

Unit 35: Sound Creation and Manipulation

Unit code:	J/600/6928
QCF Level 3:	BTEC National
Credit value:	10
Guided learning hours:	60

● Aim and purpose

The aim of this unit is to develop learners' abilities to use the functions of synthesisers and samplers in creative music projects, establishing a basis in acoustic theory that will be transferable and fundamental to their use of music technology in the future.

● Unit introduction

More than forty years after the first commercially available model arrived, synthesisers are still very much at the forefront of modern music-making. With the proliferation of software synthesis, the diversity of synthesisers and synthesis methods has never been greater, with the ability of the computer software designer to emulate what would be technologically difficult, and prohibitively expensive, to produce if it were ever created in hardware.

Therefore, it is critical that today's producer of music is familiar with the terminology and functionality associated with synthesisers so that they are able to control the ever-widening palette of sound.

Throughout this unit, learners will become familiar with the language of synthesis, which, even with today's advances, still borrows much from the analogue inventions of the 1960s and 1970s. To this end, wherever possible, learners are encouraged to compare software with hardware.

The other instrument to be found at the foundation of sound creation and manipulation in modern music-making is the sampler. Again, it is originally a hardware device that is now predominantly computer based. Sampling, a technique that often involves 'borrowing' and manipulating pre-existing material, has always been controversial, and it is important that learners balance the development of these skills against continuing discussion on ownership and plagiarism. The concept of 'free' music has been computer-driven, and learners should prepare for the world of work with a balanced view.

● Learning outcomes

On completion of this unit a learner should:

- 1 Understand the relationship between acoustic theory and the fundamentals of synthesis
- 2 Be able to use the editing functions of a synthesiser
- 3 Be able to use the editing functions of a sampler
- 4 Be able to realise musical ideas that combine synthesis and sampling techniques.

Unit content

1 Understand the relationship between acoustic theory and the fundamentals of synthesis

Acoustic theory: frequency; wavelength; amplitude; fundamental and harmonics; integer and non-integer multiples; instruments eg strings, open and closed pipes; envelope eg attack, sustain, decay, release

Subtractive synthesis: creating timbres by removing upper partials from a complex waveform; filter cut-off; filter resonance

2 Be able to use the editing functions of a synthesiser

Editing functions: eg oscillator, amplifier, filter, envelope generator, low-frequency oscillator, modulation, patch-bay, preset, monophonic, polyphonic, parameter select, parameter change

3 Be able to use the editing functions of a sampler

Waveform editing: eg acoustic theory of waveforms, loops, sample start and end points, sample looping, selections, regions

Creating instruments: eg instruments, zones, groups, file organisation, multi-sampling, velocity layers, one-shot, reverse

Editing parameters: eg volume, pan, filter, LFO, modulation, hold, voices, Mono/poly

4 Be able to realise musical ideas that combine synthesis and sampling techniques

Synthesis: creating original sounds appropriate to the style of the musical project

Sampling: capturing, editing and organising sample data appropriate style of the musical project

Musical ideas: arranging skills (awareness of structure, idiom, texture); originality and plagiarism (sample clearance, MCPS, acceptable idiomatic use, notions of ownership); combining synthesis and sampling techniques in the same musical project

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 explain the relationship between acoustic theory and the fundamentals of synthesis [IE, CT, SM]	M1 illustrate the relationship between acoustic theory and the fundamentals of synthesis	D1 analyse the relationship between acoustic theory and the fundamentals of synthesis
P2 demonstrate the editing functions of a synthesiser competently with limited tutor support [IE, RL, SM]	M2 demonstrate the editing functions of a synthesiser confidently with total independence	D2 demonstrate the editing functions of a synthesiser showing mastery of the processes involved
P3 demonstrate the editing functions of a sampler competently with limited tutor support [IE, RL, SM]	M3 demonstrate the editing functions of a sampler confidently with total independence	D3 demonstrate the editing functions of the sampler showing mastery of the processes involved
P4 realise musical ideas that combine synthesis and sampling techniques. [IE, CT, RL, SM, EP]	M4 realise musical ideas that combine synthesis and sampling techniques competently.	D4 realise musical ideas that combine synthesis and sampling techniques with confidence and flair.

