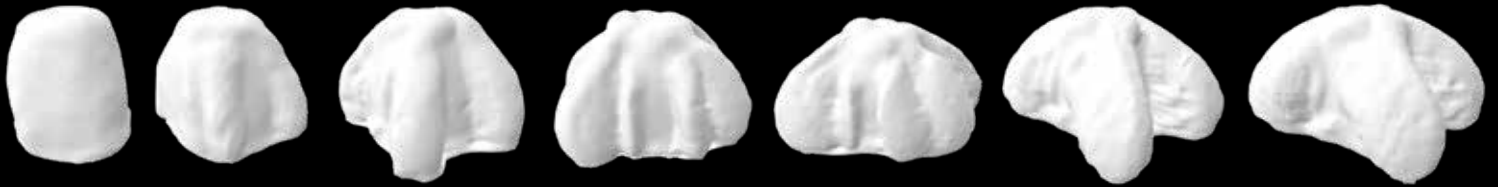
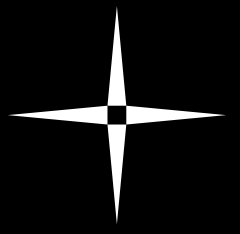


EVOLUTION OF PUR



POLYURETHANE AS AN ORGANISM

One of the most interesting characteristics of pur foam is that it expands and find its way through the air. It 'breaths' and lives during the 2hrs growing process.

Polyurethane chemistry is very complex. It is formed by the reaction of the isocyanate and alcohol groups to form a urethane bond. This creates a long chain with alternating a hard and a soft segment.

- 1 VISUAL RESEARCH
- 2 RESEARCH QUESTION
- 3 FINAL WORK

RESEARCH PAPER

1 VISUAL RESEARCH

ERNST HAECKEL

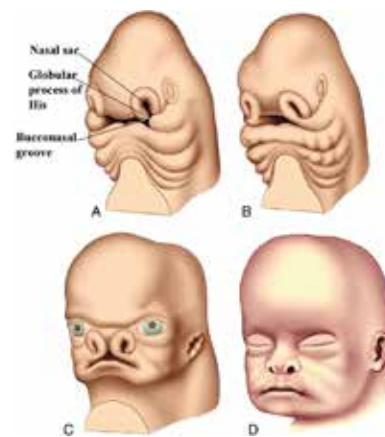
I am really inspired by the work of Ernst Haeckel and found visual similarities with his illustrations. Ernst Haeckel (1834–1919) was a German-born biologist, naturalist, evolutionist, artist, philosopher, and doctor who spent his life researching flora and fauna from the highest mountains to the deepest oceans. He really wanted to explain his findings. To do this, he created hundreds of detailed drawings, watercolors, and sketches of his findings which he published, including several organism collections. Haeckel's work was as remarkable for its graphic precision as for its understanding of organic evolution.



From jellyfish, lizards, spider legs to sea anemones, Haeckel emphasized the symmetries and order of nature, and found beauty in even the most unlikely creatures.

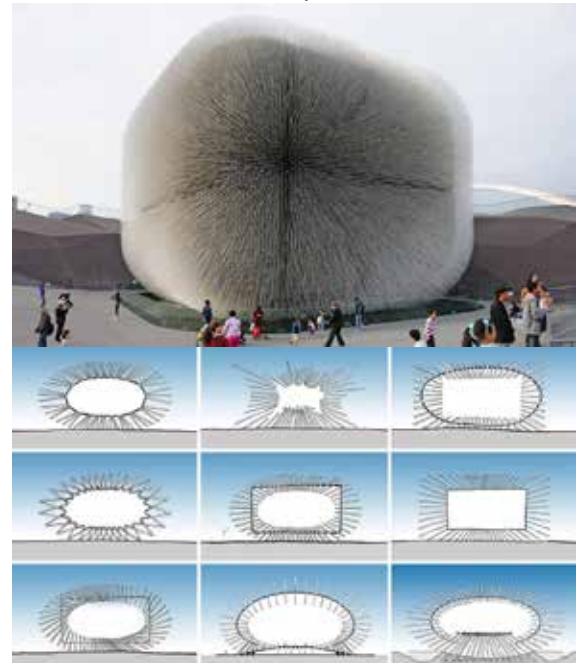
I bought the book *The Art and Science of Ernst Haeckel* by TASCHEN last year because of all the interesting shapes and visuals. When I scroll through the book I see the organisms become alive and work together. How he portrays living organisms

so that it is understandable is a way I could do with pur foam to make the growth process understandable. The evolution of humans is also an interesting image if we're going to talk about the evolution of pur.



