

Facilitating collaborative discussion on food futures using a tangible toolkit

Laure Smits

Department of Industrial Design
Eindhoven University of
Technology
Eindhoven
l.y.smits@student.tue.nl

Lynn van der Zwan

Department of Industrial Design
Eindhoven University of
Technology
Eindhoven
l.m.b.v.d.zwan@student.tue.nl

Jorn van Dijk

Department of Industrial Design
Eindhoven University of
Technology
Eindhoven
j.n.v.dijk@student.tue.nl

Dylan van Oosterhout

Department of Industrial Design
Eindhoven University of
Technology
Eindhoven
d.c.j.s.v.oosterhout@student.tue.nl

Milda Virbickaite

Department of Industrial Design
Eindhoven University of
Technology
Eindhoven
m.virbickaite@student.tue.nl

Arian Ettefaghpour

Department of Industrial Design
Eindhoven University of
Technology
Eindhoven
a.ettefaghpour@student.tue.nl

ABSTRACT

This article explores the use of a toolkit as a tool to critically reflect on food futures and make this discussion more tangible. The results of using the toolkit were collected through using a combination of the controlled- and naturalistic observation techniques (Mcleod, z.d.). The toolkit encourages people to talk and create discussion about food futures. Through this design probe, we aim to enable reflection on a set of social, ethical, cultural, environmental and political issues surrounding food futures. Results show a potential for the use of tangible discussion toolkits to discuss futuristic and imaginary concepts.

KEYWORDS

Collaborative Discussion, Food Futures, Tangible Toolkit

1 Introduction

This article aims to explore the potential of a tangible toolkit designed to evoke discussions on the imaginaries of the future, and how they intersect with ideas of ‘sustainability’ in an age of climate crisis, where a specific focus on the social practices of eating and future food in everyday life is tackled (Lockton, 2022).

Within this study there is a collaboration with the IMAGINE project from Oslo. IMAGINE is a 13.7m research project (2021–24) funded by the Research Council of Norway, led by Consumption Research Norway (SIFO) at Oslo Metropolitan University. This project is paralleling a master’s course at Oslo Met relating to the IMAGINE project themes of “How do we imagine eating, dressing, and moving sustainably in the future?”. (Lockton, 2022) In this piece we seek to complete field research about the discussion of future food for the target group 18–28-year-old university students.

Most studies about food in the future state that it is no secret that there are many challenges and problems on this planet that threaten future food sustainability and the security of the planet itself. (Hassoun et al., 2022a) One of the biggest problems is climate change, but also the growth in the world population, high levels of food waste and loss, and the risk of a new disease or pandemic. (Hassoun et al., 2022b) Next to those problems there are also different visions about how people think and imagine the future of food. In research from Hebrok and Mainsah there is stated how visions of the future of food are often dominated by technology, however design has an opportunity to question some of those ideas.(2022) All those problems require innovative, sustainable, and practical solutions to secure sufficient food for all. (Boyacı-Gündüz et al. 2021; Mondejar et al. 2021)

Our purpose is to make a discussion about the future of food more tangible, by using a design probe that is made to evoke discussion amongst generation Z and evaluate the outcomes. The toolkit is focused on the cycle of food: get (buy or grow), consume and waste. The design probe we developed fits within the field research scope and will deliver qualitative data outcomes, data gathered from observations and surveys to allow for an exploration on how to facilitate a discussion on the future. Other studies focus on the problems of future food (Hassoun et al., 2022a; Khan et al., 2018; Bader and Rahimifard 2020), while we are aiming to create something that could make an imaginative concept more tangible.

2 Related Works

2.1 Field Research in Design

Field research typically develops qualitative research, where data is collected directly from the participant as seen in the quote “data could be gathered from a range of sources, but observation and/or

in-formal conversation are usually the main ones, besides interviewing, which is the most important one” (Žikić, 2007). Furthermore, he states in his report of qualitative field research that he finds interviews, observations and documents the most prevalent forms of data gathering as noticed in: “typical qualitative ethnographic research employs three kinds of data collection: interviews, observation, and documents”. This perspective on field research is similarly also supported with the quote “participant observation is an omnibus field strategy in that it simultaneously combines document analysis, interviewing of respondents and informants, direct participation and observation, and introspection” (Genzuk, 2003). It can therefore be noticed that field research typically involves hands-on data collection through qualitative means and focuses on active participation through a participatory study. A discussion toolkit would for that reason be well supported in the field research scope, and the qualitative data derived from surveys, observations and participant interactions would help support the premise of discussion engagement and generation within the scope of the future of food.

2.2 Use of Toolkits in Design

Toolkits are often described as a collection of components, wherein they can be utilized by the user to educate themselves or develop ideas for the future as noticed in “toolkits (made up of a variety of components) are specifically confirmed for each project/domain. People use the toolkit components to make artefacts about or for the future” (Sanders & Stappers, 2014). Toolkits can also be used as an incentive to help people figure things out or talk about certain topics (Fisher et al., 2019).

These toolkits can utilize physical objects such as paper, pens or shapes, and written/visual information. This is supported by the argument “toolkits are made of 2D or 3D components such as pictures, words, phrases, blocks, shapes, buttons, pipe cleaners, wires, etc.” (Sanders & Stappers, 2014).

2.2 Discussion Generation Techniques

By investigating the implementation of other toolkits in the design discussion scope can aid in understanding how to generate discussions with a toolkit. An example of the implementation of a toolkit in successfully evoking a discussion in design is the ID toolbox utilized by (Bekker et al., 2015). It consisted of a physical box consisting of the littleBits, light sensor, color LED, infrared sensor and remote control, along with various transparent and semi-transparent materials. The session was conducted in two 60-minute sessions, in a four-step process: imagine and discover, make and prototype, test and present, reflect. Working with groups of four, the children were presented with inspirational material and background information related to the challenge. By being creative, followed by utilizing the physical pieces of the toolkit box, they were able to apply the information that they gathered in step 1, to then create and build in the second step. A further example about the implementation of a toolkit in discussion generation is seen in the following quote “generative toolkits describe a participatory design language that can be used by non-designers (i.e., future users) in the front end of design so

that they can imagine and express their own ideas about how they want to live, work and play in the future” (Sanders, 1999).

