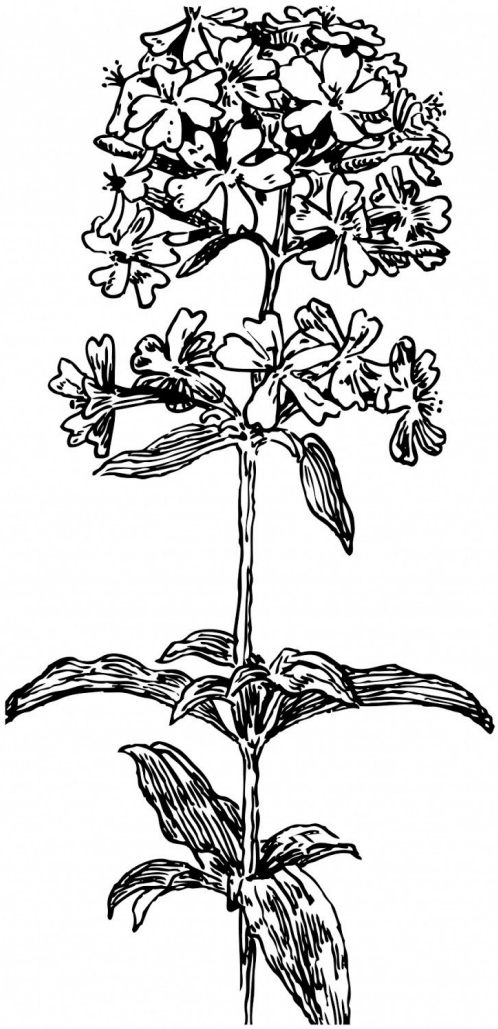
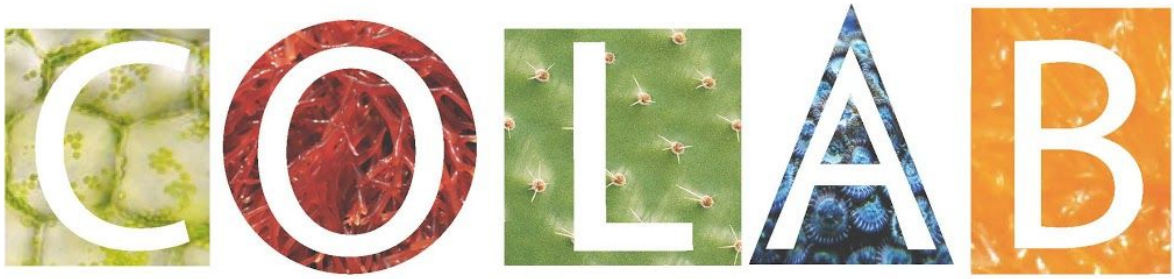
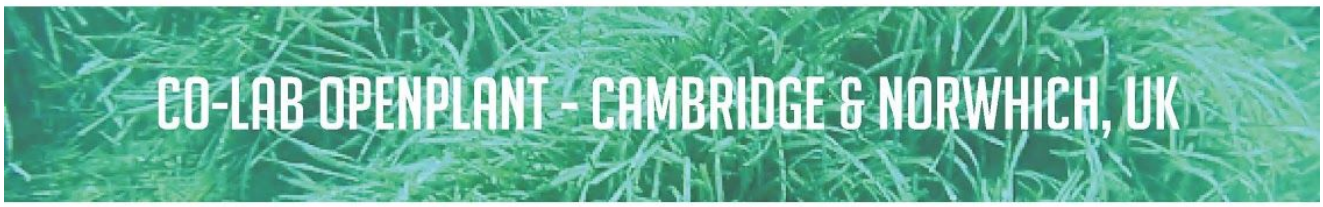
Co-lab Open Plant

Report and project archives







OpenPlant

OPEN TECHNOLOGIES FOR PLANT SYNTHETIC BIOLOGY

Open Science School

コ•ラボ co-lab

interdisciplinary workshops

ateliers interdisciplinaires

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 709443

Report and project archives

Open Science School. Paris, January 2017

Visit our open google drive to access to all the presentations, documents, pictures, and videos: https://goo.gl/hyWTE0

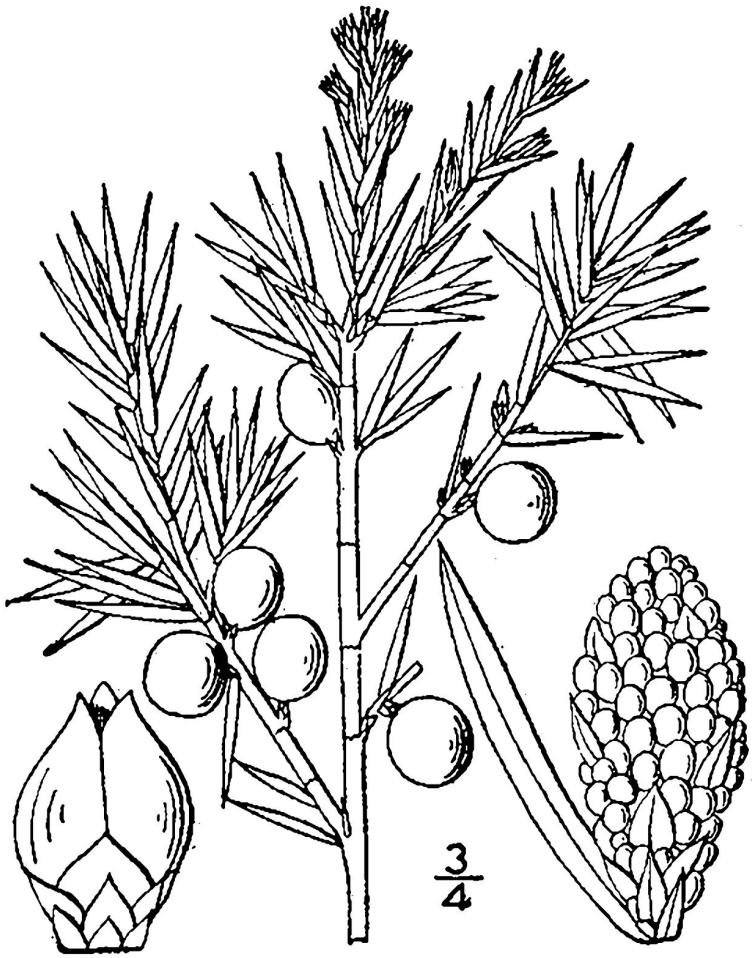
Website: www.opensciencesschool.org

Twitter account: @ossparis and hashtag #biocolab

Co-lab Open Plant report

Table of Contents

Introduction



Acknowledgements

This workshop would not have been possible without the support of Open Plant Fund. We thank Open Plant, the University of Cambridge, The John Innes Centre for making this possible. Jenny Molloy and Colette Matthewman to help us organizing, ordering, and taking care of some of the sessions in Norwich and Cambridge. Thanks also to Carlos Lugo, who took care of the groups during the Big Making Days. This project have received support from the European Project togetherscience.eu

This would not had been possible without the generosity and energy of Paolo Bombelli, that accepted to be the Primary Supervisor of the project, helped proposing amazing workshops and opened the doors of his house for a few days to offer a place to the visitors coming from Paris, and to Chris Howe that kindly came to talk to us and opened his lab.

Makerspace Cambridge, the University of Cambridge, and the John Innes Centre provided amazing facilities and rooms for free to organize this activities. Thanks as well to the technician and the university personnel that received organizers and participants.

And of course, we thank all participants that made all the projects possible and the good energy that keeps the workshop running everyday:

Nina Dowbenko
Ekaterina Petrova
Aizhan Zhussupova
Geoff Ma
Brontë Crouch
Karen Chan
Mia (Hui) Ben
Mihails Delmans
Sydney Schaefer
Claire Restarick
Chen Anran
Mie Monti
Mari Ohno
Lucie Studená
Michael Friedman
Aleks Berditchevskaia
CJ Ong
Ciara McCarthy
Jake Levi
Ana Bravo
Ebenezer Antwi Gyamera
Tincuta Heinzel
Emilia McLaughlin
William Hopper
Danielle Wilde
Johanna Kleinert
Erin Cullen
Ken Murohashi
Lucas Von Chamier
Alexander Mayorov
Nadia Radzman
Valentin Hammoudi
Daniel de la Torre
Nick Prior
Freddie Morrison
Victoria Mitchell
Roger Castells Graells
Hang Zhang
Carmen Mirzarafie
Daiana Mirzarafie-Ahi
Sarah Imperatori
Steph Kedik
Katie Wickens
Svenja Keune
Ariana Mirzarafie-Ahi
Hongxia Wang
David Turner
Gabriela Doria
Johana Kleinert
Bonnie Leung
Erin Cullen
Mihails Delmans
Liz Ciokajlo
IGEM Cambridge Team

For last, but not least, thanks to you, reader. We hope you enjoy this report.
The co-lab Open Plant organizing team in Open Science School:

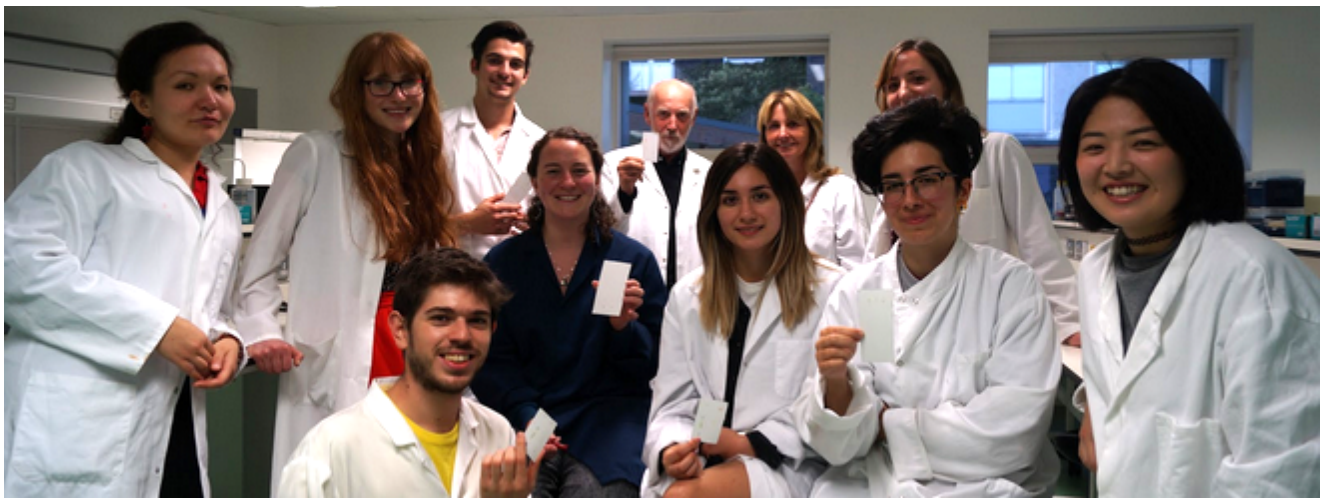
Paloma Portela
Mourdjen Bari
Imane Baïz
Ke Fang
Lena Asai
Juanma Garcia
Francesca Perona
Juliette Lenouvel
Celine Tchao

Manifesto

We believe that science and art are both creative fields of study. Our workshop is a place where artists, designers, and scientists meet to initiate collaboration. We aggregate artists and designers to learn biology. We encourage scientists to value and learn artistic approach and design thinking. We bring artists, designers, and scientists together to explore the possibilities of biological design.

The goal of the Co-lab workshops project is to foster the creation of truly interdisciplinary projects around life sciences. Interdisciplinarity is a tool to solve complex problems that are beyond the reach of any discipline alone. To be able to do this, many soft-skills need to be developed. However, we believe that they are central to face the challenges of this emerging new world: conceptualization, inter-cultural communication, project-based learning, adaptation, and willingness to learn.

We also believe that 1 + 1 is not equals 2, but sums much more. Being able to exchange knowledge is the most valuable tool that a community can have. Being able to use the skills that we have learned from our field in another discipline makes us valuable.



Introduction

Co-Lab (means “collaboration” in Japanese) is a hands-on workshop, facilitated by designers and researchers, aiming to foster conversation and interdisciplinarity in biology. Our workshop brings artists, designers and scientists to meet and initiate conversation to explore the possibilities of collaboration in biological design.

The 5th edition of Co-Lab workshops is funded by Open Plant and called “Co-lab Open Plant”. It was hosted at Makespace Cambridge and Department of Plant Sciences at the University of Cambridge, and received a grant from the OpenPlant Fund. OpenPlant is a collaborative initiative between the University of Cambridge, the John Innes Centre and the Sainsbury Laboratory in Norwich. The initiative promotes interdisciplinary exchange, open technologies for innovation and responsible innovation for sustainable agriculture and conservation. The facilitator, Open Science School, is an non-profit organization based in the Center for Research and Interdisciplinarity of Paris. Open Science School promotes citizen science, interdisciplinarity and new models of research.

The event consisted of 3 separate ideation workshops and a ‘Big Making Days’ dedicated to prototyping with activities that bridges together artists, scientists and designers to brainstorm and work on an interdisciplinary project around synthetic biology

and life engineering. The programme includes pigment extraction, making electricity with plants, an ethnography activity, and a series of participatory lectures.

What is the future of plant research? Can we rethink how we eat, harvest and interact with plants? What if we can generate electricity from our garden? What if each household had its own algae bioreactor? How can GM crops be utilised other than for food consumption? Co-lab open plant series has the objective to create new research ideas around plant synthetic biology and fostering further collaborations by establishing links between designers, artists, and scientists. We will hold our biodesign workshop at University of Cambridge and John Innes Centre - both important institutions contributing to the development of plant science & synthetic biology. This is part of a EU's initiative named DITOS 'Doing it Together Science'.

General programme

- DEBATE - In the 5th edition of Co-Lab, we focused on discussion of plant synthetic biology from an ethnographic point of view. When scientific research borrows methodology from ethnography, which is the systematic study of peoples and cultures, discussions can digress beyond the technological barriers of plant science. How can Scientists place their research in the context of culture and society, to understand how their work is perceived by the public? How can artists and designer utilise their projects to reshape public perception on GMO and plant science?

- EXPERIMENT - We had 2 lab sessions:
    - Plant pigment extraction: We performed pigment extractions from natural plants and algae (betalain from beetroot, carotenoids from chili pepper, phycocyanin from spirulina, chlorophyll from spinach, indigo from Indigofera tinctoria). We can use this as a way to explain the function of metabolic pathways and ways to analyse our products.
    - Making electricity from plants: Preparation of bioelectrochemical systems made from plants and carbon fibres. Create electricity out of your garden! Learn about electrophysiology. We had our special guest from Cambridge University, Dr. Paolo Bombelli, who demonstrated how to make electricity from plants in the workshop. Check out the Moss Table and MossFM projects.

- IDEATION & PROTOTYPING - Participants were grouped into small interdisciplinary groups (with a balanced number of scientists and artist/designers) for the final project. Every group made a brainstorming about their ideas and gave a proposal by the end of the first sessions. Some groups were selected to take their proposal further and continue to prototype the ideas on the big making days.

What will you gain from Co-Lab workshop?

