

Future Eating: Exploring Imagined Paths to Sustainable Food Futures

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Abstract

Through the collaboration with the visualization centre, Norrköping, for their Food&Future project, this thesis explores speculative food futures. It aims to understand how design fiction can act as a medium for critical reflection using future food imagery.

To get a deeper understanding, a series of workshops were conducted to explore personal and cultural associations with current foods and the values required for shaping the future of food. A tangible result of this was NourishNext, a diegetic prototype of an online grocery platform set in 2050, which was created based on emerging food trends and insights generated from the workshops.

In this thesis, Design for Sustainable Behavior is applied to discuss how the current artifact could be improved or serve as a starting point for behavior change, and how it will function based on the design stance chosen.

It also aims to comprehend the complexities surrounding the acceptance of future foods, ethics and technology. The findings and research contribute to reflecting on design's role in enabling sustainable food transition through imagination and a value-driven mindset.

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Motivation for choosing food futures

I chose to work on the future of food to work in this thesis because food is an essential part of life. However, human systems and methods of farming and consumption are leading to global ecological and economic problems, further aggravated by climate change and impacting livelihoods. To reverse this trend of exploitative produce and consumption, we need regenerative systems that promote life. Achieving this not only requires reforming the agricultural system but also rethinking our consumption patterns. Consumers ultimately decide the food they consume, how healthy their diets should be, and what future they want to be a part of. Without the awareness of the current food context, they cannot identify the changes needed to envision a better future.

“ Only if we understand, can we care. Only if we care, will we help. Only if we help, we shall be saved” - Jane Goodall.

I learned that the Visualization Centre in Norrköping was already working to educate viewers about this issue through their exhibition space. Hence, I took this opportunity to collaborate with the Visualization Centre for my thesis, where one of the main goals was to enhance visualizations, making them more engaging and reflective, using future projections of food products.

In a world that is constantly changing and urgently in need of major transitions, especially in key sectors like food, this holds immense potential for further exploration.

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PART 1

1 Introduction

Food is an integral substrate that all species thrive on. Over the years, the value placed on food, shifted from being a prerequisite to a multimodal experience. Globalisation and trade, which facilitated cultural exchange, carved synergistic pathways for a multitude of traditional and contemporary recipes. Gastronomy today seeks to materialise and define cultural identities through food experiences. Individual food choices are moulded into personality and self-identity. It also enables interpersonal connections and social bonding.

Given that the current food system is problematic due to a lack of holistic planning and recognition, it has become one of the major threats to the planet, with agriculture occupying half of the world's habitable land (Ritchie & Roser, 2024) . The value associated with food has shifted significantly from being a survival necessity to an element that forms cultural identities.

While modern innovations like cultured meat, 3D printed foods and insect diets are evolving to provide future food solutions, it is uncertain if they truly are capable of driving the sustainable food transition.

This thesis seeks to explore people's outlooks on future food alternatives and their speculations about food futures. It attempts to examine how they respond to such innovations and if they find them acceptable. Imagining hypothetical scenarios containing different elements on both macro (the environment) and micro (lifestyle associated with the in-built world) levels will be the outcome of a series of exploratory workshops conducted. A diegetic prototype will translate those elements into something tangible for the main users in the Visualisation Centre to interact with.

1.1. Modern Food Practices and Nutrition

Today, modern food practices are contributing to many problems both in production and in consumption, which need to be tackled. From the consumption point of view, the side effects of hedonic consumption (eating solely for pleasure) are causing obesity, eating

disorders and emotional dysregulation (Ridder & Gillebaart, 2022). Studies reveal that foods high in dietary fats, in contrast to protein and carbohydrates, have a minimal effect on satiation and might therefore lead to passive overconsumption (Blundell & Macdiarmid, 1997).

In addition, food security has also been a pressing issue in recent years. According to FAO, lack of access to nutritious and uncontaminated food continues to prevail among billions of people across the world (FAO, Hunger and food security). Foods that are highly processed have high concentration of energy, sugars, saturated fats and salts. Fast foods are easily accessible and affordable compared to fresh fruits and vegetables (FAO, Hunger and food security). Living on fast food with poor nutrients, combined with psychological distress and lack of food accessibility, causes physiological changes (FAO, Hunger and food security). Children experiencing hunger and malnutrition are more likely to develop diabetes later in life (FAO, Hunger and food security).

1.2 The Environmental Cost of Food Production

The food system in totality is one of the prominent drivers of biodiversity loss, imperilling around 24,000 of the 28,000 (86%) species globally (UNEP, 2021). The compulsion to boost yields for growth and reduce costs by using intensive fertilisers, pesticides, and insecticides is causing soil degradation and threatening millions of insect species, particularly bees, which are essential cross-pollinators.

Food production contributes to 26% of global CO₂ emissions and 70% of land use. At the same time, the demand for animal products is rising and the overconsumption of processed meat is facing significant ethical and welfare backlash.

Furthermore, livestock contributes to 34% of protein consumed internationally through meat, milk and eggs, but is accountable for more greenhouse gas emissions as opposed to other food sources (FAO, 2017). In addition, 80% of the world's soya bean yield is fed to livestock (WWF).

Production of soy contributes to climate change through deforestation and monoculture farming. This causes habitat loss, disrupts natural ecosystems, and threatens local livelihoods (WWF).

Seafood, on the other hand, has lower carbon footprint compared to animal-based products such as beef, pork and chicken (Auld, 2022). However, the environmental impact of seafood is species-specific. Crustaceans like lobsters and shrimps tend to have a higher footprint compared to farmed mussels, oysters and anchovies, making the latter more sustainable (Auld, 2022).

This highlights the need for a major food transition, where sustainable practices are prioritized.

1.3 The future of Food

While the prospects of food remain uncertain and unclear, there is ongoing scientific research surrounding consumable future food products. While many debate that techno-centric solutions might hinder our connection with food, others argue that continuing on the same trajectory might lead to dependency on innovative or alternate food choices that are not in the frame of reality yet.

Cultured meat, 3D printed foods, edible food packaging, insect protein and mycoprotein are examples of ongoing research in future food products. While insects and mycoprotein are already in practice in certain parts of the world, they aren't widely accepted as food sources yet due to a lack of cultural and social acceptance.

From a food production point of view, various farming techniques are being tested and implemented to optimize crop yields in controlled environments. In addition, organic farming and agroecological approaches are being explored to tackle monoculture practices to boost soil fertility and promote diversified crop rotation (Galanakis, 2024).

Studies also indicate that the future of food will focus on balancing macro and micronutrients, ensuring transparency and reliability, advanced digitization, personalized nutrition, biotechnology and the bioeconomy (Galanakis, 2024).

1.4 Encouraging Sustainable Living through artifacts

Design has the capacity to drive sustainable change through products, services, and interactions that can directly or indirectly lead to transformation.

At a small scale, this can be achieved through the help of artifacts. In the context of sustainable living, they play a role in creating environments that motivate individuals to engage in sustainable activities in their daily lives. Artifacts help communicate and represent a body of knowledge or practice.

They can either be physical or digital in nature, serving as tools to initiate and encourage sustainable change. This thesis aims to explore the concept of using a provocative artifact to encourage critical thinking about both current and future foods and practices.

1.5 The Food&Future project

The Food&Future project, in collaboration with the Visualization Centre in Norrköping, is an initiative aimed at helping viewers reflect on their dietary practices in relation to the existing food landscape.

The Visualization Centre is a platform for communication exploration, interaction, science, technology, informatics, research and innovation aiming to add value through science based data (Visualization Centre). It creates an atmosphere for exploring immersive experience technologies to provide users a seamless experience into the scientific reality of the world (Visualization Centre).

The aim of the collaboration with the Visualization Centre was to develop an interactive interface that helps users understand future food products through a future food grocery store set in the year 2050. The project was conducted using a plausible future scenario to help viewers connect current food contexts with those envisioned in the alternate world. By including content backed by ongoing research like lab meat, insect protein, mycoprotein, 3D printed foods and edible packaging, and by combining them with the insights derived from participatory workshops, the goal was to build a prototype capable of impacting viewers through provocation and reflection. The idea was also to help them realise the future consequences of current foods and trends as well as what might lie ahead if the world continues on its present trajectory.

1.6 Objectives

The framing questions of this master's thesis focus on facilitating user engagement by aligning with the goals of the Visualization Centre. The objective (*fig 1*) is to explore how depictions of future foods could encourage critical reflection. The objective was to design a future food grocery platform, showcasing a range of products undergoing scientific exploration and those that are not widely consumed yet.

Given this context, the framing question can be formulated as: “How can a future food scenario foster provocation to reflect on current food practices through a speculative digital artifact?”

The framing questions consists of three main components:

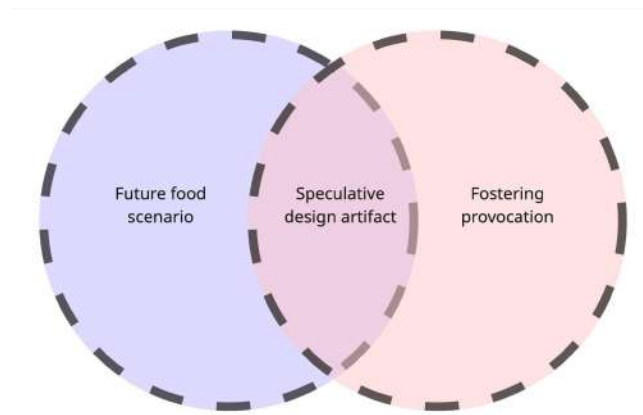


Fig (1) Project objectives

Future food scenario: The future scenario depicts many future products based on emerging trends and studies. Moreover, the content attempts to align with the results of the data collected during participatory workshops.

Fostering provocation: Future food products are used to spark curiosity and encourage viewers to reflect on what they see. They aim to provoke thought about future food contexts in relation to current realities.

Speculative digital artifact: A digital prototype in this context is conceptualized as a future food grocery store to enable provocation by making the artifact visually engaging and interactive.

This thesis also seeks to explore users' attitudes and perception towards food futures through the lens of Design for Sustainable Behaviour. While it does not directly use the sustainable behaviour model to assess impact and drive behavioural change, it seeks to evoke discussion on the topic.

2 Theoretical Frameworks

To align with the objectives of the project, the frameworks examine the intersection of consumer attitudes, perceptions, values and culture with food in terms of what is preferred in envisioned worlds. The Cone of Futures is used to explore which type of future works best in practice within the project's context. The Theory of Planned Behaviour, is applied to discuss perceived behaviour, subjective norms and attitudes by connecting current studies with project findings.

Furthermore, design fiction is used to ask 'what if' questions. It is mainly used to structure workshops for data collection and build the diegetic prototype with product scenarios that users can play with. It helps in connecting current food choices with future consequences and possibilities through imagination.

2.1 Design for Sustainable Behaviour

Design for Sustainable Behaviour (DfSB) aims to understand and influence (Lockton, 2016) user motivations and consumption attitudes. It adopts a multi-disciplinary to 'design with intent' (Lockton, 2008), exploring problem-solving and design spaces to enable behavioural change. The main objective is to tackle the social and environmental impacts of products and services using design interventions.

Studies indicate that there are four key principles commonly found in DfSB frameworks (Niedderer et al., 2014): (i) Making it easier for people to adopt a desired behaviour; (ii) Making it harder for people to perform an undesired behaviour; (iii) Encouraging people to want to perform a desired behaviour; and (iv) Discouraging people from wanting to perform an undesired behaviour. Additionally, DfSB addresses three dimensions: (i) the environmental dimension, which focuses on stimulating users to adopt sustainable practices; (ii) the social dimension, which promoted healthier lifestyles; and (iii) the

build environment dimension (Ludden and Offringa, 2015; Ceschin and Gaziulusoy, 2016).

In this thesis, Design for Sustainable Behaviour is used to reflect on whether environmental and social elements discussed in future food workshops and represented to a speculative artifact can help users adopt sustainable thinking by enabling imagination of food futures. It is also used to reflect on how 'design for intent' can be implemented through design fiction to facilitate behavioral change, encouraging a shift from undesired to desired behaviour by improvizing the current speculative artifact.

Apart from this, in a broader context, there are two categories of theoretical angles through which behavior-oriented practices can be viewed (Selvefors, Reström and Strömberg, 2023): System 1 (Automatic) and System 2 (Reflective), based on psychologist Daniel Kahneman's framework (Selvefors, Reström and Strömberg, 2023).

The automatic system enables impulsive decisions to function instinctively and subconsciously, requiring low effort, which results in more immediate responses (Selvefors, Reström and Strömberg, 2023). Meanwhile, the reflective system relies on conscious, mindful and deliberate decision-making, which takes longer and requires cognitive focus.

In this thesis, the reflective system will be used to provoke reflection, as it aligns with the aim of speculative futures. One of the main theories within the reflective system is the Theory of Planned Behaviour.

Icek Ajzen's (1991) Theory of Planned Behaviour (TPB), is a theoretical framework (*fig 2*) for understanding and predicting human behaviour. The framework is chosen to explore the user's motives and reactions through the fictional artifact, while also offering insights into how it could have been designed more effectively.

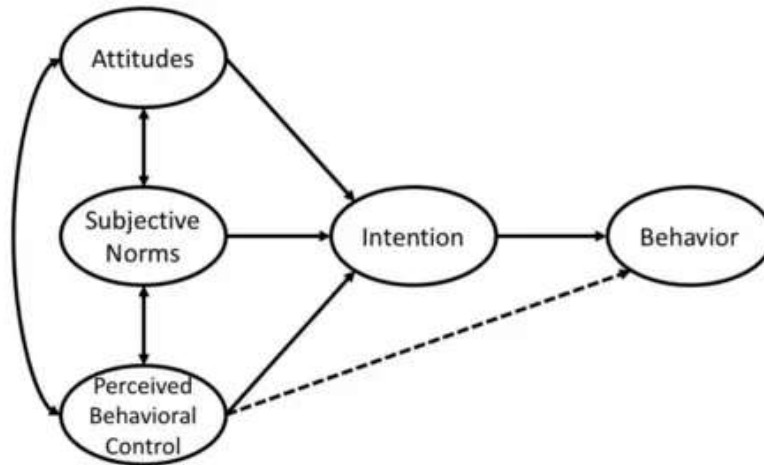


Fig (2) Theory of Planned Behaviour by Ajzen (1991)

Source: https://ascnhighered.org/ASCN/change_theories/collection/planned_behavior.html

Additionally, it helps raise questions about whether the interface and its content, if developed beyond the current scope, could potentially impact individual perceptions and attitudes. It can also function as a feedback mechanism to understand how fostering awareness of current food choices and dietary habits, through thought-provoking interactions, can help shift attitudes. The framework is used to explore how it can be integrated into design fiction practice, to not only make it provocative but also to ensure that provocation leads to meaningful impact.

Implementing the framework helps examine the role design fiction plays in shaping dietary habits and inspiring sustainable choices.

The Theory of planned behaviour consists of attitudes, subjective norms and perceived behavioural control.

Attitudes : An individual's attitude towards a behaviour is determined by their beliefs about its outcomes and overall evaluation (Ajzen, 1991). When a person has positive attitudes towards a behaviour, they are more likely to make intentions to engage in that behaviour, but when they have negative attitudes, they are less likely to do so (Ajzen, 1991).

In the context of this project, the fictitious artifact acts as a reflective tool to engage with new ideas about future of food sustainability. While the thesis does not directly aim to change user attitudes, it explores how design elements can influence attitude in positive and desirable ways. In doing so, it acknowledges the role of speculative design in opening alternative ways of thinking about food realities. This guides users to become more receptive to sustainable food practices.

Subjective Norms: Subjective norms are socially acceptable ways to be influenced by those around them (Ajzen, 1991). They impact beliefs about social approval or disapproval (Ajzen, 1991) of a practice.

While subjective norms are challenging to implement in food futures considering geographical and cultural aspects, they provide a nuanced perspective into the acceptance of future foods. Many studies indicate that adopting future foods lies in both personal and social acceptance which is influenced by economic and technological factors. The subsequent chapters discuss if future foods will be integrated, accepted and normalized into future food practices.

Perceived behavioural control (PBC) : Perceived behavioural control is how one perceives the ease or difficulty of performing a behaviour. It contains factors like self-efficacy (the belief that one can perform the behaviour) and perceived controllability of the situation (Ajzen, 1991). It also involves having keen internal awareness of one's ability to shift behavior while being conscious of external factors or the environment's influence on one's self.

This will be used to analyze how the speculative digital artifact can be enhanced or reinterpreted to help users achieve perceived control over their behaviour, by shifting their intentions more effectively.

2.1.1 Power in Decision-Making

Power in decision making is a cluster of intervention strategies used to influence decisions users make towards products and services.

The framework of Karin Lidman and Sara Renstrom (*fig 3*) is used in the thesis to discuss the design intervention strategy the speculative artifact must adopt to make an impact on users. It is divided into motivating and directing strategies (Selvefors, Reström and Strömberg, 2023).

Motivating strategies help individuals take control over their behaviour by strengthening intention, thereby paving way for desired behaviour. This can be achieved through:

Enlightening: This includes providing users with knowledge that influences their attitude towards the required behaviour (Selvfors, Reström and Strömberg, 2023). When knowledge helps redefine their values and beliefs, it helps reinforce changes in personal practices or habits. This helps users become aware of the consequences of their actions and behaviours. Through this process, the individual's inner motivation can become resilient, supporting self-reflection on their behaviour.

Spurring: Spurring introduces an extrinsic mechanism like a reward-based system or points (Selvfors, Reström and Strömberg, 2023) to propel the user to make positive changes to their behaviour through positive experiences.

Moreover, directing strategies on the other hand, do not allow the user to be in control of their behavior but facilitate performing the desired behaviour by using steering and forcing mechanisms.

Steering: Here, the decision-making process is made easier by making it seem obvious (Selvfors, Reström and Strömberg, 2023) by subtly prompting them to incline towards positive behaviour. Recycling bins in public spaces are an example of a steering mechanism.

Forcing: In forcing, users are either provided with limited functionality in a product or encounter obstacles (Selvfors, Reström and Strömberg, 2023) that restrict their actions, directing them away from undesired behaviour by creating a negative experience.

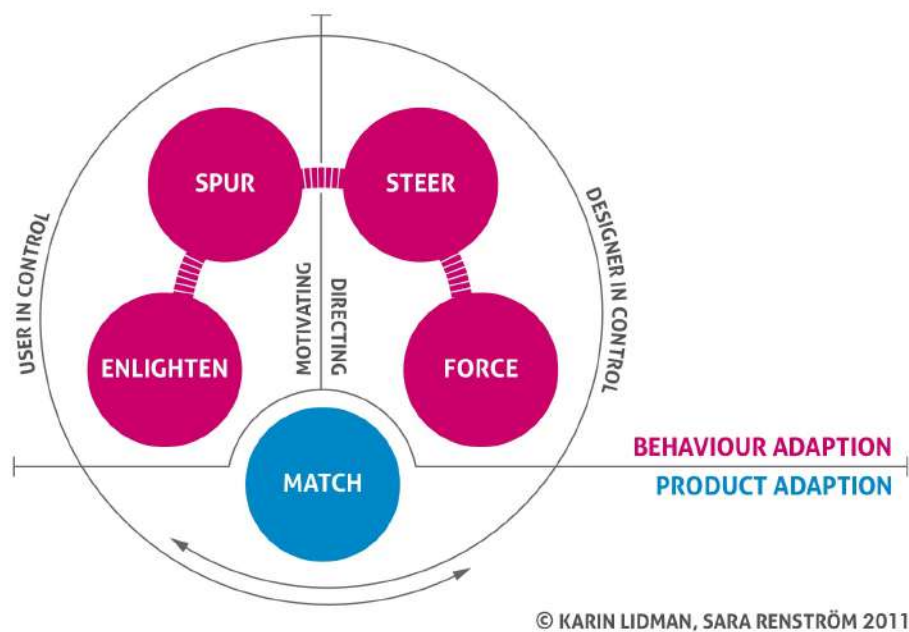


Fig (3) Power In Decision Making by Lidman & Renström (2011)

The Power in Decision-Making is used to analyze how the prototype could be used in contexts where motivating and directing factors are necessary. For instance, would an interface describing future foods or similar concepts help people reflect on their practices? Would they make the effort to change, and is it measurable?

The model is chosen for this study because it is more suitable to work with, as it does not rely on coercive methods that enforce behaviour, but rather utilises indirect techniques to steer behaviour and action. It involves minimal steps and avoids elements like persuasive technology. Additionally, it considers users' ability to make personal choices without imposing behaviour change upon them. The model redirects actions by associating them with negative experiences.

Given the scope of the project, which is confined to an interface, it primarily focuses on *enlightening* and informing users. However, later stages in the thesis address how elements like spurring, steering and forcing can be integrated into the interface and whether they can contribute to a meaningful impact.

2.2 The cone of futures

The cone of futures (*fig 4*) is a framework used to explore and navigate uncertainties by imagining possible futures that could unfold based on current dilemmas. They help challenge and reflect existing values, perspectives, attitudes and norms by speculating alternate realities.

Speculative design that employs futures, provides insights into what changes can be made to adapt products, services and systems to achieve desired futures by asking 'what if' questions (Dunne and Raby, 2013). It also thrives on using imagination to address 'wicked problems' (Dunne and Raby, 2013).

The futures cone is split into four categories (Dunne and Raby, 2013, Voros, 2017):

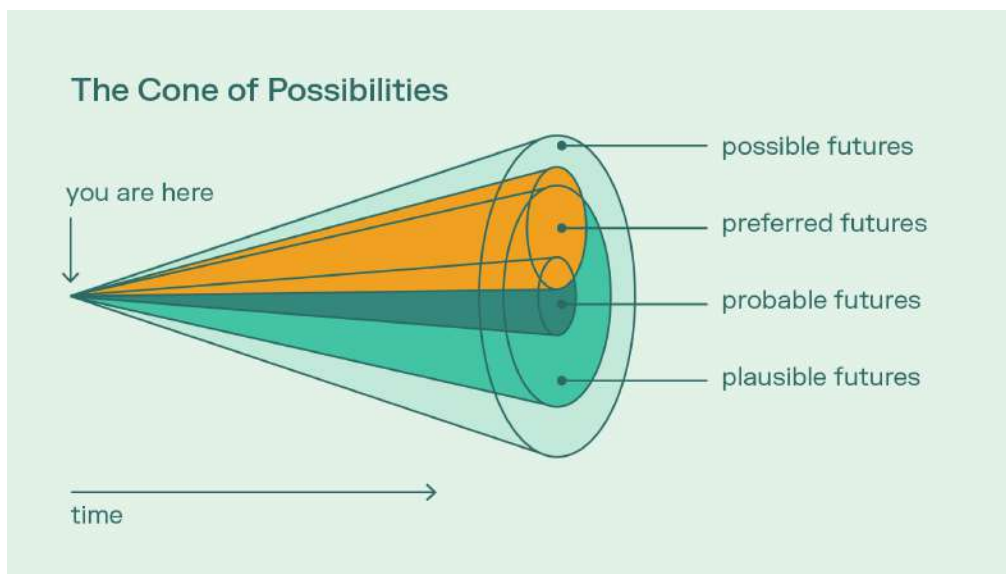


Fig (4) The Cone of Futures

Source: <https://www.delve.com/insights/speculative-design-and-a-cone-of-possibilities>

Possible Futures: These exist in contexts where scenarios are perceived as events that will unfold. They must be scientifically possible (Dunne and Raby, 2013), and there must be a practical roadmap connecting the present to the suggested scenario.

Plausible Futures: Plausible scenarios explore what ‘could’ happen based on the understanding of current reality and its workings. These scenarios do not aim to predict the future but rather focus on exploring multiple prospects to strategically tackle challenges that could arise.

Probable Futures: Probable futures refer to a space where things that are ‘likely’ to occur are envisioned based on current trends. According to Dunne and Raby (2013), this is where design operates and is recognized as a key area for engagement within design education and practice.

Preferable Futures: These sets of futures are about what we think ‘should’ happen as a collective people by intersecting cross-disciplines. However, what is preferable, varies between individuals, making it challenging to define the future precisely. Implementing these futures proves effective when applied to smaller groups rather than on a large scale.

When applying the futures cone, designers need to consider user needs instead of making assumptions or deciding future scenarios on behalf of others (Dunne and Raby, 2013). Hence, the future food workshops acknowledge this and focus on empowering participants to build their own worlds. This approach helps collect diverse perspectives and consider multiple factors when constructing an alternative world.

In this project, preferable futures are used as input for shaping a plausible world scenario, which will form the basis of the artifact. It also focuses on integrating both participant insights with exciting future food trends, to ensure that the artifact remains practical, valid and grounded in credible content.

2.3 Design fiction

Design fiction is a practice that explores alternate futures by weaving fictional contexts, storylines and narratives.

Julian Bleecker defines design fiction as ‘the practice of creating tangible and evocative prototypes known as diegetic prototypes from possible near futures to help discover and represent the consequences of decision-making’ (Near Future Laboratory).

According to the Neeley (School of Critical Design, 2024) design fiction has three primary objectives: (i) To create immersive narratives to encourage audiences to contemplate the future, (ii) To speculate on the development and application of emerging technologies, (iii) To engage people in discussions about future possibilities through storytelling.

Other studies have associated common characteristics with design fiction (Ahmadpour et al.) such as:

1. Design fiction suspends disbelief in change
2. It often examines the implications presented by potential design and technology in the context of technological conflict
3. It enables discussion of social and political context
4. It inspires discussion about desirable and preferable futures
5. It helps to reveal potential user concerns and uncertainties
6. It is not concerned with a finished design—it presents a disruptive space for emerging cultural artifacts

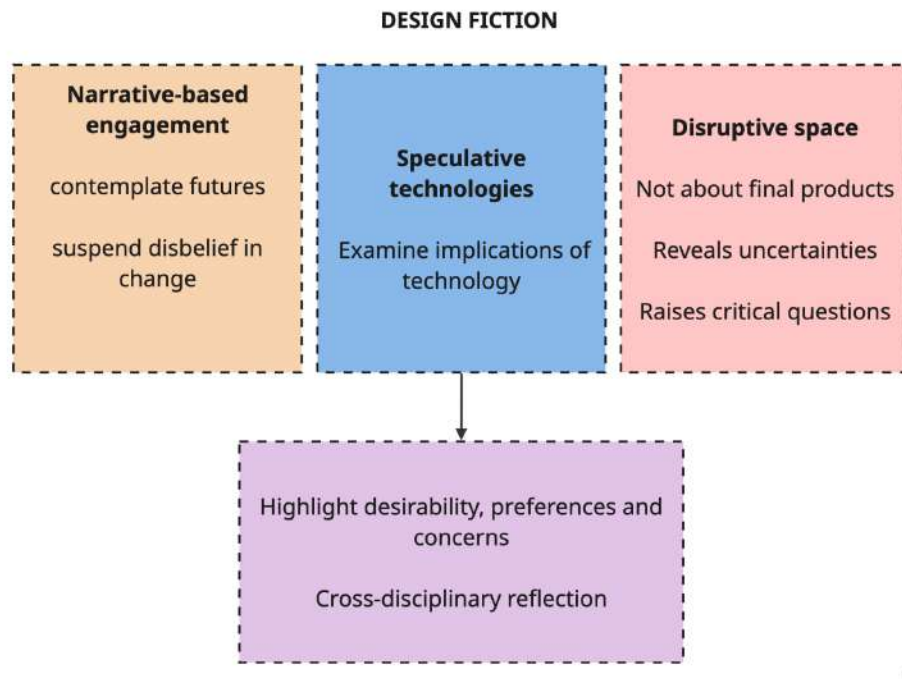


Fig (5) A self-created diagram of design fiction theory by combining Neeley's and Ahmadpour's objectives and characteristics

In the context of food futures, design fiction plays a role in developing narratives that envision food systems that do not exist yet. For example, it can incorporate visualizations based on the outer projected world, like the external environment, as well as the day-to-day lives of individuals that contribute to the overall narrative. Showcasing fictional concepts, allows for the integration of elements inspired by alternate reality, as discussed in future workshops with participants.

