FUTURE IMAGERY OF SYNTHETIC FOOD

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Abstract

With a constantly growing world population, food production through traditional agriculture and farming is putting the planet's resources to the test. Could artificial food ensure adequate nutrition for everyone in the world? Assuming that future genetics and biomolecular science will be able to meet a worldwide production of synthetic food, the following project explores through a speculative approach a plausible future scenario in which future we shift from organic to a fully synthetic food consumption. The project was conducted through the Speculative Critical Design (SCD) methodology and supported by a qualitative approach. The following study focused in particular on the consumer response to biosynthetic technology. The findings oriented the discussion on consumer product attachment and on the question of food as an object. The study considered food as a non-human entity and on the basis of the Tamagotchi effect tried to hypothesize the establishment of an emotional connection in the form of a bond with synthetic food. This strategy could be an alternative method to bring the consumer closer to this new technology. The role of the designer can be useful in facilitating the elaboration of a complex system such as the food sector which include relational, social, political, environmental, economic and technological contexts and SCD specifically could be the right way to explore these topics.

Keywords: Synthetic food, Speculative Critical Design, Consumer response, Human-non human attachment

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INTRODUCTION

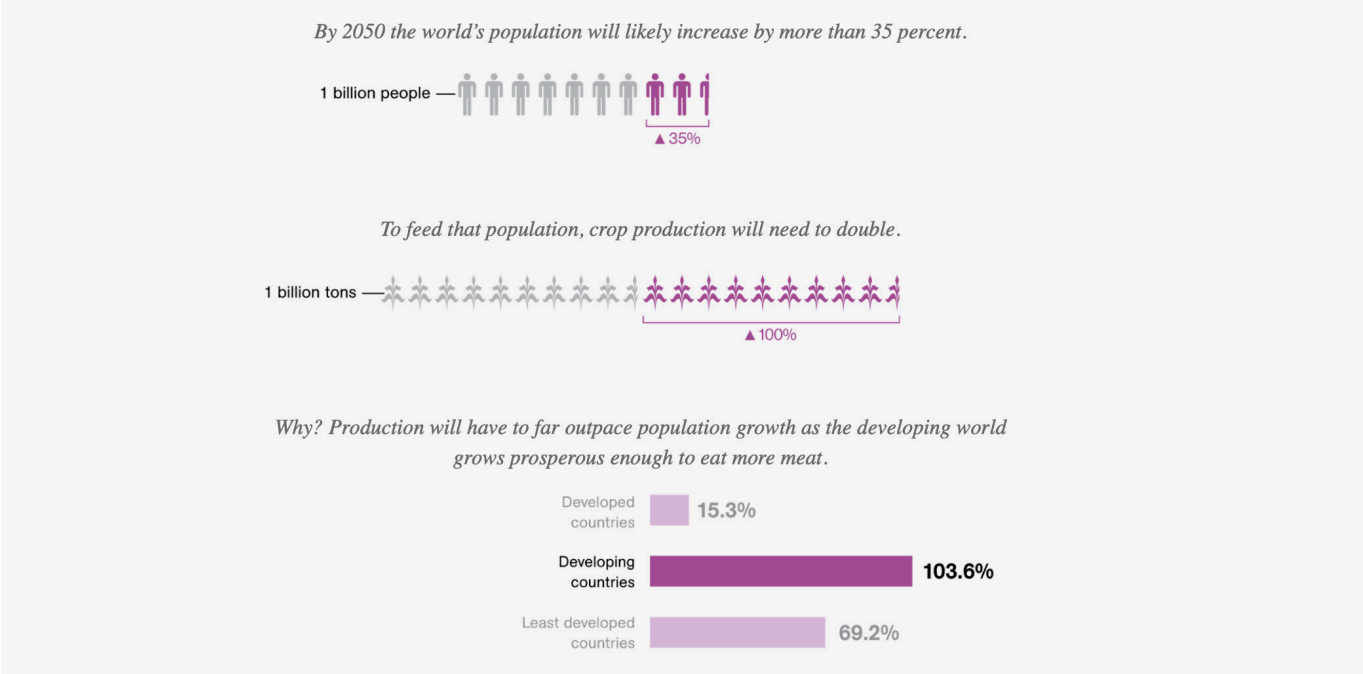


FIG.1 World demand in 2050 (National Geographic, 2018)

1.1 Background

The Food and Agriculture Organization (FAO) has predicted that 70% more food will be needed in 2050 to meet the demand of the growing population that is expected to reach 9 billion people by that date (FAO, 2018). But sheer population growth isn't the only reason we'll need more food. Added to this is the fact that the urbanization trend is constantly increasing and it is expected that by 2030, 60% of the population will reside in urban settlements. The spread of prosperity across the world, especially in China and India, is driving an increased demand for meat, eggs, and dairy, boosting pressure to grow more corn and soybeans to feed more cattle, pigs, and chickens (Foley, 2018). With the development of society and technology, people's perception of food consumption has changed dramatically and the demand for food has switched from basic "guarantee supply" to "nutrition and health" (Lv et al., 2021). In addition, due to the increasing environmental pollution and world population, novel processes are required to meet the higher demand while maintaining safety, nutritional value and sustainability (Awange & Kiema, 2019).

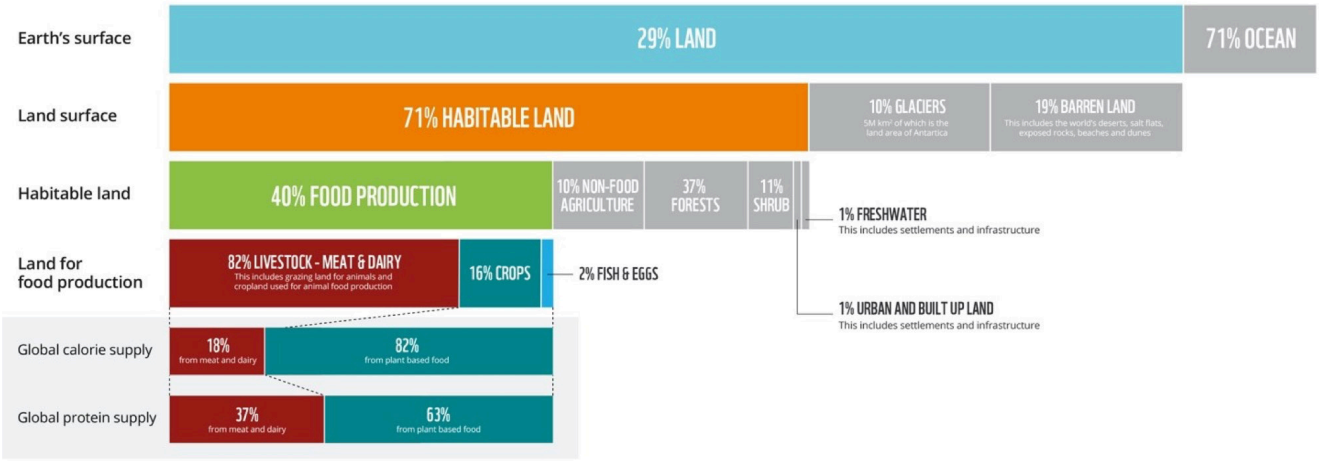


FIG.2 Global surface area allocation for food production (FAO, 2019)

1.2 Statement of a problem

According to a FAO report (FAO, 2018) food systems are the largest driver of deforestation, water use, biodiversity loss and soil degradation. Agriculture occupies half of our planet's habitable land, with the remainder for forests (37%), shrub and grasslands (11%) and cities and infrastructure (1%). Most agricultural land (82%) is used to produce animal food directly through grazing or indirectly through the cultivation of feeds such as soy, while 10% is used to grow crops for direct human consumption. Also, the aforementioned report states that the livestock sector alone is responsible for 18% of all greenhouse gas production.

The environmental demanding situations posed through farming and agriculture appearance huge, and it appears they'll emerge as even greater urgent as we strive to satisfy the developing need for food worldwide. Given that traditional approaches seem to have not yet satisfactorily mitigated the problem of global food insecurity, one wonders what technology can offer and how it can help in this race against time.

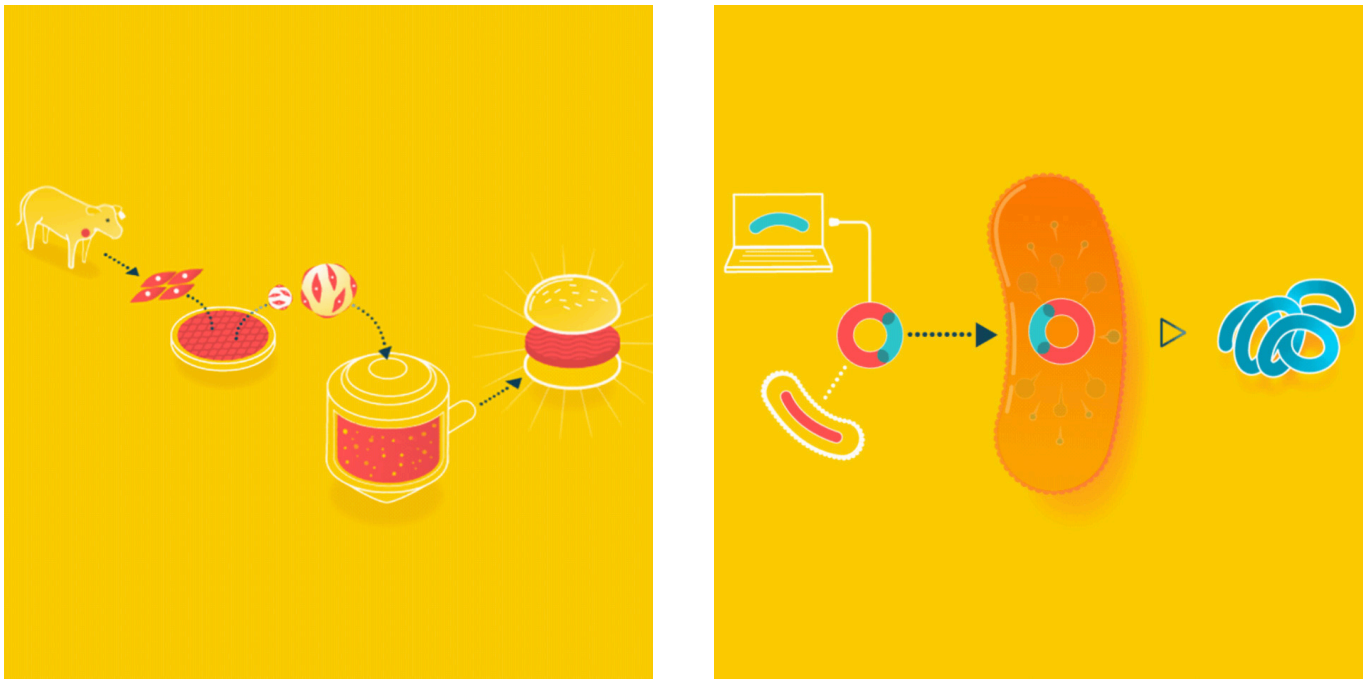


FIG.3-4 Cellular and acellular production of synthetic food (New Harvest)

1.3 Overview of the current synthetic food state of art

In recent years, synthetic biology has emerged as a discipline that merges biological research and engineering concepts (Shapira, Kwon, & Youtie, 2017). Currently, the food industry is one of several actors involved in this technological advance and although it is still at a rather embryonic stage, the room for improvement appears to be enormous.

