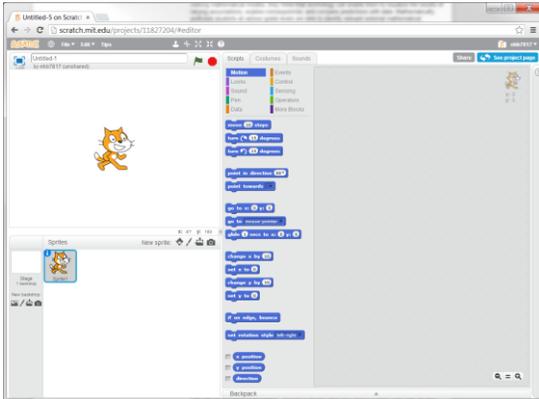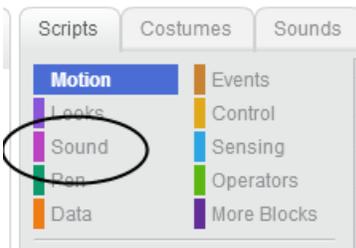# Playing "Ode to Joy" in Scratch

Open the scratch website: http://scratch.mit.edu. You should see a screen like this:

Today we'll be writing a script to play Beethoven's "Ode to Joy." We'll need to open the Sound palette, as it has the blocks we need to play music. Open it by clicking on the word "Sound" (it's near the middle of the page):


This should open the Sound Palette, which is full of blocks that make different kinds of sounds:


In particular, we want to play musical notes. We can use the play note 60 for 0.5 beats block to do just that. This block has two sockets – one for the note, and one for the beat. What do these mean?

Take a look at your sheet music for "Ode to Joy". You'll see notes that look like this: ♩ printed on bars that look like this:
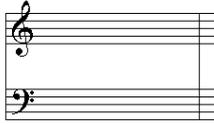
Each line and space between the lines is a specific note. We use the letters A through G to represent these, as you can see in this diagram:
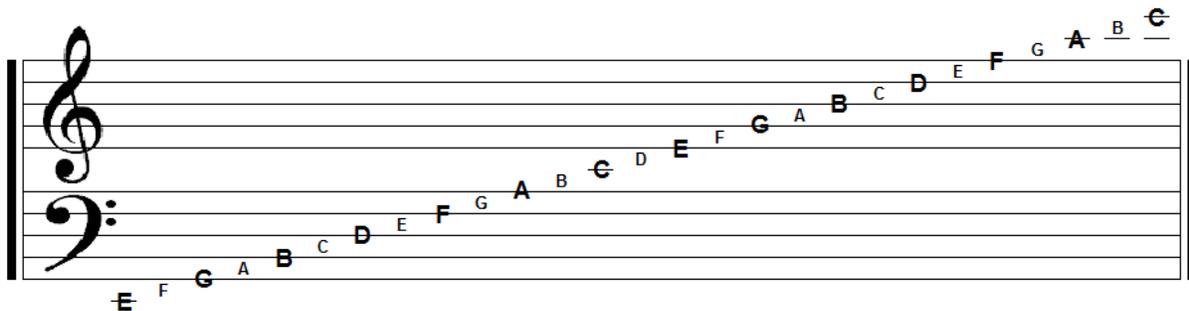

You probably also notice that the letters repeat – for example, there are four C's in the diagram. Middle C is in the very center, and there is one below (low C) and two above it (high C and a very high C). Each of these is eight notes apart, or an octave. They also have a special relationship (which is why they share a name). Middle C's frequency is exactly double that of Low C. This is true of all notes an octave apart – you'll learn more about this in your science lessons.

But for now, let's see how we can tell Scratch what note we want to play. Try clicking the drop-down menu for the note. You should see a menu that looks like this:

You can see that each note has both a name and a number. You can use your music chart to find the name that matches a note in your music. But what do the numbers mean? They are part of a musical notation that computers understand, called MIDI, and they come from numbering the keys on an electronic keyboard (as you can see to the left).
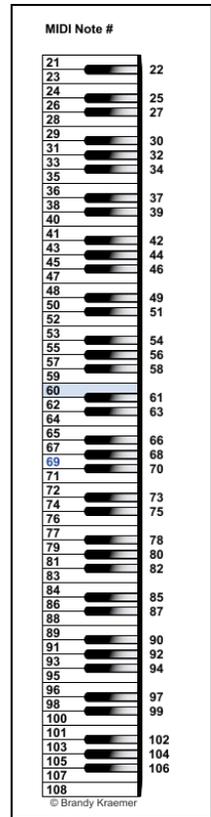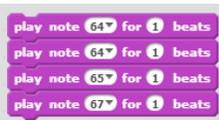
Now, what about the beat? Notes are drawn differently to indicate how many beats they should last. In 4/4 time (which is what our Ode to Joy music is using), a quarter note ♩ is 1 beat. A half note ♩ is 2 beats. A whole note 𝅝 is four beats. A eighth note ♪ is ½ a beat (0.5 beats). A dotted quarter note ♩. is 1 and ½ beats (1.5 beats).
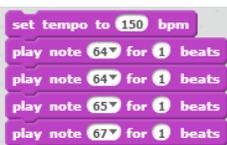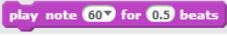
Look at the first measure on your sheet music:

We have four quarter notes, which are E, E, F, and G. Drag the

`play note 60 for 0.5 beats` into the scripts area, and set the note to E (64) and 1 beat. Drag a second `play note 60 for 0.5 beats` and hold it under the first. When you let go, it should snap in place. Set its note to E (64) and 1 beat as well. Do this two more times, with notes F (65) and G (67). Your script should now look like:

```
play note 64 for 1 beats
play note 64 for 1 beats
play note 65 for 1 beats
play note 67 for 1 beats
```

You can double-click on the script to see how it sounds. If you've heard "Ode to Joy before, it might seem very slow… and it is. "Ode to Joy" should be played with a tempo around 150-160 beats per minute. We can use a `set tempo to 60 bpm` block to set the tempo to 150 – snap it to the top of your script, so that it looks like this:

```
set tempo to 150 bpm
play note 64 for 1 beats
play note 64 for 1 beats
play note 65 for 1 beats
play note 67 for 1 beats
```

Now when you double-click your script, it should sound right. We've got a lot of measures to go, and our script will get quite long. It can be helpful to add a label to our measures. Right-click the first `play note 60▾ for 0.5 beats`. You should see a menu here:
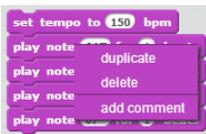

Click the "add comment" and a sticky note will appear next to the block.
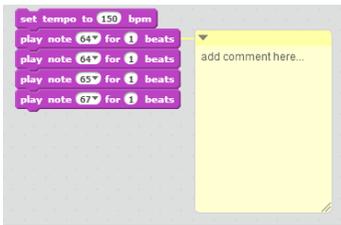
Type "measure 1" in the note. Then you can click the arrow to collapse the comment into a single line:
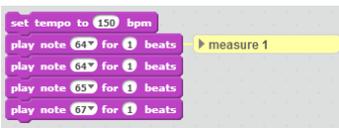
You can also use Scratch's "duplicate" to quickly create additional measures. Right-click on the first `play note 60▾ for 0.5 beats` again, but this time, click the "duplicate" option:


This creates a copy of the four blocks, which we can then click onto the bottom of our script. Then we just need to change the note and beat of our new measure. It may be helpful to write the note and beat on your sheet music, as well as label your measures:
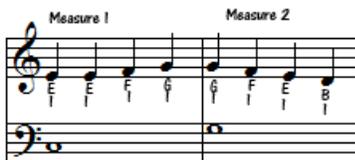
Go ahead and finish the rest of the notes on the top lines.

But what about the bottom lines?

A Scratch script can only play one note at a time, so we'll need to have a second script to play the bottom lines. Start a new script by dragging a ▮play note 60▾ for 0.5 beats▮ block next to your first script, and adding a second ▮set tempo to 60 bpm▮ block to it:
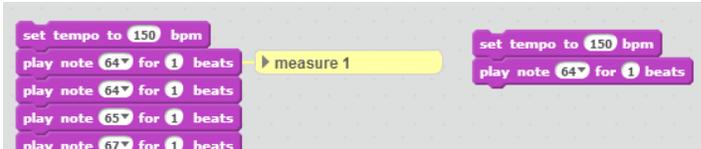
But double-clicking the blocks won't get both the play at the same time. We'll need to add a ▮when 🚩 clicked▮ to both. The ▮when 🚩 clicked▮ block tells Scratch to play a script when the 🚩 is clicked. This way, both scripts will start together. The ▮when 🚩 clicked▮ block is found in the Events palette. Click the word "Events" in the Scripts area to open the palette:

Drag two ▮when 🚩 clicked▮ blocks over and snap them to the tops of your scripts. They should now look like this:

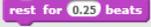Now go ahead and finish the lower lines… but wait, what about the chords in measures 8 and 16?

If a Scratch script can only play one note at a time, how can we play all three notes in the chord?

We can play one of them in our current script, but for the other two, we'll need two more scripts. These need to play *nothing* until it's time to play that note. In music, we call playing

nothing a *rest*, and in Scratch we can use the `rest for 0.25 beats` block to do so. But how long should we rest?

Count the measures until the first chord (there are 7). Each of these measures is 4 beats long. So we need to rest 7 x 4 beats. We can multiply 7 by 4 in Scratch with a block. This is found in the Operators palette (click the word "Operators" in the Scripts area to open it). Drag the block into your scripts area, and type 7 in one circle, and 4 in the other: `7 * 4`. But take another look at our measure 8:

We have a half note before our chord. A half note is another 2 beats. We'll need to add this to our 7 x 4. In Scratch, we can use an block to do addition. Drop your `7 * 4` in one of the block's holes, and then type 2 in the other. It should now look like: `7 * 4 + 2` (Scratch always does the topmost block first, so it will multiply 7 and 4 and get 28, then add 2 to the 28 to get a final value of 30 beats). This we can then drop into our `rest for 0.25 beats` block, and then our script will rest for 30 beats when the block is reached. We'll then want to play the note from our chord with a `play note 60 for 0.5 beats` block. The script should then look like:

We will need to rest again, until measure 16, when we again have a three-note chord. Add a second script for the third note, and then you can finish and play Beethoven's "Ode to Joy!"