied at many different speeds in order to produce sounds with fundamentals ranging from 45Hz to 8,000Hz
- The final composition was assembled from these transpositions of the original water drop by splicing together the individual pieces of tape.
- The first sound in *Dripsody* is the water drop at is original pitch. Then transpositions of the water drop above and below the original pitch are added and the range is gradually expanded.
- Glissandi enter at 0'35".
- The envelopes of the lower pitches heard in this work are fractionally longer than the envelopes of the higher pitches. Original envelope is expanded when reproduced at a slower speed.
- Overtone structure of water drop is not very complex little noticeable timbral change except at the highest or lowest transpositions
- Portamento effect at 1'38" using continuous speed change over the duration of the sound.

Questionnaire about the Electroacoustic Project

1. Please link the terms in Table 1 with those in Table 2. They are related to sound:

	Table 1		Table 2
1.	Envelope	A.	Mixing (Mix down)
2.	Filter	B.	Stereo L and R
3.	Frequency	C.	Amplitude
4.	Amplitude	D.	Pitch
5.	Sound spectrum	E.	Volume
6.	Stereo/Mono	F.	Attack, decay, sustain, release
7.	Echo/Flange/Delay/Reverberation	G.	Boosting and rejecting frequencies
8.	Panning	H.	Transformations
9.	Normalize	I.	Structure
10.	Tension and Resolution	J.	Creating a spatial effect
11.	Digital Signal Processing	Κ.	Harmonics/Overtones/Partials
12.	Multitrack	L.	44,100 and 16-bit resolution

Table 1	Table 2
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	

2. Did you prefer working with tonal sounds or non-tonal (real world) sounds? Why?

3. What did you learn from the project you did at Christmas?

4. Based on your experience with this project, is there any advice you would give to a teacher who wanted to introduce Electroacoustic music to 5th years? Don't be afraid to mention the negative aspects of the project – things that didn't work.

5. What will you listen out for when you next hear an Electroacoustic work?

6. Is there any further comment you would like to make?

Thank you for completing this questionnaire. A M Higgins, 29/03/04

Possible answers

Link the terms in Table 1 with those in Table 2. They are related to sound:

	Table 1		Table 2
1.	Envelope	A.	Mixing (Mix down)
2.	Filter	B.	Stereo L and R
3.	Frequency	C.	Amplitude
4.	Amplitude	D.	Pitch
5.	Sound spectrum	E.	Volume
6.	Stereo/Mono	F.	Attack, decay, sustain, release
7.	Echo/Flange/Delay/Reverberation	G.	Boosting and rejecting frequencies
8.	Panning	H.	Transformations
9.	Normalize	I.	Structure
10.	Tension and Resolution	J.	Creating a spatial effect
11.	Digital Signal Processing	K.	Harmonics/Overtones/Partials
12.	Multitrack	L.	44,100 and 16-bit resolution

Table 1	Table 2
1.	F
2.	G
3.	D
4.	Е
5.	K
6.	L
7.	J
8.	В
9.	С
10.	Ι
11.	Н
12.	A

1.	Can you name any electroacoustic piece or pieces?
2.	Can you name any electroacoustic composers?
3.	What do you know about harmonics/overtones?
4.	Do you remember anything about the spectral view of any of the sounds you were given?
5.	If you remove the attack portion of a sound, does it make any difference?
6.	<i>Attack – Decay – Sustain – Release</i> . Have you seen this anywhere? Can you comment?
7.	When panning is used, how does it affect what you <i>hear</i> ?

- 8. When panning is used, how does it affect what the waveform *looks like*?
- 9. What sort of things can you do to structure a piece of Electroacoustic music?

10. In the list of ten items below, rate them in order of importance in the world of Electroacoustic music compared to the world of Romantic Music (e.g. Tchaikovsky).
1 = the most important element; 10 = the least important element

Romantic music	Place CMcG	Place SW	Electroacoustic music	Place CMcG	Place SW
Pitch/Melody			Pitch/Melody		
Rhythm(s)			Rhythm(s)		
Beat/Time signature			Beat/Time signature		
Speed(s)			Speed(s)		
Harmony/Dissonance			Harmony/Dissonance		
Texture/Layering			Texture/Layering		
Style/Features			Style/Features		
Timbre/Tone colour			Timbre/Tone colour		
Structure/Form			Structure/Form		
Dynamics/Volume			Dynamics		

Summary of answers given in the Joint Questionnaire, C6

They had learnt:

- ✓ names of three works
- ✓ only *one* composer's name
- how to engage with harmonics/overtones
- about panning even though they didn't use it in their pieces
- how to structure a piece with recurring sounds, rhythms, sections beginning, climax and resolution

They did not know:

- \mathbf{X} how to analyse the spectral view
- \mathbf{X} what difference it would make if you removed the attack portion of a sound
- \mathbf{X} about envelope, on paper, despite incorporating the term into their peer discussion

Romantic music (19th Century):

Both placed **Structure** as the most important element – number 1 *(Should be lower)* **Timbre** was at 3rd and 5th places *(Should be higher)* Dynamics at 2nd and 3rd Melody at 2nd and 4th Harmony at 7th *(Should be higher)* Style at 10th and 6th Speed at 5th and 8th The other number 10 was Beat/time signature

(Comment: Surprisingly unaware of the characteristics of that era)

Electroacoustic music:

No 1 = Rhythm and Dynamics *(Should be lower)* Structure was at 2 and 3 *(Should be higher)* Timbre was at 5 and 7 *(Should be higher)* Pitch was as high as 3 and 6 Beat was at 4 and 10 Texture was at 2 and 8 Number 10 = Speed and Beat

(Comment: Wildly varying and inaccurate opinions)

<u>Alien Complete</u> - Transcript of the composer's explanation to the class

AMH: Talk us through your piece

C McG: One of the sounds I liked the most was the heartbeat and that's kind of going through my piece and I used an envelope effect which was kind of fading in, coming in quietly, then getting louder and fading out again. I kind of had a spacey theme, that was kind of what I was going for, even though I wasn't supposed to, but...