The diegetic prototype which is the main highlight in design fiction, is an imaginary object that exists within the created world (Kirby, 2010). It acts as a medium to help the audience interpret and connect with the fictional world.

The project will implement design fiction to facilitate world building and character building workshops for participants to immerse themselves in their in-built futures. These fictitious ideas will be embedded in the diegetic prototype to enhance engagement. Additionally, design fiction complements the application of futures cones, making it an exploratory method.

2.4 Scope and limitations of study

There are some limitations in the frameworks used in this thesis. The Theory of planned behaviour, as a framework, has constraints when assessing behavioral impact. The current scope of the thesis primarily focuses on understanding how design fiction can help people reflect on current food dilemmas and practices. Additionally, the Theory of Planned Behaviour focuses on behavioural change, whereas the objective of the thesis is to explore how design fiction facilitates reflection on food dilemmas and practices.

Another challenge is that subjective norms are very complex, particularly in the context of food-related behaviors. Cultural perspectives on food vary and are influenced by traditions and personal beliefs. Food choices are influenced by social and economic factors, making them less predictable through TPB's conventional approach to individual intention-driven behaviors.

Furthermore, the artifact is limited to a digital interface and lacks immersive features such as AR or VR which restricts the ability to fully immerse viewers in the future scenario.

Given the timeframe of this project, the future products displayed in the current user interface are assumed to be sufficient in triggering reflection among viewers.

3 Literature Review

3.1. TPB in sustainable food consumption

The Theory of Planned Behavior has been widely applied by researchers to understand food consumption patterns.

Studies show that self-identity plays a crucial role in decision-making as it is closely linked with attitude (Dunn et.al). Identifying oneself as 'healthy' is associated with following a healthier diet and the perception of being a 'healthy eater' influences intentions (Dunn et.al). Many consumers rely on past experiences and knowledge to determine what is harmful, and what is right, shaping their attitudes and intentions (A.J. Cook, Kerr and Moor, 2002).

A study that examined sustainable food consumption conducted in Belgium by Vermeir & Verbeke (2008) found that self-related determinants (Vermeir & Verbeke, 2008) during the intention formation process (Vermeir & Verbeke, 2008) were linked to human values.

In recent years, products that are marketed as sustainable have become more appealing to consumer values (Conner, 2002, Kletzan et al, 2006). Studies have documented that consumer attitudes toward organic food products are viewed as tastier, higher in quality, more reliable, safer and beneficial for environment and personal health (Dowd and Burke, 2013). Support for local foods is based on perceptions of better quality which is tied to values (Dowd and Burke, 2013)

Research has also explored a relationship between ethical values and intentions to purchase sustainable foods (Dowd and Burke, 2013). 'Ethical consumerism' (Dowd and Burke, 2013) which has emerged in the last few years has been dealing with animal welfare, human rights, health, fair trade, anti-globalization and ethical values (Auger and Devinney, 2007, Carrington et al, 2010).

A study conducted by Dowd & Burke (2013), found that positive moral attitude and ethical self-identity play a crucial role in predicting purchase intention. Additionally, positive moral attitude and perceived behavioural control have profound effects on predicting intentions (Dowd & Burke, 2013). This means that commitment to moral values has shown to improve food choice outcomes when combined with TPB. They

have also exhibited an independent effect (Dowd & Burke, 2013) on the intention to purchase sustainably sourced foods (Dowd & Burke, 2013).

Multiple studies have identified personal values, moral attitudes and ethics as determining factors to perform sustainable behaviour. By using this as a foundation, the thesis aims to incorporate a world building workshop to examine the values that participants prioritize while envisioning future food scenarios. They help establish personal connections to a future world, and the workshops aim to understand the values participants want and prioritize. Additionally, these studies serve as feedback to analyse findings from the workshops and compare them with existing research.

3.2 Design fiction in food

The goal of design fiction in food studies is to explore future scenarios to understand the link between consumer choices and their impact on the food system by focusing on technology, usage, and sensory experience (Corona, Wathélet & Minvielle, 2024).

Food in relation to future studies, has not been extensively explored in literature due to limitations of scientific foresight (Corona, Wathélet & Minvielle, 2024), as well as complexity of factors such as gender, cultural diversity (Hurly, 2008) and ecological concerns like climate change, food security and loss of agricultural land (Hurly, 2008).

Discussions surrounding the future of food is often biased, as it mostly revolves around biotechnology while overlooking other interconnected aspects. The literature itself lacks diversity in exploration. As a result, design fiction examples tend to be technology-oriented, which presents a limitation. However, for this thesis, they are taken as inspiration to create the artifact.

Corona, Wathélet & Minvielle (2024) who discuss design fiction and future studies, provide various examples in their paper that address food-related challenges, such as green consumption, culinary flavors and food production.

- (1) *Algaculture* by Burton Nitta (2010) explores the relationship between algae and humans (*fig 6*). The concept is set in a future where algae enhances the human body by thriving inside organs and making them semi-photosynthetic (Burton Nitta, 2010). This symbiotic relationship enables humans to partially function like

plants, converting sunlight into food. A portable aquaculture device allows coexistence with algae forming what Burton Nitta refers to as 'symbionts' (Burton Nitta, 2010) where both entities depend on each other for survival (Burton Nitta, 2010).



Fig (6) Algaculture model by Burton Nitta (2010)

Source: <https://www.burtonnitta.co.uk/Algaculture.html>

- (2) Neo Fruit by Meydan Levy (2019) addresses challenges in food production by creating artificial food. It contains aesthetic and textural properties using 4D printing technology (fig 7).



Fig (7) NeoFruit by Levy (2019)

Source: <https://designawards.core77.com/speculative-design/84449/Neo-Fruit.html>

The project uses cellulose and phytochemicals (Levy, 2019) to shape the structure and content of fruits, and integrate micro-tubes (Levy, 2019) with minerals and vitamin liquids (Levy, 2019). This was done to provide a unique experience which is absent in regular food supplements (Levy, 2019).

- (3) The Anthropocene Cookbook (*fig 8*) by Cerpina and Stenslie (2022), explores many speculative food projects like adapting the human body to digest cellulose, converting plastic into food, growing cultured meat and fish and using human bacteria to create cheese (MIT Press, 2022). The book encourages thinking about

current eating habits, challenges food taboos (MIT Press, 2022) and depicts a new generation of recipes for humanity to sustain itself.

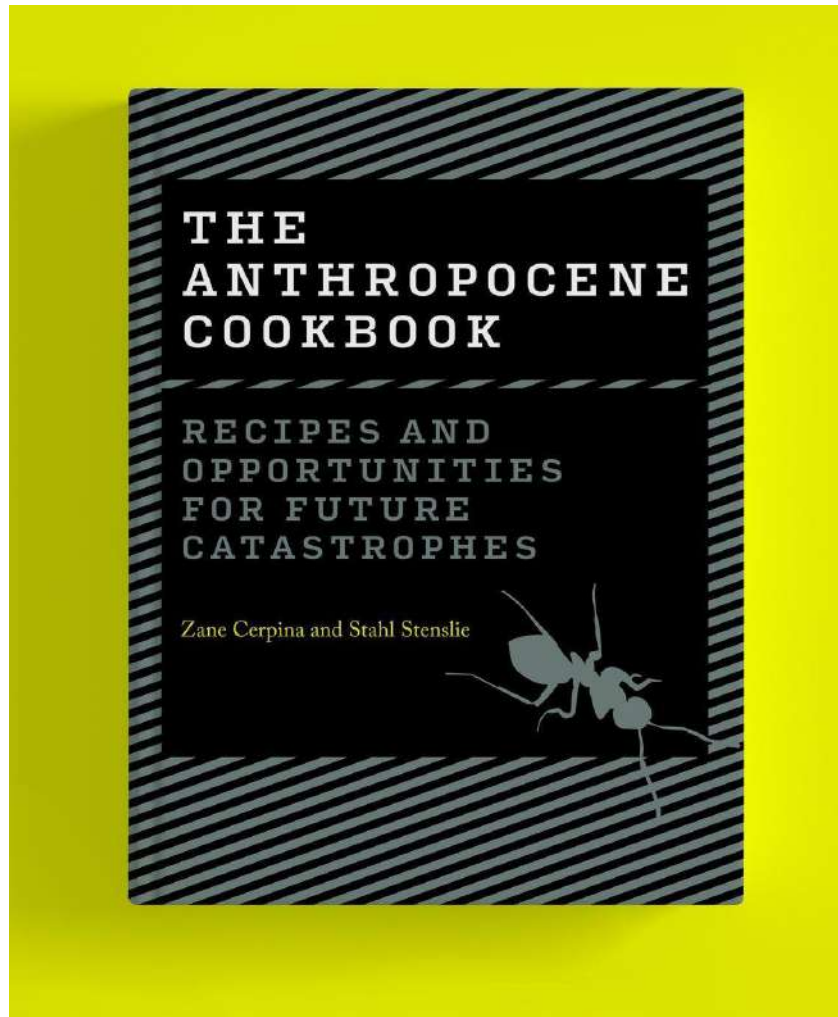


Fig (8) The Anthropocene Cookbook (2019)

Source: <https://anthropocenecookbook.com/>

- (4) *Designs for an Overpopulated Planet: Foragers* by Dunne & Raby (2009) takes inspiration from evolutionary science and molecular technology (Dunne & Raby, 2009) to modify bodies based on nutritional knowledge (Dunne & Raby, 2009). By combining synthetic biology and harnessing nutrients from non-human foods (Dunne & Raby, 2009), the project imagines digestive system devices (*fig 9*) transforming humans into 'new urban foragers' (Dunne & Raby, 2009).

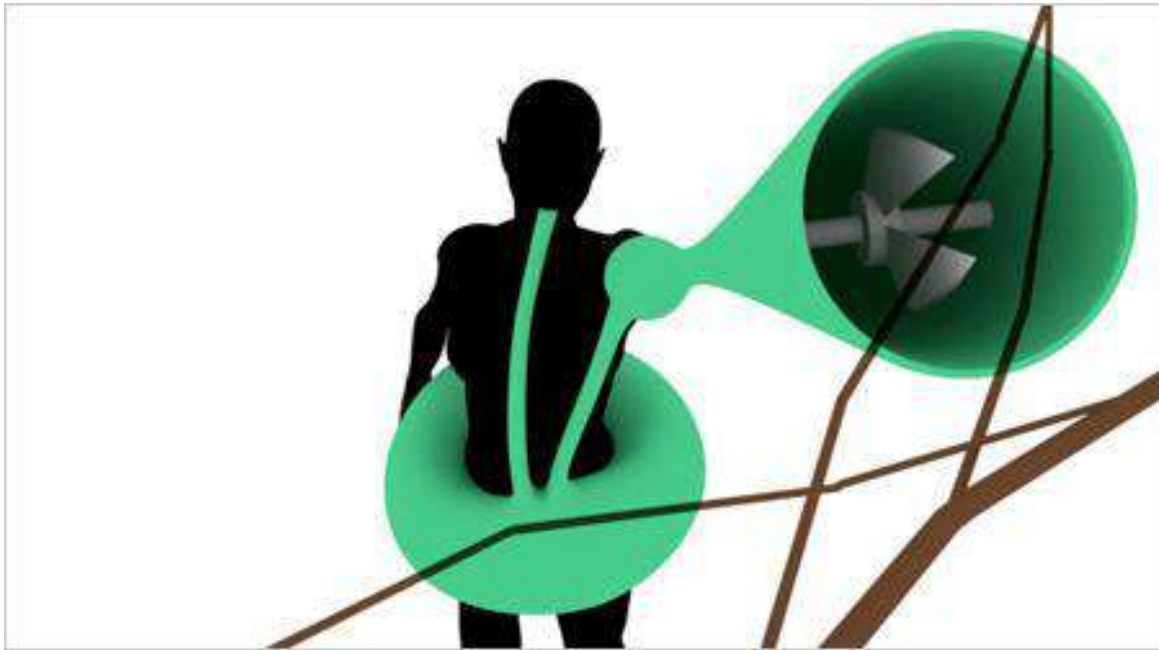


Fig (9) Foragers by Dunne and Raby (2022)

Source: <https://dunneandraby.co.uk/content/projects/510/0>

(5) *Skinny as a Bird* by Hebrok & Mainsah (2022) is a food delivery service (*fig 10*) that provides meals tailored to customer's nutritional needs. It demonstrates the use of design artifacts (Hebrok & Mainsah, 2022) based on the emerging global food trends to encourage reflection on sustainable food consumption practices. Overall, the project explores 'what if' scenarios related to food culture and food delivery technology (Hebrok & Mainsah, 2022). It aims to evoke reflection on ethical, political, socio-cultural and environmental challenges, digital future technologies (Hebrok & Mainsah, 2022) and their impact on food practices.

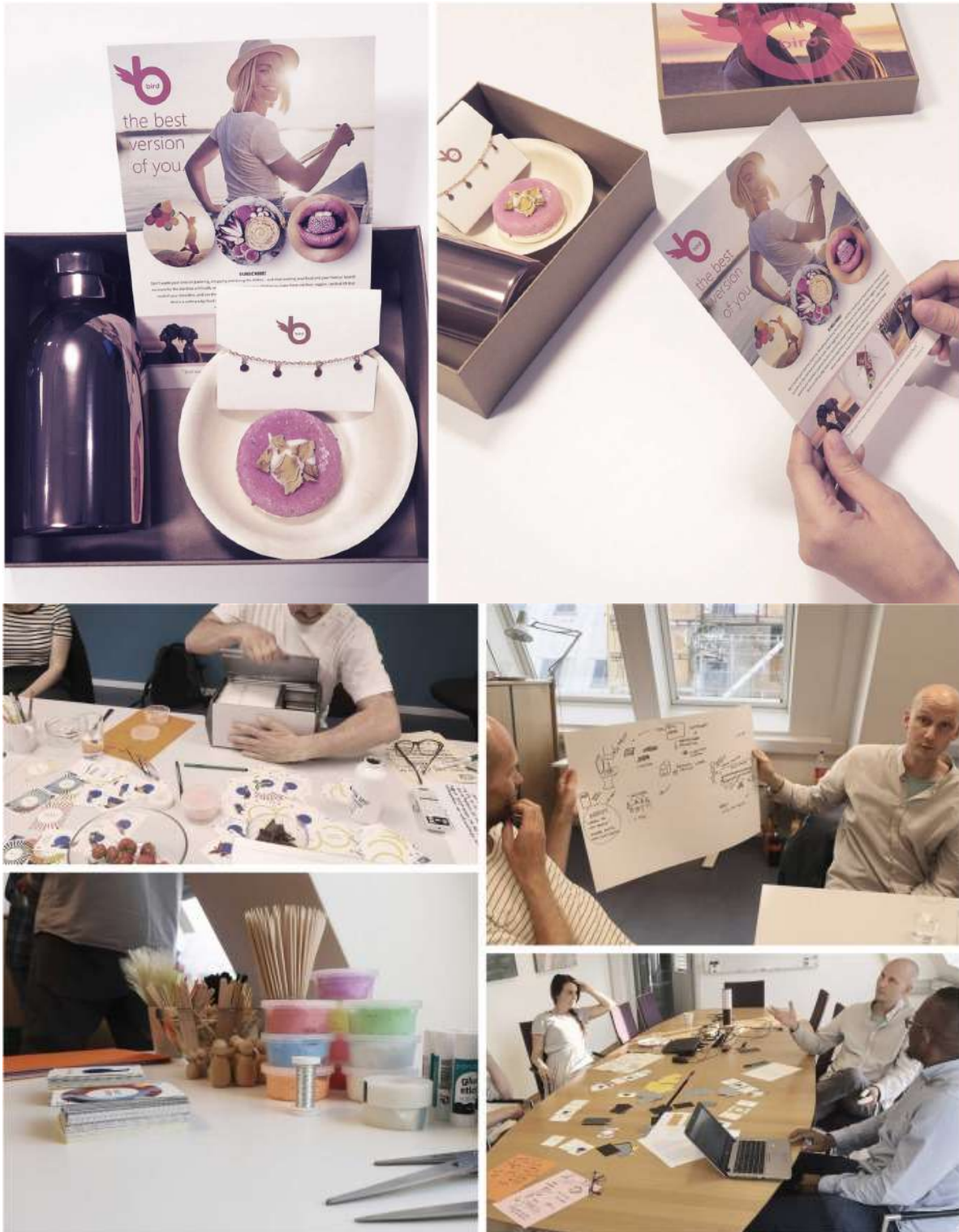


Fig (10) Skinny as a Bird (2022)

The above examples demonstrate the ability for design fiction to play a crucial role in food consumption. This highlights the potential of including food in future studies. Diverse knowledge can be used to create speculative concepts that shift consumer perception of food through conceptualizations using different mediums as touchpoints.

Rather than showcasing the artifact to the user, co-creation helps them immerse in the process, transforming them from viewers to participants. Effective impact can be made through involvement, broadening their understanding of the food system and the role they play within the embedded system.

The previous literature mentions that values, ethics, morals and self-identity tie to TPB, indicating their role in shaping intentions. If this is the case, then design fiction can facilitate a shift in mindset and attitude toward food. There is potential to include food in future studies and link it to behavior, adding a layer of depth to this niche area. The above examples serve as inspiration for designers and futurists to advance this existing work and contribute to impact.

3.3 Future foods

This chapter introduces various future foods that are currently a part of ongoing research, with some already in practice today. It explores these innovations to understand what lies ahead to encourage reflection on whether these foods will eventually turn into a reality.

3.3.1 Insect diets

Research shows that insects are capable of being a substitute for animal-sourced protein (Castro et al, 2018). They are considered to be a viable option because they prevent large-scale deforestation which is used for livestock grazing (Castro et al, 2018). Insects produce lower carbon emissions and ammonia compared to Livestock (Gravel & Doyen, 2020). They contain important minerals like zinc, iron, sodium and potassium (Castro et al, 2018), making them very nutritious. Hence, they are viewed as a future trend in protein consumption.

Consumer acceptance due to psychological reasons (Poma et al, 2017) is one of the many challenges it needs to overcome to gain recognition (Mlcek et al, 2014). Lack of

guidelines to regulate large-scale production (Belluco et al, 2017) and global food safety regulations (Castro et al, 2018) are some of the other challenges it faces.

The main goal of insect-based foods is to replace protein sources that contribute to environmental degradation. However, more research is required to understand functionality, functionality, cost effectiveness, tastiness, sustainability and consumer safety (Gravel et al, 2020).

3.3.2 Cultured meat

Cultured meat is made from animal cells and is one of the key subjects being explored in biotechnology. Its purpose is to serve as an alternative to conventional meat by considering animal welfare, environmental impact and sustainability (J Post et al, 2020). Cultured meat is suggested to be the solution forward to reduce water consumption, land use and emissions.

Unlike conventional meat production, cultured meat can prevent infections and antibiotic use, by reducing the exposure to contagious pathogens (J Post et al, 2020). It is also seen as a solution for addressing animal ethics and improving sustainable meat production.

From a transportation perspective, cultured meat has the advantage of being produced in facilities closer to consumers, reducing carbon emissions and also logistical challenges (J Post et al, 2020). However, cultured meat faces challenges around acceptance, technology regulation and economic impact on communities whose livelihoods depend on animal farming (J Post et al, 2020).

3.3.3 3D printed food

3D printed foods are a product of additive technology which provide customizable food options based on consumer expectations and a wide range of preferences tailored to diet, allergies, nutrition requirements and taste. Nutritional profiling (N Nachel et al, 2019) can be achieved by replacing unwanted ingredients with healthier alternatives (N Nachel et al, 2019). This technology can be used to produce ready-to-eat meals serving the demands of individuals with specific dietary and health related needs.

In addition, food printing technology might be economically disruptive (Baiano, 2020) by changing production process, material supply, consumer demand and policy (Baiano,

2020). It can pave the way to smart food production (Baiano, 2020) by increasing localized food manufacturing and reducing transportation costs (Baiano, 2020). Some of the other benefits include time and energy savings, opportunities for customization and creativity, reduced food waste and efficient food storage (Baiano, 2020).

3.3.4 Edible packaging

Edible packaging utilizes biodegradable materials designed for edible wrapping or coating around food (Petkoska et al), eliminating waste generation. This acts as a solution to combat plastic packaging which is derived from petrol deposits. Research shows that nanotechnology can enhance functionality to edible plastics by using bioactives, antimicrobials, vitamins and nutrients (Petkoska et al).

Usually, the materials are developed using natural polymers (Petkoska et al) although the specific composition depends on the nature and form of the product. Moreover, the material must be compatible with sensory elements (Petkoska et al). Bio-based materials used in edible packaging are developed from biomass or natural sources like lipids and proteins (Petkoska et al).

As research in this area continues to evolve, it is expected that edible plastics will incorporate smart design packaging with properties like intelligence, dynamism and sustainability.

3.3.5 Mycoprotein

Mycoprotein is derived from fungus and is considered as a sustainable source of protein, offering greater health benefits than meat, due to its fibrous structure (Finnigan et al, 2019). It is produced through fermentation so it has a low footprint.

Quorn mycoprotein by Marlow Foods, is seen as a meat substitute. The term 'Quorn' was formed in 1983 (Shubrook, 2024) as a trademarked name to describe vegetable protein derived from fungus, used as a substitute for meat. It is usually obtained from *Fusarium Venenatum*, a microfungus (Shubrook, 2024). It is cost-effective, sustainable and acts as a good protein source by providing a meat-like structure. Currently, it is consumed in 17 countries (Finnigan et al, 2019).

The production of mycoprotein saves water and lowers carbon footprint compared to chicken and beef (Finnigan et al, 2019). It also helps regulate cholesterol, glucose and

insulin (Finnigan et al, 2019). When compared to beef, Quorn grounds use ten times less land, carbon and water (Finnigan et al, 2019).

Converting agro-industrial waste into protein source is being explored in fungal biotechnology and how this concept can be applied to combat environmental challenges on a global scale (Ijaz Ahmed et al, 2022).

PART 2

4 Research methodologies

To generate insights and collect data, research design methodologies were used to attain clarity and direction on how to create the prototype. The double diamond of speculative design by Cristina Colosi (2017) and diegetic workshop framework (2025) were used to guide the process.

The Diegetic Workshop Framework does not yet exist in academic literature, making it a self-created framework designed as a tool that can be adapted and implemented in future thinking and design fiction studies. Therefore, it represents the main knowledge contribution of this thesis. It can be integrated into the exploration of fictitious scenarios surrounding sustainability, culture, politics, technology and other versatile domains, especially in relation to participatory aspects.

Since the application of design fiction in food studies is still emerging, the Diegetic Workshops Framework contributes to ongoing exploration of food fiction. It serves as an evocative tool, expanding perspectives in relation to speculative narratives that shape discussions.

4.1 The double diamond of speculative design

The double diamond of speculative design proposed by Colosi (2017) is a combination of the double diamond design process and speculative design, modeled into one.

The Double Diamond (Design Council): The diamonds in the model (*fig 11*) represent the problem space and the solution space. The problem space, the first diamond is where problems are defined and explored. The solution space which is the second diamond is where concepts are made functional through iteration, prototyping and testing. It is then divided into four phases: discover, define, develop and deliver.

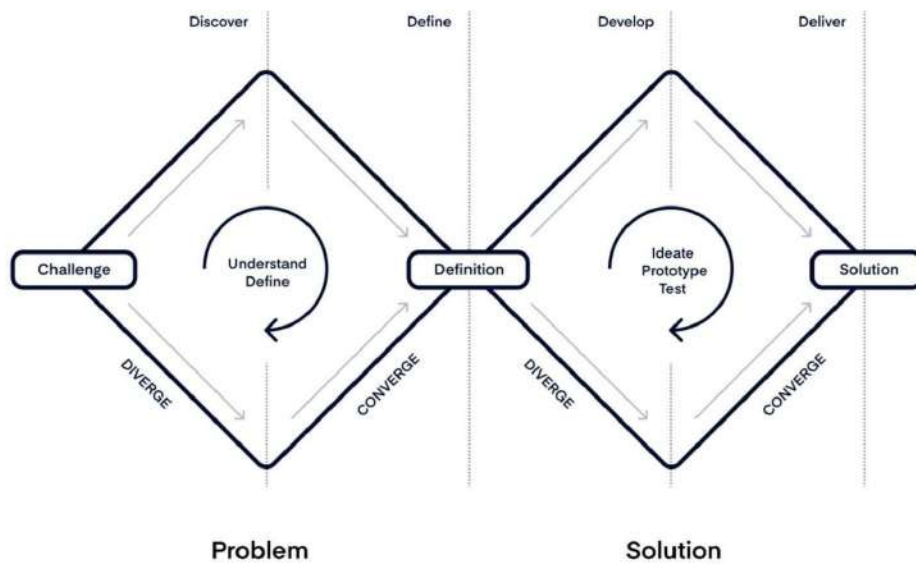


Fig (11) The Double Diamond Framework by the Design Council

Speculative design: This plays a role in ‘stimulating debate about the direction in which society is headed’ (Neely, 2024) by using tangible artifacts. Speculative design emerged to explore the role of design in encouraging thought and reflection on broader environmental, technological, social, cultural and ethical concerns. The goal of speculative design (Neely, 2024) is:

- To provoke thought and debate about potential futures.
- To challenge the norms and expectations of conventional design.
- To explore the impact of emerging technologies on society and the environment.

The speculative design framework (fig 12) incorporates the four phases of the Double Diamond: Discover, Define, Develop, and Deliver, whilst integrating the speculative design process. In addition, the diamond is divided into two phases: the scenario space and the artifact space.

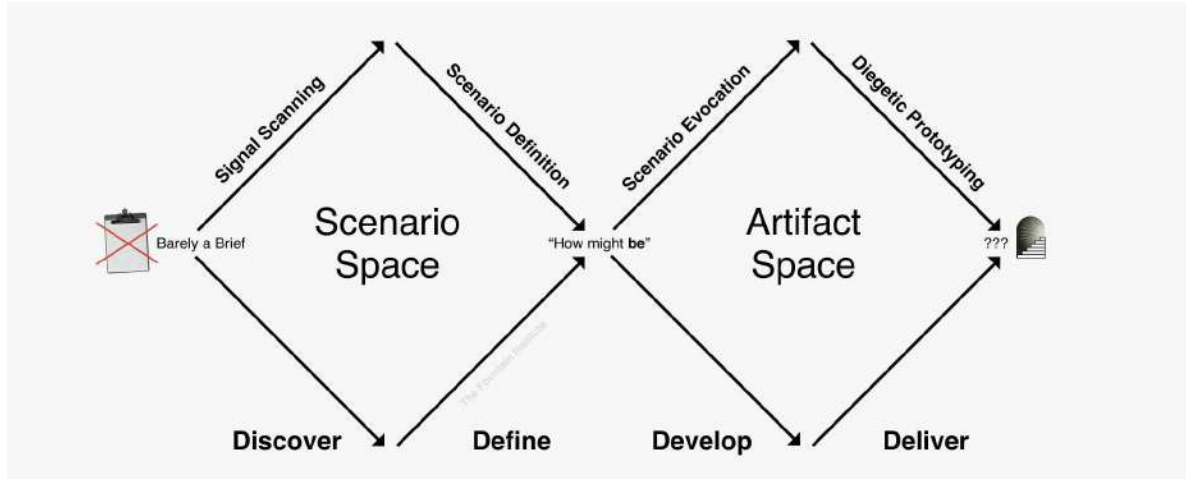


Fig (12) Speculative Design Framework by Colosi (2017)

The first phase, Discover, involves using research methods such as surveys and exploring secondary findings from literature sources to examine a context. This includes understanding people's preferences and assessing where the future is headed. The process of doing this is called 'signal scanning' (Colosi, 2017), which helps envision multiple possibilities of the future. During this phase, research on existing future food literature and current trends was conducted, as demonstrated in earlier chapters. The workshop series were based on literature studies exploring future foods. In this phase, world-building and character-building were conducted to gather ideas that would help define the alternate world more effectively while building the speculative artifact.

The Define phase involves imagining how 'signals' might evolve within a given timeframe (Colosi, 2017). For instance, what would be the effects or outcomes of continuing certain trajectories? (Colosi, 2017). The resulting picture that emerges from exploring this possibility is what defines a possible future scenario (Colosi, 2017).

