# Cooking Up Ideas: Evaluating The Cookery as a Sensemaking Tool for Addressing Societal Challenges

Master's Thesis

Psychology – Human Factors & Engineering Psychology (HFEP)

Faculty of Behavioural, Management, and Social Sciences (BMS)

University of Twente

Student: Alexandru-Lucian Amariei

1st supervisor: Dr. Cesco Willemse (CoDe, BMS Faculty)

2nd supervisor: Dr. Simone Borsci (CoDe, BMS Faculty)

3rd supervisor (external): Dr. ir. Cristina Zaga (HCD, ET Faculty)

**Abstract**

This work represented the first empirical study exploring The Cookery's potential to facilitate the addressing of societal challenges. Societal challenges are complex problems our society faces and must be addressed holistically (Brown et al., 2010). Tackling them calls for cross-disciplinary approaches, such as transdisciplinarity, where stakeholders from all societal areas should collaborate (Polk, 2015). However, this can create further complexity when approaching a challenge. Approaches such as sensemaking, where people use familiar frames of understanding to approach novel situations, can reduce this complexity (Weick et al., 2005). This approach stays at the foundation of The Cookery. The study explored how people experience this sensemaking-based tool while addressing societal challenges regarding their preparedness to address and understand the issue, and through further qualitative insights of the users. A between-subject, mixed-methods design was used. Sixteen participants, students and university staff members, were recruited and split evenly across two conditions: The Cookery and Focus Groups, a classic method used in co-design practices. Data were collected through recordings of post-session discussions and individual written responses, with subsequent content analysis. The findings indicate that The Cookery enhanced participants' preparedness, provided an environment that encouraged creative thinking, and raised awareness of diverse approaches to tackling challenges. These findings show the value of sensemaking and of tools using this approach in enhancing collaboration and perspective sharing to tackle societal challenges, applicable in contexts like education and stakeholder engagement. Future studies should continue developing The Cookery and investigating its usefulness in these contexts.

*Keywords*: The Cookery, societal challenges, sensemaking, transdisciplinarity, qualitative research

**Acknowledgements**

At least for now, this study represents the conclusion of my work from the previous years at the University of Twente, both professionally and academically. The last one and a half years especially were intense and full of experiences that helped my growth. Although it might seem simple on the surface, the whole installation and thesis are the sum of sleepless nights and many experiences I will cheer and take with me in the future. Therefore, I can only submit this thesis after acknowledging the people who helped me during this journey.

This study would not exist without The Cookery. I want to thank the whole DesignLab team for the opportunity and support in realising this 'shower thought' and bringing it to the stage of being displayed at Dutch Design Week and then back at UT to be displayed and used. Moreover, I want to thank *Kris Pals-Krukkert*, *Julieta Matos-Castaño*, and *Cristina Zaga*, as they were the ones with whom this idea started, mentored me, and trusted me to take it from an absurd concept to a strong, tangible interactive installation. Its realisation would have never been possible without my most amazing colleagues and friends, whose skills made The Cookery physically exist in about six weeks of continuous work and sleepless nights. I will not rewrite the whole colophon, but I must thank again at least *Cristina Ionaș, Pablo San Gregorio, Leon Peters, María Cobo Muñoz, Jamila Blokzijl, Laura Maškanceva, Rayhan Bayuaji, Xian Bodelon Ruibal, Jorge Davo Sainz, Thijs Bianchi,* and *Lars van der Werf* for getting this done. They are the real cooks in The Kitchen.

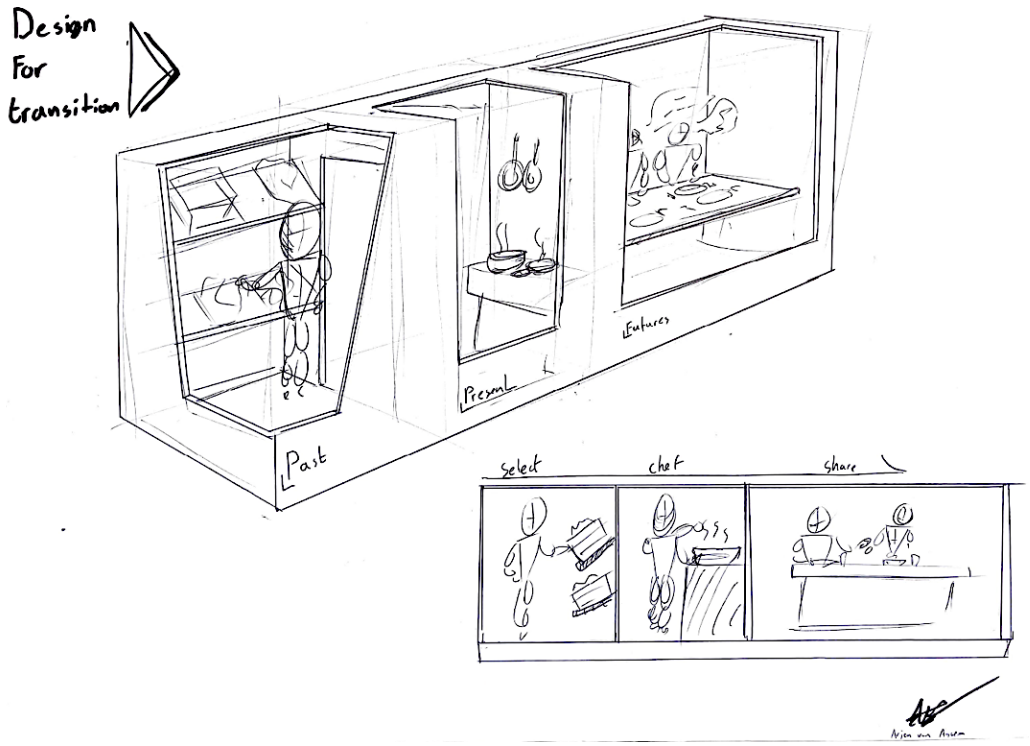
This thesis wouldn't have been done without some fantastic supervisors. Major thanks to *Cesco Willemse*, who helped and motivated me to complete this work. I am grateful for allowing me to learn from him, always understanding me and what I was doing, being kind in his approach, and constantly reminding me to trust myself and my decisions. *Simone Borsci* is one of the people I am glad I met and had the opportunity to work with and learn from in the previous years at UT. I do not understand how he did not get tired of supervising my work, but I am glad he did not, as I cannot quantify how much I learned from him in the last few years. Last but not least, many thanks to *Cristina Zaga*, whose honest and always warm support in getting this done and whose experience in qualitative approaches was invaluable for me and my development. I also want to express my thanks in the context of the thesis to my dear friend *Rayhan Bayuaji*, who did not hesitate for a second to jump in and use his time to be a moderator and, pretty much, a second researcher in this study. His tolerance in listening to my stream of ideas and steering me back on

track was so valuable and inspiring, and I am grateful for it. Also, thanks to the participants in this study, who took their time during the summer holidays to come and help me with this study.

I also want to express my deepest gratitude to my dear friends: *Jorik Ordelmans, Bogdan Covrig, Constanța Roșca, Andrei-Ionuț Mitrea, Daffa Paramitha, Jasper-Sebastian Hasler, Louis Nelissen, Maya van der Berg, Emma Lloyd*, and everyone else who helped me. Their support was always valuable and pushed me to go forward, from feedback to ideas and from a coffee to a motivational speech when I was mentally drained.

Lastly, but definitely not least, I must thank my lovely parents: *Gabriela-Luminița Amariei* and *Gheorghe Amariei*. Even if they were not here physically, their support and love have kept me through ups and downs since I came to The Netherlands, and even more so during this process. They taught me to be better, always aim to do what I love, and care for the people around me. I hope I do justice to these learnings and will always nurture them in my life.

Much love, gratitude, and all the best things to everyone!




*The very first sketch of The Cookery, credits to Arjen van Assem*

## Contents

# Introduction

## Societal Challenges

*Societal challenges*, or wicked problems, are defined as issues that are difficult to handle due to a growing gap between the complexity, the human capacity to deal with them, and the other problems that might arise when trying to solve one issue within a particular challenge (Brown et al., 2010). Multiple sectors can be considered as continuously changing and subsequently creating issues. In their work, George et al. (2016) provided several examples of the grand challenges that our society is facing. The different societal stakeholders recognise issues such as climate change, ageing societies, and gender inequality. These challenges require a coordinated and sustained effort from responsible societal agents, such as academia, the public sector, industry, and the citizens.

Besides requiring multiple stakeholders to be involved, societal challenges also refer to situations where addressing one facet of a problem could lead to other impediments. For instance, when addressing complex topics such as gender inequality through research, offering an equal playground to all agents involved is crucial. Multi-dimensional methodologies such as intersectionality could be employed to address this holistically. For this example, intersectionality focuses on considering the experiences, social dynamics, and backgrounds of those directly influenced by the research and aspects like the researcher's biases and cultural influences (Esposito & Evans-Winters, 2021). Failing to do so could result in findings or solutions that do not address the discussed topic or challenge holistically and might create more injustice than they fix. These situations require looking for innovative ways to address these challenges responsibly and ethically to ensure that possible adverse outcomes are limited and the challenge can be addressed appropriately. Tackling these social issues demands creative and inclusive strategies incorporating various viewpoints and expertise. Moreover, they require continuous knowledge sharing and involvement of various societal stakeholders, which can happen at different disciplinary levels.

## Cross-Disciplinarity in Addressing Societal Challenges

Addressing societal challenges requires innovative and inclusive approaches that bring together diverse stakeholders and their perspectives. Cross-disciplinarity is an essential aspect of addressing societal challenges. Mobjörk (2010) offered three perspectives on cross-disciplinary practices:

- *Multidisciplinarity* involves researchers from different disciplines collaborating to solve a problem while remaining within the boundaries of their respective disciplines.
- *Interdisciplinarity* involves researchers from different disciplines who use their respective knowledge and other researchers' expertise. Instead of being limited by their knowledge domain, they aim to create a shared framework to tackle complex issues.
- *Transdisciplinarity* involves researchers collaborating with practitioners (e.g., citizens and policymakers) to solve complex challenges. Academic knowledge is blended with non-academic knowledge to create solutions for real-life problems.

Transdisciplinarity differs from other cross-disciplinary approaches by transcending academic boundaries. One benefit of this approach is its focus on solving real-life complex challenges. Compared to other solutions, transdisciplinarity promotes involvement, considers the needs of societal stakeholders, and understands which issues we should focus on (Polk, 2015). Another benefit is the integration of diverse stakeholders and their knowledge in the process. Researchers bring their knowledge, but non-academic knowledge is also welcomed and utilised (Polk, 2015; Prell et al., 2021). This approach aims at creating more efficient, practical, and inclusive solutions. Transdisciplinarity offers a framework for tackling societal challenges, but its success also depends on the tools and processes that foster collaboration and mutual understanding.

## Working Towards a Common Goal: The Co-Design Approach

### *The Complexity of Societal Challenges and Design Practices*

Transdisciplinarity and co-design provide valuable frameworks for addressing complex societal issues, but their effectiveness relies on creating practical tools to support collaboration and innovation. For instance, considering the example of gender inequality mentioned in the first section, holistic practices such as intersectionality are already used. Esposito and Evans-Winters (2021) focused on academia, where practices like intersectional qualitative research represent approaches that look beyond merely finding an answer and examine the research process, considering what other aspects influence the work output. However, these holistic approaches can create complexity that could affect the process towards finding solutions.

The complexity and volume of information involved in the design process can become hindering factors. Dorst (2019) discussed how designers have developed strategies to deal with

this information overload and the complexity of the issues addressed. These strategies, called reasoning strategies, are methods used to limit the burden on short-term memory. It is emphasised that design is often a team effort, where actors must work concomitantly to reach common ground and ease the cognitive load created by the process. Another relevant strategy is understanding and considering precedents, actions, or challenges encountered before, from which learnings can be applied in current design projects. The same work of Dorst (2019) highlights the need to work together through the example of the struggle of the Dutch mental health system to meet the demands of upcoming demographic and economic demands. The 'Redesigning Psychiatry' project aims to cater to this societal challenge's complexity by reimagining the Dutch mental health sector to match the purpose for 2030 (Reframing Studio, n.d.). Bringing together universities, government agencies, and mental health organisations aims to create a collective understanding between the stakeholders and the society's values. The healthcare system needs to be changed accordingly to match those. This example shows how approaches must evolve to manage societal complexities and accommodate diverse perspectives for shared understanding.

### *Co-Design as a Practice to Work Together on Challenges*

A notable practice that aims to involve multiple stakeholders and account for their experiences in generating findings is co-designing. Co-design existed as a practice for over 50 years (Sanders & Stappers, 2008). It differs from the classical approach to the design process, where the user is a passive object of the study, and the researcher holds the power and knowledge. In co-design, the roles are mixed up. All stakeholders are involved in the design process to find a solution, empower each other, and use all the knowledge individuals bring. As a collaborative process, co-design aims to foster inclusive, creative problem-solving that aligns with the principles of transdisciplinarity.

