# GCSE COMPUTING LIVE LESSON ACTIVITY SHEET

## MAKING MUSIC USING COMPUTERS

### OBJECTIVES

- In this lesson you will learn how computers can be used to generate sounds
- You will understand how sound is sampled and stored in digital form

### INTRODUCTION

Natural sounds exist as analogue waves. Sound can travel through any medium: solid liquid or gas – but not a vacuum. For a sound to be stored on a computer, it must first be converted into a digital signal.  This process is called **sampling**.



This is the sound wave

These points are the samples
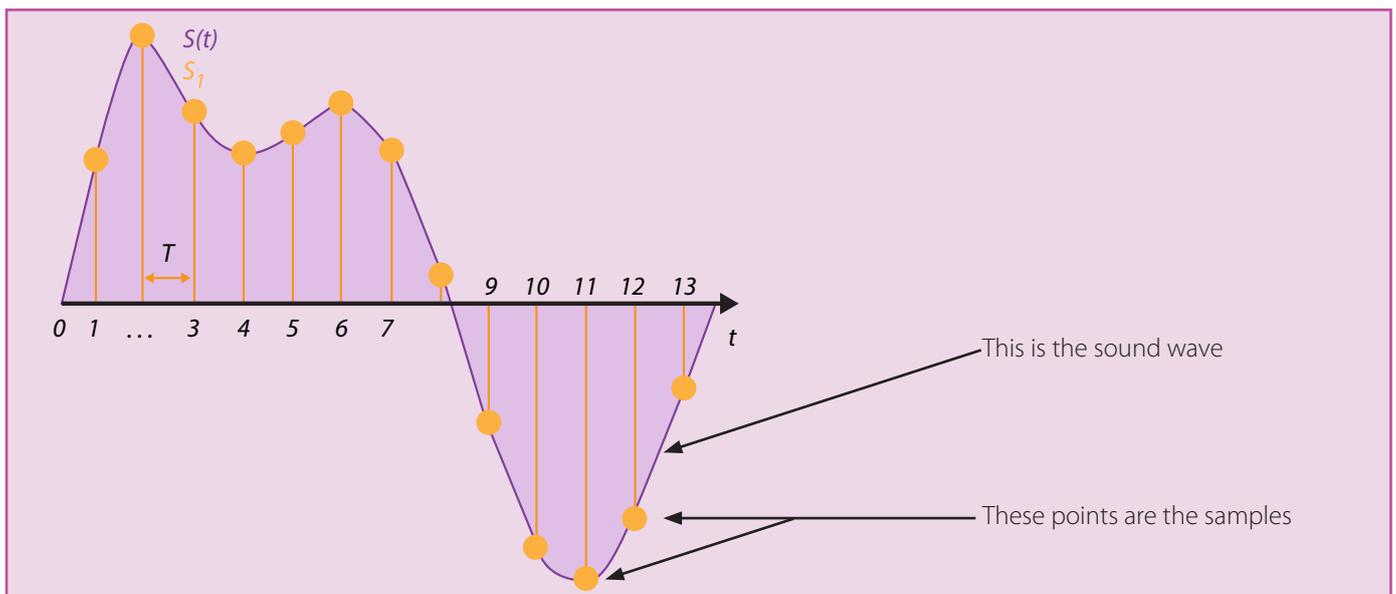
The number of samples taken per unit of time is called the **sample rate**. The higher the sample rate, the better the quality of the sound playback as the digital wave will follow the analogue sound wave pattern closely. However, the more samples that are taken, the more bits will be stored so the larger the file size will be. Sample rates are measured in KiloHertz (KHz). Typical rates are between 44.1 – 192KHz.
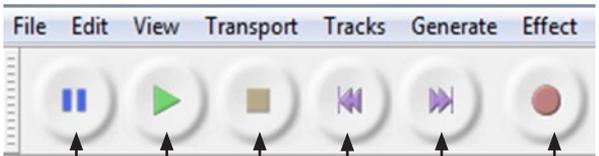
### EXPERIMENTS WITH SOUND

