



**The Theremin project (Level 3) -optional**

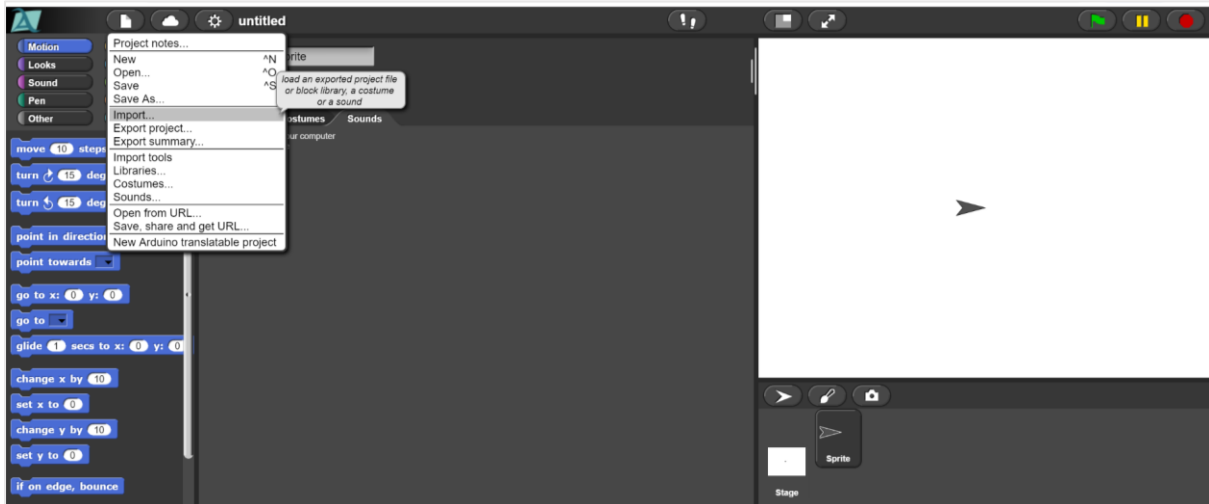
**Worksheet for students**

**Team:.....**

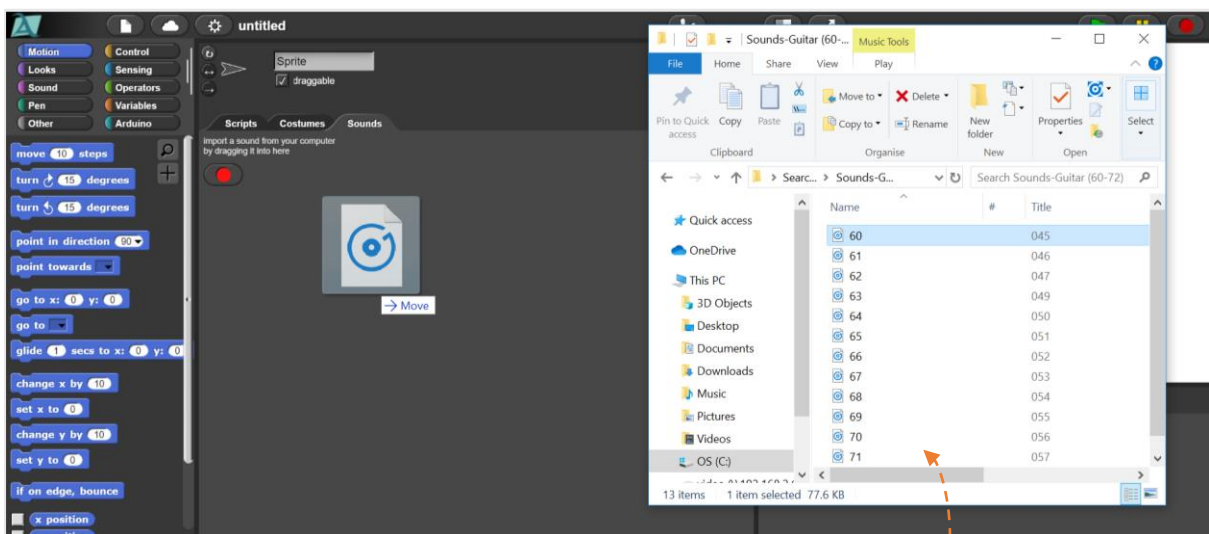
### Level 3 - Creating a two-hand operated Theremin that reproduces sound (created or imported by the students) through the PC

What about selecting the sounds that the Theremin will reproduce?

You can import sounds in 2 ways: either by selecting “import” from the dropdown menu (see Figure 7) and choosing the file that you would like to add



or by simply dragging and dropping each file in the Sounds zone.



The imported sounds can be wav or mp3 files and should be named as appear above (60-72) for the needs of Level 3.