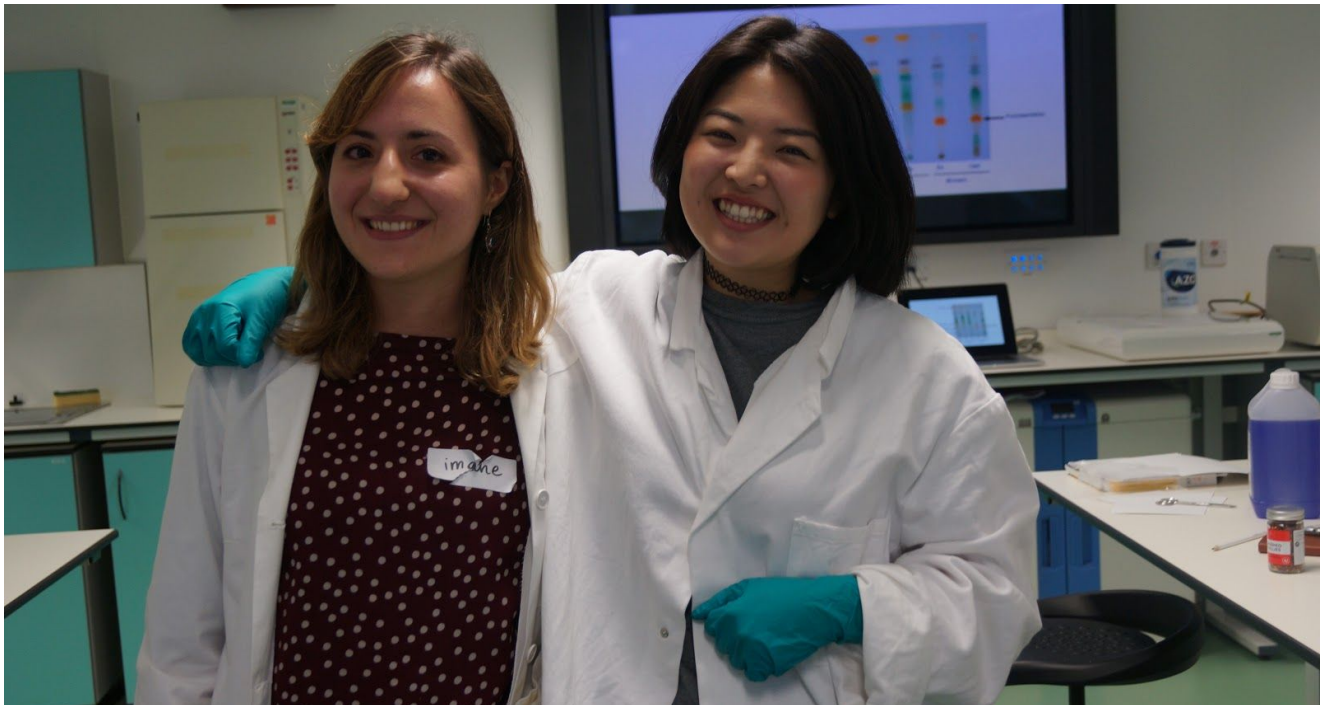
Co-Lab workshops aim to establish links between scientists, artists and designers. If you are a designer or artist, you will learn basic knowledge around synthetic biology and plant science, and explore biology experiments. If you are a scientist, you will learn a different way of thinking, a different type of creativity from art and design, learn about design thinking and methodology. Besides that, everyone would learn from each other in the group project during the workshop, and we would love to see everyone can become friends and work together even after the workshop.

Why Ethnography?

GM crops give limitless possibilities to optimize human life, but why does the public reject it? Objection to GM food is admissible - people are cautious of what goes in their mouth. In contrast, the use of GMO in medical, energy production and material engineering receives less objection. Public perception of GM crops are heavily influenced by the context it is placed in. Thus borrowing ideas from ethnography, which is the systematic study of peoples and cultures, discussions can digress beyond the technological barriers of plant science.

Philosophy

There is a relatively clear reason why the design, arts and science should meet - they are all creative disciplines. Arts, design, and science all have the capability of changing the ways humanity views the world.



The organisers of the workshop were united under the question of the meaning of true or deep interdisciplinarity. We initially asked ourselves “how do we facilitate the communication of science and design?” We were inspired by the Bauhaus teaching method which replaced the traditional pupil-teacher relationship with the idea of a community of artists working together. Learning by teaching allows a very effective transfer of knowledge, because it makes participants stronger in the skills that they master and also creates an space to acquire new skills. In order for true collaboration to happen, mutual respect must exist. These dynamics flip the teacher-student role constantly and effectively create an horizontal scenario for interaction to happen.

During the Bauhaus Weimar period, the Bauhaus workshops were co-led by a craftsman as a master of works and an artist as a master of form. We also co-assign the leading role of the courses to a scientist and a designer and show how real conversations, controversies and agreements take place between them, so that the participants make up their own perspective. We challenge the gap existing between these disciplines creating an universal basic language for interdisciplinary idea generation.

“Scientists are very much entangled in their culture and this culture is not pristine, untouched by other cultures and practices.” (Bruno Latour). Bruno Latour’s theory of

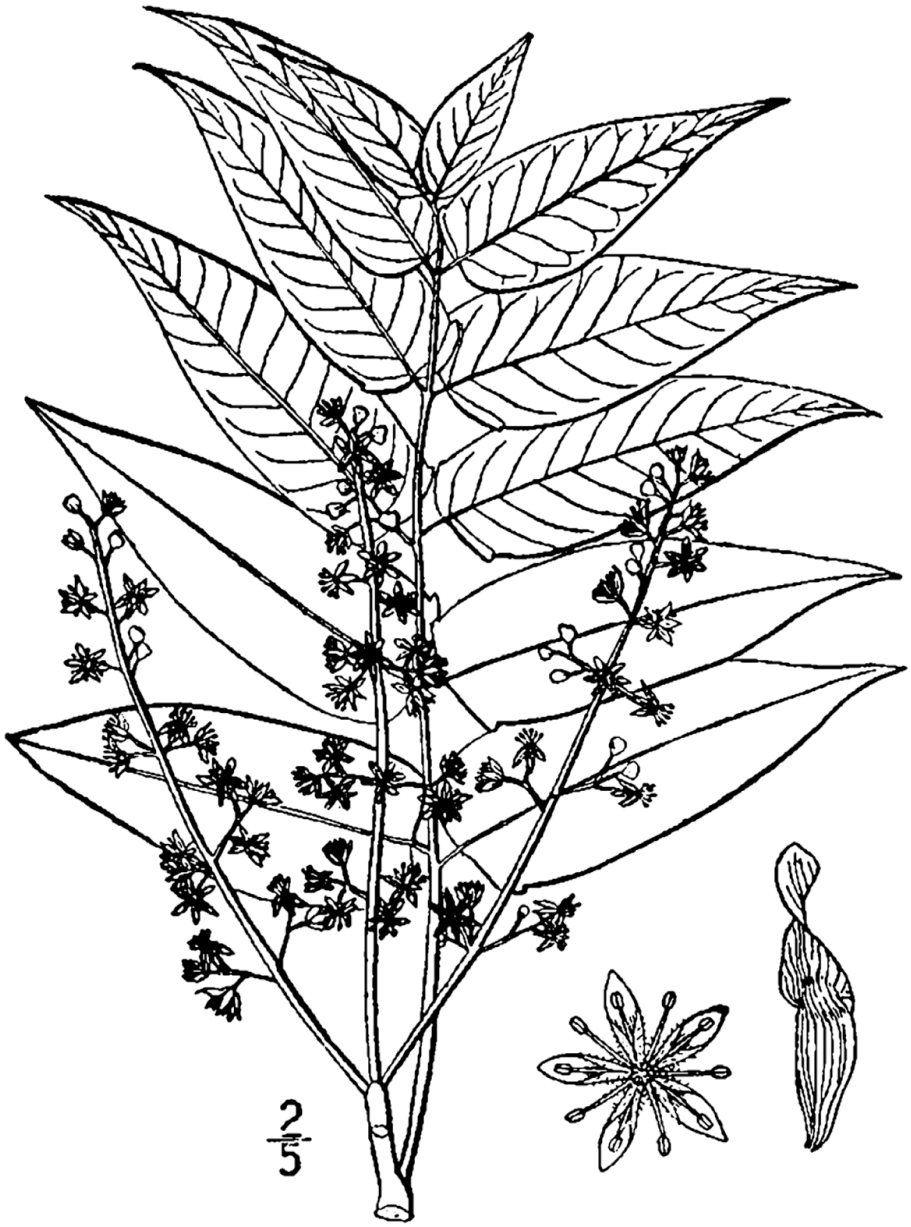
construction of scientific facts explains how science lacks contribution from other disciplines. We reverse Latour's anthropological study in laboratories to actually involve citizens in the brainstorming for scientific projects. We believe that collaboration should be pursued from the point of idea generation, and not just once the technology is released. Co-Lab is our attempt to prove that such effort is needed to connect science with people from different disciplines to challenge ways science can be utilised in various settings and scenarios.

Through the collaboration and discussions in the workshop, we hope the participants will be inspired to bring back these workshops to make in happen in their city and spreading the significance of interdisciplinarity. Most importantly we hope these workshops will encourage participants to connect and form valuable relationships and help to bridge the gap between the disciplines. We believe that we need to create a community of people who are interested in discussing and engaging in issues that are bigger than one discipline can manage.

For example, synthetic biology has the capability of changing nature, including us - humans. With the development of technology, we are able to engineer and design organisms to create or destroy. For that, we need to take in account how this technology will influence society beyond its technical use. How does it affects the language, laws and relationships between living material and society? Technology creates desirable solutions for growing demands of our human population. However, human beings do not always desire efficiency-driven solutions. The reality of human nature makes it challenging to introduce new values, rituals and customs into cultures. For example, our world invested a substantial amount of resources to develop genetically modified crops (GMCs) as a food replacement, but a large sector of the public views them with skepticism. This brings up an interesting idea of how the narrative actually transforms the trajectories of technology and progresses them into never imagined territories.

If scientific research has a clear awareness of the needs of society and the world from its very conception, the impact and reach of technologies will increase. When ethical values, religion, philosophy, or culture conflicts with technology, it is virtually impossible to overturn the public's perception. This becomes harder once a technology is labeled as being controversial. The complexity of this wicked problem requires solutions from divergent perspectives, like science, social science, and design.

Ideation workshops



The ideation workshops

The first phase of co-lab Open Plant consisted of 3 ideation workshops with activities that bridges together artists, scientists and designers to brainstorm. The program consists on a series of lectures, practicals and exercises, and a final brainstorming in groups.

General schedule

<table>
<tr><th></th><th>Day 1</th><th>Day 2</th><th>Day 3</th></tr>
<tr><td>10am - 11am</td><td></td><td>Scientific references and publishing</td><td rowspan="2">Debriefing and idea development</td></tr>
<tr><td>11am- 12pm</td><td></td><td rowspan="3">Practical case: ethnography</td></tr>
<tr><td>1pm - 2pm</td><td>Introduction</td><td>Lunch</td></tr>
<tr><td>2pm- 3pm</td><td>Collaboration in biodesign</td><td rowspan="3">Idea development</td></tr>
<tr><td>3pm - 4pm</td><td>Interdisciplinary plant synthetic biology / introduction</td><td>Upscaling technologies / Philosophy of Science / Debating</td></tr>
<tr><td>4pm - 5pm</td><td rowspan="2">Making electricity with plants</td><td rowspan="2">Extracting pigments from plants</td><td>Prototyping and documentation</td></tr>
<tr><td>5pm- 6pm</td><td>Present your project</td></tr>
<tr><td>6pm - 7pm</td><td></td><td></td><td>Dinner</td></tr>
</table>

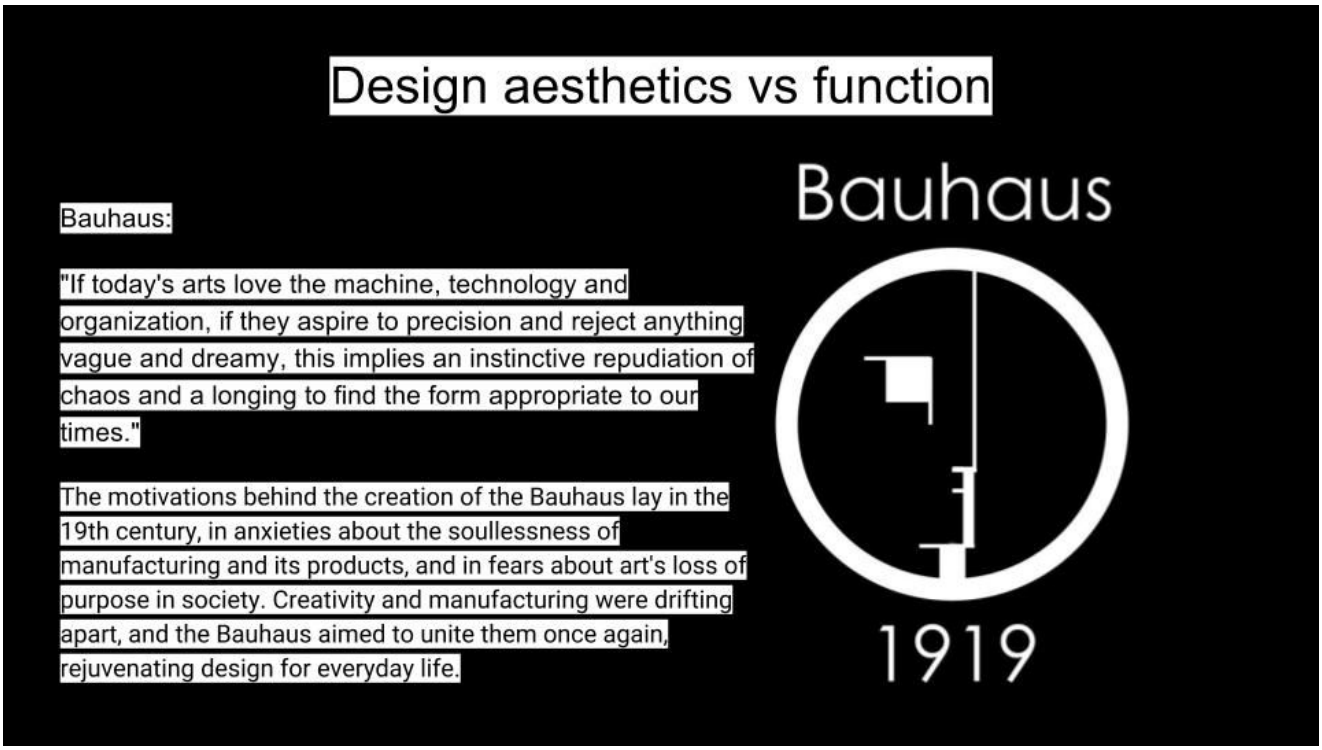
Lecture: Collaboration in biodesign

The introduction to the workshop explained the roots of design as a discipline from a historical point of view and outlined some recent works in the fields of biodesign, bioart and interaction between the arts and life sciences. It also explained in parallel the potential of synthetic biology and basic concepts such as “what is a gene?”, “what is a plant cell?” or “how can I use synthetic biology?”.

Design is as an interdisciplinary field of study: it mixes the ideas and concepts of both art and science. Design can have an objective and a methodology, it tries to solve a problem or to question a subject, just as science or engineering can do. On the other hand, it doesn’t rely on the scientific method to arrive to conclusions and uses many artistic tools to convey its message and conclusions. Design nowadays has diverged and expanded, having

developed tools linked to ethnography, arts or technology that allow us to connect to people. Hence, design seems to have bridged some of the gaps between science and art.

To see this presentation and much more, visit our open google drive: https://goo.gl/hyWTE0

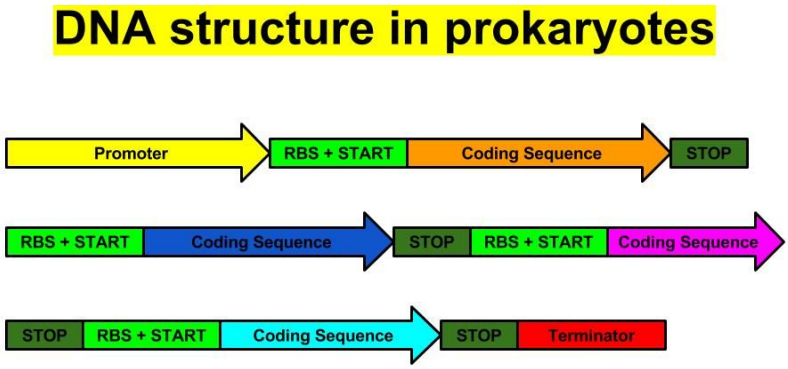


Lecture: interdisciplinary and plant synthetic biology

Synthetic biology is a new discipline in the crossroads of design, biology, and engineering. While genetic engineering and biology are generally problem-centered and try to go deep in the understanding of the problem, synthetic biology doesn't always go in this direction. Synthetic biology is influenced by systems biology – the big data science of biology – in its approach. Synbio is more interested in the big picture of the system rather than the properties of each of their elements. In general, we can can identify some of these following elements as differential characteristics: standardization of methods and materials, robot-automated experimentation, extensive use of chemical DNA synthesis, and engineering terminology.