Multiple frameworks and tools are used for co-designing. The work of Sanders and Stappers (2014) emphasised the idea of making and generative stages. Making represents the creative act of transforming meaning by those involved in the co-design process. They describe a sequence of design stages: a fuzzy front end using probes and toolkits, followed by a traditional development process involving prototyping. They propose a revised framework to align with the regular design process timeline, including pre-design, generative, evaluative, and post-design

phases. They discussed and emphasised using tangible tools to facilitate the design process, such as probes, toolkits, and prototypes, to support the design process.

Besides the framework and its respective tools mentioned beforehand, many other tools are employed in co-design. In their work, Kerr et al. (2023) highlighted the added value of co-design methods when addressing challenges, mentioning how it allows for meeting unforeseen and unexpected needs and priorities. They categorised a wide range of methods used for co-design, for instance, brainstorming, focus groups, prototyping, and many others, based on their intended purposes. Their proposed usage categories for each method are exploring, ideating, prototyping, testing, sensemaking, and provoking. Each co-design tool can serve one or multiple purposes, depending on the group's design phase and the challenge they address. It is essential to look at and adapt to these to address a challenge adequately.

### *Focus Groups*

*Focus groups* are an approach used in co-design and qualitative research. They are represented by group discussions on a specific topic guided by a trained moderator (Sim & Waterfield, 2019). The dialogue and the interactions between the participants in such a setup can generate insight into how they perceive a topic, both from an individual and a group perspective. Focus groups can be conducted in multiple ways depending on the session's aim and available resources. Nyumba et al. (2018) identified several ways in which they are executed. A single focus group represents the classic approach, where participants and moderators discuss a topic as one group. When the facilitators and the observers are separated from the participants, studying and noting their interactions without being seen, the approach is considered a two-way focus group.

The role of the moderator also influences the type of this approach. If two moderators with separate roles facilitate a session, the approach is considered a dual moderator focus group. Furthermore, a duelling moderator focus group happens when the moderators take opposing sides of the session's topic to stimulate in-depth data generation. A respondent focus group is conducted by appointing one of the session's participants as the discussion leader to create a different group dynamic. Researchers can opt to conduct a mini-focus group when the pool of participants is limited or hard to access. Lastly, online focus groups can also be used as an approach, where participants can discuss a topic using online channels. The appropriate type of focus group for a situation must be determined by its aim and the fit to the research or design process.

**Sensemaking as an Approach to Making Sense of the World**

In their work, Sanders and Stappers (2014) mentioned how the pre- and post-design phases are crucial in co-design to understand people's experiences within the context of their lives, focusing on the past, present, and future. Sensemaking enhances co-design by helping participants create shared meaning and adjust their mental models to new challenges. From an organisational perspective, sensemaking is the instrumental, subtle social process of taking familiar experiences and applying them in other contexts to attribute meaning to the events around us (Weick et al., 2005). When individuals encounter situations they cannot initially understand using their existing mental models, they tend to create new frames of understanding for their challenges (Maitlis & Christianson, 2014). Mental models represent an individual's internal representations of the external reality, aiding them in interacting with the world around them (Jones et al., 2011). While mental models represent the structures already in place, sensemaking is the process through which these are adapted and modified based on the experiences individuals encounter in their lives (Westbrook, 2006). The sensemaking approach involves going beyond merely interpreting the situation by constructing new mental models to address novel scenarios they encounter.

Sensemaking concerns multiple processes that can create new meanings for things in our environment. It can be represented by individual cognitive, collective social, or discursive processes (Brown et al., 2015). Individual cognitive processes related to sensemaking are focused on evaluating and interpreting and are exemplified through developing mental frameworks, schemata, or models (Maitlis & Christianson, 2014). This effort is mainly done when an actor encounters a situation that requires a solution by themselves. Secondly, collective sensemaking emerges when multiple actors engage in a process. It usually happens in social contexts, where the collaborative sensemaking process can create a collective understanding of the world around them (Matos-Castaño et al., 2020). The work of van der Giessen et al. (2022) explored the emergence of collective sensemaking while tackling the societal challenge of forced displacement. Their findings highlight how people who employed a change-oriented action strategy and started working together developed their sense of self-worth through bonding and identifying with the refugees and their peers instead of developing this individually. This approach allowed the respondents to place themselves in the bigger issue context instead of the local one and discover how they could contribute to the challenge. Behaving this way allowed the agents to collaborate and address the situation. Lastly, discursive aspects of sensemaking represent the linguistic and

communicative processes employed in creating narratives and shaping identities (Maitlis & Christianson, 2014; Brown et al., 2015). It concerns how individual discussions and written content create meaning within a particular societal context. In conclusion, sensemaking occurs at different levels as people develop new meanings to the novel situations around them. This approach encourages diverse viewpoints among stakeholders, encouraging collaboration to address societal challenges effectively.

## The Cookery: A Tangible Sensemaking Experience to Address Societal Challenges

### *What is The Cookery?*

Sensemaking, transdisciplinary, and co-design principles converge in tools like *Design for Transition – What's on Your Menu*, aiming to facilitate collaboration and collective understanding through an interactive, tangible, and easy-to-use experience. Colloquially known as The Cookery, this tool is an interactive exhibition depicting society's changes and challenges and exploring ways to address them (University of Twente, 2023). A representation of the entire tool can be seen in Figure 1. Depending on the process stage, it includes physical, analogue and digital elements that aim to create an engaging experience for the participants. Its primary purpose is to elicit debates and discussions about societal challenges among individuals, enable them to learn from each other and create a shared understanding frame about the issue.

**Figure 1**

*The complete Cookery, as it was presented at Dutch Design Week 2023*

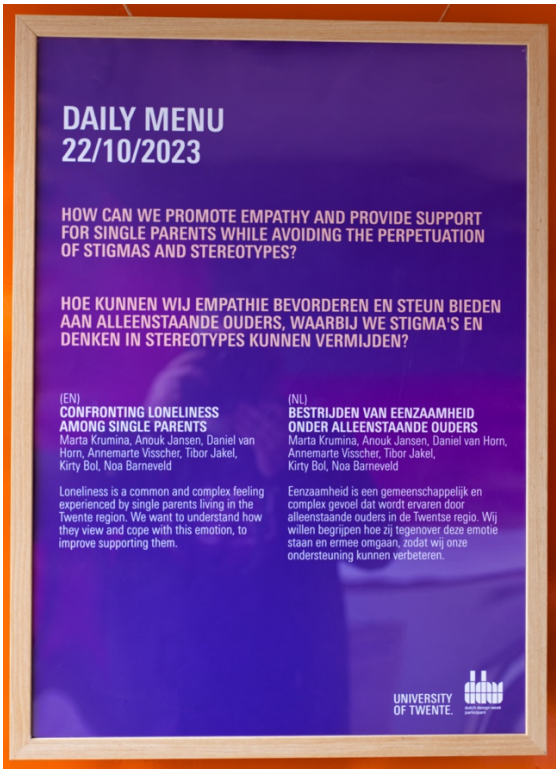
From a sensemaking perspective, The Cookery makes an analogy between the process of addressing a societal challenge and the cooking process. The concept development team chose this metaphor as it represents an everyday activity that individuals engage in, thus offering a more straightforward frame of understanding for the complicated process of addressing societal challenges. Moreover, the aim was to ease the load of such an approach on the participants and empower them in addressing a societal challenge. It starts with a wicked problem and then guides participants through three stages to tackle it. These stages represent everyone's past, present, and futures, and how these can be used to address the societal challenge in focus. A maximum of four people can use the tool at the same time due to the capacity constraints of the space and the system. Through this process, The Cookery aims to inspire its users to exchange ideas, become aware of their complementary perspectives, collaborate on creative solutions, and develop joint strategies to tackle complex societal challenges.

***The Menu***

Using The Cookery requires a societal challenge. The Menu represents this within the context of the metaphor used and serves as a pre-phase of the entire process (Figure 2). Regarding users, the participants should come from different societal groups and possess a basic understanding and willingness to address the proposed topic. This societal challenge must be phrased as a question that individuals must read and then remember throughout the process. As per the definition of societal challenges, they should be broad enough to offer opportunities to explore the different facets of a challenge yet specific enough to focus on a particular area to reduce off-topic discussions.

**Figure 2**

*Example of The Menu, used at Dutch Design Week 2023*




***The Pantry***

The Pantry represents the first phase in The Cookery process. It presents 30 ingredients to the participants, each representing a value. The participants can choose three values to take with them in the next stage of the process. These values should be the ones that each participant finds the most relevant for themselves, as elements from their past that shaped their perspectives, and relevant for the societal challenge they must tackle. Apart from the limitation to a maximum of three values and the instruction, there is no other limitation on choosing the values. Each value has a personalised label and barcode for use in the next stage. These values were decided based on three main categories:

- Community & Collaboration (fruits and vegetables): communication, trust, respect, inclusivity, empathy, care, flexibility, kindness, sharing, fairness.
- Knowledge & Curiosity (baking goods): creativity, learning, critical thinking, wisdom, discipline, growth, resilience, generosity, innovation, literacy.

- Openness & Transparency (packaged goods): integrity, accountability, honesty, responsibility, agency, leadership, advocacy, clarity, public interest, privacy.

An image of The Pantry can be seen in Figure 3, and the complete list of the values and associated ingredients, with the names used in the tool, can be found in Appendix A. The design team decided on the values and the categories they belong to, including a comprehensive range of options. The allocation of values to ingredients and categories was done mainly randomly. For some associations (e.g., Communication Garlic), the decision was made with a slight resemblance between the ingredient and the value they convey, or for comedic value, by the lead concept developer.

**Figure 3**

*The Pantry*

***The Kitchen***

The Kitchen is the second stage of the process. This phase aims to have participants put the values they chose in the first stage into practice to solve the societal challenge. To do this, each participant must choose one of the eight appliances on display. The entire process of using the values and choosing a device is done using a tablet. For each appliance, the interface on the tablet presents the name of the approach it represents, a short motto, and a brief description of what the approach entails. The Kitchen can be seen in Figure 4. A detailed list of the appliances with the associated text can be found in Appendix B.

**Figure 4**

*The Kitchen*

The eight approaches from which participants can choose, with their meanings, are:

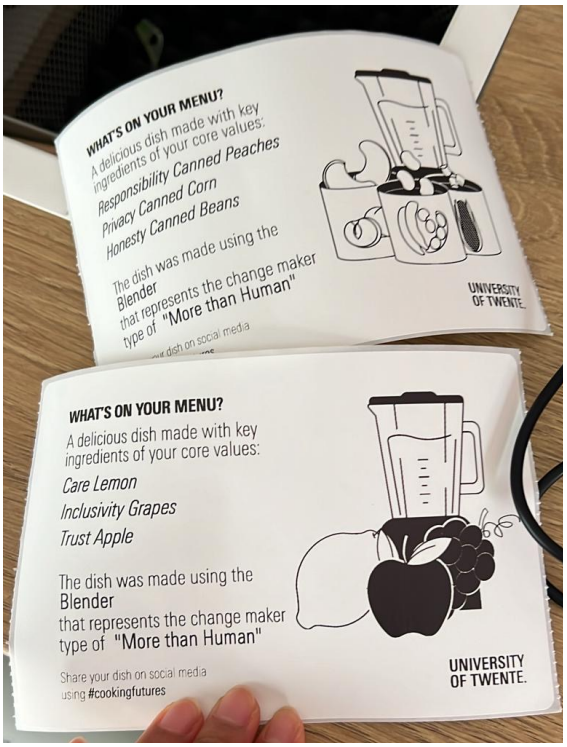
- The Nature Lover: emphasising learning from and the usage of nature.
- The Educator: empowering others through skill transfer and enabling them to build solutions.
- More than Human: looking beyond human limitations and learning from other species.
- The Game Changer: challenging the status quo and looking for unconventional solutions.
- The Community Builder: emphasising the creation of communities and collective work.
- A Child's Heart: learning from children and approaching challenges more playfully.
- The Artist: finding solutions through the usage of creative arts.
- The Historian: emphasising learning from past events.

The approaches in The Kitchen were based on an exercise used in a workshop at the PRIMER 2022 conference. This event was at the *Speculative Futures the Hague* workshop, where participants could experience a dilemma-based card game to explore smart city futures (Eventbrite, n.d.). This workshop presented the approaches as *types of smartness*, or worldviews, that can be used to create urban experiences. They were considered adequate by the concept developers in the context of The Cookery and slightly adjusted to the state and description provided beforehand. The lead concept developer allocated each approach and appliance. It was based on whenever a resemblance between the appliance's purpose and what the approach entails was seen.

After the participant decides on the approach, they receive a sticker with written and illustrated choices representing their dish (Figure 5). They can use it in the last stage of the process. The participants are also invited to grab a reflection plate from The Kitchen and take it to the last stage of the process.