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers CT – creative thinkers	RL – reflective learners TW – team workers	SM – self-managers EP – effective participators
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Essential guidance for tutors

Delivery

This unit is aimed at music producers, composers and sound designers. The essential role of synthesisers and samplers in contemporary music production should be explored in depth and learners encouraged to focus on the practical benefits of a high level of familiarity with the technology and techniques involved. This exploration of the tools and techniques available to users of synthesisers and samplers will underline their essential role in the creation of modern music.

Using the correct vocabulary for this unit is vital and should be integrated into delivery so that learners familiarise themselves with the appropriate terminology and reinforce the links that this unit makes with acoustic theory. This unit should be delivered in practical workshop sessions. Ideally, learners should have access to a range of synthesisers; some sequencing packages provide an extensive range that is more than adequate to address the software element of this unit; other packages will need to be supplemented with stand-alone or plug-in software synthesisers. The same holds true for software samplers. Learners should have access to their own computer for these sessions. Hardware synthesisers should also be available. While it is unlikely that each learner will have sole access to a synthesiser of this type in a class setting, the opportunity to compare software and hardware, especially 'vintage' analogue hardware, is an invaluable teaching aid in this subject.

How the delivery of this unit is structured will depend on learners' prior experience. Some centres may choose to deliver this unit at the start of the course, but it is more appropriate that learners already have a good working knowledge of *Unit 14: Listening Skills for Music Technologists* and *Unit 32: Sequencing Systems and Techniques*. Demonstrations where all learners watch the tutor's screen may be required, but ought to be limited so that learners are engaged with their own computer or synthesiser set-up as much as possible.

Learners will develop musical ideas from an early stage. Learning and assessment of the theoretical/technical aspects of the unit should be integrated into practical creative tasks wherever possible. Learners are not obliged to treat learning outcome 1 as an entirely theoretical exercise, preceding any practical work. The analysis that learners perform as a natural part of the work they carry out for the later outcomes could form the basis for the written work required for learning outcome 2.

Group sizes should be kept to a level that allows tutors to engage in regular contact with learners who may be spending significant amounts of time isolated through headphone use, and a classroom management system should be in place that supports this style of activity. Therefore, it is essential that the whole group balances this with regular reviews of work in progress.

It is likely that some project work will provide evidence that will meet more than one grading criterion. It is probable that work of this nature will take place in the later stages of the course, after a range of techniques has been learnt.

Finally, learners should be encouraged to integrate the skills learnt in this unit into their other work wherever possible. It is vital that they see how the ability to use a synthesiser and sampler can support much of the work they will be undertaking in other units.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction to the programme and structure of the programme of learning.
Understanding the relationship between acoustic theory and the fundamentals of synthesis. Theory classes on: <ul style="list-style-type: none">• acoustic principles• musical instrument theory• synthesis – the terminology of subtractive synthesis• the sections of a subtractive synthesiser.
Assignment 1: Acoustic Theory and the Fundamentals of Synthesis – P1, M1, D1 <ul style="list-style-type: none">• Learners to prepare written piece OR• Learners to prepare presentations with tutor facilitation.• Learners to give presentations.• Peer and tutor feedback to be reviewed and actions noted.
Using the editing functions of a synthesiser. Tutor-led workshops to cover: <ul style="list-style-type: none">• editing functions• recreating sounds• using different synthesisers.
Assignment 2: Recreating a Sound with a Synthesiser – P2, M2, D2 <ul style="list-style-type: none">• Learners will give practical demonstrations.• Tutor observation.• Optionally – learners create a written report.
Using the editing functions of a sampler. Tutor-led workshops to cover: <ul style="list-style-type: none">• using captured audio• creating sampler instruments• editing sampler parameters.
Assignment 3: Using a Sampler – P3, M3, D3 <ul style="list-style-type: none">• Learners will give practical demonstrations.• Tutor observation.• Optionally – learners create a written report.
Using synthesis and sampling techniques to create a musical project. Tutor-led workshops to cover: <ul style="list-style-type: none">• using synthesisers with sequencing software• using samplers with sequencing software.