A basic gene consists of several DNA parts (e.g. promoters, terminators, etc.)) that form complementary codes, each of them giving a precise instruction: “stop”, “start”, make “this” or “that”. DNA is basically shared between all life forms with very little change. This allowed scientists to transfer “blueprints” and instructions from bacteria to plants, or the other way around. Synthetic biology has advanced a lot in recent year and is even able to create new components from scratch thanks to a deeper knowledge of genetics and life sciences. Some of the current trends and tools of synthetic biology:

1. Genome editing
2. Xenobiology and XNA
3. Laboratory automation
4. DNA scaffolds
5. Deep sequencing and microbiome studies
6. Cell-free devices



To see this presentation and much more, visit our open google drive: https://goo.gl/hyWTE0

References

- IGEM Giant Jamboree 2016 booklet: http://2016.igem.org/Giant_Jamboree

Lab practical: Making electricity with plants

Create electricity out of your garden! Learn about electrophysiology. We have our special guest from Cambridge University, Dr. Paolo Bombelli, who will demonstrate how to make electricity from the plant in the workshop! Check out his The 'Moss Table' and the "Moss FM" projects. Those prototypes operate on a technology named plant-Microbial Fuel Cell (p-MFC).

In this experience, we take advance of the electrochemical potential in acid soils, that comes from plants and bacterial activity. Plants use the energy from the sun to produce their own food; this process is called photosynthesis. Some of the photosynthetic products

can be realised into the soil where the plant lives through the roots. This process is called exudation and bacteria living in proximity of plant's roots can grow on them. Bacterial growth is therefore supported by oxidation of substrates which causes the production of negative and positive charges: electrons and protons respectively.

By using the plant-microbial fuel cell technique, it is possible to capture electricity that is generated as plants and soil bacteria interact. The electricity generated is clean and the plants can continue to grow as normal in the marshland areas. As plants in marshland grow they produce organic compounds through photosynthesis but 70% of this material is wasted and leaves the plants through the root system. Bacteria in the marshland soils will breakdown this extracted material and this decomposition produces electricity.

Mapping the electron potential of the soil and the pH doesn't only demonstrate this concepts but makes society participate in the research process by finding new location for soil-powered electrical power plants.

In fact, as a curiosity, marshlands and wetlands in general are not only an energy source nowadays, but are the source of most non-renewable energy that we are using at the moment. Petrols and coals were mostly formed at the base of wetlands, where lack of oxygen and low pH prevented organic matter to go through a complete decomposition.

To know the detailed protocol and much more, visit https://goo.gl/hyWTE0

References

1. Electricity generation by a plant microbial fuel cell with an integrated oxygen reducing biocathode. Koen Wetser et al. Applied Energy (2015) link: www.sciencedirect.com/science/article/pii/S0306261914010460
2. http://www.biosolarcells.nl/onderzoek/kunstmatige_bladeren/plantpower-living-plants-generate-electricity.html
3. http://newatlas.com/plant-microbial-fuel-cell/25163/

Discussion: scientific references and publishing

Referencing, peer review, and publishing are very important for the scientific community and it is sometimes hard to imagine for outsiders. In order to exchange opinions and knowledge on these topics, we had the opportunity to discuss with Professor Chris Howe and the postdoctoral researcher Paolo Bombelli. We introduced some topics relevant to publishing in science, such as impact factor, open access, and the process of peer reviewing.

- **Journal Impact Factor** (JIF) is a measure reflecting the average number of citations to articles published in journals, books, patent document, thesis, project reports, notes and any other approved documents. It is measure the relative importance of a journal within its field, with journals of higher journal impact factors deemed to be more important than those with lower ones. This measure can be controversial as it is sometimes the sole indicator taken into account to measure the quality of the work of

a scientist. Scientists are often pushed to publish in high impact factor journals. This pressure could in some case lead to bad research practices.

- **Peer review** (also known as refereeing) is the process of subjecting an author's scholarly work, research, or ideas to the scrutiny of others who are experts in the same field, before a paper describing this work is published in a journal or as a book (source: wikipedia). In a peer-reviewed journal, the articles are not reviewed by the editorial board but rather by a committee of scientists that volunteer for free to do the job of reviewing articles of their own field of expertise.
- **Open access** journals have free of charge access for the community. That means articles will be accessible by anyone without the need to belong to an academic institutions or pay for the access. This has been the subject of many initiatives by the scientific community or funding agencies. In the European Union, the funding program Horizon 2020 requires projects to make sure any peer reviewed journal article they publish is openly accessible, free of charge.

To see his notes and much more, visit our open google drive: https://goo.gl/hyWTE0

Design practical: Ethnographic Research

GM crops give limitless possibilities to optimize human life, but why does the public reject it? objection to GM food is admissible - people are cautious of what goes into their mouth. In contrast, the use of GMO in medical, energy production and material engineering receives less objection. Public perception of GM crops are heavily influenced by the context it is placed in. Thus borrowing ideas from ethnography, which is the systematic study of peoples and cultures, discussions can digress beyond the technological barriers of plant science.

“Ethnographic research usually involves observing target users in their natural, real-world setting, rather than in the artificial environment of a lab or focus group. The aim is to gather insight into how people live; what they do; how they use things; or what they need in their everyday or professional lives.” (Gov.uk on user-centered design and ethnographic research). In this workshop, we inspired the participants to play one or more of four different roles for the ethnographic research.

1) **Observer**: The observer is the most common role for ethnographic research. An observer observes the targets in their nature settings.
2) **Interviewer**: The participants interview in the field. Interviews provide for what might be called “targeted” data collection: Collecting data on reaction
3) **User**: The user perspective encourages the participants to reflect on their own life experience as an user, and give feedbacks from a first-person point of view.
4) **Infiltrator**: The participants could play the role of infiltrator by actively stimulating the

reaction of the targets.

To see this presentation and much more, visit our open google drive: https://goo.gl/hyWTE0

References

- https://www.gov.uk/service-manual/user-research (Gov.uk on ethnographic research)

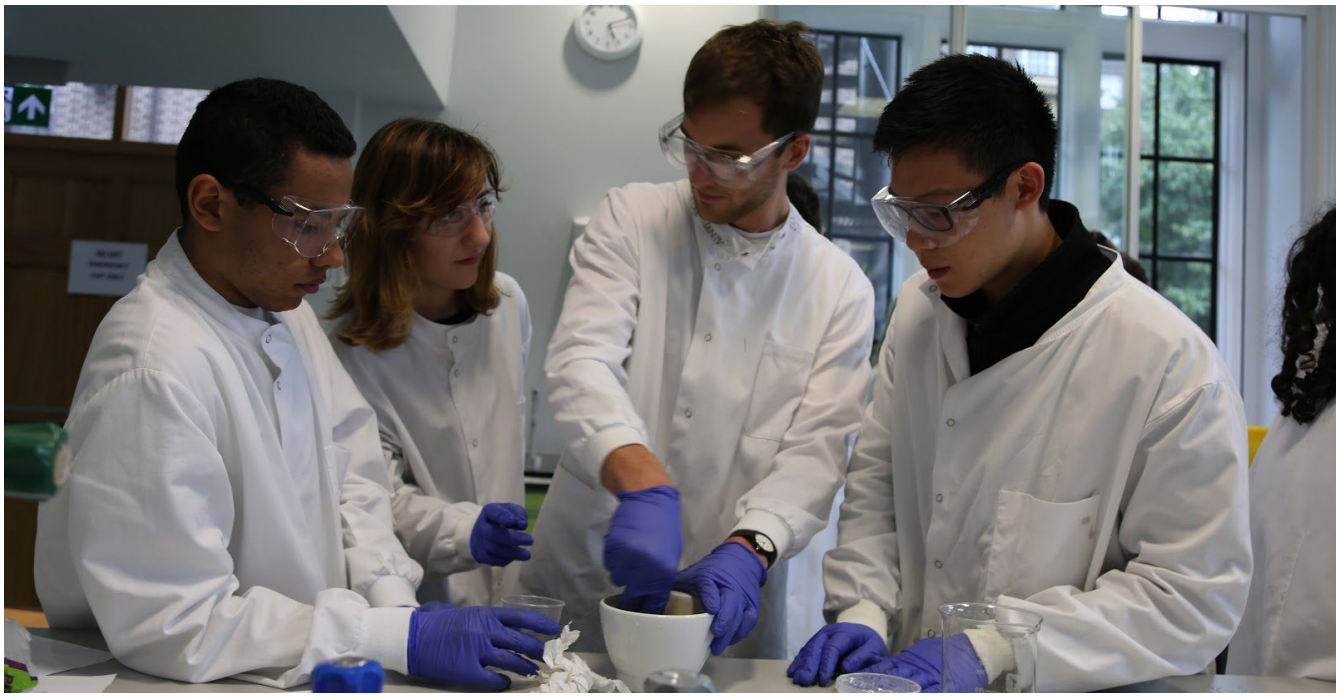
Lab practical: Extracting pigments from plants

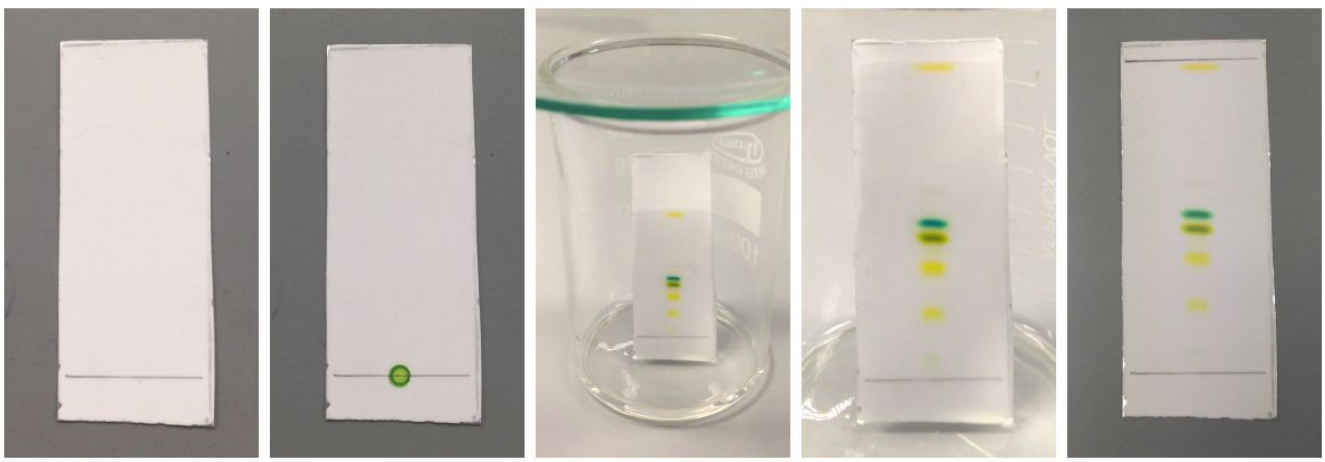
Plants use pigments in their leaves to absorb light energy and convert it to chemical energy. This energy is transferred to and trapped inside the chemical's bonds of organic molecules such as carbohydrates, proteins, and lipids. Several different pigments are involved in the absorption of light, such as chlorophylls and carotenoids. This experiment showed participants how these photosynthetic pigments can be extracted from plants and then separated (adapted from SAPS Plants for Schools), using a technique called TLC (thin layer chromatography).

Thin-layer chromatography is a chromatography technique used to separate non-volatile mixtures. Thin-layer chromatography is performed on a sheet of glass, plastic, or aluminium foil, which is coated with a thin layer of adsorbent material, usually silica gel, aluminium oxide (alumina), or cellulose. By capillarity, the solvent is going to "climb up" the adsorbent and porous material, just like water will climb up your clothes if you step in a pond. While

the solvent goes up the porous layer, it will bring along and carry up different chemicals, and they will be deposed at different heights.

When the plant biomass is produced, it can carry an important economical value inside, but often we would need to extract specific components from it. This happens especially in pharmaceutical industries and chemical plants. We made a thin layer chromatography with an extract of a plant of choice and some others like chili peppers, beetroot, carrots, spinaches. To see this presentation and much more, visit https://goo.gl/hyWTE0






www.darrantchemicals.co.uk
METHYLATED SPIRITS
DANGER

Proposal Archives

Proposal 1: Synthetic blossoms

Team members

Gabriela (Plant science)

Erin (Plant science)

Johanna (Design)

Imane (Interdisciplinary project management)

Céline (Design)

Keywords

Imaginaries, synthetic biology, speculative design, design anthropology, nature aesthetics.

Abstract

Humans have a natural connection to flowers. We would like to explore what plant features are important for people regarding their interaction in flowers. Through this exploration we also aim to find imaginaries of aesthetics of nature. We will conduct an experience in four phases : Exploration, speculative design, anthropology design and synthetic biology evaluation.

Objectives

Our project has the following objectives:

1. Exploring what features are important for people regarding their interaction with flowers
2. Exploring what nature means for people in terms of aesthetics
3. Exploring the boundaries of human imagination
4. Evaluating the possibility to design flowers using the tools of synthetic biology, based on the findings of the exploration stage

Description

Exploration Stage Using an ethnographic approach we would like to explore what plant features are important for people in their interaction to flowers. We are interested in differentiating features that are perceived with the different senses (i.e colour, aroma, texture, durability, etc.). We would like to identify key components that define the aesthetics of nature. For these we are designing a questionnaire that we will apply to stakeholders such as plant growers, marketers, consumers, gardeners, scientists and representatives of the blind community. We will analyze the data and use the main findings to develop subsequent stages of the project.

Speculation Design Stage We will do a creative session during the Co-Lab Making Day in October, where we will present the main findings of the explorations stage. We will imagine and represent flowers inspired in these findings, but challenging the pre-established conceptions of the aesthetics of nature. The participants should be able to use diverse techniques of representation such as drawing, sculpture, digital tools, etc. We will photograph the prototypes resulting from the creative session and we will use the photographs for the next stage.

Anthropology Design Stage In this stage we will test the public acceptance of the creations from the speculative design stage. We will show the prototypes ! from the creative session to a group of stakeholders equivalent to the one in the exploration stage. We will evaluate their response to the prototypes.

Synthetic Biology Evaluation Stage In this stage we will assess the possibilities to design the prototype flowers using the tools of synthetic biology, based on the outcomes of the previous stages. We will consult experts and do a literature review of the topic.

Motivation

For us, flowers were an interesting subject because of their aesthetic aspect. However, for the scientific community and for the society, it’s the occasion to develop a new paradigm

for flower manipulation and GMOs. On the other hand, for designers, they are important concepts as they relate to culture. Flowers are the raw material for creation, and this would give more understanding on how the object we design can connect to people.

Request for materials for Big Making Days

Paper of different colours

Pairs of scissors, glue, plastic, pipe cleaners, CD, iridescent stickers, cutters = 100£

Traveling cost of interviews

References

As part of the ethnography design practical, the team “synthetic blossom” conducted a series of interviews in the market of the city of Cambridge, where they interviewed flower sellers and people in the market. They were interested in what aspect of flowers was most interesting for people.

They especially took an extract of the interview where the shop owner described the relation of blind people and flowers. The team found this particularly relevant and were inspired by this to included non-visual elements such as smell.

"What is nature ?"

Collaboration between artist and scientist ?

① research design

Hypothesis of human imagination of nature, Aestheticism

From Creation

recreate a new aestheticism, questioning nature

speculate about it

Can human imagination compete with nature? Can AI help?