AMH: How did you keep the audience's attention? There wasn't really a structure.

C McG: I didn't have a structure, but because I was working on it every day, I kind of got to know the music and I got to know what was coming next, if you know what I mean, so I didn't really notice not having a structure cause I knew what was coming next. I knew the piece off by heart. But since I stopped doing the project and I got the CD last week and I listened to it for the first time, I noticed just how unstructured it was. There wasn't a main climax to it. Because I was doing the piece every day and I knew the piece to death, mixing sounds and trying stuff, I kind of knew what was coming. I didn't feel that it wasn't structured at the time.

AMH: What are the main elements in electroacoustic music that you might even see in your own piece?

C McG: I think the effects that you can put on sounds, the transformations and how you can make an ordinary sound into something completely different. You know, you can make a piece out of just one sound and no one would be any the wiser. You wouldn't believe how much you can do with just one sound or... I think that's what electroacoustic is to me. It's kind of just abstract sounds that are placed so that they gel together and they fit.

<u>SvL</u> – Transcript of the composer's explanation to the class

AMH: Talk us through your piece

SW: At Christmas I thought that electroacoustic music was a bit all kind of over the place because it was so unstructured. Some pieces... I was... it was really hard to concentrate... and keep your attention for a long time, so, I decided to have a structure to the piece. You'd kind of say "Oh yeah, I heard that before". You repeated sections. I had a beginning, a climax and an end. I didn't really have a theme, but I knew that I wanted it to be, you know, kind of rhythmical and structured well because, basically I think that it keeps your attention better and I decided not to use loads of sounds or even sounds that were overlapping each other because I thought that it made you feel a bit headache-y. You kind of didn't want to listen any more so that's why I used, kind of you know like, one sound, you know, a bass sound or... I didn't really think that loads of sounds mixed together worked very well so, I used lots of silences; and then like in the middle there's a big climax where people can go "oh". (*Bell goes off for the end of class*)

AMH: So structure was important for you

SW: I think that the contrast between silence and loudness worked well because you know it wasn't all going on at the same time. There were breaks where people could kind of sit there and think about it, not having to fully concentrate all the time and I think that you need that in electroacoustic music - a little bit of silence here and there because there's so much going on and other things and there are so much sounds that clash, that silence gives it a break and gives it more structure, I think.

AMH: What's your view of electroacoustic music now? You were negative at Christmas.

SW: Now my opinion has changed a bit. I think that the more you work with it the more you look at it, composing especially like, just me and Ciara on our own, it made you see that it actually is music. You have to have a structure to it. You have to have certain themes going through, because if you don't it just ends up being all sounds clashing. Now I do feel that it's a type if music that, if it's done well, it can sound OK.

Table 1: Objective Musical Concepts in Trials A, B and C

Trial A	Trial B	Trial C	
Mainly pitch shifting and time stretching; dynamics and fade-ins and outs; manual pitch bending; reverse, looping, speed change; no knowledge of flange, envelope or filter	Pitch bending; normalizing; stuck with preset sounds; echo ("cool"); robot ("really bad"); fades; able to describe looping, reversal, reverb, multitracking, acousmatic. Unable to explain flange, 44,1000Hz, stereo sampling	Stretching, pitch shifting, filtering noise, reverse; fade- out; loop duplicate; fade-in; trimming; "I used an envelope effect which was kind of fading in, coming in quietly, then getting louder and fading out again"	
Claim they are able to describe sounds; can't explain why; avoided technical terms	Used adjectives e.g. " <i>tinkly</i> " rather than technical vocabulary to describe pieces	Use of clave – "solid sound – nice beat"; robotic effect; effective; formal; fluid; "winding down like a turntable";	
"Blurry and echoey"	"Eerie and futuristic"	Manipulate, tonal, non-tonal, the sounds gelled, <i>"my piece</i> <i>is formal"</i>	
Omitted sound transformation in the definition of electroacoustic music	2 sounds feature a lot; 1 st time normal; 2 nd and 3 rd time transformed to make it aggressive	Manipulating sound; explained electroacoustic quite well to their peers	
Called it "noises and effects"	Called it "a big mix of sound effects"	Expressed new respect for the genre: "since I've spent the time with it, I've kind of learned to appreciate it more for what it is."	
Disputed that music is organized sound if out of context	Agreed that music is organized sound; but went on to say that anything could be classified as music; liked echo; changed the sound of a person running into a gunshot effect;	"You can take sounds and organize them in a way that would be musical, or that would have a melody, or that would be rhythmical. Electroacoustic music kind of shows you that's possible"	
Music conveys emotion /idea/ story; felt it was music	Thinks it is not technically music. Unsure of its status. Then said that all sounds are music.	Live sounds that you <i>can</i> make music from	
Did not discover higher level principles of electroacoustic music	Did not discover higher level principles of electroacoustic music	Discovered higher level principles of electroacoustic music	
Aware of rhythms and cadential points within the 'story'; "the insects were the beat"; substituted tonality with detection of moods	Fixated on time signature, beat, melody and elements found in tonal music; Tried to find beat and melody in the music	Scale, beat, bass notes, recurring idea, overlapping (imitation), pedal.	