Here, the insights derived from the Food&Future workshops and literature studies helped form an idea of what to build. Since the workshops focused on gathering ideas based on participants' preferences, they served as a way to integrate as many ideas as possible to conceptualize the world from which the artifact originates.

The solution space, 'Develop', explores questions such as 'What does it mean to live in such a world?' and 'Which products and services would people use?' (Colosi, 2017).

Hypothetical concepts are created to depict elements from the scenario space, allowing designers to bridge current realities and future possibilities by investigating user and participant narratives.

The workshops focus on participants building their own worlds and then embedding preferred lifestyles within those contexts. The character and world building workshops were conducted to address the questions suggested by Colosi (2017) to understand how people think they might conduct themselves in that world.

The final phase, 'Delivery', involves making the concept world tangible through diegetic prototypes that serve as fictitious material from the envisioned world. The goal is to enable users to immerse themselves in the future through touchpoints that can take the form of products, services, interactions, writings, films or other representations that bring the speculative scenario to life.

In this context, the insights from the workshops were used to develop the content of the future food grocery store and provide inspiration for visual storytelling and mood boards. Hand-drawn sketches were translated into low fidelity and high-fidelity wireframes to create the website of the future store.

Apart from the phases, the first diamond which represents the scenario space, begins with divergence, the exploration space where traces of emerging futures (Colosi, 2017) are examined. This is followed by convergence, where the scenario is defined.

The second diamond, the artifact space, contains 'scenario evocation' (Colosi, 2017), where fictional objects are ideated. Then, the artifact is refined and developed. Through interaction with the artifact, this phase aims to evoke a change in perception regarding both current and future reality.

4.2 The diegetic workshop framework

The diegetic workshop framework (fig 13) is created to structure design fiction workshops, guiding the flow of a workshop or a series of workshops set within speculative futures. Borrowing from the concept of the diegetic prototype, the framework is developed to understand the world people want to be a part of.

The purpose of the framework is not only to explore what individuals seek but also what they seek collectively. While beliefs and perspectives may vary individually, they intersect through many commonalities and shared themes. This framework helps interpret and connect elements, further guiding the next stages of the design process.

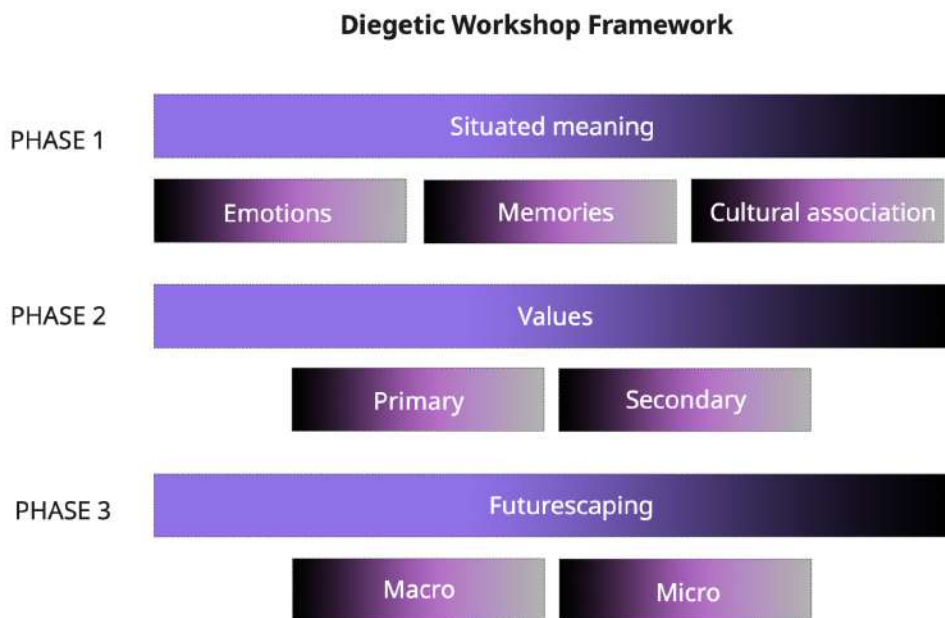


Fig (13) A self-made diagram of the Diegetic Workshop Framework (2025)

Additionally, the workshop framework itself serves as an evocative tool that encourages participants to discuss and question the present food scenarios.

The diegetic workshop framework is divided into three parts:

Situating meaning: Situating meaning acts as a medium to comprehend emotion, culture and personal experiences of participants in relation to both present and the future

scenario. Before building alternative futures, it is important to understand the current trajectory, which is rooted in psychological and cultural facets. To grasp the context in essence, emotions, memory and cultural association must be considered. To understand emotions, designers can address it by questioning: *How does this present reality of a (product, service or a system) make you feel? What emotion does it elicit?*

This exploration can be done by presenting a product, an imagery or an environment that sets the mood for participants to express those elements. Designers can select the tools that best help them understand emotions associated with the scenario.

Next, is understanding memory, which focuses on the question: *“What memory of past association does it give rise to?”* This involves participants connecting their responses with previous experience or past events in relation to the current scenario.

The third element is cultural association, which plays a significant role in tradition and practices within product settings. However, its relevance is very diverse and contextual, sometimes indicating specific use rather than broad application. Geographical aspects also need consideration. A deeper understanding can be achieved through surveys and ethnography methods that collect participant responses in detail.

Values: Values play an integral role in shaping beliefs and our outlook on the world, influencing the futures we prefer to thrive in. They affect lifestyles, consumption choices, and behaviour. Within this framework, values can be divided into primary and secondary categories, where participants construct their imagined worlds based on values. Primary values are those that are generally recognized, such as trust, security and connection, while secondary values are more specific to the individual. This provides a holistic perspective, helping to grasp what participants seek while connecting to their specific values. Although using both value categories is not mandatory, they help in understanding nuances in how people perceive futures.

Futurescaping: This is the third part of the framework, where values are used to construct preferred futures, forming a fundamental aspect of world-building. This phase assembles future scenarios at both the macro (the larger environment) and the micro level (identities and lifestyles). First, the extrinsic environment is built as a whole, and then intrinsic aspects like characters, personas, and lifestyles are embedded. It follows a zoom-out and zoom-in approach, representing two interconnected layers of the process. The world can be built using guidance provided through prompts, toolkits and visual

aids that facilitate the creation process. This allows participants to explore how they would perform a particular activity when engaging with a product or navigate everyday contexts.

5 The Food&Future workshop series

The workshop series was designed to guide participants through a journey, allowing them to immerse themselves in the exercises and the food future world they were building.

To recruit participants, an online form was created to collect information about their age, dietary preference and availability for the workshops. The sessions included fika breaks and lasted between 1.5 to 2 hours each. There were a total of three workshops involving eight master students from Linköping University between the age group of 18-35.

The workshops were divided into three sessions where each of them aligned to a stage of the diegetic workshop framework: photo-elicitation for situated meaning, storyboarding and character building for values, and futurescaping. The workshops were set in preferred futures, meaning that participants had the freedom to choose and create their own worlds.



Fig (14) Post-its from workshop 1

5.1 Photo elicitation (workshop 1)

Photo elicitation is the process of using a collection of imagery to provoke culturally relevant reflections in interviews (Harper, 2001). The method is used to evoke emotions, memories, feelings and cultural cues that might be overlooked in verbal discussions.

Photo elicitation is chosen in the context of this project since it is challenging for participants to visualize futures without being guided through images. It is also used to trigger responses, allowing participants to reflect on whether they find the images appealing enough to try, what motivates them to consume them and what memories, experiences and emotions are tied to food examples shown.

The photo elicitation workshop is divided into two phases:

Phase 1: The first phase aims to capture participant's emotions, perceptions, and cultural associations triggered by food imagery. An online survey was conducted beforehand to understand the participants' backgrounds and select food images they might relate to.

The images featured a mix of Asian and European cuisines and were chosen deliberately for their components like meat, dairy, chocolate, and seafood known for high CO₂ emissions. Participants were asked to write their thoughts on post-it notes and engage in discussions. The images were deliberately chosen based on geographical aspects. The food images shown were a mix of Asian and Western foods. It was kept as diverse and common, with a minimal number of images as possible at the same time. The cuisines contained beef, prawn, chocolate, dairy products and just to mix in dry fruits and a vegetable bowl as well.

This phase addresses three questions:

- How does this food make you feel? What emotions does it elicit?
- What memories or associations come up?
- Does it have any cultural association in your country?

Food has a strong connection to memory, and the question was posed to gather insights and identify patterns between participants' responses to find conjunctions. The question about cultural association seeks to understand how the same dish carries different cultural meanings across regions.

Phase 2: The second phase used futuristic food images to prompt participants' responses about their willingness to try such foods. The images selected in phase 2 is based on ongoing research surrounding future foods that include cultured meat, insect protein, 3D printed food, consumable algae, fungi, moss and molecular gastronomical food. The images for this phase were mostly AI generated and some were chosen based on ongoing food explorations. The questions asked under this phase focused on what emotions participants felt after looking at the image, whether they found it appealing, and whether they would be willing to try it.

5.2 Storyboarding (workshop 2)

Storyboarding is widely employed in many design processes especially in the field of visual design normally in filmography and animation. It acts as a tool to streamline the visual representation process and imagine the world and characters. This workshop took a turn of using storyboarding to help participants visualize the world and shaped the goal of the workshop to see what they envisioned through their lens.

Prior to the workshop, a fictional world was built to set the participants in the mood. They had to read the story in the world of 2050 to immerse themselves in the 'future mood'. This fictional article or storyline was AI generated and took inspiration from Robert Zemeckis' film series Back to the Future.

In order to build a future food world, participants had to base it on two elements, values and guiding questions. They had to 'build a world on values' and guiding questions helped them guide towards what to focus on while building the world. They weren't fixed questions but the purpose was to help them get an idea to storyboard rather than make them endlessly ponder what to imagine.

The values are divided into primary and secondary values as mentioned in the diegetic workshop framework. The foundation of this exercise was built on values identified in Workshop 1, such as connection, trust, affordability, and reliability, alongside individual secondary values that resonated personally with participants but they were also allowed to add other values that resonated with them. To guide the process, participants were provided with a set of questions designed to inspire elements for their 2050 future narratives. These were:

- What do farms look like in 2050? Are they vertical, underwater, space-based, or AI-controlled ecosystems?
- Are there living buildings that grow food? How might food production integrate into everyday structures?
- Do people still farm the land, or is food entirely produced by AI, lab-grown methods, or controlled environments? Will individuals visit farms or grow their own food?
- What's the relationship between nature and technology in this world? Is there an abundance of nature, or do people rely on synthetic or lab-grown alternatives?
- What do grocery stores look like? Do they still exist, or is food delivered directly to homes by technology?
- What does a typical meal look like? Is it a nutrient-efficient product created by AI or lab-grown ingredients?

This workshop focuses on world building by creating the larger speculative food environment and exploring what it might entail in the future of 2050.

5.3 Character building (workshop 3)

In the third workshop, participants were encouraged to select avatars and associate character traits to their future persona (*fig 15*) of 2050 and associate a food lifestyle for the specific world they had created in workshop 2. These scenarios focused on day-to-day activities participants would perform from a sustainable practice perspective with foods. The three scenarios were designed to explore their interactions with future food realities in different contexts.

This workshop was conducted online on a Miro board, where participants had to drag and drop post-its around their selected avatars. They were assigned with three tasks. First, they had to choose an avatar from a collection of imaginary comical characters to

represent their persona. Then, they filled out a persona template, including details such as name, gender, likes and dislikes, profession, hobbies, philosophies, aspirations and motivations. Finally, they were provided with three scenarios and a scenario template to fill in relation to their associated food lifestyle.



Fig (15) Screenshot from the MiroBoard of the list of tasks for workshop 3

In scenario 1, participants had to describe what they would cook in their future kitchen and how they would store the food. Scenario 2 involved imagining themselves attending a future food festival on a weekend, where they interact with future products. Scenario 3 required participants to ideate on how they would segregate waste in 2050.

6 Research findings

6.1 Thematic process

Since there were many insights generated in each workshop, a structured process had to be used to organize and analyze recorded discussions and documented responses. The process includes breaking down collected data into keywords followed by coding where the keywords are chunked and clustered and then they are turned into themes followed by interpretation leading to analysis of the findings (*fig 16*). While breaking down insights from some workshops, additional modifications were added to organize it based on personal requirements. The results of this process help to better understand linkages and find commonalities between participant responses and many times the same things are said in different ways. The upcoming chapters contain interpretations and understanding of insights after applying this process.

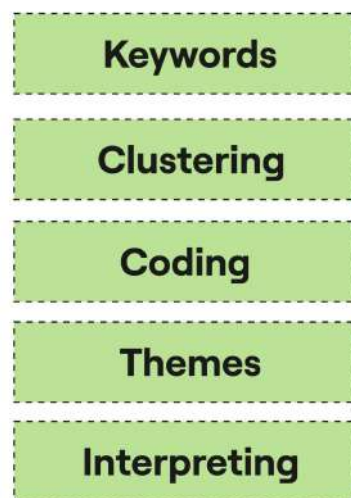


Fig (16) Thematic process

6.2 Food as an artifact

During the first phase of the photo elicitation workshop, participants responded to images by connecting them to memories with family and friends : “Stronger the emotional connection, the stronger the taste”. Given that there are strong memories associated with foods, it can be seen as an artefact that makes emotions and memories tangible.

Synthesis of workshop 1

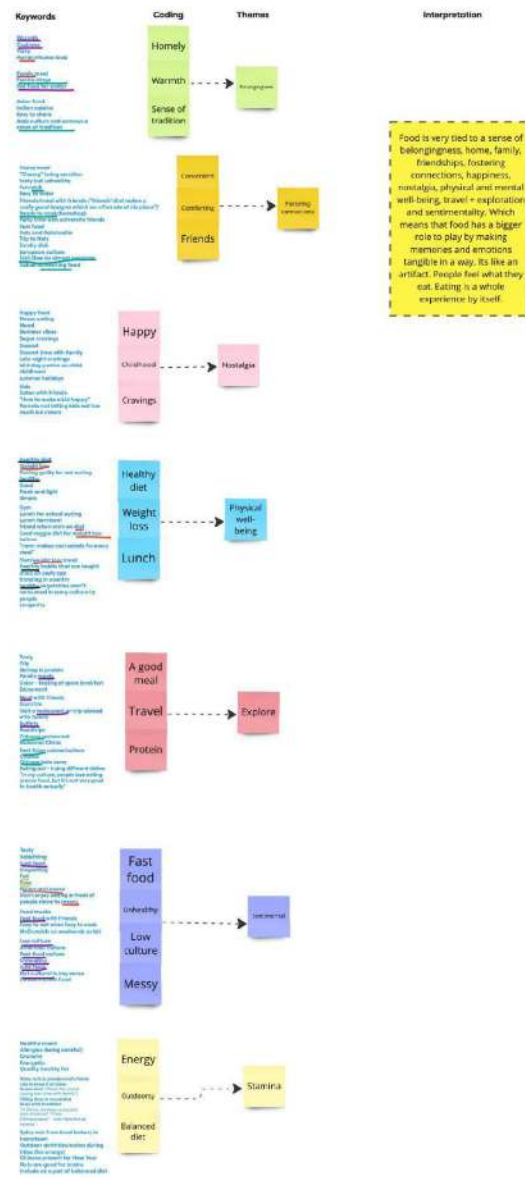


Fig (17) Thematic process/synthetic of phase 1 (current foods) from workshop 1

In the session, each image from a food category evoked a different emotion that mostly depended on the cuisine, quality of the food, aesthetic and the culture it originated from. Asian food with hot rice elicited "Warmth", "Feeling of cosiness", and "restaurant time with family". Cheesy foods like Lasagna were perceived as not suitable for everyday

consumption and was linked to meals shared with family and friends. Another milk-heavy product like ice cream was linked to childhood memories.

They also associated it with coping with stress, managing mood swings and fulfilling sugar cravings. Seafood like prawn evoked memories of travel and social gatherings. However, some participants could not associate with it directly since they aren't accustomed to eating it. A fast food item like a beef burger, received mixed responses. While some described it as tasty, convenient and fun, others interpreted it as unhealthy to consume since it contains too much meat for a meal. It was also associated with childhood memories and food trucks.

Vegetable bowl and dry fruits images elicited associations with weight loss and dieting. Dry fruits were linked to morning breakfast, hiking, and other adventurous activities, since they are often consumed as energy bars.

From a cultural point of view, some of the images featured traditional cuisines across regions and many foods were not a part of their primary cultural background. Hence, the group was requested to express what they perceived of foods depicted from other cultures.

The south asian rice cuisine was generally regarded as traditional, while one participant specifically associated it with Arab culture.

Foods like burgers and lasagna were seen to be a part of fast food culture. Burgers were associated with American culture and were perceived as having no cultural integrity or "low culture".

Seafood was recognised as a coastal cuisine and raw vegetables were seen to be embedded in European culture through salads. Although, one participant expressed, "salad is not my cultural thing, but nowadays it's a trend in my country" and another stated "In my culture, people don't like to eat raw vegetables".

The fast food images like the meat burger sparked discussions around meat consumption. Some of the insights focused on how meat is more filling due to its protein content compared to vegetables. Participants also noted that meat is linked to fulfilling basic dietary requirements, calculated in terms of calories. One of the participants expressed, "veggies don't have meat so it doesn't feel like a proper meal". Another participant emphasized that each individual's dietary needs differ and measuring

protein intake based on body weight wouldn't work for everyone – “some need to include more veggies in their diet and some need more meat. It's subjective”.

Food image	Keywords	Coding	Theming	Interpretation
Asian food with hot rice	Warmth, Cosiness, Tasty, Homely/home food, Family meal, Festive binge, Hot food for winter, Asian food, Indian cuisine, Easy to share, Arab culture, Tradition	Homely, Warmth, Sense of tradition	Belongingness	Food evokes warmth, family, and culture. Creates emotional connections and a sense of belonging.
Cheesy foods (e.g., lasagna)	Heavy meal, “Cheesy” being emotion, Tasty but unhealthy, Fun with food, Fancy vibe, Friend/family meals, Fast food, Trip to Italy, European culture, Family clash	Convenient, Comforting, Friends	Fostering connections	Rich, indulgent, shared meals that connect people. Emotionally comforting but not everyday food.
Ice cream	Happy food, Stress eating, Mood, Summer vibes, Cravings, Dessert, Childhood memories, Kids, Guilt of overconsumption	Happy, Childhood, Cravings	Nostalgia	Links to childhood joy, emotional eating, cravings. Both light-hearted and reflective.
Vegetable bowl	Healthy diet, Weight loss, Guilt for not eating clean, Gym, Lunch, “Diet”/salads trend, Early habit, Longevity	Healthy diet, Weight loss, Lunch	Physical well-being	Health-focused, tied to physical fitness and lifestyle. Often shaped by personal or cultural beliefs about eating.
Seafood (e.g., prawn)	Tasty, Oily, Protein, Family meals, Travel, Restaurant, Asian/coastal cuisine, Chinese influence, Exploring new dishes	A good meal, Travel, Protein	Explore	Associated with exploration, exotic locations, and richness. Not universally relatable but often celebratory or aspirational.
Beef burger (fast food)	Tasty, Junk food, Disgusting, Fun, Easy, Messy, Food trucks, Fast food culture, Low culture, “Not cultural”	Fast food, Unhealthy, Low culture, Messy	Sentimental	Mixed: fun and nostalgic but also criticized. Brings up cultural identity and modern eating habits.
Dry fruits	Healthy snack, Allergies, Crunchy, Energetic, Balanced diet, Outdoor meals, Popular snack, “Not labelled as snacks”	Energy, Outdoorsy, Balanced diet	Stamina	Viewed as fuel. Symbol of physical endurance, healthy routines, and practical nourishment.

Fig (18) A summary of results (phase 1)

The findings indicate that certain foods are deeply rooted in tradition while others are seen as modern or too commercialized. The cultural signification of a dish affects how it is viewed. Foods with similar category are diverse with preparation style and ingredients which define the value each food carries in different societies.

Variations in flavor and brand identities play a role in shaping consumer preferences, accessibility and trust in quality. Some participants also noted how food marketing created the desirability to buy foods.

Hence, food visualizations are very subjective and cannot be generalised. It varies based on personal and cultural contexts and hence indicates the need for a more nuanced approach to understand the way foods are perceived.

Overall, food serves as a tangible object or artifact which holds space for memory and emotion. It helps bridge the two by providing a multi-sensorial experience, making it more enriching.

6.3 Perceptions of future food products

In the second phase of photo elicitation, six images of future foods were shown to participants to understand their perception and their level of acceptance.

The insights derived suggested that the future of food depends on aesthetic, textural and gustative properties. Future foods become more convincing to try when they induce a sense of familiarity with what we currently eat. Resemblance in color, form and texture play a role in building trust. Affordability is also a crucial factor in making food choices. Innovative food concepts would likely be expensive when implemented, making them less affordable to economically backward groups.

Synthesis of workshop 1 (phase 2)

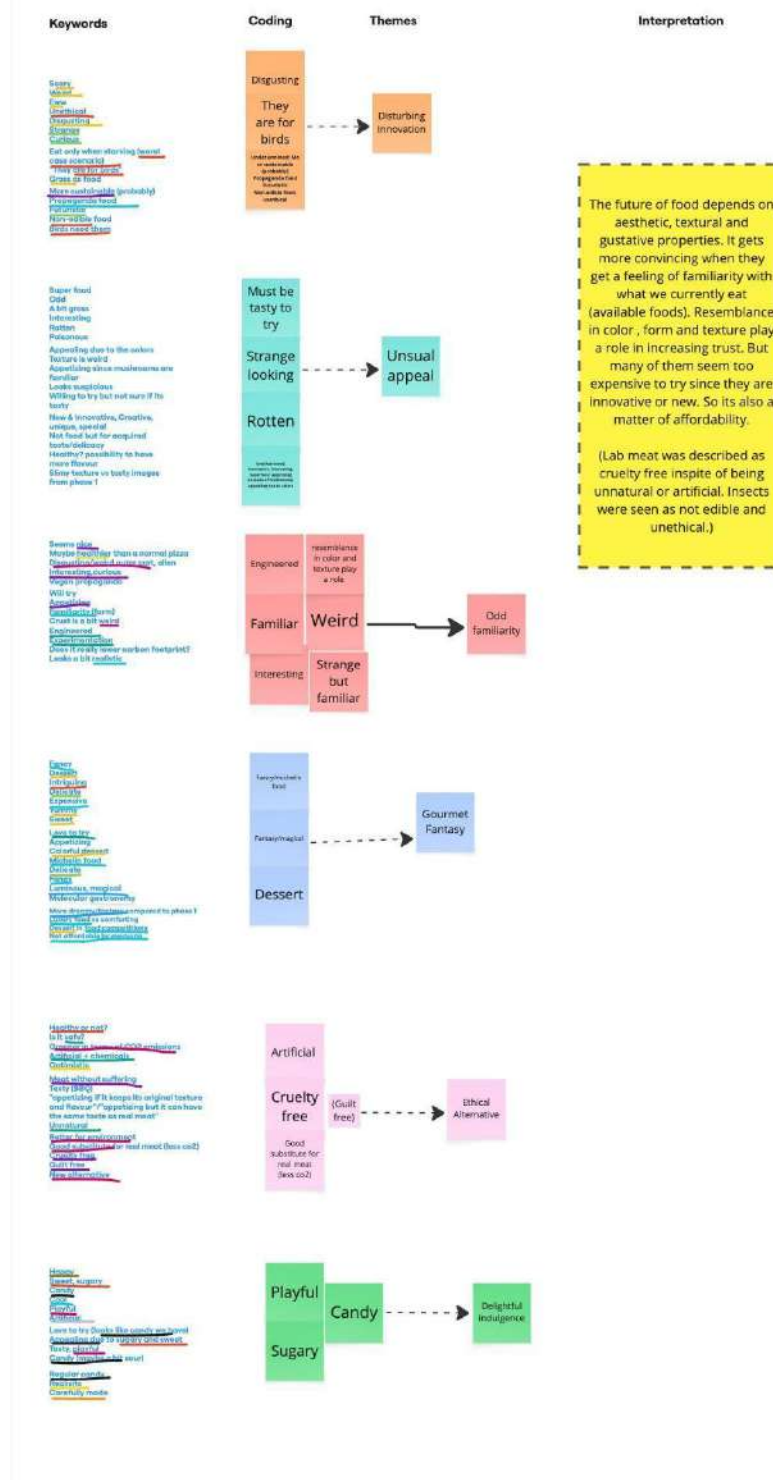


Fig (19) Thematic process/synthetic of phase 2 (future foods) from workshop 1

In terms of specific foods, insects evoked emotions described as “strange”, “disgusting”, “gross”, “curious”, “unethical and scary” and “unappealing”. Participants expressed a willingness to try them only as a resort to cope with starvation. The reactions were influenced by the way insects were depicted, which in this case, was an AI generated clip of live insects. A few participants admitted they might be open to trying them if they were fried or integrated into a cuisine.

Insects were also regarded as more sustainable, unrealistic but probably normalized in the future, inedible and ultra modern.



Fig (20) AI generated image of live insects

A mycoprotein cake made of mushroom was viewed as “odd”, “interesting”, “rotten”, “poisonous”, “inedible”, “mouldy” and even looked like super food to a few. It had mixed reactions of being both appealing and unappealing. Some found it appealing due to its colorscape, saw it as appetizing due to the familiarity of mushrooms, and expressed a willingness to try if it is safe and edible. Others found it unappetizing due its unusual texture. The mushroom cake was seen as new, innovative, creative, unique and primarily for those with an acquired taste.



Fig (21) AI generated image of mushroom cake

The third image, which was a pizza with a moss-based crust, was perceived as “healthier than a normal pizza”, “an alien looking pizza”, “vegan propaganda”, “a weird looking crust” and “a fusion pizza blending futuristic and traditional elements”^s. Some participants were open to trying it if it tasted good, due to its familiar shape and form. Others didn’t find it appealing since the crust appeared like a forest floor, and they would only consider eating it without the crust. The moss pizza imagery was regarded as engineered, bizarre, and an experimented Italian product.



Fig (22) AI generated image of moss pizza

Next, a molecular gastronomy dessert with macarons elicited responses such as “fancy”, “intriguing”, “delicate”, “expensive” and “yummy”. It was perceived as appealing and appetizing, since it looked luminous and magical, resembling michelin foods. The macaron dessert within the molecular gastronomy concept, was also seen as luxurious and “dreamlike” due to its striking visual appearance.



Fig (23) AI generated image of a macron with consumable package

The image containing lab meat was described as “artificial”, “greener in terms of CO₂”, “raw” and “cool” though some were worried about its health implications. Participants were willing to try since it is produced with no animal suffering, as long as it replicates and retains the original taste and texture of natural meat. It was described as cruelty free despite being unnatural or artificial.

In addition, lab meat was seen as a better substitute for real meat due to its lower CO₂ emissions, environmental benefits, guilt free consumption.



Fig (24) AI generated image of cultured meat

The 3D printed dessert with geometrical forms elicited responses such as “happiness”, “playfulness”, “too sugary” “crunchiness” and was described as looking like “candy for kids”. It appeared both appetizing and unappetizing depending on the perspective of participants. The item was seen as appetizing since due to its sugary nature, yet in contrast was also perceived as unhealthy. Lastly, the dessert was regarded as regular candy, more realistic, more carefully prepared and not something that could easily be prepared at home.



Fig (25) Image of 3D printed dessert

Source: <https://www.wsj.com/video/3-d-printers-hit-the-sweet-spot-dessert/>

During the discussion phase, participants emphasized on safety, affordability and reliability as important factors that influence the acceptance of future foods. Their concerns centred around unfamiliarity and uncertainty surrounding ‘unknown’ foods, leading to skepticism about health risks in artificial food production.

There were also conversations about how future foods are techno-centric and how solutions that are organic and authentic, for example local foods can be prioritised. Many participants preferred technology to act as a partner or assistant rather than dominate food systems. They were also aware of GMO foods being sold and promoted by large corporations, which are detrimental to health and not a solution for addressing poor soil health caused by monoculture practices.