Speculation + Design Anthropology

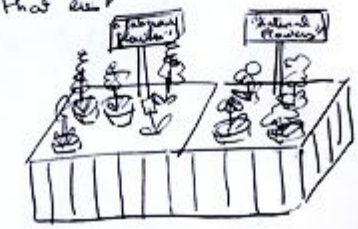
prototype it, drawing it, modelise it,

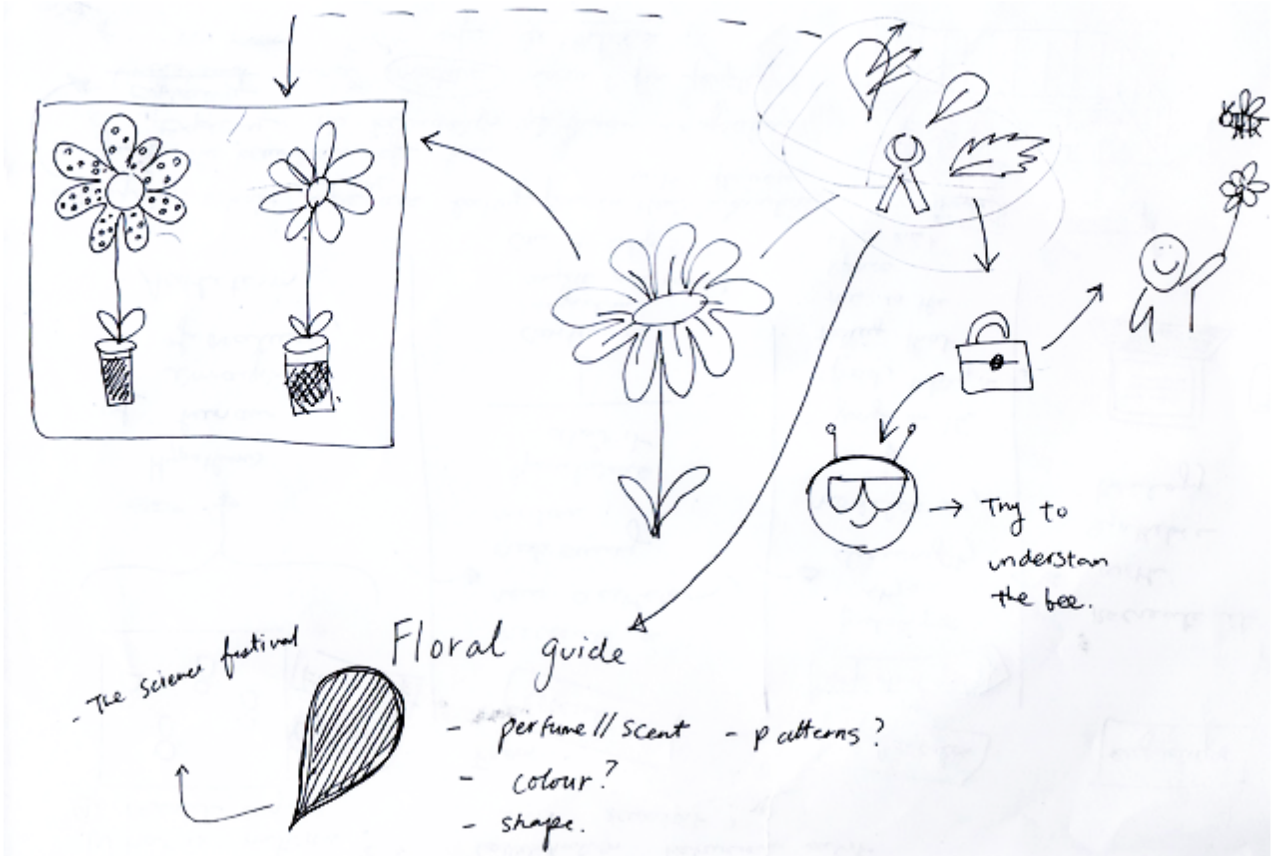
going on the field, testing it telling that this is the specie ..... that exist

engineering

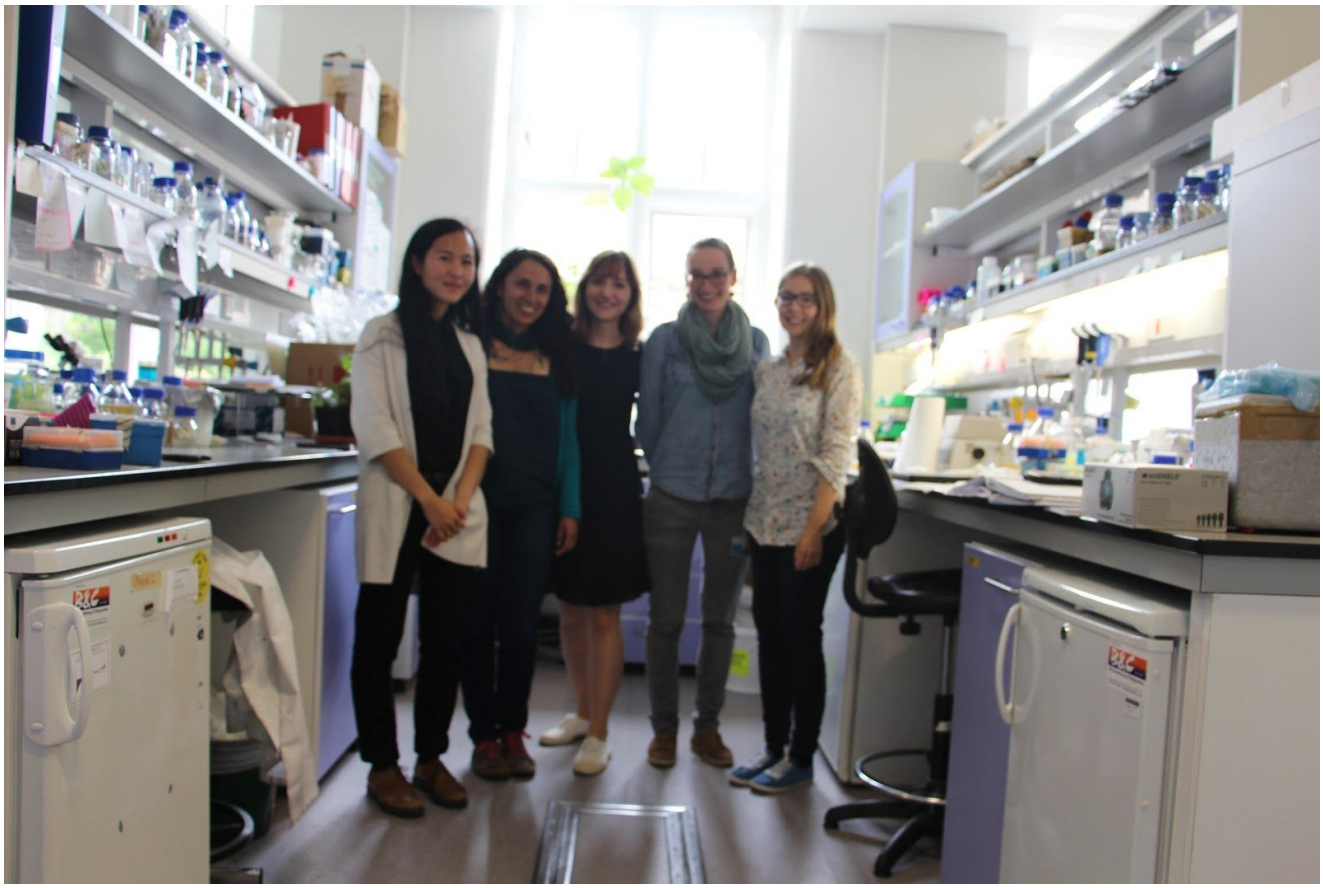
Recreate it with Synthetic Biology

* Exploring what people are looking for in their interaction with flowers
* finding the boundaries of human
  Exploring the boundaries of human imagination
* ~~Explaining~~ what (nature) means for people in ~~their~~ term of ~~aesthetics~~.






BURY LANE
BURY LANE
BURY LANE
BURY LANE



Proposal 2: The Strawberry Project

Team members

Paolo Bombelli (Energy Biology)

Ke Fang (Design human-computer interaction)

Juliette Lenouvel (Cognitive Sci / Biology / Philosophy)

Danielle Wilde (Design embodied interaction)

Abstract

The genetic modification of food is not accepted in many countries (e.g., Europe) at the present time (2016). We have create a factionary scenario to include the civic society in a discussion about genetic modification of food. We are proposing a critical design intervention, where a beloved food (strawberry) is genetic modified with gene obtained by a, generally disliked, organism (cockroach). We aim to discover if (a) people would be willing to eat the strawberry, and (b) if they support a change legislation so that such foods could be brought to market.

In our pilot study, we began by proposing a strawberry modified through the insertion of a cockroach gene that enriched the presence of Vitamin B in the strawberry and lead to enhanced melanin production amongst people who consumed the transgenic strawberry. In our main study, we chose to use alien DNA to provide the benefit of enhanced lucid dreaming to provide people with the possibility of an activity that is not easy to access, yet that supports psychological robustness, problem solving and fun.

Keywords

Greenpeace, GM technology, Science Communication, Strawberries, Lucid Dreaming, Alien DNA, Consummation, Legislation.

Objectives

1. To understand if here is a statistically significant correlation between (a) a person's willingness to consume an unusual GM food, and (b) their willingness to support funding of legislation changes to enable the GM foods to be brought to market.
2. Do statistics hold across scientists and nonscientists?
3. What causes might contribute to the results of Q2?
4. What can the scientific community and organisations such as GreenPeace learn from such outcomes? How can the survey outcomes be effectively communicated to an organisation such as Greenpeace and the scientific community, so that the outcomes might be fully considered?

Description

General Introduction

107 nobel prize winners signed an open letter accusing GreenPeace regarding their statement against “golden rice”, a GM technology aimed at solving vitamin A inefficiency in less-developed areas. The letter urged GreenPeace to stop their (anti-science)//anti-debate activities, which they believed is misleading society. Neither the extreme statement (which spoke about genocide) from the scientists nor Green Peace’s (destructive//not contributive to dialog activities) showed a tolerance for discussion, which we believe is sorely needed for the general public. The STrawberry Project, therefore intends to establish discussion, between scientists, activist organizations such as GreenPeace and the general public.

Using critical design, we intend to propose the modification for a strawberry through the addition of alien DNA, collected from meteorites by NASA. The result will be a transgenic strawberry that, when eaten, enhances the ability of a person to achieve lucid dreaming. A lucid dream is usually defined as a dream in which one is aware that they are dreaming. Once this awareness is realized, the dreamer can do anything imaginable. Uses of lucid dreaming include confronting fears, problem-solving, and having fun. Lucid dreaming is prevalent amongst small children, but becomes harder to achieve as the brain matures.

Our intention is to survey participants from geographically and sociologically diverse backgrounds, using one-on-one interviews and online surveys. Once data collection is complete we will analyse the data and determine in what form it needs to be presented in order to open the listening of scientists and Greenpeace to civil conversations around this – perhaps unnecessarily – emotional issue.

Main scientific idea/aim in a general context

In many circumstances, once a person has formed an opinion they may be extremely reluctant to reconsider that position. Emotional subjects such as GM foods elicit such intractability from people. (ref the sci challenge of civic acceptance of GM).

In a clear, if unconventional attack 100 Nobel Scientists recently wrote[1] to Greenpeace accusing Greenpeace of unacceptable crimes against humanity resulting from the intractability of Greenpeace on issues pertaining to Genetic Modification of Food.

To include civic society in this debate, we are proposing a critical design intervention, where we insert genetic material from an unconventional source into a strawberry, to discover if (a) people would be willing to eat the strawberry, and (b) if they support a commitment of funding to change legislation so that such a food could be brought to market.

[1] http://supportprecisionagriculture.org/nobel-laureate-gmo-letter_rjr.html

Significantly, we make use of critical design in order to prompt our survey respondents to shift from an automatic mindset and seriously consider our proposal, so that they might respond from a reflective space to our proposal, rather than to their assumptions about our proposal. As Dunne and Raby write, for provocative designs to be successful, "a slight strangeness is the key – too weird and they are instantly dismissed, not strange enough and they're absorbed into everyday reality" [Dunne & Raby, 2001, 63].

In our pilot study, we began by proposing a strawberry modified through the insertion of a cockroach gene that enriched the presence of Vitamin B in the strawberry and lead to enhanced melanin production amongst people who consumed the transgenic strawberry. To our surprise participants did not consider the insertion of a gene from a cockroach into a strawberry to be unsettling enough for them to reflect. Rather they responded with their existing opinion on GM Foods. One participant also pointed out that there are foods we can eat already that enhance melanin production so the modification was unnecessary, and carried too many unknowns for a redundant risk.

For this reason we have chosen to use alien DNA in our main study, to provide the benefit of enhanced lucid dreaming. Strawberries are a popular food eaten in many countries, found that strawberries were considered desirable by the majority of our survey participants. The choice of lucid dreaming is to provide people with the possibility of an activity that is not easy to access, yet that supports psychological robustness, problem solving and fun. Lucid dreaming is prevalent amongst young children. Yet is more difficult to achieve by adults.

A lucid dream is usually defined as a dream in which one is aware that they are dreaming. Once this awareness is realized, the dreamer can do anything imaginable. Uses of lucid dreaming include confronting fears, problem-solving, and having fun.

With regard the use of alien DNA, as reported in the Proceedings of the National Academy of Science (Callahan, et al, 2011), researchers have been discovering components of DNA in meteorites since the 1960's. NASA now have three lines of evidence that together give confidence these DNA building blocks were created in space. (ibid.). We intend to build on these findings to capture the imaginations of our survey participants and invite them to consider our proposal seriously.

Giving an extreme scenario about GMO food, there are 4 differents possibilities:

1) Correlation 1 : People can accept to eat/use it and accept that it will be legalized
2) Correlation 2 : People can accept to eat/use it but not accept that it will be legalized
3) Correlation 3 : People can not accept to eat/use it neither be legalized
4) Correlation 4 : People can not accept to eat/use it but accept that it will be legalized

Phases and methodological approaches :

Phase 1 (one month)

- Research into opinions of the different stakeholders: scientists, activists, other citizens
- Development of questions for the survey
- Design of the elements to be used in the survey, including in person and online interviews. This phase will also involve the development of cultural probes to encourage people to engage with the proposition through a range of means, including embodied reflection
- Data collection

Phase 2 (3 days)

- Data analysis
- Further research into scientists and activist stakeholder groups to determine appropriate design of the data
- Development of visual material and probes for these stakeholders

Ethical/safety aspects

- Informed consent.
- placebo effects but also nocebo effect may happen

Motivation

GMO is a dichotomising subject, often experienced as a serious taboo. It involves sociological, ethical and scientific debates: Is it safe for humans? Is it a fair-production

(sociological, political field) ? Is it ethical, can we modify “Nature” (ethical field) ? The ethical field is controversial and is mainly link to the question of what is a “natural/ acceptable” modification or not (debate from time immemorial, see the book “Evolution Man, Or, How I Ate My Father”, Roy Lewis).

The sociological/political aspect may be change depend of our mode of production. Then, still we cannot predict to 100% the evolution of every technologies and innovations.

However, we can more or less predict what are the probabilities depend of the technologies and then we can give a percentage of “safety” future. With GMO, in a scientific point of view, we don’t know yet the impact. Some people are OK to take the “risk/advantage” to eat it, other not. Then, it is not because they are OK to choose to take the risk, that they think it might be allowed. In the opposite, this is not because they are not OK to take the “risk/advantage” that they want to forbidden it. My personal interest is to see how people link their personal choose to the society choose.

Request for materials for Big Making Days

We estimate a total cost of £500 max, for:
Phase 1: materials needed to develop the probes and hand-outs to a carefully designed quality
Phase 2: materials for brainstorming, bodystorming and prototyping to develop packs for the scientist and activist stakeholder group. We also may need to support some travel, if funds allow.

References

- Michael P. Callahan et al. Carbonaceous meteorites contain a wide range of extraterrestrial nucleobases PNAS 2011. doi:10.1073/pnas.1106493108.
- Dunne, A., and Raby. F. Design Noir:The Secret Life of Electronic Objects. Birkhäuser, Basel, Switzerland, 2001.
- Greenpeace. All that glitters is not gold. Video. Available online at: http://www.greenpeace.org/international/en/campaigns/agriculture/problem/Greenpeace-and-Golden-Rice/
- Nobel Laureate GMO Letter Supporting Precision Agriculture (GMOs). Available online at: http://supportprecisionagriculture.org/nobel-laureate-gmo-letter_rjr.html
- Saunders DT et al. Lucid dreaming incidence: A quality effects meta-analysis of 50 years of research. Conscious Cogn. 2016. doi: 10.1016/j.concog.2016.06.002.