Fundamentally, synthetic foods can be defined as food substances or products that are produced artificially rather than through natural processes. They involve the creation of entirely new organisms with DNA sequences created from scratch. The process starts in a laboratory where the researchers extract molecules that are subsequently combined or duplicated to produce the desired substance in vitro. Finally, the product is collected and processed to be distributed to the consumers (Ducker, 2021).

When it comes to synthetic food production there are basically three approaches: cellular, acellular and extraction from plant or animal-based materials.

Cellular production methods in their most basic form are about taking a number of cells and proliferating them in a nutrient-rich medium. This process involves taking a number of cells from a particular animal and proliferating them in a nutrient-rich medium. After the cells are multiplied, they are attached to a sponge-like 'scaffold' and soaked with further nutrients to allow additional growth to form muscle fibres. They may also be mechanically stretched to increase their size and protein content. Additional components may

be added to provide other important nutrients or aspects (Bagrie, Williams, Croy, & Borkin, 2016). Among the cellular products, cultured meat is perhaps the best known and most cited one.

Acellular production is slightly different in that it uses micro-organisms, such as bacteria or yeasts, to synthesise a range of different nutrients. Essentially, different types of bacteria or yeast are grown on a food medium and through excretion or fermentation different nutrients are created. This process has been used to make substitute products for the likes of egg whites, gelatine and milk proteins. It's basically the same procedure that is used to obtain insulin and is similar to brewing beer (Bagrie et al., 2016).

The third process used is the extracting and isolating of different nutrients from a variety of plants and animal foodstuffs. Common plants being used include soybeans, peanuts, sunflower seeds, cottonseed, sesame, rapeseed, oil cake, peas, wheat gluten, and other green material from plants. To identify suitable nutrients to imitate a certain food product the basic biochemistry of each is first studied to understand their characteristics and possible applications. The promising ones are then tested in a variety of recipes or formulations to see how they perform (Bagrie et al., 2016).

While all three approaches have produced trial products, just the latter two are producing commercially available products on a big scale.

FIG.5 Impossible Burger ingredients (Impossible Foods, 2018)

1.4 Impossible Food case study

According to a recent report meat production at its current levels is unsustainable as it contributes heavily to the increases in greenhouse gas emissions, deforestation, soil degradation and water stress (Dent, 2020).

Impossible Foods attempts to produce a lab-grown alternative for meat, using an entirely different production method. The company produces burger patties by purely using plant-based molecules. According to an internal report (Brown, 2018) their burger uses 75% less water, generates 87% less greenhouse gases, requires 95% less land and 100% fewer cows. It delivers the same protein and iron as a burger made from a cow but its protein comes mostly from plants and it's produced without the use of hormones or antibiotics. Thanks to the discovery of heme, an iron-rich molecule in animal proteins they succeeded in recreating the flavor of real burgers purely from plant-based ingredients.

“what if in the future we shift to a fully synthetic food consumption”?

1.5 Purpose of this study

According to several studies, by applying synthetic biology technology in future food may be possible to get rid of the drawbacks of the traditional agriculture and husbandry while improving resource conversion efficiency. Overall, synthetic biology driven food industry has the potential to address the challenges of sustainable food supply in the future (Lv et al., 2021). Assuming that future genetics and biomolecular science will be able to meet a worldwide production of synthetic food, this project attempts to provide a plausible future imaginary that explores the research question “*what if in the future we shift to a fully synthetic food consumption”?

Specifically, the following work will consider a future in which the achievement of a sustainable food system will be guaranteed by the transition from organic to synthetic food.

2.
APPROACH

A	B
Affirmative	Critical
Problem solving	Problem finding
Provides answers	Asks questions
Design for production	Design for debate
Design as solution	Design as medium
In the service of industry	In the service of society
Fictional functions	Functional fictions
For how the world is	For how the world could be
Change the world to suit us	Change us to suit the world
Science fiction	Social fiction
Futures	Parallel worlds
The “real” real	The “unreal” real
Narratives of production	Narratives of consumption
Applications	Implications
Fun	Humor
Innovation	Provocation
Concept design	Conceptual design
Consumer	Citizen
Makes us buy	Makes us think
Ergonomics	Rhetoric
User-friendliness	Ethics
Process	Authorship

A/B, Dunne & Raby.

FIG.6 A-B Manifesto (Dunne & Raby,2009).

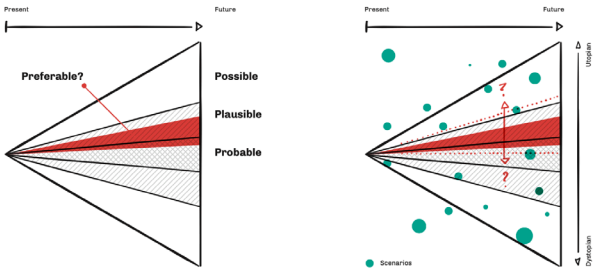


FIG.7 Speculative scenarios (Mitrovic, 2005)

2.1 Speculative Design

The project was conducted using the practice of speculative critical design (SCD), which combines Speculative Design and Critical Design. The term Critical Design was first used by Anthony Dunne in his book, “Hertzian Tales” (Dunne, 1999), referring to an attitude toward design rather than a movement or method. Speculative design is a critical design practice that comprises or is in relation to a number of similar practices, such as critical design, design fiction, design futures, anti-design, radical design, interrogative design, discursive design, adversarial design and so on. The focus is on a discursive activity founded in critical thinking and dialogue which questions design practice. It uses speculative design proposals to challenge narrow assumptions, preconceptions and givens about the role products play in everyday life (Dunne & Raby, 2013).

Dunne and Raby suggest no unique, free-standing methodology to use for conducting SCD. In their view, SCD is not a methodology, but rather a position the designer takes on (Dunne & Raby, 2013). Since there is no constraint on the correct use of this practice, the project became based on the premise of the article “Speculative and Critical Design: Features, Methods, and Practices” (Johannessen, 2018). The design process was therefore divided into three sections. In the first part the context of the debate was identified and analyzed, in the second part the focus was on the conception, the search for problems and the creation of a scenario and finally in the third part the scenario was materialized in order to provoke the audience.

The individual sections, which will be sub-

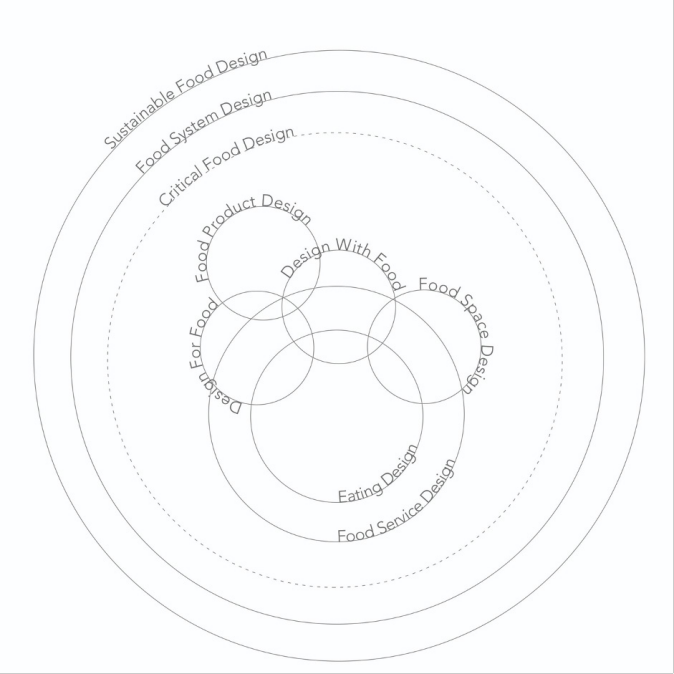


FIG.8 Food Design 2.0 (Zampollo,2016)

sequently analyzed in detail, also include methodologies that are part of a qualitative research approach, which have proved to be useful in the collection of primary and secondary data.

2.2 Critical Food Design

Since the main topic my thesis revolves around is food, I consequently wanted to identify and focus on a specific area. However, before going into details I would like to provide a clear and detailed explanation of what is meant by Food Design and to do so I will rely on the words of Dr. Francesca Zampollo, researcher in Food Design and founder of the International Food Design Society (IFDS).

“Food Design is, simply, the connection between food and Design. Food Design is the design process that leads to innovation on products, services or systems for food and eating: from production, procurement, preservation, and transportation, to preparation, presentation, consumption, and disposal “ (Zampollo, 2016).
Given the large amount of disciplines that deal with Food Design she later developed her own graph on how these Food Design sub-disciplines intersect and merge, and how other disciplines inform and influence Food Design. A Food Design sub-discipline, and the one I’ll focus, is Critical Food Design. Critical Food Design is the discipline that makes us think about food and eating issues, that raises awareness, exposes assumptions, provokes actions, and sparks debate on food related issues, problems and future possible scenarios (Zampollo, 2016).

3.
METHODS AND DESIGN PROCESS

3.1 Define the context for the debate

The practice of speculative and critical design revolves around a topic, which technically is the context that a speculative designer wants to insert in the social debate (Dunne & Raby, 2013). Therefore, the first step is to define this context and build arguments around this specific area.

The food sector represents one of the most complicated and interconnected systems since it involves different actors such as consumers, business models and policy makers. In particular, synthetic food, precisely because it was in its infancy, is a source of great discussion and debate. Although the research argues that this new technology has significant benefits and significant potential, synthetic foods face nowadays four key barriers to further progress: commercial scalability, technicalities of creating equivalent imitations, regulation related to the labeling of food and its safety and finally consumer acceptance (Bagrie et al., 2016).

