CONCRETE CYMATICS

INTRODUCTION

Concrete and mortars aren't exactly going through their strongest era. Architects today are now over the hype building with concrete was in the last Century.

So how can we make concrete hot again and still offer **"energy-aware"** applications? **How can we bring concrete back and make it better?**

Because of the competition's theme: "concrete and energy" we thought of **approaching the task literally**. Coming up with ideas on how to **apply energy directly to concrete** we landed on the concept of **Cymatics**, and decided to do research on it and put the concrete to test.

So what is Cymatics?

Roughly, it's the study of visible sound and vibration and its name comes from the Greek word **κῦμα** "wave".
Normally the fluid to be tested would sit on a plate, diaphragm or membrane. While vibrated, regions of maximum and minimum displacement are made visible in a thin coating of particles, paste or liquid. Different patterns emerge depending on the frequency of the waves of the vibration applied.

During our research we were lucky enough to work with an expert in this field. He is an architect, sound expert, and artist who has been experimenting with paint and Cymatics for three years and making art pieces with this technique. He was of course very interested in trying with concrete. He provided us with the materials and gadgets we needed and guided us during the process. Also, we were very inspired by his work and we learned a lot about the whole science from him.

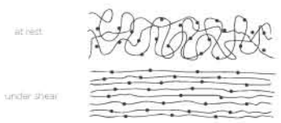
We used a home-made amplifier and placed a customized **round, flat plate on it with a small distance to the speaker.** Attached to the amplifier was a **synthesizer** on which we streamed the sound through.

We decided to work with **3 parameters** when doing the tests. Amount of concrete, amount of water (which essentially is the parameter "density" on its own) and frequency of the sound waves induced.
The next panel explains and compares the different samples we took.

The conclusions we make from reading the results we obtained are the following:
Very high frequencies produce interesting sinusoidal patterns but the liquid moves too fast and the waves aren't as noticeable and fairly small in height. Also it is noticeable how the water separates from the concrete and stays on the surface.
For lower frequencies, and most of the rest of the spectrum, the results in form of patterns didn't differ too much. For almost all the musical notes we tried, even in different octaves, the outcomes were very similar.

DOING IT WITH CONCRETE

Concrete is a Non-Newtonian fluid when mixed with water. Its viscosity depends on the shear rate or applied stress and so behaves differently from Newtonian fluids (like water) organizing its particles in different ways. Working with concrete then becomes very interesting combined with Cymatics and reveals its potential to us as we study its possibilities.



APPLICATIONS

If we could manage, with some sort of additive, to create a **hybrid** and **speed up the setting process** for it to be short enough to obtain an interesting shape for the final product requirements, we could **avoid** one of the most expensive and environmentally aggressive steps of the building with concrete process, its **casing**
If we look into it at a smaller scale, it could also be used for making **concrete panels for façades**. For interesting **textures** if the frozen splatters were visible to the outside, or for acoustic and thermal **insulation** if they were trapped inside the panels creating porous complex air chambers.

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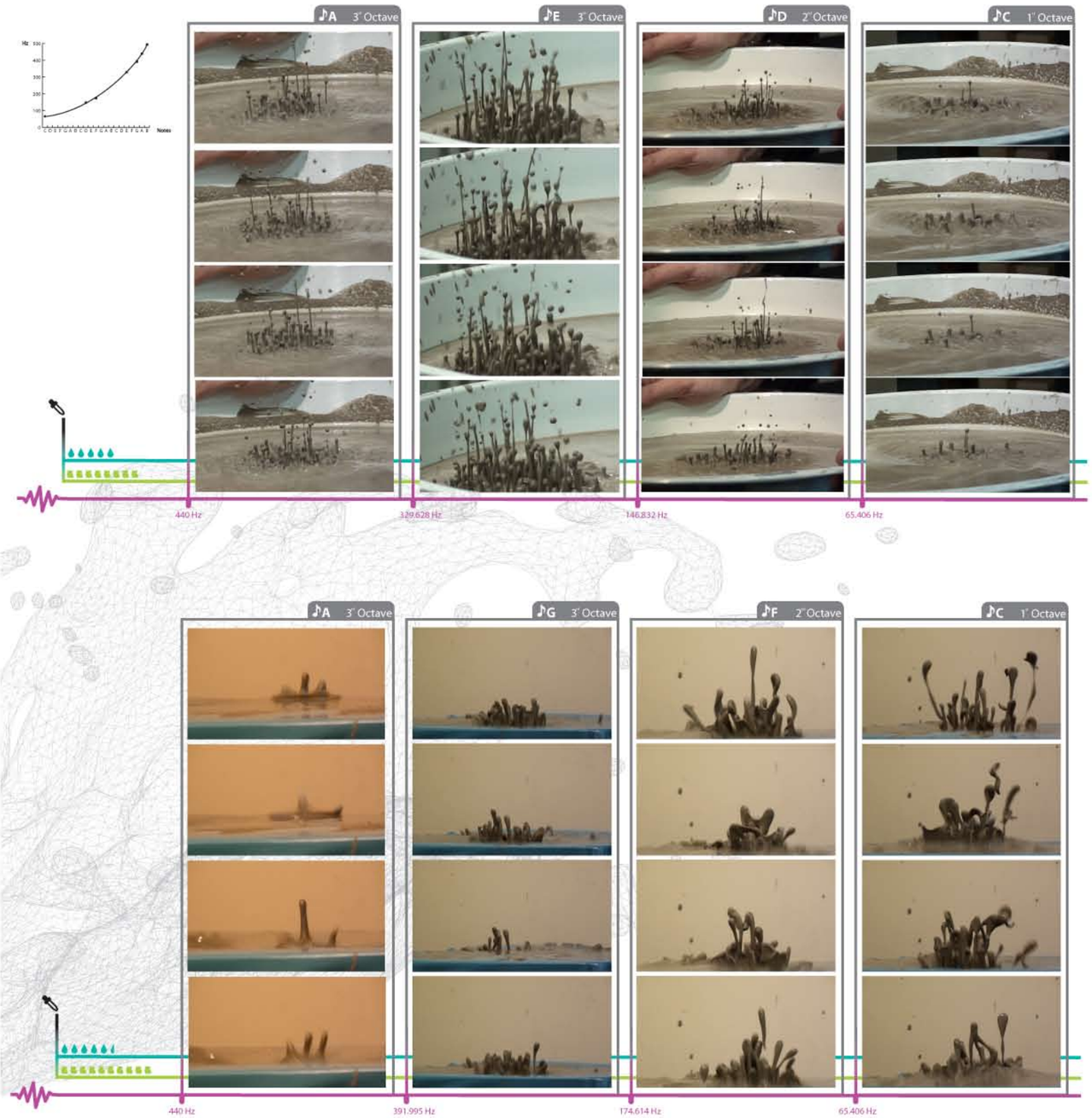

5TH CONCRETE DESIGN COMPETITION ENERGY 2011 2012