**Figure 5**

Example of a dish stickers received after completing The Kitchen phase




### *The Dining Room*

The Dining Room is the third and last phase in The Cookery. It aims to allow participants to discuss their choices and views of the proposed societal challenge. After each participant finishes The Kitchen stage, they can sit at the Sensory Interactive Table (Figure 6). This table is a multimodal tool that measures eating behaviour and displays visual stimuli using pressure cells and LED structures (de Vries, Haarman, Harmsen, Heylen, & Hermens, 2020). In The Cookery, the table's capabilities are limited. It displays 30 moving blobs, each corresponding to one of the ingredients in The Pantry. Furthermore, it was chosen instead of a regular table because it matches the theme of the last stage, fitting the type of a futuristic table. When all participants are at the table, the last phase can begin.

**Figure 6**

*The Sensory Interactive Table in The Dining Room*

In this stage, the participants must follow the sub-process from the reflection plate they got in the previous stage. They can also use the sticker depicting their choices in the previous stages as a helping element in the discussion. The full sub-process of reflection can be found in Appendix C. It was designed to stimulate future thinking about the societal challenge, individual experiences, and previous choices in The Cookery. It starts at the individual level, inviting participants to reflect on their selections and envision the future regarding the proposed societal challenge. A period of ten years is given to think about this future scenario. Moreover, each participant has one minute to answer this question and share their views with the others, counted by a kitchen timer at the table. The ten-year time frame was deemed realistic by the concept development team for envisioning future scenarios using the limited number of individual choices. When the time expires, the next willing participant at the table must repeat the same exercise. The individual reflection ends when all participants have addressed the individual statement.

After the individual reflection step, a one-minute discussion between participants must be done. The participants are asked to have a plenary discussion about what they have learned from each other. This final step is expected to stimulate the collective understanding of the challenge and raise awareness about the complementarity of perspectives of the stakeholders at the table. This part is also limited to one minute. The time limitation was selected for individual and

collective stages due to where the tool was first assembled and used: at the Dutch Design Week 2023 event.

***Informal observations***

The Cookery was designed to be displayed at Dutch Design Week 2023. Before the event, it was subject to an informal two-week piloting phase, in an incomplete version, at DesignLab at the University of Twente. That was done to check if visitors understood how to use it, if they could do so by themselves, and to test the robustness of the electronics in the system. There was no precise number of users from this trial period. Based on the feedback and observations from the design team, there were minor improvements to the system and the elements within the space to improve its usage. However, the main takeaway was the need for a moderator to explain the process.

Further observations were made during the nine days the interactive exhibition was at Dutch Design Week 2023. It is estimated that around 800 individuals used The Cookery during the event. This estimate is based on the anonymous data stored in the system and checked after the event, the estimates of the moderators present during the week, and several uses for testing the system. For this instance, the observations were also informal and verbally reported by the moderators. The reception from the public was positive. Participants mentioned how The Cookery made the proposed societal challenges easier to understand, the discussions easier, and the process engaging through empowering them to place themselves in the context of the societal challenge together with others.

Similar observations were made after the installation was moved back to DesignLab University of Twente. Some aspects of The Cookery (e.g., the values in The Pantry) were used in the Responsible Futuring workshops (University of Twente, n.d.). The tool was also used by students from the Space for Ethics course from the Faculty of Geoinformation Science and Earth Observation at the University of Twente. Furthermore, it was used by different groups interested in addressing societal challenges (e.g., the future of education and languages) and by interested DesignLab visitors. Participants appreciated the tool and acknowledged its value in facilitating complex discussions. Nonetheless, all observations were still informal and not quantifiable. Therefore, it was determined that empirical observations of The Cookery are needed to gain insight

into the tool's validity in addressing societal challenges, the design decisions taken during its development, and the robustness of its theoretical foundation.

**Research Goals**

This study explored The Cookery as a tool for facilitating discussions about societal challenges between stakeholders and empirically compared with a traditional focus group approach. The framework of Sanders and Stappers (2014) highlighted the importance of considering people's experiences in developing solutions, especially in the pre- and post-design phases. A similar process of guiding people through their past, present, and futures lies at the foundation of The Cookery, together with sensemaking as an approach to attributing meaning to novel situations people encounter. The main indications of the added value of The Cookery came from informal comments from previous participants that the analogy used in The Cookery made the process of addressing a societal challenge tangible and easy to understand due to its interactivity and engagement in comparison to traditional discussions. Nevertheless, there was no precise evaluation of whether and how this process and the sensemaking elements facilitate addressing societal challenges compared to the classic co-design method of focus groups. This study aimed to fill this gap and provide practical insights for future research and practice.

A mixed-methods comparative study was conducted to observe how addressing a societal challenge in The Cookery, shaped by sensemaking and promoting transdisciplinary collaboration, differs from tackling the same societal issue in focus group settings. This approach entailed using the same process in two different conditions, with the main research question being:

RQ: Is The Cookery significantly different from a focus group regarding users' experience of the methodological procedure and their perceived preparedness and understanding of societal challenges?

The Cookery's power in aiding the expression and integration of subjective experiences when addressing societal challenges was explored in terms of changing the participants' sense of how empowered they felt before and after using the tool and how their understanding of a complex societal challenge changed. Furthermore, sensemaking and how this concept supports addressing a societal challenge in The Cookery was investigated. The following research sub-questions were devised to address these aspects:

- SQ1: How does The Cookery methodology perform compared to a focus group when it comes to changing the perceived preparedness to address a societal challenge of the participants before and after using the tools?
- SQ2: How does The Cookery impact participants' understanding of complex societal challenges compared to a focus group after using each tool?
- SQ3: How do users perceive the experience of using The Cookery compared to the focus groups in terms of usage and emergence of topics after using each tool?

## Methods

### Research Design

This study employed a between-subject, mixed-methods design to explore and compare the use of The Cookery process in two different settings: within the tangible design experience itself and a focus group. Content analysis was chosen as the primary method due to the study's exploratory nature. The Cookery has not been empirically researched; its development relied primarily on design decisions, as presented in *The Cookery: A Tangible Sensemaking Experience to Address Societal Challenges* section. The study's sub-questions examined how this process might shape participants' approach towards a societal challenge across the two setups. For this purpose, collecting and analysing qualitative data generated during the sessions was considered appropriate.

Focus groups, a standard method in co-design practices, were selected as a comparative setup due to their efficiency in generating qualitative data that reveal participants' perspectives (Plummer, 2017). The Cookery, designed as an interactive tool to facilitate group discussions, enabled the exploration of sensemaking elements. Therefore, the same process was applied in The Cookery and focus groups, with sensemaking elements removed from the latter to serve as a control. The Ethical Committee of Behavioural and Management Sciences (BMS) at the University of Twente approved the study (request no. 240946).

## Study Participants

### *Researchers Description*

The research team consisted of the primary researcher and a moderator, who also served as a secondary researcher. The primary researcher coordinated the development of The Cookery and its process. He had prior experience with research designs similar to the one used in this study but limited experience with qualitative analysis methods. To enhance objectivity and ensure reflexivity, the primary researcher employed journaling and repeated check-ups of the coding process throughout the study, enabling continuous reflection on potential biases. Additionally, he acted as an observer during the sessions, appointing a moderator to reduce any bias from direct moderation.

While involved in The Cookery's development, the moderator did not directly contribute to the tool's process development. This separation from the core elements of The Cookery was desired to create a more impartial moderation. The moderator's experience in facilitation and knowledge of qualitative methods, including coding, also enabled them to conduct an inter-rater reliability test after data collection with the primary researcher.

### *Participants*

In total, 16 participants voluntarily took part in this study, which was deemed sufficient to generate adequate data from participant statements in the open discussions after the sessions and written responses to the open-ended questions before and after each session. Eight participants were in The Cookery sessions (Session 1: n = 4, Session 2: n = 4) with an average participant age of 30.5 years (SD = 14.91, range = 19 – 64). They were cisgender male (n = 4) and women (n = 4), with 75% of them having an undergraduate level of education ($n_{HS}$ = 1, $n_{MBO}$ = 1, $n_{B}$ = 4) and the rest a postgraduate degree ($n_{M}$ = 2). Four participants were current students, and 4 were members of staff at the university.

In the Focus Group condition, 8 participants participated in the sessions (Session 1: n = 4, Session 2: n = 4) with an average participant age of 35.4 years (SD = 14.62, range = 19 - 61). They were cisgender male (n = 5) and women (n = 3), 62.5% of them having an undergraduate degree ($n_{HS}$ = 4, $n_{B}$ = 1), and the rest had a postgraduate level of education ($n_{M}$ = 2, $n_{PhD}$ = 1). Five participants were staff members at the university and 3 were students.

### *Sampling and Inclusion Criteria*

Due to time constraints, convenience sampling was employed to recruit participants. The researcher contacted them with a brief description of the study and the opportunity to join the session on a first-come, first-served basis. Participants who did not select a group were randomly assigned to a session based on their availability and open spots in each condition. This random allocation was considered appropriate given the transdisciplinary nature of the study, ensuring that the demographic characteristics of participants in each session (e.g., age, gender, background) could vary.

Two sessions were conducted for each condition, with four participants per session. To ensure appropriateness, two inclusion criteria were established: participants had to be at least 18 years old and have no prior experience with The Cookery. During one Focus Group session, a participant mentioned having previously encountered The Cookery. This aspect was clarified after the session, informing that they had only interacted with it in a limited demo phase and were unfamiliar with the entire process. Consequently, their participation was considered valid.

### *Researcher-Participant Relationship*

Some participants in the study were familiar with either the primary researcher or the moderator before participating. Several participants were colleagues at the University of Twente, while others were acquaintances. Nevertheless, no relationships (e.g., direct supervision) raised ethical concerns regarding their participation or the validity of the collected data.

## Materials

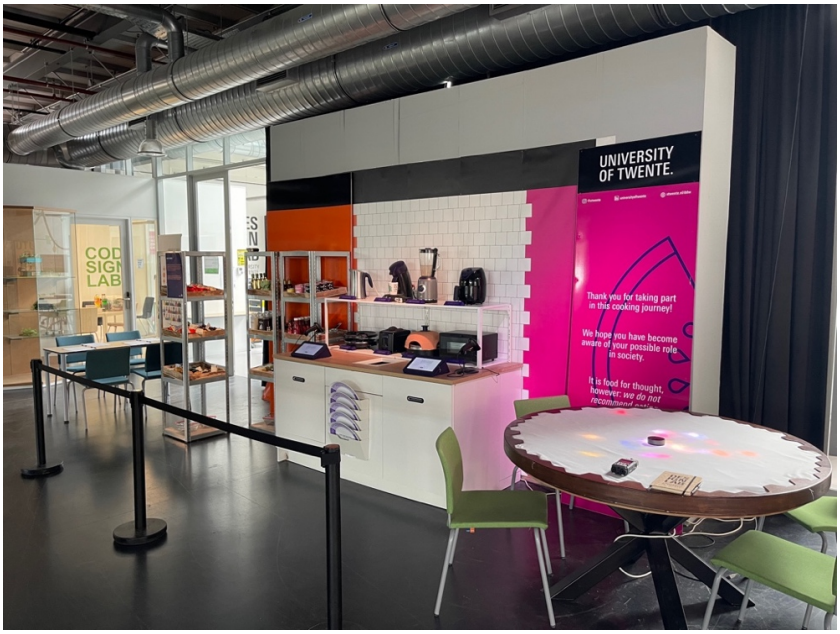
### *Experimental Setups and Materials for Each Condition*

The informed consent received by all participants consisted of two parts (see Appendix D). The first part, an information sheet, included the study's aim, participant rights, mutual benefits, and contact details for the researchers and supervisors. The second part was the consent form, composed of six statements to which participants must agree before beginning the study. Participants completed a demographics questionnaire alongside the informed consent. This questionnaire asked for information on age, gender, educational background, and current occupation, which helped assess the diversity within each group and between conditions.

All sessions were audio recorded using three recorders. These devices were placed in The Cookery and in the room where the focus groups took place in a way that they captured participant comments, verbalisations related to the process and tool, and responses to questions effectively. Recording started after participants provided consent and continued until the post-session questions were answered and no further comments were made. The Cookery was used in its original form, as detailed in the study's *The Cookery: a tangible sensemaking experience to address societal challenges* section (Figure 7). To manage access during the study, a limiting fence was placed around The Cookery, situated in an open area within DesignLab. This barrier was aimed at preventing visitors from interrupting participant interactions.

**Figure 7**

*The Cookery condition setting of the study*




In the focus group condition, participants used several materials. Each participant received 30 values on pre-cut paper pieces (without associated ingredients) to select the three they considered most important. They were also given descriptions of the archetypes on separate pre-cut papers, followed by a reflection sheet for the final step (Figure 8). A standard timer was provided to monitor time during the reflection phase.

**Figure 8**

*The Focus Group condition setting of the study*

A societal question was used as a material to stimulate discussions during the sessions. The question comprised a short background of the challenge and the question itself for the participants to remember. The question was:

> "Energy transition represents the structural changes in energy supply and consumption and is one of the significant challenges our society is currently facing. However, involving multiple parties in discussions about this topic can be difficult. How can we ensure that everyone feels welcome to discuss and contribute ideas about the future of energy transition?"