I consequently wanted to focus on the section concerning consumer response, both because of my interest in the behavioral field and because of my professional background which would not allow me to address the problem from an engineering and scientific point of view in an exhaustive way.

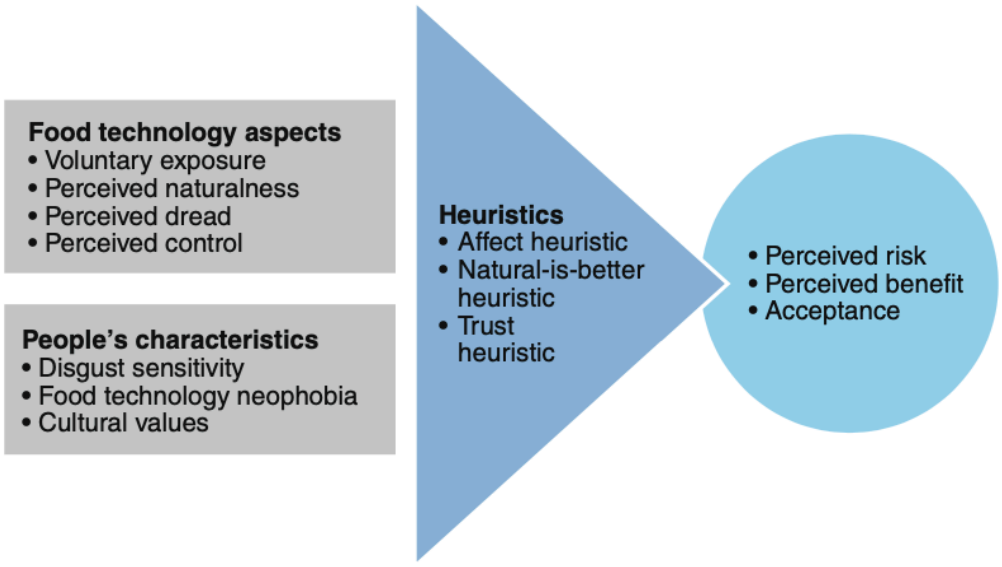


FIG.9 Factors influencing the perception of food technologies (Siegrist & Hartmann, 2020)

3.1.1 Consumers acceptance on novel food technologies

In order to obtain an overview of the problems and limits that influence consumers' response to synthetic food, a literature review of the article "Consumer acceptance of novel food technologies" was performed (Siegrist & Hartmann, 2020).

Technologies employed along the food sector have enhanced the safety, nutritional value and sustainability of food, and yet food technologies are not always perceived in a positive way by consumers (Bearth & Siegrist, 2018). "Why do consumers reject food technologies that experts perceive safe? What factors influence consumers' perceptions and acceptance of novel food technologies?"

Many purchasers understand the usage of food technology as contradictory to healthy, nutritious, tasty meals, which can be a mission for the meals industry. It is therefore essential to take consumers' perspectives into consideration all through the early tiers of product development.

Unlike in different domains, technological improvement in food has little obsolescence over time, new technology now no longer update older ones that much, however construct upon and upload to. As a consequence, there may be plenty much less strain for consumers to accept improvements in comparison with different domains. Firstly, humans by nature tend to be conservative about unfamiliar new foods and thus new food technologies. Secondly, the negative image of highly processed food is strongly influenced by a perceived lack of naturalness.

How a food technology is perceived by consumers depends basically both on the perceived aspects of a food technology and on the individual characteristics of the consumers. Furthermore, both of these factors influence the heuristics that consumers rely on when it comes to food acceptance and risk evaluation. Consequently, people's assessment of food technology is frequently primarily based totally on heuristic processes, not on elaborate information processing. People rely on heuristic attributes rather than calculated reasoning in situations where the risks and dangers of a food have to be assessed.

It was in the interest of the project to focus on heuristics rather than on technological aspects and individual characteristics. Three types of heuristics that play an important role such as affect, trust and natural-is-better heuristics, has been identified (Siegrist & Hartmann, 2020). The first one proposes that people rely on the affective meaning that they associate with an image or the associations elicited by an object when asked to evaluate its risks or benefits. The second one implies that people depend on others' performance or assessments, helps them reduce complexity and remain capable of acting in a complex environment. Specifically, to understand how people decide whom to trust, it is helpful to distinguish between two types of trust, namely social trust and confidence. Social trust is based on perceived value similarities, and people tend to trust institutions with similar values as theirs and to distrust institutions whose values differ from theirs, whereas confidence is based on past experience or per-

ceived competencies.

Finally, the third heuristic states that naturalness in foods is of high importance, and natural foods are automatically perceived as healthier and tastier, as well as better for the environment. The absence of human processing is a key feature of perceived naturalness.

The article therefore highlights how societal acceptance needs to be examined at an early stage of development in order to achieve a successful introduction of these new food technologies.

3.1.2 Synthetic food knowledge workshop

The literature review illustrated how the experiential system is more important than the analytical system in how novel food technologies are perceived. Several quantitative studies have collected rather conflicting data on the propensity or otherwise of people to try synthetic foods, highlighting once again how complex the decision-making processes that influence us are (Bryant, Szejda, Parekh, Deshpande, & Tse, 2020) (Hocquette et al., 2015).

I therefore decided to personally collect the opinions of some consumers through a workshop in order to obtain a series of qualitative data.

The workshop was held with a total of 4 participants aged between 20 and 25 years. The target group was chosen based on geographical and age reasons. The

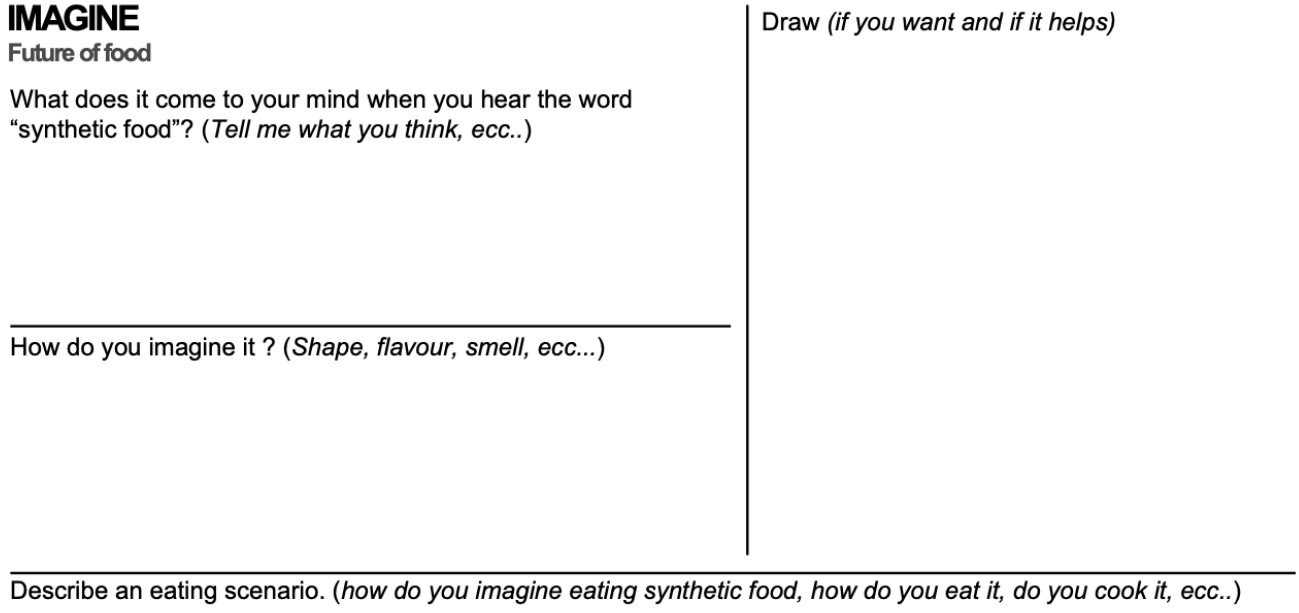


FIG.10 Workshop on synthetic food (Branconi, 2022)

activity, performed individually, consisted of one part for questions and one for graphic illustration. The goal was to have their idea and their point of view on synthetic food and identify the second step in the design process, that is what could be a future food scenario according to them. This was followed by a recorded group discussion in which the participants shared and compared their opinions and responses. The workshop lasted for a total of 30 minutes and the questions presented were structured as follows: 1) "What does it come to your mind when you hear the word" synthetic food? (Tell me what you think, ...) ". 2)" How do you imagine it? (Shape, flavor, smell, ...)". 3)" Describe an eating scenario. (How do you imagine eating synthetic food, how do you eat it, do you cook it, ...)".

The workshop and the subsequent group discussion brought out several reflections.

The participants agreed on the ineffectiveness of the term "synthetic" as it neither convinces nor entices the consumer. The word "synthetic" has been repeatedly compared to the term "false" and "unnatural". This finding substantially reflects the third heuristic principle analyzed in consumer acceptance, namely "natural-is-better". There is no real pessimistic or optimistic predisposition as the participants limited themselves to defining the food of the future as something efficient for our diet, which goes beyond the mere experience of pleasure. Also, there is no clear idea of what synthetic food might look like, but rather it seems that the general idea is influenced by science fiction culture. The sensory characteristics in

particular reflect a vision rather rooted in science fiction culture since clear references to cinematographic works of that specific genre emerge. The idea that the food of the future can be customized and tailored to one's needs is something that has been brought to the attention. In particular, personalization does not refer exclusively to sensory but also nutritional properties. There is therefore the idea that in the future, synthetic food can guarantee a balanced diet capable of providing the necessary needs without creating certain problems such as overconsumption. Although everyone agrees that synthetic food is a laboratory product, only one person was aware of synthetic food, specifically Impossible Burger. This proves, albeit in part, that most of the participants were never interested in learning more about this alternative food. The exercise also highlighted how a lack of knowledge about the topic is evident and how general culture is mainly influenced by the culture of the big screen rather than by scientific and professional communication channels.

3.1.3 Semi-structured interviews

Finally, in order to achieve an even more complete overview of synthetic food, I wanted to conduct a series of semi-structured interviews with experts in the food sector. In this way I was able not only to get further feedback but also to cross-check the data collected up to that point.

