



**Interactive Music Science Collaborative Activities**  
 Team Teaching for STEAM Education

**Deliverable 5.2**  
**Initial music activities based on mathematical equations**  
**and geometric curves**

Date:	30/9/2017
Author(s):	Daniel Martín-Albo (WIRIS)
Contributor(s):	-
Quality Assuror(s):	Laurent Varin (CABRI), Erica Andreotti (UCLL)
Dissemination level:	PU
Work package	WP5 – Workbench of iMuSciCA prototypes
Version:	1.0
Keywords:	music activities based on math equations
Description:	This deliverable reports on the initial implementation of the music activities based on mathematical equations and geometric curves.



H2020-ICT-22-2016 Technologies for Learning and Skills  
**iMuSciCA** (Interactive Music Science Collaborative Activities)  
 Project No. 731861  
 Project Runtime: January 2017 – June 2019  
 Copyright © iMuSciCA Consortium 2017-2019

# Executive Summary

This deliverable reports on the initial implementation of the music activities based on mathematical equations and geometric curves. Users can hand-draw strokes that are converted into the most suitable mathematical equation. Moreover, users are able to sonify (play) those functions, which, for this the tool assigns a particular frequency, depending on its y-value, to each point of each function.

This document provides a URL to access the demonstrator of the tool, as well as a brief user manual. The demonstrator is accessible here: <http://imuscica.wiris.net/sonification/release/v1/tool.html>

<b>Version Log</b>			
<b>Date</b>	<b>Version No.</b>	<b>Author</b>	<b>Change</b>
04-09-2017	0.1	Daniel Martín-Albo (WIRIS)	Initial content
19-09-2017	0.2	Daniel Martín-Albo (WIRIS)	Sections 1, 2 & 3 written
22-09-2017	0.25	Daniel Martín-Albo (WIRIS)	Ready for internal review
26-09-2017	0.5	Daniel Martín-Albo (WIRIS)	Included input from Laurent Varin and Erica Andreotti
27-09-2017	0.6	Daniel Martín-Albo (WIRIS)	Included URL in Executive Summary
30-09-2017	1.0	Vassilis Katsouros (ATHENA)	Submission to EU

## **Disclaimer**

This document contains description of the iMuSciCA project findings, work and products. Certain parts of it might be under partner Intellectual Property Right (IPR) rules so, prior to using its content please contact the consortium head for approval.

In case you believe that this document harms in any way IPR held by you as a person or as a representative of an entity, please do notify us immediately.

The authors of this document have taken any available measure in order for its content to be accurate, consistent and lawful. However, neither the project consortium as a whole nor the individual partners that implicitly or explicitly participated in the creation and publication of this document hold any sort of responsibility that might occur as a result of using its content.

This publication has been produced with the assistance of the European Union. The content of this publication is the sole responsibility of iMuSciCA consortium and can in no way be taken to reflect the views of the European Union.

**iMuSciCA is an H2020 project funded by the European Union.**

## TABLE OF CONTENTS

<b>Executive Summary</b>	<b>1</b>
<b>1. Introduction</b>	<b>5</b>
<b>2. Installation and technical requirements</b>	<b>5</b>
<b>3. Description of demonstrator and user manual</b>	<b>6</b>

## LIST OF ABBREVIATIONS

Abbreviation	Description
URL	UNIFORM RESOURCE LOCATOR
ATHENA	ATHENA RESEARCH AND INNOVATION CENTER IN INFORMATION COMMUNICATION & KNOWLEDGE TECHNOLOGIES
UCLL	UC LIMBURG
EA	ELLINOGERMANIKI AGOGI SCHOLI PANAGEA SAVVA AE
IRCAM	INSTITUT DE RECHERCHE ET DE COORDINATION ACOUSTIQUE MUSIQUE
LEOPOLY	3D FOR ALL SZAMITASTECHNIKAI FEJLESZTO KFT
CABRI	Cabrilog SAS
WIRIS	MATHS FOR MORE SL
UNIFRI	UNIVERSITE DE FRIBOURG

# 1. Introduction

In this deliverable we describe the environment to perform music activities based on mathematical equations and geometric curves. First, we will provide details on how this environment can be installed, its technical requirements and then we will briefly describe how to use the environment.