Food image	Keywords	Coding	Theming	Interpretation
Live insects	Scary, Weird, Unethical, Disgusting, Bizarre, Caution, Grass as food, Poor acquisition, Non-edible food, Eat only when starving, "They are for birds", Nurtured	Disgusting, "They are for birds"	Disturbing Innovation	Insects seen as non-edible and unethical. Despite being a potential protein source, they are rejected based on cultural and ethical grounds. They evoke disgust and are only considered in extreme necessity. Although they can be consumed when fried or flavored in some way.
Mushroom cake	Super food, Odd, Appetizing, Interesting, Poisonous, Rotten, Texture is weird, Looks suspicious, Slimy texture, Not food but acquired taste, Healthy	Must be tasty to try, Strange looking, Rotten	Unusual appeal	Aesthetic and textural properties affect acceptance. While it's appealing in theory, visual and tactile factors make it suspicious. Some willingness to try if tasty.
Pizza with moss	Seems nice, Healthier?, Engineered, Familiar, Interesting programs, Will try, Engineered, Odd but weird, Realistic, Strange but familiar	Engineered, Familiar, Interesting, Weird	Odd familiarity	Even though moss is unfamiliar, its similarity in texture and form to traditional pizza helps its acceptance. It is both strange and familiar, which generates curiosity.
Macaron with molecular gastronomy	Fancy, Delicious, Intriguing, Sweet, Futuristic, Appetizing, Colorful, Michelin food, Playful, Magical, Luxurious	Dessert, Gourmet, Fantasy	Gourmet Fantasy	Seen as indulgent, luxurious, and futuristic. Acceptable due to its familiarity with known dessert forms and high-end appeal.
Lab meat	Healthy?, Ethical, Artificial, Guilt free, Tasty, Good substitute, Less CO2, Cruelty free, Clean meat, New alternative	Artificial, Cruelty free (Guilt free)	Ethical Alternative	Considered acceptable due to its ethical benefits (no animal suffering) and potential environmental advantages. Artificiality is acknowledged but balanced by familiarity in taste.
3D printed dessert	Happy, Colorful, Sugary, Candy, Fun, Playful, Carefully made, Novelty, Regular candy	Playful, Sugary, Candy	Delightful Indulgence	Familiar and fun—resembles existing candy. Acceptance is high due to its playfulness and visual appeal, though novelty adds curiosity.

Fig (26) A summary of results (phase 2)

6.4 A world based on values

This workshop was conducted to explore something integral to each individual which are values. Values are deeply connected to people's outlook on the world and shape their attitudes towards how they navigate daily life. As mentioned in literature in previous chapters, personal values have largely influenced food choices by exhibiting an independent effect (Dowd & Burke, 2013). Hence, borrowing from this concept, imagining future through this lens, would provide a way to better comprehend the future possibilities.

While storyboarding the world, participants had to identify the values most important to them before sketching their ideas on paper. The world they were asked to construct was

based on the main values generated from Workshop 1: connection, safety, reliability, trust and affordability. Nonetheless, they were free to add to the list.

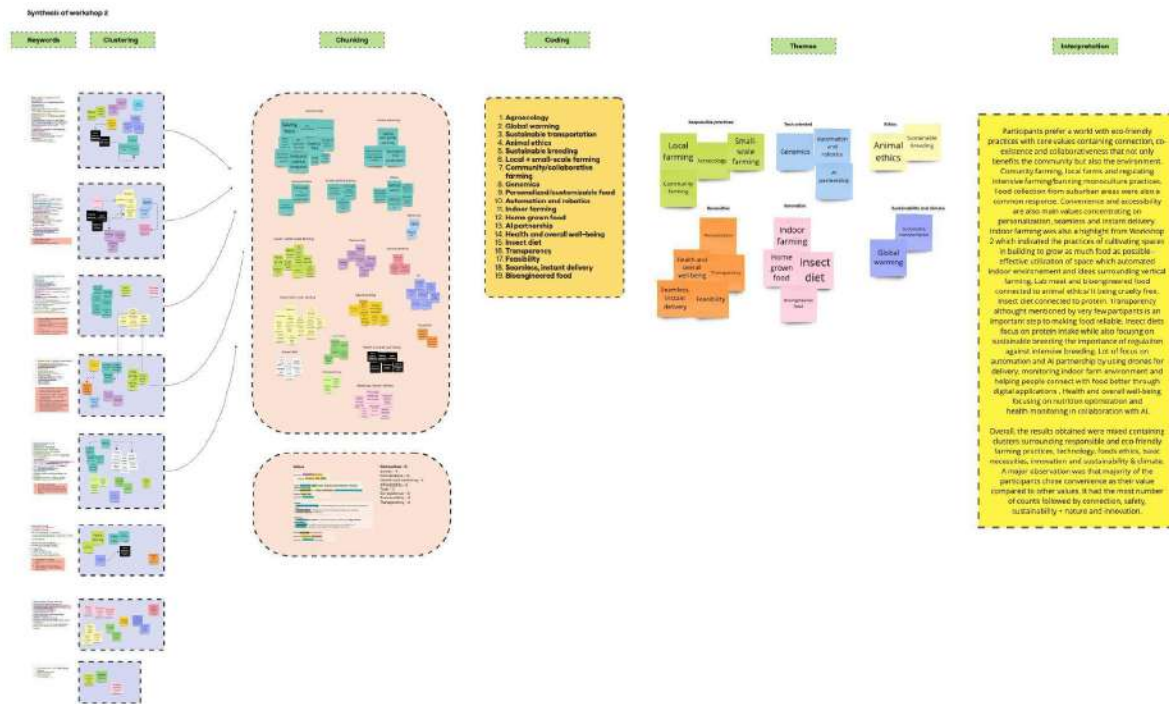


Fig (27) Screenshot of workshop 2 synthesis

The clustered insights from participants, are coded into the following themes:

Agroecology – This contains topics surrounding bee conservation, adopting permaculture practices, chemical free farming and promoting local food produce to reduce CO2 emissions from transportation. It also includes growing food in urban spaces stated by one of the participants, “I imagine that buildings have to start to accommodate space for growing food and not just for living” to increase one’s connection with nature and promote cross-pollination.

Global warming – Here, one of the ideas a participant came up with was about colder countries taking advantage of a warmer climate to increase food production.

Sustainable transport - A concept where sustainable transportation is facilitated through localized farming closer to cities or in suburban spaces. This way, food gets transported through drone delivery decreasing reliance on long-distance transport.

Animal ethics- A world where sustainable breeding of animals and insects is promoted through research, exploration and regulation. Other elements include home-grown lab facilities which promote consuming food which is cruelty free and a society that rejects overcoming unsustainably bred products.

Small-scale farming - This was a very common theme mentioned by majority of the participants focusing on adopting organic micro-farms with a 'farm to city' and 'farm to table' approach where participants stated "for the ecology and for the natural cycle of life, it's still important to have a real farm". It was also mentioned that it helps preserve the integrity of soil as a participant mentioned "if you rotate in smaller patches, you won't deplete all the nutrients in one area".

Community farming: Farming practices where communities take responsibility for caretaking, storing and distributing equal amounts of resources within the community and also preserve farming skills (*fig 27*). One of the participants mentioned "It's very important to retain different farming skills".

VALUES: CONNECTION, TRUST, SAFETY, RELIABILITY
 SECONDARY: CO-EXISTENCE, NURTURING..

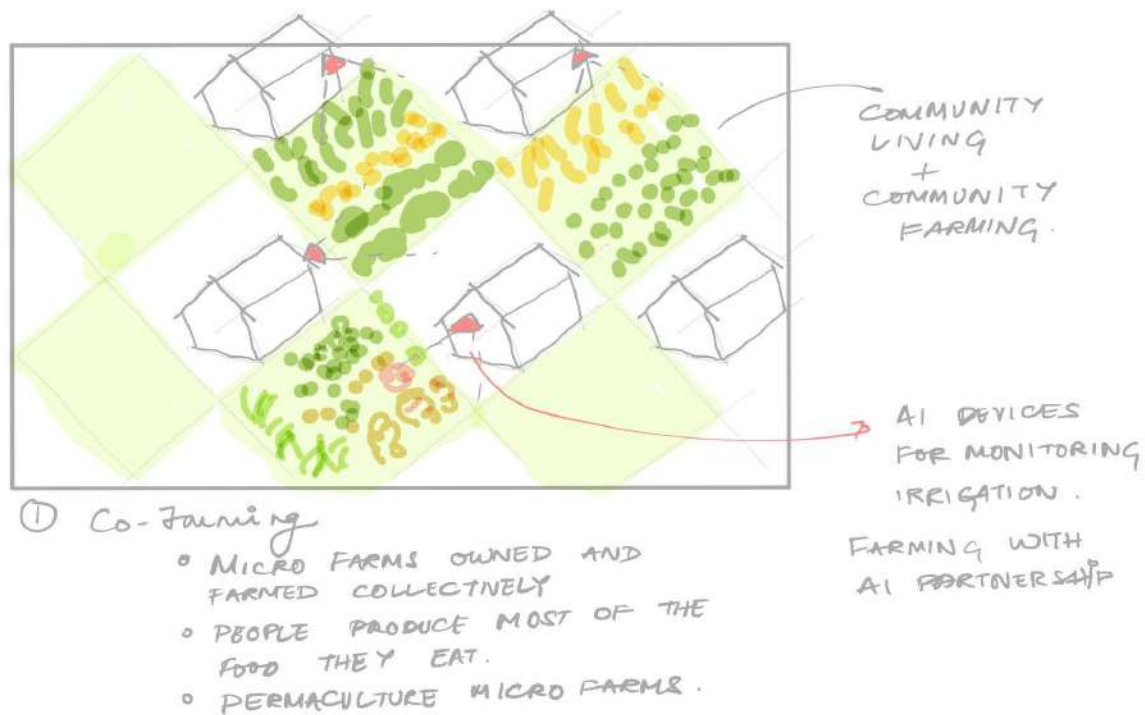


Fig (28) A Participant's storyboard on community farming

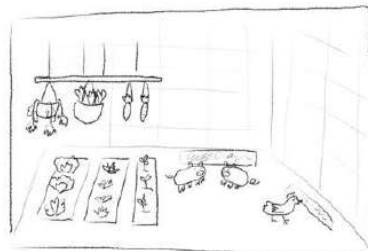
Personalization: Here, genetically modified food facilitates growing foods with customizable nutrient requirements to consume only what is needed for the body.

Automation and robotics: Automation is used to build a system which monitors light, water and soil sequestration to facilitate nutrient supply to plants. Outdoor farms are managed by self-driven tractors, automated cameras and sensors in larger patches. Heavy agricultural machinery is replaced by drones in contexts which require collecting berries or fruits as stated by a participant “instead of having big machinery that destroys nature, you can have drones flying”, which helps avoid disturbance in the surroundings. Homes have automated farms where food is collected and preparation is facilitated by an assistant robot.

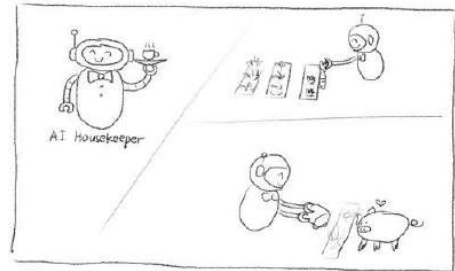
AI partnership: This contains highly advanced AI controlled vertical farms and an AI housekeeper which helps in calculating nutrient requirements. AI partnership in this

theme also includes enabling farming communities to take part in food and seed exchange through an app which facilitates seed collection and storage.

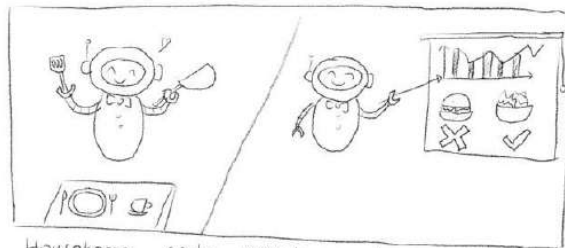
Primary values: Safety, Trust
Secondary values: Convenience



Everyone has a greenhouse at home, growing vegetables and raising animals.



There's an AI housekeeper who taking care of the plants and animals.



Analysing your daily diet and helping to improve it.

Fig (29) Participant's storyboard on AI partnership

Health and well-being - The theme is about growing organic food for physical and mental well-being by adopting it as a hobby.

Indoor farming: Here, buildings create spaces to grow food and facilitate terrace farming. Growing different plantations in different building floors focuses on effective utilization of space.

Insect diets - Insects are harvested sustainably in the countryside and used as a replacement for animal protein. They are harvested in small hubs in cities by considering animal welfare.

Transparency - This is where food products contain detailed description about ingredient sources, production cycle and carbon footprint indicators.

Seamless, instant delivery – Here, high-speed delivery service is made available through drones with an option to video call before ordering. Stores have developed an interface that provides tactile user experience to explore foods remotely, before ordering.

Bioengineered food – In this theme, food safety is achieved through lab meat because it is much hygienic compared to regular meat and doesn't contain microplastics.

Overall, the themes point towards responsible and eco-friendly farming, food ethics and innovation and sustainability.

6.5 Future lifestyles

In the third workshop used three main scenarios to craft future lifestyles:

Cooking & food storage in the home kitchen: Majority of the participants envisioned their kitchen to have organic ingredients and homegrown produce. They preferred farming in backyards and relying on locally sourced foods. Few participants integrated AI-powered robot housekeepers into their future kitchen to make cooking and meal planning more convenient. As one participant stated, “Robot housekeeper helps me process seasonings and other ingredients that are difficult to make on my own”.

[illegible]

Fig (30) Synthesis process of workshop 3

Stews and soups were preferred meals since they are easy to store. Fresh food delivery, bulk purchasing and jar storage were viewed as techniques to reduce unwanted package waste. Moreover, automated cooking technology and creative leftover use were proposed to decrease waste.

Interaction with products in future food festivals: Here, participants imagine interactive workshops for children, where they would be taught about edible cutlery and zero-waste practices. The workshops also include insect cooking classes as part of the experience.

Other ideas focus on exchanging home-grown organic food and local products, promoting a community-driven food system. Barter-based sections are included to

strengthen the local economy as one participant suggests “Food festivals could have a biter section, so people who grow food can either exchange or sell their produce”.

In addition, to expand food palette experiences, gourmet foods are introduced in the festival to explore unique flavours and experimental dishes.

Waste segregation: The emphasis here is on reducing storage needs by using food products as much as possible without leaving out the contents to reduce waste from generating,

AI assistance in sustainable purchasing is used to help make responsible food choices and reduce unnecessary consumption. In addition, organic waste management through composting and repurposing organic scraps were proposed.

Other ideas include using technology to sort waste in segregation hubs to enhance the waste management system and rubbish incinerator to convert waste into electricity. As a participant expresses “Waste would be thrown into a vacuum chute, which then leads underground to a big sorting facility, where smart ai and robot arms are able to sort the things perfectly through a vision system to be reused or recycled”.

Scenarios	Coding	Theming	Interpretation
S1 – Kitchen & Storage	Organic ingredients, edible packaging, food storage tech, automation, DIY systems, plant-based food	Sustainable food, alternatives, tech in cooking, waste reduction	Preference for local, healthy, low-waste, tech-supported food systems
S2 – Food Festival	Food workshops, local markets, home-grown sales, sensory tasting, communal cooking	Education, zero waste, local/global food, sensory experience	Support for learning, sharing, and experiencing food sustainably
S2 – Waste Segregation	Waste sorting tech, DIY composting, AI recycling, circular systems, community initiatives	Waste reduction, tech for sustainability, local solutions	Interest in smart, shared, circular waste systems

Fig (31) A summary of results (workshop 3)

The three scenarios reveal a vision for a future where food is grown, stored, consumed and disposed of in a sustainable and innovative manner. The insights reveal a shift towards sustainable consumption with waste reduction, eco-friendly packaging and food repurposing.

6.6 Research analysis

Among the various values that were chosen to build a world in workshop 2, convenience received the highest number of mentions, followed by connection, safety, health and wellbeing, affordability, trust, co-existence, sustainability and transparency.

Ideas with core values centred on connection, co-existence and collaboration focused not only on benefiting the community but also on supporting the environment. Convenience and accessibility were core values emphasising on personalisation, seamless interaction and instant delivery. This reveals that while ethical and environmental factors play a role, ease of access and self-sufficiency are dominant in shaping values. It also demonstrates that participants were aware of food systems extending beyond personal consumption.

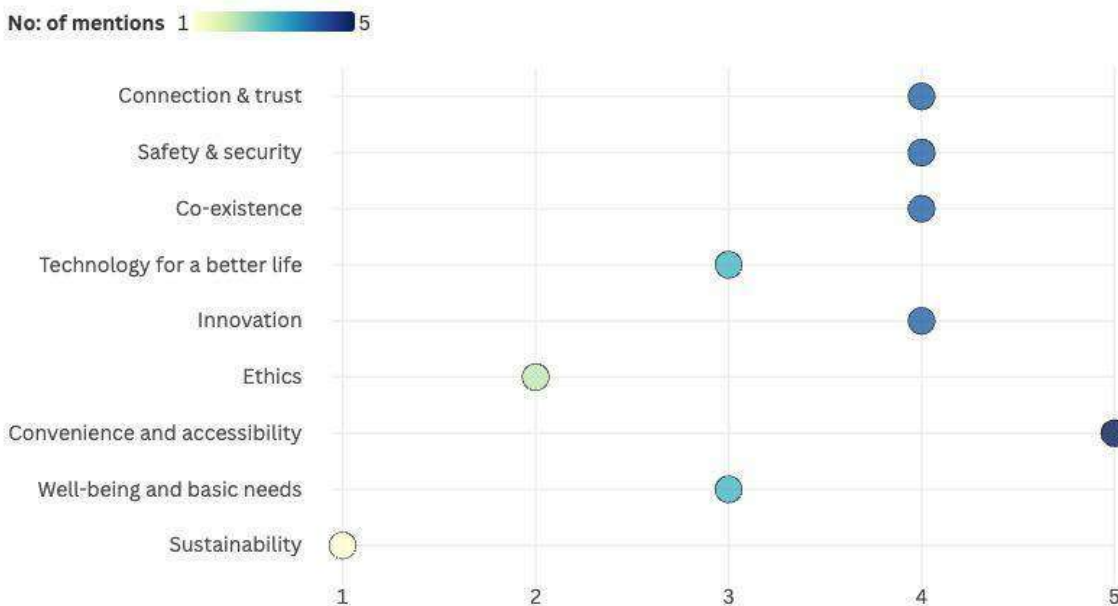


Fig (32) Number of mentions per value

This suggests that participants prefer ease of use and less taxing processes, with assistance and automation playing a role in making their lives easier in the envisioned

future worlds. It also indicates that they do not prefer a future entirely devoid of technology.

Interestingly, similar responses can be observed in studies conducted in Finland, which explored youth perspectives on transformation of food systems (Kalijonen et.al). In both studies, participants valued convenience and efficiency. Their responses varied, but aligned with the majority of participants in this workshop.

For example, in the Finnish study, agriculture was primarily regarded as a system requiring efficiency. Another insight shared was the reuse of excess foods and repurposing it as biofuel. Participants in the Food&Future project proposed recycling food scraps and repurposing leftovers.

Ethical concerns around meat consumption and gourmet dishes were observed in both studies, with the importance of quality and health being recognized as a way to benefit the environment and improve animal welfare (Kalijonen et al).

Furthermore, Finnish participants preferred customised food delivery, the exploration of gourmet foods and cuisines, along with a need for cheaper options. This was also recorded in Food&Future workshops. Both studies stressed on locally produced food, reducing transportation emissions, and increasing home-grown organic food produce.

In the context of the workshops, from the participants' point of view, small-scale and locally sourced foods were considered more ethical and sustainable compared to industrialized foods. They envisioned a self-sufficient food system that adapts to their daily needs, even including the possibility of 3D printing food at home. This shows that participants were interested in exploring innovative food solutions while also wanting them to feel authentic and meaningful rather than artificial, large-scale or detached from nature.

Technology was also a noticeable theme in both studies. Finnish participants viewed technology as a solution to environmental issues, focusing on techno-centrism. In contrast, most participants in this thesis project, viewed technology as a partner.

This highlights the need to view future foods through a pluralistic sense and examine them from multiple perspectives rather than through singular approach, such as techno-centrism, which would make the outlook narrow and biased.

7 Diegetic prototype

7.1 The world of 2050

The artifact is set in the reality of 2050 presenting both synthetic foods alongside organic foods, it is set in a dilemma in which synthetic foods are more affordable in contrast to organic options. The global economic collapse, driven by climate change and environmental degradation has caused local farming communities to collaborate. It is set in a transformative period where citizens seek to strengthen the local economy.

In this world, synthetic foods thrive as organic foods fail to grow in a toxic environment. Growing organic food is also very intensive and demands a lot of resources, time and labour.

This world was created because many participants repeatedly indicated the importance of organic foods in each workshop. Hence, the world is set in a context where it is deprived of organic food to encourage users to introspect on its importance.

The main goal of the future food website is not to be biased towards technological solutions but instead showcase a reality that doesn't exist yet and use this, to make the interface more engaging.

The featured food products in the website are selected based on current studies that examine future food alternatives, They are incorporated to encourage viewers to reflect on whether they truly want to be apart of a world where food is artificial, less authentic and machine made. This allows viewers to introspect and critically engage with the evolving food landscape in relation to current dilemmas.

Additionally, the website provides an option for users to join an online local farming community. This initiative is designed to strengthen local food production and foster collaboration.

7.2 NourishNext

NourishNext is an online grocery food store that offers innovative selection of foods like 3D-printed foods, insect-based protein powders, mycoprotein products, cultured meat and plant-based meat alternatives. The store also provides products with edible plastic packaging, ready-to-eats and desserts.

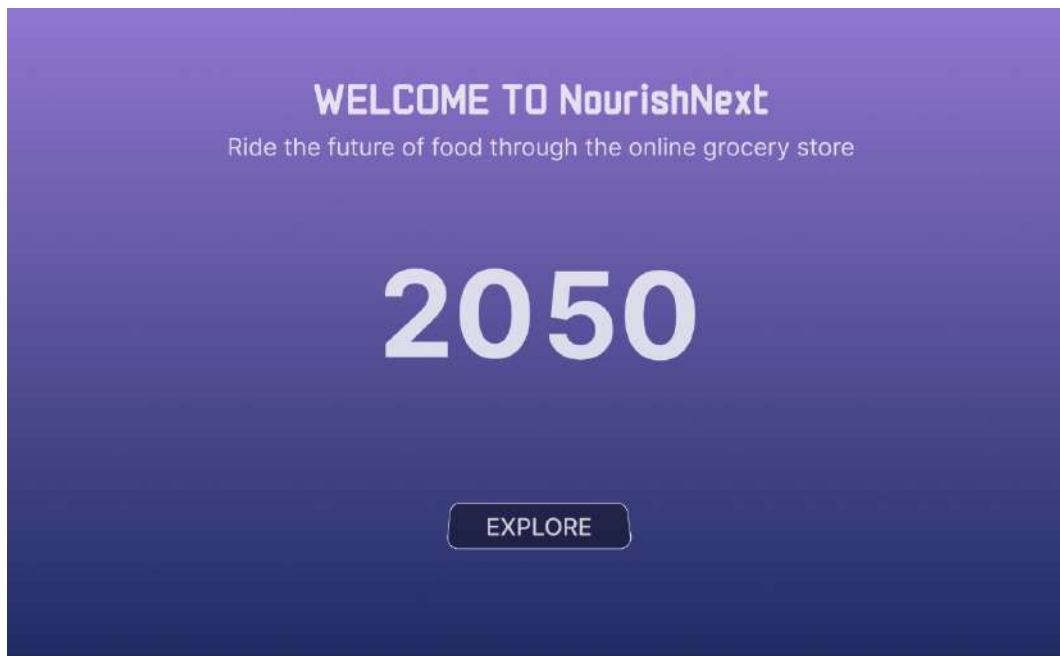


Fig (33) Main splashscreen of NourishNext

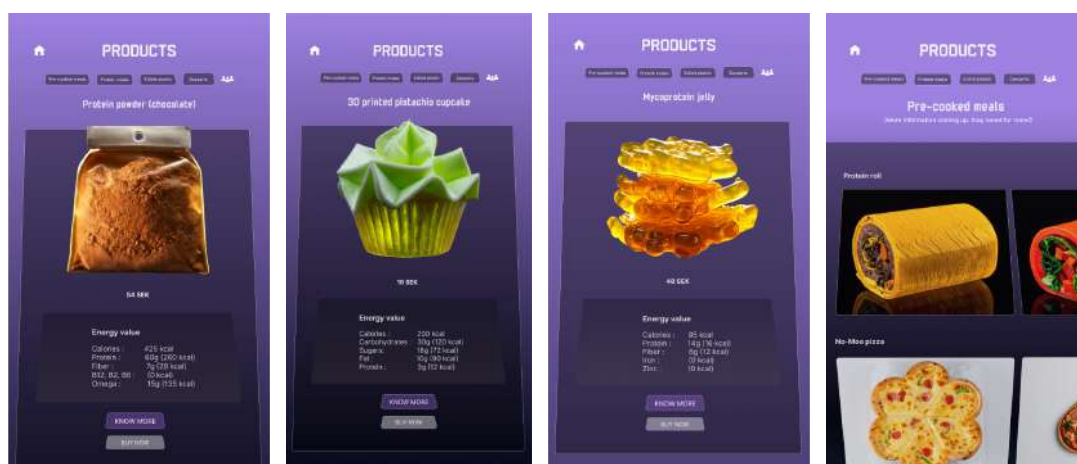


Fig (34) Figma screenshots of some of the future food categories

Additionally it provides a seamless drone delivery service, making sure that customers can access foods without leaving their homes.

Every year, the store helps organize a community-driven food festival that facilitates food education events and food exploration. It features activities that connect people with food. Some of the activities include organic farming workshops to teach participants how to care for soil, DIY cutlery and low-waste tool sessions where they create reusable items from the available organic materials, sustainable insect cooking classes and sessions of soil education.

Guests are allowed to explore innovative recipes and gourmet foods. The community conducts food exchange where people swap homemade or home grown foods to strengthen local food networks.

NoursihNext also gives the opportunity for people to build local seed banks to strengthen the local system making sure that future generations have access to healthy nourishment.

In essence, it aims to revise organic and authentic food sources that have been lost to time. While it currently offers engineered products, its vision is to gradually transition towards an locally integrated food system. By sustaining community driven networks, it seeks to shift consumer habits away from artificial foods by normalizing organic food consumption.

7.2.1 User testing and feedback

After building the prototype, an initial round of online user testing was conducted. A form was sent to those who tested the website which had to be filled. The idea was to assess if the content encouraged them to reflect on current foods and practices. Additionally, there were also questions asking them about their favorite food category in the website and whether they would add a new category (*Fig 35*).

Which food section did you find most interesting?

13 responses

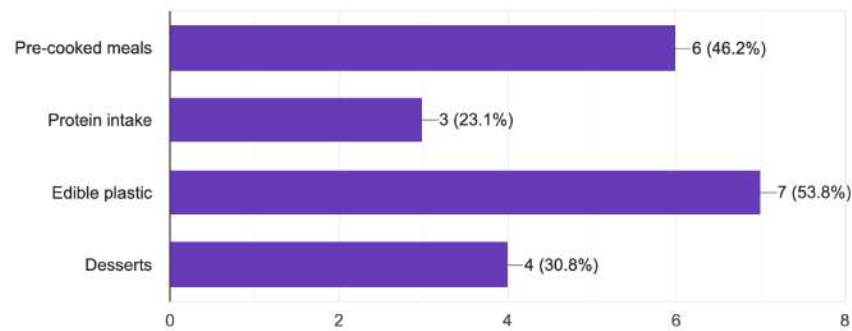


Fig (35) The most interesting food category

Results showed that 53% of the respondents found edible foods to be the most engaging (Fig 29) , followed by pre-cooked meals at 46%, desserts at 30% and protein intake at 23%. Since this was a multiple choice question, participants could choose more than one option.