The three experts involved were respectively Martí Guixé, designer and concept explorer in food design, Francesca Zampollo, researcher in Food Design and founder of the International Food Design Society (IFDS) and Julia Kunkel, director of the Food Design Lab at L 'École de design Nantes Atlantique. The interviews (Guixé, Zampollo, & Kunkel, 2022) have been conducted on Zoom, they lasted approximately 30 minutes each and the questions presented were structured as follows: 1) "What's your opinion on synthetic food"? 2) "What kind of design strategies could be used in a speculative scenario"? 3) "How and where design should intervene in this context"?

On the basis of the mainly free modality of the interview, the interviewees preferred to elaborate a discussion not limited to the simple question.

A common element among all the participants was certainly the fact that synthetic food nowadays is limited to recreating foods existing in nature. According to them, this new technology should move away from the mainstream pattern and propose a series of culinary innovations. This observation, in some way, aligns and expands the idea that emerged in the workshop that synthetic food can be something configurable and customi-

zable. In fact, the creation of new culinary products passes through the possibility of expanding concepts and fighting the prejudices we have towards sensorial and nutritional characteristics. Although the freedom of creation is a point of contact between experts and average consumers, so are the cultural drivers that are holding back the acceptance of this new technology. In fact, food consumption patterns represent the first elements that must be analyzed and overcome in order to successfully introduce synthetic food. People inherently understand new concepts based on existing reference points and have difficulty detaching from them. Experts agree that the best strategy for breaking free from mental models lies in education and training. The introduction of novelties into well-defined systems subject to years of evolution such as food is comparable to a very slow and exponential learning curve. The learning speed is directly proportional to the training frequency. In essence, therefore, the consumer should be exposed gradually and continuously if the new habit is to be established. This specific discussion has brought out a consideration on what the influence of the present generation may be on the future one. This reflection leads me to ask: “Will future generations be able to move away from the idea of food that we still have today and, if so, how far can they go”? “Will a gradual shift from organic to synthetic food be needed”?

Finally, another subject of discussion was the social and legislative implications linked to this new technology. These last two issues, although relevant, have been excluded from my study as they represent

a further element of the food system. The reason for this exclusion lies simply in the fact that I had previously emphasized that the object of the analysis of my study is represented by the behavioral model in consumers response. Thus, focusing on social and legislative issues would have meant working on a completely different and far-reaching element of the system.

3.2. Ideate, find problems, and create a scenario

The next step is to ideate to find problems to explore a topic (Dunne & Raby, 2013). To elaborate on these problems further, the SCD designer draws from the 'designer's toolkit' and adapts whatever method suitable. SCD makes use of two types of scenarios: The design of alternative presents and the speculation about possible futures (Mitrovic, 2015). The first scenario is effective to analyze society in its current form, and the latter to analyze the direction of development.

At this point in the design process, I wanted to take a further step towards a precise direction, in order to identify which area of intervention was in line with my interests and insights. Although I had a fair amount of information and feedback, I felt that the nature of the issues were not completely sufficient to delineate a place of interven-

tion. As previously mentioned, this study focuses on the behavioral aspect, therefore I decided to dig deeper into the actors that play an important role in the food context, such as emotions.

In addition to the obvious nutritional benefits it provides, food can also be an instrument of emotional connection with the consumer. For example, when a function-primarily based totally food plan is imposed, emotion is stripped away. Some drivers of a function-based diet encompass health concerns, dietary restrictions and shortage of options. On the opposite hand, the drivers of an emotion-primarily based totally food plan encompass affiliation and context. Consequently, analyzing how the functional value of food behaves with respect to the emotional one represents a significant area of study. At this point, a strategy that could be used in order to create a speculative scenario in which synthetic technology is widely accepted could be to highlight synthetic food for its functional benefits or to hypothesize how it is necessary to instill emotions and narratives instead.

Finally, I decided to focus on the second strategy, in particular trying to hypothesize if it could be possible to increase the attachment to food and if creating an emotional bond with it could be a solution to establish a new habit.

3.2.1 The role of consumer product attachment and human-non human bond

Considering the fact that food can be considered as "non-human", I wanted to deepen the concept of attachment between man and product, in particular by hypothesizing and considering food as a product. Consequently, I decided to first provide a general definition of what consumer product attachment (CPA) is and then I explored the theme of human-non human attachment trying in some way to apply it to the food context. Consumer product attachment (CPA) is defined as strength of the emotional bond a consumer experiences with a durable product (Schifferstein & Zwartkruis-Pelgrim, 2008). It implies the existence of an emotional tie between a person and an object. An object to which a person is attached is considered to be special and typically means a lot to that person.

Norman, an expert in field of Human Factors, discussed human attachment to products in his book Emotional Design (Norman, 2004). He proposed three levels of object attachment: visceral (immediate attraction to an object based on its appearance), behavioural (love for a product because of its function and usability, based on the quality of interaction experiences), and reflective (strong emotional response to an object that has special meaning to the individual). In a passage of Emotional Design, he asserted that people become attached to objects that represent or are associated with meanings and feelings.

"We become attached to things if they have a significant personal association, if they bring to mind pleasant, comforting moments. Our attachment is really not to the thing, it is to the relationship, to the

FIG.11 Tamagotchi toy (Maize, 2020)

meanings and feelings the thing represents" (Norman, 2004).

At this point I decided to explore examples of "human-non human attachment" that would enhance the concept of relational bond rather than the object itself. I felt that the most symbolic case was represented by the Tamagotchi, of which I will provide a complete overview in the next section.

3.2.2 Tamagotchi effect

Tamagotchi, released in 1996, was an egg-shaped portable gadget and the premise of the game was to hatch and raise a virtual pet into adulthood. Depending on the care provided, the Tamagotchi responded to its user and developed characteristics in relation to the quality of care it received. The Tamagotchi's success, according to Bandai, is because it appealed to the human nurturing instinct, in this case the urge to care for a digital pet, following its growth and development and making sure it doesn't die (Allison, 2006). It managed to provoke strong emotional responses and attachments in players due to a sense of responsibility. It also gave players a sense of duty or obligation, because the continual play required them to check in every few hours to keep their digital pet alive and healthy. The establishment of this emotional relationship

with the object is what has been defined as the “Tamagotchi effect”, which is the development of emotional attachment with machines, robots or software agents.

3.2.3 Starchat workshop

The latest literary revision, in addition to the material collected so far, has definitively determined the direction of what should have been the design intervention. The problems encountered in the response of consumers to synthetic food and in particular the role of the consumer attachment in a human-non-human bond have therefore represented the core of the conceptualization of my design. At this point, the last step to take, before realizing the concept, was to generate speculative scenarios with the help of some participants. This was necessary in order to confirm the validity of the insights and outline a plausible future vision.

According to the Food Design Thinking methodology, Starchat represents a valid technique in generating valuable and useful information that help to generate

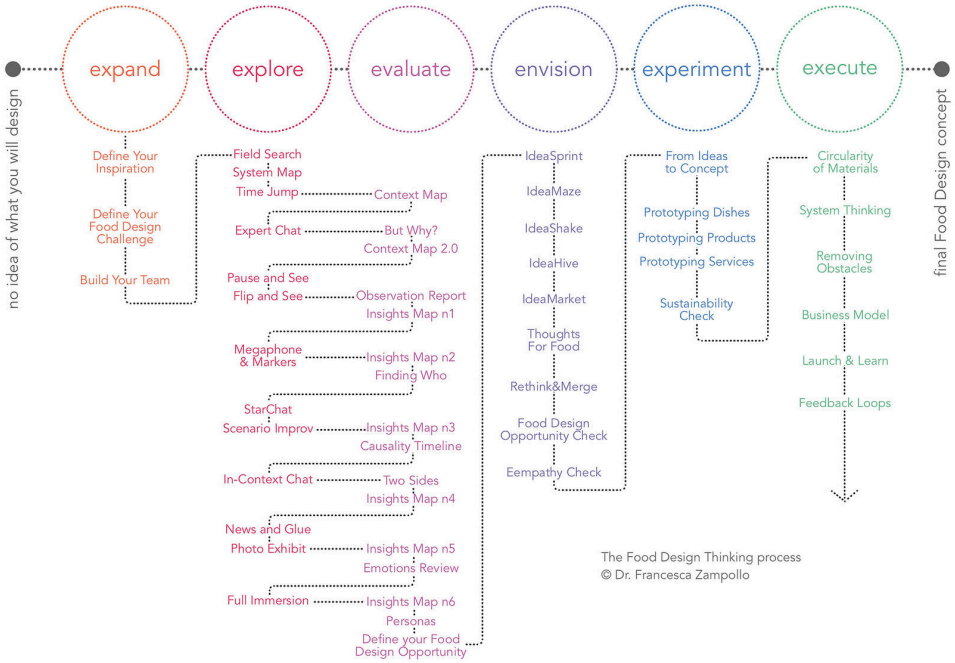


FIG.12 The Food Design Thinking process (Zampollo, 2016)

ideas as well as detailed target user profile (Zampollo, 2016). Starchat is a method that allows to ask one question to a group of people, to which they will respond using metaphorical thinking. The method has 204 cards, each presenting one icon. Participants answer the question through the icons presented in three cards that they choose. In order to get relevant information, it is really important to bring up the icons in the participants' awareness and let them answer the question. Answering with an image allows people to engage in metaphorical thinking, which is a fundamental way we think and interact with the external world. The discussion is conducted with a specific technique that allows for meanings to be placed in the middle of the group, as opposed to trying to convince others. It starts with one person showing her 3 cards, describing what she sees and how she interprets the images, and finally answering the question through the chosen cards. Then, one by one, the other participants interpret the first participant's cards and answer the question through her cards. Once the round is completed, the second participant shows her cards, describes them and answer the question. And so on, until everyone has presented and discussed.

The question, in this case adapted in the form of a sentence, was formulated as follows: "In a home context, think about a scenario where synthetic food is involved (it can be food preparation, an eating experience, a discussion, whatever you want)".

The workshop was held with a total of 4 participants aged between 20 and 25 ye-

In a home context, think about a scenario where synthetic food is involved

(it can be food preparation, an eating experience, a discussion, whatever you want)

FIG.13 Starchat workshop (Branconi, 2022)

ars and it lasted approximately 45 minutes. The target group was chosen based on cultural and age reasons.

It did not offer an incredible amount of useful data, partly due to lack of experience in conducting it and partly due to limited timing, however the discussion proved fruitful and engaging.