Topic and suggested assignments/activities and/assessment

Assignment 4: Synthesis and Sampling Project – P4, M4, D4

Learner practical work/resource-based learning.

Review of unit and assignments.

Assessment

This unit requires a variety of evidence to be created by learners. Learning outcome 1 can be addressed as a written assignment. Taped interviews video evidence or online quizzes can also be used, although these might need to be supplemented with written work to satisfy higher grading. Alternatively, learning outcome 1 can be combined with other practical criteria in this unit. Demonstrating editing functions while using appropriate terminology to describe the process is an acceptable way to do this, as long as appropriate measures are in place for recording evidence against each criterion.

To achieve P1, learners will provide a simple and elaborated explanation of the fundamentals of synthesis with reference to acoustic theory. Elaborating this with reference to examples (recordings of sounds created) will evidence M1. For D1, learners will discuss how closely the chosen model of synthesis reflects all attributes of acoustic theory, and limitations imposed by this model with a reference to alternative methods.

Learning outcomes 2 and 3 can be evidenced using a variety of formats, but in a practical context are most easily addressed with video evidence of demonstration(s) supplemented by tutor observation reports. The demonstration(s) should be carried out as a response to predetermined questions in order to maintain fairness of opportunity. To meet learning outcome 2 learners will demonstrate the recreation of a given sound using the editing parameters of a synthesiser. Learners who require some tutor intervention will achieve P2. Learners who require no tutor intervention will achieve M2. To achieve D2, learners will need to answer a set of predetermined questions on the process they are undertaking, using appropriate technical language.

Learning outcome 3 requires learners to demonstrate the use of editing functions of a sampler to create a sampler instrument from recorded sounds. Those learners who require some tutor intervention will achieve P3. To achieve M3 they will be required to perform this demonstration with no tutor intervention. Answers to predetermined questions using technical language will evidence D3. As an alternative for learning outcomes 2 and 3, learners might provide written explanations, which could provide evidence for distinction grading only, or for both learning outcomes as a whole in situations where individual observations are difficult to manage (large class sizes, for example) as long as the tutor is satisfied that independence can be assessed fairly using this method.

Learning outcome 4 requires the production of the musical project that combines synthesis and sampling techniques. Evidence will consist of the completed project, together with a written report detailing the techniques used. A musical project that contains the use of synthesis and sampling techniques will achieve P4. To achieve M4 the evidence will show that learners have used synthesis and sampling techniques in ways that are musically appropriate, and have a clear understanding of the process involved. Distinction level learners will demonstrate mastery of the skills required to use synthesis and sampling to the extent that their music demonstrates imagination, creativity and flair that is not inhibited by technical limitations.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, M1, D1	Acoustic Theory and the Fundamentals of Synthesis	Explain the basic concepts of subtractive synthesis and the terminology of subtractive synthesisers with reference to acoustic principles.	<ul style="list-style-type: none"> Written piece. OR: presentation.
P2, M2, D2	Recreating a Sound with a Synthesiser	Demonstrate how to recreate a specific sound using the editing functions of a subtractive synthesiser.	Evidence to include: <ul style="list-style-type: none"> video footage tutor observation written report (optional).
P3, M3, D3	Using a Sampler	Capture sounds, then using the editing functions of a sampler manipulate those sounds into a sampler instrument that can be played via a MIDI keyboard.	Evidence to include: <ul style="list-style-type: none"> video footage tutor observation written report (optional).
P4, M4, D4	Synthesis and Sampling Project	Combine the techniques of synthesis and sampling in a creative music project.	Evidence to include: <ul style="list-style-type: none"> the project as a mixed-down stereo file a report detailing the techniques employed in the project.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Music and Music Technology sector suite. This unit has particular links with the following unit titles in the BTEC Music and Music Technology suite:

Level 1	Level 2	Level 3
	Exploring Computer Systems used by Musicians	Composing Music
		Sequencing Systems and Techniques
		Acoustics for Musicians
		Music and Sound for the Moving Image

Essential resources

For the most of the unit, learners will need classroom/workshop sessions where they are able to apply the skills demonstrated by their tutor in the preparation of their own work, and request assistance where appropriate. Classrooms will need to be equipped to an appropriate standard, with modern, reliable computers running software that allows access to at least one fully-featured subtractive synthesiser, and preferably a range of simpler synthesisers whose design is based on the terminology of subtractive synthesis. A software sampler with editing facilities should also be provided. Digital audio workstations that have these features built in are ideal, as they also provide the framework for creative work. Access to adequate monitoring for demonstration and private study, projection and printing facilities is also required.

Ideally, learners should have access to hardware synthesisers, modelled on subtractive principles, or vintage analogue.

The classroom will also need facilities for the creation of written reports, utilising screenshots or equivalent.

Indicative reading for learners

Textbooks

Aikin J – *Power Tools for Synthesizer Programming* (Backbeat UK, 2004) ISBN 978-0879307738

Cann S – *How to Make a Noise: A Comprehensive Guide to Synthesizer Programming* (Coombe Hill, 2007) ISBN 978-0955495502

Duffell D – *Making Music with Samples: Tips, Techniques, and 600+ Ready-to-use Samples* (Backbeat, 2005) ISBN 978-0879308391

Gorges P – *Synthesizer Programming* (Wizoo, 2008) ISBN 978-3934903647

Jenkins M – *Analog Synthesizers: Understanding, Performing, Buying from the Legacy of Moog to Software Synthesis* (Focal Press, 2007) ISBN 978-0240520728

Russ M – *Sound Synthesis and Sampling (Music Technology)* (Focal Press, 2008) ISBN 978-0240521053

Journals

Computer Music

Music Tech

Sound On Sound

Websites

Audio.tutsplus.com

Audio tuts and blog

www.macprovideo.com

Online education community featuring tutorial videos and training for popular AV applications

www.musictechmag.co.uk

Music technology magazine

www.soundonsound.com

Sound on Sound magazine

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	analysing the links between acoustic theory and the fundamentals of synthesis
Creative thinkers	creating music
Reflective learners	responding to feedback during the creative process
Self-managers	working towards a deadline
Effective participators	planning creative projects.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	deciding how to use creative tools
Creative thinkers	exploring the links between acoustic theory and synthesis
Reflective learners	giving and receiving feedback in 'critique' sessions
Self-managers	balancing the requirements of the assignment against personal creative involvement
Effective participators	seeking tutor approval for practical work.

● Functional skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	using software tools
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	using software tools
Manage information storage to enable efficient retrieval	using software tools
Follow and understand the need for safety and security practices	using software tools
Troubleshoot	using software tools
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	preparing presentations/writing reports
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	preparing presentations/writing reports
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: <ul style="list-style-type: none"> • text and tables • images • numbers • records 	preparing presentations/writing reports
Bring together information to suit content and purpose	preparing presentations/writing reports
Present information in ways that are fit for purpose and audience	preparing presentations/writing reports
Evaluate the selection and use of ICT tools and facilities used to present information	preparing presentations/writing reports
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	preparing presentations/writing reports
Mathematics	
Draw conclusions and provide mathematical justifications	using the parameters of acoustic measurement to illustrate synthesis techniques and terminology

Skill	When learners are ...
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	contributing to 'critique'-based peer feedback sessions
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	preparing presentations/writing reports.