In the research paper “Life café, a co-design method for engagement” an investigation into the implementation of provocation to elicit different reactions in a co-design session was carried out. In this paper, the researchers suggest three different roles to carry this out, namely design developers, design facilitators and design generators (Fischer et al., 2019). They suggest in this paper that along with the utilization of these different roles, the tools used to elicit reactions and discussions from the participants should be recognizable and standardized as to be used by everyone. This can be observed in the quote “the design quality of the resources plays a part in how they’re used, can add value and encourage users to take ownership, feel comfortable and enjoy using them. The kit needed to be accessible and appeal to everyone, no matter what group or demographic” (Fischer et al., 2019). This orientation around the tools used in the co-design session to provoke and create discussion among the participants is also supported by Simon Bowen, recognized in an extract from his research journal “using provocative conceptual designs to foster human-centered innovation”. In this journal he states the purpose of a critical artefact to “suggest an alternative possibility outside stakeholders’ and designer’s current understanding. Stakeholders’ and designer’s engagement with the critical artefact then provokes them to reflect on the limitations of their current understanding that consequently broadens their understanding” (Bowen, 2009).

2.4 The Future of Food

2.4.1 The Present Food Industry

It is no secret that there are many challenges and problems on this planet that threaten future food sustainability and the security of the planet itself. Hassoun et al. describes in his research article “the fourth industry revolution in the food industry” that climate change is one of the biggest contributors to the challenges we face on Earth. This can be seen in his statement “one of the biggest problems is climate change, but also the growth in the world population, high levels of food waste and loss, and the risk of a new disease or pandemic” (Hassoun et al., 2022a). This is further supported by “all those problems require innovative, sustainable, and practical solutions to secure sufficient food for all” (Boyacı-Gündüz et al. 2021; Mondejar et al. 2021).

The fourth industrial revolution, colloquially called industry 4.0, has revolutionized the way in which food is produced, transported, stored, perceived and consumed worldwide. This has led to the emergence of new food trends. Industry 4.0 has significantly modified the food industry and led to substantial consequences for the environment, economics, and human health. “Industry 4.0 grasp onto progressive digital, physical and biological technologies such as (artificial intelligence, machine learning, big data, IoT (internet of things), the Cloud, blockchain, smart sensors, cybersecurity, robotics e.g.” (Hassoun et al., 2022b). This statement is further supported through the following quote “robotics and autonomous systems have been developing as promising technologies to improve sustainable development and

increase the quality, productivity, and efficiency of the food supply chain” (Khan et al., 2018; Bader and Rahimifard 2020).

When investigating how we eat our food nowadays, it is interesting to observe the impact that our peers have on our eating habits. Observing the following statement “parents have a big contribution in the intuitive eating habits for their children. This can be related to specific characteristics of the home environment. To change these characteristics and habits there needs to be an increasing understanding of characteristics of home food and meal environments.” provides us with even more insight into how we eat our food nowadays (Rodgers et al., 2022).

2.4.2 The Future of Food Industry

In the 2021 edition of the Dutch Design week, the Embassy of food theme was the Supermarket of the future (World Design Embassies, 2021). The themes of designs consisted of 9 categories: education, technology, non-food, packaging, health, food waste and protein transition. The curators of the exhibition aspired to explore how the supermarket will look like in 2050, and what could change. This direction and topic are interesting in the sense that this vision could change depending on how you view the future yourself.

The trend of growing the food closer to or even in the supermarkets themselves has been ascending in the past few years. Now we are used to seeing bio sections in the supermarkets where the food from local farmers is provided. “The next step seems to be micro farms in the supermarkets themselves” (Dickson, 2020). These kinds of farms, developed by companies such as Infarm and deployed in various locations around the world, take only around 2 square meters but can produce the crop equivalent of 400 square meters of farmland. Controlled by IoT mechanisms, these farms require 75% less fertilizer and even 95% less water. Therefore, vertical farming is considered to be the future of agriculture.

3D printed food, while not yet very well known to the general public, has been possible since the first 3D printed compatible with food creation in 2007 (Brunner et al., 2018). Currently it is not widely available and affordable to regular consumers, and the people who have tried it describe food from 3D printed to be “alien” and overprocessed. Still, a lot of startups are attempting to change this view by making familiar foods into more eco-friendly 3D printed alternatives, examples including artificial meat, desserts and bakery goods. (StartUs Insights, 2020).

In addition to the innovative production methods, there are also novel sources and uses of food, such as insects, powdered algae and lab-grown meat. There is a clear environmental benefit with these emerging sources, since it requires less land and resources, as well as producing less waste. However, as it is not yet widespread in most countries, it is often difficult for consumers to have easy access and attraction to it (Kauppi et al., 2019). And while some innovators and businesses try to create meals and food products as exquisite as we can imagine, another part of future

speculators expect the future food to be much simpler – example being the gruel shown in movies like the Matrix, or a white rectangle of substance in THX 1138 where every required nutrient is a single kind of meal and taste (Retzinger, 2013). Therefore, superfood smoothies, one meal a day and food supplements as pills are taking a bigger part in a busy working person’s lifestyle these days, where productivity and speed may matter more than enjoyment, for which all-in-one substances may be the best solution.

3 Methods

The purpose of this study was to investigate how a discussion can be evoked with students between the ages of 18-28 through the implementation of a tangible interactive toolkit devised around the senses of sound, sight, and touch. The design probe was developed to investigate the research question “How can a tangible toolkit evoke a discussion about the future of food among students aged 18-28?”.