Trial A	Trial B	Trial C
"We layered sounds using the tearing paper sound to keep a rhythm."	Described layering in the multitrack window in terms of homophony/polyphony: "I broke it up into 3 layers. I put one part against another part. It wasn't just homophonic"	"I did a loop duplicate; they're not all after one another; they kind of come in before the other one is finished"
Described moods	Described dynamics and repetition; associative	Described features; dynamics, winding down; climax; <i>"repetition is</i> <i>essential so you're not</i> <i>confused; "</i> first 8 seconds – one idea repeated; then more rhythmical; <i>"crazy stuff</i> which worked well"
Used moods to describe their relationship with the music	Related works back to how they made them feel – relaxed, having to concentrate, enjoyable	Not overpowering; repetition makes it more musical; Time at the end to absorb it in.
does not feature	not feature	does not feature
Pre- and post-questionnaires did not show any learning; too much guidance given with the pre-listening session (list of words); no sense of stylistic features for any era shown in answers	Went to an electroacoustic concert but could not discuss it with any new insights	Big learning curve in terms of the organization of their pieces; reflective; critical thinking; You know, you can make a piece out of just one sound and no one would be any the wiser.
"There are so many different ways to change one sound in the software, it would take a long time to fully explore them all."	<i>"The title is important – it sets the mood"</i>	"Trial and error needed to find a style you like in this genre"
Not surprised by dissonance and lack of a beat in music	Reacted badly to dissonance and lack of a beat in the music	Used dissonance well; spoke about beat a lot
Optimistic and willing to continue; articulate opinions	Cynical and uncomprehending; puzzled comments	Reflective and 'won over'. Has learnt to appreciate it. Amazed at the versatility of sound.
Looking out for things now	Wouldn't go to a concert voluntarily	Had gone to a concert and expressed an interest in the teacher's CDs.
<i>"I have a better understanding of what is going on."</i> Interested in doing some more work with this type of music.	"Did someone drop him on his head as a baby?"	"I have now grown to respect it"; "Now I do feel that it's a type if music that, if it's done well, it can sound OK."

Table 2: Composing Procedures in Trials A, B and C

Trial A	Trial B	Trial C
No strict parameters: compose a piece lasting 30"	Stricter parameters: Asked to use two contrasting sounds; 30 – 60"; to use repetition and variation; not to write a programmatic piece	Fill 60" with sound(s) in a manner that makes sense to you (and that you like) Must be abstract. Use as few sounds as possible
Constructed a programmatic piece: a story made from sound effects	Constructed a programmatic piece: a story made from sound effects; unable to structure a non-illustrative piece; Structure: ABC and ABA	Constructed an absolute piece each: "to have an idea running through it, not just one sound here and one sound there."
Did not develop motives Counter-rhythm at one point. Dynamics play a big part; "The most musical aspect: builds up, reaches a climax and winds down"	Did not develop motives Plop at the end (<i>'class'</i>); applause (indoor reverb in outdoor scene);	Developed motives "Needs a bass part – holds it together – gives it substance" "Structure holds the listener's attention and gives them time to think"; recurring ideas
Wanted to try a melodic ostinato but ran out of time; enjoyed the sounds – but too many to choose from	Found unusual combinations of sounds 'weird'; criticised this mix; Influenced by sound source rather than exploring possible transformations	Used noise as a recurring idea to give continuity; didn't feel the need to fill it with sound; silence NB; good use of clave; two bass notes – one cello + one other transformed sound;
No attempt at abstract piece	Poor attempt at abstract piece	Good abstract pieces
Aware of the listener: "you can't let the audience's mind wander contrast to keep it from being samey and boring"	Aware of the listener: "to keep the listener interested and keep their attention"	"The listener will thinklistening in waiting for something to happen"
"The sounds we were presented with were good. Enough of them were similar that you could get a theme going"	"It would be too hard to keep someone's attention for 30" with just two sounds"	"One sound, one note can be stretched change pitch could make a whole song on one note"
Learned about climax: getting loud; something that makes it stand out; could end abruptly	Knew about climax already	Worked to a climax – dramatic;
Aware of contrast as a device	Aware of contrast as a device	Both had unity/continuity; a bong effect so it's not overpowering; water – fluid – end; spaced out drips – rhythm; recurring bass notes;

Trial A	Trial B	Trial C
Timpani Perfect Cadence (implied chord V to chord I)	Contextually inappropriate use of applause and percussive gesture; able to define reverberation but unable to apply it correctly	One piece very well worked out – she liked tonal; other had new ideas coming in at the end and less development – preferred non-tonal
Knows there has to be a theme going through it	<i>"It kind of wrote itself"</i>	Dynamic contrast in one piece; More 'action' in the other
Did not discuss programmatic or absolute music before starting	Discussed programmatic and absolute music before starting	Actively strove to create an abstract piece
Unaware of the importance of structure until prompted	Aware of structure but unable to create it; no structure at all in their abstract attempts	Structured pieces; musically justified reasons behind the sound organization; "one idea not heard again just makes you confused"
Used sounds to illustrate a story rather than as independent entities e.g. "we used the bell to signify the end of the battle"	Used sounds to illustrate a story rather than as independent entities	Used sound to create an effect. Each sound fulfilled a purpose e.g. rhythmic, movement, dynamic; changed the dynamic so that it would lead you up to a climax;
Wanted to try a melodic ostinato but ran out of time; enjoyed the sounds – but too many to choose from	Found unusual combinations of sounds 'weird'; criticised this mix; Influenced by sound source rather than exploring possible transformations	Used noise as a recurring idea to give continuity; didn't feel the need to fill it with sound; silence NB; good use of clave; two bass notes – one cello + something transformed;