Extra: Interview extracts from strawberry team

Gender	Where are you from?	Age	Occupation	Would you eat it?	Do you think funding should be provided to shift legislation to enable GM foods to be available to the public?	
Male	Iran/Norway	50	factory worker	NO	NO	there's a lot of discussion about GM in Norway at the moment. We really don't know what the long term consequences are – in 4/5 years time we may learn something that we don't know now. It's important to recognise this and be cautious
Female	London	20	unemployed / on dialisis	YES	YES	I'm on dialysis, so anything that can let me stay in the sun a bit longer would be great. Also, I want my daughter to have the best opportunities when she grows up
Male	Cambridge	27	unemployed	YES	YES	Totally agree
Female	Spain	28	MBA student	NO	NO	there already exist foods that can protect us from the sun. We should go back to transgenic
Male	Denmark	31	Scientist, with a background in genomic engineering	YES	YES	I'm a scientist. It's easy
Male	Spain	35	Animator - video games	some concerns	YES	really cautious. We need to be sure the checks and balances are in place (and are appropriate)
Female	Cambridge	38	Radiographer	YES	YES	we're scientists
Male	Cambridge	37	SYS Admin, with a degree in bio	YES	YES	we're scientists
Female	Lithuania	37	Sales	NO	YES	ethically, morally and religiously against, so would never eat. Yes it should be avail, but cautiously
Male	Denmark	38	General Manager	probably	YES	I'm more liberal
Male	South Africa	29	Marketing	YES	YES	
Male	France	38	Actor/consultant	NO	depends	imapct of GM organisms is not clear long term - on our health or on other organisms. It really depends on the risk of contamination. We can't be 100% certain it won't spread

Proposal 3: The Friedman show

The Friedman Show feat. wine and philosophical debate (F-SWAP)

Team members

Michael (Bioengineering, maths)

Mie (Plant science, synthetic biology)

Lucie (Plant science, travelling)

Ciara (Plant science, synthetic biology)

Abstract

Synthetic biology is becoming an increasingly important field in solving big issues e.g. food security. However, it is necessary to bridge the gap between scientific development and social acceptance of these technologies: without acceptance from the public, this field can never reach its full potential. We propose an open discussion amongst students from different backgrounds, along with experts from both philosophy and science, on the perception of genetic engineering by the public.

Keywords

Discussion, humanities vs. sciences, synthetic biology, provocative, ethics

Objectives

- Encourage communication between science, journalism and Philosophy Societies to debate how synthetic biology is perceived by non-scientists
- Discuss how scientists could better engage with the public

Description

Workshop agenda:

1. Introductory talk on synthetic biology and explanation of core scientific language (and briefly, our project)
2. Smaller discussion groups with questions to prompt discussion e.g. ‘Would you eat a strawberry containing cockroach DNA?’
3. Larger whole group discussion about how synthetic biology is viewed by non-scientist/debunking myths/how perception of synthetic biology could be improved
4. Could write an article about how the workshop goes in a university newspaper to reach an even wider audience

What would we need to do?

- Contact societies

- Contact scientists/philosophers to join the debate and attract people to attend
- Create prompt questions
- Summarise an article for distribution
- Advertise the event
- Find someone to film the event so that we could put it online?

Motivation

Allows for non-scientists to debate on science. Explores an important issue for our generation, and provides a platform for a debate which isn't explored enough. Making the event interdisciplinary enables the issue to be examined from different perspectives.

Request for materials for Big Making Days

Refreshments: cheese and wine - £150
Money for filming
Conference space - £10
Marketing - £50

References

The group was very inspired by the meetup "Citizens without borders". https://www.meetup.com/Citizens-without-Borders/

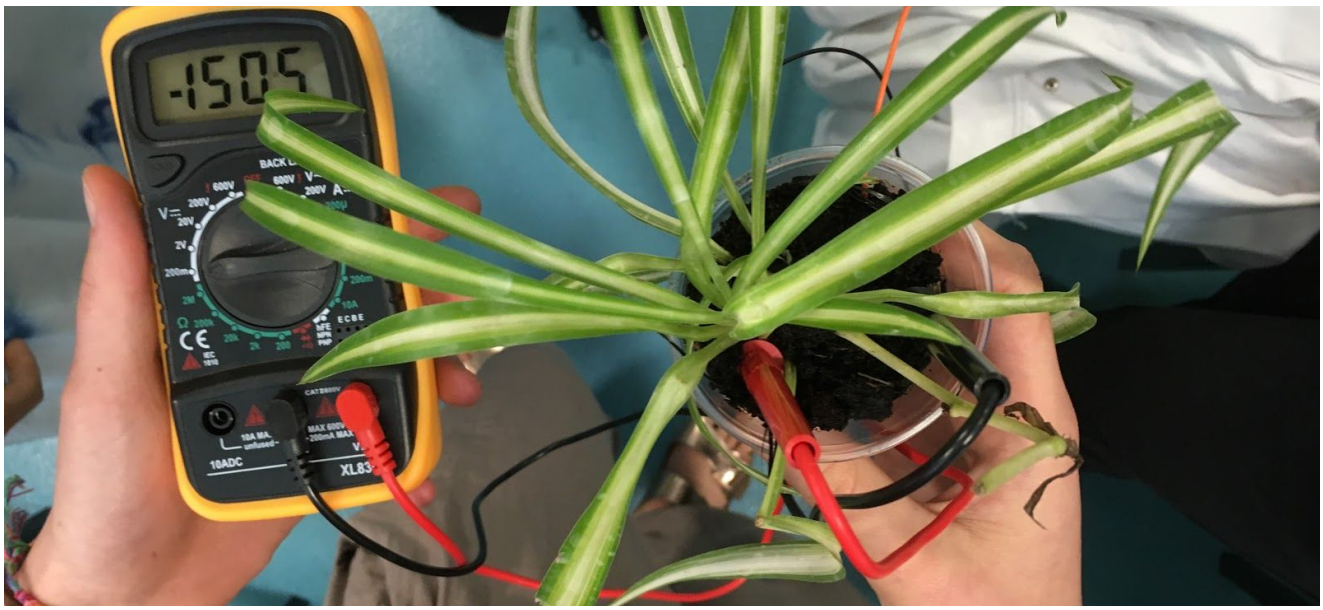
Proposal 4: Do plants feel pain?

Team members

Mari Ohno (Design and sound artist)
Ana Bravo (Synthetic Biology)
Lucie Studená (Synthetic Biology)
Geoff Ma (Synthetic Biology)

Abstract

The participants of this project were surprised by the fact that we can measure electricity from plants, and in some ways, communicating with them and “feeling them”. Humans, however, do not always empathize with plants in the same way they do with animals. We can see facial expressions, hear noises, feel the movements or imagine their pain. But, do plants feel pain? The team took to the streets the photo-bioelectrochemical system, that measures the potential in millivolts between the soil and the roots of a plant. Then, interviewed people to ask if plants feel pain at the same time they constructed a narrative about this design.



Keywords

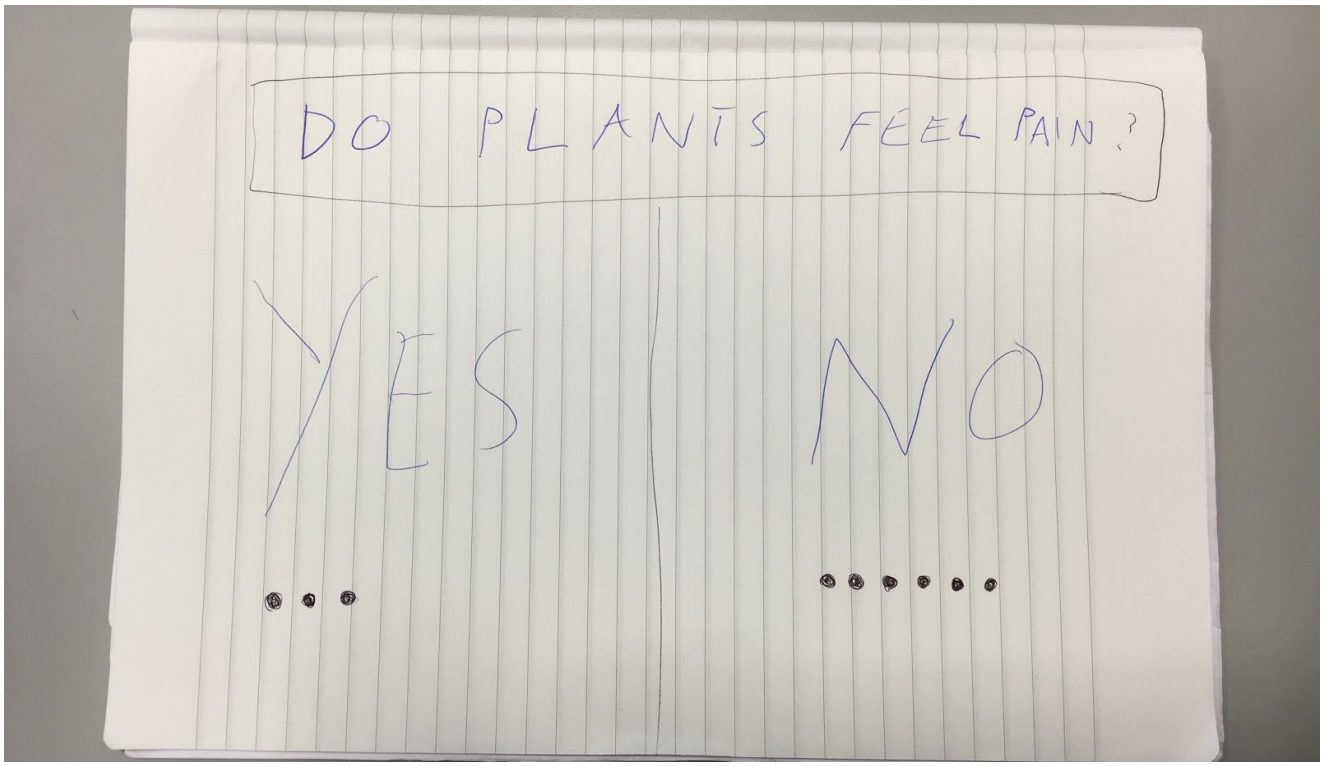
Empathy, photo-bioelectrochemical system, plants, pain, ethnography.

Objectives

- To see the public perception on the photo-bioelectrochemical system and how could it possibly change the view we have of plants.
- To study pain and empathy between humans and nature.

Description

As result of their interviews, the team took about 15 interviews. A third of them responded “yes” to the question “Do plants feel pain?” and the rest responded “no”.



Proposal 5: Tilealgae

Team members

Francesca Perona (Art-sciences, environmental design)

Claire Restarick (Life Sciences)

Brontë Crouch (Art)

Ke Fang (Physics, Interaction design)

Abstract

Following their ethnographic study and interviews combined with an intense brainstorming, this team decided to focus their proposal in the idea of making the space between time out of algae. Their statement was: when space between tiles remains dirty, what do people do to tackle this problem? They came up with a series of preliminary analysis on how the market could react to this, and what are the potential problems that this might need to solve during the development of the product.

Keywords

Tiles, algae, environmentally-responsible cleaning, ethnographic research, human-centered.

Objectives

The sole objective of this project is to make a small customer research on the idea of making a biological materials for the space between tiles. This material would be easier to clean.

Description

Interview questions:

1. What's the most difficult thing to clean in bathroom or kitchen?
2. (do you have tiles in these spaces / would you like to have tiles)
3. What products do you use? Why? Do you think they are sustainable? (how often do you clean?)
4. How much money do you spend on these products?
5. How often do you clean sink / shower? For how long?
6. Would you use something 'living' growing in those places …

Problem statement:

Space between tiles remains dirty. What do people do to tackle this problem?

Profile of the 7 interviewees:

- Cleaner
- Couple (60s)
- Mother of 4
- 30 lady
- Mum in her 50s
- Woman in her 50s
- Guy (married) mid 30s

Findings:

- Cleaner: outlined his main issue in cleaning are dirty gaps between tiles (mould).
- He needs to use chemical products that require multiple application for visible results.
- People using public toilets in cambridge said they find them reasonably clean.
- Most of women (in their 30-50) clean bathroom regularly therefore don't see need for a product to improve effective cleaning. 1 interviewee mentioned she doesn't even need chemicals because of frequent cleaning habit.
- Mother of 4 cleans every day, because it gets dirty very easily.
- It's common to have tiles in bathroom but in the uk there are painted walls too.
- Some people drew connection between kitchen and bathroom cleanliness.
- Elderly couple would probably use product.
- Concerns: about colour of our product not matching tiles (aesthetics); about using biological products: not too keen but positive about it. People are aware that bacteria

are present in products used in the everyday, this helps to make our product acceptable.

- For genetically modified products:
    - Mother concerned
    - Elderly happy as long as it's (...safe?)

Target market:
drastic change from the initial idea of proposing to housewives to:
> people with mobility issues
> professional cleaners
> people with no attachment to their home (proposing students, young professionals sharing flats)

Idea on how to target frequent cleaners:

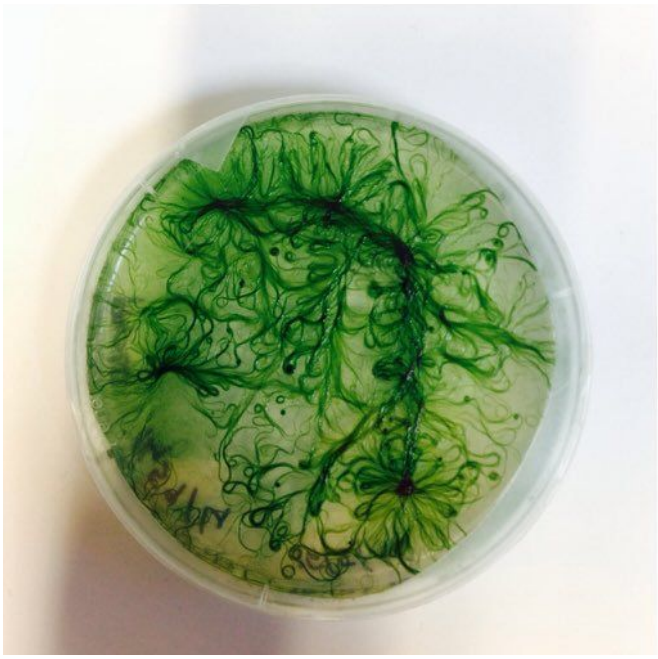
- How can we hack habit of housewives
- Aesthetics (nice smell, nice design)

Foreseen problems in design:

- Long lasting
- Kids could eat it

Proposed spaces:

- Kitchen / bathroom (private)
- Public toilets / public tiled floors



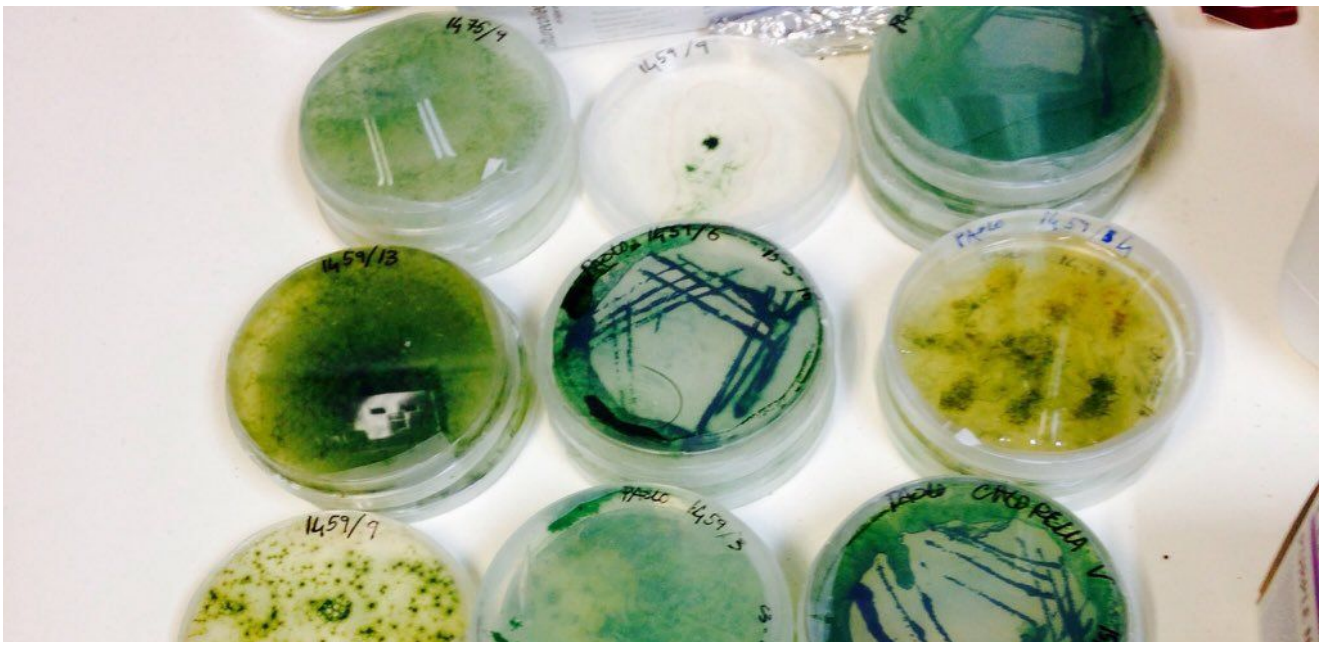
Motivation

The motivation from this project came from the interest of their members into ethnography, human centered design, and product development.

