ENGINEERING IN THE MOVIES

GOOD VIBRATIONS

STEM

Science, Technology and Engineering Focus

Scene 3
Take 2

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INTRODUCTION

Some of the biggest moments in cinematic history hit your ears before your eyes. The first spine-tingling notes from John Williams’ **STAR WARS** main title and Booger’s no-contest belch in **REVENGE OF THE NERDS** stay with you long after you have left the cinema.

But for a movie’s sound team, it’s about capturing the subtlety and realism that makes a film truly memorable.

In cinema’s early days, experimental attempts were made to merge audio and visual entertainment, with nearly 40 different varieties and many one-offs before the talkies (movies with sound) hit the scene.

Productions such as **DON JUAN** in 1926 featured a score and sound effects but no dialogue; it wasn’t until **THE JAZZ SING** spoke to audiences in 1927 that the talking picture revolution truly took hold of Hollywood.

First through mono, then stereo and then onto Dolby Digital.

OVERVIEW

Learn all about how we can see sound and vibration through these three practical fun experiments.

Sound is produced by vibrations: bigger vibrations produce louder sounds and faster vibrations produce sounds with a higher pitch.

Sound waves travel through solids, liquids and gases, moving through each of these by vibrating the molecules in the matter. Sound travels about four times faster and further in water than it does in air.
1. Cut out the bottom of the cup.
2. Cut the balloon in half and dispose of the neck end.
3. Stretch the remaining piece of the balloon over the top of the plastic cup.
4. Secure the balloon with sticky tape.
5. Tape the clear acrylic tube to the side of the cup.
6. Glue the small mirrored piece and stick onto the centre of the balloon drum.
7. Secure the LED pointer onto the acrylic tube, making sure that the light hits the mirror.
8. Lastly, position your mobile phone speaker next to the bottom of the cup and play some music. Make sure you have the sound on full volume and watch what happens when you turn the LED pointer on.

**EXTENSION**

Experiment by playing different sounds at different volume. What changes of patterns are there?

**YOUTUBE GUIDE**

www.youtube.com/watch?v=vY6BTjAARkA
**Challenge 2: The Sound Carousel**

This experiment will illustrate how to move objects with only sound by using the power of resonance.

1. Start by blowing into the bottle. Record this on your mobile phone. What frequency do you think the sound is?
2. Attach the bottles to each end of the dowel rod with the elastic bands (as seen in the illustration).
3. Secure the pivot to a secure surface. A bench vice in design technology would work well.
4. Balance the centre of the dowel rod on the pivot point.
5. Now play the recorded bottle sound through a speaker towards the bottles and see what happens.

**Extension**

The more exact frequency you play, the faster the carousel will spin. The force comes from Helmholtz resonance. Experiment by playing different sounds at different volume. Do the bottles spin?

**Youtube Guide**

www.youtube.com/watch?v=SemQS4RLeFU

**Materials**

- Wooden dowel rod
- 1.5 litre bottles (x2)
- Rubber bands (x2)
- A pivoting point
- Mobile phone
- Speaker

**Terms & Concepts**

- Resonance
- Haptics
- Ultrasound
- Acoustic
- Feedback
**Challenge 3: Sound Sandwich**

For this experiment, you will make a cool sound instrument that is super annoying for your teacher!

1. Start by stretching the large rubber band from one end of the lolly stick to the other.
2. Cut off the bendy part of the straws and sandwich these between the two lolly sticks. Place one at each end, about an inch from the ends.
3. Wrap the rubber bands around the ends of the lolly sticks. Make sure they are not touching the straw.
4. Hold the sandwich to your mouth and see what happens when you blow.

**Extension**

When you blow, the large rubber band will vibrate and create an annoying sound. See how long you can play your instrument before your teacher has had enough.

**YouTube Links**

www.youtube.com/watch?v=IADGbk5xk6I
www.youtube.com/watch?v=LVWTQcZbLgY

**Sound Wave Exercise**

Label the following points on the diagram above:

- **Peak** – the tip of a wave.
- **Trough** – the bottom of a wave.
- **Wavelength** – the distance from a peak to peak or trough to trough. It is the length of one wave.
- **Amplitude** – the height of a peak in the wave

On the diagrams on the right, draw a wave that has:

- (A) A quieter sound
- (B) A higher pitch
- (C) A louder sound
- (D) A louder sound and a lower pitch

**Materials**

- 1 pair of scissors
- 2 bendy straws
- 2 large wooden lolly sticks
- 2 large rubber bands
- 1 small rubber band

**Terms & Concepts**

- Reverberation
- Vibration
- Peak
- Trough
- Wavelength
- Amplitude
Royal Academy of Engineering

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