To study the usefulness, and appropriation of this toolkit in evoking the discussion about the food futures, a field study was conducted in which we recruited individuals to participate in discussion sessions. Participants were asked to gather in groups and utilize the design probe to start discussing and brainstorming about the cycle of food in the future: get (buy or grow), consume and waste. Within these sessions, our aim is to investigate (i) change of theme during the discussions, (ii) frequency in appearance of subthemes, (iii) how people interact with the probe and the way they utilize it for discussing, (iv) the body language of participants while interacting with the probe and each other during the session, (v) the troubles they encounter with the probe and the way they resolve or ignore it, (vi) the affordance of the probe, and (vii) the repetition of the themes.

3.1 Participants

A total of 13 individuals participated who were divided into 3 groups; 4 (group 1), 5 (group 2), and 4 (group 3) people. Participants were selected based on their age and occupation. Requirements detailed participants needed to be between 18-28 years of age, be a student and have no prior knowledge about the IMAGINE project. Participants were recruited randomly through personal and professional circles of the researchers.

3.2 Research Set-Up

Three separate sessions were carried out over two meeting rooms on the Eindhoven University of Technology campus. The first session consisted of four participants, the second five participants, and the third session four participants. Before each session began, an informed consent form was handed out to each participant to read through and acknowledge their willingness to participate in the user testing with the assurance of personal privacy by signing it (Figure 1). Along with this, a short explanation of the scope of the study was explained as well as the toolkit itself within 5 minutes before the testing began (Figure 2 and 3). This explanation

involved the research question, the scope of investigating how and to what extent the developed toolkit could affect a discussion about the future of food, and that the session was expected to last no longer than 35 minutes.



Figure 1: Start of the Discussion Sessions



Figure 2: The Discussion Toolkit

Once the aforementioned steps were completed, participants were introduced to the soundscape, which lasted 5 minutes (figure 3). The purpose of introducing the soundscape first was to further orientate the participants to the scope of the project and explain the cycle of food (e.g. get, consume, waste). The sound bites of the soundscape are made to inspire the participants in their thought process and start the first discussion.



Figure 3: Soundscape

After the soundscape was played to the participants, they were given the freedom to investigate the rest of the toolkit and utilize whichever component of it they felt most helpful in their discussion about the future of food. The toolkit includes five components of which one was already completed (e.g. the soundscape). The other sections that the participants were allowed to choose from were; discussion cards (figure 4), visual timeline (figure 5), interaction cards (figure 6), and physical artifacts (figure 7). Figure 8, 9 and 10 show how these components were used during the sessions.



Figure 4: Discussion Cards



Figure 5: Visual Timeline



Figure 6: Interaction Cards



Figure 7: Physical Artifacts

Then, participants were given the freedom of which of the different components of the toolkit to use till the end of the session. The goal of this was to enrich their discussions in a natural and unbiased way by letting them choose their own path.



Figure 8: Toolkit in Use 1



Figure 9: Toolkit in Use 2



Figure 10: Toolkit in Use 3

3.3 Design Probe

A toolkit containing five different components was created for the purpose of this study. This section elaborates on each component, how it was created and used.

3.3.1 Discussion Cards (figure 4)

The discussion cards are based on the product reaction cards (Microsoft, 2002). They consist of a list of 118 words (60% positive and 40% negative). The discussion cards can help participants describe pictures, sounds or artifacts they have chosen. These are added to give more value to participants' ideas. This way they can better express their thought on the topic of food. Figure 4 shows how the discussion cards were incorporated into the design probe and all 118 words are featured.

3.3.2 Visual Timeline (figure 5)

The timeline can be used in combination with the other fragments in the toolkit. This was added to visualize participants' thoughts and ideas in a timeline. It also provides an opportunity for participants to discuss the future. How do they see it emerging? When do important events arise? What are these events? These questions can be related to the three categories: getting, consuming, and disposing of waste. As an aid, images were given (FigureX5), which depict different possible futures of food. As mentioned earlier, the fragments are based on the senses. The images included with the timeline are based on the sense of seeing. A benefit of the timeline is that it is a quick and visual method to create a timeline based on participants' discussions.

3.3.3 Interaction Cards (figure 6)

The interaction vocabulary cards (Diefenbach et al., 2013) are regularly used in design processes. This method is used to bring out different dimensions about describing interactions in design. The cards consist of 11 dimensions, each in pairs with the opposite attributes. Often this method is used as a conversation starter. The interaction vocabulary cards are integrated into the design probe to give participants the opportunity to better ground their opinions. They will examine the cards themselves and can also use them in combination with the other fragments of the toolkit to create rich discussions.

3.3.4 Physical Artifacts (figure 7)

The physical artifacts are wooden chips with different icons displayed on them. The goal of the chips is to have something physical to play around with and talk about the icon displayed on it. All the icons are related to food and food futures, focusing on the different components in the cycle of food; get, consume and waste. Participants can use these chips as an individual conversation starter but also in combination with the cards or timeline.

3.3.5 Soundscape (figure 3)

Soundscapes are auditory elements that are played (in a research circumstance) to the participant to elicit a reaction from them. These reactions can vary between the purposes of the soundscapes, such as building a scenario for the participants to listen to or playing different noises to evoke different reactions from the participants (Axelsson et al., 2019). Soundscapes can contain any auditory cues that the researchers want, such as noises of a busy school, calm natural noises, or dialogue. In the research journal “the category of soundscape study” by Qin Youguo (2005) she finds that the three basic elements of soundscape studies can be defined as sound, environment and human. As soundscapes are by nature auditory elements, they can be used in combination with visual stimulus to create better involvement and orientation with the research. Sound also elicits emotional reactions that visual or tactile experiences would not.