In terms of reflection, 84% (Fig 36) of users found the website to provoke thought and reflection. 92% of users felt that the visualisations helped provoke thought about current foods.

Did the website/interface provoke thought or spark reflection overall?

13 responses

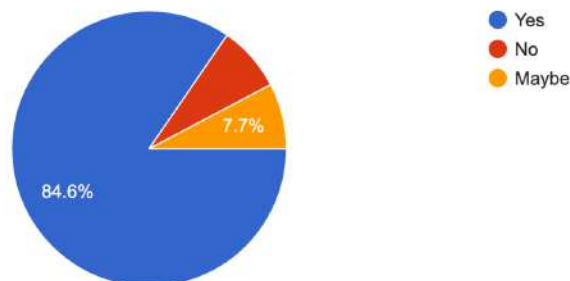


Fig (36) Percentage of users who voted 'yes'

The next segment required users to explain why and how the visualizations or context helped provoke reflection or what they did not. The responses were mixed. Some answers were in-depth while others focused on aesthetic aspects on the website.

The responses reflected on how the producers aren't far away from achieving the reality of 2050 and the fact that the content is communicating about the shift in agricultural methods into something artificial. They expressed that 'future foods' will degrade the nutritional value and the content is indicating to make conscious choices today.

Sustainable future in relation to the future economy was also mentioned. Elements that are detrimental to soil health can hinder economic development.

Another response connected edible plastic products, to the current challenges of plastic waste and how it is interesting to see future concepts being developed to tackle such challenges

Other responses focused on visual engagement with feedback on the visuals, color and contrast making it easier to identify patterns in future foods. Some users appreciated warm tones and close-up shots created a sense of intimacy, making the experience feel personal. Sections such as edible plastic sparked curiosity as some users admitted that they have never heard of it before.

When assessing whether the website provoked reflection about their food practices, the responses varied. 69% voted yes, while 15.4% chose no and maybe. Regarding whether lab-grown meat, insect protein, edible packaging, and other innovations will be the future reality of food, 46% voted no, the other 46% voted yes, and 7.7% voted no.

The final questions focused on interactivity and navigation. 61.5% of users didn't report issues while navigating the site and 38.5% experienced issues. Navigation received the most number of votes in terms of areas needing more improvement.

After the user testing, another testing round was conducted at the Visualization Centre. However, the prototype did not function on the touch table due to scaling issues. Additionally, the current design relies on vertical scrolling, whereas the touch table has a horizontally broad screen. Therefore, adjustments are needed to adapt the layout, to make it more compatible.

Overall, survey results indicate that the research question – “How can a future food scenario foster provocation to reflect on current food practices through a speculative digital artifact?” has been addressed.

Through participatory workshops and the user survey, the future world resprising participant insights, proved valuable in enabling reflection, with the website acting as a medium. The scenario of 2050 presented on the website reflects participants’ responses and their desire for a self-sufficient, organic, local, and community-driven food world, assisted by technology.

PART 3

8 Discussion

8.1 Reflecting through the dfsb lens

The primary goal of the prototype was to encourage reflection, rather than behavioural change, as it was out of the scope for this thesis.

If the project had a broader scope, it could have explored ways to help people adopt new behaviors by intervening in perceived behavioral control. This could be achieved by setting intentions and providing the necessary space and resources to strengthen intentions to perform desired behaviours.

This would involve extending the current prototype into a game, an exercise or a scenario-based stimulation. For example, users could interact with future foods, by completing tasks like grocery shopping or cooking and then reflecting on their experience. Another example could be a game that imposes penalties when users make unsustainable choices, reinforcing the undesirability of such decisions. In this way, undesired choices could discourage users, creating a learning loop where they recognize the ease or difficulty of performing certain behaviours (Azjen, 1991). This approach aligns with the Power in Decision-Making Model by Lidman et al (2011).

In addition to ‘enlightening’, the current interface could incorporate ‘spurring’ as an app to introduces an extrinsic mechanism, such as a reward-based system or points (Selvefors, Reström and Strömberg, 2023), to propel the user toward making positive changes to their behavior through positive experiences. A game or scenario simulation could use a reward-based system (Selvefors, Reström and Strömberg, 2023) by presenting users with a positive future projection as a reward for their current positive choice, and conversely, a negative projection for a negative choice.

When it comes to the directing approach, ‘steer’ might not align given the context of futures because ‘steering’ is oriented towards making the behaviour seem obvious (Selvefors, Reström and Strömberg, 2023). It might not work as it is hard to determine what ‘obviousnesses’ in food related behaviour would have evolved in the future.

‘Forcing’ can be used in the context of a scenario-based stimulation of making people fulfill desired tasks through exposure to a future version of current products that restrict them from having a healthy lifestyle. This might help direct the performance of undesired behaviour (Selvefors, Reström and Strömberg, 2023) in the present by creating a negative future experience.

When it comes to attitudes, the current prototype can be adapted into an application that presents users with future scenarios for some of the food products they use, giving them a negative projection to encourage them to steer (Lidman et al, 2011) themselves towards changing their approach to food in their daily life and adopting sustainability. Future positive scenarios can also be used to illustrate how better behaviour leads to a better future, while negative behaviour results in negative future consequences. The app could also enable them to track their progress in given timeline to see how far they have come in achieving the desired outcome. Behaviour repetition could be stimulated through reminders of a negative future scenario to help them change their attitude towards food to promote sustainable choices.

In the context of food futures, external factors play a role in shaping beliefs about what is normal and acceptable. Speculative design can play a role in understanding what foods people might consume in the future considering external factors like climate change and other influences. Yet, since this is a subject with cultural and economic complexity, it is difficult to study how norms will play a role in impacting future beliefs.

In a study conducted by Brahma, Lulley & Tang (2015) it was inferred that measuring the impact of interventions is challenging and varies depending on the type of product (Brahma, Lulley & Tang, 2015). The study concluded that methods like eco-steer and eco-technical interventions might succeed (Brahma, Lulley & Tang, 2015), yet consumer acceptance could hinder the adaptation products based on such strategies (Brahma, Lulley & Tang, 2015). Additionally, determining what is socially acceptable poses a challenge, as individual preferences and social norms vary. This makes it challenging to measure the accuracy of the effectiveness of strategies.

Hence, subjective norms remain an unexplored aspect in this context. However, from the viewpoint of this thesis, a diegetic prototype must be very regional and culturally specific to reverse-engineer people’s behaviour toward adopting sustainability.

Given that the current prototype did have an effect on users, it suggests there is potential in raising awareness of one's behavioural performance as it is connected to being conscious of how external environmental factors influences individuals (Ajzen, 1991). Therefore, when negative future scenarios depict negative consequences of unsustainable choices, presenting a future degraded environment like the Anthropocene Cookbook (Zane Cerpina & Stahl Stenslie) might help develop internal awareness to shift people's beliefs and develop the right intent towards the context of food. This could also make it easier for people have perceived control over their behaviors.

While this is the case, practice theory would still work better, as users can actively inculcate sustainable practices using the artifact as a medium. This approach could be comparatively more effective than DfSb, as it focuses on action and less on mental processing. Sustainability is a practice rather than just a reflective concept. However, due to time constraints, there was lack of opportunity to pursue this thesis from the perspective of practice theory.

8.1.1 Design stance

Selvefors, Renström and Strömberg (2023), discuss the concept of design stance which is about how a designer's perspective shapes the way they create sustainable products. They outline three approaches to design for sustainability.

The Directing Stance focuses on creating design interventions that guide people towards sustainable actions (Selvefors, Renström and Strömberg, 2023). The goal is to encourage people to act in a way that aligns with a specific behaviour. However, this stance does not align with this project, as it follows a facilitative approach rather than a directive approach.

The Enabling Stance is based on the idea that sustainable practices must be integrated into people's life by making them accessible and desirable (Selvefors, Renström and Strömberg, 2023). This stance emphasizes on introducing artifacts that encourage sustainable living naturally. It also encourages exploration and reimagining daily practices by being open to possibilities (Selvefors, Renström and Strömberg, 2023).

In this project's context, representing future foods as actual physical objects that users can use kinesthetically, could have been more impactful. Engaging with the senses could help users connect emotionally, with sustainable choices, making them more aware of their impacts. While an online grocery store or a website might provide useful information, it might not be enough to create soulful immersion. Incorporating better immersive experiences like AR/VR could allow people to navigate speculative environments.

The Co-Prototyping Design Stance promotes collaborative creation of artifacts or prototypes alongside users, in this approach, participants actively engage in designing the elements that shape their sustainable practices. Instead of enforcing behavior change, designers act as facilitators by helping communities build systems that support sustainability (Selvefors, Renström and Strömberg, 2023).

The diegetic prototype was developed based on participant's preferences and aspirations, indirectly making it a co-created vision of a sustainable future. However, this did not extend directly to the users of the Visualization Centre.

This stance seems to be more promising to develop future food artifacts. Instead of assessing predefined paths, it focuses onco- building them over a period of time allowing people to prototype their own choices. By using speculative design as a co-prototyping stance, future foods can become more inclusive, adaptable when it comes to diverse perspectives on sustainable living. The only drawback is that this stance might only be applicable for smaller groups.

8.1.2 Design implications

Selvefors, Renström and Strömberg (2023) also suggest reflecting on seven questions when it comes to implementing a design. Each of the questions will be explored in this project's context:

Which systems level are addressed? – Working with systems is complex and it depends on which level in the system needs to be addressed. This requires the need to take the right design approach. In this case, the project sits at the very bottom of the systemic level

which is product interaction. If a fictional prototype manages to impact people's attitude using DfSB towards food using the right design stance, some change might occur. But it might not be as effective on a larger scale. The authors suggest a practice oriented approach that could be more effective, making it valuable to explore a diegetic prototype within the food context.

Who impacts the design? – Here, users are most likely to impact design. In this project, the student participants in the workshops shaped and defined many parts of the website's content, particularly areas requiring information about the products through world building exercises. The diegetic workshop framework that was designed had a notable impact on participants. When asked whether the exercises and discussions helped shift their perspective and attitude towards food, the majority responded 'yes'. This shows that design fiction has the potential to make an impact when combined with DfSB, allowing users to contribute to the design process.

Who and how many will be reached? – While this depends on the context, when considering how many people the current prototype can reach, since its focus on user interface and basic aspects makes it easier to implement. Secondly, since it is a digital website, it does not require many resources to implement and can reach more people. It is easier to implement when it is an enabling stance, as co-prototyping requires constant effort and cannot be scaled up or made accessible to everyone.

Who is responsible for bringing about sustainable outcomes? – Both the user and the designer share the responsibility of achieving sustainable outcomes. While designers attempt to facilitate change, it ultimately depends on the user to internally reshape their intentions to achieve desired outcomes.

Here the prototype fulfilled its purpose by enabling the majority of users who tested the website to reflect on current foods and practices. However, it was not designed to steer behaviour in this case.

Can the intended outcomes be ensured? – It is challenging to address this question. Even if the prototype's purpose shifts towards inducing behavioral change, it would be difficult to predict the outcome, as the duration and extent of its impact are beyond the designer's control.

Will the effects be short-lived or long lasting? – In the context Food&Future project, the prototype is designed for a short-lived effect but has the capacity to evolve into something more, creating a long-lasting impact. A long-term effect can last when it takes a co-prototyping stance, as users constantly engage with it and build it themselves.

Are there any unintended consequences? – It can have consequences when other strategies are implemented on a systemic scale or at a higher level of the system. However, some unintended consequences could arise, such as users facing technical problems while navigating the site or being unable to understand what they are supposed to do with the artifact when its purpose is not explicitly mentioned. For example, if the current prototype is displayed in the visualization centre, its futuristic nature might make it less straightforward. Thus, viewers will have to read a description before navigating the site.

8.2 The role of diegetic workshops

This chapter will discuss the characteristics of design fiction outlined by Ahmadpour et al. (2019) about the diegetic workshops' outcomes.

Design fiction suspends disbelief in change: Here, the workshops create opportunities to explore alternative solutions for the future. The aim during the sessions was for participants to realise that innovative solutions exist and it is possible to turn these ideas into a reality to initiate change.

Many of the things the participants developed could act as real solutions to assist food transition. Therefore, design fiction can be used as a tool to drive change, especially when they are co-created.

It often examines the implications of potential design and technology in the context of technological conflict: Many discussions in the workshops steered towards addressing technological conflict, especially that tension between artificiality and authenticity. Many participants considered community farms and limited use of technology, aiming for a balance where technology supports soil health.

This perspective extends to the products that need to be designed in the future, and the effort was made to reflect this within the speculative digital artefact. Fictional objects

play an important role in examining complex aspects of technology by making space for dialogue.

It enables discussion of social and political context: The workshops provoked discussions surrounding environmental, social and economic contexts, with limited focus on political aspects. However, few participants mentioned animal rights and ethics in the discussion while talking about regulating intensive breeding and promoting sustainable breeding.

The discussions also addressed the economic challenges of introducing innovative solutions, recognising that they might be unaffordable and inaccessible at the beginning. Additionally, participants also explored community living, emphasising that tightly knit communities can strengthen local economies.

Design fiction can help bridge the gap between multiple disciplines that are often overlooked. Since food exists at the intersection of all disciplines, building speculative narratives helps explore ethical, social, environmental, economic and political contexts in daily lives as both consumers and citizens, which are embedded in people's identity and choices.

Therefore, diegetic workshops provide a space to make this happen by helping participants reflect on these intersections.

It inspires discussion about desirable and preferable futures: The main purpose of organising the workshops was to focus on preferable futures to understand what participants view as desirable. The discussions covered various aspects in both world building (macro world) and character building and lifestyle (micro world), reflecting the values people prioritise while shaping a future.

It helps to reveal potential user concerns and uncertainties: The discussions that were provoked revolved around future foods like cultured meat, insects, etc., which caused uncertainty regarding the acceptance of cuisines. Concerns were also addressed about how such artificial foods might impact traditionally evolved foods. There lie many uncertainties in terms of consumer safety, affordability, trust and accessibility.

It is not concerned with a finished design, it presents a disruptive space for emerging cultural artefacts: The workshops contribute to building a prototype that is exploratory and iterative rather than focusing on concrete outcomes. The content within the speculative

digital artefact will provide space for users to reflect. When feedback is gathered, the prototype will continue to grow and evolve, creating opportunities for deeper explorations of cultural nuances associated with food.

8.3 Working with futures

The futures cone provided clarity in determining which futures to explore based on the context. The workshops focused on preferred futures, aiming to identify values and concerns surrounding the future of food, helping participants express their visions.

The goal was not to create utopias but to generate insights that could contribute to building a prototype based on a plausible scenario. The artifact was designed with plausible futures in mind, ensuring it remained grounded. This allowed viewers to connect the present with potential futures more easily, enabling meaningful feedback on the prototype's effectiveness. When working with futures it is important to recognize that people's preferences do not reflect what will happen, but instead serve as a compass for navigate uncertainties.

Avoiding an excessively utopian or dystopian approach in building a world, presents challenges. To prevent ideas from diverging too far, values and guiding questions were used to maintain the structure of the ideas. Before this, the first workshop, grounded in existing research, acted as a foundation helping participants develop their thinking within a realistic context rather than immediately jumping into imagined futures.

Despite these efforts, dystopian concepts will arise and cannot be entirely avoided. However, anchoring ideas in established contexts remains crucial for example, traditional farming methods that embrace ecological principles but are at a risk of being lost or old agroecology methods that promotes regeneration.

Future workshop sessions must guide discussions back to present-day concerns, bridging speculation with practicality to have a nuanced vision of the future. This also means finding a careful balance between imagination and realism to prevent speculative futures from being misinterpreted as predictions. It is the designer's responsibility to integrate existing elements into narratives rather than making forecasts, ensuring the process catalyzes reflection and inquiry. Establishing imagination in relation to current

trajectories before constructing future worlds improves the credibility and relevance of speculative design, making it easier to validate those ideas to an extent.

8.4 The role of generative AI

Generative AI played a crucial role in shaping both Workshop 1 and the digital artifact through future food imageries. One of the key observations was that, despite being provided with specific prompts, AI often generated images of foods packaged in plastic. The images reflect a strong bias toward associating “packaging” with conventional plastic.

While AI proved very effective in producing aesthetic food visuals, there were limitations when it came to generating images with alternative packaging materials. When prompted with terms like “recycled plastic packaging” or “seaweed packaging”, the AI produced bizarre images. This indicates that AI models are trained with a heavy material bias reflecting how dominant plastic is in datasets.

If the current images need further improvement to remove plastic packaging, creating 3D models of future foods or re-editing AI generated images through graphic manipulation with non-plastic packaging would be alternative methods to achieve this.

Yet, despite its biases, AI holds potential as a research tool as it aids in making speculative products feel present and believable. By helping participants and users engage with future food products, it facilitated deep discussions.

9 Conclusion

The current food system is leading to global ecosystem collapse due to industrial harmful practices and overconsumption patterns. Malnutrition remains widespread, and fast food is both cheaper and more convenient, leading to increased consumption. Meat serves as an easy solution for nutrient intake, as it does not require people to calculate and combine nutrients from other plant-based sources. Additionally, intensive breeding of livestock is leading to biodiversity loss.

By considering these challenges, biotechnologists are developing solutions, but many of them remain techno-centric, often overlooking other subjects. This creates a gap, as future food research must pay attention to social, cultural and ecological aspects.

Concepts like design fiction enable extensive exploration in future contexts that require more dialogue. It plays an important role in mapping different futures, by helping people anticipate possibilities. Since food is a fundamental part of society, a true food transition requires interdisciplinary collaboration ensuring that it's seen as something that's beyond a consumable product.

Additionally, to contribute to the transition, DfsB can be applied to steer users towards sustainable choices as long as it is tailored to specific cultural and regional contexts. This indicates the need for external factors to be examined along with behavioral impact.

As consumers, we choose what we value. Values play a crucial role in shaping our lives and the world in which we thrive in. It becomes important to align with the right values as conscious consumers, considering sustainable and ethical choices before purchasing a product.

This indicates the immense scope for future food studies, and as the global context evolves, it reveals how imagining futures can help us recognize where the planet is headed.

Food is an evolving landscape, and while the future remains uncertain, we can utilize tools and methodologies embedded in design fiction, speculation, sustainable strategies, futures thinking and more to navigate it effectively by constructing worlds that are not far away from the current reality.

Appendices

A. The Food&Future poster used to recruit participants



B. Workshop plan

WORKSHOPS	Stage 1	Stage 2	Stage 3	Stage 4
(1) Photo Elicitation Goal: Record emotions/thoughts associated with common food products consumed vs utopian food products/contexts. (Total duration : 1 hr 15 mins) (offline)	Introduction to the project and workshops + Fika (setting the context) (5 mins)	Write down what comes to your mind based on the images you see (Phase 1 - A total of 10 images of current foods (30 seconds per image = 5 mins))  (Discussion session (5 mins)) 	Write down what comes to your mind based on the images you see A total of 7 images (2 mins per image = 14 mins)  (Discussion session (20 mins)) 	Final discussion and wound up
(2) World Building (What next?) Goal: Get insights about on future worlds. Total duration: 1 hr 30 mins (offline)	Briefing about the workshop (2 mins). What next? (Exercise 1a) : Imagine the year 2056. What would the planet be like? Ponder over it and generate a positive picture of the year 2056 by using ChatGPT Duration: 15 mins (Exercise 1b) : Based on the response ChatGPT generated, illustrate/sketch the world on the sheet as detailed as possible. Duration: 20 mins (Fika break: 5 mins)	Generate a positive picture of the year 2056 by using ChatGPT Duration: 7 mins (Exercise 2b) Based on the response ChatGPT generated, illustrate/sketch the world on the sheet as detailed as possible. Duration: 15 mins	Please present both your scenarios to the group (20 mins total) Wrap up.	
(3) Persona mapping Goal: Understand who they want to be in the future they built themselves. Total duration: 1 hour 20 mins (online on miro/offline)	Summary of previous sessions and briefing about the workshop (2 mins). Exercise: Imagine yourself in the (positive) world you built last time. What would you look like? What would you be like? What would your lifestyle be? Use the persona canvas to describe who you would be in 2056. Duration: 30 mins	Exercise: Based on your lifestyle, try to imagine what you would be eating in 2056 by filling the sheet. Duration: 20 mins	Presentation (total): 20 mins & wrap up	

miro

C. Screenshots of the online survey form used for participant recruitment (empty form)

Food&Future Workshop (series)

B *I* U ↺ ✕

Hello Foodies!

Did you know that our food practices are the number one driver of climate change? Have you ever wondered why that might be? Whether you're concerned about climate change, curious about the future of food, or simply want to have some fun around the topic of food—these workshops are for you!

Join me in exploring the utopian world of 2056!

Expect free fika (because snacks are life!), creative sketching, brainstorming sessions, and engaging discussions with a vibrant participant group.

Since this is part of a master's thesis project, consent forms will be provided before any recordings.

Workshop Details:

Maximum Participants: 8

(Note: Workshops 2 and 3 will build on the activities and insights from Workshop 1. Participants are required to attend all three sessions for a complete and immersive experience).

Tentative Dates:

Workshop 1: February 15th (Offline/remote)

Workshop 2: February 21st (Offline/remote)

Workshop 3: February 22nd (Online)

The exact location for offline workshops will be confirmed after registration. A WhatsApp group will be created after registration, and the group link will be sent to your email address for updates.

(Note: Dates might be adjusted based on participants' availability during the weekends of February 15th - 16th and 21st - 22nd.)

What's your name? *

Short answer text

Which country are you from? *

Short answer text

Which is your age group? *

☐ 18-24

☐ 25-30

☐ 31-40

What is your dietary preference? *

☐ Non-vegetarian

☐ Vegan

What is your dietary preference? *

☐ Non-vegetarian

☐ Vegan

On which of these dates will you be available? *

☐ FEB 15TH

☐ FEB 16TH

☐ FEB 21ST

☐ FEB 22ND

☐ On all the dates

Your email address: *

Short answer text

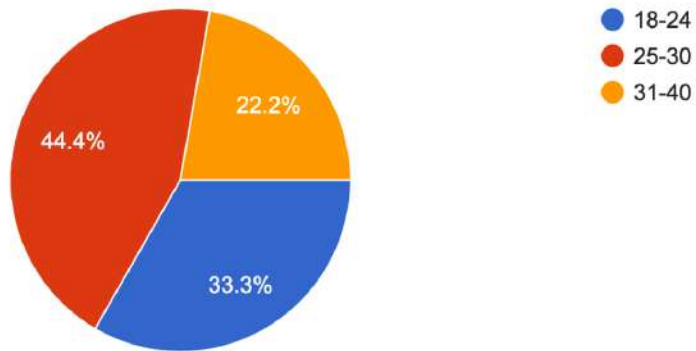
Your WhatsApp number: *

Short answer text

Results from the respondents

Which is your age group?

9 responses



What is your dietary preference?

9 responses



Which country are you from?

7 responses

India
Sweden
China
Sweden
India
France
Finland

D. Post-its from workshop 1 (phase 1)

Image 1 (Asian food with hot rice)



Image 2 (Cheesy food - Lasagna)

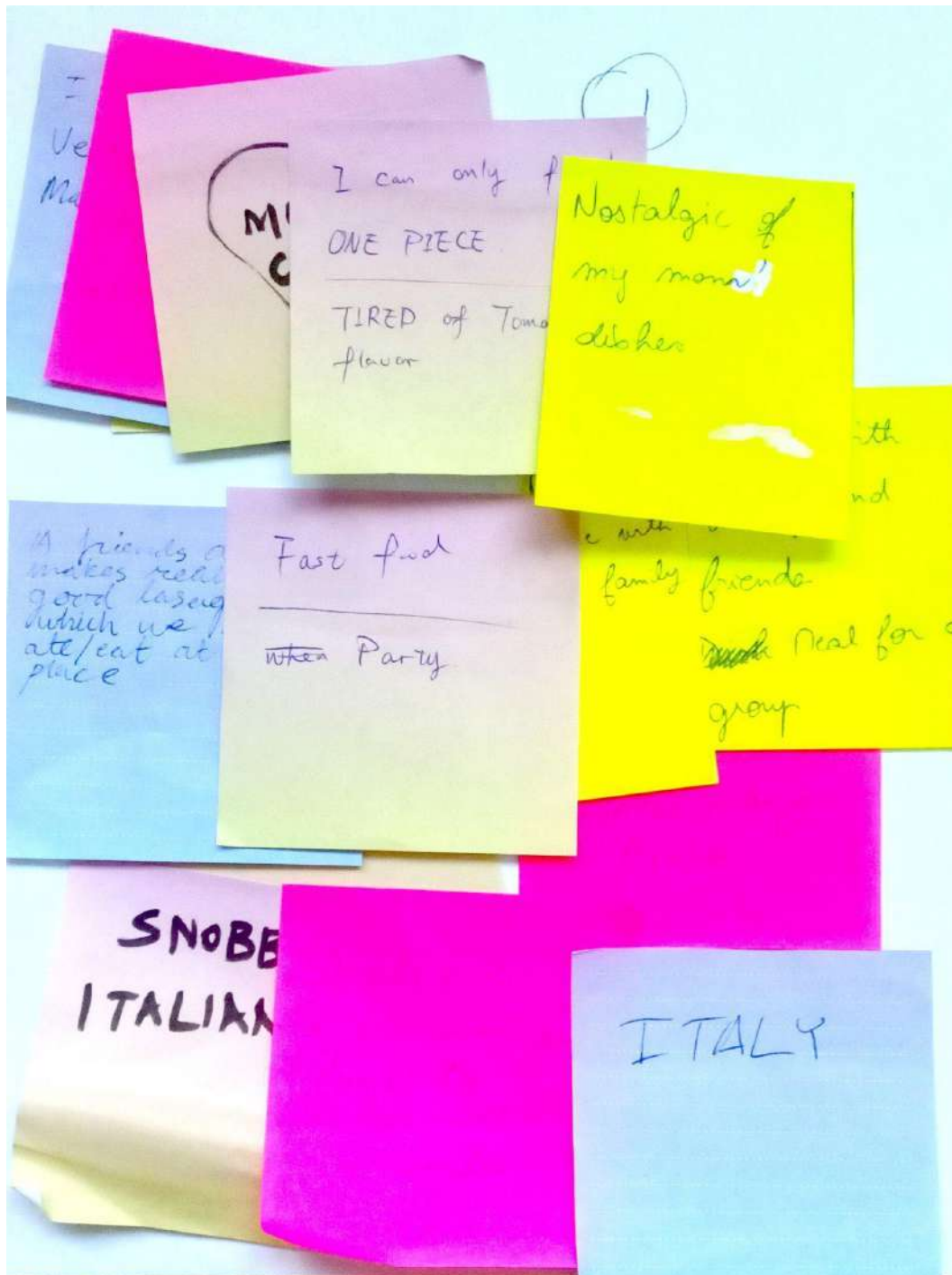


Image 3 (Ice cream)