From the analysis of this exercise, it was possible to identify some key elements which were then used in the realization of the design proposal. One of these is the engineering behind synthetic technology. In a speculative scenario, all participants agree that in the future the dynamic and efficient lifestyle requires technological applications capable of producing food in a short time. This has led to a general idea that the most suitable technology may be some kind of 3D printer that builds food quickly. In particular, there was considerable interest in the creation and customization of the meal. All users, in accordance with their vision, have imagined an extremely advanced customization process that can be found in simple configurators up to photoediting softwares. There is the general idea that a fundamental aspect of synthetic technology resides in the freedom to create foods modulated on the basis of our needs and interests. This not only encompasses physical and sensory properties but extends to nutritional qualities. The other key element found in the discussion is the type of experience between the person and the food during the process. Although one of the points of common agreement is speed and efficiency, what arouses the most interest is certainly the degree and strength of en-

gagement. Particularly striking was the example of a participant who used the image of a well and a joystick to describe the food creation process as a complete event that allows you to experience it from the beginning to the very end in a challenging and rewarding form.

These elements, in addition to the insights from literary reviews, interviews and workshops led me to the creation of a precise design that will be explained specifically in the next section.

3.2.4 Concept

In this section I will present the design concept plus the theories and assumptions that support the decision-making process. However, before explaining the different elements, I would like to focus on the main cornerstones around which it revolves. Following the information gathered in the previous stages, I felt it was right to focus mainly on providing “knowledge and transparency”, “freedom of experience” and especially “emotional attachment in a human-non-human relationship”. The project can be briefly introduced with the following words: “technology as a medium for establishing a bond with synthetic food”.

The concept is composed of a physical product, in this case a bioreactor, and an app integrated with it that basically works in parallel. To facilitate the understanding

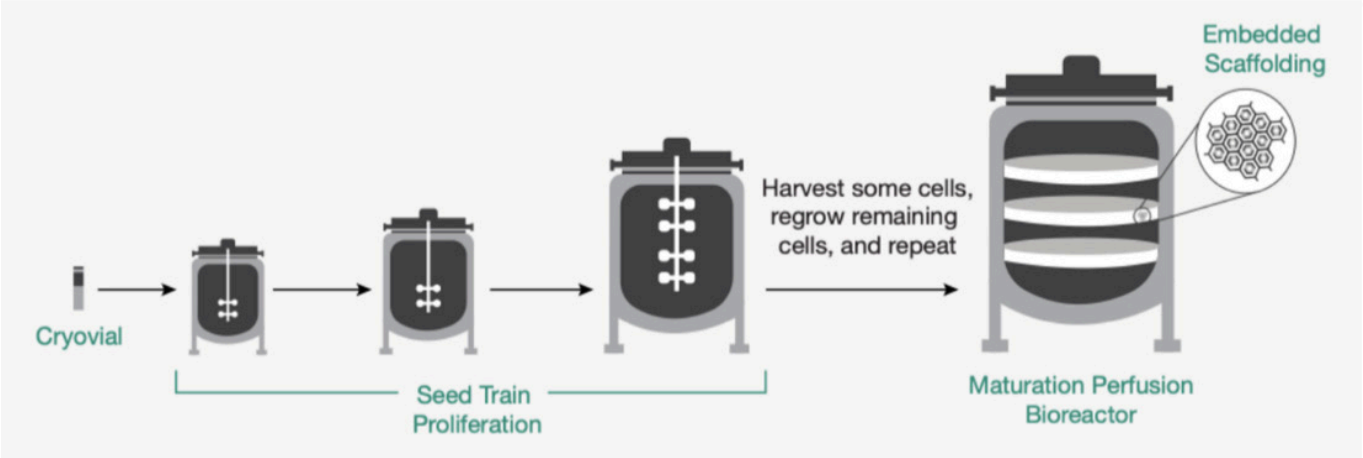


FIG.14 Bioreactors operation (Medium, 2021)

of the design proposal, I will analyze the different elements individually. I would also like to point out that this section will contain only the descriptive part as it is my interest to first provide a precise overview of the concept. In the next chapter the scenario will be visualized with the help of images and storytelling.

First of all, bioreactors are nowadays used in cellular agriculture as devices that provide the ideal conditions for cell proliferation and growth. The main premise behind bioreactors is to increase the percentage of nutrients present in the growth medium that is eventually converted into animal cells and tissue. In simple terms, they are the tool that allows the cell to grow up to the formation of a tissue. To cultivate cells, bioreactors have to maintain the correct conditions for cell growth. To manage all of the various processes within a bioreactor, strong monitoring systems must be present. There are three different types of monitoring systems currently used in cell culturing bioreactors: offline, at line, and online. However, they are not built for scalability as they are quite large in size.

In my case I decided to consider the housing context as I felt it was the most relevant environment in which to propose the new technological innovation given the fact that by the end of 2030, 60% of the population is expected to live in urban settlements. Given the engineering complexity behind this technology, it was not in my interest to focus on the design and its complex functions. Consequently, the monitoring procedures are limited exclusively to the control of the parameters of water, energy and nutrients since consi-

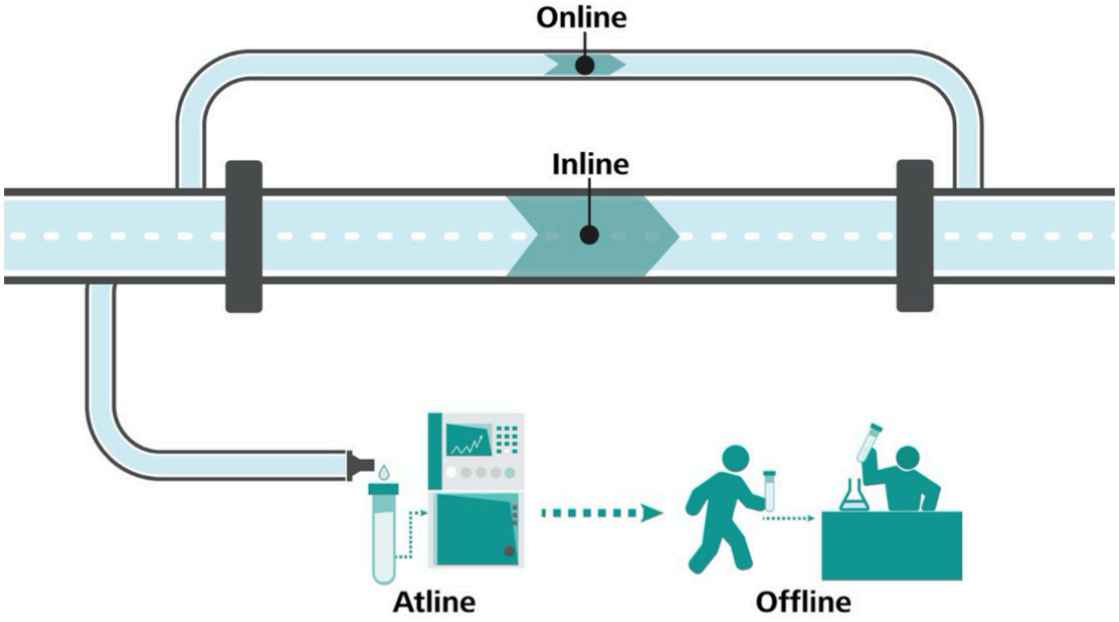


FIG.15 Monitoring bioreactor systems (Medium, 2021)

dering a real situation would have meant making the project purely engineering and not feasible for my skills.

I therefore opted for a simple and clean shape that also recalled the aesthetics of home devices familiar to most people. I did not focus on the operation so I simply imagined a bioreactor in which it was necessary only to insert a sample and wait for the duration of the process to see the final result. What makes the real difference on the physical product is its interface. In fact, digital emoticons will communicate to the user the state in which the food is inside the bioreactor. Therefore, if the ingredient is lacking in water, a specific emoticon will signal the problem to the user. At the base of this design intervention there is the previously analyzed "Tamagotochi effect". In particular, the concept of "Animism" is what expresses the connection that is established between the digital interface, food and the human. Frude (Frude & Jandrić, 2015) defines it as our tendency to "attribute life and consciousness to inanimate objects" which, in turn, creates an emotional attachment between the user and objects. The different emoticons represent the medium with which the person interconnects with food as through its different outputs (emoji lack of nutrients, water or energy) it communicates to the person how the state of the food depends on the user inputs.

The digital app allows the user to perform these input actions and determines how the human can relate to food. Once again, my focus is not on the feasibility of the app but rather on the specific interactions and the consequent type of relationship that

is created with food. Before moving on to the explanation of the different features I would like to add that the app, in accordance with the speculative methodology, is unclear, not user friendly and with a satirical tone.

The first screen includes respectively a section dedicated to the creation of a synthetic ingredient, one for monitoring its parameters and finally one concerning information on the technology behind the bioreactor. The first two will be analyzed below while the third was not taken into consideration as it was not relevant to the main topic.

Starting from the “create” feature, the user is able to choose from an assortment of different ingredients. Since the previous discussions had highlighted the ineffectiveness of the term “synthetic” I decided to use imaginative names that did not recall the idea of a laboratory product. Each ingredient is explained following a precise and recurring structure that includes the source, the process, the experience and the recommendations. The first one explains the origin and the synthetic typology of food, the second one how it develops and grows, the third one what type of culinary experience to expect and finally the last one what are the precautions and steps to be taken in order to obtain a satisfactory result. The first three categories were developed as one of the most frequent problems encountered in workshops and literary review was the knowledge gap combined with a lack of transparency. From the analysis of the information, I deduced that part of this responsibility was attributable to the con-

sumer himself and his, often unfounded, strong stance against meals coming from laboratories. The other big culprit was certainly the food industry which, due to a weak and limited communication, fueled mistrust and prevented broader dialogue about the best solutions for the future of food. This suggested me that one of the next steps to be taken was to involve the consumer through a strategy that communicates information in a clear and transparent way. The solution was therefore to incorporate the necessary information through clear communication providing in this way knowledge to the user. Then, the category concerning the recommendations finds its basis in the need to involve the user in an engaging way through gamification strategies. Gamification is the use of game design elements in a non-game context where the purpose is to make situations more interesting and engaging. Additionally, it can be used to motivate action, promote learning, and solve problems (Sjøvoll & Gulden, 2017). In fact, each ingredient requires a different monitoring and involvement by the user. This not only allows the person to develop certain knowledge but at the same time implies a dynamic and differentiated interaction.