The moderator presented the question to the participants at the start of each session. In The Cookery, this question was printed and displayed at the entrance of The Pantry, allowing participants to refer to it if needed. In the focus group sessions, participants received the question on paper to consult throughout the process.

***Measurements***

To address the first and second research sub-questions, each participant answered two open-ended questions before and after completing the process to determine if there were changes

in their preparedness and understanding of the societal challenge (see Appendix E). For SQ1, it was aimed to observe changes in the level of preparedness to address the societal challenges reported by each participant before and after completing the session in each condition. For SQ2, the participants were asked about their reported understanding of the societal challenge before and after each session. These pre- and post-measurements were done to determine if there was a change in addressing a societal challenge between the two conditions. The duration of the sessions was recorded and used to see if there were significant differences between the conditions that could have affected the experience participants had while using the tools.

To address SQ3, the emerging themes from the open discussions conducted after the sessions were used, as they represented direct insights from the participants. Moreover, these code categories were used to substantiate the changes in the preparedness and understanding mentioned previously. The participants were asked four open-ended questions after they finished the process to assess their experience during the sessions they took part in (see Appendix E). The first two questions explored the session's usefulness in addressing the societal challenge, while the final two open-ended questions focused on participants' perceptions of the session's strengths and areas for improvement. This part was done in a plenary session, with participants being allowed to contribute to the discussion or refrain from providing an answer. This approach allowed everyone to express their opinions and build upon each other's comments to generate sufficient insight for the analysis.

**Data Collection**

Data were collected across four sessions during June and July 2024. Collection methods included audio recordings, written participant statements, and time tracking for each session. The researcher set up and monitored the audio recording equipment in both conditions and during the plenary discussions. Written notes, along with the informed consent forms, were gathered at the end of each session. The time taken at each stage was recorded and later cross-checked with the audio recording timestamps. To minimise researcher bias, the researcher limited interaction with participants during the sessions and instructed the moderator to facilitate the process without contributing content-related input. All data, including raw files and transcriptions, were securely stored in the researcher's OneDrive cloud for the study's duration and deleted from the devices' internal storage.

The study was conducted at DesignLab at the University of Twente. This location was chosen because The Cookery was located there when the study was conducted, which was required for one of the study's conditions. Furthermore, it was easily accessible to the study participants. The focus groups were held at the same location, in rooms prepared beforehand by the researcher for the sessions.

## Procedure

The procedure was divided into three parts: pre-process (common to both conditions), condition-specific, and post-process (common to both conditions).

### *Pre-Process*

Before each session, the researcher met with the moderator to review the session protocol. The moderator was instructed on their role, which included assisting participants with procedural questions while refraining from offering content-related guidance. The same moderator facilitated all sessions to maintain consistency.

On the day of each session, the researcher prepared the settings: ensuring The Cookery's functionality in its dedicated space and arranging the focus group room with tables, chairs, and materials on the table in front of the participants. Audio recording devices were placed in predefined spots to capture clear discussions for data analysis.

Upon arrival, participants were welcomed by both the researcher and moderator. The researcher provided them with a two-part informed consent (see Appendix D) and instructed them to review it and ask any questions. After confirmation, the participants and the researcher signed the consent form in duplicate, one copy for the participant and the other for the researcher, which included additional study questions. The researcher then introduced the moderator and stepped back, documenting observations and tracking the time required for participants to complete each stage. Participants were instructed to direct questions to the moderator and avoid engaging with the researcher unless advised otherwise. Next, the moderator presented the societal question and asked participants to answer the two pre-process questions individually in writing. Once completed, the moderator began the condition-specific process.

### *The Cookery Condition*

Participants began the task in The Pantry, the first stage, where the moderator instructed them to consider the societal challenge question. They were encouraged to browse the shelves and select three values, represented by ingredients, that they deemed necessary for addressing the problem. Mini shopping baskets were provided to carry the ingredients to the next step. In The Kitchen, participants used tablets on the countertop to choose one of eight archetypes to implement their selected values and address the question. Upon selection, a label was printed with their choice. They collected the label and a reflection plate, proceeding to The Dining Room for the final stage. Participants followed the reflection process outlined on the plate, using a timer to manage time independently. The Cookery process concluded once all participants had completed the reflection.

### *Focus Group Condition*

Participants were seated and provided with 30 values on paper sheets. Considering the societal question, they each selected three values for addressing the challenge. After making their selections, they reviewed a second set of papers representing eight archetypes and chose one to address the challenge. Once all participants completed these steps, they proceeded to the reflection stage. The reflection process mirrored that of The Cookery condition (see Appendix C). Upon completion of reflection, the focus group session concluded.

### *Post-Process*

After completing the process, participants were asked to respond to the same two questions they had answered before the session, writing their responses individually. Once all participants finished, the moderator initiated a plenary discussion with four open-ended questions. Participants were encouraged to share insights freely or refrain if they preferred. The moderator used probing questions to encourage discussion but did not share personal opinions or ask additional questions. The discussion concluded once all questions were addressed. The researcher then thanked the participants, provided a debriefing, reiterated the study's purpose, explained how their data would be used, and offered participants the option to receive the research results.

## Data Analysis

### *Data Transformation*

The audio recordings from each session were first merged in Audacity by combining recordings from the three devices to produce a single audio file per session. These merged audio files were then transcribed using Amberscript's automatic transcription feature. Due to the unsatisfactory quality of the automated transcripts, the primary researcher manually reviewed and corrected each transcript for accuracy. The finalised transcripts were subsequently imported into ATLAS.ti for qualitative analysis.

Participants' written responses, including demographic information and answers to the pre- and post-session questions, were manually transcribed into an Excel table and later imported into ATLAS.ti. Demographic data were analysed in Excel using built-in formulas.

### *Coding of the Pre- and Post-Session Data*

The responses to the pre- and post-session questions were coded individually, with the primary focus on capturing participants' reported understanding and preparedness as expressed in each written response. Each statement's meaning was coded according to its representational content. For instance, if a participant provided a personal definition of the societal challenge, it was coded as their "own interpretation of the challenge," indicating their unique perspective and perceived level of understanding. No further in-depth coding was conducted on these responses, as this level of analysis was considered sufficient for addressing the questions' intended purpose to see if there are changes in understanding and preparedness.

### *Content Analysis of the Open Discussions*

Content analysis was used to gain both quantitative and qualitative insights. The content analysis focused on the plenary discussion segments of each session. The analysis process was based on recommendations by White and Marsh (2006), with some modifications. Unlike their method, an initial text sample was not selected initially; instead, all data was coded from the beginning using the first set of codes. The primary researcher familiarised themselves with the data by reviewing and repeatedly reading the transcripts. Once well-acquainted with the content, a coding system was developed. This step involved line-by-line inductive coding of participants' responses, focusing on the meaning conveyed by each statement. Relevant statements were coded

as individual quotes within their context. Strong affirmative statements were also coded according to the preceding participant's statement, provided they were not simple affirmations to maintain the discussion flow. When applicable, multiple codes were assigned to a single quote.

Following the initial coding round, codes were grouped into broader themes, defined as code categories. Each code was reviewed for overlap with similar codes, merging any that were nearly identical into a representative code, thus reducing granularity and enhancing clarity. This step constituted a second round of coding. After the second round, a sample of 35 meaningful quotes, each assigned a single code, was independently coded by a secondary researcher. This sample represented approximately 10% of the dataset and included a balanced selection of codes from each theme. The second researcher used a codebook with detailed code definitions to complete the coding. Upon completion, the sample and assigned codes were reviewed collaboratively with the primary researcher to resolve discrepancies. The agreed-upon codes for this sample were then analysed in SPSS using the Crosstabs function, with Cohen's Kappa calculated to quantify inter-rater agreement (see Appendix F). Codes not used by either rater were acknowledged but excluded from the dataset, as they did not impact Cohen's Kappa calculation. A chi-squared test of independence was conducted to examine differences in the distribution of thematic codes across the two conditions (McHugh, 2013). All assumptions for the test were met. The test was done in SPSS using the Crosstabs function (see Appendix F).

***Reliability of the Content Analysis***

The reliability analysis yielded a Cohen’s Kappa value of 0.615, with an observed agreement rate of 62.85%; both researchers assigned 22 out of 35 quotes the same code. According to the scale provided by Landis and Koch (1977), this Kappa value marginally indicates substantial agreement between the coders. For six quotes, the researchers assigned different codes. However, these codes fell within the same overarching Code Category (e.g., “Different Backgrounds” and “Limited Background”, both within the “Diversity and Stakeholders” category). However, these instances were not included as agreements in the reliability calculation. The remaining disagreements were discussed post-coding and retained in the calculation.

# Results

## Duration of the Sessions

Table 1 shows the duration of each session and the steps during them. In all sessions, the duration of the Reflection phase was the highest. Furthermore, the other two steps took longer in The Cookery condition compared to the Focus Group sessions.

**Table 1**

*Duration of the steps of the process and the total duration of each session*

| Step of the process | The Cookery | | Focus Group | |
|---|---|---|---|---|
| | Session 1 | Session 2 | Session 1 | Session 2 |
| Values | 04:29 | 05:37 | 03:37 | 02:48 |
| Archetypes | 06:06 | 07:56 | 04:27 | 03:31 |
| Reflection | 06:58 | 13:18 | 12:17 | 08:25 |
| Total | 17:33 | 26:51 | 20:31 | 14:44 |

## Changes in Understanding and Preparedness in the Two Conditions

The first question participants had to answer individually, both before and after the tasks, was: “What is your current understanding of the societal challenge you were presented with?”. Table 2 summarises the frequency of changes in understanding reported by the participants.

**Table 2**

*Frequency table with the changes in understanding after the sessions in both conditions*

| Change in understanding after the sessions | The Cookery Condition | Focus Group Condition |
|---|---|---|
| No reported change | 4 | 5 |
| No change | 3 | 2 |
| Change | 1 | 1 |

In The Cookery condition, all 8 participants provided their definition of the challenge as an answer to this question (coded as “Own interpretation of the challenge”) before the session started. These interpretations varied, with participants referring to technological and/or societal implications. One participant directly stated involving others in the discussion (coded as “Inclusivity in addressing”). After the session, 6 out of 8 participants mentioned involving other people in the discussion about the challenge, considering multiple perspectives or understanding each other values (coded as “Inclusivity in addressing”). Regarding changes in understanding, 3 participants reported no change in their understanding, 1 participant reported an increase in understanding, and for the other 4 participants, there was no explicitly reported change in understanding.

For the answers in the Focus Group condition, 6 out of 8 participants provided their own interpretation of the challenge before the session. Of these, 5 of them made direct references that were coded as “Inclusivity in addressing”. Two participants reported not understanding the challenge (coded as “No understanding of the challenge”). After the session, the statements of 6 out of 8 participants included mentions of involving other people in the discussion about the challenge, considering multiple perspectives, or understanding each other values (coded as “Inclusivity in addressing”). As for the mentions of changes in understanding, 2 participants reported no change in understanding, 1 reported a change in understanding, and the other 5 did not directly report the change in understanding.

The participants were also asked to answer the “How prepared do you feel at this moment to address the societal challenge you were presented with” question before and after completing the tasks. Table 3 shows the number of participants that reported, or not, a change in their preparedness after the sessions.

**Table 3**

*Frequency table with the changes in preparedness after the sessions in both conditions*

| Change in preparedness after the sessions | Frequency for The Cookery Condition | Frequency for the Focus Group condition |
|---|---|---|
| No reported change | 1 | 2 |
| No change | 1 | 3 |
| Small increase | 2 | 0 |
| Increase | 3 | 2 |
| Significant increase | 1 | 1 |

For the participants in The Cookery condition, 4 participants reported that they not felt prepared to address the societal challenge (coded as “Not prepared") before the session started. Two participants reported that they felt somewhat prepared (coded as “Feeling fairly prepared”), 1 participant reported that they felt prepared enough (coded as “Feeling prepared”), and 1 participant reported that they felt well prepared (coded as “Feeling well prepared”). After going through the task, 3 participants reported that they felt more prepared to address the challenge (coded as “Increase in preparedness”), 2 participants reported that they felt a bit more prepared to address the challenge (coded as “Small increase in preparedness”), 1 participant reported that they felt much more prepared (coded as “Significant increase in preparedness”), 1 participant reported that they had no change in preparedness (coded as “No change in preparedness”), and 1 participant’s statement did not report directly any change in preparedness (coded as “No reported change in preparedness”).

In the Focus Group condition, 5 participants reported feeling prepared to address the challenge before performing the task. One participant reported feeling somewhat prepared, and 2 participants reported not feeling prepared to address the challenge. After the task, 2 participants reported that they felt more prepared to address the challenge, one participant reported that they felt much more prepared, 3 participants reported no change in preparedness, and the statements on two participants did not report directly any change in preparedness.

**Quantitative Content Analysis of the Open Discussions**

After coding the participants' statements from the open discussions conducted after each session, these codes were grouped into 10 overarching code categories. These categories represent the main topics encompassing multiple related codes. Table 4 presents the frequency of each code category, overall and within each condition, and the percentage of the utterances from a code category within each condition. A detailed breakdown of the frequency of individual codes within each category is provided in Appendix G.