Within this study, a soundscape of five separate fragments (see link in section title) was created. The purpose of the soundscape was to elicit various smaller discussions within the groups about the three stages of getting, consuming and disposing, and have this aid them as they began utilizing and interpreting the rest of the design probe. The soundscape was developed using the program Audacity and compiled through Soundcloud which had inspirational audio fragments (sound-bytes) and instructions about how to proceed. The first fragment of the soundscape had the participants discuss how they saw the future of food. The second fragment revolved around sound-bytes related to getting food, after which the participants could discuss what this meant to them. Following this was the third fragment which contained sound-bytes related to eating food, after which the participants could discuss what this meant. The fourth fragment of the soundscape revolved around disposing of waste in the future, which contained sound-bytes centered around this topic. Once each fragment was played and talked about, the fifth fragment of the soundscape was played which summarized all the three main fragments, had the participants briefly discussed how they fit together, and were then introduced to and allowed to experiment with the rest of the design probe how they wanted.

3.4 Data Gathering and Analysis

For the purpose of gathering the data from the sessions, we used a combination of controlled and naturalistic observation (McLeod, 2015). The interaction with the toolkit is left entirely for participants to explore and qualitative data will be extracted from multiple factors at once - body language, speech, tangible

interaction with the toolkit. Moreover, participants were invited to fill in a short online survey at the end of the session. The goal of this end-survey was to eventually be able to combine both datasets to reduce the chance of conclusions being affected by bias.

For documentation purposes and data collection, the qualitative data was recorded by taking notes during the sessions. Thematic content analysis (Anderson, 2007) was decided to be used for analyzing collected data, as many topics might occur during the sessions and several textual sources - multiple observation notes and survey responses will need to be merged to uncover insights. Following the sessions, the topics discussed were divided into bigger themes of the session and among groups to see how many were discussed per average session. Data on the interaction with the toolkit was grouped into categories until it could answer a pre-defined list of questions (appendix A), which was used as a base for observations and used afterwards during analysis as a way to turn relevant results into insights.

4 Results

In this section, the results of discussion sessions with the design probe are described following the structure of the observation questions, as well as a summary of the post-discussion survey responses.



Figure 11: Forming a Mood Board

4.1 Changing and Recurring Themes

A lot of themes during the sessions are recurring, however there are also unique themes in each group session. Certain topics were discussed in every one of the 3 sessions - drones bringing food, supermarkets and their role in the future, pills as compressed food. These topics emerged as the participants were listening to the soundscape with sounds reminiscent to those topics and pictures visualizing them. Opposite views occurred when people considered how realistic certain things are considering their realization. For example, while some participants believe the pills will be main source of food in the future, other counterargument that the experience will be more important and fine dining will remain desirable. This and similar constructive arguments occurred in all sessions about the 3 topics, and all the different opinions were appreciated and valued (Appendix B).

The discussions followed a chronological narrative as suggested by soundscapes, first discussing the getting of food, lastly the waste methods. This is important in consideration that among all groups, more time was committed to getting and consuming than the waste part of the discussion. Different themes emerged when people started to talk about their personal experiences and moved away from only using the tools provided. Cultural differences are likely to be one of the contributing factors, such as a participant of group 3 discussing the sustainable approach that their homeland supermarkets take on selling fresh products every day, with the peers from the Netherlands where supermarkets and their customers focus on efficiency rather than ecology. Whilst many views differ, most of the participants have a positive view of the future, that the processes will be more efficient and/or natural.

4.2 Interaction with the Design Probe and Discussion

The initial discussion after the sound clips is limited as participants mainly discuss the sounds, they heard and what sounds could be, while not going deep into the topics and waiting for the moderators to indicate the next steps. Discussion became more elaborate and in-depth after the whole box was opened and the different parts in the process were combined. Due to time limits, participants had to finish exploring earlier than they naturally would. The soundscape was not reused later in the process.

As soon as they opened the boxes, the groups took out all the various materials and looked through them, at first each component separately; the pictures, cards and physical artifacts after later combining and dividing them into groups. There were significant differences in use, for example group one was actively combining different types of cards to form a timeline on the table, while groups 2 and 3 kept the cards in their category and mainly flipped through them and kept the casual discussion going. While text cards mainly stayed in place, the pictures and icons were spread around the table.

4.3 Body Language during Interaction

Participants were curious, actively picking and going through the materials, postures becoming more open through the discussions, although initially reserved as to how the toolkit should be treated. Some people even stood up when overlooking the whole toolkit, working collaboratively with each other.

4.4 Issues Concerning the Use and Purpose of the Toolkit

The beginning seemed to be a bit unclear, also when exactly they should start exploring the toolkit. The purpose of the cards and the differences between the two sets of cards were unclear for the majority; the 1st group tried combining them with other tools while the 2nd and 3rd just read through them and did not use them more actively. The text was too abstract in cases and not always seemed connected to the rest. However, some would try to apply the text card to the topic in discussion, adding it to other cards such as pictures, combining similar phrases. The timeline of the

pictures required some extra explanation for one of the groups. The sound purpose was also not clear to everyone, 2 of the 3 groups tried guessing what they heard, specific sounds, not for inspiration as intended.

Participants understood the premise of the toolkit, however many found it difficult to grasp how all the pieces fit in together, and in what order the parts should be used. The groups approached it in different ways, for example group 1 really focused on the physical artifacts and the timeline, whilst the others used it mainly for sparking ideas. This might indicate that the toolkit can be interpreted differently by the users even with pre-defined instruction.

4.5 Post-Discussion Survey

All 13 participants of the study filled in the post-discussion questionnaire (Appendix C). When asked to indicate to what extent the toolkit allowed them to be more imaginative when imagining the future from 1 to 5 (one being not at all), the average value was 3.23. Because an average was used, it is difficult to conclude what those who scored low/high think about it. Also, it was noticed there were not any scores given of 1 or 5. Therefore, it can be said that everyone stayed in the “safe space” of giving their score.