The next step in choosing the ingredient concerns its customization. One of the most common insights I got from the co-design “Starchat” workshop concerned the inclusion of a food configuration system. Customization is what lets users make their own selections about what they want, or set preferences for how information is organized or displayed. But even more, as emerged from the theories

of emotional design, we become attached to things if they bring to mind pleasant and comforting moments. Consequently, creating a food that can remind us of a good experience or improve our situation could be a strategy for establishing an emotional bond. This could also enhance user experience because it allows users to control their interaction.

A configurator was therefore added to allow the user to modify some sensory properties and a series of nutritional values. Since it was not my interest to research every quality or even propose a study on sensory attributes, I simply considered some of the most known properties based on a purely personal scale. Among the sensory ones, color, texture, size, taste and shape were taken into consideration. From the point of view of a speculative imaginary, I thought that offering great freedom of customization was a plausible and achievable future condition. If color and shape are completely modifiable according to the user's will, the other three properties are limited to a series of options. As for the texture, the most recognized ones were considered, on a personal scale, such as creaminess, wateriness, firmness, crunchiness and chewiness. The available sizes are divided between small, medium and large. Finally, for the tastes, the five basic flavors were considered: sweetness, sourness, bitterness, saltiness and umami (Lindemann, 2000).

The nutritional qualities, on the other hand, concern those properties that have an impact on our body and health. These are nutrients that provide energy, contribute to body structure, and regulate che-

mical processes in the body. One of the insights that emerged from the two workshops concerned the personalization of qualitative attributes that lend themselves to the needs of each individual and that is why I decided to introduce the possibility of modulating their level on the basis of personal demands. The key nutrients considered are carbohydrates, fats, proteins, water, vitamins, and minerals.

The “create” section therefore represents the first step to bring the consumer closer to synthetic technology as it allows to bridge the knowledge gap in a reliable and transparent way and also further engages the person through customized elements.

The section dedicated to the “status check” was created in order to monitor the parameters of the food inside the bioreactor and gamify the interaction. It is also another way that food uses to communicate with the person as it will be possible to determine its condition even without being in the proximity of the bioreactor. The user will be able to interact with the values of nutrients, water and energy via the app. Although the technology allows them to be controlled automatically, I considered essential to maintain human input as removing the person from the “man-machine equation” it would not have been possible to exploit the dynamics of the “Tamagotchi effect”. As it had already been said previously, the ingredients have different characteristics and types of attention. Some foods will be more demanding than others so the type and frequency of user interaction will depend on specific needs. The quality of attention will have a significant impact on the final

result as it will determine the success or failure of the process. Indeed, a successful creation resides in constant vigilance to its needs. Thanks to this technology I speculated that the relationship of care between the ingredient and caretaker can create an intimate bond, even if it is just an object. As in the case of Tamagotchi, therefore, food becomes a reflection of its user's dedication and creates perceived accountability to it.

3.3 Materialize the scenario to provoke the audience

The last step of the process is to materialize the scenario as either narratives, objects, or a combination of both in order to provoke the audience and create debate (Auger, 2013). Objects, or props, can be either physical or digital, and, as prop suggest, an object may be fake and non-functional, as long as it appears to be a real representation of a concept. However, to achieve realness, the prop must have a sufficient level of detail (Johannessen, 2018). Whereas traditional design often strives to make messages as clear as possible to enable users to think less, the SCD practice attempts to do the opposite. In SCD discursive practice, it is important to ask questions without dictating the audience's perception of an answer or a solution (Tharp, 2013). Therefore, to enable the audience to entertain personal interpretations, SCD scenarios are often

FIG.16-17 Neste bioreactor (Render courtesy of Media.Work Studio) & Neste* App (Branconi, 2022)*

open-ended, unclear, and complicated, and strive to provoke using dark humour and satire.

I opted for storytelling through the use of images and narrations as it is one of the strategies used by the SCD practice to build empathy and reach people emotionally.

3.3.1 Neste*

Neste is our latest innovation that aims to finally release the enormous potential of synthetic biotechnology.

You will have at your disposal not only the N7 bioreactor but also an integrated app that you can download on your devices and interact with the machine remotely. We believe in the relationship between man and food and that is why our motto is “Bond with your food”. Our recent studies have shown that the best way to establish a connection is through the concepts of transparency, knowledge and emotional attachment. Unlike other technologies, we place man at the center of the project and that is why we have not excluded him from the man-machine equation.

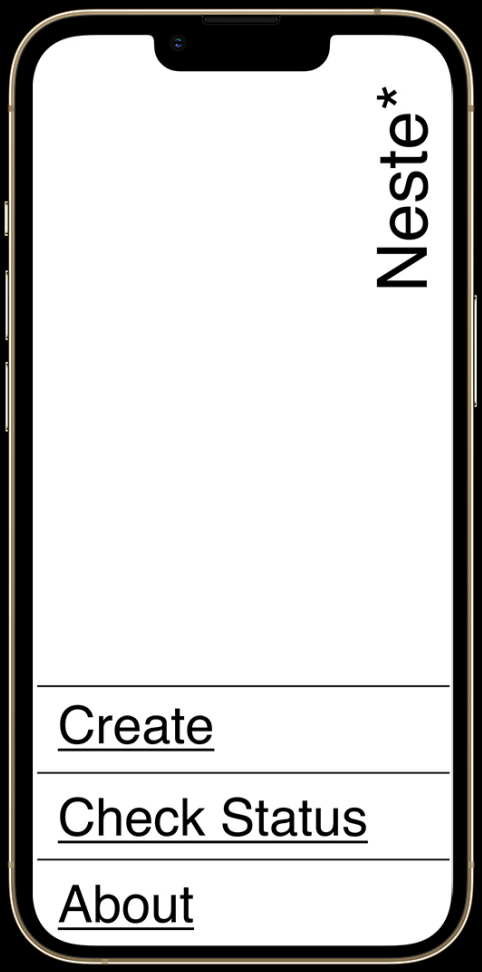


FIG.18 Neste home page and Create Section (Branconi, 2022)*

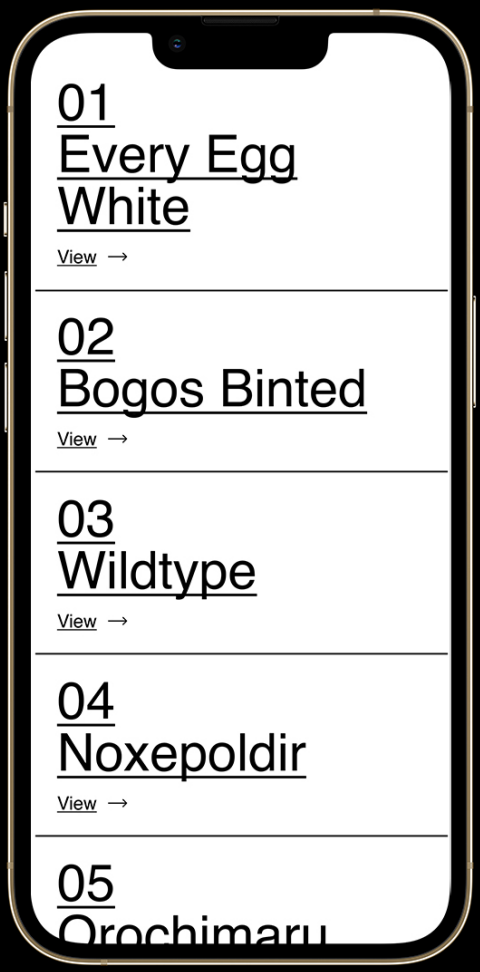

01
Every Egg White
View →
02
Bogos Binted
View →
03
Wildtype
View →
04
Noxepoldir
View →
05
Orochimaru

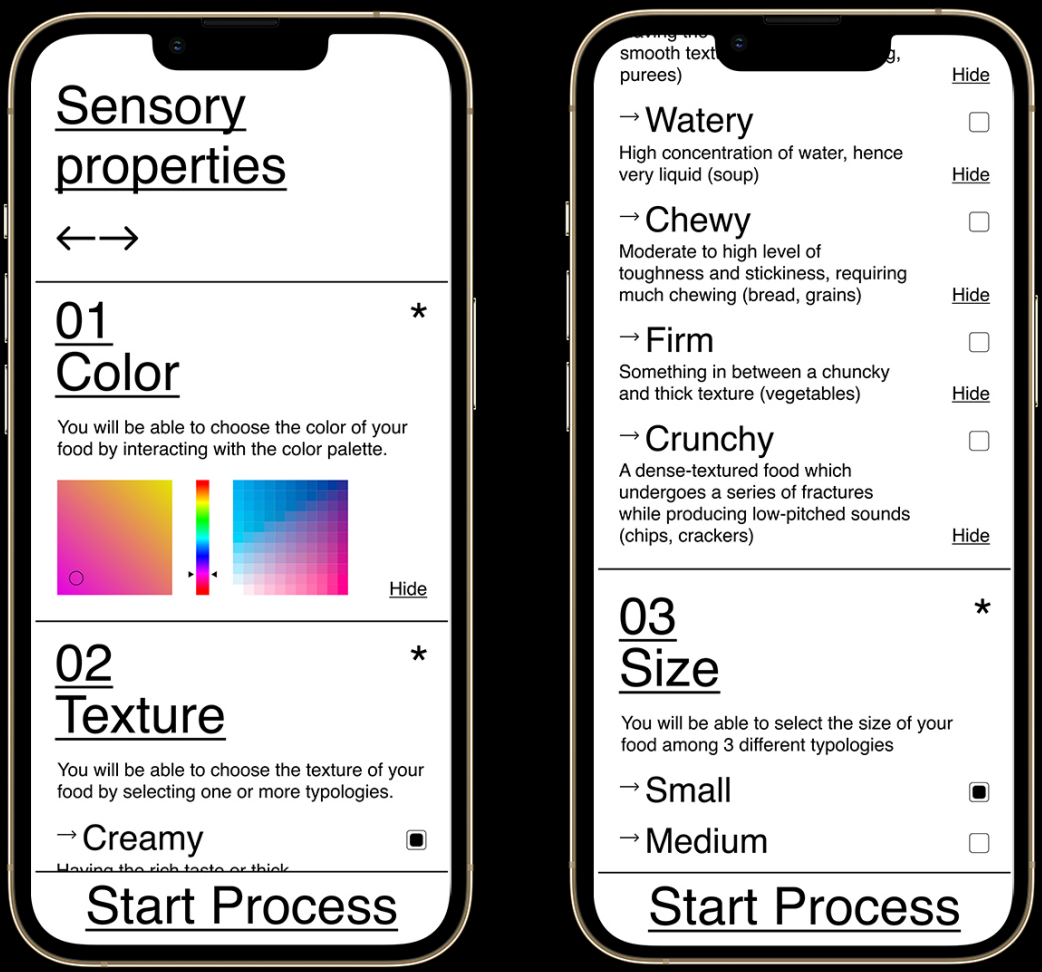
FIG.19 Ingredient 1 feature (Branconi, 2022)

You will have a wide choice of ingredients and if you don't know what it is, don't worry, we will provide you with a detailed description of the origin, the production process, the culinary experience you will try and finally also a series of tips and recommendations for getting the most out of your ingredient. We care about our re-

FIG.20 Ingredient 2 (Branconi, 2022)

putation and that is why you will be able to further inform yourself on the specific website of each food company.

