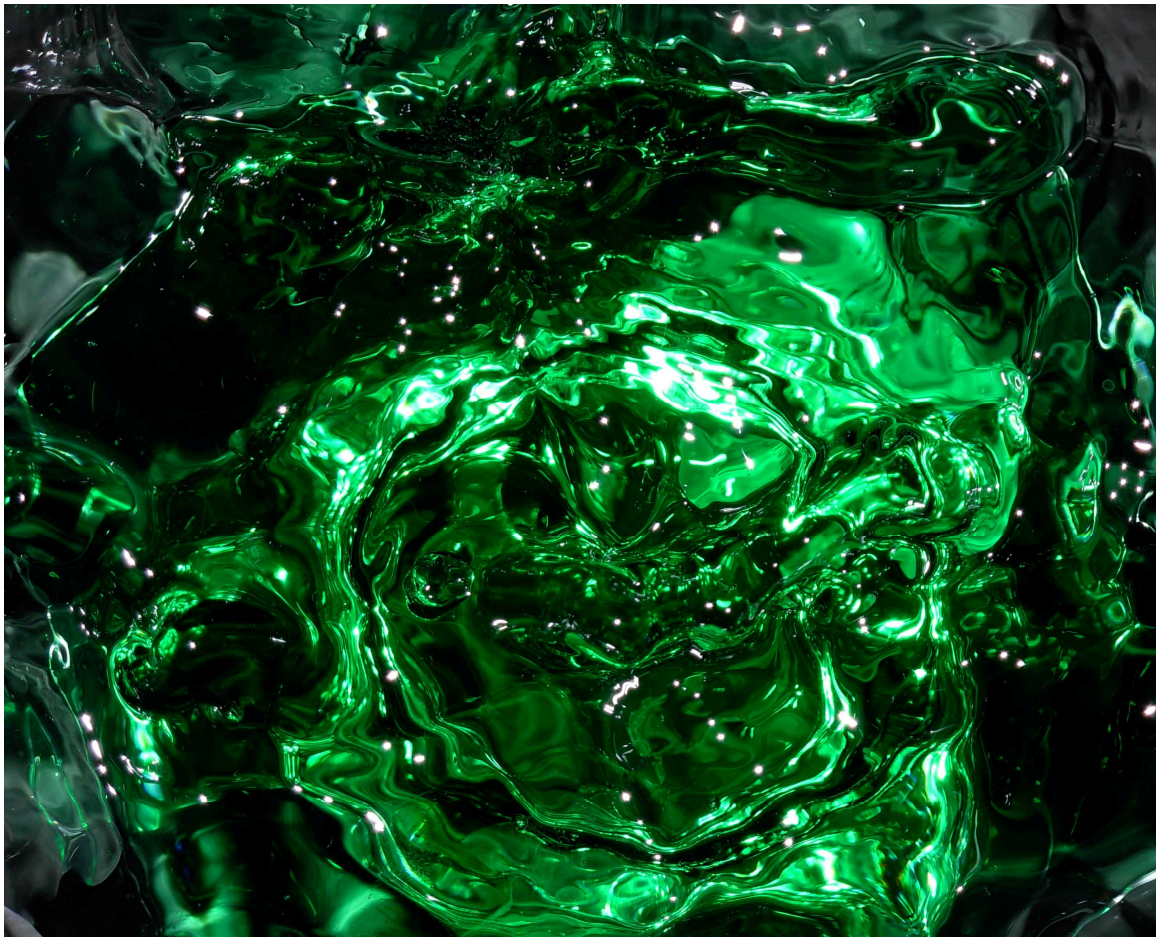
Group Assignment #3
Effects in Water Created by Oscillating Speaker

