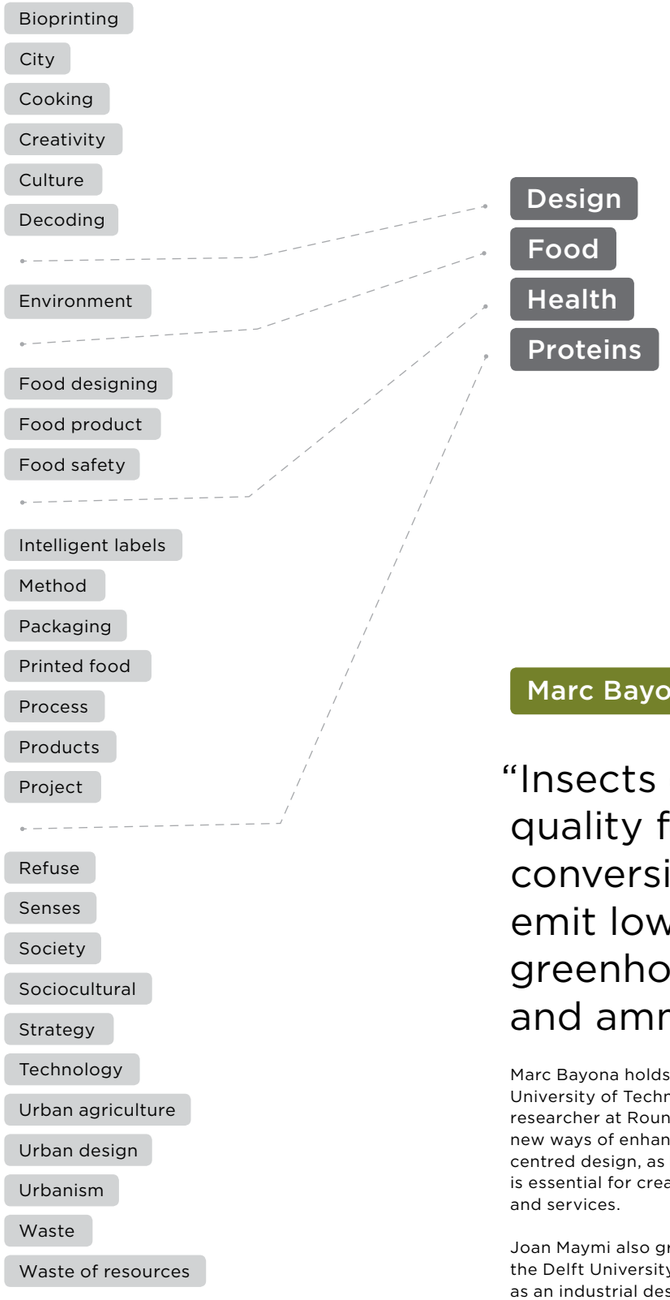


Marc Bayona Joan Maymi

“Insects can provide quality food, have high conversion ratios and emit lower levels of greenhouse gases and ammonia”

Marc Bayona holds a Master of Science from the Delft University of Technology and is currently a design researcher at Round Feather. He passionately explores new ways of enhancing sustainability through user-centred design, as he believes that understanding people is essential for creating valuable sustainable products and services.

Joan Maymi also graduated as a Master of Science from the Delft University of Technology and at present works as an industrial designer at Josper Charcoal Ovens. He has gained experience in human-centred design and sustainable development projects through his active involvement in projects in developing countries like Vietnam, India.

Insects, Food and Design

Despite the fact that insects are a promising source of proteins and are consumed in many countries, they are often rejected as food in Western societies. Food can be refused for a number of different reasons, among which repulsion appears to have been the foremost. The problem was addressed in the design workshop entitled ‘Insects, Food and Design’ held at ELISAVA to explore changing Western perceptions of eating insects. The workshop began investigating the cooking of insects, and the following ideation phase addressed people's motivations to make insects appealing. This paper presents three different concepts that emerged from the workshop.

At present, a major part of the world’s protein consumption comes from the livestock industry (animals, i.e. meat). Unfortunately, the meat industry has terrible consequences for the environment and is perhaps one of the most polluting of human activities. Furthermore, the population growth rate makes maintaining current levels of animal production in future impracticable. One possible solution to the reduction of livestock production that would guarantee people’s diets were still rich in protein could be to eat insects. Insects usually have high amounts of protein and lower polluting rates than livestock. A key feature is their feed conversion rate —given that insects are cold blooded, they are far more efficient at converting food into body mass.

Proteins: the base for a healthy body

In order to maintain a healthy body, access to appropriate quantities and quality of food is essential. A certain amount of proteins and other nutrients are vital in ensuring the right balance. In fact, during certain phases such as childhood, adolescence and pregnancy, proteins seem to be especially important.[1]

Proteins, derived from the Greek root *protos*, meaning ’of primary importance’, are amino acid compounds made from long chains of smaller molecules that can be classified as essential, non-essential and conditional. Essential proteins are obtained through food and can be said to be ‘complete’ when they contain all essential amino acids, mostly found in products such as red meat, eggs or dairy produce, besides a few vegetables like quinoa. Other foods such as legumes, broccoli and soy products are excellent sources of protein although

1 WHO/FAO/UNU Expert Consultation (2002). Protein and Amino Acid requirements in human nutrition. WHO Library Cataloguing-in-Publication Data,retrieved from: http://whqlibdoc.who.int/trs/who_trs_935_eng.pdf

▲ Raw material. Photograph: Iñaki Gargallo.