**Table 4**

*Frequencies and percentage of the utterances coded under each code category, in each condition*

| Code Category | The Cookery Condition | | Focus Group Condition | | Total |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Approach Strategies | 16 | 5.81% | 3 | 1.96% | 19 |
| Challenging Task | 13 | 4.72% | 12 | 7.84% | 25 |
| Communication and Collaboration | 22 | 8.00% | 18 | 11.76% | 40 |
| Diversity and Stakeholders | 38 | 13.81% | 34 | 22.22% | 72 |
| Engagement and Experience | 35 | 12.72% | 5 | 3.26% | 40 |
| Engaging with Other's Perspectives | 50 | 18.18% | 22 | 14.37% | 72 |
| Personal Insights | 47 | 17.09% | 29 | 18.95% | 76 |
| Perspective Change | 15 | 5.45% | 11 | 7.18% | 26 |
| Quality of Discussions | 2 | 0.72% | 9 | 5.88% | 11 |
| Suggestions from Participants | 37 | 13.45% | 10 | 6.53% | 47 |
| Total | 275 | | 153 | | 428 |

The chi-squared test of independence was conducted to see if there was an association between code categories and conditions. It showed a significant association, $\chi^2$ (9, N = 428) = 35.934, $p < .001$, indicating that the code categories differed significantly across the two conditions, with each condition strongly influencing the emergence of certain code categories. The "Approach Strategies" code category had more code occurrences in The Cookery condition, with 5.81% of the total coded utterances. For the Focus Group, the percentage was 1.96%. The participants

repeatedly mentioned the plurality of ways a societal challenge can be approached as part of this theme. In the “Challenging Task” theme, more utterances were present in the sessions of the Focus Group condition. Participants mentioned that either the task or the societal challenge was difficult to understand and approach, with 7.84% of these instances occurring within the Focus Group sessions and 4.72% in The Cookery condition. Similarly, “Communication and Collaboration” codes were higher frequency-wise in the Focus Group condition. Participants made 11.76% of the statements coded as part of this theme, while 8% of the condition statements were coded for The Cookery condition.

Utterances related to “Diversity and Stakeholders” had a higher representation within the Focus Group condition, with 22.22%, while in The Cookery condition, they represented 13.81% of occurrences. This code category also represented the highest number of coded utterances within the Focus Group condition. The statements in this category mainly mentioned the different backgrounds and values of the participants and the need to employ an inclusive perspective in addressing challenges. The “Engagement and Experience” category had more utterances coded in The Cookery condition, with 12.72%, compared to 3.26% coded in the Focus Group condition. Participants commented on the tool setup and sensemaking elements more often in The Cookery condition. Statements part of the “Engaging with Other's Perspectives” theme were also encountered more often in The Cookery condition, with 18.18% present in this condition. This frequency also represented the code category with the most coded utterances in this condition. These mainly referred to sharing perspectives and values and the need to understand others' viewpoints.

More utterances were present in The Focus Group condition for the “Personal Insights” category, with 18.95% coded in this condition, compared with 17.09% coded in The Cookery condition. This theme included statements where participants directly mentioned how the process influenced their approach or engaged in reflective actions. A higher number of utterances was also present in the Focus Group condition for the “Perspective Change” category, with 7.18% of the total. The codes in this theme were attributed to statements mentioning changes in the perspective or limited perspectives of the participants. The “Quality of Discussions” theme was more prominent in the Focus Group condition than in The Cookery condition, with 5.88% coded utterances. These statements referenced the complexity of discussions and the perceived need for

deeper exploration of the topic. Conversely, participants stated more about improving the setup in The Cookery condition, with 13.45% of total utterances in this condition's sessions. These were direct mentions of how the tool, or the process, can be improved based on each participant's experience during the sessions. A summarised list of the future improvements for The Cookery, based on participants' insights, can be found in Appendix H.

## Qualitative Content Analysis

### *Approach Strategies*

The "Approach Strategies" theme encompassed statements where participants discussed how the societal challenge could or should be addressed. Several participants' statements acknowledged the existence of multiple approaches to addressing challenges and explicitly expressed this realisation after completing the task. Additionally, a few statements within this theme included participants' references to the novelty of the approach or the need for additional steps in tackling the challenge.

> "I think personally, I have realized that there are other ways and approaches to, to this societal challenge." (Participant in the second session of The Cookery condition, coded as 'Multiple ways of approaching')

> "I've never thought of it, uh, this way especially. And it's a very unique way, uh, to change my perspective on, uh, how to solve the solution. Like, uh, without these steps or guidance, I would have thought a whole other way." (Participant in the second session of Focus Group condition, coded as 'Novel Approach')

### *Challenging Task*

During the open discussions, participants commented on the challenges they encountered throughout the sessions. These statements were categorised under "Challenging Task". They included references to confusion caused by the societal challenge, which made addressing the issue more complex. Additionally, participants mentioned uncertainties about how to perform specific tasks or phases, such as the reflection in the third phase, and questioned the overall purpose of the task.

> “I think either, well, I'm not sure if that's the goal for, for this session today, but what should be the end result somehow?” (Participant in the second session of the Focus Group condition, coded as ‘Difficulty in understanding the task’)

> “…because I was more thinking of solving the challenge rather than solving a good like environment for discussion of the challenge. Okay, so that's just something that was a bit, uh, difficult for me, I guess.” (Participant in the first session of The Cookery condition, coded as ‘Hard to understand the societal challenge’)

***Communication and Collaboration***

Statements in which participants referenced the importance of communication and collaboration were coded under this theme. Participants frequently emphasised the need for teamwork and highlighted the benefits of collaboration when addressing challenges. Regarding communication, participants noted or implied its crucial role in fostering discussions on important topics.

> “I see the value of, yeah, creating immersive experiences, interactive experiences, like engaging moments for us to, to think together.” (Participant in the second session of The Cookery condition, coded as ‘Collaborative approach’)

> “I think, uh, the most I would have learned from it in this sense is if we would now have to have a discussion with the four of us, I would be better informed how to communicate with you guys during the challenge rather than, um, addressing the challenge very much in a different way.” (Participant in the second session of The Cookery condition, coded as ‘Communication’)

***Diversity and Stakeholders***

The “Diversity and Stakeholders” theme encompassed statements in which participants discussed differences or similarities in their backgrounds, perspectives, and values. Participants frequently acknowledged the diverse backgrounds present and emphasised the importance of having a range of expertise when approaching challenges. Some comments also highlighted participants' different or shared values, noting their relevance in addressing societal issues. Additionally, some statements within this theme stressed the need for inclusivity in tackling such

challenges, with participants highlighting the value of involving multiple stakeholders to ensure a comprehensive approach to societal issues.

> "I think it was nice to see the different kinds of disciplines that you can use to come to a conclusion." (Participant in the first session of The Cookery condition, coded as 'Different backgrounds')

> "I never thought about talking about energy transition [laughing] or including people in this way. So that's I think that's a good way." (Participant in the second session of the Focus Group condition, coded as 'Inclusive Approach')

***Engagement and Experience***

The "Engagement and Experience" code category included statements where participants commented on the setups and their experiences with them. The coded statements captured participants' appreciation of the setup and comments on their overall experience using it. Additionally, this theme encompassed references to the value of interactive experiences in similar processes, specifically their potential to foster creativity, engagement, and inspiration. Finally, it included mentions of sensemaking elements unique to the experience in The Cookery setup, as discussed by participants.

> "I think the workflow and how everything works together is quite nice. So, the, uh, the scanning and, uh, that the dish rolls out, uh, with the waiting time and stuff, I think is pretty cool." (Participant in the first session of The Cookery condition, coded as 'Appreciation of existing setup')

> "…every label was kind of ambiguous, like you had the name, but for each of us, I think some of them represents different things like sharing or like, yeah, um, it was kind of interesting to see how, uh, also we interpret this" (Participant in the first session of The Cookery condition, coded as 'Appreciation of existing setup')

***Engaging with Other's Perspectives***

The "Engaging with Other's Perspectives" theme included statements in which participants discussed the importance of sharing and understanding perspectives and values. Participants emphasised the need to make others aware of each other's viewpoints and values. Additionally,

this theme included statements where participants acknowledged that understanding these perspectives is valuable in addressing challenges.

> "Um, my understanding of the challenge remains the same, except for considering the different values that have been put on the table. Uh, because my value is obviously shaped by my perspectives" (Participant in the second session of The Cookery condition, coded as 'Sharing Values')

> "If you say, well, we focus on learning, then it's meant to not understand exactly what the other means." (Participant in the second session of the Focus Group condition, coded as 'Understanding Others')

***Personal Insights***

The statements where participants reflected on various aspects of the session were included in the "Personal Insights" code category. For example, statements in which participants considered their actions during the session or their role in addressing the challenge were coded under this theme. Additionally, instances where participants expressed preferences for task execution, such as a preference for working in smaller groups, were included. This theme also encompassed quotes where participants explicitly referred to changes in their ability to address the challenge, their understanding, or the skills they gained to tackle it.

> "I think when you are with four people, it's better to, uh, talk to each other than when you have larger groups." (Participant in the second session of the Focus Group condition, coded as 'Group Size')

> "…but maybe these things are in the background somewhere, but I, I don't know, that was, uh, something that opened my eyes a little bit." (Participant in the first session of The Cookery condition, coded as 'Personal Reflection')

***Perspective Change***

The "Perspective Change" theme captured instances where participants mentioned changes in their perspectives. It included statements in which participants expressed how their viewpoints had shifted or could shift after completing the task and engaging in discussions with others. Some statements also referenced the potential for perspectives to change over time. Additionally, this

theme encompassed instances where participants acknowledged perceived limitations in their viewpoints when working through the process of addressing a challenge.

> "I think this is just a really nice idea and the installation was changing my perspective of the issue and yeah, addressing different issues." (Participant in the first session of The Cookery condition, coded as 'Change in Perspective')

> "I feel like that based on the time pressure, we didn't really discuss it in how I would envision it in the future, I think I gave my perspective in the following years, but I don't really see that much in the future." (Participant in the first session of the Focus Group condition, coded as 'Lack of future perspective')

***Quality of Discussion***

In the "Quality of Discussion" code category, statements referring to various aspects of the discussions were included. Several participants commented on the complexity of the discussions and the need for deeper engagement with these societal topics. Additionally, some participants mentioned that the discussions could be inefficient and might not achieve the desired outcomes.

> "But could still result in hefty discussions." (Participant in the first session of the Focus Group condition, coded as 'Complex Discussions')

> "I also agree with this last point. I didn't really feel that we had a really deep discussion. It was just showing an opinion based on this. We could build and build and build…" (Participant in the first session of the Focus Group condition, coded as 'Deeper Discussions')

***Suggestions from Participants***

The "Suggestions from Participants" theme included statements where participants provided feedback or suggestions on improving the tools to achieve their goals. These suggestions ranged from comments about modifying specific elements of the tool, such as the values in the first phase, to adding additional steps that could make the process more effective for participants and for addressing the challenge.

”…the values, I honestly think that especially for this kind of challenges, it would be important to include, um, non-human actors.” (Participant in the second session of The Cookery condition, coded as ‘Adding more values’)

”it can break the ice and it can also just, eh, you know, sparkle like some other conversations that actually will serve this purpose. So, maybe encouraging a little bit like “oh, what do we have here?” or this kind of things.” (Participant in the second session of The Cookery condition, coded as ‘Stimulate Discussions’)

## Discussion

This study explored the effectiveness of The Cookery as a sensemaking tool for addressing societal challenges, comparing it to a traditional focus group setup. By analysing participants' preparedness, understanding, and experience through the process, the study assessed how The Cookery facilitates complex tasks for addressing societal issues and the difference the sensemaking elements create. Key findings revealed that The Cookery enabled a more significant sense of preparedness and encouraged various approaches to address challenges than in the focus group setups, as reflected in the emergence of the themes in the open discussion post-session. While both conditions highlighted the importance of communication and collaboration, The Cookery's interactive design engaged the participants and enhanced their awareness of others' perspectives and values. However, it did not create a better understanding of the proposed societal challenge. These findings align with the research objectives by providing insights into how sensemaking and co-design elements in The Cookery support collaborative approaches to societal challenges, especially in comparison with traditional focus group setups. This section discusses these findings in the context of sensemaking and transdisciplinarity, proposes suggestions for practical implications, and addresses limitations and directions for future research.