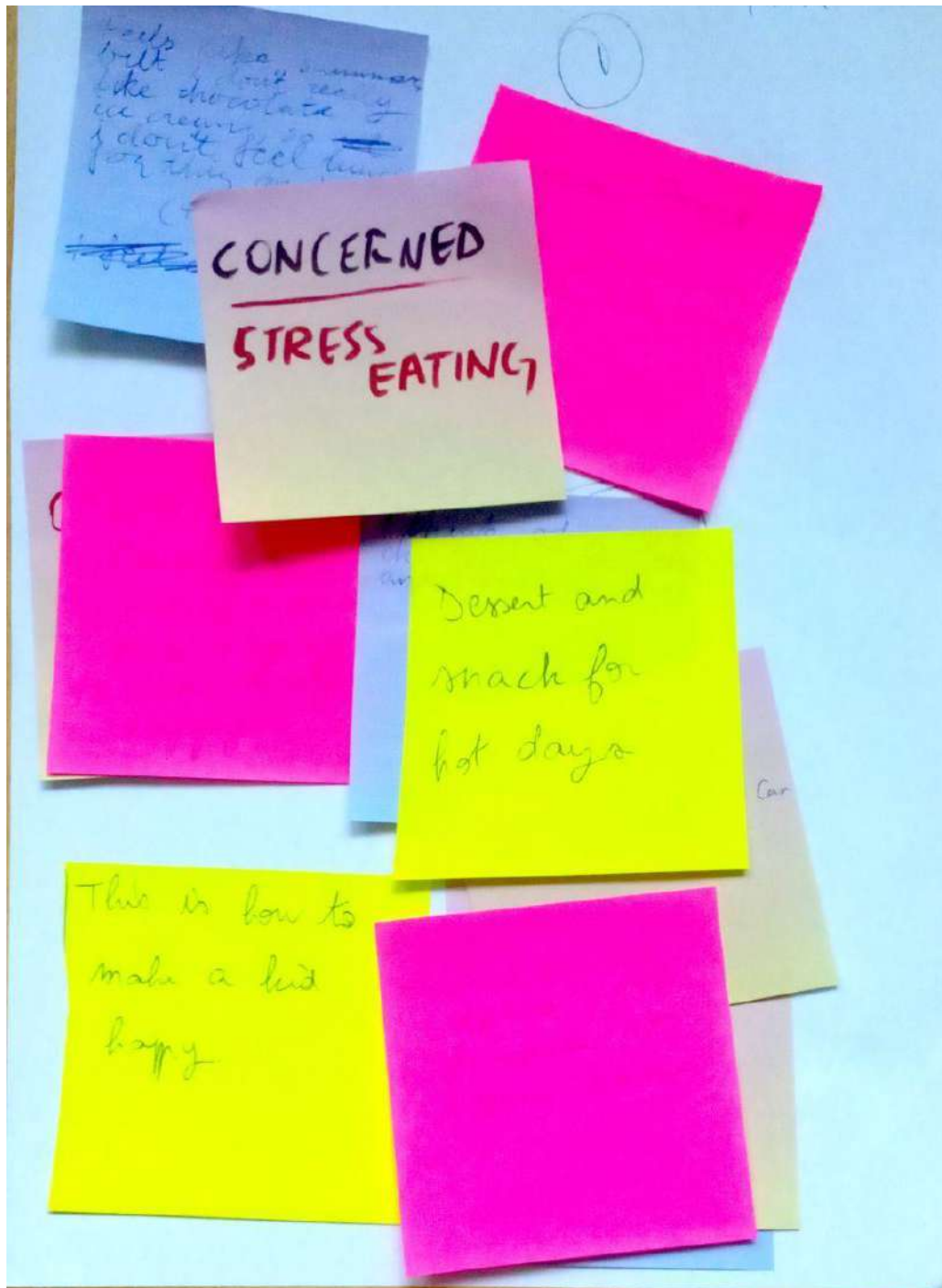


Image 4 (vegetable bowl)

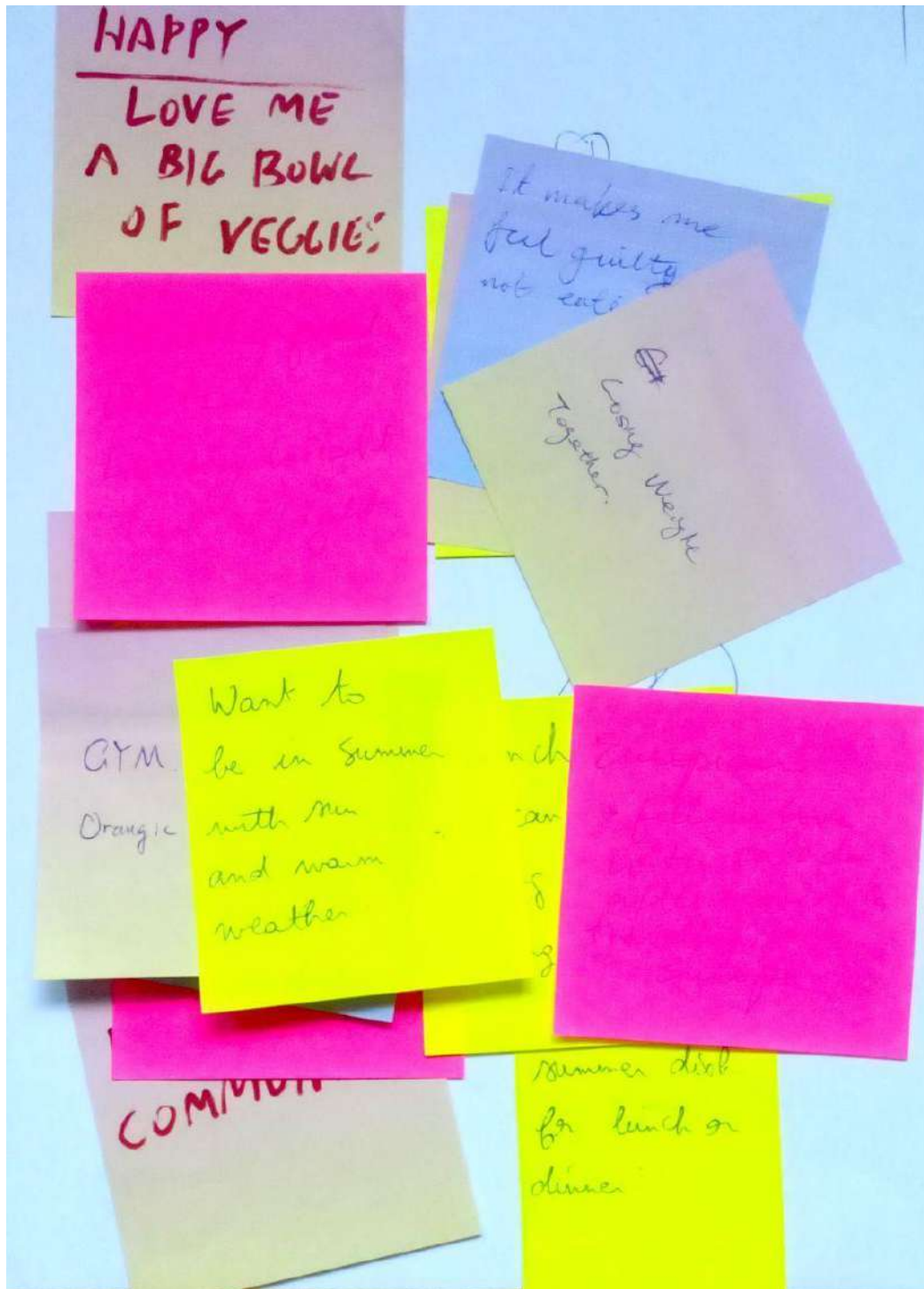


Image 5 (Seafodd- Fried prawn)

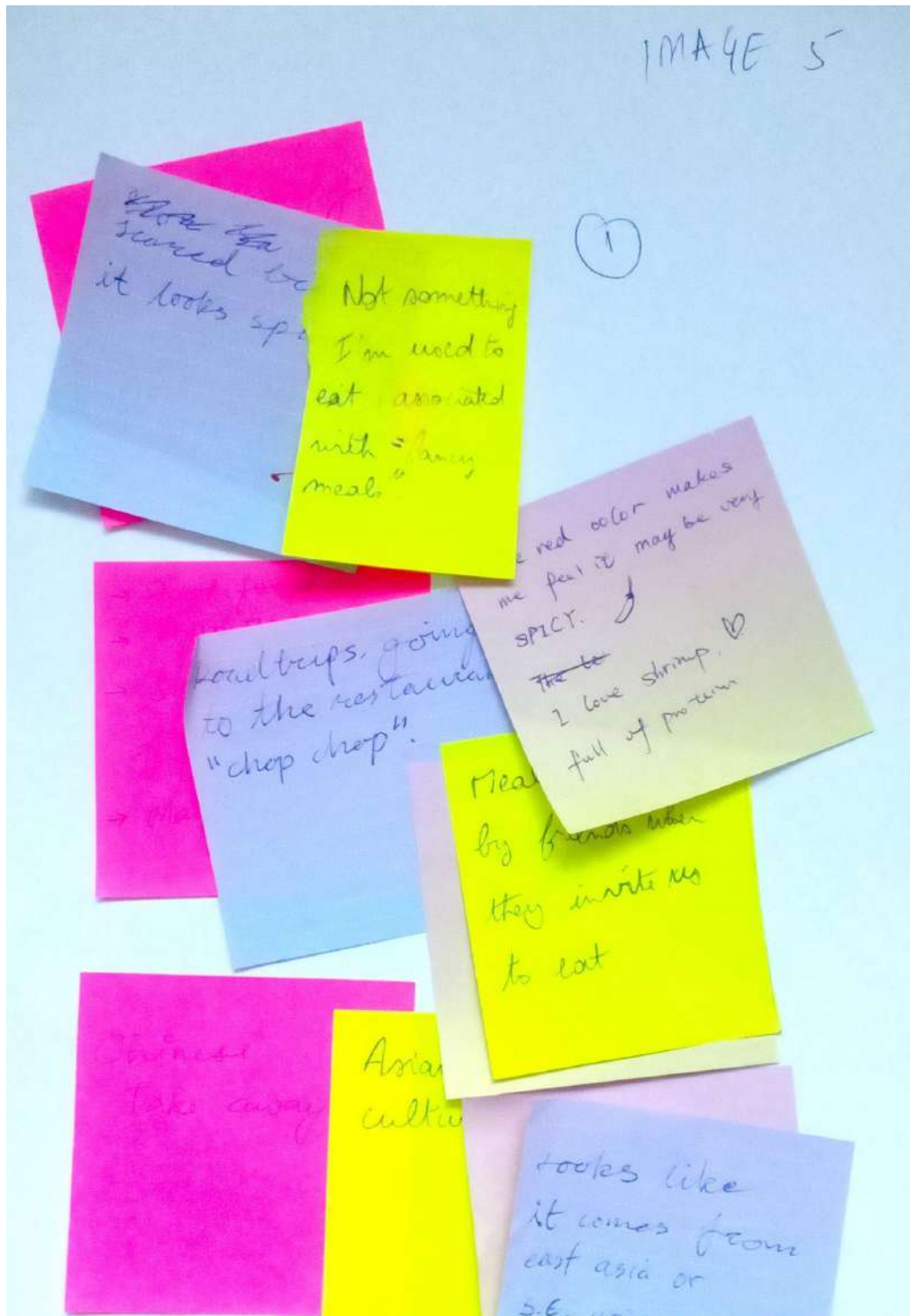


Image 6 (Fast food - beef burger)

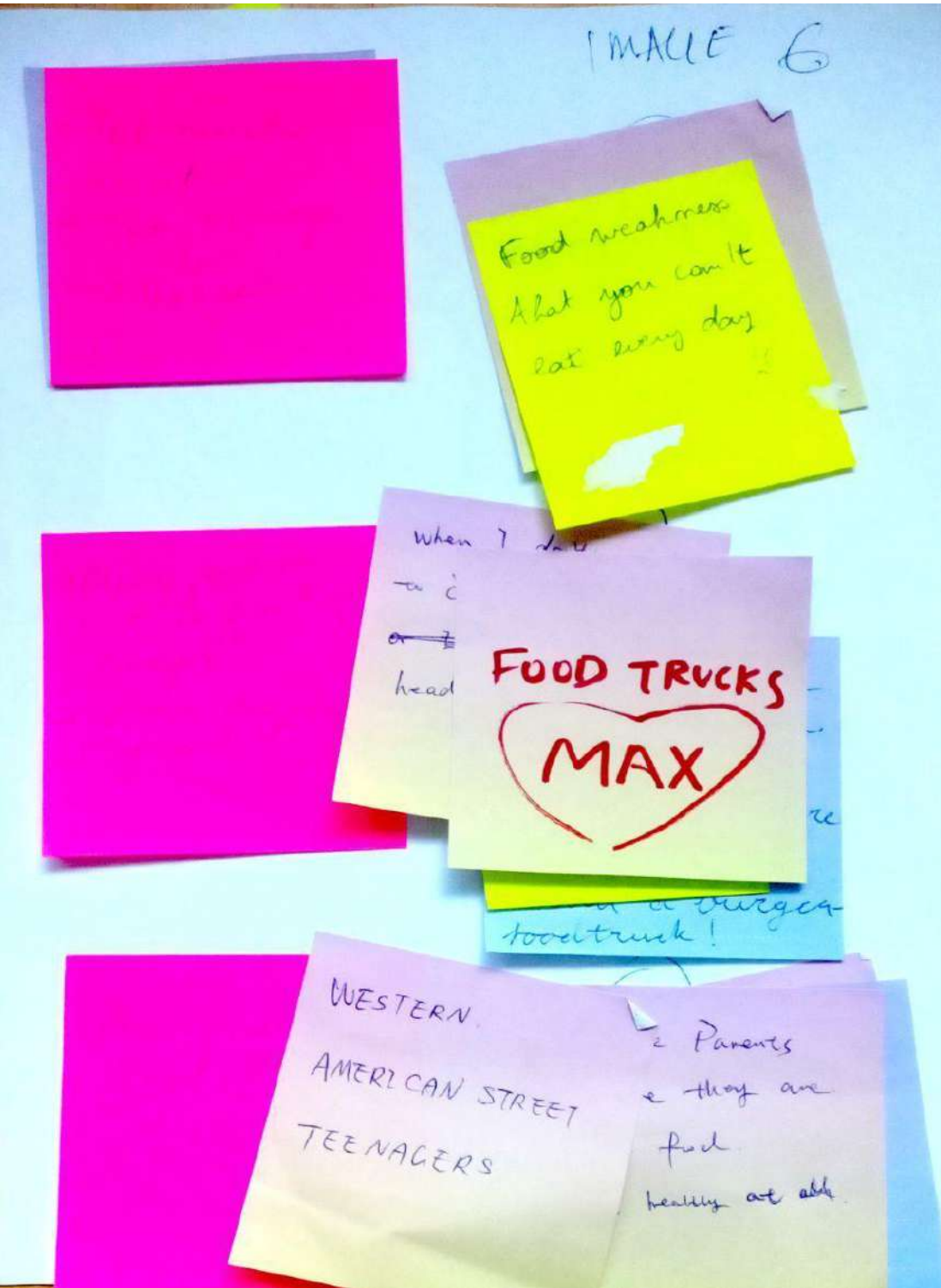
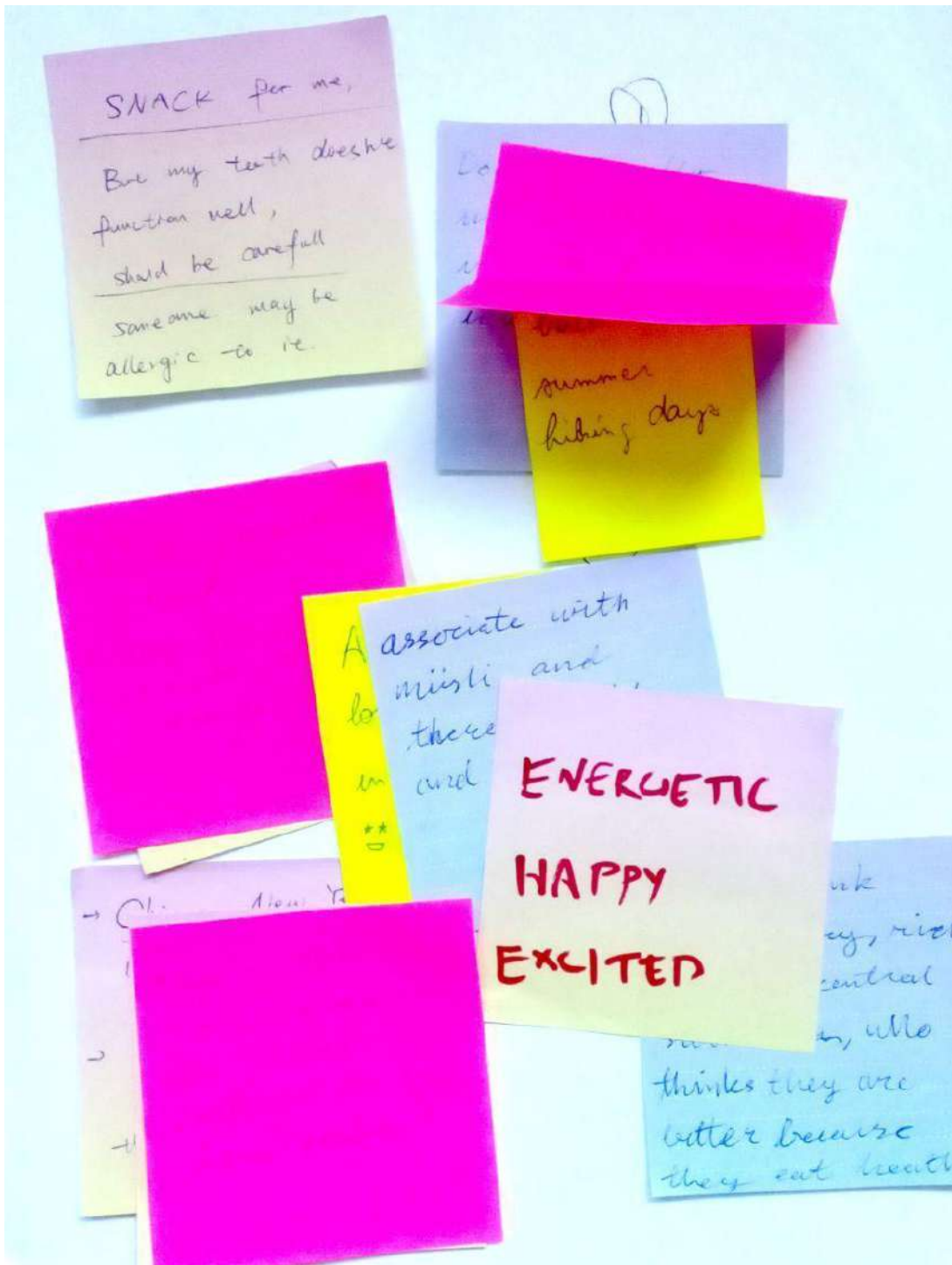


Image 7 (Dry fruits)



E. Post-its from workshop 1 (phase 2)

Image 1 (Live insects)

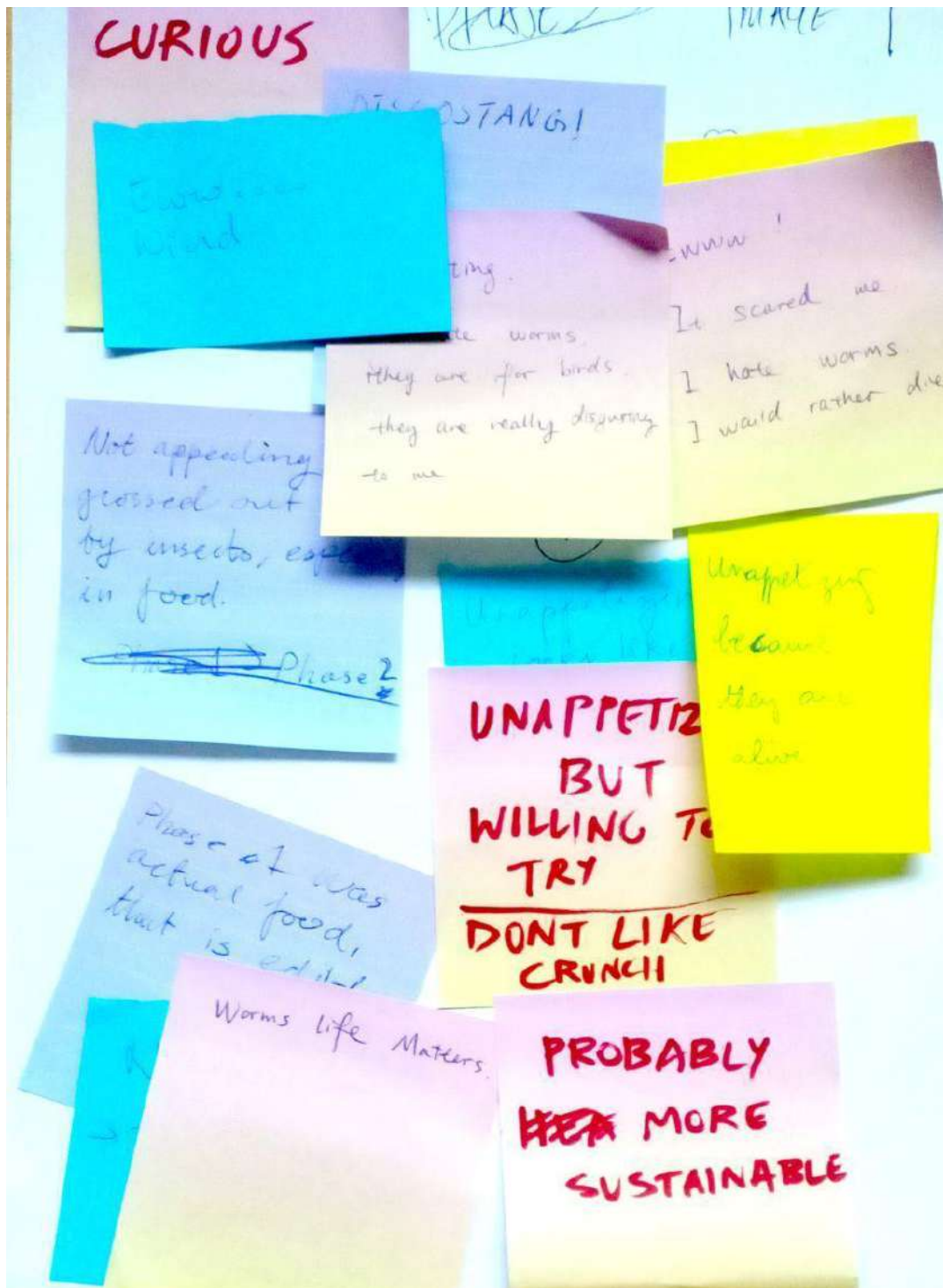


Image 2 (Mushroom cake)

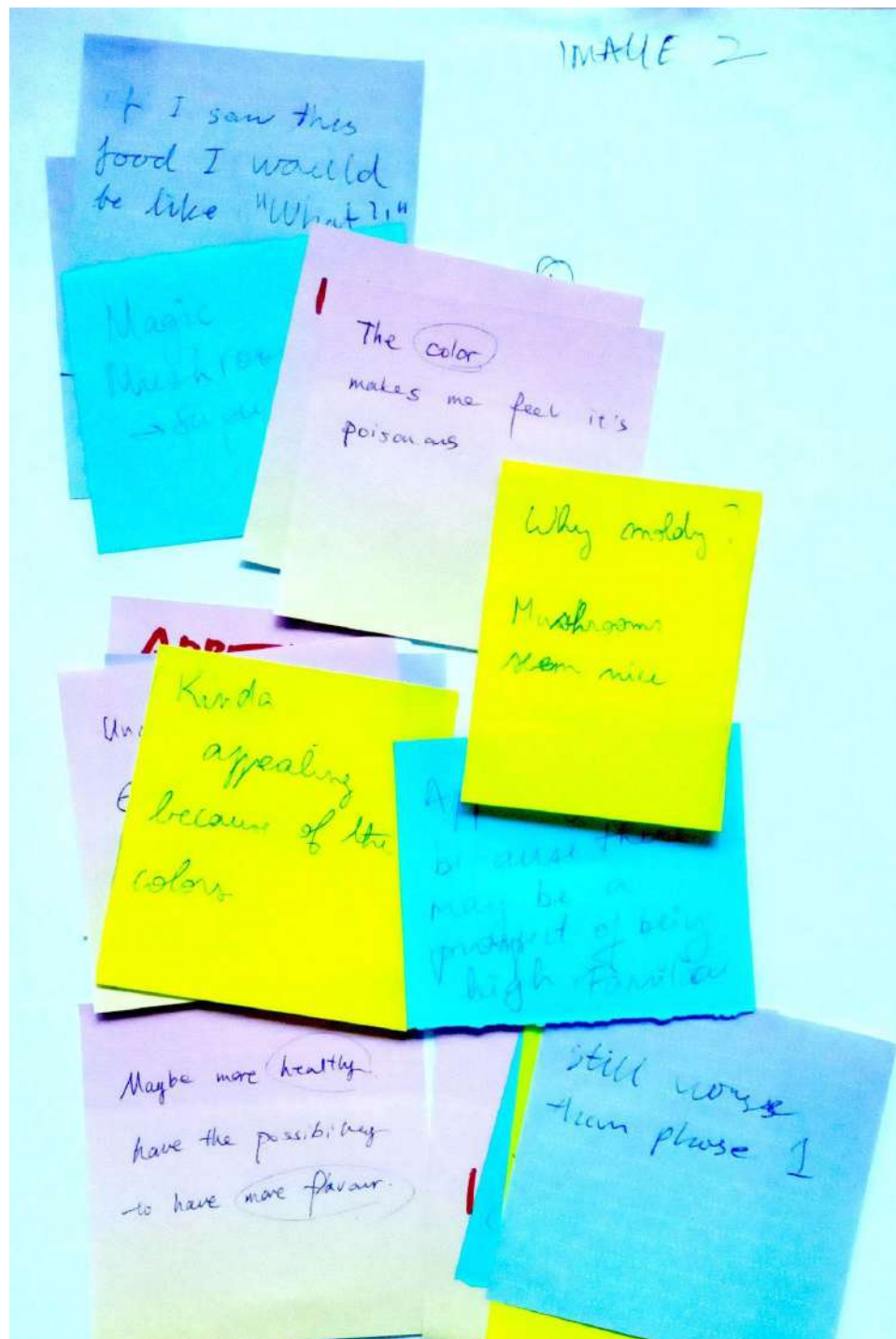


Image 3 (Consumable moss pizza)

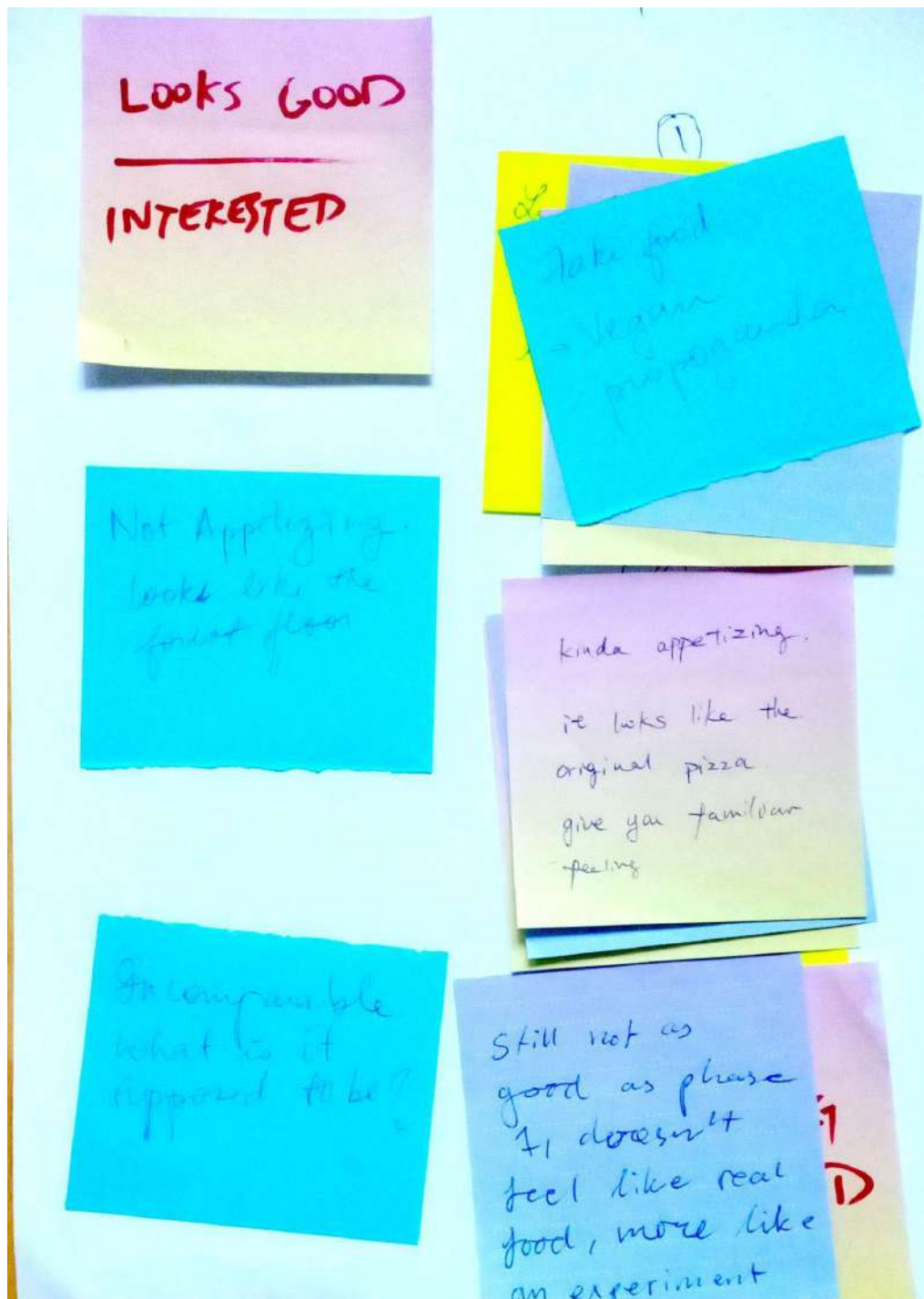


Image 4 (Macron with a consumable package layer)