Photo taken 12/4/07



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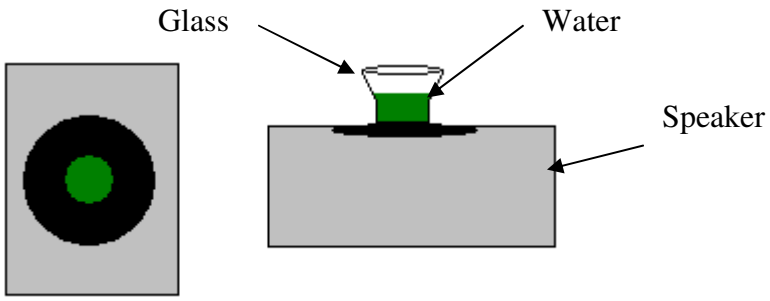
The purpose of this image is to see the effect an oscillating container has on water. This represents what naturally happens in air when sound is transferred through a medium. The major difference here is that the sound is directed vertically, and the water has a large enough mass to be pulled down by gravity. We attempted to use many different types of songs to create the desired effect, but the type of music that worked best was rap songs with long high amplitude base licks. We used different types of lighting, but I liked the effect that the flash created in the water. We also tried using Windex instead of water because it is less viscous. This however resulted in the creation of bubbles that were distracting in the images.

To create this flow we used a speaker, and a glass, and approximately a cup of water. Using tape we attached the glass to the speaker. This means the class will move with the same frequency as the speaker that is creating the sound. A diagram of the system is shown below:



To create the desired effect in the water we had to use songs that had high amplitude base notes. These low frequency waves from the speaker would then vibrate the glass creating waves in the water. Because the waves were being created in such a confined space they would quickly begin to interfere with each other. Constructive interference was seen where there were large splashes in the water, and destructive interference was seen when there wave canceled each other out resulting in minimal movement from the neutral water level. The best images we captured were when there was mostly constructive interference and large height differences in the water. We used a computer program to record the music while we were taking pictures. This data was then analyzed to find the high frequencies (Hz) and corresponding sound levels (dB). The

notes that created the waves in the water had frequencies ranging from 600Hz to 8000Hz, and had corresponding sound levels between 20 dB and 36 dB. These represent the deeper base tones in the music. The higher frequency tones created smaller waves that had a lesser effect on the water.

There was no visualization technique required to see the flow that we were creating. The water itself created very interesting photos. I chose a photo in which we changed the color of the water using green food coloring. The dilution was approximately 1 drop of food coloring per cup of water. For lighting we turned off most of the lights in the room, leaving one on so we could see what was happening. The main source of light was the flash on my camera. Using the flash created unique effects in the water highlighting seemingly random sections.

To take this photo I used a Nikon CoolPix L5. This is a 7.1 mega-pixel digital camera. The image was taken with pixel dimensions of 3072 pixels wide by 2304 pixels high. The focal length of the camera for this image was 22mm. To take this picture I set the shutter speed to 1/64 of a second, the apertures f-number to 1/4.4, and an ISO of 79. The field of view of the image is approximately 5in, and the picture was taken 11in from the top of the glass. Other than cropping, I decided not to use any Photoshop techniques to alter my photo. I liked the presence of reflections from the glass, the color, and the highlights. I played with some different functions, but ultimately decided I like the original image the most.

Overall I think this image shows how a contained fluid flow can be beautiful, and give the simultaneous feeling of looking at something extremely small, and something extraordinarily large. My favorite aspect of this photo is the highlights created by the flash in the water. This makes the water almost look like it is sparkling. The only aspect I might have liked to change is the color of the water. We only hade green food coloring, so I was unable to photograph any other colors. This image does a good job of showing how a vibrating container can create waves in the water that interact, some creating destructive interference, others creating constructive interference. My intent was realized better than I could have hoped. If I decided to continue pursuing this idea I would try and capture a time-lapse video of the water from its rest state. This would allow everyone to see what I was able to see in terms of escalation of the waves as they interact.

Bibliography

1. "Frequency." Wikipedia. 10 Dec. 2007 <http://en.wikipedia.org/wiki/Frequency>.

2. How Stuff Works. 10 Dec. 2007 <1. http://electronics.howstuffworks.com/speaker.htm>.