Experiment Report: Sound wave and water
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Experiment Aim

I know that sound waves have some effect on water. I think the water may jump but I don't know how high. I want to see how high the water jumps, and at what frequency and volume it happens.

My aim is to see how much sound waves will affect the water on the cling wrap. I will achieve my goals by using a tone generator on my iPad to generate a pure tone at different frequencies and volumes.

Experiment Design

1. Put a bluetooth speaker in a bowl, and cover it in cling wrap.
2. Pour some water onto the cling wrap.
3. Use a tone generator on an iPad to generate tones at different frequencies, starting at 1Hz and increasing the frequency.

4. Stop changing frequency when the water reacts. Describe the behaviour of the water.
5. Keep changing frequency, and then record the frequency when the water reacts, and describe the behaviour of the water.
6. Keep a video log, via a screen recording of the tone generator and a video recording of the water.

Experiment Data

Run 1

Start at 1Hz.

Volume 1%

Water moved towards edge of bowl as countertop not level.

Increment by 1Hz steps.

Incremented to 1204Hz, no visible response in the water.

Run 2

Start at 1Hz

Volume 10%

Audible at 150Hz

Keystrokes from Tone Generator causing artifacts in terms of waves. Laptop moved to different surface.

Incremented to 650Hz, no visible response.

Noise uncomfortable, ear protection placed.

Incremented to 1200Hz, no visible response.

Run 3

Start at 1Hz

Volume 25%

Incremented to 1200Hz, no visible response.

Run 4

Start at 1Hz

Volume to 50%, limit upper frequency to 300Hz for safety

Water noticed to vibrate at 202Hz, but careful observation demonstrated that the speaker had vibrated itself to be in contact with the side of the bowl, thus vibrating the sides of the bowl.

Revised design to place speaker on sponge to mitigate vibrations through bowl.

Run 5

Start at 1 Hz

Volume at 50%.

16Hz visible

90Hz circular vibrations

150Hz looks like jelly

350Hz looks like glass

Uncertain as to whether it's stopped reacting, dropped a piece of paper on the water, which vibrated out to the edge.

Run 6

Runs 1-5 were with a sine wave.

Changed to Square wave - pulse tone.

1Hz - visible pulse

10Hz - pulsing vibration at higher frequency, as expected.

Each frequency seems to have its own pattern of vibration, with the change in pattern visible every time the frequency changes.

Run 7

Changed to Triangle wave - dot tone.

Similar characteristics to square wave, in that the pattern changes with each change in frequency.

Run 8
Changed to Sawtooth wave - rising pulse, rapid drop.

1Hz - visible

Similar characteristics to square and triangle, pattern changes with each change in frequency.

Experiment Review

A sound wave's influence on water depends on its frequency, volume, and shape of the wave. At a low volume, the sound waves did not seem to influence the water much, but at higher volumes they definitely did. This is because at higher volumes bigger waves were generated, and bigger waves have more energy. The difference between low frequency and high sound frequencies is that high sound frequencies sound higher to the ear. Secondly, at low frequencies, the vibrations in the water were further apart, and at high frequencies, they were more like a ripple. This is because at low frequencies, the waves are are further apart, and at high frequencies, the waves are close together. The shape of a sound wave also affects the vibrations, as with the sine wave you couldn't see any effect on the water until 16Hz, but with a square, triangular, and sawtooth wave, you could see the vibration even at 1Hz. This is because a sine wave is smooth, but the other waves have sharp edges.

Challenges:

The keystrokes on my laptop were causing vibrations, so I had to move my laptop to another surface. The sound at 650Hz was painful, and we had to wear ear protection. At low volumes, there were no vibrations, so I had to increase the volume.
At high volumes, the speaker vibrated and hit the side of the bowl, vibrating the water through the bowl, which we did not want.
So we installed a sponge below the speaker to stop the vibration. The sponge also made the speaker higher, which moved it closer to the water, so it probably helped with the vibrations.

Conclusion

Sound waves can affect water. The different frequencies, the type of wave, and the volume or energy of the sound wave all influence the way the water moves.