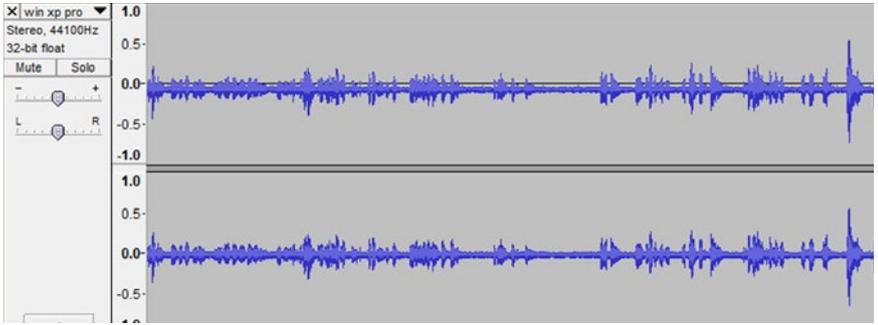Add sounds to a program:               **Scratch beatbox**                 **Python sound player**

# RECORD YOUR OWN SOUNDS WITH AUDACITY

Using the program **Audacity** you can sample your own sounds.





Pause    Play    Stop    Go to beginning of    Go to end of track    Record



This shows a stereo track of recorded, sampled sound



Save and open files

Set record and playback parameters

Generate sounds or silence

Add special effects

1.    Record some sound clips to use in your programs.

2.    Use effects to make the sounds more interesting.

3.    Import these into the other programs that we will be investigating today.

4.    Try out different sample rates. Do they make a difference to the quality of the recording?

# CREATE A CRAZY INPUT DEVICE USING MAKEYMAKEY

This is a circuit board based on Arduino and contains a microcontroller (rather than a full-blown CPU).

It can be used for control projects but today, we will use it as an input device.

1. Connect the Makey Makey CLICK, ARROWS and SPACE with crocodile clips to the fruit.
2. Now connect one crocodile clip to EARTH and hold the other end to ground the circuit.
3. Now load the Scratch piano project: http://scratch.mit.edu/projects/2543877/
4. Play the piano with fruit keys!!
5. It doesn't have to be just fruit!
   Draw "controls" on paper using a pencil (because the graphite conducts electricity).
   Clip the crocodile clips to the pencil marks.
   Tap them to play the sounds.
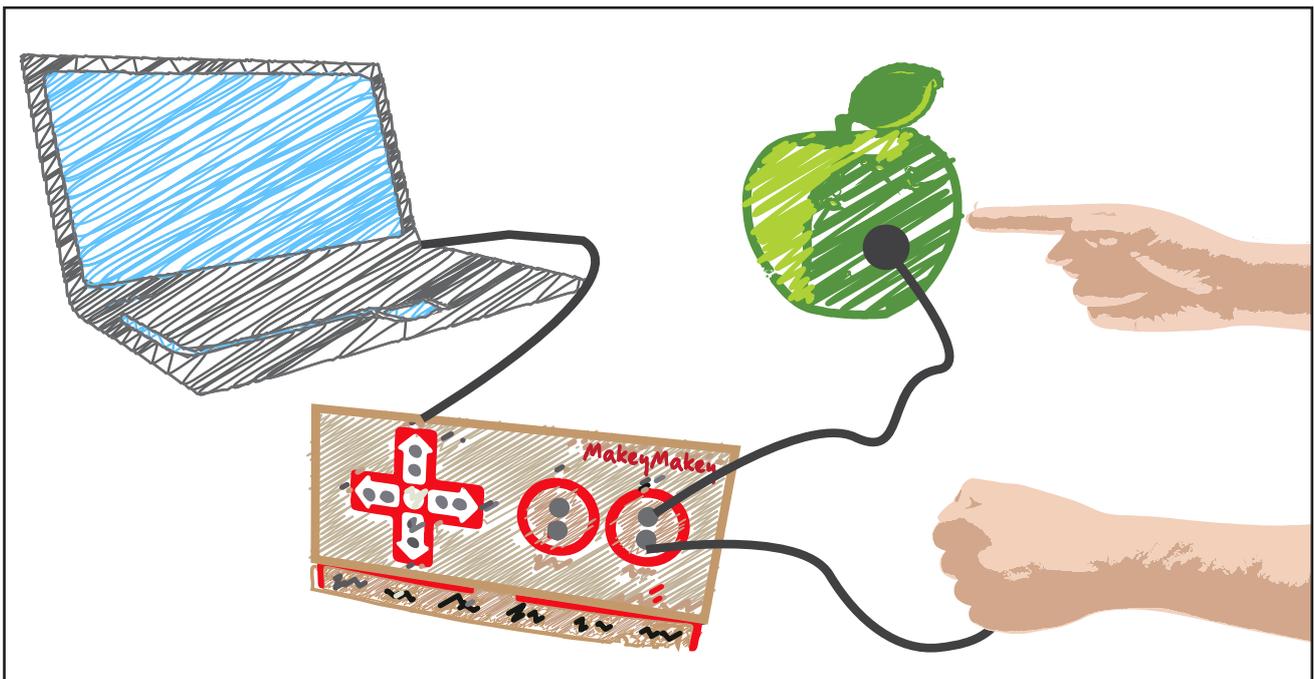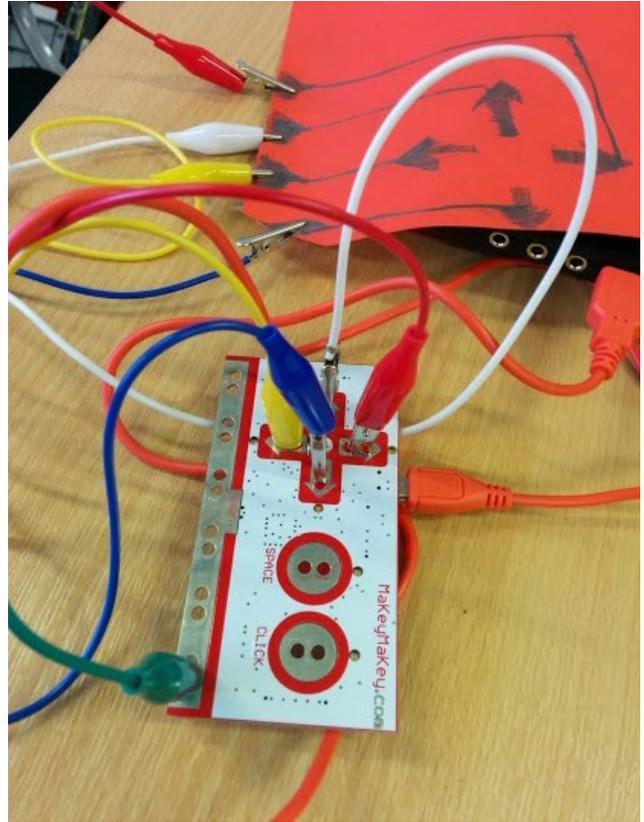
# PYTHON SOUND PLAYING PROGRAM