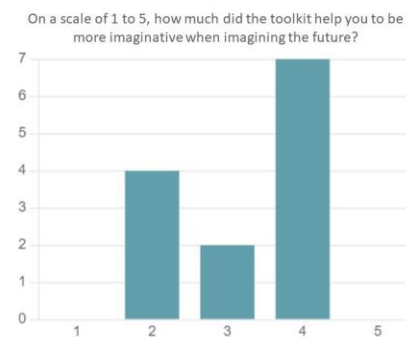


Figure 12: Responses Question 1 – Post-Session Survey

Each of the participants chose a different section of the toolkit which was most inspiring to them. What stands out from the responses is that no one chose the interaction cards and keywords. The participants also indicated that they had the longest and most intense discussion when using the sounds.

The most unnecessary and uninspiring parts of the toolkit were indicated to be interaction cards. These did not feel connected to the toolkit and the thoughts behind using the toolkit. Another person indicated that some key words did not belong with the interaction cards (they were distracting rather than helpful for using the toolkit). A few participants indicated that they did not find anything redundant, but rather that there was a lot going on too simultaneously.

The question about whether the discussion was more elaborate due to the toolkit was divisive. Some indicate that the toolkit

helped enough in triggering ideas. Others indicated that they were still missing a piece. As an idea, they gave that they would like to see existing food systems to get a better picture, or they would like it to be more concrete overall. Some also indicated that the instructions for the rest of the toolkit were too long for the given time of 25 min. They would like to be given longer time to look at this.

Concerning the effect the session had on them, a few indicated that they were happy to hear hopeful and positive things about the future. It gave them new ideas and directions to think about. Yet there was a large majority who indicated that they did not change their attitudes as a result of using the toolkit. The reason given was that the discussions were not long enough to properly address them.

New ideas also emerged for where the toolkit could be used, such as in a working group with different stakeholders. Other settings include:

- Workshop in the museum
- Food related places
- Study related setting
- R&D of food companies
- Brainstorm sessions

Overall, most participants indicated that the toolkit helped them discuss the topic of food. However, there are some comments on certain sections in the toolkit that will be considered, such as the interaction cards and keywords. Before using the toolkit, it was indicated that they would like some more time to explore the toolkit themselves, so that they can go deeper into this to engage in a more concrete discussion with each other.

5 Discussion

5.1 Interpretation of Results

The analysis of the results provides us with an overview of how a toolkit may serve and evoke discussions about the future. The sessions showed that there are both advantages and limitations to this approach. The toolkit succeeded at evoking discussion, as the participants were eager to mention and talk about various topics, however those talks did not transition into more in depth discussion. This is likely due to many inspirational topics and concepts being introduced in a short amount of time, which some participants described as overwhelming, resulting in little time reserved for each theme. An important take away from this is that the toolkit content must be adjusted to the length and size of the session, so there is enough time for participants to explore all materials and have enough time to investigate the themes.

The broad food journey spreading from getting the food to getting rid of the waste, while familiar to the participants, also added to the issue of surface level discussions. The participants had to be moderated to fit their discussion in the timeframe and did not know in advance how many sound clips and other materials they would get in advance. Therefore, the time spent discussing the

soundscapes was in some cases longer than the time exploring the rest of the toolkit. In that limited time frame, some parts of the toolkit remained untouched, which is mainly the case for the discussion and experience cards. Because the cards required reading and deeper analysis of the topics, it was more difficult to combine them with more simple inspirational materials like pictures and icons, which were much easier to understand. The primary function of the product evaluation and experience cards, which we used as a base, is to evaluate products and designs (Lallemand, n.d.). In this case it was not the purpose of toolkit materials, therefore the textual information was difficult to incorporate in a short session.

The last factor that greatly impacted the way the participants used the toolkit was the general goal of the session and the (un)clarity of it. There was a clear timeline of the topics that emerged during the soundscapes and the timeline visual. This allowed participants to think chronologically, and some groups even put together a "mood board" (figure 11) around the timeline to visualize their discussion. However, many other participants did not quite understand what they are meant to do with the materials and used them in a limited way, looking through and mentioning what caught their attention. For the toolkit to be more incorporated, the journey may be more specified and different pieces of it linked together.

Concerning the setting of the toolkit, the participants indicated rather practical uses for the system, such as working and education groups working with stakeholders. Showing thus the potential for a broad use of the toolkit in various environments.

5.2 Limitations

A total of 13 participants were asked to take part in the study. This study, however, does not address the use of the toolkit by other participants. Now we have only used participants who are still studying at this university. Consider, for example, people with political positions or other cultural backgrounds. By using participants with different societal or cultural backgrounds, different results may be obtained from the study. The study was held in a closed room so that there would be as little outside influence (e.g. noise and other distractions) as possible. Outside events may influence the discussions that will take place when using the toolkit. For future research, it will be necessary to further explore the influences on the results and whether a closed meeting room is the right space to conduct this study.

During this study, an observing technique was used to obtain data. Researchers took on the role of a fly on the wall. This was not fully adhered to as interruptions and prompts were needed during the study to help the participants move forward and stay on time. The results could have been affected by these interruptions and prompts so further analysis is needed to determine the effect and influence of this. After participants finished using the toolkit, they all completed a digital survey which was the fastest and easiest way for us to collect post-session data. Making use of other research methods could provide different information so for example, with the use of interviews, participants' responses could

be elaborated upon. Future work could focus on determining the best course of action for this and which method creates the most insightful results.

During the sessions, it was immediately clear that a 30-minute discussion timeframe was too little. For the future, we suggest expanding this timeframe more so that the participants can take their time to explore all sections of the toolkit. Some attention should also be paid to the participants' biases about food. Participants can try to push through their biases on the subject into discussions which will produce different results and some people that might take over the conversation. So future work should look further into the influences and results of this happening.

5.3 Future Work

Due to several different factors, there are some suggestions for future work to be made in this section.