UK PAVILION

Thomas Heatherwicks Studio designed the pavilion for the World Expo 2010, known as Seed Cathedral. Within the theme future of cities they looked for relationships of cities and nature. Because British cities are the most greenest of the world and London has the first major botanical institution with a collection of 25 per cent of the world wild



plant species they designed a Cathedral of seeds. The pavilion houses 250.000 seeds in 'hairs' of 7,5 metre acrylic rod.

OLAFUR ELIASSON

Olafur Eliasson is mainly concerned with the relationship between technology and nature. He works very spatially, his final work is experiments, develops, designs, and produces artworks, exhibitions, and architectural projects. The way of working out, often large and robust, inspires me. He works with architecture and well-regulated systems.



PLANET EARTH

When I was watching the netflix series planet earth at home, I saw visual similarities between the coral and the results of purfoam. The shapes and textures come close to the organic pur foam creations. I could imitate a very unique coral. Only pur foam is always cream colored and it will never be as soft as soft pieces of coral. But on top of that there are 3 meter high corals that are even stronger and more massive than purfoam. What fascinates me the most are sea anemones that behave like marine animals or live corals / flowers. They have



no skeleton and are attached to a surface with a suction foot. A sea anemone is capable of changing its shape dramatically.



The column and tentacles can lengthen, bend and twist. The gullet and mesenteries can turn inside out or the oral disc and tentacles can retract inside the gullet.

2 RESEARCH QUESTION

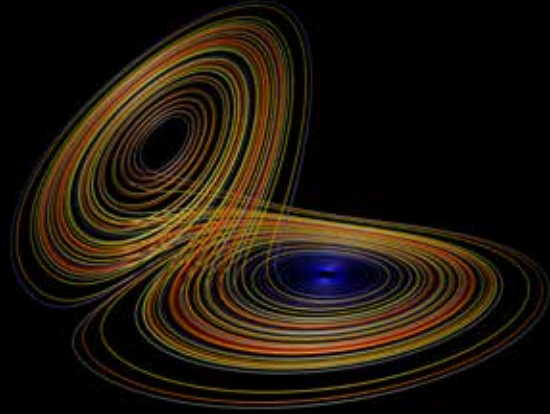
HOW RELATES THE GROWING OF PUR FOAM TO CHAOS THEORY?

Chaos is the science of surprises.

Chaos theory is the name for the area within mathematics that investigates the behavior of nonlinear dynamical systems or systems theory. The official name in mathematics is dynamic systems. It examines conditions in which chaos occurs and which properties it has.

The concept of chaos has a technical meaning here, so not as chaos on the road. It means that apparent disorder is precisely determined and arranged according to an algorithm or calculation rule. The crazy forms that pur foam makes are related to mathematics. It is not that it just goes somewhere. There is certainly a calculation rule here that determines that the foam grows more or less through the disposal of air. An example, if you spray pur in a balloon then it comes out of the nozzle. Even if you close pur in a vacuum tupperware, it still finds a way to get out of the corners. Through this research I was curious what would happen if I work with the chaos theory. If you would purp in a normal situation you get a non-symmetrical mess on pur. When I spray in a colander, I change the system and make another supply of air. The resulting shape is totally different and sometimes even almost symmetrical. If you make replicas of this, these will all be different by the air supply. You can also make small changes that completely deviate the final shape. In the chaos theory they describe that a small change in one state of a nonlinear system can result in a big difference.

The Lorenz-attractor is a fractal that corresponds to the long-term behavior of chaos theory. There is a point that the birth is, then by small changes he always



turns away. It looks really controlled, but it is true that the first line is peelable and then everything turns out. Samuel Won is talking about chaos theory in his TED talk about the small changes in daily life have big outcomes. For example when only 2 important people were killed, a big first world war happened. When you only forget to lock you car, you car, laptop and harddisk are stolen. If you make an obstacle in the middle of the polyurethane before the growth process, the whole foam will split and there will be a totally different object at the end.

Chaos theory is a feedback loop. They become chaotic when there is feedback present. For example in the stock market, when the value of a stock rises or falls, people are going to buy or sell that stock. Then the price of the stock is to rise or fall complete to the ground.

Chaos theory deals with non-linear things and it is impossible to predict or control precisely. Even slight errors in measuring the state of a system will be amplified dramatically. That is exactly how pur foam works. You can adapt it so that you can work almost exactly with it, but you will never be able to achieve extreme precision. That is due to so many parts. Think of how empty the can is, how the pressure is, how full there is sprayed, how often you shake the can and so on.

2 FINAL WORK



A selection of experiments that connect to chaos theory. You see that some are trying very hard to show themselves. Others easily pass through or along the barriers

In this case my topic of interest was the difference between a change in the pur foam (because normally it's used for isolation), now i use it as a research method and almost mathematical way. I played With themes like the law of nature, contructions and the consequences of an incidental change.