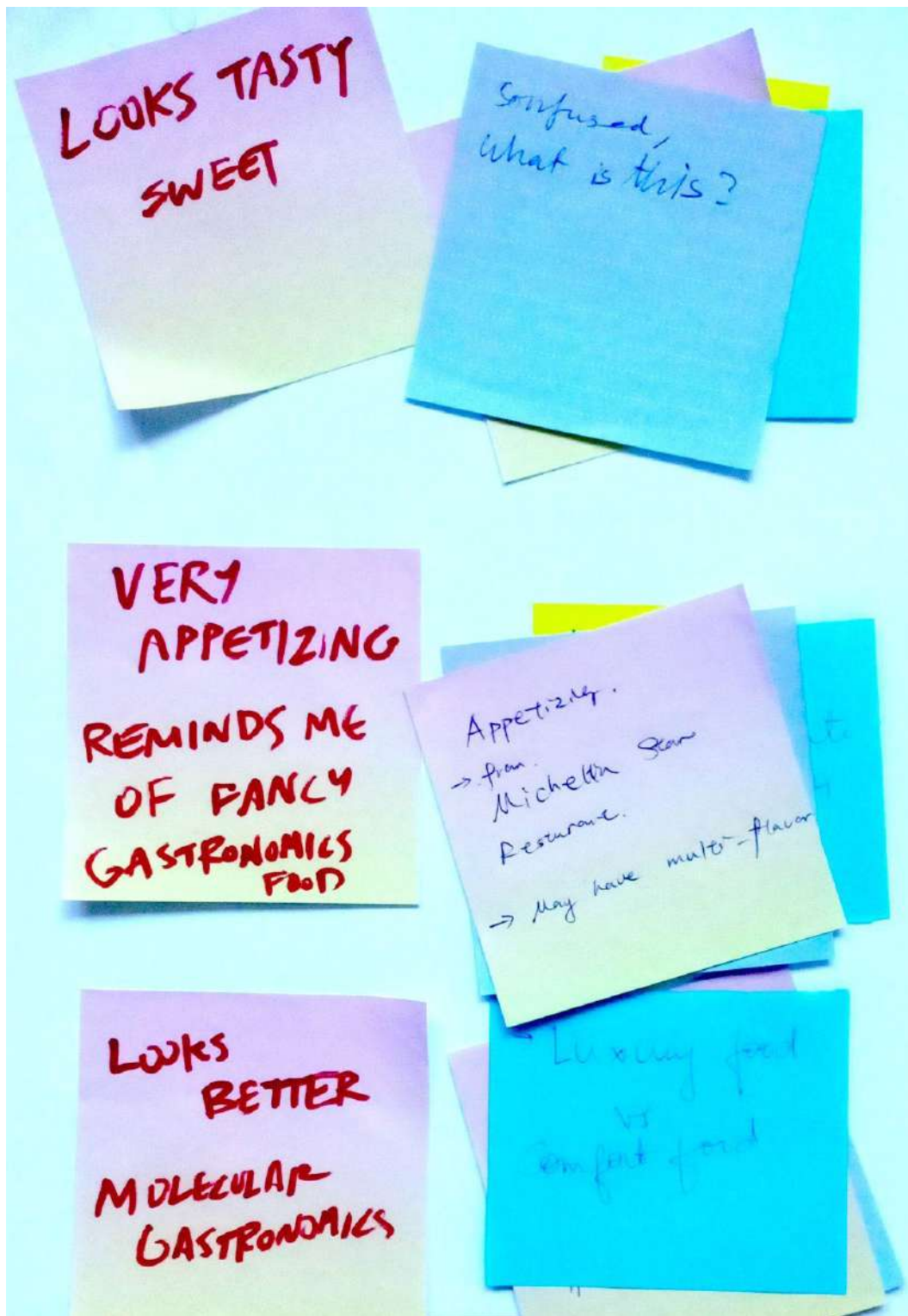


Image 5 (Cultured meat)

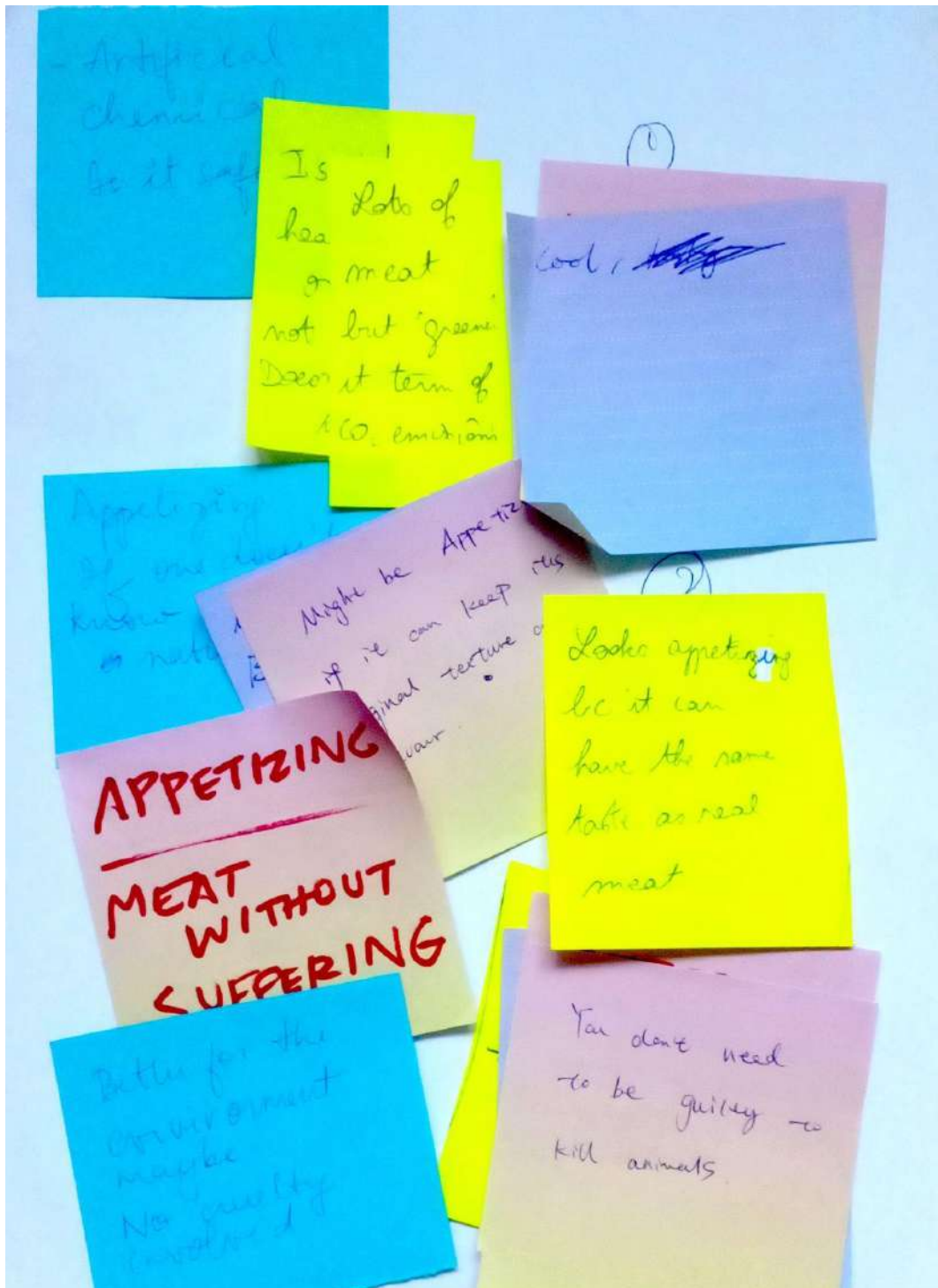
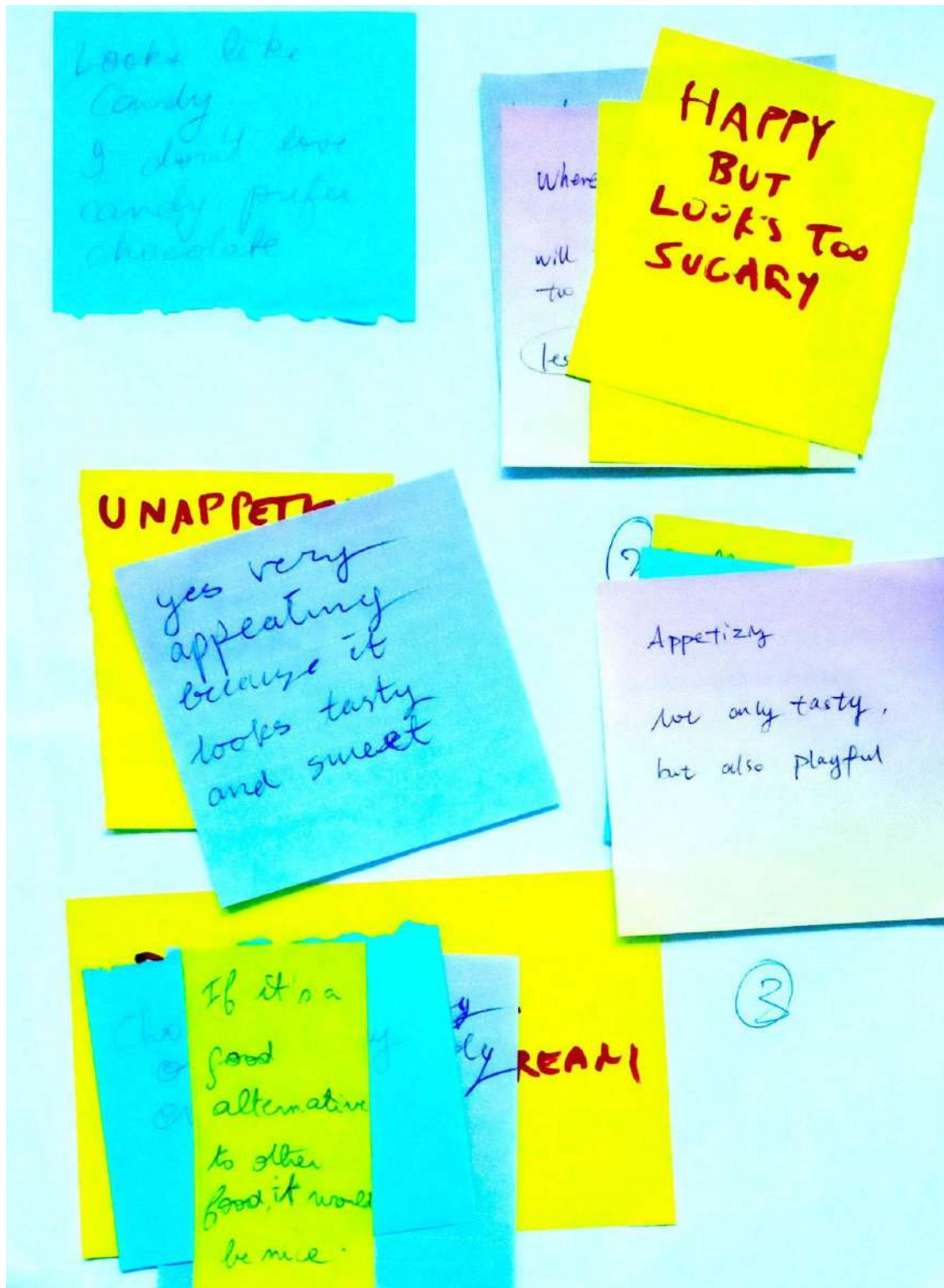


Image 6 (3D printed dessert)



E.. Insights from World Building exercise (Sketches and transcribes)

Participant 1

“Micro farms, in this case it’s a suburban setting that we all individually are . So we manage these farms as a community, as you live as a community, and maybe the farms are more based on permaculture values, and AI could be used for monitoring the farm, irrigation, these kinds of things. And it’s more, I imagine, a partnership with AI, but more also a partnership with people you live around and with.

If you go to the next one. It’s again, like, what could it be if you’re in a city setting, I imagine that buildings have to start to accommodate a space for growing food and not just for living. And this is like something like that, where each of us have a garden. And the garden again could be controlled or monitored by AI, so it doesn’t have to be our primary occupation as growing food. But, so that could be the partnership with AI, that would help making this process a bit easier. And maybe it’s connected to some kind of an app, where it’s just like the farm will kind of game, but actually it’s connected to a real thing, where it tells you, okay, your tomatoes are ready for harvest, or it’s time to plant something new.

I don’t imagine that we need robotic AI to do all the work, but more that it can help us to say, okay, it needs to be watered, it does the watering itself. But it tells you, okay, this is ready, time for harvest.

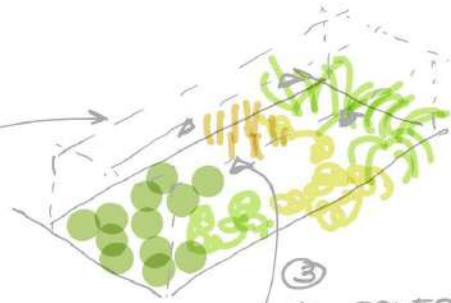
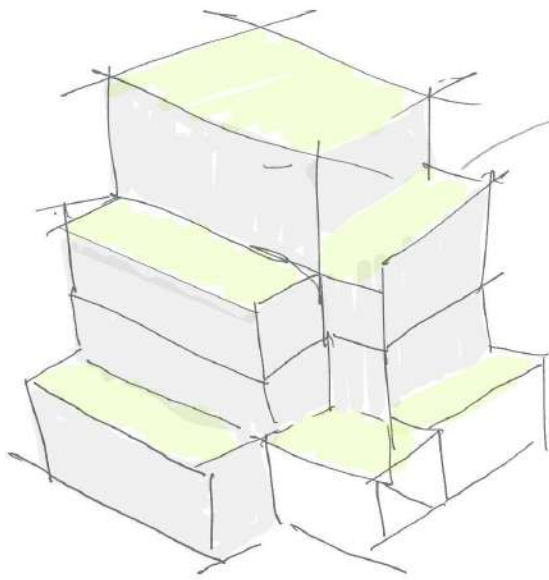
Again, it’s a connection, like, how would grocery shopping look like? I imagine it could be more like a food exchange thing. So, like each of us can grow what we want or what we can, and then we exchange the excess with other people, with other things they might grow. So, it’s no longer a direct exchange for food for money, but it’s like you’re all creating different kinds of value in terms of different products. So, re-imagine what grocery shopping should look like? I also imagine that we should have a world where we ban any kind of chemical additives, no microplastic plastics, no monoculture. Like we imagine the laws, the laws have to be really strict because all of these things are creating all the diseases we currently have and the challenges we face.

Like monoculture causes so much biodiversity loss. So, these kinds of processes that are currently in farming, I would imagine we should ban them and focus on producing real food that is highly nutritious. So, for me, you have to grow really highly nutritious food, you have to grow it with highly fertile soil. I don't think you can separate the soil from really good food, which I think is the problem with hydroponics and stuff like that today. Because hydroponics is where they grow the food in water. They tend to have lower nutritional value. So, I still imagine that we start to treat the earth as precious and I always use the metaphor of like a pregnant mother. Like you wouldn't starve this mother and put chemicals in this mother, you would actually nourish it with all the things it needs to grow the food. So, that kind of.

Yeah, it's kind of this where we take care of the soil and the soil also makes sure that we get highly nutritious food. Because it's known that food like 50 years ago had higher nutritional content. Like oranges would have higher vitamin C than oranges of today. That's because our soil is depleted. So, we should not even say go back but like know what works and actually that should be the law and everything else should not even be allowed. Because it's like you don't have to think of feasibility. And then I connected this to a farming app or like how we share it. So, I imagine each one of us could be like seed savers because there are so many seeds that get lost. So, let's say you grow like some types of tomatoes, I grow some types of eggplant in something and all of us like are both like we are all like both producing some food but also saving and becoming like little warriors or like kind of like I can't remember, someone who takes care of this heritage of seeds. And then whatever we have, we put it on this app saying I'm growing this, you're growing this and on the day of the harvest you say I have this, I have like I don't know 10 kilos of this or 5 kilos of this and then you check and exchange with what you want.

Whatever you cannot exchange then you can either process it into some kind of long term storage like either can it or make jams out of it and then you can exchange it. So, people are more conscious of what they're eating. Because I think growing food can be both for your health but also for your mental health. So, no matter what jobs we are doing in offices or whatever it could be a way to actually like a hobby that boosts your mental health by connecting to nature directly.

I think today the disconnect we have from the food we are eating is like a major problem. So I think if we like, I think of it at the values level if we connect that connect like we go back it really like connect with the food we grow then all the other solutions would come out of that connection”.



③
AI - POWERED
IRRIGATION +
MONITORING

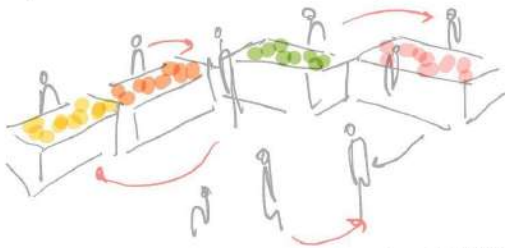


④ GARDEN CONNECTED
TO APP TELLING YOU
HARVEST TIME & TO DO

② GROWING SOME OF THE FOOD
IS NORMAL AND EXPECTED

BUILDINGS IN CITIES ARE ALL
DESIGNED WITH GROWING
SPACE.

⑤ GROCERY SHOPPING

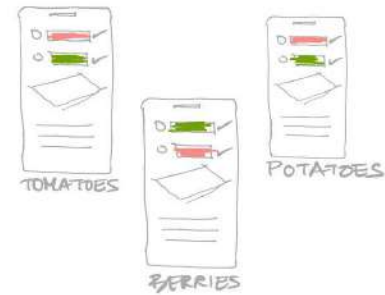


- FOOD SHOPPING = FOOD EXCHANGE
YOU GROW WHAT YOU CAN &
EXCHANGE EXCESS FOR OTHER
FOODS.

⑦ HIGHLY PROCESSED & CHEMICALS IN FOOD IS BANNED.



⑥ FARMING APP FOR SHARED FARMING



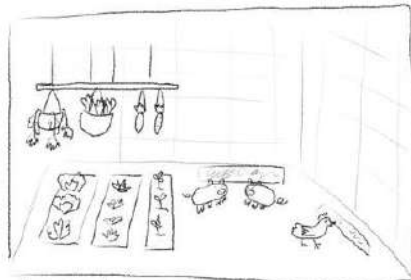
- EACH ONE ADOPTS
A TYPE OF SEED &
COLLECTIVELY WE
CAN PRODUCE.
- SEED SAVERS.

⑦ GROWING FOOD FOR HEALTH & MENTAL HEALTH → Connecting to Mother Nature.

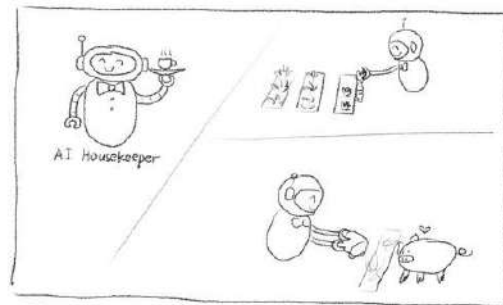
Participant 2

“Also, I’m thinking that if there’s not enough space, it could also be the idea like Lotta’s, like there’s a common area to do some farming. And then there’s AI housekeepers who could help to grow the vegetables to take care of the animals. And also the AI housekeeper could handle those cooking things and also do some like personalized analysis about your eating habits, like help to analyze like every day how much proteins or fats you take and then give help to optimize the nutrition and give advice on the like your daily diets. Yeah, that’s basically the ideas. Because if you like homegrown foods, like vegetables, like those meat things, I feel it’s like more safer and possible. And also one thing is like if you grow the food at home, it also reduces transportation needs, I think, the consider of the sustainability, like lowers carbon emissions somehow”.

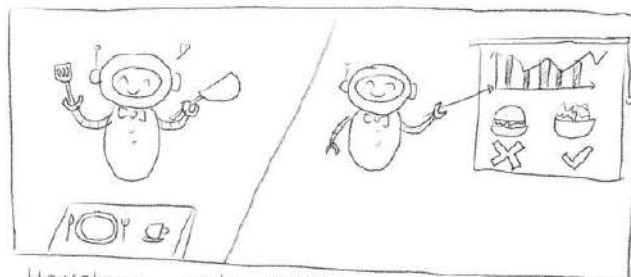
Primary values: Safety, Trust
Secondary values: Convenience



Everyone has a greenhouse at home,
growing vegetables and raising animals.



There's an AI housekeeper who taking care
of the plants and animals.



Housekeeper cooks everyday meals

Analysing your daily diet and helping to
improve it.

Participant 3

“Yeah. Mine was, well, not as nicely drawn, but It's okay. Sustainable and innovative. So mine was not as much of a total revamp, I guess. Was more, I guess I tried to see more what might be feasible, or like more feasible, I guess. So the first picture is how you can grow stuff more sustainably. You know, when they let the field rest and they rotate it, they do it in smaller patches, so that, what's it called? you can have like flowers scattered around or like whatever, and then the pollinators can, what's it called? Like take the pollen or how do you say it? Pollinating. Yeah, exactly. And yeah, which will also help like save a lot of like bees and stuff. And I thought, and also the nutrients, like different plants use different nutrients. So like if you rotate in smaller patches, you won't like deplete all the nutrients in one area and then move on. And then I was talking about self-drive or talking, writing, drawing about self-driving tractor and like drones and

stuff. So that you don't need as much manual labor and that these could all be automated and controlled by like one farmer for like a huge area.

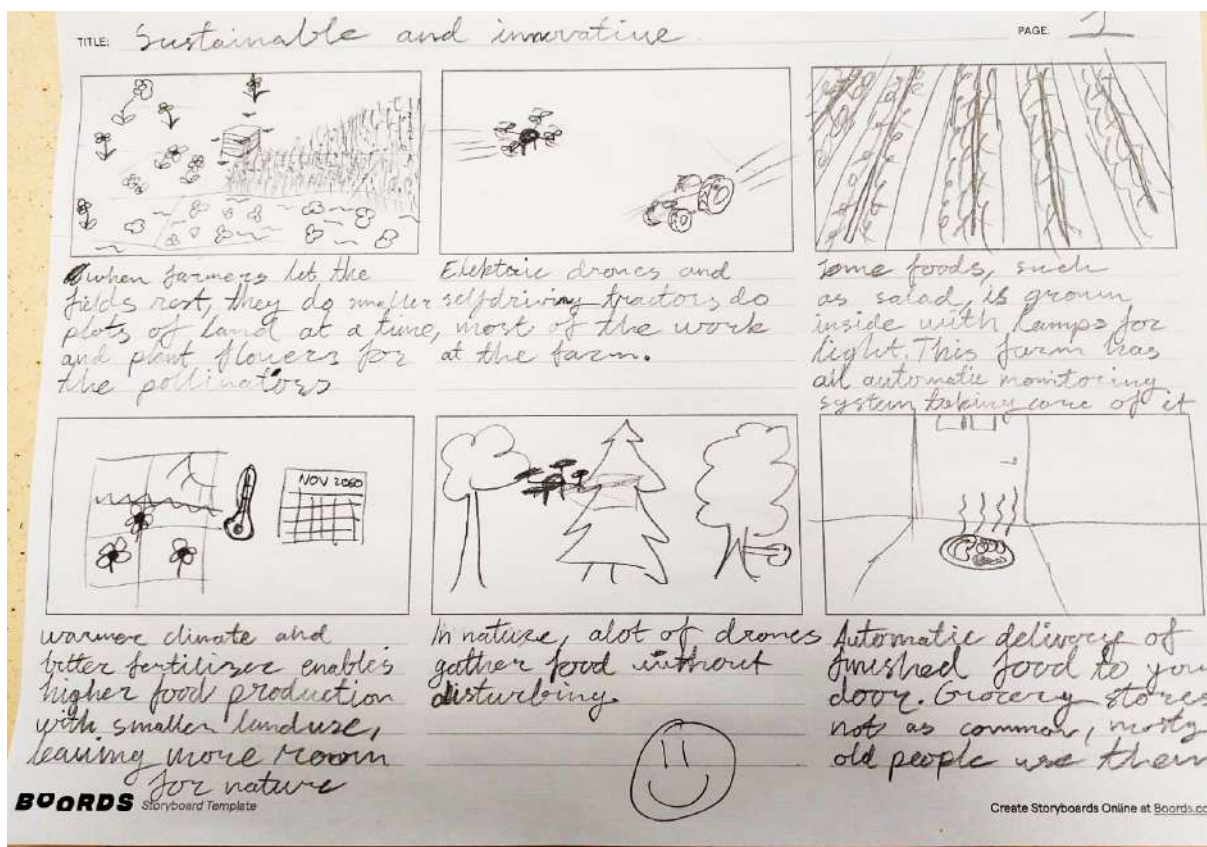
And with like, I don't know, some cameras or sensors or whatever. I don't know. And then some foods could be grown indoors, like they have in ICA in Torneby. They have like the salads inside. With like automatic monitoring system that like gives water and nutrients and all of this. And I was thinking of maybe, you know, use global warming to make something good. So you can see there November 2060 and we can still grow food outside even though it's November. And you could, what that would lead to is less land usage for more food. So that you could get like more like forests and natural areas. And also in that you can have better fertilizers so that you can get even more food. And yeah. And then for like berries and mushrooms and stuff. Again, drones flying around to not like, instead of having big machinery that destroys nature, you can have like just flying, pick a berry and I don't know. And then the last one was about the grocery stores. There was a question. And I thought that there would be like delivery will be like more common in the future.

And that only old people born like at this time would still go to the grocery store. And so you would deliver like a pre-made meal to wherever you live. I mean, it seems like it's becoming more common.

So I just thought maybe, I don't know.

And yeah, I mean, I couldn't fit a lot in this one, but I guess some. So yeah, trying to make it sustainable using technology, I guess. So that we can do it for a longer time.

Just one thing that strikes me is the warm climate is, we'll say, correct in most of the parts of the world, but global warming is also influencing extreme weather conditions. And this is one very big point for farmers that they can't rely on anything according to the weather because they can't rely on what they did previously because the season and everything has changed. All the weather conditions has changed. And so they just can't really. Yeah. And nothing is reliable. And so they just sometimes lose a lot of their harvest record because of one extreme weather condition. So I think it's, yeah, I think that can be very difficult for farmers in the future. So yeah, we may try to get more resistant culture. But if modified genetic plant doesn't work, it will be”.



Participant 4

"Sustainability for food safety, affordability, and like, in general, it's farming still led by human, but with the help of technology. And I found it hard to dissociate what is my ideas with what can be done. So it's less innovative than what I want to say. So I would say that insects can really be a big part of our our alimentation in the future. And I think it can be possible to have insect farms in the city. With, like, factories to transform insects just next to. And I think, yeah, this can be still in the city. It can be in the city because I feel like we can get lots of insects in small places. Now we don't have all the rules. I don't know how it will evolve, but it's not like chicken when it's better for them to have more space and everything. I don't know how research about insects intelligence will change everything, but I guess right now we don't have any specific rules about the comfort of insects. How they must be stored.