1.    Open the Python program called: Music Box.py

2.    There are a selection of sound effects in the folder. You can program different sounds to play when keys are pressed on the keyboard.

3.    Essentially, you need to copy the key handler code and then edit the key and sound that will play.
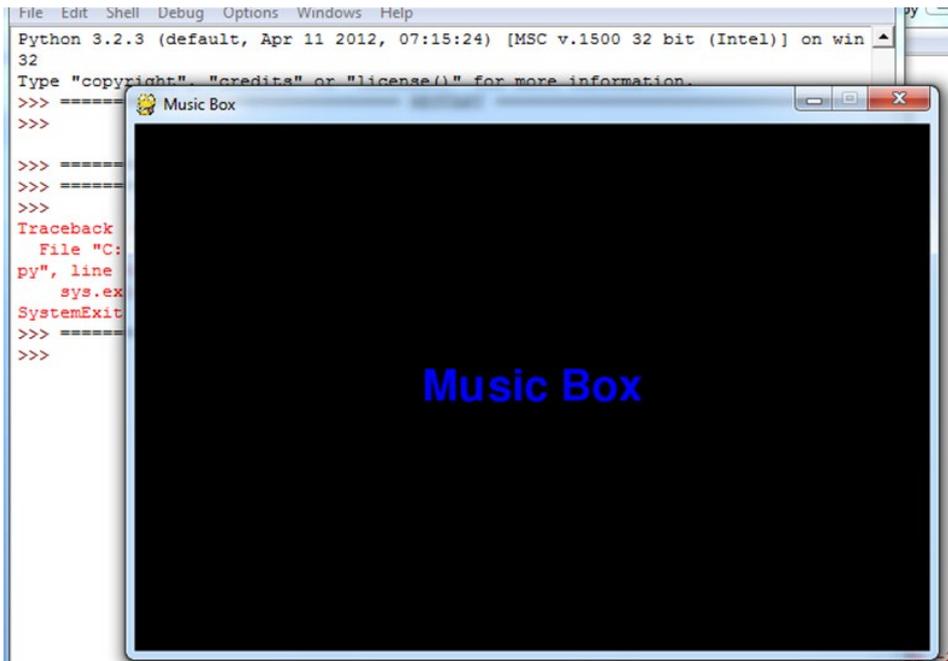


```python
while True:
    for event in pygame.event.get() :
        if event.type ==QUIT:
            pygame.quit()
            sys.exit()
        if event.type == KEYDOWN and event.key ==K_SPACE:
            pygame.mixer.music.load("start.mp3")
            pygame.mixer.music.play(0,3)
            pygame.mixer.stop()
        if event.type == KEYDOWN and event.key ==K_UP:
            pygame.mixer.music.load("reverse.mp3")
            pygame.mixer.music.play(0,3)
            pygame.mixer.stop()
```