▲ Elaborated product.

▲ Commercial product sample.

“The introduction of insects in Western diets needs to surmount technical and also cultural barriers, given that insects are neither consumed nor accepted as a food source in the West”

they usually need to be completed with other products. Legumes in combination with grains, for instance, generally form a complete chain of amino acids. Animal protein is therefore an important factor in a healthy diet.

Proteins: the base for a healthy body

Most proteins are derived from livestock and fish, both of which pose challenges for sustainability. In terms of land and water, for instance, beef production consumes many more resources; it is also a source of pollution and one of the main causes of greenhouse gas emissions. The impact of beef, in particular, and of livestock, in general, is huge. As Jason Clay states, ’globally, cattle affect ecoregions of greater biodiversity than any other single agricultural commodity.’[2]

Furthermore, due to the ‘Westernisation’ of food habits, developing countries are increasing their consumption of meat.[3] As a result, approximately two-thirds of agricultural land is currently used to maintain livestock, which requires the use of chemical fertilisers, pesticides, antibiotics and hormones without a full understanding of their impact.[4]

In addition to these threats, by the year 2050 the global population is projected to grow to at least 9 billion people. This will undoubtedly lead to a parallel increase in the consumption of livestock products (meat), which is predicted to double by 2050,[5] making unsustainable demands on arable land, fresh water and other resources for producing food, and using chemicals to ensure a high production rate.

2 Clay, J. (2004) *World Agriculture and the Environment: A Commodity-by-Commodity Guide to Impacts and Practices.* Island Press, Washington, DC.

3 Delgado, C.; Rosegrant, M.; Steinfeld, H.; Ehui, S.; Courbois, C. (1999). *Livestock to 2020: the next food revolution.* IFPRI Food, Agriculture, and the Environment Discussion Paper 28. Washington, D.C. (USA): IFPRI.
— Delgado, C.L., Rosegrant, M.K., Meijer, S. (2001). *Livestock 2020: The Revolution Continues.* No 14560, International Trade in Livestock products Symposium, January 18-19, 2001, Auckland, New Zealand from International Agricultural Trade Research Consortium.

4 Clay, J. (2010). *How big brands can help save biodiversity.* (video file), source: http://www.ted.com/talks/jason_clay_how_big_brands_can_save_biodiversity.html, TED talk, last viewed 28 Sept. 2013.

5 Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M. & de Haan, C, eds. (2006). *Livestock’s long shadow: environmental issues and options*. Rome, FAO.

Mini-livestock: **an efficient and low-impact protein production form**

Alternative answers to such potential threats are, however, being explored. One potential solution is the introduction of mini-livestock, i.e. small animals such as arthropods and invertebrates, as a source of direct protein at a low environmental impact. Insects can provide quality food, have high conversion ratios and emit lower levels of greenhouse gases and ammonia.[6] Most insects are harvested in the wild although some, like bees and silkworms, have been long domesticated. Recent examples of edible insects being commercially farmed for human consumption include the house cricket, the palm weevil and the giant water bug in China.[7] Although it is technically feasible to mass-produce insects for human consumption, knowledge and methodology for large-scale breeding have yet to be developed.[8]

Food acceptance: repulsion

The introduction of insects in Western diets needs to surmount technical and also cultural barriers, given that insects are neither consumed nor accepted as a food source in the West.[9] Western culture seems to have created a wave of negativity around the idea of eating insects that hinders their introduction, so perhaps we should begin by broaching the subject from the point of view of consumers. Design approaches such as User Centred Design explore possible pathways for increasing the future consumption of insects in the West. At a week-long design workshop held at Elisava, twenty-one students focused on the potential of User Centred Design to overcome such cultural and emotional barriers, including feelings of repulsion. The students were divided into seven groups of three, and asked to come up with innovative sustainable solutions to make insects appealing to Western societies. We shall now present three of the resulting proposals.

6 Oonincx, D. G. A. B., van Itterbeeck, J., Heetkamp, M.J. W., van den Brand, H., van Loon, J. J. A., van Huis, A. (2010). An Exploration on Greenhouse Gas and Ammonia Production by Insect Species Suitable for Animal or Human Consumption. PLoS ONE 5(12), e14445.
Oonincx, D. G. A. B., de Boer, I. J. M. (2012). Environmental Impact of the Production of Mealworms as a Protein Source for Humans – A Life Cycle Assessment. PLoS ONE 7(12), e51145.

7 Jäch, M. A., «Fried Water Beetles: Cantonese Style», *American Entomologist*, vol. 49, núm. 1, (2003), p. 34-37.

8 Kok, R., Lomaliza, K., Shivhare US. (1988). The design and performance of an insect farm/chemical reactor for human food production. *Canadian Agriculture Engineering*. 30, 307-17.

