Sound Printing

Level	Beginner
Academic Connections	Science, Engineering
Core Concepts	Sound Energy, Engineering Analysis
Duration	1-2 class periods

Understanding sound as energy can be challenging for students. Like other energy forms it is difficult to manipulate. This lesson will allow students to do both. Students will 3D print their voices and learn about sound waves using a sound wave generator. Their sound wave file can be used to understand how pitch, intonation and syllabication change sound waves.

LEARNING OBJECTIVES

By the end of this workshop, the student will be able to:

• Understand how pitch, intonation and syllabication change sound waves.

• Plan and organize the project.

• Create digital 3D sound waves using CAD.

• Use appropriate design tools to create full-scale 3D printed models.

ESSENTIAL QUESTIONS

• How is sound transferred in a material (e.g., air, water)?

• What happens to sound in a vacuum?

• What influenced the amplitude of your soundwave?

REQUIREMENTS

• Educator PC with access to:

  – Microsoft PowerPoint
  – QuickTime application program
  – Internet connection

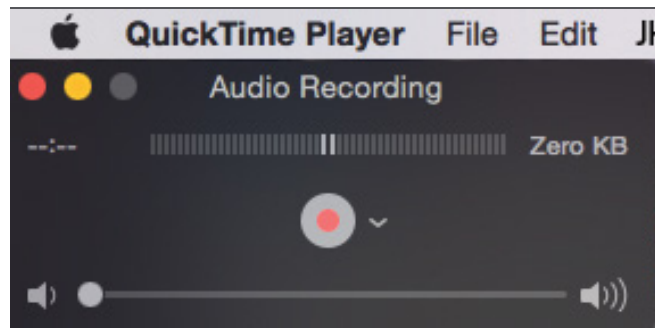• Projector

• 3D printers

• CAD design tool

PROCESS WORKFLOW

DESIGN PROCESS: CONCEPT

Students will record their names or a one- to three-word phase. The voice recording can be done using Garage Band, QuickTime, or any other program that allows you to save the audio file.
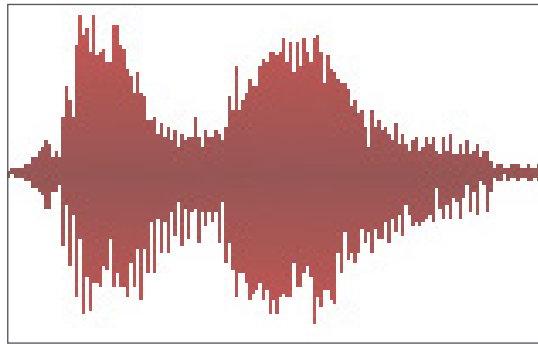
https://itunes.apple.com/us/app/garageband/id682658836?mt=12&ls=1

https://www.apple.com/osx/apps/#quicktime

**DESIGN PROCESS: FORMALIZATION**

To convert the voice file to an image, students upload the file to Transloadit.com. The audio file of their voice is turned into a sound wave image. The image can then be saved.

https://transloadit.com

An SVG file is needed for getting the image into a CAD program. Students can change their sound wave image into an SVG file using the website http://www.online-convert.com.
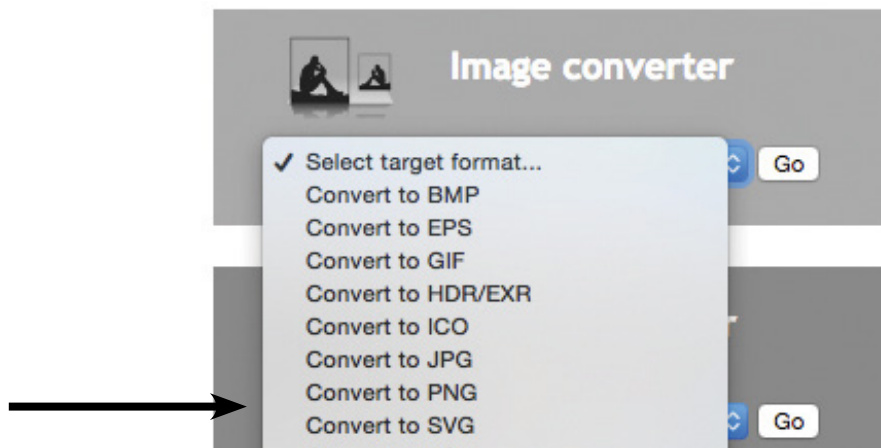
Using your CAD program of choice, students can now import their SVG sound wave, which will turn it into a 3D file. Once their sound wave file is in the CAD program, you can have the students manipulate it to meet your lesson objectives.