References

The members of the team were inspired by arabic tiles and a phenomenon called “square roots”, when the roots of trees split between tiles in the sidewalks making beautiful geometrical but biological patterns.

A big part of the inspiration also came from the petri dishes at the lab of Paolo Bombelli. They noticed the beautiful patterns that some cyanobacteria produce while growing in petri dishes.



Proposal 6: PETall Bin

Team members

Steph Kedik (Artist)

Freddie Morrison (Plant Biology)

Colette Matthewman (Plant Biology, Project Management)

Aurore Coince (Microbiology, Plant Biology)

Abstract

We live in a plastic-based society, built on a rapidly growing landfill mountain of non-degradable plastics. The UK alone uses over 5 million tonnes of plastic each year, with less than 30% currently being recovered or recycled (British Plastics Federation, 2016). Plastic waste that is not recycled is sent to landfill or for incineration, producing pollutants that are harmful to the environment we live in. Plastics are filling up our oceans and even making it into our food system. There is an urgent need for creative solutions to deal with the plastic waste polluting our planet, and to convert it into benign or useable forms.Our aims are to investigate novel methods of reducing plastic waste coming out of the home, to draw attention on a domestic scale to the problems of plastic waste, and to raise pertinent questions about responsibility.

To achieve these aims, we have designed the PETall Bin, a flexible design that incorporates both form and function. The design harnesses the power of nature and integrates it into the common pedal bin to provide a new innovative method for degrading and recycling plastics in your own home.

Description

Plastics are widely used in modern society for a variety of purposes. Many of the products derived from plastics are packagings or disposable items that make their way rapidly into the waste system. Plastics are filling up our oceans and even making it into our food system. The UK alone uses over 5 million tonnes of plastic each year, with less than 30% currently being recovered or recycled (British Plastics Federation, 2016). Plastic waste that is not recycled is sent to landfill or for incineration, producing pollutants that are harmful to the environment we live in. There is an urgent need for creative solutions to deal with the the 70% of plastic waste that is polluting our planet and convert it into benign or useable forms.

Our aims are to investigate novel methods of reducing plastic waste coming out of the home and to draw attention, on a domestic scale, to the problems of plastic waste. Our design will harness the power of nature and integrate it into the common pedal bin to provide a new innovative method for degrading and recycling plastics in your own home.

There is wide acceptance that the buildup of plastics in the environment is a huge problem.

However, there are few solutions being employed to deal with all the waste that is produced, and to prevent its accumulation in the environment. Our design will not only raise awareness of the issue, but also important questions about environmental responsibility: Who is responsible for resolving the plastic waste crisis? Governments? Manufacturers? Society as a whole? How can we begin to resolve these issues?

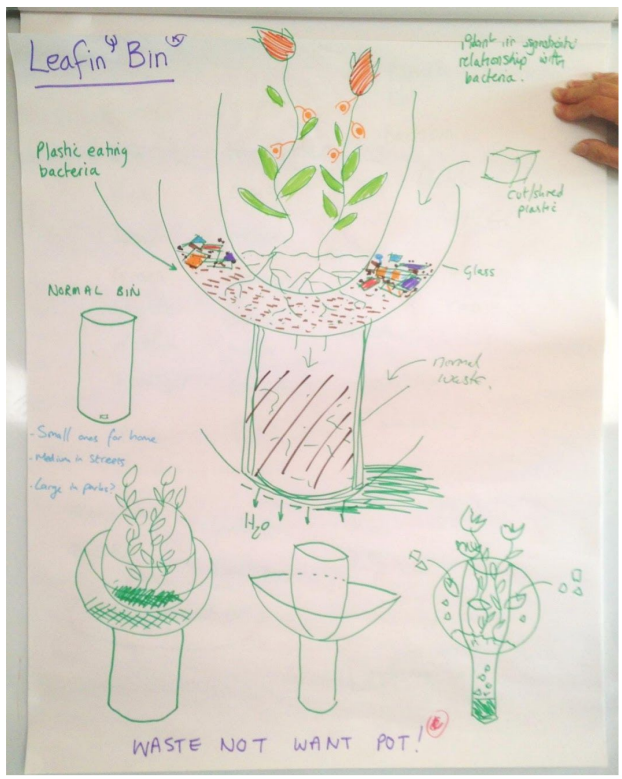
Objectives

Design a creative solution that combines form and function in a product that integrates easily into the home environment. The design will be attractive, functional and educational.

1. Build a prototype as a tool to stimulate discussions around of plastic waste issues, recycling and environmental responsibility.
2. Explore (through the literature) the potential for using plants and bacteria to form a living ecosystem for the degradation of plastics.
3. Design a bioengineering strategy to improve the efficiency and reduce risk in the biological system

References

- Yoshida et al., 2016. A bacterium that degrades and assimilates poly(ethylene terephthalate). Science, DOI: 10.1126/science.aad6359
- Shah et al., 2008. Biological degradation of plastics: A comprehensive review. Biotechnological Advances, DOI: 10.1016/j.biotechadv.2007.12.005



The Big Making Days

The Big Making Days

The workshop consisted of 3 ideation workshops and a 'Big Making Days' prototyping workshop. Three proposals were selected to become projects, continue to the prototyping phase and spend three days prototyping. Their objectives for the Big Making Days were:

Project 1: VRICKS (Virus Bricks for Citizens)
#virus #3Dmodel #SyntheticBiology #LearningByDoing #DesignToShare

- Designing the components of the blocks
- 3D printing components of the Virus Blocks

Project 2: TEB (The Edible Books)
#Food #Books #Edible #Supplements #Education

- Experiment with flavours and make edible book with rice paper
- Print on the book using edible ink and printer
- Make own rice paper if time allows them to (mix cereal, vitamin tablets etc.)

Project 3: SMELL YOU LATER
#Perception #Smell #diyEEG #SmellDirectory #EmotionAndScent

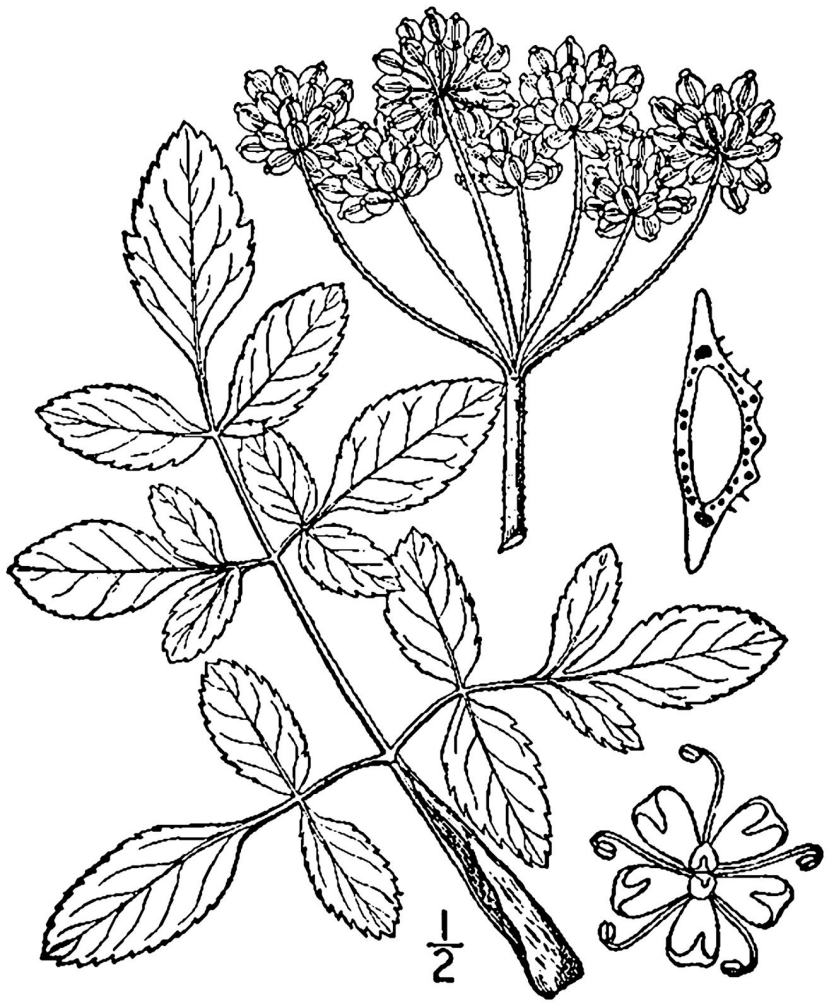
- Create a standard experiment to introduce users to specific smells. From there we will record their EEG scans along with completing a questionnaire about their reactions to the smell to gain quantitative and qualitative insight.
- Potentially build a dictionary of smells which would have invoke most uniform neurological responses.
- Use odors of sweat from people experiencing different emotions, such as fear, relaxation or tiredness.

General schedule of Big Making Days

<table>
<tr><th></th><th>07 OCTOBER (FRIDAY)</th><th>08 OCTOBER (SATURDAY)</th><th>09 OCTOBER (SUNDAY)</th></tr>
<tr><td>10.00 - 10.15</td><td></td><td>BREAKFAST</td><td>BREAKFAST</td></tr>
<tr><td>10.20 - 13.00</td><td></td><td>Group Work</td><td>Group Work</td></tr>
<tr><td>13.00 - 14.00</td><td></td><td>Lunch</td><td>Lunch</td></tr>
<tr><td>14.00 - 15.00</td><td rowspan="2">Group Work</td><td rowspan="4">Group Work
+
Common pub night</td><td rowspan="2">Group Work
+
documentation</td></tr>
<tr><td>15.00 - 16.00</td></tr>
<tr><td>16.00 - 17.00</td><td rowspan="2">SynBio for Schools Discussion at Cambridge Makespace</td></tr>
<tr><td>17.00 - 18.15</td><td>Presentation & Pizza</td></tr>
</table>


co-lab
interdisciplinary workshops

Project Archives



Project 1: Smell You Later

Team members

Sydney Schaefer (Design)

Alex Mayorov (Chemistry, Biology)

Juliette Lenouvel (Cognitive Sci / Biology / Philosophy)

Mourdjen Bari (Game Designer)

Keywords

Perception, DIY Science, EEG, cognitive sciences, Smell directory, Emotions and smell.

Abstract

Having the aim to investigate at the relationship of emotion and smells, this team utilised EEG scans to connect to sense of smell and person's psyche. They sought to developing a framework, based on EEG and questionnaires, to elucidate these factors and to assemble a dictionary of smells, the reactions to which are most uniform and repeatable. Such a dictionary could have applications ranging from storytelling via an olfactory sequence of smell "snapshots" to mood control.

The participants took full advantage of the facility at of Makespace, especially during the Big Making Days. It was a fantastic experience for the workshop, as Makespace Cambridge is such a wonderful space and the participants were very thankful for this opportunity. We were able to host over 20 participants to work on the ideas developed during the

Brainstorming Weekends. We would like to thank Directors of the Makespace, Jenny, Carlos and all Makespace members for providing us with such an amazing experience.

Objectives and specific aims

1. To determine if we have a common ‘smell language
2. Can we communicate using this language?
3. What is the cause of different reactions to smells?

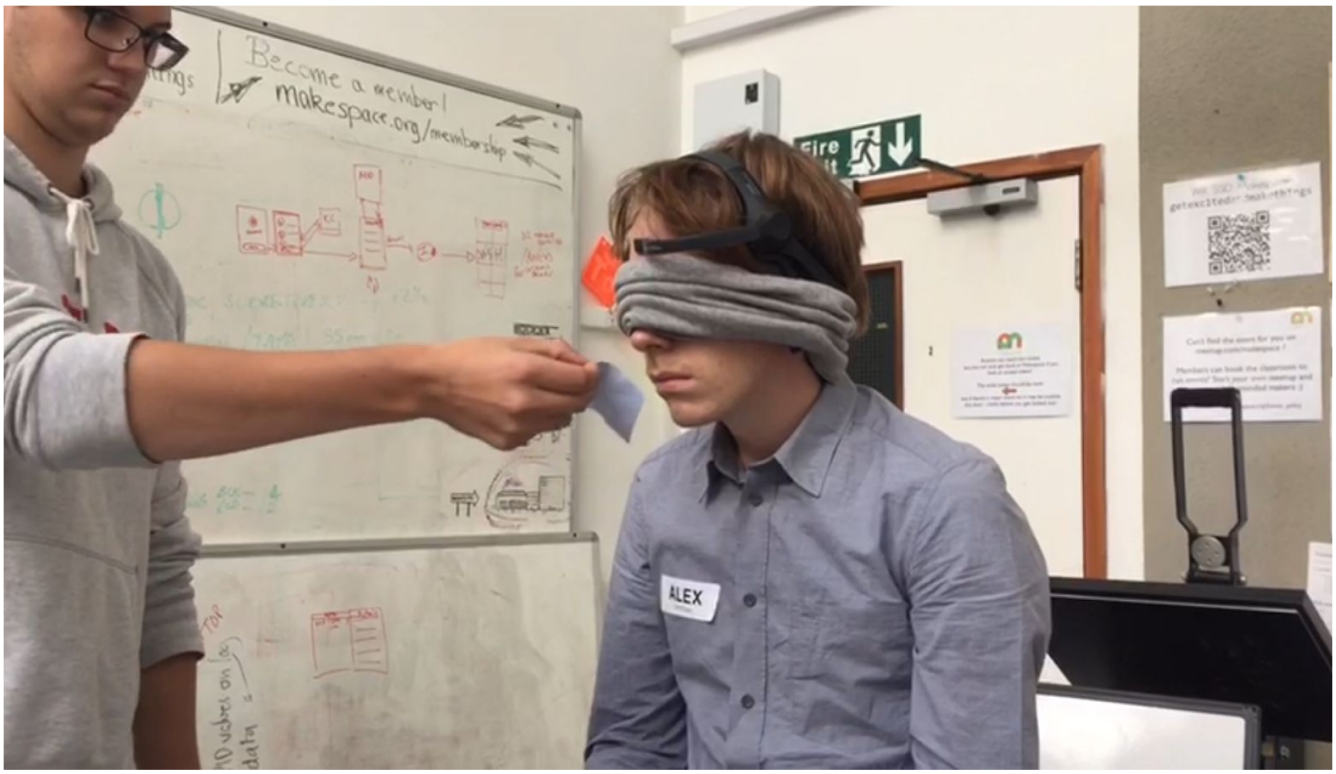
The flavour conductor

1. We would like to determine if there exists a common ‘smell’ language by interviewing people blinded to the source of smell (e.g. pieces of fruit presented in covered cups). For the smells which are hard to imitate with available products or commercial chemicals on the small scale, we plan to interview customers in places with distinct smells (e.g. a leather shop, a hairdressing studio, a traditional pub). We are fully aware of the impossibility to dissociate visual from olfactory cues in the latter case, and hope to create mixtures as close as possible to such smells during the testing stage (part 2).
2. We aim to produce combinations of smells corresponding to a “short” story with a simple plot. Every “episode” of such a story would be tested separately. Finally, we would present full sequences and see how closely interpretations of people agree with each other.
3. We also want to look into the causes of different reactions to smell. As a part of our questionnaire, we ask about earliest memories people associate with a particular smell. This may elucidate olfactory priming which all children within a particular culture are subject to. Additionally, it would be interesting to research the molecular properties that results in smells.