Change this…

In this program, we are using the Pygame libraries to play the sound. In the line: "`pygame.mixer.music.play(0,3)`" the music file selected in the previous line will play once without repeat (the 0) for a maximum of 3 seconds (the 3). If you change 0 to -1, the sound will loop continuously. Try out some different sounds and effects.

# SCRATCH BEATBOX

The Scratch beatbox program allows you to generate sounds when keyboard keys are pressed.

Can you program it to produce more sounds and make the interface more exciting?
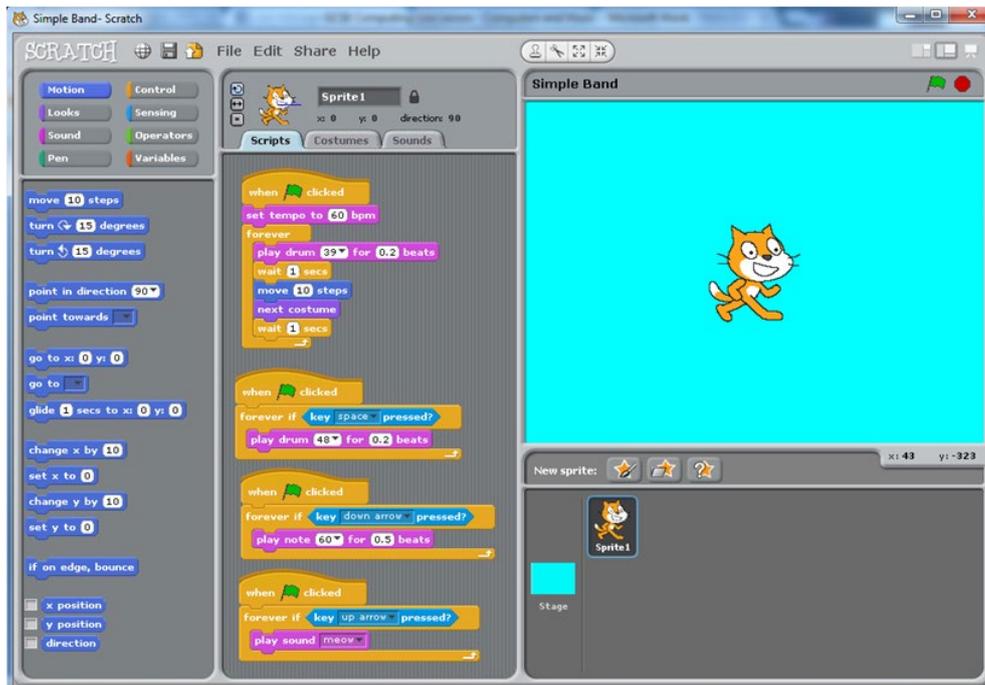


# QUESTIONS

In this lesson you have looked at many ways in which computers can be used to generate sounds. You have also seen that analogue sound can be sampled and stored as a digital file.

1.   How does sample rate affect the size of the stored file?
2.   Investigate how sound can be used as input to control a program. Who might find this form of input useful?
3.   How are sound commands used on mobile devices? What are the problems associated with voice recognition?
4.   Find out about MIDI: what is it and how has it influenced popular music?
5.   Investigate novel ideas of playing and generating sounds using a computer. We used fruit and a Makey Makey but could we invent a new musical instrument?

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