Table 3: Constructivist Learning Environment and Action Learning in Trials A, B and C

Trial A	Trial B	Trial C	
Worked in pairs; had to share the piece.	Worked in pairs; had to share the piece.	Worked in pairs; each girl owned a piece.	
Shared and developed ideas together	4 girls preferred working together; 2 girls relented only after trying it apart	Retained autonomy in the group – "Ciara used the clave note as well but she put a kind of a robotic effect on it whereas I don't even think that I changed it"; each girl 'owned' her own piece; supported each other.	
Pair work only; no individual work	Pair work; also tried working as individuals – unsuccessfully	Individual had more power within the group	
"We just weren't getting the sounds we wanted so we had to change them"	Self-criticism: "the sounds are very independent of each other so it might be better to try and mingle them a bit together"	"You can make a whole song on one note if you just rearrange it all"	
Left to their own devices	Part 1 investigated timbre using real world sounds; Part 2 investigated structure using a tune	One girl only realised a week after finishing when she heard her piece on CD that her piece was not well structured. NB Reflection	
One pair fought	One pair fought; said it would be "easier to work on your own." It wasn't.	One girl's piece made the other more aware of structure; listened to each other's views	
Video captured the whole process. Teacher visited each group in turn	Felt isolated when working on their own and when the teacher wasn't in the room	Liked not being supervised during some of the composing – could experiment more	
group in turn.	teacher wasn't in the room	– could experiment more	

Table 4: Teaching Strategies in Trials A, B and C

Trial A	Trial B	Trial C
Pre-composing listening	Pre-composing listening	Pre-composing listening
Little or no familiarity with	Listening journal; Went to a	Trial B experience plus some
the repertoire	concert	extra listening
Explored sound using audio	Explored sound using audio	Explored sound using audio
editor	editor	editor
Waveform and Multitracking	Waveform and Multitracking	Waveform, Multitracking and
windows	windows	Spectral views
Teacher did not model any	Teacher modelled an example;	Teacher modelled examples;
example	didn't help	this helped a lot
One unplanned teacher	More input at the start.	Big teacher input at the start;
intervention: re climax -	Teacher mad one unplanned	kinaesthetic, visual, auditory,
analogy	intervention: re sounds and	blackboard, props, journal for
	context; analogy	record-keeping, modelling
Almost non-existent support	Preparatory work extending	Scaffolding, Coaching and
	over weeks; little guidance	Fading as necessary; withdrew
	during the composing period	guidance when composing
		began
"Hearing a sound in your	Too many students working at	Re panning: "we knew what
head and trying to get it out of	same time – teacher could not	we wanted but we couldn't do
<i>the computer</i> ". More support	provide adequate support,	it on our own". They said that
needed	especially when the 6 students	they would like to have had
	were working alone	more support.
One hour of sound and	Two hours of sound and	Two more hours of sound and
software exploration:	software exploration:	software exploration: adequate
inadequate	inadequate	
One hour of composing –	Four hours to compose two	Open-ended composing; six
inadequate	pieces – inadequate	hours for one piece
Had covered Classical,	Pre-project training in analysis	Had studied Baroque,
Romantic periods as well as	of Baroque music; no contact	Classical and Romantic
some 20 th century music in	with later styles yet	periods; no 20 th century
class		experience yet

Trial A	Trial B	Trial C
Nothing to base their composing on: no familiarity with repertoire	Listening journal: some familiarity with repertoire – 8 tracks on CD	Some hands-on experience of illustrating a story in sound; some familiarity with repertoire
Problems with trimming, naming, saving, retrieving and managing files	Problems with trimming, naming, saving, retrieving and managing files	Named and organized files and folders without difficulty
56 sounds: too many sound files, especially non-tonal	20 sounds: too many non- tonal sound files; poorly chosen sounds e.g. animals	20 sounds: hardly any non- tonal sound files. Tunes were included as source files
Not asked to limit themselves to a few sounds	Asked to limit themselves to a few sounds; did not comply	Asked to limit themselves to two sounds if possible; did not comply
Left to their own devices; had to refer to elements associated with tonal music	Part 1 investigated timbre using real world sounds; Reflection-in-action led to Part 2 –investigation of structure using a tune	One girl realised a week after finishing that her piece was not well structured. Heard it on CD. Reflection NB
One hour of composing – inadequate	Four hours to compose two pieces – inadequate	Open-ended composing; six hours for one piece

Trial C: Post-composition interview with Ciara and Susan together

AMH: What did you learn?