### Interpretation of Findings

The first research sub-question (SQ1) concerned whether The Cookery outperforms the focus group setup in changing participants' preparedness to address the societal challenge. Six participants reported increased preparedness to address the societal challenge after doing the task in The Cookery setup. This difference is bigger than in the focus group setups, where three participants reported increased preparedness. Looking at the themes, participants mentioned

multiple times during the open discussions after The Cookery sessions that they gained awareness of multiple ways to approach a challenge as part of the "Approach Strategies" theme. The increased frequency of utterances related to this theme suggests that participants thought more creatively and expansively on ways to approach the challenge after engaging with the interactive experience, compared to the focus group setup. Support for this finding also comes from the substantially higher frequency of the "Engagement and Experience" theme in The Cookery sessions. Participants made more utterances referring to creativity and feeling inspired by the usage of interactive installations in this type of task. This finding aligns with previous findings that mentioned how interactive tools can enhance participants' creativity and help generate ideas by supporting activities such as group brainstorming (Buisine et al., 2017). Furthermore, this theme and the emergence of the "Approach Strategies" theme are also relevant for the third research sub-question (SQ3), showing the value that The Cookery could provide in empowering participants through creativity.

Additionally, the sensemaking elements used in The Cookery likely added to the increased engagement, broadening participants' perspectives and making addressing the challenge easier. As previously mentioned, sensemaking emerges when people attribute meaning to novel situations based on their existing view of the world (Weick et al., 2005). The cooking metaphor at the foundation of The Cookery served as a relatable framework, helping participants connect abstract societal issues to a familiar process and enhancing their confidence in addressing societal challenges. These findings highlight The Cookery's added value compared to the regular focus group setups, better empowering its users to tackle complex challenges together, thereby addressing the first research sub-question (SQ1).

Moreover, the sense of working together might influence how complex problems are approached. Matos-Castaño et al. (2020) mention how sensemaking can emerge when multiple actors work together to create a collective understanding of these new situations. The process employed in both conditions is asking the participants to share their values and then briefly discuss what they learned from each other. This step aims to allow the users to share knowledge, raise awareness of the perspectives, and make the participants aware of the complementarity of factors in complex challenges through speculating about the future. Mentions about “Communication and Collaboration” were slightly higher in the Focus Group condition. However, participants in both

conditions recognised these aspects, emphasising the need to discuss with others, understand each other, and create a shared understanding of the issue to address these challenges. These aspects could support the group members' trust and collaboration during the process (Ng et al., 2023). These findings further address the first research sub-question (SQ1): The Cookery outperformed the focus group setup concerning participants in this condition, who reported feeling more equipped to tackle the complex challenge together with others.

The second research sub-question (SQ2) concerned changes in participants' understanding of the societal challenge after using the tools. The reported differences are the same in both conditions when looking at the participants' reported understanding of the societal challenge after being part of the sessions. After both sessions, the participants mentioned how the task, especially the societal challenge, was challenging. This observation is represented by a similar number of utterances in both conditions coded under the "Challenging Task" theme and with a higher percentage of utterances of this code category in the Focus Group condition. Some participants noted how the societal question phrasing seemed double-faceted, and it was unclear what the end-result of the session should be. This shortcoming of the study design indicates that these questions should be simplified from the beginning and be accessible to people with various educational and professional backgrounds.

From a transdisciplinary perspective, all participants in the study were either students or university staff members. Unfortunately, this did not create a transdisciplinary group. Ideally, professionals or citizens should be involved in these discussions about complex societal challenges (Polk, 2015; Prell et al., 2021). In these tasks, sharing and building upon existing knowledge could improve understanding of the issue. Participants emphasised the need for the diversity of the stakeholders in the discussion and the value of inclusivity in the task, as shown by the frequency of codes in the "Diversity and Stakeholders" theme. The users recognised the process in both conditions as raising their awareness of others' perspectives on these challenges. This finding aligns with the added values transdisciplinarity can provide, as mentioned in the Introduction, emphasising the need for diverse societal stakeholder engagement to enhance collaborative outcomes. It can be further supported by the "Engaging with Other's Perspectives" and "Perspective Change" themes emerging in both conditions. Utterances coded under these themes were present in both conditions, with an even higher frequency after The Cookery sessions for the

first theme. This finding is relevant for the third research sub-question (SQ3). It suggests that participants recognised the value of listening to others' viewpoints and understanding them in these approaches, even more so after the sessions in The Cookery. As the literature mentions, aligning stakeholders' views is crucial in collective decision-making processes, especially when aiming for long-term societal impact (Schormair & Gilbert, 2021). By allowing them to express their values and perspectives, they can identify conflicts and work together towards creating a common ground. For the sessions of this study, participants emphasised understanding others' views and perspectives as a benefit of using the tools rather than focusing on the societal challenge.

Participants frequently stressed the importance of the values they or other members in the session chose. According to Sanders and Stappers (2014), past experiences are a core part of the pre- and post-design phases. Understanding people's experiences in the context of their lives and subsequently working together is very important for designing solutions for complex challenges. Choosing the values in the first step of the process represents what each participant must choose as past aspects they want to use in addressing the challenge. Therefore, this follows this framework and how people use their experiences and existing mental models to shape their views.

When further examining how participants experienced both setups, the average session times were higher in The Cookery setup. This difference could be due to the longer time needed to use the interactive installation than the task done with the simplified paper-based tool in the focus groups. Furthermore, the number of suggestions for improvement participants gave for The Cookery sessions was significantly higher than that of the focus group sessions. Having multiple elements that people must interact with and use tangibly could be considered distracting and more demanding for the participants (Dorst, 2019). The information overload these elements can cause for the participants should be accounted for and reduced to facilitate working together towards a common goal and reduce the cognitive load created by the process. Based on the frequency of codes, participants generated more utterances coded after the sessions in The Cookery. However, there was no mention of the process being too demanding in either condition. Contrarily, participants appreciated the setups, shown by statements of appreciation in both conditions as part of the "Engagement and Experience" theme, with a higher frequency in The Cookery condition. The trade-off between the complexity of the tool, process, and cognitive load was not explicitly explored. Therefore, the degree to which The Cookery's complexity influenced the ability of the

participants to address complex societal challenges cannot be determined. However, based on the emergence of the codes and statements related to the engagement of the participants, it can be concluded that The Cookery delivers a more engaging and enjoyable approach to addressing societal challenges.

The longest phase of each session occurred in the reflection step. The times for individual and group reflection were of a predefined amount of one minute each. However, it was at the moderator's discretion to allow more time for the participants to express their opinions and discuss their perspectives altogether. Although this could be considered a deviation from the standardisation of the study procedure, it is something the researcher and moderator accounted for beforehand as a regular occurrence during moderation. It was necessary to allow the participants to express their ideas freely and at their own pace. These needs for a moderator and flexibility in the process also align with the informal observations made beforehand. More utterances were generated after the session in The Cookery setup. Besides "Approach Strategies", "Engagement and Experience", and "Suggestions from Participants", the "Personal Insights" theme especially had more codes in this condition. The participants expressed their opinions and reflected on their choices more after the sessions in The Cookery than in the traditional focus groups. These results show The Cookery's potential to generate more insights and deeper reflective processes in the participants, findings relevant to the third research sub-question (SQ3).

**Practical Implications**

This study's findings show that The Cookery is a promising tool for addressing challenges compared to a regular focus group setup. Thus, it brings several contributions that can be used in different areas. The Cookery represents a strong artifact that could be used in addressing societal challenges. This contribution is based on the results related to increasing preparedness and more emergent discussion topics of the participants after using the tool, more than in a traditional focus group setup. The Cookery setup had a higher engagement, as expressed by the participants. These different experiences from the focus groups could be attributed to the sensemaking elements that ease the complexity of a novel, complicated task. The informal observations and statements from the participants have mentioned how this tool offers a practical medium for sharing ideas and reaching common ground in an educational context. One participant directly mentioned how these tools are inspiring and valuable to bring to educational settings. Moreover, previous studies

mentioned how similar sensemaking tools are already used in educational settings to engage students and foster collaborative learning (Garzotto et al., 2020; Li et al., 2022). Besides aiding students, sensemaking tools can also benefit teachers, as they can enhance teaching by adjusting to the knowledge and experience students bring into the academic contexts (Fitzgerald & Palincsar, 2019). Therefore, The Cookery can be an excellent device to open discussions between students from multiple disciplines and backgrounds working together.

The usage of The Cookery should not be limited only to educational contexts. The study's participants greatly emphasised the need to create inclusive discussions and bring diverse stakeholders to the table to solve societal challenges collaboratively. These findings align with the theoretical principles of transdisciplinarity, where academic knowledge should be merged with non-academic wisdom. As mentioned by Dorst (2019), complex challenges are varied in our society and require a collective effort to tackle them. A tool like The Cookery could represent an ideal approach to bringing stakeholders from different areas, such as academics, citizens, and policymakers, together and making it easier to create a collective understanding of the issue. Even more, based on the participants' statements in the conducted sessions, it might be even more valuable to offer the possibility of understanding the perspectives of others towards an issue before approaching it. Previous findings in the literature indicate how co-design tools could bring various stakeholders together to collaborate in tackling societal issues such as urban development (Mcarthur & Xu, 2021). Moreover, embodied sensemaking interactive experiences similar to The Cookery were also used to facilitate ideation in the process of addressing challenges (Jaasma et al., 2017). The sensemaking and tangible nature of The Cookery offers an interactive and informal platform to facilitate and support co-designing activities and holistically addressing societal challenges.

From a theoretical perspective, the process used in The Cookery can also enrich previous frameworks. This process entails participants choosing values relevant to themselves, employing them to address the proposed challenge, and then reflecting on how it might influence the challenge in the future and discussing it with others. Based on the results, this process looked efficient in both conditions, albeit to various degrees. This method matches the framework of Sanders and Stappers (2014), where tangible tools can be used to generate solutions and facilitate the design process at different stages. The process of The Cookery aligns with the expectation that employing

it might facilitate co-designing for a solution. Simultaneously, it seems to be focused on the pre- or post-design phases. Its aim is not to find a solution but to offer the possibility for several stakeholders to understand each other and reach a common ground to address complex issues. Participants in both sessions repeatedly mentioned that the value selection step was instrumental in understanding the stakeholders at the table. From a practical standpoint, this means that the simplified process, similar to the paper-based setup in this study, can also be employed in addressing a societal challenge or co-design sessions, even if it might not provide the same level of engagement conferred by its sensemaking elements and tangibility. This implication is particularly important if people would like to use The Cookery outside of the spot where it is located, considering the significant costs and resources needed to reproduce it fully.

**Limitations**

Although this study's results support the value of The Cookery in addressing societal challenges and provide valuable insights into its contributions, several potential limitations must be recognised. The homogeneity of the participants' sample represents the first methodological limitation of the study. This lack of diversity limited the perspectives created in the discussions. As mentioned, all participants were students or university staff members, which did not create transdisciplinary groups during the sessions. Nevertheless, the discussions were fruitful and generated noteworthy patterns for understanding how The Cookery performs relative to focus groups. A greater diversity in participants' professional and cultural backgrounds could enhance the richness of discussions. This aspect was further addressed by the participants and mentioned as an important aspect within the "Diversity and Stakeholders" theme emergent in both conditions. The discussion topics could differ in groups, with some participants having a better knowledge of the proposed societal challenge, such as professionals in the area of energy transition, in this study's case. Therefore, this limitation creates a promising avenue for future research. By creating transdisciplinary groups, the understanding of the participants with less experience on the proposed topic can be enhanced through sharing knowledge.

The phrasing of the societal challenge question used in the study represents the second methodological limitation. Based on participants' feedback, the question might have introduced vagueness that influenced participants' understanding and how they approached the task. Several participants reported that the question could have been more explicit. This limitation was reflected

in the "Challenging Task" theme, showing participants' difficulties in understanding the question in both conditions. Future work should consider the phrasing and piloting of societal questions to ensure clarity and accessibility, especially when involving participants with varied educational or professional backgrounds.

**Future Research**

While this study supports the value of The Cookery in addressing societal challenges, it also creates future research and practical avenues. The findings of this study show how collective sensemaking can help tackle complex issues through collaboration and the usage of familiar frames of understanding. This study's qualitative insights emerged through a content analysis of participants' statements after the sessions. This method provided valuable insights for this introductory study on The Cookery and simultaneously allowed data quantification of the emerging themes. However, future studies could employ qualitative methods, for instance, thematic analysis, that could provide deeper qualitative insights (Esposito & Evans-Winters, 2021). A methodology like thematic analysis could further understand how sensemaking and transdisciplinarity emerge, how these concepts relate to using such tools, and enrich these theoretical fields.

Furthermore, Esposito and Evans-Winters (2021) emphasise that various factors, including participants' experiences and backgrounds, should be considered during the research process to achieve a holistic and inclusive view of the topic. In the case of The Cookery, this entails further examining how users' perspectives shape their approaches to addressing challenges. Additionally, this focus could extend to the insights generated during the tool's usage, particularly during the reflection phase, where participants spent most of their time during the sessions of this study. Future research can investigate further how individuals experience such tools and how their experiences and cultural or professional backgrounds relate to collective sensemaking and transdisciplinarity.

The literature supports using interactive tools for educational purposes and stakeholder engagement. Moreover, the participants also emphasised these contexts during the sessions. Thus, The Cookery could be explored further in these contexts to understand better how it benefits participants. This exploration could provide additional theoretical insights into the impact of collaborative sensemaking and transdisciplinary approaches in these fields.

