

## **Guillian Graves, fundador, designer e CEO da Big Bang Project agency**

### **- In what consistes your research work?**

Thanks to design - a design practice that puts usage, users, and the environment at the heart of its reflection - my objective is to draw on the Life Sciences to respond creatively to the major challenges of today and tomorrow. To address these challenges, I founded and directed the Big Bang Project agency, which specializes in the research and development of bio-inspired innovations.

First based in Paris, then in Brittany, the agency takes its name from the eponymous theoretical model describing the stages in the evolution of the Universe, from the moment when Space, Time and Matter arose to the present day. These events led to the creation of atoms and galaxies after a long series of phase transitions. Both in its process and in the means implemented to understand it, the Big Bang inspires our project. It involves scientists, engineers and creators, and takes advantage of the co-evolution of technologies and knowledge to build new hypotheses, new concepts and new visions of our past, present and future world.

Our teams are resolutely and systematically multidisciplinary and our networks of scientists, designers and engineers work hand in hand to respond to problems in a concrete manner, anchored in reality while maintaining scientific rigor. This approach allows us to continuously explore themes such as the future of housing, energy, health, food, mobility, sports or space, etc.

Depending on the targeted problem, the bio-inspired solutions we design can take different forms. They can be embodied in new materials, products (goods and services), experiences, places, forms of organization, etc.

### **HORN - What was the bioinspiration for this work?**

Assembled in the form of panels, traditional solar cells have the role of transforming the sun's rays into electricity. The use of scarce resources in their manufacture, the complexity of their production method as well as the geographical constraint of a good implantation make the acquisition and the installation of solar devices expensive and complicated. However, the emergence of a new generation of solar cells is likely to transform these devices as much as the objects of our daily life.

The solar cells developed by Professor Michael Graätzel's team at EPFL are inspired by plant photosynthesis: they use dye molecules to transform the sun's rays into electricity. These new solar cells imitate this principle and use a dye to capture and transform light into energy. This dye can be applied at low cost by screen printing on different types of supports: rigid or flexible, opaque or transparent. The cells can thus be flexible, translucent, colored and accessible to the greatest number. Placed under the midday sun, they cannot compete with their silicon competitors. On the other hand, they are more active in diffuse light, i.e. under cloudy skies, indoors, in the morning or evening.

Thanks to the use of this technology developed by EPFL and a multidisciplinary approach mixing design, science and engineering, designer Guillian Graves has developed a new kind of energy autonomous home object: Horn. Horn is a wireless speaker made almost entirely from a folding of this new generation of flexible solar cells. These cells ensure the object's energy autonomy by capturing the ambient lighting in the home.

The shape of the speaker evokes the pavilion of the gramophone. It takes up its architecture in order to draw from its physical performances of amplification. Its geometrical construction with eight sides optimizes the captation surfaces of the cells applied in bands by silk-screen printing. The red color of these bands allows to absorb a larger part of the light spectrum. Their slight deformation softens the strict geometry of the object. In order to save energy, the speaker is equipped with a single speaker. Its power is increased tenfold by the structure of these flexible folded cells, whose shape and color optimize the capture and its output.

In short, Horn is a speaker that transforms our relationship to energy. By using the solar technology developed by Professor Graëtzel as a material, it participates in the elaboration of new typologies of autonomous objects for tomorrow.

### **NAUTILE - What was the bioinspiration for this work?**

The environmental performance of traditional kettles is still often unsatisfactory. Through an approach that combines industrial design and bio-inspiration, designer Guillian Graves and bio-engineer Mishka Mélo have developed a sustainable and efficient alternative to the traditional kettle: Nautile.

The shapes, materials, structure and internal mechanisms as well as the manufacturing process of this electric and combustion kettle were inspired by nature in order to minimize its energy consumption, responsible for 80% of its environmental impact.

In nature, the nautilus moves along the sea floor by precisely controlling the volume of water that fills the different cavities of its mineral shell. Built on this principle, Nautile integrates four internal tanks. Each tank is the size of a cup and is spherical in shape, which is optimal for limiting heat loss. They allow the user to fill only what he or she needs and thus, to summon only the necessary energy.

Termites regulate the temperature of their habitat by designing a complex architecture. Based on this principle, Nautile incorporates a similar structure. A central chimney and numerous channels run through the three-dimensional printed object. They allow the user to heat a volume of water quickly and efficiently, with a minimum of energy.

The toucan has a light and robust beak that allows it to regulate its body temperature, and the polar bear protects itself from the cold with a fur made of hollow and insulating hairs. Inspired by these principles, Nautile has an insulating layer that encompasses the volumes of water to be heated. It is composed of a honeycomb structure and numerous cavities in the ceramic material, itself insulating. They allow the user to keep the water hot as long as possible so that the same volume is not reheated later.

Based on these four principles, an internal mechanism controls the desired water temperature. It allows the user to select an optimal temperature for his drink while saving energy.

In short, Nautil is an easy-to-use, high-performance kettle with a reduced environmental impact, proof that nature can be a source of inspiration for designing more sustainable innovations.

### **GROWDUCE - What was the bioinspiration for this work?**

In the home, each of us produces an annual quantity of 60 kg of organic waste. In order to be recycled, it requires the implementation of recycling channels that are often complex and far from their original collection point.

However, in nature, each waste of a species is a resource for others. They are recycled locally by dozens of species of micro-organisms (bacteria, fungi or actinomycetes) and macro-organisms (insects, worms, crustaceans or gastropods) that feed on them. It is by digesting them that these organisms will produce new materials that will be suitable for a new use.

Thanks to an approach mixing industrial design and life sciences, the designer Guillian Graves and the bio-engineer Aakriti Jain have developed an efficient, sustainable and entirely local alternative to organic waste recycling in the home: Growduce.

A cross between a biocomposter and a 3D printer, Growduce is a home recycling and biofabrication device. It is intended to recycle our organic waste by transforming it into everyday objects. To do this, Growduce uses biology as a technology and process.

The lower part of the object, made of ceramic, hosts a colony of 'acetobacter' bacteria that lives in symbiosis with yeast. The upper part of the object, a glass bell, allows the user to incorporate the waste and add various natural additives.

The organic waste that is incorporated is digested by the micro-organisms through a process of fermentation and metabolization. They are then transformed into a rubbery membrane that grows on the surface of the compost. It is a brand new raw material that the machine uses to sculpt, with the help of a system of interchangeable molds, everyday objects for different uses, with little or no maintenance.

The properties, color, smell and taste of the cultured membrane will depend on the additives added, while the shape and texture will depend on the mold used. Once dry, the membrane will provide us with fully biodegradable objects made of cellulose, the main component of plants, widely used in the fields of health and well-being, food, energy, clothing, or packaging.

The first recipes and molds imagined allow the user to transform locally his bio-waste into bandages with healing properties, beauty masks, gloves and other clothing, new types of food or even logs for home heating.

In short, the Growduce device offers a new way to recycle organic waste locally by transforming it into new sustainable and biodegradable objects. It also invites us to reconsider the negative image we have of bacteria and other micro-organisms, which are capable of providing us with many services.