## 2. Installation and technical requirements

This tool is intended to be included as an iframe using the following code:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html>
  <head>...</head>
  <body>
    <iframe src="http://imuscica.wiris.net/sonification/release/v1/tool.html" height="400"
frameborder="0" width="650"></iframe>
  </body>
</html>
```

The tool adapts itself to the size of the container iframe, although a minimum iframe size of 650x400 is required.

### 3. Description of demonstrator and user manual

This tool allows students to “sonify” (play sounds) from math equations. The demonstrator of this tool is accessible here: <http://imuscica.wiris.net/sonification/release/v1/tool.html>

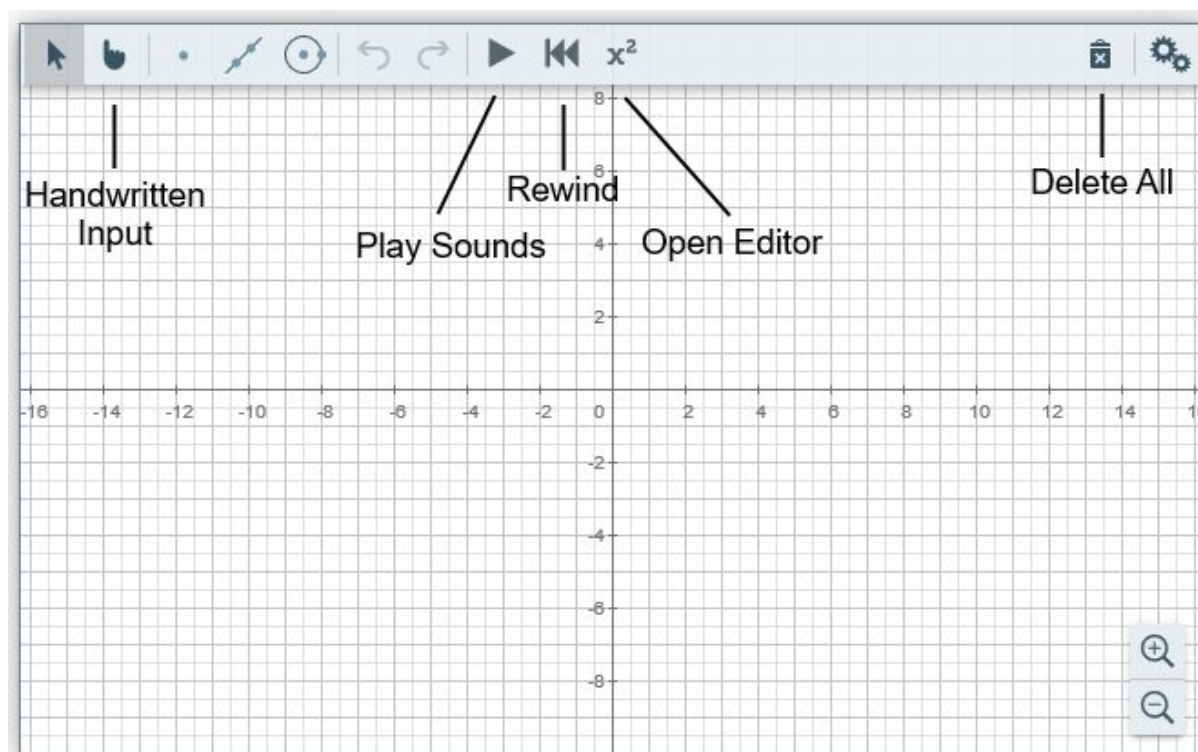
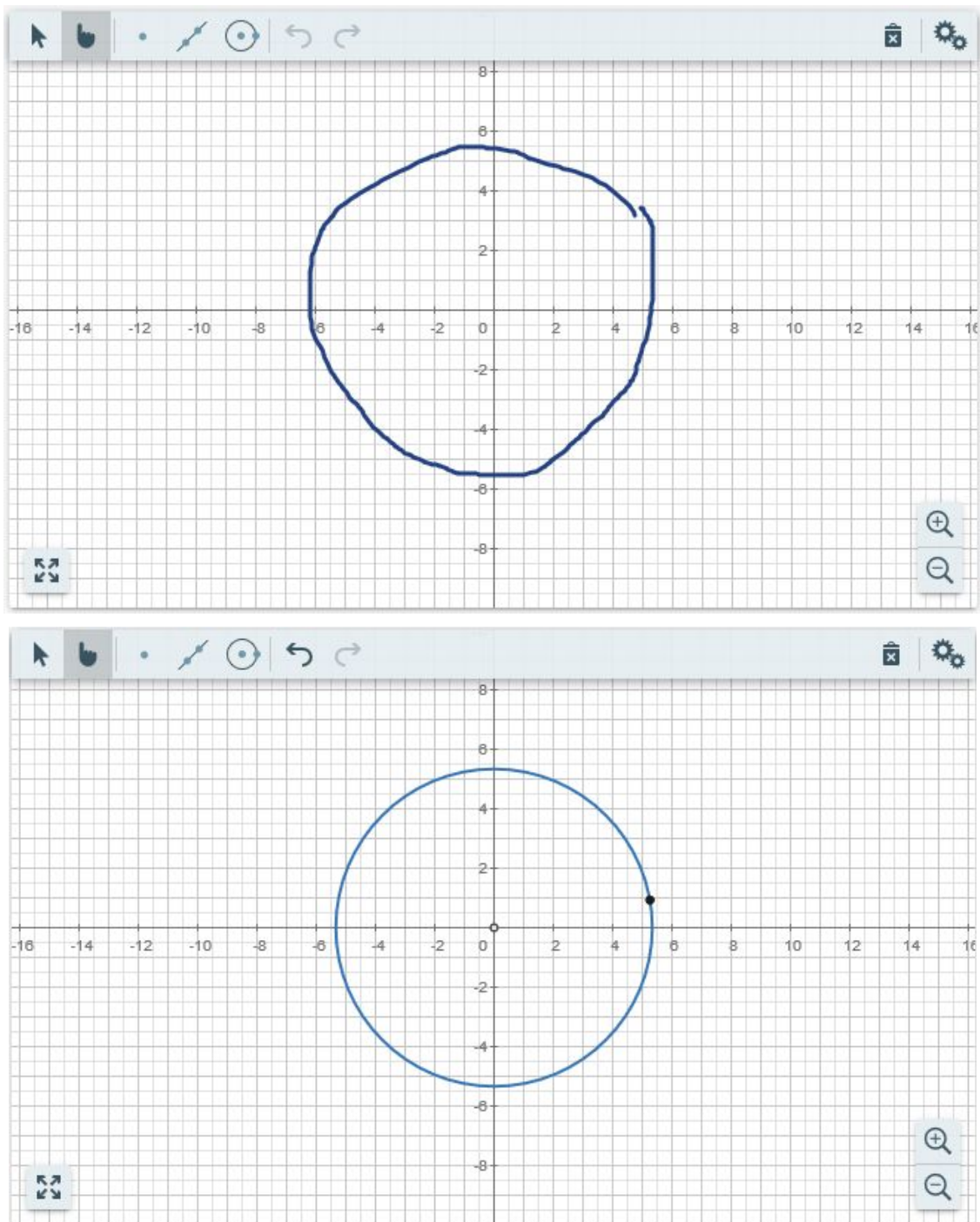


Figure 3-1: Sonification tool interface