You can download sound samples from here:

[https://www.philharmonia.co.uk/explore/sound\\_samples](https://www.philharmonia.co.uk/explore/sound_samples)

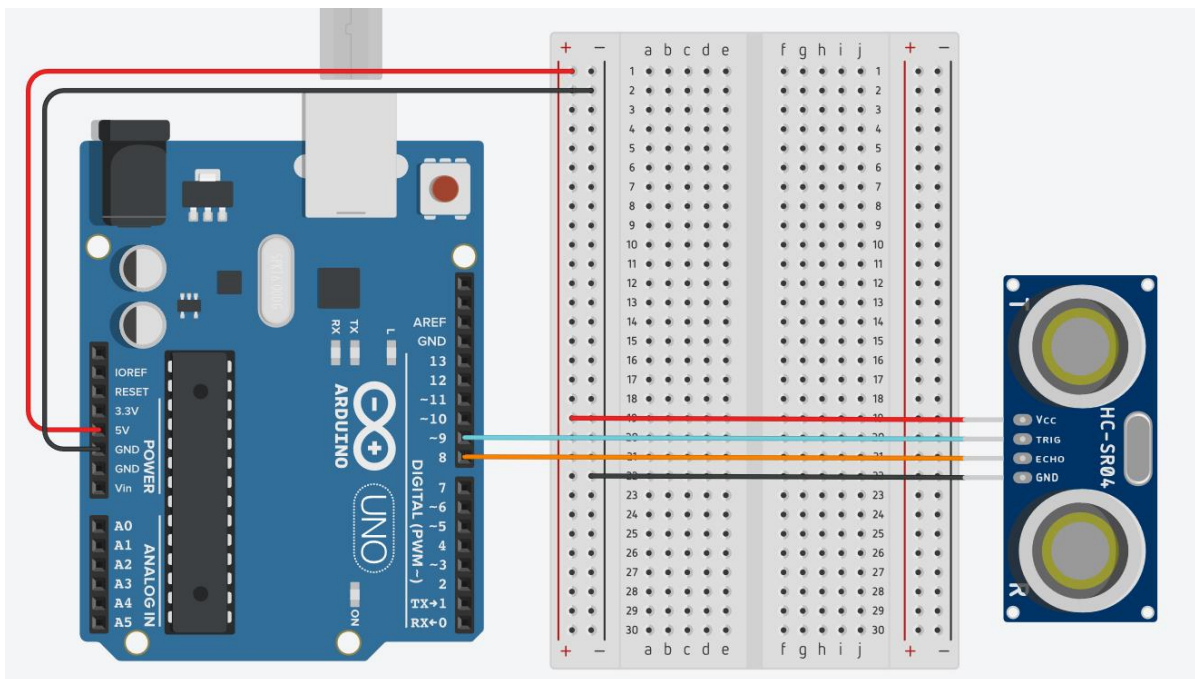
You can download a ready- made list from here: <http://www.roboscientists.eu/wp-content/uploads/2019/09/Sounds-Guitar.zip>

### Time for circuit making!

*Skip this step if you have completed successfully level 2.*

The image below depicts an already connected breadboard to the Arduino board with an Ultrasonic sensor (HC-SR04). You will also need a photoresistor and a 10 K $\Omega$  resistor. **How will you connect them?**

Try to draw the circuit below or create the simulation on TinkerCAD.



**What does the Ultrasonic sensor do?**

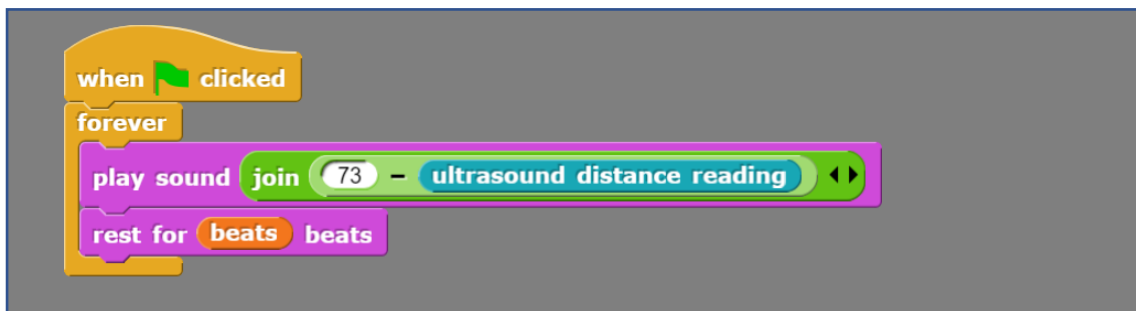
### Time for hands-on practice!

Let's create the circuit using your Arduino board and the corresponding electrical components. Work in teams!