The sessions lasted for 30 minutes each which, referring to results, is too short to explore the whole toolkit to its full extent. The users must listen to the soundscape but also understand all the other aspects of the toolkit and start their discussion. Because the sessions lasted for only 30 minutes only a few topics of the toolkit were discussed. For future work, we suggest taking more time to fully explore the toolkit and allow participants to take their time. By doing this, the toolkit can be further analyzed in-depth, and improvements can be made based on longer interactions.

This could also be the case for not using the product reaction and interaction vocabulary cards. The users do not have enough time to read and use the cards. It must be further analyzed if this is indeed the reason for not using the cards or whether they just did not see it fit with the rest. An optimization of each component of the toolkit can be considered based on this potential future analysis.

Participants had to listen to the soundscape to understand the toolkit and its topics first. However, there is no time limit when to start the new soundscape which resulted in long discussions about the same topic. So, a new approach with time slots for each topic could help avoid taking too long on one topic. This could be done in combination with better explanations of the whole toolkit together or in a new way. The best way to approach this is something to be looked further into in future work.

As an evaluation method, we wanted to use the fly-on-the-wall approach. However, we noticed that we had to intervene several times during the sessions which resulted in us not being silent observers anymore but more facilitators. This change is tricky because maybe with a better timeslot around each subject, and better explanation of the toolkit itself this might not have happened. In future work, a better observation method can be explored to fit better with the chosen field methodology as well as the appropriate method to observe discussion sessions like these.

5 Conclusion

This article aimed to figure out whether a tangible toolkit could help evoke collaborative discussions on food futures. Results show that the toolkit can indeed make a difference, but more work needs to be done to increase the experience and results of the toolkit itself. Each individual component needs to be critically reviewed and analyzed in order to find ways to improve it but as they are now, they are sufficient for evoking discussion on food futures.

ACKNOWLEDGMENTS

We would like to thank Dan Lockton for allowing us the opportunity to work on a challenge presented by the IMAGINE project. Thank you for the support during this project.

REFERENCES

- Anderson, R. (2007). Thematic content analysis (TCA). Descriptive presentation of qualitative data, 1-4.
- Axelsson Ö, Guastavino C and Payne SR. (2019). Editorial: Soundscape Assessment. *Front. Psychol.* 10:2514. <https://doi.org/10.3389/fpsyg.2019.02514>
- Bader, F., & Rahimifard, S. (2020). A methodology for the selection of industrial robots in food handling. *Innovative Food Science & Emerging Technologies*, 64, 102379. <https://doi.org/10.1016/j.ifset.2020.102379>
- Bekker, T., Bakker, S., Douma, I., Van Der Poel, J., & Scheltenaar, K. (2015). Teaching children digital literacy through design-based learning with digital toolkits in schools. *International Journal of Child-Computer Interaction*, 5, 29-38. <https://doi.org/10.1016/j.ijcci.2015.12.001>
- Bowen, S. (2009). Critical artefact methods: Using provocative conceptual designs within participatory human-centred design. *Nordes 2009: Engaging Artifacts*. <https://doi.org/10.21606/nordes.2009.048>
- Boyaci-Gündüz, C. P., Ibrahim, S. A., Wei, O. C., & Galanakis, C. M. (2021). Transformation of the food sector: Security and resilience during the COVID-19 pandemic. *Foods*, 10(3), 497. <https://doi.org/10.3390/foods10030497>
- Brooks, B. M., Schulte-Fortkamp, B., Voigt, K. S., & Case, A. U. (2014). Exploring our sonic environment through soundscape research & theory. *Acoustics Today*, 10(1), 30-40.
- Brunner, T. A., Delley, M., & Denkel, C. (2018). Consumers' attitudes and change of attitude toward 3D-printed food. *Food Quality and Preference*, 68, 389-396. <https://doi.org/10.1016/j.foodqual.2017.12.010>
- Cobussen, M. A. (2019). Sound, soundscapes, and sound art. Retrieved from <https://hdl.handle.net/1887/3249363>
- Dan Lockton. (2022). Contested Futures of Sustainability. TU/e.
- Dickson, I. (2020). The supermarkets that grow their own food. CGTN Europe. Retrieved from <https://newseu.cgtn.com/news/2020-07-07/The-supermarkets-that-grow-their-own-food-RUYpZl04Kl/index.html>
- Diefenbach, S., Lenz, E., & Hassenzähl, M. (2013). An interaction vocabulary, describing the how of interaction. In *CHI'13 Extended Abstracts on Human Factors in Computing Systems* (pp. 607-612). <https://doi.org/10.1145/2468356.2468463>
- Fisher, H. E., Craig, C., & Chamberlain, P. (2019). Life café. A co-designed method of engagement. *The Design Journal*, 22(sup1), 445-461. <https://doi.org/10.1080/14606925.2019.1595431>
- Genzuk, M. (2003). A synthesis of ethnographic research: Occasional papers series. Centre for Multilingual, Multicultural Research (eds) University of Southern California, Los Angeles.
- Hassoun, A., Ait-Kaddour, A., Abu-Mahfouz, A. M., Rathod, N. B., Bader, F., Barba, F. J., ... & Regenstein, J. (2022a). The fourth industrial revolution in the food industry—Part I: Industry 4.0 technologies. *Critical Reviews in Food Science and Nutrition*, 1-17. <https://doi.org/10.1080/10408398.2022.2034735>
- Hassoun, A., Bekhit, A. E. D., Jambak, A. R., Regenstein, J. M., Chemat, F., Morton, J. D., ... & Ueland, Ø. (2022b). The fourth industrial revolution in the food industry—part II: Emerging food trends. *Critical Reviews in Food Science and Nutrition*, 1-31. <https://doi.org/10.1080/10408398.2022.2106472>
- Hebrok, M., & Mainsah, H. (2022). Skinny as a bird: design fiction as a vehicle for reflecting on food futures. *Futures*, 141, 102983. <https://doi.org/10.1016/j.futures.2022.102983>
- Kauppi, S. M., Pettersen, I. N., & Boks, C. (2019). Consumer acceptance of edible insects and design interventions as adoption strategy. http://dx.doi.org/10.1386/ijfd.4.1.39_1