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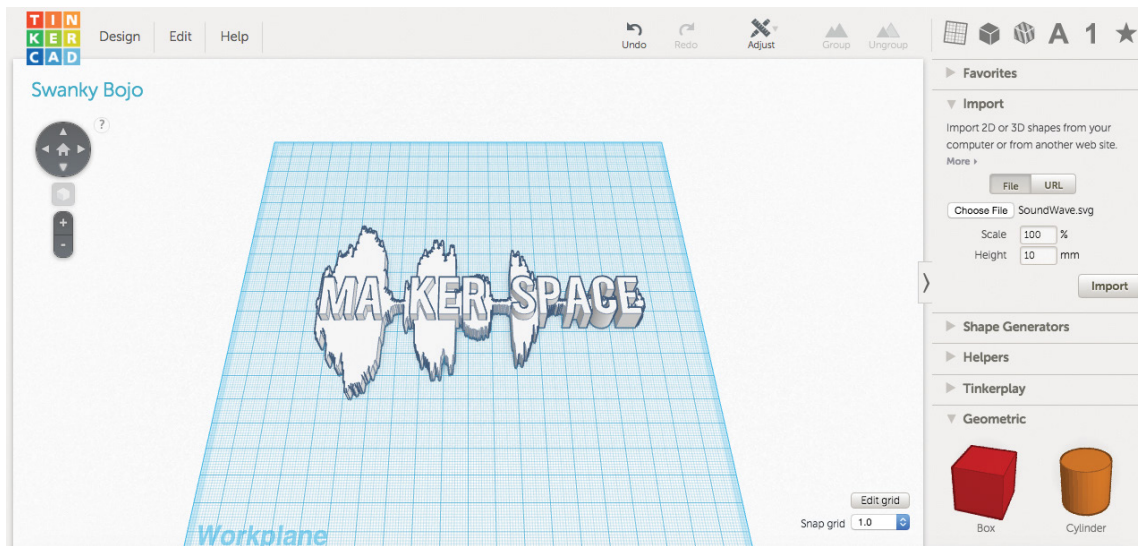
Within your CAD program of choice, you can have the students break up their names or phrases into their multiple syllables. Have students place the broken-apart word(s) over the sound wave file to show how intonation and syllabication affects sound waves. You can even create a sound energy-inspired art piece.

ASSESSMENT CRITERIA

LEVEL	LEVEL 1 (50-59%)	LEVEL 2 (60-69%)	LEVEL 3 (70-79%)	LEVEL 4 (80-100%)
Knowledge/ understanding **3D drawing concepts**	3D CAD drawings are incomplete or illegible.	There is limited use of 3D design features and tools.	Most 3D design tools and features have been used properly.	All 3D design tools and features have been used properly.
Thinking/ Inquiry **Level of complexity**	Drawings do not challenge the student's design skill.	Drawings consist mostly of basic shapes with few elements that challenge the student's design skill.	Drawings contain some elements that challenge the student's design skill.	Drawings contain complex shapes that challenge the student's design skill.
Application **Design concept**	Final product does not resemble the voice recording.	Final product reflects a few elements of the voice recording.	While some relatively complex features could not be accomplished, the final product reflects most elements of the original scaled sketches.	Final product closely resembles the voice recording.

TIPS FOR EDUCATOR

FURTHER LEARNING
• Study Jams: http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/sound.htm

WEBSITE LINKS
• TinkerCAD – https://www.tinkercad.com
• Image to SVG converter – http://www.online-convert.com/
• Sound wave generator – https://transloadit.com/demos/audio-encoding/generate-a-waveform-image-from-an-audio-file
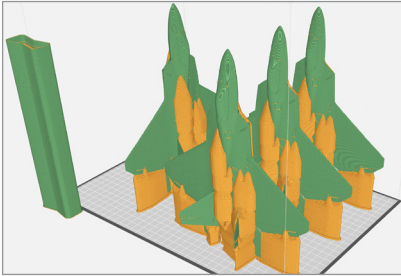
SUPPORTING FILES: STUDENT PROJECTS
• https://goo.gl/y1YEbj
• https://goo.gl/kkIXvp
• https://goo.gl/SAeCal

SUGGESTED RESOURCES

NESTING

Students will learn what nesting is and how it impacts the 3D printing process. Students will learn 3D printing considerations for tolerances and support material removal.

CHESS SET

Design a chess set that includes six unique game pieces: pawn, rook, knight, bishop, queen and king.

CAMERA ACCESSORIES

Design gadgets that can help take photos or videos. These can be added to conventional cameras, cellphones and action cameras.

To access additional 3D Learning Content and resources visit:

http://www.stratasys.com/3DLC

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