9 KoBolckman,S. K.J.F. (2010). New, Novel, Innovative and Emerging Applications of Insect Rearing. Symposium No. 5. 12thWorkshop of the Arthropod Mass Rearing and Quality Control Working Group of the IOBC, October 19–22, Vienna, Austria.
— Van Huis, A. (2013). Potential of insects as food and feed in assuring food security. Annual review of Entomology. 58, 563-583.

BugBag

This concept starts from the beginning and intends to educate the next generation by teaching kids nutritional values. The proposed packaging invites children to play and enjoy their snack in new ways. The ant cookie is shaped so it can be easily snapped and therefore shared with their friends during school breaks.

As it is still up to parents to choose what their children eat, we decided to focus on the nutritional values of insects and offer diverse and healthy alternatives to regular biscuits. In future, parents will be even busier than they are today, although they will of course continue to organise their family lives and take care of their children as efficiently as possible. With Bug Bag they are able to offer their kids a healthy take-away snack, in the knowledge that such nutritional values are just what they need.

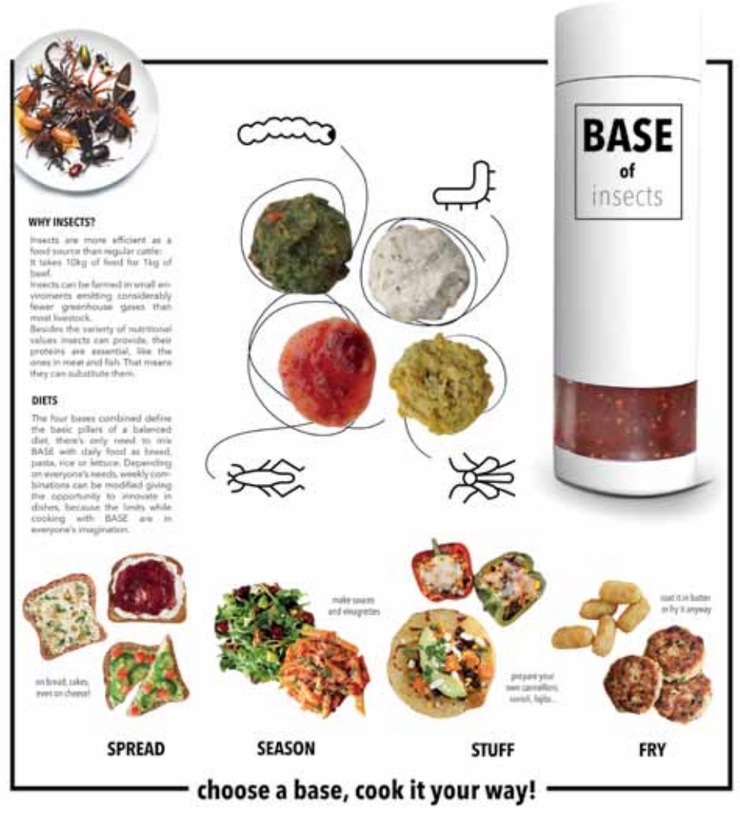
Health and fun are the key concepts that will determine our view of nutrition in the future, helping to create food awareness and promoting new educational values.

Bug Bag. Cristina Florensa, Arnau Pares, Julia Thomann. Barcelona, 2014.

Base

Base responds to the need of feeding future generations in a sustainable and wholesome manner. It consists in four culinary bases that fulfil our daily nutritional requirements, easily, creatively and healthily. Thanks to its fresh and natural components that combine several types of insects and everyday ingredients, Base obtains a perfect balance between sustainable development of products and nutritional solutions. The product, therefore, satisfies the basic requirements of a balanced diet (vitamins A and C, iron, calcium), replacing the essential proteins of meat and fish with new protein sources.

The project was an opportunity for students to gain professional experience and challenged them to do their part to improve the world in which we live.



Base. Elia Bagó, Alexandra Ballotta, Elsa Casanova. Barcelona, 2014.

Cuicsa

Contemporary society is constantly undergoing changes. Technological innovation strives to make life easier, and yet to a certain extent it also makes it more stressful. We have less and less time for comfort and relaxation, which thus becomes very valuable. People need quality time to eat and ensure they lead healthy lives, and the fact that they don't have enough time to plan these carefully gives rise to a number of emotional dilemmas. In order to avoid fast food and poor quality, Cuicsa proposes a new hybrid concept: slow-fast-food.

Cuicsa is conceived for people who want to eat healthy meals but have no time to cook and consider eating out a waste of time and money. Cuicsa is a sustainable and wholesome product that consists of cooked mealworms, which make it unique. Containing other select ingredients such as vegetables and pulses, it is a complete, healthy and tasty meal able to meet all our nutritional needs. The product is easy to eat and to carry; it is clean, light and designed to give consumers more restful and relaxing lunchtimes. Each box of Cuicsa contains four *cuics* or portions, ready to eat in just two bites. The packaging itself makes the product easy to consume, with no need for cutlery.

Cuicsa. Berta Aracil, Ona Bombí, Marina Caubet. Barcelona, 2014.