SW: I learned, especially from this session, that electroacoustic IS actually music. I think the last session we had, it was more kind of, because you were working with sounds that were kind of daily sounds or you know, not daily sounds ... jungle kind of sounds... sounds that you were already given, it was very much the sound of... you know, what other people are doing for you. I think with this one – it's more your own. You know, you can mess around with sounds, you can make it musical or you could change it around. I think that, I learned that, you know, you can basically make music from anything. Like sounds, you know can be... when they played it in any way... you could... as in... one sound, one note can be, you know, stretched or change pitch and that could make a whole song on one note if you, like, re-arrange it all. So I think I definitely learned that, you know, sounds CAN be used to make, you know, music and music that has a melody and a rhythm, especially with my piece. I think that mine definitely is kind of musical because the aspect of electroacoustic music that I didn't really like was the fact that there's so much sounds going on together in most pieces that I've heard – all these sounds clashing and kind of competing to be the loudest. I think with mine it's more of a structure. More kind of like, what I'd like to hear, more easy listening. And I think when you're listening to music you don't want to have to concentrate so much and have to analyse everything that's going on. It gets annoying and you just throw it away, whereas with the piece that I did, anyway, it's more easy to listen to. You could listen again and again without getting sick of it or getting annoyed with it, because you know, it's not overpowering.

CMcG: I agree with Susan. I feel now that electroacoustic music is more... music... like when I first started at Christmas... I just felt it was sounds just thrown together and that not an awful lot of thought was put into it, they weren't doing any kind of recurring themes, but since I've spent the time with it, I've kind of learned to appreciate it more for what it is. Live sounds or daily sounds like the birds... a train... that you *can* make music from that whereas sounds that we listen to every day, we don't even think twice about it being music, whereas now I think I would and I'd be listening out for, you know, funky beats or from just a car or, you know, a train that... you know, something like that.

AMH: What is music?

CMcG: Music, for me, personally is something that I enjoy listening to, that... I think it has to have some sort of recurring melody or theme or a beat that I can get into. That would kind of be music to me.

SW: Yeah, I think music is probably sound, really, 'cause like you know sound *is* music. People say you've got a very musical tone to your voice or, as you say the sound of the train coming in or the noise of rustling paper.. I think that's music... I think music is organized sound, probably. You can take sounds of rustling leaves or you can take sounds of voices and you can just organize them in a way that would be musical, or that would have a melody or that would be rhythmical. I think that electroacoustic music kind of shows you that's possible.

Trial C: Interview with Composer of <u>SvL</u> (Susan)

(Technical terms and ideas relating to sound and composition are underlined)

AMH: Could you explain your piece for us? Play any bits that might illustrate your points.

SW: Well, basically my personal opinion is that I don't like lots of sounds all together, but you obviously need climax so that's why my climax is real dramatic because everywhere before that is all silence, and kind of you know, ... like there's gaps and then there'd be a bit of a noise but even the noises aren't really that loud, so I just thought that it worked better to have kind of a structure...instead of having all sounds, all sounds, all sounds... to have, like, silence, loudness, slowly winding down and I think dynamics played a part in mine as well. It was kind of getting loud, getting soft. So basically I like the repetition in it because it just kind of makes it more musical I think, maybe, a bit because most of the pieces I've heard so far it's just been one idea and you haven't heard it again and it makes you all kind of confused. I think the beginning of mine, you know, there's repetition; the first eight seconds or so, there's two ideas... sorry, one idea, repeated twice and then it starts getting more rhythmical with two kind of 'thun-thun' notes and I've used the noise filtered all through my piece. That's like a recurring idea because I think that you need, kind of, things to let you know that this is like one piece, not just bits of pieces put together... to give continuity... to have some idea running through and not just a sound here and a sound there, so all along here is all very easy to listen to; there's not much sound, there's more silence and then it gets louder with the bass note here, which is a cello note... I don't think I did anything to it and then. I'm not sure what sound I used there. It could have been a clave note. Or the end of some note - I reversed it and made it longer; I stretched it and changed the dynamics on it so that it would lead you to up to a climax. The pitch was changed as well. Then the climax is totally different from the start. It's all noises together. I've used these two 'Crosstalk' sections. They're the main idea but then I have, like, two bass kind of notes, which is the cello again and it's the end of something, reversed again. It kind of gives you a 'bong' effect so that it's not overpowering. These two because they're so loud, as it is, are kind of adding to it, a bit, I think. Then you have the noise again, just to, again, give continuity to the piece, just to show you that it's one piece. And along here I've used water sounds just to make it more fluid, make it more, you know, it's coming to an end, especially with this one - I faded it out. It's getting kind of loud and then, soft, soft, soft. And this was an organ note. I changed the pitch and made it go winding down like on a turntable... that sound effect. And then the noise again. And then the last one was the drips. They're spaced out... there's one final drip. I took that from 'Dripsody'- that was already spaced.

The <u>clave</u> note, I used that <u>quite a lot</u> in mine because I think <u>it kind of hits you</u>; it's a <u>solid</u> <u>sound</u>, you know what I mean; there's nothing kind of like 'oh, what was that?' and you kind of know it's the... whatever. It's a thing and <u>you could mess around with</u> it and make it sound... Ciara used the clave note as well but she put a kind of a <u>robotic effect</u> on it whereas I <u>don't even</u> <u>think that I changed</u> it. I think I just left it; maybe I put a <u>fade</u> in on it. It gave a <u>nice beat</u>.