On the one hand, a student can hand-draw directly some strokes, that will be converted automatically to math equations (see Figure 3-2) and the corresponding geometrical primitive will be drawn. To this purpose the pen-enabled multimodal interaction interface (see D4.2 “First Version of Pen-enabled multimodal interaction interface”) has been integrated in the tool. Functions can also be drawn by using the supporting buttons on the top: ‘point’, ‘lines’ and ‘conic sections’.



**Figure 3-2:** Example of recognizing user input strokes. Top: the user has drawn a stroke with the intention of drawing a circle. Bottom: the recognition engine transforms the stroke into the most suitable geometric primitives, which is indeed a circle

Moreover, the user can press the play button ► that will play the frequencies corresponding to the y-values of the shown functions. At this moment, the frequencies played range between 494 Hz (for the highest value) and 262 Hz (for the lowest value) which corresponds to B-C notes.

On the other hand, the user can press the  $x^2$  button (see Figure 3-1) in the toolbar to open a math editor (see Figure 3-3), where he/she can handwrite an equation. After he/she presses the accept button, the equation will be transformed into the corresponding function (more details on this in



Deliverable D3.2 - First Version of Technical Specifications for Adapting Core-Enabling Technologies, section 3.5.2).

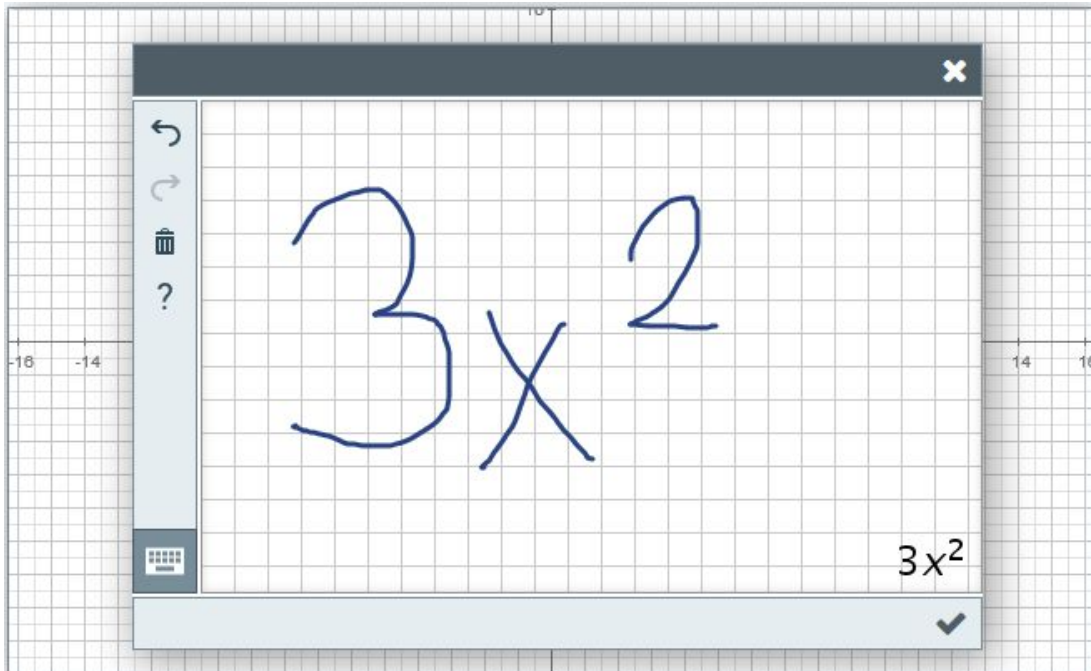


Figure 3-3: Area to introduce handwritten math

Once the user has provided an equation (in the form of strokes), the engine will recognize it, as shown in Figure 3-3. Then, after pressing the ✓ icon, the equation will be drawn as a geometric function. Again the user can press the ► icon and the tool will play sounds for the drawn functions (see Figure 3-4): a particular **frequency** is assigned to each y-value.

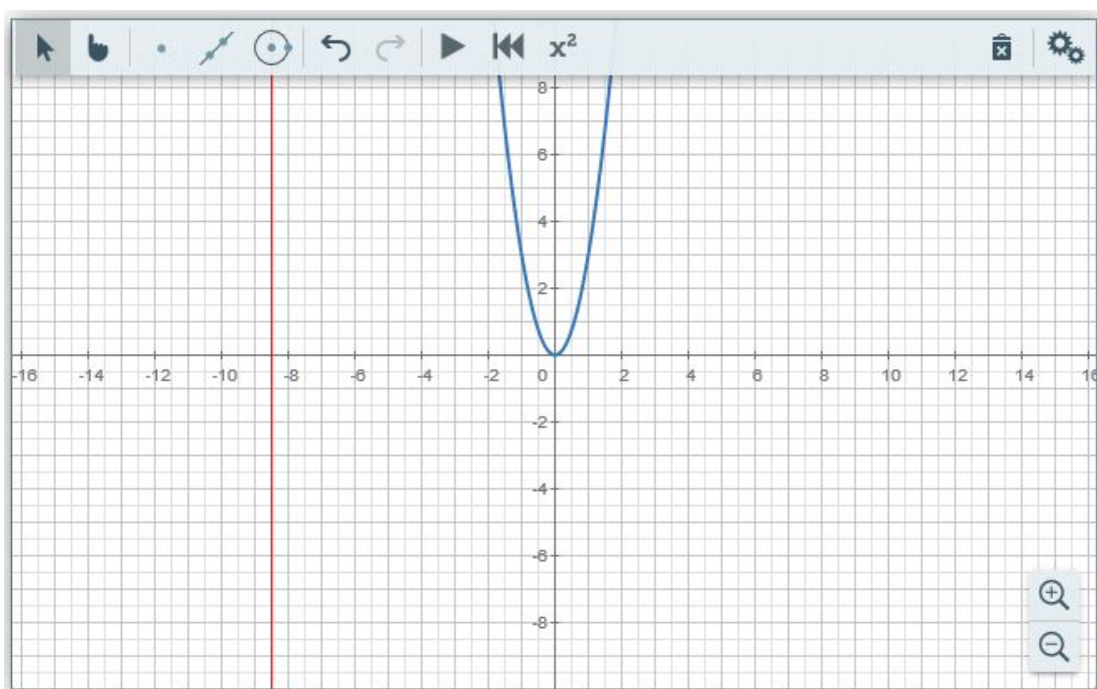


Figure 3-4: Tool displaying the red bar which moves from the left to the right thus indicating the position being played at that moment