Description

1. Synaesthesia, vision and smell

Concept, research on how vision and smell are connected and how smell influences one's reaction to an object. Disconnection (not “normal connection” affect the way we perceive our environment. Synaesthesia is a disconnection or a not “normal” connection between different perceptions. The most common is about grapheme-colour synaesthesia but it also exist one about olfactory-gustatory synaesthesia (see paper Synaesthesia or vivid imagery? A single case fMRI study of visually induced olfactory perception.) Those with Synaesthesia perceive smell differently, blind persons perceive more/ “better” the smell than those with normal sight.



2. “Normal perception people” and their abilities to understand different perceptions

Often “normal perception people” don’t really understand or get why blind people or synaesthesia people react differently. Smell is a strong unconscious and conscious component of our behaviour and has a big influence on our general perception/ it is not just about “smelling something”. We would like to create an “unusual situation” between smell and vision in order to put “normal people perception” in a not normal situation and make them feel that when the smell change, they is not just a “smelling” change but their behaviour change also. Feeling differently may help them to better understand that blind people and synaesthesia people have not just “a different perception of one sense”, but have another perception because the sens (the vision for blind people) is linked to other sense and perception in general, and also influence our behaviour and our feeling, even if this feeling seems not to be caused by a different sens. From there we would be able to see how to influence smell more directly and see the potential that lies within the area.

Current experiments have led us to infer the following things:

1. When users are confronted with an object, they assumed there SHOULD be a smell and therefore begin looking for one, whether or not one is present.
2. The container has an influence on the strength of the smell and the confirmation bias works in favor of this situation. It allows for our brains to not overwork themselves as what they were expecting to smell was the result.

Using smells not associated with the container gives users a sense of dissociation, as users were able to identify the exact smell AFTER they had visual confirmation of the object. (the connection between vision and smell must be determined more thoroughly and looking at how far we can move away from the exact object until the association is gone)

Future versions of the experiment after the experience at the Big Making Days:

Ver1:
-- Unmarked containers with easier method for ‘smelling’
-- Larger Variety of Smells
-- smell focused

Ver2:
-- Use fake bottled smells to make an objects smell like something different
--visual focused

Strategy mistakes: In the art gallery and the fudge shop I interview people who work in there, who may have been un-sensitised to the smell and biased in their responses. Need to research semantics people associate with different smells. This compile a vocabulary, which we then can use to tell stories. But need strong repeatability of associations.

3. Storytelling with smells

Different channels of perception are currently used to tell stories, including visual (cinema), auditory (audiobooks) and touch-based (Braille alphabet). The channels vary in the method and immediacy of their influence on people. The sense of smell is arguably the most pervasive ways of influencing a person; however, a method of communicating through smell has not been researched thoroughly.

We want to research the smells which are universally (at least, in Western societies) associated with particular emotional and semantic constructs. It is very important to understand how personal experiences manipulate the perception of smell, e.g. the smell of cigarette smoke provokes the sense of security and relaxation only in smokers. On the other hand, odours of rose and freshly cut grass are generally associated with “love” and “freshness”, respectively.

We wonder if combinations of several smells would have defined semantics. As an extension of the example above, the odours of rose and cut grass together may be interpreted as “fresh love”, “love from first sight” etc. We appreciate that the ambiguity in interpretations is unavoidable, but we embrace it. The smell “sketches” we want to produce with sequences of our smell combinations would be inherently poetic.

<u>Progression 1:</u>

- Building a smell library
- Interviewing/surveying/researching into what smells are associated with what and how certain smells are generally viewed.
- Figure out outliers/controversial smells

  <u>This can be an ongoing project as this library will change with each progression</u>

Progression 2:

- Tell a story with smells. Maybe give group the same smells later to see if they now associate them with the smell
- See how well users can remember the story
- Tell same story with no smell
- See how well users can remember the story
- Simply have smells in same order. Ask what users believed we were attempting to tell them. Have users tell a story based upon the scents
- We will determine the smells ourselves and see what best matches the story that we choose to tell
- Interview users post to see reaction

Material requested for Big Making Days

MATERIAL	**PRICE (GBP)**
Borrow EEG	0
Wood paper (4D workshop)	21.45
Fragrances (8 types)	85.17
Wood Veneer	18.24
TOTAL IN GDP	124.86

References

- Coelho, J. S. (2007). Eating behaviour in response to olfactory food cues: The role of dietary restraint. *Dissertation Abstracts International*, *68*, 654.
- Little, A. C., Connely, J., Feinberg, D. R., Jones, B. C., & Roberts, S. C. (2011). Human preference for masculinity differs according to context in faces, bodies, voices, and smell. *Behavioral Ecology*, *22*(4), 862-868. doi:10.1093/beheco/arr061
- Higuchi, T., Shoji, K., Taguchi, S., & Hatayama, T. (2005). Improvement of nonverbal behaviour in Japanese female perfume-wearers. *International Journal Of Psychology*, *40*(2), 90-99. doi:10.1080/00207590444000050
- Stafford, L. (2012). The essence of the human condition?. *The Psychologist*, *25*(12), 884-887.

Achievements during the Big Making Days

- Setting up of the EEG-smartphone interface able to measure in real time brain waves.
- Fabrication of a smell library with different scents.
- Design and perform of blind experiments.
- Analysis of EEG data.
- Printing of the EEG data in wooden paper using a laser cutter.

Media from the project

Experimental design videos
Smell you later! 1/4: https://youtu.be/_lZawy0Bp04
Smell you later! 2/4: https://youtu.be/S4vW0t4SYv4
Smell you later! 3/4: https://youtu.be/WslNeqYpVT4

Audio recordings
Smell you later! 4/4: https://youtu.be/7uSvtQhbSN8

Presentation: To see this presentation and much more, visit our open google drive: https://goo.gl/hyWTE0

Project 2: VRICKs

Team members

Paloma Portela (Molecular Biology)
Lucas Von Chamier (Physics, Biology)
Roger Castells Graells
(Virology, plant biology, education)
Aizhan Zhussupova (Plant research, conservation, education, design)
Juanma Garcia (Biotechnology, education, microscopy)

Abstract

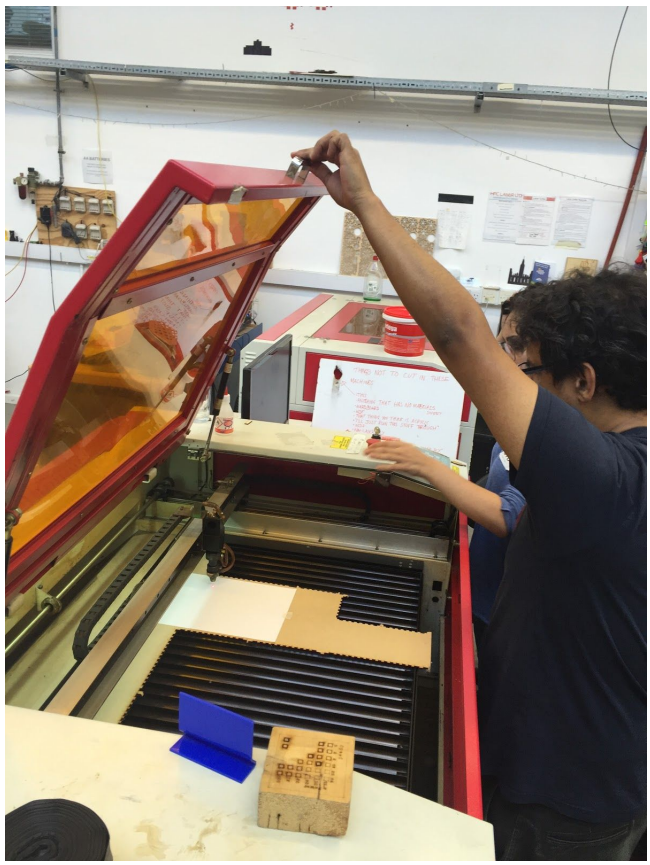
VRICKS is a citizen science based project that aims to connect students and general public with science. Virology is the basic scientific direction of the project. Researchers go to a classroom or science event, they pitch the project and the participants play, design and assemble viral structures using the VRICKS box. Participants upload pictures of the assembled structures in Twitter/Instagram. Researchers pick their favourite structure once a week and comment on it in the blog of the project. Additionally, researchers get inspired by the proposed structures and might even add new VRICKS to the collection. In the end, we have a citizen science project, which combines education, creative thinking and advanced research technologies.

Keywords

virus, 3D model, synthetic biology, learning by doing, design2share, citizen science

Objectives

- Bring science to students and general public;
- Help students participate in the designing and creative processes of science;
- Learn some useful information;
- Development of critical thinking in kids



Motivation

As we all know entertainment is something what catches attention and touches our feelings, while education permits to learn something new in order to grow and develop. Educational entertainment (or edutainment) is a way to provide and share information, which might serve both for education and entertainment purposes. It includes popular science television productions, movies, museum exhibits, and computer software, which use entertainment to attract and maintain an audience, while incorporating deliberate educational content or messages.

But, we also know that it is better to do it once personally, especially closer to “natural conditions” than to hear about it a number of times, but never get a chance to actually give it a go, since with the first a complete set of all learning objectives is implied: as we are

getting closer to Know, Feel, Practice, Share and Enrich. A long growing social concern of kids too much into digital technologies and less into real communication calls for coming up with something funny, interactive and highly educational, making communities, positive personal and group communication stronger.

Nowadays researchers are studying and using the structures of viruses in order to create nanoparticles with new applications. To do so, the structure of the virus coat protein needs to be known. This process can include the modification of the coat protein in order to, for example, add foreign proteins like GFP, green fluorescent protein, and use it as a bioluminescent marker.

Material request for Big Making Days

4 units	PLA filament 1 kg. Blue, yellow, white, red	£15 per unit	Total £60
3 units	1 kg plaster	£10 per unit	Total £30
3 units	Plastic mold	£5 per unit	Total £15
3 units	Latex liquid 0.5 kg bag	£10 per unit	Total £30

TOTAL: £135

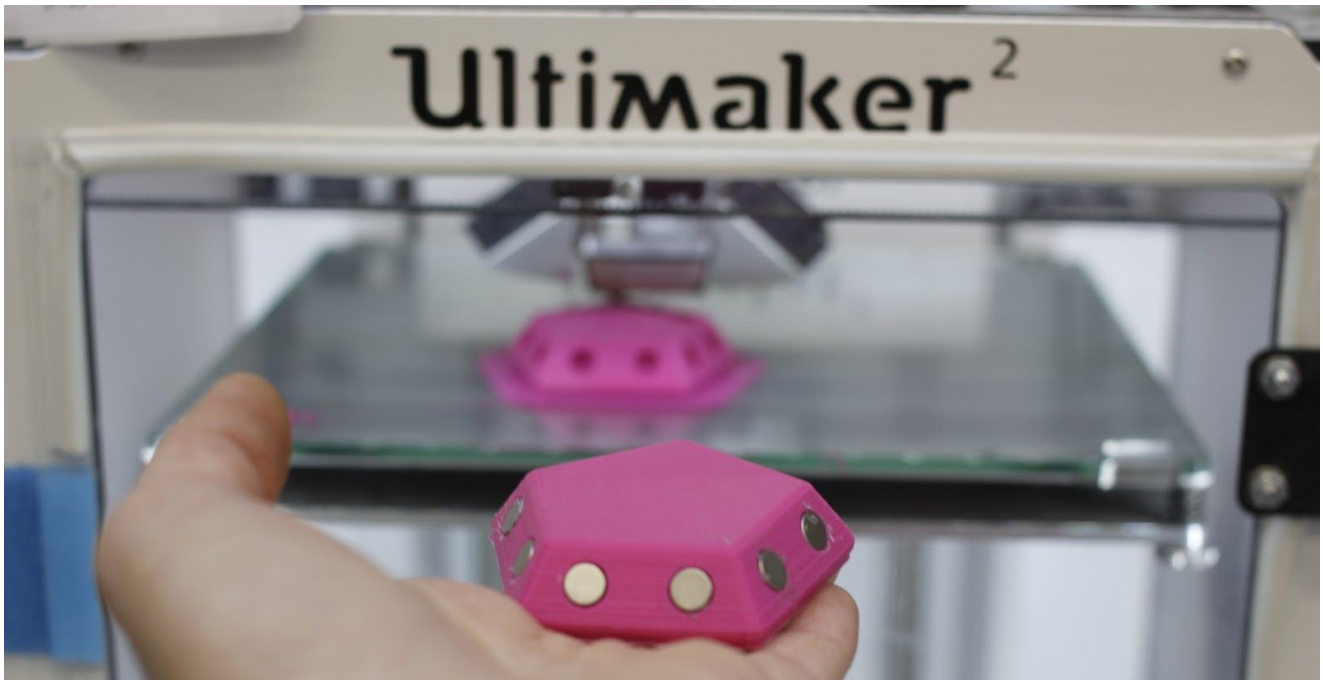
Achievements during the Big Making Days

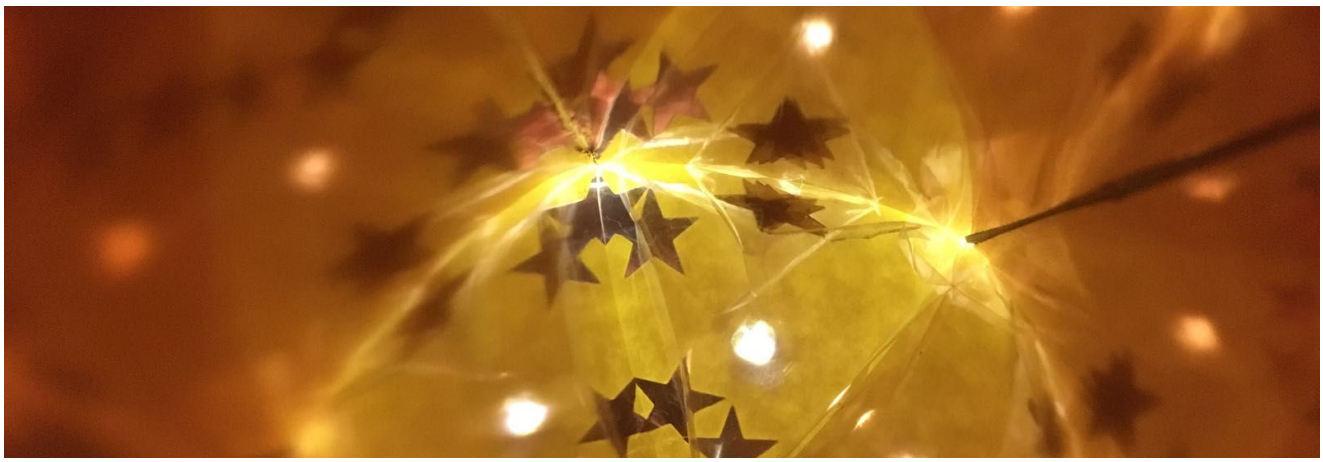
- Design of alternative VRICKS pieces made out of:
    - PLA, assembled by magnets in the 3D printer
    - Paper, assembled by velcro, in the laser cutter
    - Wood, self assembled, in the laser cutter
- Design of kaleidoscopes to replicate repetitive patterns found in viruses
- Design of a logo, a box, and a distribution channel for VRICKS
- Assembling on a few virus particles and research on the scientific justification

Media from the project

VRICKS printing: https://youtu.be/UN2asyx3nMk

To see this presentation and much more, visit our open google drive: https://goo.gl/hyWTE0





Project 3: Edible Book

Team members

Imane Baïz (Art and Science)
Nick Prior (Environment)
Ariana Mizarafie (Interdisciplinary biosciences)
Diana Mizarafie (Politics, philosophy and economics)
Mariana Visan (Healthcare)

Abstract

The edible book aims to present the traditional hardback book in a new light. The edible rice paper will add an additional layer of sensory experience to reading the book, whether for educational purposes aimed at young children, or for novelty purposes aimed at opening the minds of gift-givers, and even as an innovative medium for communicating food science principles, inside and outside the kitchen.

Objectives

The objective is to produce a book made of edible material whose content and material are connected in such a way that synergistically enhances an educational experience, culinary experience, etc.

- Prototype an edible book that looks and functions like a traditional book, where the paper and ink are fully edible
- Bind the pages in such a way that doesn't compromise the integrity of the object
- Design a story or content that complements the texture, appearance or taste of the material

Description

Books have been a staple of knowledge accumulation and sharing across civilisations for a very long time. So has the art of cooking and culture-building around food and the essential habits of preparing and consuming food. Merging these two core aspects of civilization can provide a unique opportunity to enrich experiential education for children, adults interested in cooking and food supplements, as well as anyone else who wants to partake in the novelty of synergistic consumption of nutrients for the body as well as the mind.