From a practical standpoint, The Cookery itself can be improved. The participants in this study provided multiple suggestions for improvement, such as adding a preparatory step and prompts to stimulate the discussion (see Appendix H for the summarised list). These improvements could be further introduced and assessed in The Cookery. Nevertheless, this will entail reiterating the study to see how these elements change the process of the tool and aid the users in addressing complex challenges.

## Conclusion

This study revealed the strength of The Cookery in aiding in the process of addressing societal challenges. It showed how sensemaking can emerge and how it can aid people in collaborating toward a common goal. Participants in The Cookery sessions reported increased preparedness to address a societal challenge after using the tool. Moreover, they appeared more engaged with the task, looking at multiple ways to tackle the challenge and include people in the process. These findings contribute to sensemaking and transdisciplinarity areas by showing how a tool based on sensemaking could aid in engaging stakeholders and ease the process of tackling complex challenges. It also reveals the potential of The Cookery to be used in different contexts, such as education. Furthermore, it shows how its fundamental process of going through past, present, and futures matches existing co-design frameworks that can address similar challenges.

The limitations of this study concern the lack of transdisciplinarity in the participants' sample and the ambiguous societal question used during the tasks. Despite these limitations, this research is a first step towards investigating The Cookery and building up the knowledge on how sensemaking-based tools can aid in addressing challenges. Future work should explore in-depth how The Cookery can engage transdisciplinary groups and how it can be used in different contexts. Moreover, The Cookery can be iterated further to add elements that improve participants' experience with the tool. Further development of tools like The Cookery and approaches such as sensemaking can bring societal stakeholders to the table and reduce the burden of addressing complex societal challenges our society encounters.

**References**

Brown, V. A., Harris, J. A., & Russell, J. (2010). *Tackling Wicked Problems: Through the Transdisciplinary Imagination.* Taylor & Francis. https://doi.org/10.4324/9781849776530

Brown, A. D., Colville, I., & Pye, A. (2015). Making Sense of Sensemaking in Organization Studies. *Organization Studies*, *36*(2), 265-277. https://doi.org/10.1177/0170840614559259

Buisine, S., Guegan, J., & Vernier, F. (2017). *Technological innovation in group creativity. Creativity, design thinking and interdisciplinarity*, 185-201. https://doi.org/10.1007/978-981-10-7524-7_12

de Vries, R. A. J., Haarman, J. A. M., Harmsen, E. C., Heylen, D. K. J., & Hermens, H. J. (2020). The Sensory Interactive Table: Exploring the social space of eating. *Proceedings of the 2020 International Conference on Multimodal Interaction (ICMI '20)*, 689-693. https://doi.org/10.1145/3382507.3418866

Dorst, K. (2019). Design beyond Design. *She Ji: The Journal of Design, Economics, and Innovation*, *5*(2), 117-125. https://doi.org/10.1016/j.sheji.2019.05.001

Esposito, J., Evans-Winter, V. (2021*), Introduction to Intersectional Qualitative Research*, SAGE Publications.

Eventbrite. (n.d.). Workshop 6: Co-shaping smart city futures by balancing Chronos & Kairos. *Eventbrite*. https://www.eventbrite.com/e/workshop-6-co-shaping-smart-city-futures-by-balancing-chronos-kairos-tickets-394447502097?aff=odcleoeventsincollection&_gl=1*1xd6ukb*_up*MQ..*_ga*NjkzMTg4OTUyLjE3MTYxMjY0MTI.*_ga_TQVES5V6SH*MTcxNjEyNjQxMi4xLjAuMTcxNjEyNjQxMi4wLjAuMA.

Fitzgerald, M. S., & Palincsar, A. S. (2019). Teaching Practices That Support Student Sensemaking Across Grades and Disciplines: A Conceptual Review. *Review of Research in Education, 43*(1), 227-248. https://doi.org/10.3102/0091732X18821115

Garzotto, F., Beccaluva, E., Gianotti, M., & Riccardi, F. (2020). Interactive multisensory environments for primary school children. *Proceedings of the 2020 CHI Conference on*

*Human Factors in Computing Systems* (pp. 1-12). https://doi.org/10.1145/3313831.3376343

George, G., Howard-Grenville, J., Joshi, A., & Tihanyi, L. (2016). Understanding and tackling societal grand challenges through management research. *Academy of Management Journal*, *59*(6), 1880–1895. http://dx.doi.org/10.5465/amj.2016.4007

Jaasma, P., Smit, D., Van Dijk, J., Latcham, T., Trotto, A., & Hummels, C. (2017). The blue studio: Designing an interactive environment for embodied multi-stakeholder ideation processes. *Proceedings of the eleventh international conference on tangible, embedded, and embodied interaction* (pp. 1-10). https://doi.org/10.1145/3024969.3025002

Jones, N. A., Ross, H., Lynam, T., Perez, P., & Leitch, A. (2011). Mental models: An interdisciplinary synthesis of theory and methods. *Ecology and Society*, *16*(1). https://doi.org/10.5751/ES-03802-160146

Kerr, J., Cheers, J., Gallegos, D., Blackler, A., & Kelly, N. (2023) *The Art of Co-Design: A Guide to Creative Collaboration*. (1 ed.). BIS Publishers, Amsterdam, The Netherlands.

Landis, J. R., & Koch, G. G. (1977). The Measurement of Observer Agreement for Categorical Data. *Biometrics*, *33*(1), 159–174. https://doi.org/10.2307/2529310

Li, Y., Kothiyal, A., Weber, T., Rossmy, B., Mayer, S., & Hussmann, H. (2022). Designing Tangible as an Orchestration Tool for Collaborative Activities. *Multimodal Technologies and Interaction*, *6*(5), 30. https://doi.org/10.3390/mti6050030

Maitlis, S., & Christianson, M. (2014). Sensemaking in Organizations: Taking Stock and Moving Forward. *The Academy of Management Annals*, *8*(1), 57-125. https://doi.org/10.1080/19416520.2014.873177

Matos-Castaño, J., Geenen, A., & Van der Voort, M. (2020). The role of participatory design activities in supporting sense-making in the smart city. In S. Boess, M. Cheung, & R. Cain (Eds.), *Synergy - DRS International Conference 2020*, *August 11-14*, *Held online.* https://doi.org/10.21606/drs.2020.133

Mcarthur, I., & Xu, F. (2021). MetaPLACE: co-designing sino-australian urban media for participatory placemaking. *Proceedings of the 5th Media Architecture Biennale Conference* (pp. 42-53). https://doi.org/10.1145/3469410.3469415

McHugh M. L. (2013). The chi-square test of independence. *Biochemia medica*, *23*(2), 143–149. https://doi.org/10.11613/bm.2013.018

Mobjörk, M. (2010). Consulting versus participatory transdisciplinarity: A refined classification of transdisciplinary research. *Futures*, *42*(10), 866-873. https://doi.org/10.1016/j.futures.2010.03.003

Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2023). A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. *International Journal of Qualitative Methods*, 22. https://doi.org/10.1177/16094069231205789

Ng, J. S. C., Chervier, C., Roda, J. M., Samdin, Z., & Carmenta, R. (2023). Understanding stakeholders' perspectives on the collaborative governance challenges in Sabah's (Malaysian Borneo) jurisdictional approach. *The Journal of Development Studies*, *59*(11), 1699-1717. https://doi.org/10.1080/00220388.2023.2222212

Nyumba, O. T., Wilson, K., Derrick, C. J., & Mukherjee, N. (2018). The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and evolution*, *9*(1), 20-32. https://doi.org/10.1111/2041-210X.12860

Plummer, P. (2017). Focus group methodology. Part 1: Design considerations. *International Journal of Therapy and Rehabilitation*, 24(7), 297-301. https://doi.org/10.12968/ijtr.2017.24.7.297

Polk, M. (2015). Transdisciplinary co-production: Designing and testing a transdisciplinary research framework for societal problem solving. *Futures*, *65*, 110-122. https://doi.org/10.1016/j.futures.2014.11.001

Prell, C., Miller Hesed, C. D., Johnson, K., Paolisso, M., Teodoro, J. D., & Van Dolah, E. (2021). Transdisciplinarity and shifting network boundaries: The challenges of studying an

evolving stakeholder network in participatory settings. *Field Methods*, *33*(4), 405-416. https://doi.org/10.1177/1525822X20983984

Reframing Studio. (n.d.). *Redesigning the Dutch mental healthcare sector.* Retrieved from https://reframingstudio.com/work/redesigning-the-dutch-mental-healthcare-sector

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *Co-Design*, *4*(1), 5-18. https://doi.org/10.1080/15710880701875068

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

Schormair, M. J. L., & Gilbert, D. U. (2021). Creating Value by Sharing Values: Managing Stakeholder Value Conflict in the Face of Pluralism through Discursive Justification. *Business Ethics Quarterly*, *31*(1), 1–36. https://doi:10.1017/beq.2020.12

Sim, J., Waterfield, J. (2019) Focus group methodology: some ethical challenges. *Quality & Quantity, 53*, 3003–3022. https://doi.org/10.1007/s11135-019-00914-5

University of Twente. (2023). Design for transition. Dutch Design Week '23. Retrieved May 13, 2024, from https://www.utwente.nl/en/dutch-design-week/dutch-design-week-23/design-for-transition/

University of Twente. (n.d.). Responsible futuring. DesignLab. Retrieved May 20, 2024, from https://www.utwente.nl/en/designlab/responsible-futuring/

van der Giessen, M., Langenbusch, C., Jacobs, G., & Cornelissen, J. (2022). Collective sensemaking in the local response to a grand challenge: Recovery, alleviation and change-oriented responses to a refugee crisis. *Human Relations*, *75*(5), 903-930. https://doi.org/10.1177/00187267211004688

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science*, *16*(4), 409-421. https://doi.org/10.1287/orsc.1050.0133

Westbrook, L. (2006). Mental models: A theoretical overview and preliminary study. *Journal of Information Science*, *32*, 563-579. https://doi.org/10.1177/0165551506068134

White, M. D., & Marsh, E. E. (2006). Content analysis: A flexible methodology. *Library Trends, 55*(1), 22–45. https://doi.org/10.1353/lib.2006.0053

## Appendix A

## List of ingredients and the associated values in The Pantry

| Community & Collaboration *(fruits and vegetables)* | Knowledge & Curiosity *(baking goods)* | Openness & Transparency *(packaged goods)* |
|---|---|---|
| Communication Garlic | Creativity Olive Oil | Integrity Hot Sauce (even spicier) |
| Trust Apple | Learning Flour | Accountability Canned Pineapple |
| Respect Hot Pepper (spicy) | Critical Thinking Chocolate | Honesty Canned Beans |
| Inclusivity Grapes | Wisdom Honey | Responsibility Canned Peaches |
| Empathy Orange | Discipline Milk | Agency Ketchup |
| Care Lemon | Growth Eggs | Leadership Fish Tin |
| Flexibility Avocado | Resilience Salt | Advocacy Bouillon |
| Kindness Potato | Generosity Sugar | Clarity Pasta |
| Sharing Mushroom | Innovation Butter | Public Interest Rice |
| Fairness Tomatoes | Literacy Cocoa Powder | Privacy Canned Corn |

## Appendix B

## List of the appliances in The Kitchen with their descriptions

| Appliance | Type of smartness | Motto | Description |
|---|---|---|---|
| Kettle | The Nature Lover | "Boiling ideas from Mother Nature" | You consider Nature a crucial element of our lives. You are letting it inspire you in the choices you make. Even more, you want to learn from the way it manages life to solve challenges that might arise. |
| Coffee Machine | The Educator | "Teaching others how to make the best espresso" | You want to empower others through skill transfer! Instead of just offering solutions, you want to organize tutorials and exchange knowledge with others. In a nutshell, you aim to inspire and enable others to build their own solutions. |
| Blender | More than Human | "Blending knowledge from multiple species" | You think we should look beyond our human limitations. From the bugs in the ground to the cows in the fields, all living beings are influenced by our choices and can impact our lives. You want to involve other species in finding solutions that shape our society. |
| Air Fryer | The Game Changer | "A different flow of cooking" | You want to challenge the status quo. Instead of following mainstream trends, you find more meaning in exploring uncharted territories and providing new alternatives using the resources we already have, to solve the challenges we face. |

| | | | |
|---|---|---|---|
| Gourmet Grill | The Community Builder | "Different foods on the same grill" | You rely on the community around you. Social structures are the spark of life and the spring of inspiration. Instead of taking on challenges by yourself, you want to gather others and their perspectives to work together. |
| Bread Toaster | A Child's Heart | "Even a child can toast bread" | You learn from the way children explore the world with curiosity. From not being bothered by insignificant things to purely speaking their mind, the younger generation inspires you. You want to learn and approach challenges in the same pure and playful way. |
| Pizza Oven | The Artist | "Dough as a creative canvas" | Art can be the best source of inspiration to solve societal challenges and find inventive solutions. Artistic expression is the breeding ground for transformative ideas! |
| Toaster Oven | The Historian | "Baking recipes passed down from past generations" | You look at the past generations and civilizations for inspiration. They have already been through situations and crises that can guide us in the present. You value their wisdom and view the past as a source of knowledge. |

# Appendix C

## Process of the ‘reflection plate’ in The Dining Room

**Appendix D**

**Two-part informed consent of the study**

## Information sheet for *The Cookery - validating a sense-making based tool for tackling societal challenges*

This study is part of the project "The Cookery - validating a sense-making based tool for tackling societal challenges." Your contribution will be used to explore the similarities and differences between using a process for addressing societal challenges with The Cookery and a focus group. Your input, both qualitative (e.g., comments) and quantitative (e.g., scales you will fill in) during this session, will be used as data to explore this. You will receive more information about the task itself during the session from the moderator. The data we gather during the session, namely the audio recordings and the answers to the questionnaire(s), will be used to explore and quantify the effectiveness of The Cookery as a tool for eliciting discussions about societal challenges and for writing an MSc thesis. The benefit for you will be experiencing a process for addressing societal challenges, sharing your perspectives on it, and discussing it with other participants.