The title is *Silence versus Loudness*, which is what it is, because at the beginning it's <u>so silent</u>, there's <u>gaps</u> everywhere and then the <u>loudness comes on</u> half way through in the climax. It's so loud; it's almost like 'Oh my God'. <u>It really shocks you</u>. So I think that the reason I really call it that is because people would say they don't go together, they're <u>opposites</u>, but when you put them <u>in the right kind of way, they do fit</u>. It can actually be <u>more effective</u> to have silences and

loudness together and <u>suddenly</u> after one another, because my piece from the very beginning is very kind of <u>formal</u>. This is it and this is it. And then next of all, the <u>dynamics getting louder and</u> then, <u>crazy stuff</u>, which <u>I think worked well</u>. <u>I think if I had loads of different sounds from the</u> beginning it wouldn't have had that effect, the climax I think you need it. Because there's repeated sections and there's kind of a rhythm there, the <u>listener</u> will think 'alright this has got a bit of a beat to it' and then they'll be kind of listening in and <u>they'll be waiting for something to</u> happen and then it does happen so I think the <u>climax would definitely take your attention</u>. And also, the ending, it gives you time to <u>relax and mellow out</u>, so that the listener, when they hear it will say ' yeah it started off slowly but it got, you know, a good climax. The end gives you time to say' oh yeah, I like that' and time to absorb it in.

AMH: You keep mentioning noise. Was it actually noise?

It was noise, yeah, noise just filtered, so it wasn't as harsh, I think. It was a good one to lead you into a silence, I think. It goes tchhhh... so.

Trial C: Interview with composer of <u>Alien Complete</u> (Ciara)

(Technical terms and ideas relating to sound and composition are underlined)

CMcG: Well I think my piece is <u>different from</u> Susan's. I think it shows <u>two aspects</u> of electroacoustic music.

Susan's shows more of how you can get a <u>kind of a melody</u>. It's <u>more musical</u>. Whereas I think <u>mine is more sounds</u>. I think it's more <u>kind of raw</u>, in a way, even though I did use <u>recurring</u> <u>bass notes</u>, <u>cellos</u>, <u>things like that</u>. I think mine shows a different view that you can get from electroacoustic music. I like to have <u>a lot more stuff going on</u>, like action-wise. Having <u>not an</u> <u>awful ot of silences</u>... but having kind of <u>different sounds</u>, to see what the <u>listener</u> likes and dislikes about it.

<u>I didn't have a plan</u>. I kind of had all my sounds just all thrown together and when I heard Susan's when she was making her piece... <u>I kind of got influences off her to have a structure</u> and to <u>organise my sounds better</u>.

Before, I basically thought that electroacoustic music was just a whole bunch of sounds thrown together.. But now I realise there kind of IS structure to it and you don't just throw it together in five minutes. It takes a while to do and it's kind of appreciated more now that I've done it. I did it kind of for myself – what I liked. I wasn't really taking anybody's opinion into consideration. Susan helped me a bit – what she liked and disliked and, with myself and my own opinions, I kind of worked around that.

My favourite section would be <u>my violin/train like section</u> (*plays it*). I kind of like the next section as well (*plays it*). The train sound was actually on the computer already and I made it <u>fade in and I used it three times</u> – I did a <u>loop duplicate</u> on it. They're <u>not all after one another</u>. They kind of <u>come in before the other one is finished</u>. And the same with the <u>bassoon</u>. I kind of <u>took the end...I trimmed the end off it and I made it repeat</u>.

I kind of like <u>the cello</u>, really. I thought that was kind of nice. You could <u>do quite a lot with it</u>. I only used <u>one note</u>. It was the cello. It was kind of like the <u>scale</u>. And you could change <u>the pitch</u> and you could <u>stretch it</u>. I think it was nice for <u>a bass</u>. It really <u>helped your piece to come along</u>. The <u>tuney bits</u>, I took them from the pieces that were on the computer and I either <u>changed them</u> around or I reversed them or added... I filtered them or added an effect to them. I think maybe my drip-heartbeat which I have going through the piece, I feel it's like <u>a heartbeat</u>. I just left it alone 'cause I liked the beat (*plays it*). I didn't space them to come out like that. They were like that already – from '*Dripsody*'

Screen shot and brief analysis of <u>SvL</u>



S v L (Silence v Loudness) by Susan Wilkinson: March 2004

Screen Shot of the finished waveform

This piece works well. The start has a long note and repeated rhythmic idea on the clave. The long note acts as a pedal through the piece and unifies it. There is a 3-note melodic figure played and reversed at about 16". The cello is heard for the first time at 19". The climax is reached between 31" and 35". Some new elements are introduced after this but they are not out of place. There is a gradual winding down. The dripping sounds at the end would have been more effective if they had played a part earlier on. However, having a rhythmically based ending to correspond with the beginning is a good idea. Apart from the climax, the sounds are deliberately separated by silence or by their different timbres. (AMH)



Screen shot and brief analysis of *<u>Alien Complete</u>*

Alien Complete by Ciara McGinley: March 2004

Screen shot of waveform

It is apparent that there is no climax. The loudest section occurs relatively early, between 20 and 24". The start has potential. It hints at something interesting but nothing evolves from this. A cello note intrudes a few times. It's difficult to know why. The heartbeat sound works well, however. Two separate melodic figures are played and reversed. These do not seem to have any relevance to the rest of the piece. Likewise, there are other melodic interruptions that do not seem to have a function. There is no structure. The individual timbres, if organized better, could make an impact. (AMH)

Appendices for the Artefact

Appendix Art1



An extract from <u>*FADE*</u> in the multitrack window during the editing process