- Khan, Z. H., Khalid, A., & Iqbal, J. (2018). Towards realizing robotic potential in future intelligent food manufacturing systems. *Innovative food science & emerging technologies*, 48, 11-24. <https://doi.org/10.1016/j.ifset.2018.05.011>
- Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., & Wensveen, S. (2011). Design research through practice: From the lab, field, and showroom. Elsevier. <https://doi.org/10.1109/TPC.2013.2274109>
- Lallemand, C. & Bernhaupt, R. (z.d.). SELF-EXPLORATION OF USER- EVALUATION METHODS. Canvas.
- Martin, B. (2018). Soundscape Composition: Enhancing our understanding of changing soundscapes. *Organised Sound*, 23(1), 20-28. <https://doi.org/10.1017/S1355771817000243>
- McLeod, S. A. (2015). Observation methods. *Simply Psychology*. Retrieved from www.simplypsychology.org/observation.html
- Media. (2021). Toolkit: What is it & how to create the perfect one? elink Blog. Retrieved from <https://blog.elink.io/toolkit/>
- Mondejar, M. E., Avtar, R., Diaz, H. L. B., Dubey, R. K., Esteban, J., Gómez-Morales, A., ... & Garcia-Segura, S. (2021). Digitalization to achieve sustainable development goals: Steps towards a Smart Green Planet. *Science of the Total Environment*, 794, 148539. <https://doi.org/10.1016/j.scitotenv.2021.148539>
- Qin Youguo. (2005). The category of Soundscape study. *Architectural Journal*, 01:45-46.
- Retzinger, J. P. (2013). Speculative visions and imaginary meals: Food and the environment in (post-apocalyptic) science fiction films. In *Cultural Studies and Environment, Revisited* (pp. 9-30). Routledge.
- Rodgers, R. F., Hazzard, V. M., Franko, D. L., Loth, K. A., Larson, N., & Neumark-Sztainer, D. (2022). Intuitive Eating Among Parents: Associations with the Home Food and Meal Environment. *Journal of the Academy of Nutrition and Dietetics*. <https://doi.org/10.1016/j.jand.2022.01.009>
- Sanders, E. B. (1999). Postdesign and participatory culture. *Proceedings of Useful and Critical: The Position of Research in Design*. University of Art and Design, Helsinki.
- Sanders, E. B. N., & Stappers, P. J. (2014). Probes, toolkits and prototypes: three approaches to making in codesigning. *CoDesign*, 10(1), 5-14. <https://doi.org/10.1080/15710882.2014.888183>
- StartUs Insights. (2020). 5 top emerging 3D food printing startups impacting the industry. 5 Top Emerging 3D Food Printing Startups Impacting The Industry. Retrieved from <https://www.startus-insights.com/innovators-guide/5-top-emerging-3d-food-printing-startups-impacting-the-industry/>
- Von Hippel, E. (2001). User toolkits for innovation. *Journal of Product Innovation Management: An International Publication of the Product Development & Management Association*, 18(4), 247-257. <https://doi.org/10.1111/1540-5885.1840247>
- World Design Embassies. (2021). What will your future supermarket look like? the embassy of food makes you think. Retrieved from <https://www.worlddesignembassies.com/en/topics/hoer-ziet-jouw-toekomstige-supermarkt-eruit-de-embassy-of-food-zet-je-aan-het-denken/>
- Žikić, B. (2007). Qualitative Field Research in Anthropology. An Overview of Basic Research Methodology. *Etnoantropološki problemi/Issues in Ethnology and Anthropology*, 2(2), 123-135. <https://doi.org/10.21301/eap.v2i2.7>

APPENDIX

Here you can find the research observation questions, the theme overview of the thematic analysis, the questions of the post-session survey and short descriptions on the background of the different authors and their main roles/responsibilities in this study.

A Research Observation Questions

1. The change of theme during the discussions
2. How often do they discuss subthemes?
3. Are they done with the discussion when they need to go to the next section of the toolkit? How often does this happen?
4. How do they interact with the toolkit?
5. Are there some things that differ than expected when using the toolkit?
6. How is there body language when interacting with each other and the toolkit?
7. Are they having trouble using different sections of the toolkit? If yes, which one and how did they solve this?

8. Did the participants understand the use of the toolkit?
9. Are there themes that are recurring?

B Theme Overview

B.1 Group 1

Getting:

- Biological foods
- Smaller portions
- Lab grown meat
- Modified food
- Robots as servers
- Grow your own food

Consuming:

- Pills with everything in them
- Food about the experience and texture
- Absorbable foods
- Fine dining
- Insects
- Injection of food into system
- Restaurants with VR experiences
- Robots preparing food

Waste:

- Reducing waste to small particles with machines
- More efficient systems
- Digging a hole in earth for waste
- Reducing plastic
- Everyone has chickens to feed with waste
- Disposable/edible packaging

B.2 Group 2

Getting:

- Flying food (drones)
- Culture influences
- Online shopping → supermarkets will disappear
- Going to local farmers
- Healthier foods
- Bad label categorizations
- Food delivered to your door

Consuming:

- Quality of food (overuse of salt and sugar)
- Teaching about healthy diet in school
- No time for big lunch → big breakfast
- Over processed foods
- People are unaware of possibilities for healthy food

Waste:

- Hard to know how to recycle
- What is and is not plastic

B.3 Group 3

Getting:

- Getting food quickly
- Grow your own food
- No supermarkets → drone deliveries
- Mass production
- Markets dying out, everything is industrialized
- Not buying in bulk
- Investing time in cooking or letting someone else do it

Consuming:

- More vegetarian
- Less alcohol
- Sustainability of processed foods → pills and bottles
- Meals customized to person's appetite
- Normal to take food from restaurant unfinished
- Share groceries and waste with other households/community

Waste:

- More awareness about recycling
- Composting put to good use
- More regulations and ways of recycling

C Post Session Survey Questions

1. On a scale of 1-5, how much did the toolkit help you to be more imaginative when imagining the future?
2. Which parts of the toolkit inspired you the most?
3. Was there something in the toolkit that you felt was unnecessary or uninspiring?
4. How easily did the discussions start? What improvement in the setup would you suggest for a smoother kick-off?
5. Did you feel that the toolkit allowed the discussion to be more elaborate? If not, what do you think it is missing?
6. How did the discussion affect your attitude or belief towards the future?
7. In what kind of settings do you see this toolkit to be used in?