During this session, you will have to perform several tasks and answer questions:

- Firstly, we will ask for demographic information.
- Secondly, you will need to complete tasks in The Cookery or the focus group, based on the group you were assigned to beforehand. During the session, we will ask you not to interact with the observer. You should follow the instructions of the moderator and direct any questions to them, which they will answer as they deem appropriate. Furthermore, we encourage you to verbally express any comments, thoughts, and opinions you have about the process or the tool(s) used during the session.
- Thirdly, you will have to answer some questions at the end of the session.

Below you can find some information about your rights and about the way in which your information will be handled:

- This session will take approximately 45 minutes.

- You are free to withdraw yourself from this study at any given time, without providing a reason.
- The session will be audio recorded. The recording will be transcribed, anonymized, and used for research purposes. When the whole study ends, around October 2024, the raw files will be destroyed.
- Your answers will be anonymized, safely stored, and accessed just by the members of the research team. If you decide later that you do not agree with your data being used in the study, you can contact the researcher and ask for your answers to be removed, without providing a specific reason.

**Contact Information for Questions about Your Rights as a Research Participant**

If you need further information about the research, you can contact Alexandru-Lucian Amariei (a.amariei@student.utwente.nl) or one of the supervisors of this project. The supervisors are:

- Dr. Cesco Willemse (c.willemse@utwente.nl)
- Dr. Simone Borsci (s.borsci@utwente.nl)
- Dr. Ir. Cristina Zaga (c.zaga@utwente.nl)

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee/domain Humanities & Social Sciences of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-hss@utwente.nl

## Informed consent form for *The Cookery - validating a sense-making based tool for tackling societal challenges*

| ***Please tick the appropriate boxes*** | Yes | No |
|---|---|---|
| I have read and understood the study information dated 30/05/2024, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction. | | |
| I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason. | | |
| I understand that taking part in this study involves: | | |

| | | |
|---|---|---|
| - Providing demographic information about myself to the researcher;<br>- The session being audio-recorded and observed by the researcher. The recordings will be transcribed, anonymized, and destroyed at the end of the study, around October 2024.<br>- Following the instructions of the moderator and not interacting with the observer during the session.<br>- Expressing verbally any comments, thoughts, and opinions I have about the process, or the tool(s) used during the session.<br>- Completing the process and answering the to the questions I will receive during the session to the best of my ability. | | |
| I understand that the information I will provide will be used to explore the resemblances and differences between The Cookery and a focus group setting, and subsequently write a report. | | |
| I understand that personal information collected about me that can identify me, such as my age, gender, or profession, will be anonymized and not be shared beyond the study team. | | |
| I give permission for the anonymized answers that I provide (e.g., quotes, answers to the questions, etc.) to be used in the thesis and be archived in the University of Twente theses repository, so it can be used for future research and learning. | | |

_____ _____ _____

Name of participant Signature Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____ _____ _____

Name of the researcher Signature Date

## Appendix E

## Questions used to assess changes and stimulate discussions

### Pre- and post- questions to measure the change in understanding and preparedness

1. “What is your current understanding of the societal challenge you were presented with?”
2. “At this moment, how prepared do you feel to address the societal challenge you were presented with?”

### Questions used to stimulate the Open Discussions

1. “How did the various activities you took during the session influence your understanding of the societal challenge?”
2. “How did discussions with your group members change your understanding of the societal challenge?”
3. “How did the process of this session impact your approach to addressing the societal challenge?”
4. “What aspects of this session do you think could be improved?”

## Appendix F

## SPSS syntax used in the analysis

### Cohen's Kappa

```
DATASET ACTIVATE DataSet0.
WEIGHT BY Weight.

CROSSTABS
  /TABLES=Code_A BY Code_B
  /FORMAT=AVALUE TABLES
  /STATISTICS=KAPPA
  /CELLS=COUNT
  /COUNT ROUND CELL.
```

### Chi-square Test

```
DATASET ACTIVATE DataSet1.
WEIGHT BY Frequency.

CROSSTABS
  /TABLES=Code_Category BY Condition
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT EXPECTED
  /COUNT ROUND CELL.
```

## Appendix G

## Code occurrences during the Open Discussions

| Code Category | Code | Count in The Cookery | Count in The Focus Group | Code description |
|---|---|---|---|---|
| Approach Strategies | Multiple ways of approaching the challenge | 15 | 1 | Utterance where the plurality of ways in which a societal challenge can be approached was mentioned. |
| | Next steps | 0 | 1 | Participant expressed the need of knowing the future steps in approaching a challenge. |
| | Novel approach | 1 | 1 | Participant implied the novelty of the approach in addressing challenges. |
| Challenging Task | Difficulty in understanding the task | 2 | 4 | Participants expressed difficulty in understanding phases of using the tool or the purpose of using the tool. |
| | Hard to understand the societal challenge | 10 | 7 | Participants mentioned that understanding the societal challenge was challenging. |
| | Not addressing the challenge | 0 | 1 | Participant mentioned they did not address the proposed societal challenge during the session. |
| | Unclarity of the reflection process | 1 | 0 | Participant expressed that the reflection process during the session was unclear. |
| Communication and Collaboration | Collaborative approach | 10 | 12 | Utterance where collaboration between people or participants was implied or mentioned. |
| | Communication | 12 | 6 | Utterance where communication (e.g., discussion) between people was mentioned. |
| Diversity and Stakeholders | Different background | 12 | 0 | Utterances where the variety of backgrounds of the stakeholders was mentioned. |

| | | | | |
|---|---|---|---|---|
| | Different perspectives | 11 | 17 | Participants recognized or mentioned the diversity of perspectives that participants in the discussion have or should have. |
| | Different values | 6 | 1 | Participants recognized the multiple options for values that can be used in addressing a challenge. |
| | Inclusive approach | 4 | 12 | Utterances where the need for an inclusive approach towards addressing a challenge was mentioned or implied. |
| | Limited background | 4 | 0 | Participants recognized the lack of diversity in their background. |
| | Non-human actors | 1 | 1 | Participants expressed the need of involving non-human agents in approaching challenges. |
| | Similar values | 0 | 3 | Participants mentioned they picked similar values during the session. |
| Engagement and Experience | Appreciation for the existing setup | 7 | 4 | Participants appreciated the tool or certain aspects of the tool. |
| | Creativity | 4 | 0 | Participant made references to creativity in their statements. |
| | Engagement | 4 | 1 | Utterances where engagement with the tool or the process were mentioned. |
| | Inspiration | 2 | 0 | Participant felt inspired by the tool. |
| | Interactive experiences | 3 | 0 | The usage of interactive installations was mentioned. |
| | Sensemaking element | 15 | 0 | Statements of the participants that contained sensemaking elements specific to The Cookery. |
| Engaging with Other's Perspectives | Learning from others | 2 | 2 | Participants mentioned learning from each other. |
| | Sharing perspectives | 12 | 5 | Utterances where the sharing of opinions/perspectives with each other was mentioned. |
| | Sharing values | 12 | 3 | Participants mentioned sharing values with others. |

| | | | | |
|---|---|---|---|---|
| | Understanding others | 24 | 12 | Utterances where the need to understand others or understanding others due to the process was mentioned. |
| Personal Insights | Education | 2 | 0 | Participants mentioned the educational context. |
| | Group size | 0 | 3 | Participants mentioned the influence of the group size on the discussions. |
| | Importance for the future | 1 | 3 | Statements where participants mentioned the importance of addressing the challenge for the future. |
| | No change in addressing | 0 | 2 | Participant reported no change in their capability to address the societal challenge. |
| | No change in knowledge | 0 | 2 | Participant reported no change in the knowledge gained about the topic during the session. |
| | No change in skills | 0 | 1 | Participant reported no change in their skills for tackling the societal challenge. |
| | No change in understanding | 2 | 3 | Participant reported no change in their understanding of the societal challenge. |
| | Personal reflection | 16 | 3 | Utterances where the participant engaged in reflective processes. |
| | Personal values | 14 | 9 | Utterances where the personal values were mentioned. |
| | Reflecting on buzzwords | 1 | 0 | Participant mentioned the presence of a shallow reflection, based just on buzzwords. |
| | Reflecting on the past | 3 | 0 | Participant engaged in reflection of their past. |
| | Seeing the bigger picture | 2 | 0 | Participant mentioned the perspective of looking more holistically at issues. |
| | Versatility of the approach | 5 | 0 | Utterances where the participant mentioned the usage of the tool in other contexts. |
| | Writing down thoughts | 1 | 3 | Participants mentioned the usefulness of writing down their thoughts. |

| | | | | |
|---|---|---|---|---|
| Perspective Change | Change in perspective | 6 | 7 | Utterances where the participants' statements reflect a change in their perspective. |
| | Change in perspective over time | 6 | 0 | Participants mentioned the change of their perspective over a period of time. |
| | Lack of future perspective | 0 | 2 | Participants mentioned a lack of seeing things in the future. |
| | Limited perspective | 3 | 1 | Participants mentioned their perceived limitation of perspectives in this kind of processes. |
| | No change in perspective | 0 | 1 | Participant reported no change in their perspective towards the topic. |
| Quality of Discussions | Complex discussions | 0 | 3 | Participants mentioned the complexity of the discussions that might arise. |
| | Deeper discussions | 1 | 5 | Participants mentioned the depth that is necessary for some discussions. |
| | Inefficient discussions | 1 | 1 | Participant mentioned the inefficiency of the discussions. |
| Suggestions from Participants | Adding an icebreaker | 2 | 0 | / |
| | Adding more values | 3 | 0 | / |
| | Adding prompts to guide the process | 2 | 0 | / |
| | Adding additional reflection prompts | 2 | 0 | / |
| | Clarify the process | 1 | 0 | / |
| | Clarify the societal challenge | 5 | 1 | / |
| | Create more archetypes | 2 | 0 | / |
| | Description of archetypes | 3 | 0 | / |
| | Easiness to use | 1 | 0 | / |
| | Limited choice of values | 2 | 0 | / |

| | | | | |
|---|---|---|---|---|
| | More free descriptions of archetypes | 0 | 1 | / |
| | Placement of items | 1 | 0 | / |
| | Preparatory step | 3 | 3 | / |
| | Seeing the whole installation | 1 | 0 | / |
| | Simplify problems | 1 | 0 | / |
| | Stimulate discussions | 4 | 1 | / |
| | Support for individual role | 0 | 1 | / |
| | Time pressure | 3 | 3 | / |
| | Value overview | 1 | 0 | / |

## Appendix H

## Summary of the Recommendations for improving The Cookery

Under the ‘Suggestions from Participants’ theme, there were multiple points about improving The Cookery or its process. We will present a summarised list based on the utterances made by the participants. These suggestions could be used to refine the tool in the future.

- Preparatory step: Participants mentioned that an additional step could be added after reading the challenge and starting with addressing it to get to know the participants in the session and understand their views on the challenge.
- Prompts to stimulate the discussion: Introducing scaffolding questions (e.g., what do you mean by this?) during the process could help create more interaction between the participants of the session.
- Improvements to the first step: More values could be introduced in the first phase of the process to offer a more extensive and more inclusive range of options (e.g., including non-human actors). It was also mentioned how it should be possible to choose more than three values in this step. Lastly, adding a way, for instance, a list of the values and their corresponding values, was also mentioned.
- Improving the archetypes: Adding more free descriptions of archetypes and more archetypes that people might better identify with could be beneficial. Furthermore, these descriptions should be present also physically, not just in the digital interface.
- Improvements for the final step: Additional prompts could be added in the last step to stimulate discussions and reflection.
- Duration of the steps: Adjusting participants' time for different steps was suggested by the participants. In the second phase of The Cookery, there was a sense of time-pressure created by the possibility of just two participants choosing values at once while the other two were waiting. Furthermore, more time could be allocated in the reflection phase for deeper discussions.
- Usage of the installation: Enough space should be given so participants can see the whole installation and be comfortable to explore it.

# Appendix I

## Statement about the usage of AI

During the preparation of this work the author(s) used Grammarly and ChatGPT for grammar corrections and wording suggestions. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the work.