Screen recording demonstrating how to use the software

The following short extracts are in the works folder

Milton Babbitt: Philomel John Cage: Williams Mix Rhona Clarke: Pied Piper Donnacha Dennehy: derailed Donnacha Dennehy: Metropolis Mutabilis Roger Doyle: Under the Green Time Benjamin Dwyer: Crow Herbert Eimert: Klangstudie 11 Paul Lansky: Idle Chatter Paul Lansky: idlechatterjunior Hugh le Caine: Dripsody Katharine Norman: Hard Cash Katharine Norman: Fuga Interna - Sequence Steve Reich: Come Out (to show them) Steve Reich: It's Gonna Rain Pierre Schaeffer: Etude aux Chemins de Fer Karlheinz Stockhausen: Kontakte Morton Subotnick: Silver Apples of the Moon Edgar Varèse: Poème Electronique Mike Vaughan: Crosstalk Trevor Wishart: Vox 3 Iannis Xenakis: Hibiki-Hana-Ma

Short extracts from the repertoire help to establish the historical as well as the artistic context of the music

Process

It is recommended that the students work in pairs. Follow the plan as laid out on the CD:

- 1. Go through the origins of *Musique Concrète* and how it differs from electronic music.
- Do not skimp on the time you spend exploring the audio editor as this will prevent problems with file management when the students are working on sound transformation later. They sometimes have difficulty with the practical process of saving their chosen files.
- 3. Next, explore sound. The CD deals with five main areas of sound transformation.
- Remind the student that the performing space is important, even though there are no performers. In their compositions, sound can travel from speaker to speaker. Reverb and other effects can also add depth to their work.
- 5. When they have familiarised themselves with the available sound sources and their transforming possibilities, the students will learn how to organize them into a coherent work. The CD presents five important devices for structuring their ideas.
- 6. The section on structure gives fundamental guidelines for the students' future listening. These are the elements they will actively try to find in other composers' work.
- Be careful that their compositions do not over-emphasise a sequential story-line. You
 may need to discuss the idea of programmatic and non-programmatic music with the
 students using the examples mentioned here.
- For the task, ask each pair of students to compose a sixty-second piece, with one person 'in charge of' and ultimately responsible for one piece. The other person offers feedback.
- 9. It is possible to compose a piece using only one or two sound sources. However they may use more, as you see fit.
- 10. The audio editor on this CD works with wav files only. There is a link to a website where a free converter may be downloaded, should the students wish to use any of the mp3 examples in their own piece.

Teacher's Guidelines are found in the Resources area

Check list for composing

- timbres
- variety
- unity
- placing of events
- relationship of events to each other
- build-up to a climax
- climax
- resolution of the climax
- layers
- role of dissonance and
- use of silence as a rhythmical device

Composition section: Reminders

Listening worksheet

- 1. What is the overall duration of the piece?
- 2. How many different ideas can you hear?
- 3. What are those ideas?
- 4. How do the ideas relate to one other?
- 5. How does the composer achieve unity in the piece?
- 6. How does the composer achieve variety?
- 7. Are there any surprises? Where?
- 8. Does the piece have a climax? If so, how is it made and when does it occur?
- 9. Can you hear any 'classic' structural techniques?
- 10. Is there a beat?
- 11. Is there a tune?
- 12. Do you recognize any of the timbres?
- 13. Are there any silences between the ideas?
- 14. Where has the composer placed changes in (a) texture? (b) dynamics? (c) timbre?
- 15. Is the piece programmatic or absolute?
- 16. How relevant is the title, in your opinion?
- 17. What mood is conjured up, if any?

Resources section: Listening worksheet

References

- Babbitt, M. (1958, February). Who cares if you listen? In *High Fidelity, 8* (2). New York: Hachette Filipacchi Magazines. Retrieved April 8, 2003, from <u>http://www.palestrant.com/babbitt.html</u>
- Bennett, R. (2001). Fortissimo! Cambridge: Cambridge University Press
- Bowman, D. & Cole, B. (1989). Sound Matters. London: Schott Ed. Publications
- Bresler, L. (1996). Basic and Applied Qualitative Research in Music Education. In *Research Studies in Music Education, 6,* 5-17. University of Southern Queensland: USQ Press
- Brocklehurst, B. (1971). Response to Music. London: Routledge & Kegan Paul
- Dennehy, D. (2003, February). Rooted in Zest. In *New Music News*, pp. 9–11. Dublin: Contemporary Music Centre
- Dhomont, F. (2003). Interview. *The Whole Note*, 8 (10). Toronto: WholeNote. Retrieved November 11, 2003, from http://www.thewholenote.com/wholenote_jul_03/composer.html
- Elliott, D. (1995). *Music Matters: A New Philosophy of Music Education*. New York: Oxford University Press
- Gardner, H. (1991). The Unschooled Mind. New York: Basic Books
- Hargreaves, D. (1996). The development of artistic and musical competence. In Deliège, I., & Sloboda, J. (Eds.), *Musical Beginnings* (pp. 145–170). Oxford, New York, Tokyo: Oxford University Press
- Herschbach, D. R. (1998). Reconstructing Technical Instruction. In *Journal of Industrial Teacher Education*, 36 (1). Virginia Polytechnic and University: Digital Library and Archive Retrieved January 5, 2004, from http://scholar.lib.vt.edu/ejournals/JITE/
- Hodges, R. (1996). The New Technology. In C. Plummeridge (Ed.), *Music education: trends and issues* (pp.77-94). London: Institute of London, University of London
- Jonassen, D.H., Peck, K.L., & Wilson, B. G. (1999). *Learning with Technology: A Constructivist Perspective*. New Jersey, Ohio: Merrill, Prentice Hall
- Jonassen, D.H. Design of Constructivist Learning Environments. Retrieved March 6, 2003, from http://tiger.coe.missouri.edu/~jonassen/courses/CLE/
- Landy, L. (1991) Sound Transformations in Electroacoustic Music. Retrieved April 11, 2003, from http://www.bath.ac.uk/~masjpf/CDP/landyeam.htm
- Lansky, P. (1994). More than Idle Chatter. CD liner notes. Bridge Records 9050
- Manning, P. (1993). Electronic and Computer Music. (2nd ed.) Oxford: OUP