D Researchers Backgrounds & Roles

D.1 Laure Smits

Laure focusses on designing for education in her work. Taking a user-centered approach to the design process and involving the user almost every step of the way characterizes her work. She is dedicated to helping innovate the Dutch (secondary) educational system to fit the goals for 21st education to help ready the future generations. Her aim is to combine technology and tangible design to let children have rich interactions and learning opportunities in education.

Her role within this research project was mainly centered around the creation of the design probe. She focused most of her

efforts on developing the toolkit as she has already had quite some experience with this in her previous work. Next to this, she took on the role of project leader to help steer the project in the right direction and stay on top of things. This organizational role was also taking further in the creation of the final paper where she became the editor. Laure completed her ID bachelor at the TU/e and was therefore the only person with previous experience of a research through design process. Taking on an editor role allowed her to teach others the ways of research through design at the ID faculty and share her knowledge in a constructive way so that others could take this learning opportunity and get the most out of it themselves. Her experience helped keep the project on track and finish the research project as planned.

D.2 Lynn van der Zwan

Lynn completed her pre-master last year at the Technical University of Eindhoven. Previously she finished her bachelor's degree Industrial Product Engineering at the Hague University. She is inspired by human-product interaction projects, sustainability, nature inspired design and human behavior design. Her aim is to create and design innovative products and designs while implementing the needs of the user.

Her role within this research project was mainly to learn how to write a research paper. She had no experience with writing research projects and the field approach. It was convenient for her to learn how to execute and write a research paper for next semester so she can implement her learnings. In this paper she focused on creating the product reaction cards and interaction vocabulary cards for the toolkit. She also created the explanation cards for all the aspects of the toolkit. Next to this, she wrote the abstract and the introduction as part of the report. During the user testing sessions, she facilitated one of the three observation sessions and came up with good findings for the future works of this paper.

D.3 Jorn van Dijk

Jorn completed his pre-master at the Technical University in Eindhoven last year. Before that, he completed his bachelor's degree in Industrial Product Design at the Fontys Hogeschool in Venlo. From home he gets his inspiration to develop products. His passion lies in designing for users with a focus on vitality, sports, exercise, and motivating users.

His role during the research project was to learn more about how a research paper is constructed and how it is written. He has no experience with this and used this as preparation for future research projects. During this project, he focused on implementing the subject video into the toolkit. However, the execution of this was not ideal to implement in the toolkit. Furthermore, he created a setup for the observers to use during the user test. In addition, he focused on the limitations in the discussion and describing some sections of the toolkit in the report. During the user test sessions, he observed one of the three sessions. And later analyzed the results of the online survey.

D.4 Dylan van Oosterhout

Dylan completed his premaster and the first semester of the Industrial Design master at the Technical University of Eindhoven, having finished his bachelor's in industrial design engineering at the Haagse Hogeschool. Having grown up around the world, he is inspired by sustainability, multifunctionality and inclusion in the design field. He aims to design products and services revolving around simplicity and easy usability.

His role within the research project mainly revolved around contributing knowledge by carrying out research into the field and the problem that was being investigated, as well as investigating how the design probe could be implemented into the scope of the project through related works. Following this, he contributed knowledge by investigating important elements to include in the design probe, eventually creating the soundscape, which was an element of the eventual toolkit that was created for the user testing. He also worked as a team player, by helping some of the other team members when they were stuck or helping them refine their own sections. During the user testing sessions, he facilitated two of the three sessions, helping the participants understand the design probe, asking relevant questions and keeping the sessions on track.

D.5 Milda Virbickaite

Milda has completed pre-master and the 1st master semester of ID, previously achieved a bachelor degree in Industrial Design Engineering. She aspires to design with practicality, sustainability and creativity in mind, for issues related to preventative healthcare, with particular interest in small and wearable solutions.

Currently doing her own individual research project, Milda aimed to get more experience and practice in conducting data gathering experiments and its' analysis, therefore she took on tasks such as planning the sessions, forming questions for the survey, recording and combining data and result analysis part of the report. Completing these tasks and directly applying new knowledge from CDR course contributed to the preparations for her own paper. In addition, she did supporting tasks such as forming visual (photo) part of the toolkit, ideating on the toolkit's form and proposing the use of a visual timeline.

D.6 Arian Etefaghpour

Arian has just started his Master of Industrial Design at the Eindhoven University of Technology. Previously, he finished his bachelor's in industrial design at Tabriz Art University. He loves trying new things and migration was the biggest step in his life journey. He is interested in the aesthetics and creativity of products and their production process. Moreover, his aim is to broaden his knowledge of business and entrepreneurship during his studies.

In this project, his main focus was to learn the research process and how to write a research paper. Even though he had a role in design projects before, researching through design and authoring articles was something new to him, so he tried to act more as a listener and learn from his experienced teammates to narrow his knowledge gap. He was also present in all team meetings and two of the research sessions to get familiarized

with the field study approach by heart. Besides, he took the responsibility to write the methods which was upgraded by his team members to the final form as appeared in the paper.