Motivation

The motivation for exploring this proposal comes from a desire to instil fun into the already very rewarding activity that is reading books. In the light of a decreasing interest in interacting with hardback books on a regular basis, especially among children, the potential

of the edible book to associate eating with reading provides an opportunity to build reading habits amongst pupils.

The edible book is an original take on two well-entrenched topics. Additionally, the customisation options available at the production stage of the edible book enable unique applications such as helping care home residents with taking their daily medicine where otherwise they might lose track of it.

Material request for Big Making Days

- Commercial edible ink and paper printers exist (Canon iP7250, etc. $150; http://www.ebay.co.uk/itm/like/121460437592?lpid=122&chn=ps&adgroupid=37167790761&rlsatarget=pla-258198442503&adtype=pla&poi=&googleloc=1006964&device=c&campaignid=659272460&crdt=0).
- The ink and rice paper (Vietnamese, “banh trang”) are FDA approved under the Code of Federal Regulations Title 21 (https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr=101.22; http://edibleprintsupplies.co.uk/blog/).
- Bookbinding techniques can be tried to make the book from rice paper.
- Flavourings can be added to the paper.
- Book content can include calendars, agendas and other organisational items.
- If the commercial material is too brittle, modified materials can be attempted to be made from scratch e.g. such as wood paper. This would also be the stage where customisations could take place such as flavouring, texture, etc.

Achievements during the Big Making Days

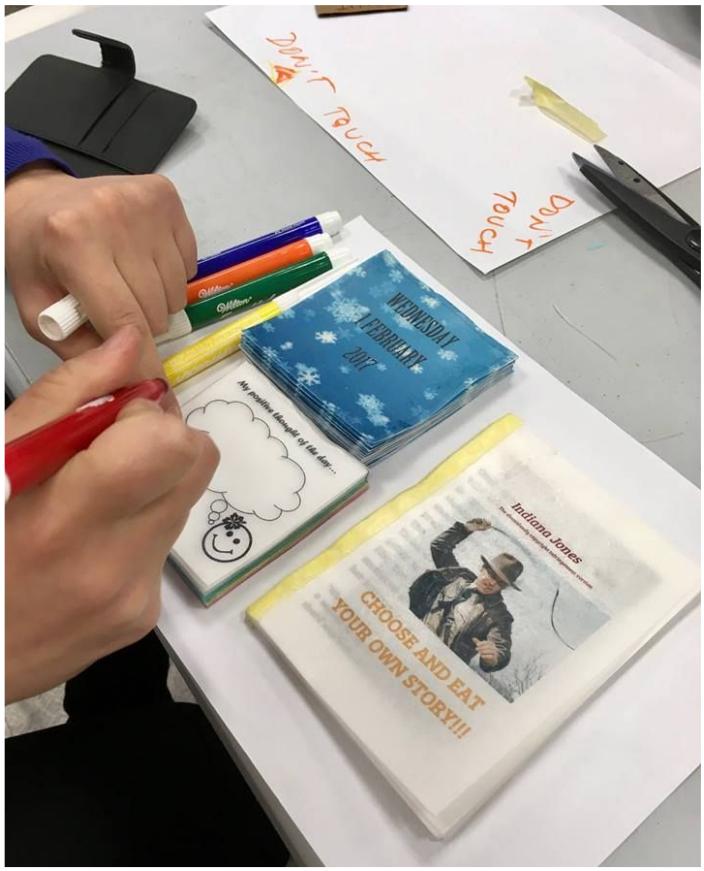
- Successfully set up the edible printer-paper and printed document, books, and all sorts of objects.
- Used edible glue to assemble edible paper into 3D structure and objects.
- Brainstormed about new uses of the technology in many more contexts.

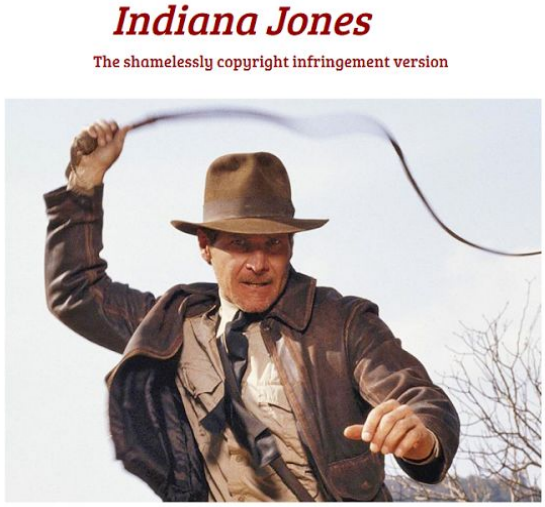
Media from the project

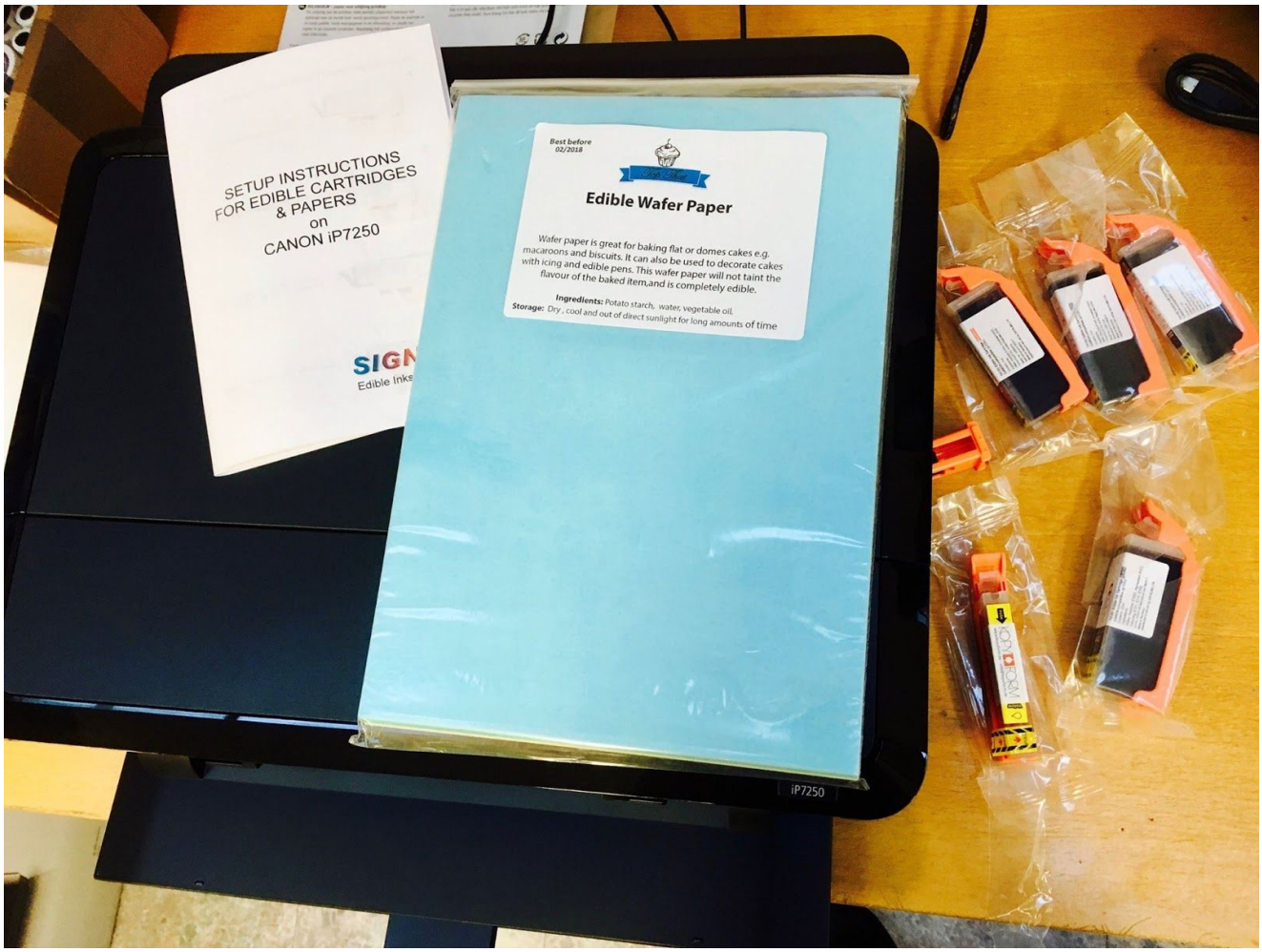
The edible book 1/5: https://youtu.be/zsSR0NxhHyE
The edible book 2/5: https://youtu.be/umMafAopdJo
The edible book 3/5: https://youtu.be/cM52LFqNliw
The edible book 4/5: https://youtu.be/XMxlSp9d52M
The edible book 5/5: https://youtu.be/VUqqfg5dhz8

To see this presentation and much more, visit our open google drive: https://goo.gl/hyWTE0


Wilton
5 count stück unités
FoodWriter
Edible Food Colour Markers
Essbare Lebensmittelfarbstifte
Marqueurs culinaires à colorant comestible
Fine Tip
Feine Spitze
Pointe fine
ClassiKool
Edible Glue
ESSENTIALS
SK
RANGE


DON'T TOUCH
WEDNESDAY
FEBRUARY
2017
Indiana Jones
CHOOSE AND EAT
YOUR OWN STORY!!!


Indiana Jones
The shamelessly copyright infringement version
CHOOSE AND EAT
YOUR OWN STORY!!!


SETUP INSTRUCTIONS
FOR EDIBLE CARTRIDGES
& PAPERS
on
CANON iP7250
Best before
02/2018
Edible Wafer Paper
Wafer paper is great for baking flat or domes cakes e.g. macaroons and biscuits. It can also be used to decorate cakes with icing and edible pens. This wafer paper will not taint the flavour of the baked item,and is completely edible.
Ingredients: Potato starch, water, vegetable oil.
Storage: Dry , cool and out of direct sunlight for long amounts of time
iP7250

Conclusions

Conclusions

Learning outcomes of participants

Participants have learned quite different set of skills depending on the group and the role they took. In general the iGEM team participating in the workshop took some of their ideas for their Human practices project, and some of the ethnographic methods we presented.

For some of the artists and designers, it was the first time in a long time that they have entered into a lab. However, the practicals were not very challenging and complex to understand, which did not represent a very big challenge or motivation for some of the scientists and even some designers.

We generally achieved to create a good atmosphere that was reflected by a continuation of the relationships that began during the workshop. Many of the attendees have seen each other again, and they presented to each other their research work, artworks, or working spaces at the university. We as organizers have also received visits in Paris from some of the participants. The overall feedback from the workshop was very positive. We unfortunately did not follow a precise quantitative questionnaire for feedback.

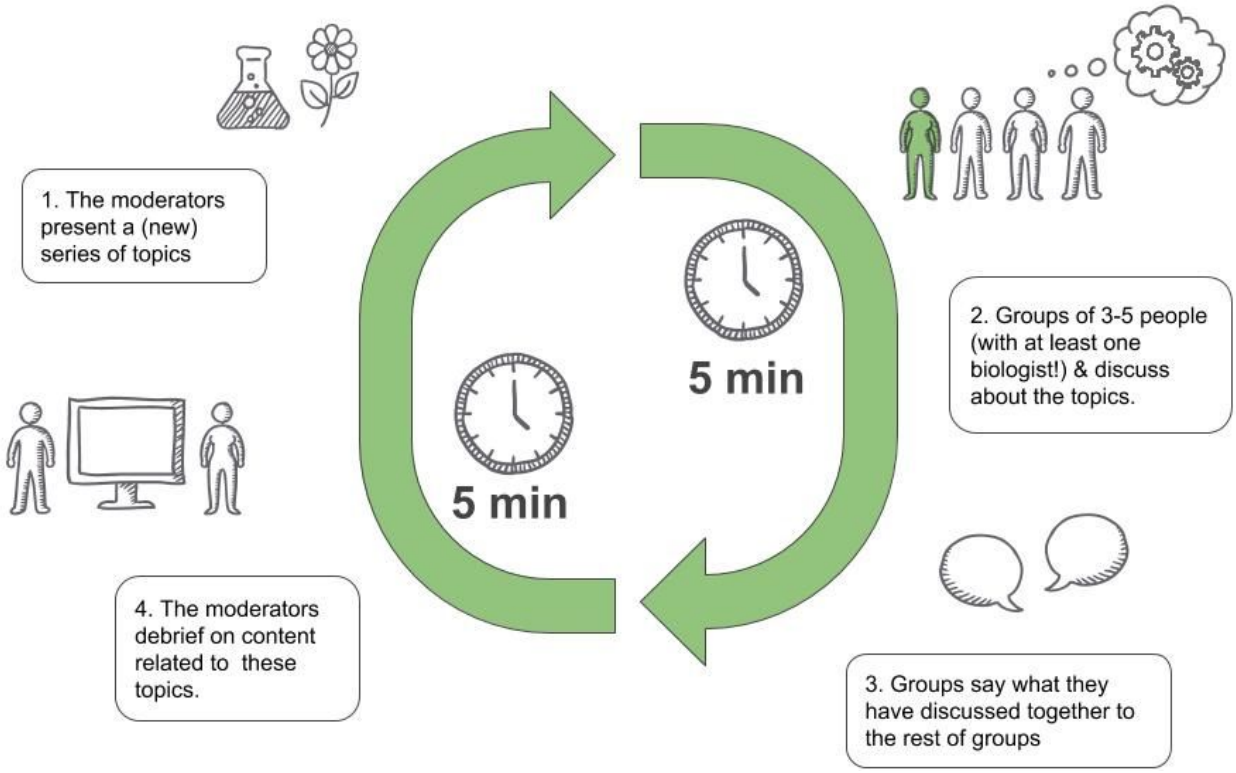
Learning outcomes and good practices from organizers

Unlike previous editions bringing a focus on a set of techniques/experimental approaches (synthetic biology), and focusing on a field (plant biology) helps narrow down the possible outcome projects by the participants. However, perhaps not narrow enough, as we can see that the outcomes are still very wide.

Looking back to previous workshops, we as organizers can see a change of trend and positive and negative aspects. In regard of the methodology: previous editions looked at human-centered design which may have lead participants to escape the wider reach of the potential projects to be developed. The ethnography (the scientific description of peoples and cultures with their customs, habits and mutual differences) could provide a way around that. We also improved gradually the sessions as they were happening. I was especially challenging to do two sessions in a row in the first week of July, but we could see in a very short of time the repetition of the same schedule.

One of the main learning points that have influenced our way of doing workshops since then, is the way of presenting science. In the first series on July 8-10th, we gave a short synthetic biology lecture to everyone. However, we realized that even if the lecture was very short and condensed, it was very tiring or boring for scientists to hear the same. They wanted to participate more. From the second session, we made a collaborative science lecture, with turns of 5 minutes to present, discuss and debrief. The scientists here were

taking an active role in explaining the topics to each other and often also diverged into interesting discussions.



Follow-up and continuation of activities

Juliette and Mourdjen, from the "Smell you later!" group, keep using the EEG headset techniques that they have learned during the workshop. Mourdjen also mentioned that the scientific approach of the workshop helped him to understand better how to design a bulletproof research project.

Roger Castells presented the VRICKS project in the Norwich Science Festival with high success. He then applied to a grant from the Open Plant Fund together with some researchers in Cambridge and got awarded 5000 pounds to continue this project and bring nanotechnology models to classrooms.

Imane Baïz and Open Science School kept using the "making electricity with plants" experiments as a wonderful demonstration of links between electronics and living organisms. Imane presented the experiment in the Berlin Science Week as part of the European Project "Doing it Together Science", a pan-European citizen science project.

The Edible Book inspired the activities *"The Edible Painting"* in the next Co-lab in Paris. In the next Co-lab - Co-lab "Playbio", we focused on the playfulness of biological materials and process. "The Edible book" was adapted to a special event "The Edible Painting" in which participants explored the fun to paint with edible everything and eat their work.

Roger Castells presenting some of his VRICKS models in the Norwich Science Festival.

Imane Baïz presenting “making electricity with plants” in the Berlin Science week.