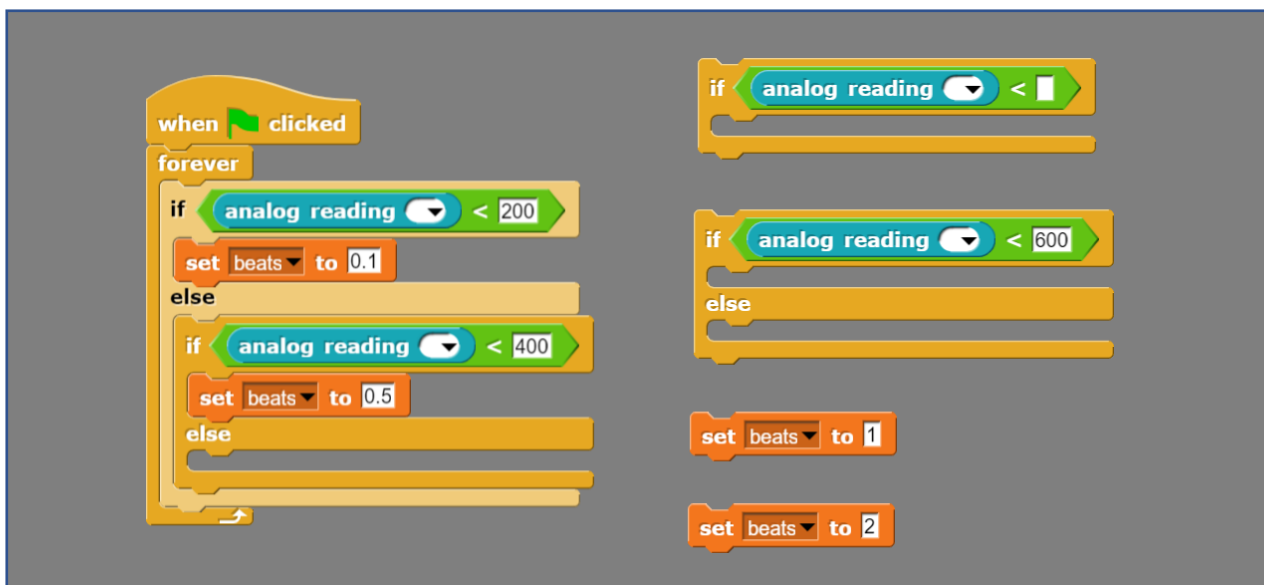
### Time for programming!

Open Snap4Arduino and connect your Arduino to Snap4Arduino.

**Are you ready to become a Theremin performer? Let's play the Theremin by waving your left hand across the Ultrasonic sensor and the other across the photoresistor.** The solution is composed by 2 scripts (see below). Script 1 is ready. Script 2 is semi-structured. In Script 2 the value of the variable *beats* changes according to the "analog reading" input value and this is how Script 1 is informed. You are a performer and you can adjust the duration of the sound by waving you hand across the photoresistor. **Compose the blocks and place them in the correct order into the scripting area, in the middle part of the window, in Snap4Arduino, in order to control the Theremin with your 2 hands.**



Script 1 – Script for controlling the ultrasonic sensor and reproducing a specific sound (The *join* block "links" the two values together and reports the result).



Script 2 – Semi-structured script for controlling the photoresistor and setting the beats (2<sup>nd</sup> hand)

Optionally you can use the script at your right-hand side to observe which sound files (notated with numbers are reproduced).



Enjoy playing the Theremin!

## Tips zone

### Programming blocks



This is a *hat* block that indicates that the script should be carried out when the green flag will be clicked.



This is a *C*-block. The slot inside the *C* shape is a special kind of input slot that accepts a *script* as the input. Any script placed *in there* will be carried out forever in a circle.



The if-else block runs its *if-input* script if (and only if) the expression in its hexagonal input reports true.

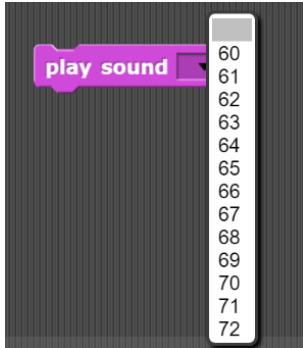
If it reports false the *else-input* is executed.



This block comes from the Variables palette and sets the variable '*beats*' to a specific value. This value can be inserted manually or can be linked to the analog readings of specific sensors (i.e. a photoresistor).



The Join block is an Operators block and a Reporter block. It concatenates, or "links" the two values together and reports the result. It also takes as argument(s) "text" (string) or "Number" datatype(s) and returns "text".



This block plays the specified sound. The sounds are notated with numbers.






As our hand approaches the ultrasound sensor (we get low values), we get high tones. For this reason, we use the subtraction operator. We subtract from the highest tone (72+1) the current ultrasound distance reading. In this way we get values from 48 (low-pitched) to 72 (high pitched) that corresponds to specific sounds that have been manually imported. The Join block ensures that the result of the operation is in a text datatype, thereby compatible with what the *play sound block* can receive as input.



The Rest for () Beats block is a music block and a stack block. The block pauses its script for the specified amount of beats.

### Electrical components

The following table is an index containing all the components that need to be implemented for accomplishing the present activity.

	<p><b>photoresistor</b></p>
	<p><b>10 kΩ resistor</b></p>
	<p><b>Ultrasonic sensor</b></p>

## **ROBOSCIENTISTS PROJECT**

Motivating secondary school students towards STEM careers through robotic artefact making

**Erasmus+ KA2 2018-1PL01-KA201-051129**

### **Creators**

Rene Alimisi, Chrysanthi Papasarantou, Konstantinos Salpasaranis (EDUMOTIVA)

### **Declaration**

This report has been prepared in the context of the ROBOSCIENTISTS project. Where other published and unpublished source materials have been used, these have been acknowledged.

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