(1999). Ownership and control of the creative process in the composition and performance of electroacoustic music. Retrieved May 2, 2003, from http://mitpress2.mit.edu/e-journals/LEA/ARTICLES/manning.html

(2003). The Influence of Recording Technologies on the Early Development of Electroacoustic Music in *Leonardo Music Journal, 13,* 5-10. Cambridge: MIT Press

- Murail, T. (2001) Interview. Retrieved October 30, 2003 through http://www.musica-ukrainica.odessa.ua/interviews.html
- National Council for Curriculum and Assessment (1996). *Leaving Certificate Music Draft Guidelines for Teachers*. Dublin: NCCA
- Norris, M. (1999). Reinstating Interpretation: the status of analysis in an electroacoustic context. In *MikroPolyphonie 5*. Paper delivered at Australasian Computer Music Conference, Victoria University of Wellington, New Zealand. Retrieved April 5, 2003, from <u>http://www.mikropol.net/volume5/norris_m/norris_m.html</u>

Papert, S. (1996). The Connected Family: Bridging the Digital Divide. Atlanta: Longstreet Press

- Paynter, J. (1992). Sound and Structure. Cambridge: Cambridge University Press
- Pitts, A., & Mawuena Kwami, R. (2002). Raising students' performance in music composition through the use of ICT: a survey of secondary schools in England. In *British Journal of Music Education*, 19 (1), 61-71
- Reigeluth, C.M., & Frick, T.W. (1999). Formative research: A methodology for improving design theories. In C.M. Reigeluth (Ed.), *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory, Vol. 2.* Hillsdale, New Jersey: Lawrence Erlbaum Associates
- Reimer, B. (1989). *A Philosophy of Music Education*. Englewood Cliffs, New Jersey: Prentice-Hall
- Regelski, T. A (1992). The action value of musical experience and learning. In J. Paynter, T. Howell, R. Orton, & P. Seymour (Eds.), *Companion to Contemporary Musical Thought, Vol.1* (pp. 105–124). London, New York: Routledge
- Russcol, H. (1972). *The Liberation of Sound: An Introduction to Electronic Music*. Englewood Cliffs, New Jersey: Prentice-Hall
- Schaeffer, P. (1966). Traité des objets sonores. Paris: Editions du Seuil
- Schafer, R. M. (1979). The Rhinoceros in the Classroom. Canada: Universal Edition Ltd.
- Schon, D. A. (1991). The Reflective Practitioner. Aldershot: Ashgate Publications
- Sessions, R. (1970). *Questions about Music*. Cambridge, Massachusetts: Harvard University Press

- Schrader, B. (1981). *Introduction to Electroacoustic Music*. Englewood Cliffs, New Jersey: Prentice-Hall
- Smalley, D. (1986). Spectromorphology and structuring processes. In S. Emmerson (Ed.), *The Language of Electroacoustic Music* (pp. 61–93). London: Macmillan
- Stockhausen, K. (1989). *Stockhausen on Music: Lectures and Interviews*. Maconie, R. (Ed.) London, New York: Marion Boyars

Swanwick, K. (1979). A Basis for Music Education. Windsor: NFER-Nelson

(1988). *Music, Mind and Education*. London: Routledge

- (1992). What Makes Music Musical? In J. Paynter, T. Howell, R. Orton, & P. Seymour (Eds.), *Companion to Contemporary Musical Thought, Vol. 1* (pp. 82–102). London, New York: Routledge
- Truax, B. (1992). Electroacoustic music and the Soundscape: the Inner and Outer World. In J. Paynter, T. Howell, R. Orton, & P. Seymour (Eds.), *Companion to Contemporary Musical Thought, Vol.1* (pp. 374–397). London, New York: Routledge

(2000). The aesthetics of computer music: a questionable concept reconsidered. In *Organised Sound*, 5 (3), 119–126. Cambridge University Press

Varèse, E. (1936). *New instruments and New Music*, Lecture at Mary Austin House, Santa Fe Retrieved January 5, 2004, from http://helios.hampshire.edu/~hacu123/papers/varese.html

(1939). *Music as an Art-Science*. Lecture at University of Southern California. Retrieved January 5, 2004, from <u>http://helios.hampshire.edu/~hacu123/papers/varese.html</u>

(1959). *Rhythm, Form and Content*. Lecture at Princeton University. Retrieved January 6, 2004, from <u>http://helios.hampshire.edu/~hacu123/papers/varese.html</u>

(1962). *The Electronic Medium*. Lecture at Yale University. Retrieved January 6, 2004, from <u>http://helios.hampshire.edu/~hacu123/papers/varese.html</u>

Webster, P. R. (2002). Computer-based technology and music teaching and learning. In R. Colwell & C. Richardson (Eds.), *The New Handbook of Research on Music Teaching and Learning* (pp. 416–439). Oxford: Oxford University Press.

White, J. D. (1984). The Analysis of Music. New Jersey, London: Scarecrow Press

Winnips, K. (2000). Quoted in article *Scaffolding to Success*. Retrieved February 12, 2004, from <u>http://www.education-world.com/a_curr/curr218.shtml</u>

Wishart, T. (1985). On Sonic Art. London: Imagineering Press