FIG.21 Sensory properties customisation (Branconi, 2022)



But that is not all. With Neste we have gone beyond your expectations, we know that. This is why we have decided to make you worthy of a God by granting you the power of creation. You will in fact be able to create your own ingredient to your liking. You can choose any color, make any shape, even choose between three types of sizes but the best is yet to come. Whether you want your dish creamy like a mousse, light and delicate like a soup, crunchy like chips, chewy like chewing gum or if you even

want all these properties put together, just select the option that suits you best. You thought it was all there. No, you are very wrong. We also thought about taste. Tired of eating a pasta-flavored tyrannosaurus burger? No problem. You can give a twist to the usual routine by giving it, for example, the exotic taste of sushi or the sweet and delicate flavor of a ratatouille.

FIG.22 Nutritional properties customisation (Branconi, 2022)

Ah, there is one more thing. We don't want our customers to complain about not being able to eat their favorite foods and gain weight. And that is why we have introduced an option that will allow you to change the nutritional parameters as well. You will be free to keep fit with healthy and balanced ingredients or you can weigh as much as an elephant if you want.

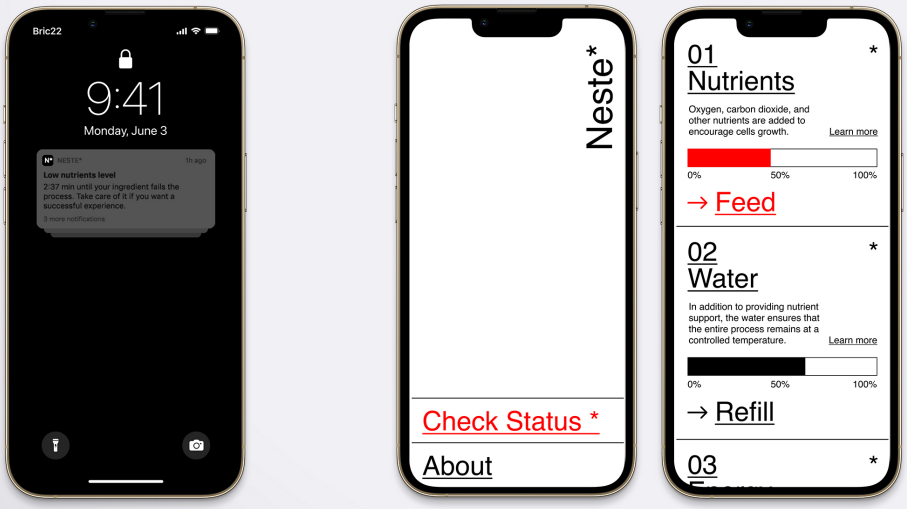


FIG.23 Notification & Status alert (Branconi, 2022)

However, the success of the ingredient depends on you. It will be as easy, or as difficult, as raising a pet. Each food has different characteristics and needs and each time you will have to be ready for a new challenge. Don't leave your poor synthetic sushi without water and remember to constantly feed your egg steak. You'll have help from us as we will send you notifications if the status conditions are not ideal.

FIG.24 Neste bioreactor interface 1 (Render courtesy of Media.Work Studio, Postproduction (Branconi, 2022)*

If, on the other hand, you are at home, you will be able to see the status of your ingredient directly on the bioreactor. A digital interface will communicate with you through simple facial expressions that will update you on the conditions of the food inside the bioreactor. It will always find a way to tell that it needs you.

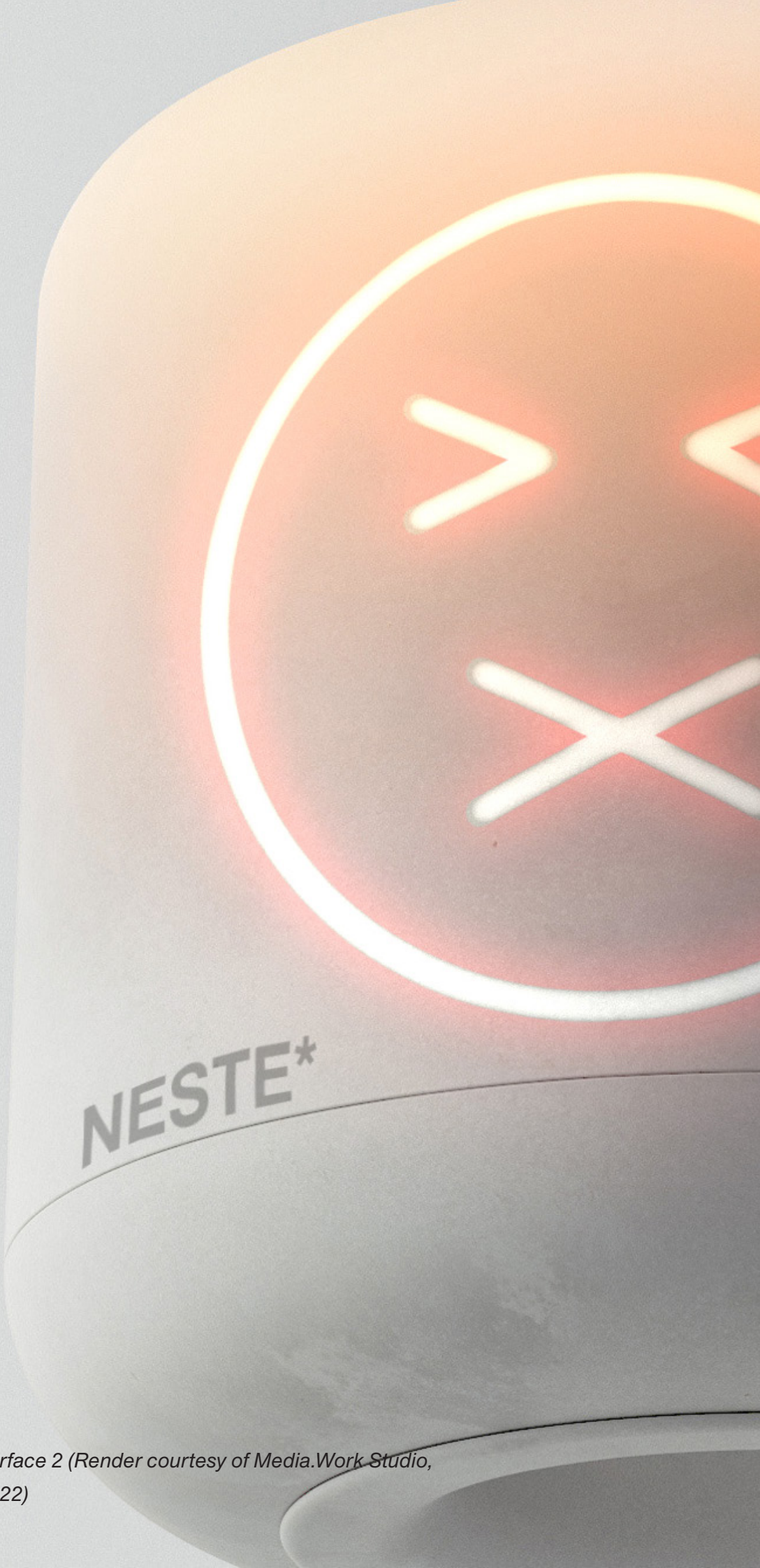


FIG.25 Neste bioreactor interface 2 (Render courtesy of Media.Work Studio, Postproduction (Branconi, 2022)*

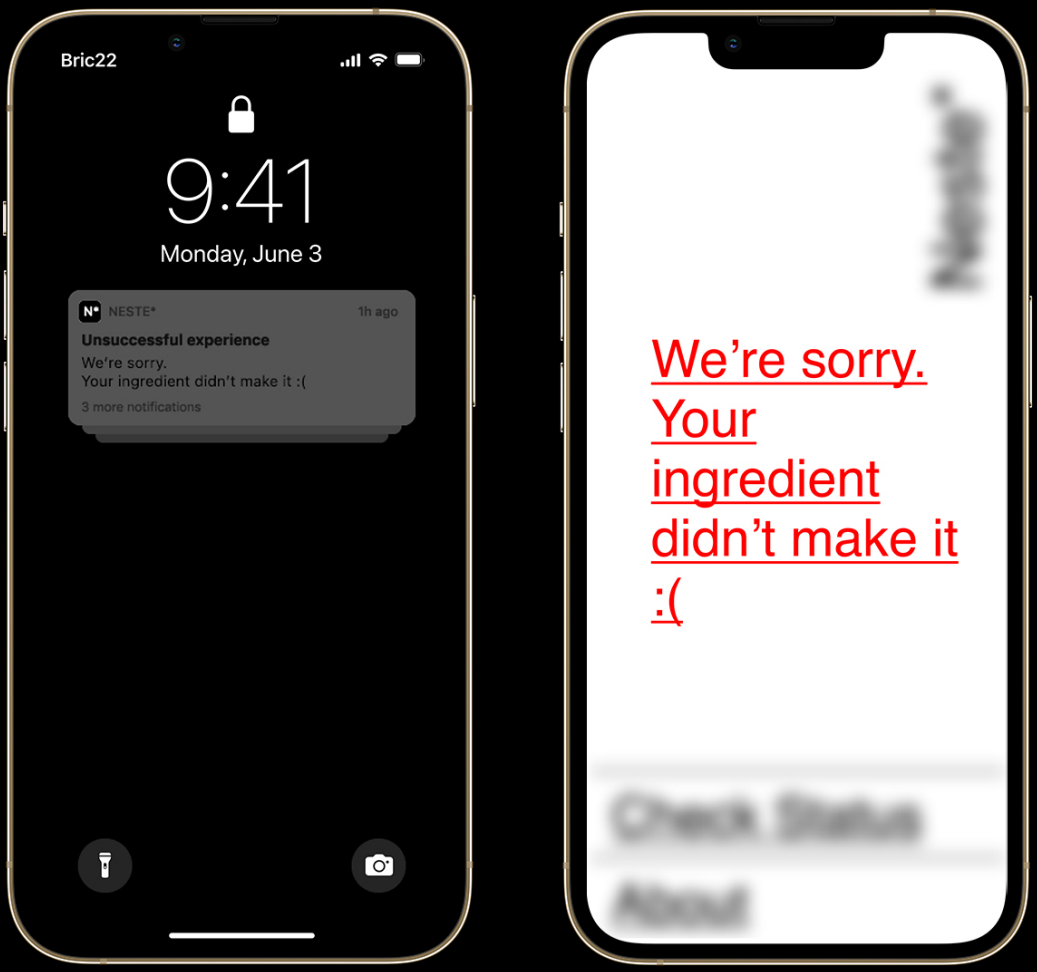
FIG.26 Neste bioreactor interface 3 (Render courtesy of Media.Work Studio, Postproduction (Branconi, 2022)*

FIG.27 Neste bioreactor interface 4 (Render courtesy of Media.Work Studio, Postproduction (Branconi, 2022)*

FIG.28 End of the process (Branconi, 2022)

We have provided you with all the tools to have an enjoyable experience but remember that success or failure will always depend on your actions.