So I would say those kind of farm can be in the city, but I believe we still need outside farm, like outside of the cities and the countries in the countryside. With maybe thinking

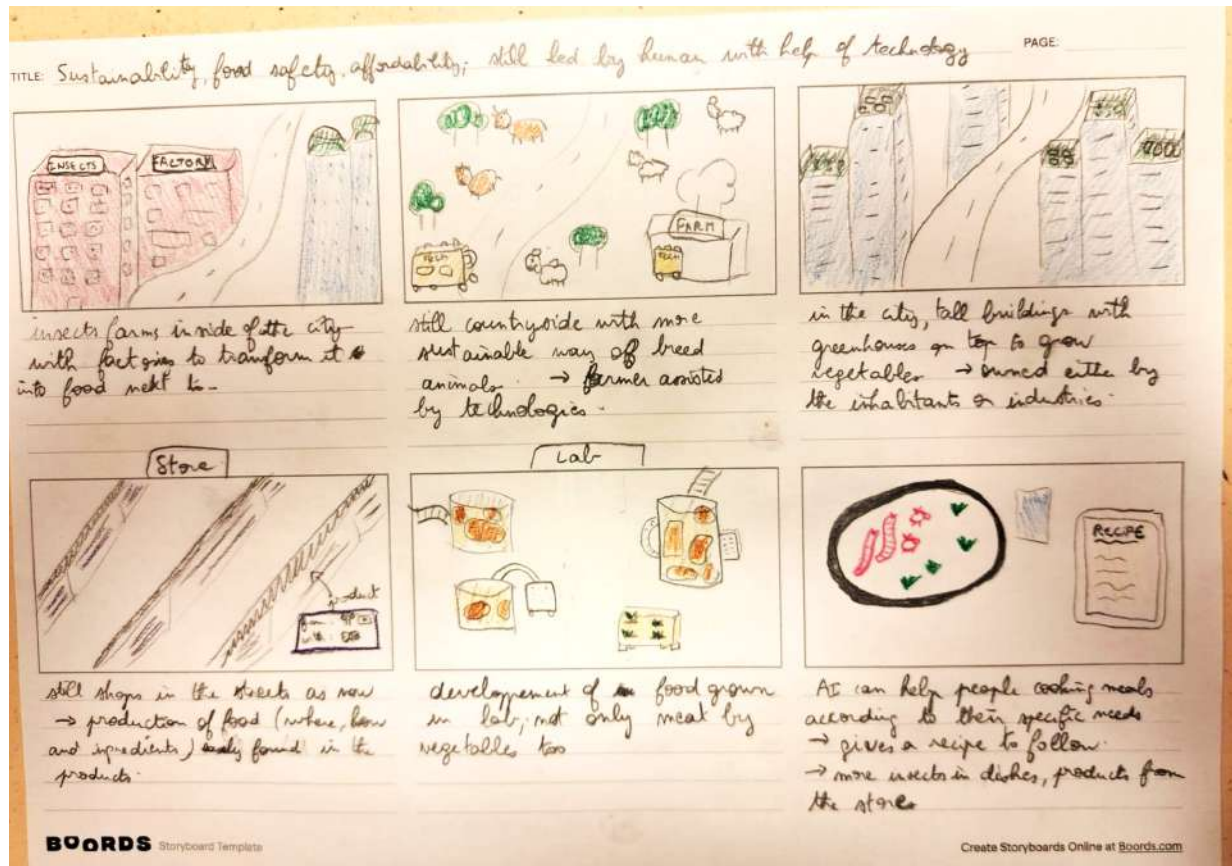
about a more sustainable way of breeding animals. And this can be used by the help of technologies because technology make it easier to have a bigger production. But without like trying to think about a more sustainable way to do it than right now with intensive farming. But I think for the ecology and for the natural cycle of life, it's still important to have real farm. I thought about also, as we talked before, about greenhouses or whatever in top of each building or all the building that can be kind of can get those greenhouses. So it's either managed by the inhabitants or the industry. I think I don't believe many people, especially in the city, will be able to take time and to have the will to do it so it can be still managed by industry company.

But still we can try to develop more farm into the city”.

I believe shops can still exist, but with more rules about disclosing where, how and everything about the food and the project we are buying. If it's like, I don't know, maybe a carpet footprint scale on each project. Say this is the carpet footprint of this project is less than this one or stuff like that. And maybe in parallel of farm, I don't know if both or just one will be developed more than the other. I don't know. Or maybe trying to develop food in lab to make it. This one is more linked with food safety. It's to have enough food for everyone. I guess if we want enough food for everyone and not deplete everything, we should keep doing research on food in lab. So that's, yeah, we will have enough food for everyone. And for the first meal of the day, I put some insects because I think it will, yeah, people will try to take their proteins into insects. And I believe AI can help people cooking their meals, for example. Yeah, you write your specific needs and the AI can help you create a recipe so that it's easier to take something that you're not used to to buy or to eat because it's kind of, you know, it's good for your health and that you don't have to think about it.

And yeah, maybe try to get something more like close farming. But this is linked to the store where you know exactly where the product comes from. So after it's just your ethic and your like you and yourself about do I want to you and yourself or maybe government rules about is it better to take all these products. So yeah, based on food safety and human and technology as a process.

Yeah, I was gonna say like animals are very hard to fit into at least mine and make it more sustainable. Like you can't really change that much because they're like living beings. You can't just put them in a high-rise building and like, you know, they still need their pastures. I think this is a really good solution”.



Participant 5

"I call this farm to table City Edition, um, and values. Well, the first one is the connection and the second value is, um, uh, I would say both like coexistence and then a circular economy, um, so here, basically, the thought would be that, um, the visitor or the customer comes into this building, which is, um, which is in its offering different products, uh, on different floors, like first, there would be like maybe plantations of like different vegetables and herbs and that kind of stuff, and when you go the floor up, there is like the fruits, uh, yeah, different kind of fruits and maybe some flowers that you could pick yourself. And then, uh, on the, on the upper, like the top floor, and the pictures or the drawing isn't that clear, but, uh, I was thinking that it would be like a field of grains. So basically, the one or the customer who goes there can pick whatever they like and then, if they want to, so they can like to use the um, what is it?"

The professionals who are on the first floor to maybe, if they want to, so they can just directly bake it into a bread, or they can take it like as they want, like as it is like grain, um, like back home, or they can maybe help with the different, I don't know, if they want some kind of help with making it to um, or like further making it into like some kind of product, um, the different things they collect there, um, and here, um, I would say that, uh, even though, like, like for me, I think it would be like it was so imp um, the most important thing that, um, even though, like the world develops, so I think, like it's still very important to kind of um keep um the different skills we have when it comes to like different farming and how we kind of like, and also then we come to the coexistence that, how we like, how we um, yeah, basically how we co-exist and those that would be live, like having those kind of uh places, uh, in the building. So maybe they would have like a farm somewhere else, but that could be like a tiny portion that they will bring to the city, um, to like make it even more accessible to everyone

I just like kept it, kept it like that so you could see like kind of like a- what is it cut, cut through so you could see like, but I don't know, cuz of course you need the sunlight and everything.

like, so they go and pick their own food or like, like, yeah, they can pick like whatever they want and like based on what they have picked, so they will pay to the directly, I would say directly to the farm.

That has like their own plantations there. Yeah, I like the, the concept because like if we can consume most of what we eat locally, that's grown locally, like not even outside, like that would be like the amount of uh, the carbon footprint to transport food is so high. So even if some of the food is grown in place, like if every supermarket had a big garden on the roof terrace, reduce the impact of like we can't grow everything. So I'm sure we can't grow rice and wheat and things like this, but some things you could grow and that already like, like I imagined in the city, not just a supermarket, but every building, the roof terrace is converted into some kind of community farm that the community takes care of and they can please salad that we don't have to like produce salad outside the city and move it and pack it in plastic. And transported using fuel. I think this kind of idea would reduce that significantly. But production, transportation, it's a very nice model. Like really farm to table”.

Values: #1 Connection
#2 Co-existence, circular economy

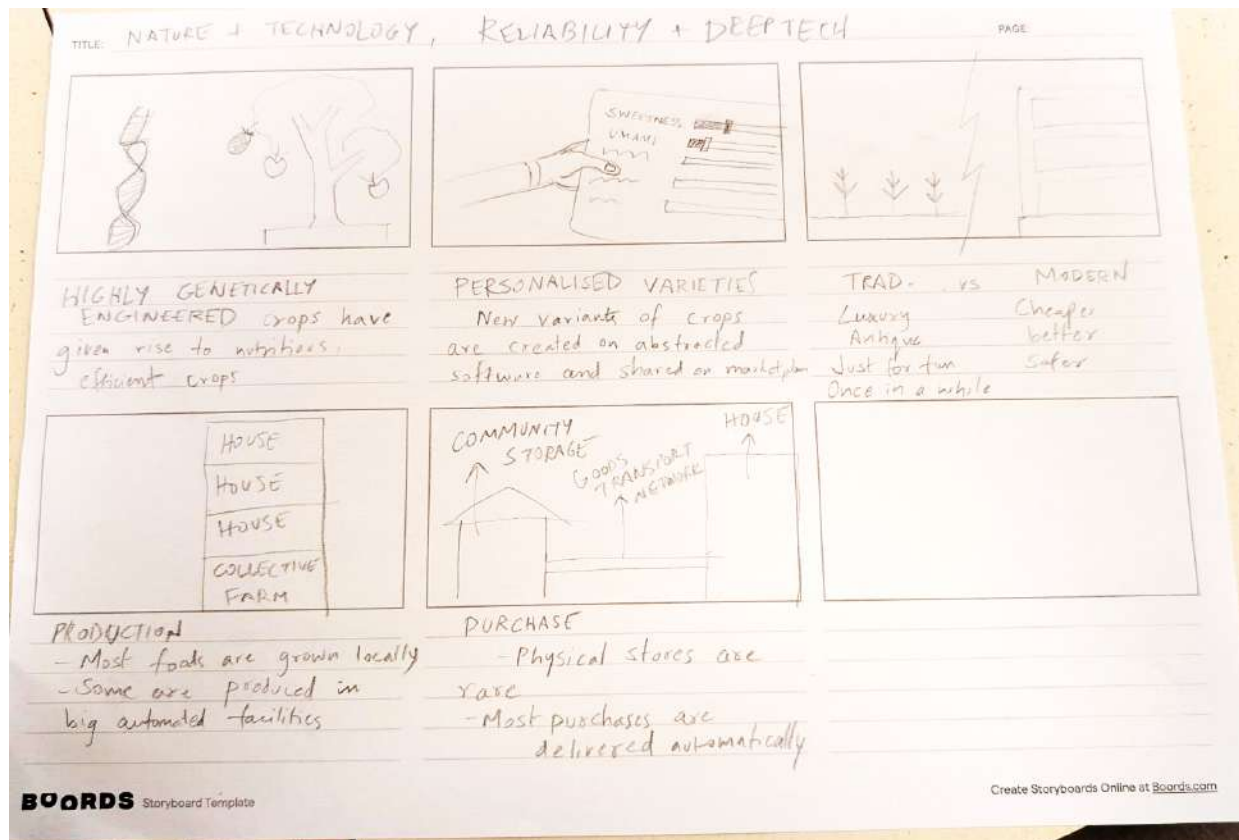
FARM TO TABLE CITY EDITION



Participant 6

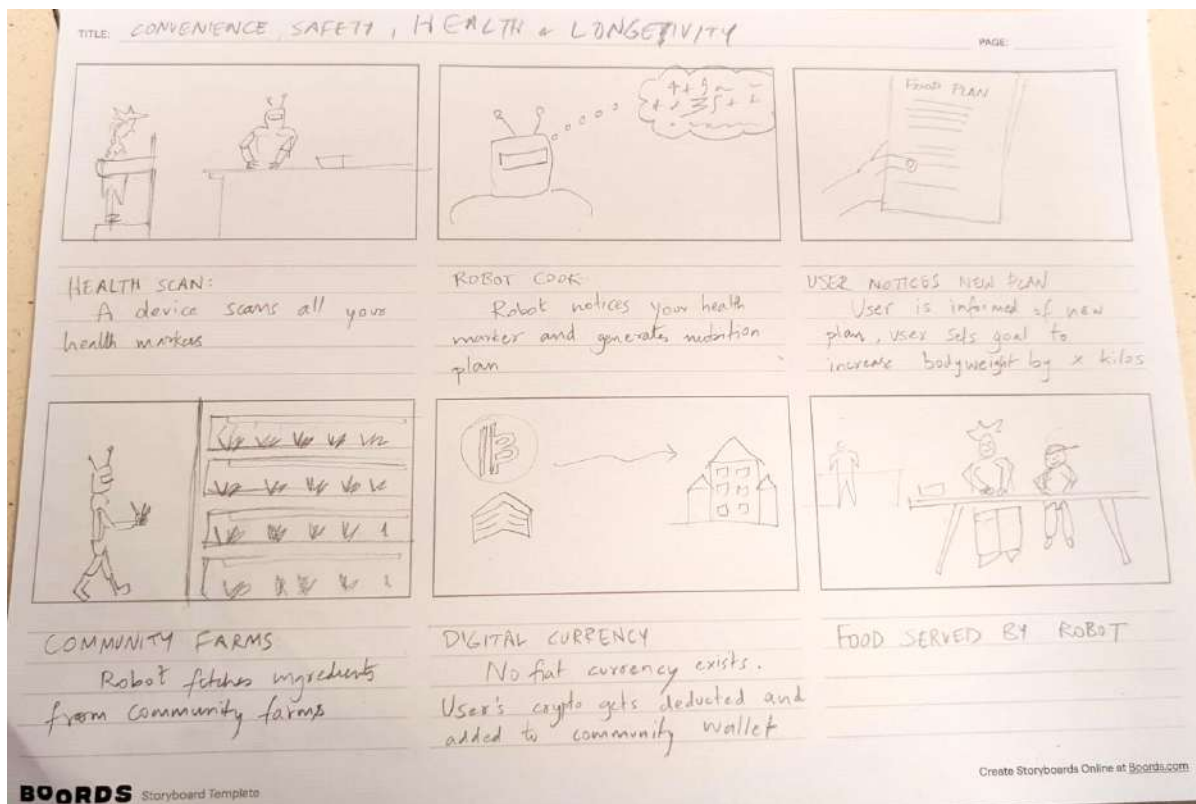


Participant 7



“ I was thinking about nature and technology. I’m like pro tech. So I’m optimistic about tech. So I think in the future we’ll understand more about genetics and genomics. And then we’ll be able to create, maybe personalize varieties. You can just select, I want tomatoes of this sweetness, this sourness, I want this consistency. And then like a seed gets created. And I think traditional versus modern, I think better modern technologies will be cheaper, better, safer. Once you understand everything. And the traditional ways of growing will be more of a luxury thing. Like if you want to experience that once in a while, you can do that and have a meal that’s made from ingredients of that. But technology is the way. It’s just like once cars were invented, like horses didn’t go extinct, but you see them in the circus.

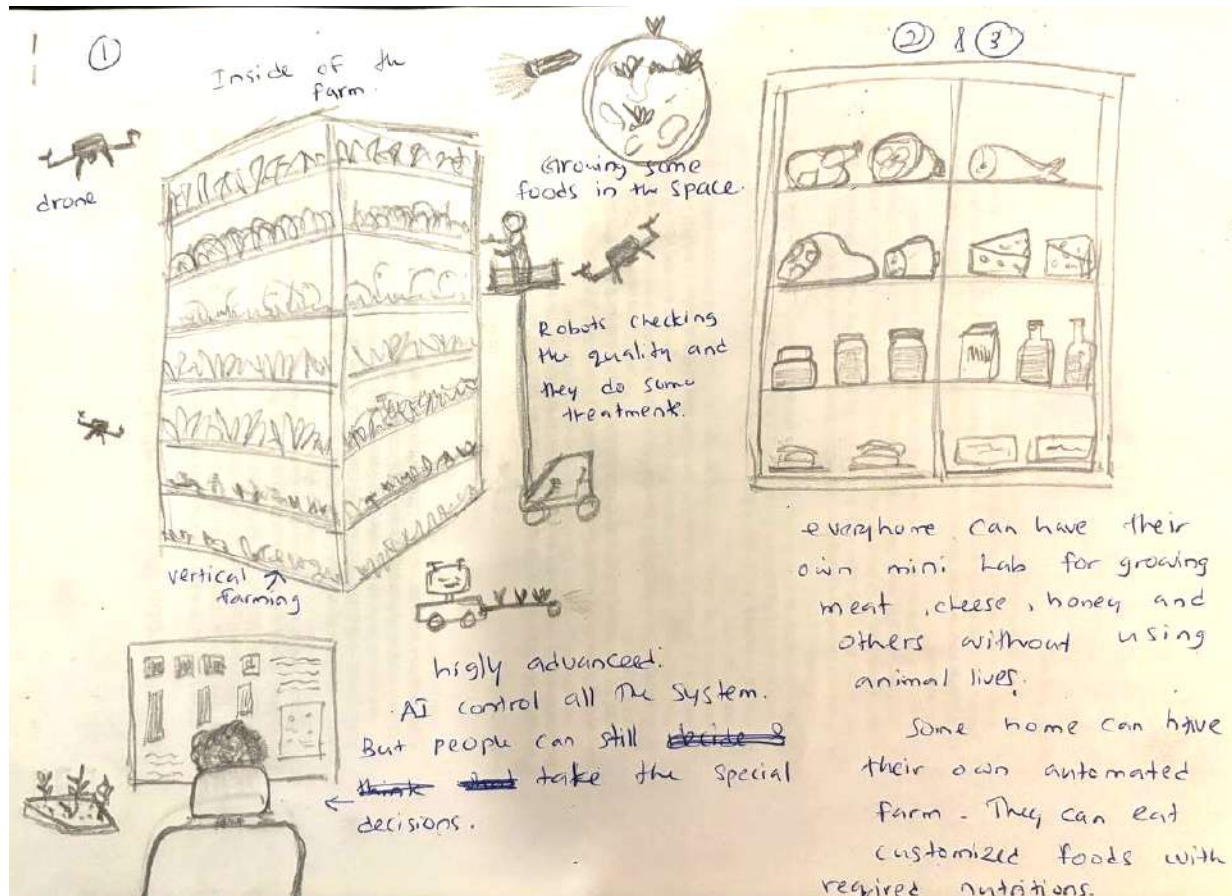
Production wise, I think it'll be distributed. Like a lot of community farms, automated ones, like maybe one housing block will have one community farm. And they get to share it and take care of it. Like how we have like a shared washing room for clothes. And then the distribution will also probably be automated with some sort of like goods transport network. Whatever is produced outside comes to like a community storage and then that gets like automatically transported to your house”.

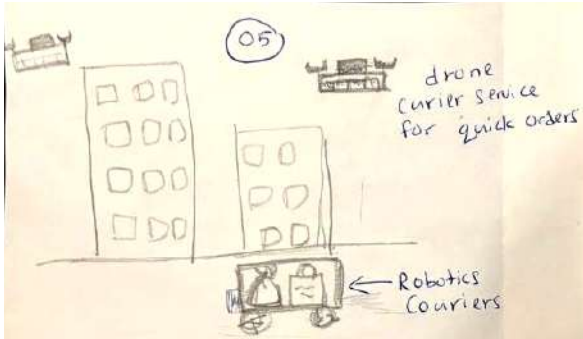


“Yeah, so here I’ve taken the value of convenience and health as the main thing. So it’s like you wake up and there’s a device which scans you. It checks all your health markers, your weight and everything. And then there’s like a robot assistant that gets that information and then it makes like a full plan for you for the next week based on your health markers. And then maybe you can set a goal in the next few months. I want to add five kilos of weight or something. And then based on that, it will make everything. And then you’ll go to the community farm, get all the ingredients, your money will automatically get cut and then the robot serves the food. I think like a big problem with like obesity and everything is just the effort that it takes to change your diet, Monitor, Buy, learn about the new ingredients, buy it, monitor everything. So that’s like

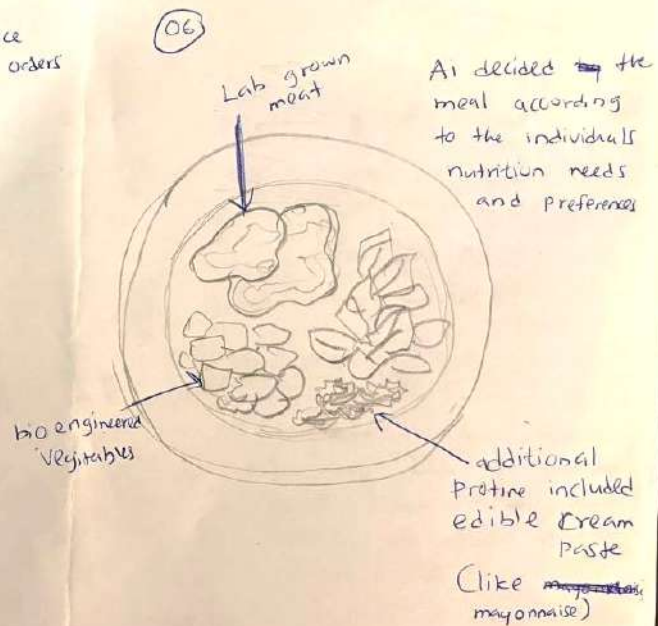
automated and taken care of. I think a lot of people can be healthier. Yeah, so that's the scenario".

Participant 8





Most of the time people don't visit for the grocery stores. People can connect with the ~~web~~ video calls with the grocery shops and select their foods. they can check the smell & feel also.



NourishNext (Feedback)

B *I* U  

Hello! I am a master's student at Linköping University, conducting research on the future of food. My thesis explores how visualisations and interactions can help viewers imagine possible futures for food and reflect on current food practices.

The current prototype, Nourish Next, is an online future food grocery store set in the year 2050. It represents one of several alternate worlds, built based on ongoing research into various future food alternatives. The store showcases foods that may not be widely accepted or normalised today—some might even seem unusual, bizarre, or thought-provoking, depending on your perspective.

This feedback form is designed to gather insights not only on improving the interaction and usability aspects but also on understanding whether it encouraged you to reflect on your relationship with food.

The feedback process will take no more than a couple of minutes, and your input will contribute to further research and understanding.

Thank you for your time and valuable perspectives!

Please click the link below to explore the future food grocery store:

[NourishNext](#)

(Note: This is an early prototype of the website, so some elements may need a gentle click to respond properly. If the link doesn't work on your phone, please try using a tablet or a laptop for a better experience).

(Note: This is an early prototype of the website, so some elements may need a gentle click to respond properly. If the link doesn't work on your phone, please try using a tablet or a laptop for a better experience).

Which food section did you find most interesting? *

- ☐ Pre-cooked meals
- ☐ Protein intake
- ☐ Edible plastic
- ☐ Desserts

If you would like to add another food section, what would it be?

Short answer text

Did the website/interface provoke thought or spark reflection overall? *

- ☐ Yes
- ☐ No
- ☐ Maybe

Did the visualisations portrayed help provoke thought about current foods? *

Did the visualisations portrayed help provoke thought about current foods? *

- ☐ Yes
- ☐ No
- ☐ Maybe

Did the food visualisations or the content in general help provoke reflection on your current food practices? *

- ☐ Yes
- ☐ No
- ☐ Maybe

If you chose 'yes', then what reflection did the content provoke about current foods and food practices?

Long answer text

Please explain why and how the visualisations or content helped provoke reflection—or why they did not. *

Long answer text

Given climate change, global warming, and ongoing research into lab-grown meat, insect protein, edible packaging, and other innovations, etc., do you think this will be the future reality of food? *

- ☐ Yes
- ☐ No
- ☐ Maybe

Did you face issues while navigating the site? *

- ☐ Yes
- ☐ No

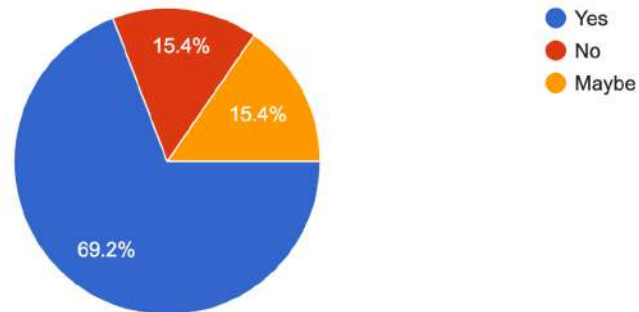
What aspect of the website needs improvement? *

- ☐ Visualizations
- ☐ Text
- ☐ Overall aesthetic
- ☐ Navigation
- ☐ Elements like buttons
- ☐ Info sections

Results from the survey (user testing)

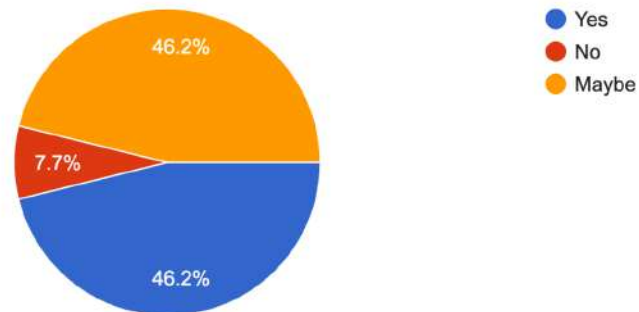
Did the food visualisations or the content in general help provoke reflection on your current food practices?

13 responses



Given climate change, global warming, and ongoing research into lab-grown meat, insect protein, edible packaging, and other innovations, etc., do you think this will be the future reality of food?

13 responses



If you would like to add another food section, what would it be?

11 responses

Foods with ratio of basic bio molecules mentioned

Frozen foods

Fresh produced

pill form meals that contain all necessary nutrients

Drinks

Dairy or dairy equivalent, breads, fruit/vegetable juices

Mix-and-match your own meal

Veggies

Greens

If you chose 'yes', then what reflection did the content provoke about current foods and food practices?

4 responses

A rough thought about containers that the food s packed in etc

The "new" foods should be as similar to regular food as possible, the more it looks like a regular steak the better.

The expectation of perfect looking foods. The artificial nature of some already existing food.

Reduce food waste and reuse or repurpose food

Please explain why and how the visualisations or content helped provoke reflection—or why they did not.

13 responses

The question helps in reflecting the insights of how can we slowly turn the food industry to our sustainable systems

the use of color, contrast, and layout highlighted key data trends and made it easier to notice patterns

The use of warm tones and close-up shots created a sense of intimacy, making the experience feel personal and engaging.

Some sections like edible plastic which i never heard and was depicted nicely in the website..that drew my attention

Sometime it generate some curiosity.

they looked very odd and the further info i read about them the odder they seem

It's makes one think about the available products we currently have and how much the producers aren't actually far away from this future in 2050 if they want to provide something better but due to their mindset and greed they would serve us products that are destructive for earth and us as consumers.

The content is telling us how agricultural practices will shift from land with natural sunlight, air and water to artificially controlled environments in future due to climate change, soil degradation, biodiversity loss and other factors. It is also indicating how food will be pre-processed and ready-to-eat rather than getting fresh produce from farm and cooking fresh meals. All these aspects will degrade the nutritional value of the food in future. The content is indicating us to make conscious food choices today to avoid unhealthy and artificially grown food in the future.

The clean-cut neon-ish design made me think of how we make everything seem sterilised and synthetic in our current society. I thought how I would like my food presented and that is in a more natural down-to-earth way.

Beautifully designed visuals and very thought provoking regarding a sustainable future for the growth of the economy through careful consideration of elements that can maintain soil health eliminating harmful practices that hinder the development of the economy

The perfect nature of the food was thought-provoking. Also, the label of plastic food was interesting and bizarre, as it is such a toxic material that we consume and are surrounded by already. It is also interesting to see how such things can be developed and altered in the future.

The colors used and the design were visually appealing

Food visuals looked tempting enough not to trigger any reflections

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