We strongly believe in synthetic biotechnology and we know that our success goes through our customers. This is why we want to offer you the opportunity to



get to know this technology in a clear and transparent way. We also know that true attachment resides in emotions.

4.
DISCUSSION

In the following section I will briefly discuss the main elements that contributed to forming the structure of my thesis, namely the synthetic food topic, the methods and approach and finally the concept.

4.1 Synthetic biotechnology evaluation

The food sector is part of those complex systems that interconnect different actors such as consumers, business models and policy makers. Therefore, for new technologies to successfully land in society, it is essential that there is a balance between these actors. Although synthetic biotechnology represents a possible solution to current farming and rearing methods, a number of aspects must be considered that could limit its future growth. This technology, while attractive, faces a number of major obstacles including commercial scalability, technicalities, regulation and consumer reaction. As regards the first and second, the state of commercial feasibility of this technology is not yet clear. If on the one hand the market pushes towards enhancing the progress of synthetic biotechnology, on the other there is academic research that curbs enthusiasm trying

to illustrate how the reality of the facts is quite different. In my current position I am unable to determine where the technology is, probably in the middle, however I believe in technological progress and that is why through my project I have imagined a future dependent on synthetic food.

In the case of regulations, it is undoubtedly true that regulatory regimes are often one of the most important influences in determining the course of technological innovation. Synthetic foods face two major regulatory hurdles in the form of food safety standards and labeling requirements. Both are complex with overlapping features and there is substantial variation between countries. For some of the emerging technologies, governing legalization doesn't even exist yet, or there are effectively blanket bans. In some cases, there is a gap between actual market practices and regulation too.

Finally, the consumer response represents the last test to pass and perhaps the most important. Even if with my project I wanted to focus exclusively on this last point, I am fully aware that in order to propose a universal design it is important to consider the others as well.

4.2 Methods and approach evaluation

The SCD practice has proved, in my opinion, the most effective strategy in exploring this particular topic. I wanted to approach my thesis from a behavioral investigation perspective and the critical and speculative approach proved to be very useful. The reflective nature of the SCD practice has allowed the construction of a project that at each stage fostered a critical attitude combined with alternative thinking. In my opinion, these are important elements in an ever-changing field such as design where the role of the designer increasingly becomes that of one who contributes to social transformations. The qualitative approach, on the other hand, has contributed to the collection and analysis of information. Literature reviews, semi-structured interviews and workshops have represented the backbone of the SCD practice which very often, if not scientifically supported, risks falling into the world of art and pure speculation.

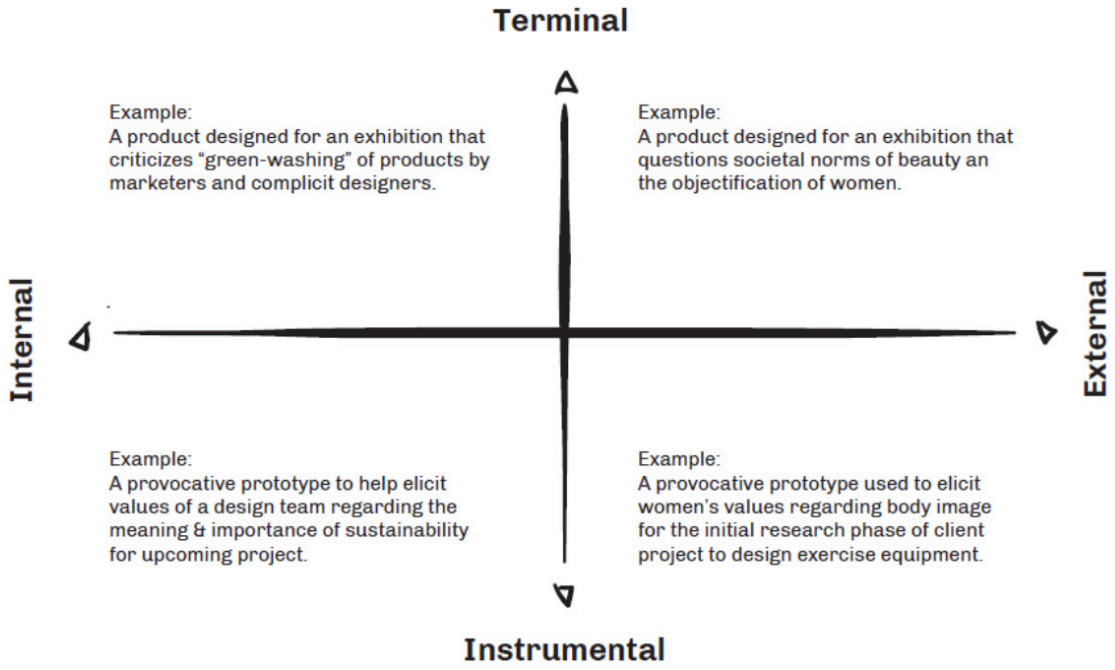


FIG.29 Types of discursive products (Tharp & Tharp, 2013)

4.3 Concept evaluation

The design proposal was mainly discussed in the "Concept" section, however there are some aspects that I wanted to evaluate in retrospect. First of all, in relation to the SCD practice, the concept created has the purpose of communicating ideas and encouraging discourse. Since the social debate is the fundamental goal and desired outcome of Critical Design, making products that facilitate this debate is the primary activity of the designer. By product Tharp and Tharp mean any type of artifact, from a simple sketch to a complex service, which serves as a communicative purpose. They distinguish between two types of discursive products, namely terminal and instrumental (Tharp, 2013). For a terminal discursive product, the job of the designer ends when the product is presented. The designer relies on the product itself to convey ideas that spark debate among its audience. On the contrary, an instrumental product serves as a provocative tool to stimulate discussion between the audience and the designer, either where the debate itself is part of a larger design research process, or where the product can steer the discussion in a given direction.

I believe that my design proposal comes close to both the first and the second concept of a discursive product. While on the one hand my goal was to propose my future vision in relation to synthetic food and see what kind of reaction it would have aroused, on the other hand I believe that the discussion itself can serve as a research field and highlight new issues. However, it is partially detached from the second as the discussion did not in the least influence the design direction since it had been carried out in an earlier phase.

5.
CONCLUSION

Synthetic foods are increasingly touted as the future of edibles and technology itself states it has made great strides. Technology has made significant progress, however the possibility of fully introducing a synthetic diet seems remote at the moment. In addition to the known limits not only technological but also legislative and economic, the greatest barrier is represented by society.

This research attempted to provide speculative scenario that would answer the question "what if in the future we shift to a fully synthetic food consumption?". Mainly from the discussion emerged a strong knowledge gap regarding synthetic food among people. Part of this responsibility is attributable to the consumer himself as it seems that the main obstacle to artificial food becoming widespread is not technology or money, but people's strong stance against meals coming from laboratories. The other big culprit is certainly the food industry which, due to a weak and limited communication, fuels mistrust and prevents broader dialogue about the best solutions for the future of food. This suggested that one of the next steps to be taken was to involve the consumer more through a strategy that communicates information in a clear and transparent way. The other major issue concerned the study of a strategy that could bring the consumer closer to biosynthetic technology. From the different studies analyzed it emerged that one way to establish an attachment with the product is through the emotional bond. The example of Tamagotchi was of fundamental importance in the creation of a speculative scenario as at the basis of the design concept of this thesis there

is precisely the development of emotional attachment with non-human entities. The Tamagotchi effect is limited to machines and software agents, so it cannot be established with certainty whether it can have the same consequences with food. In my case I considered food as an object, however this definition could very well contrast with other ideologies. The debate that could be triggered by this observation certainly represents a fertile ground for future dialogues and would also represent a way to relate the various actors of the food system. This project has several limitations as it has focused exclusively on the consumer perspective, without taking into account other actors such as business models and policy makers. The food sector is interconnected with multiple activities therefore, in order to create an efficient model of sustainable synthetic food, it is necessary to involve consumers, business and policy in a dialogue. The speculative scenario, due to its discursive and critical nature, does not offer clear data and answers, therefore it is not feasible at the moment to establish with certainty which is the ideal direction. However, the role of the designer can be useful in facilitating the elaboration of complex structures and systems that include relational, social / political, environmental, economic and technological contexts. I hope that this specular project will allow the development of alternative social imaginaries that open new perspectives on the challenges of synthetic food and I would like to end by quoting an excerpt from the book “Speculative Everything”: “This is where we believe speculative design can flourish, providing complicated pleasure, enriching our mental lives, and

broadening our minds in ways that complement other media and disciplines. It's about meaning and culture, about adding to what life could be, challenging what it is, and providing alternatives that loosen the ties reality has on our ability to dream. Ultimately, it is a catalyst for social dreaming" (Dunne & Raby, 2013).

It’s about meaning and culture, about adding to what life could be, challenging what it is, and providing alternatives that loosen the ties reality has on our ability to dream. Ultimately, it is a catalyst for social dreaming”

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