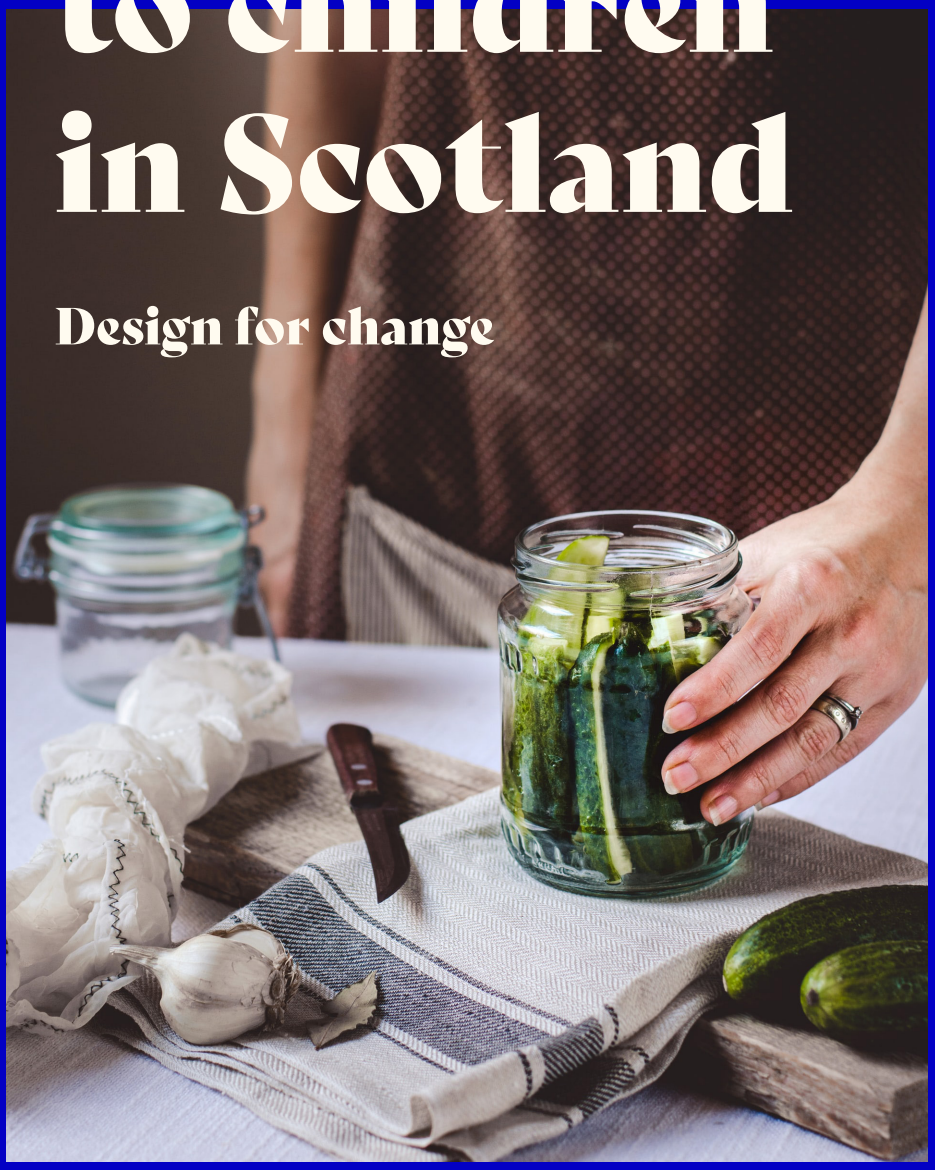
Introducing fermented food to children in Scotland

Design for change



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Abstract

Because of Scotland's poor diet, 65% of adults are overweight or obese (The Scottish Government, 2018). These unhealthy and unsustainable food behaviours cause severe physical and mental health issues, environmentally devastative food production systems, strengthens social inequalities, and are a consequence of a lack of food and health education. Through a systemic design methodology, this work tries to map the problem's systems to suggest an intervention that can provide such knowledge to Scotland's population. This intervention takes the shape of an organisation and education service called SchoolKraut, which offers a framework to primary schools across the country to lead fermentation workshops with children. Although this intervention asks for further prototyping and testing, it greatly challenges norms about education, gender, health and environment. It therefore offers a holistic more-than-human approach to the problem of Scotland's food behaviours.

« The ceremonies that persist [...] focus only on ourselves, marking rites of personal transition. [...] But imagine standing by the river, flooded with those same feelings as the Salmon march into the auditorium of their estuary. Rise in their honor, thank them for all the ways they have enriched our lives, sing to honor their hard work and accomplishments against all odds, tell them they are our hope for the future [...]. »

(Kimmerer, 2013)

Acknowledgments

I would like to thank my supervisors and my friends for their insightful feedback during this work, my family for their support, and the «force which causes mushrooms to push up from the earth overnight» (Kimmerer, 2013, p49).

Content

1. Introduction

While undernutrition is still an important issue in many parts of the world, overnutrition is a major cause of the obesity epidemic that touches mainly high-income countries. In 2015, 19.5% of the adult population across the OECD countries was obese, and «nearly one in six children was overweight or obese» (OECD, 2017). Scotland has some of the highest incidences of obesity among OECD countries (Health Scotland, 2016), with the United Kingdom being the 6th on the OECD's 2015 ranking (OECD, 2017). In addition to its environmental and social cost, obesity favours the development of diseases like cancer, as well as mental health issues, and is, therefore, an important cause of mortality in these countries (Martin-Jiménez, 2017). While curing these diet-related diseases relies on the mass-production of medicine and dietary supplements, that often initially come from natural ingredients and processes, people continue to eat and produce unhealthy food. This «food-health paradox» can be addressed through this question: what if healthy food was eaten in the first place as a resilient preventative medicine?

Because Scotland's food behaviours are tightly anchored to social norms, tradition, political and economic factors, the country's food and health issues form a very challenging wicked problem, which can never be entirely solved, only re-solved (Rittel and Webber, 1973). This work tries to address this problem through systemic and holistic Behavioural Design, guided by this first research question: how to make Scotland's food habits healthier and more sustainable? These targeted behaviours follow the Food and Agriculture Organization's definition of sustainable diets: «diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations» (FAO, 2012).

This work will first try to map the causes and consequences of Scotland's unhealthy and unsustainable food behaviours through a literature review, will then explore the opportunities to re-solve this problem, and will finally suggest a possible intervention to it.

2. Background

2.1. Scotland's food and health status quo

Scotland's unhealthy and unsustainable food behaviours are a consequence of a multitude of interconnected factors which have been accumulating for centuries. To dissect this wicked problem and understand its background in the light of previous literature and action, the causes and consequences of Scotland's health, environmental and social status quo will first be portrayed. Previous interventions addressing the problem will then be evaluated, and future challenges and opportunities will finally be identified.

2.1.1. Health

First, Scotland's diet is too high in calories, saturated fats, refined sugar, and salt, and too low in vegetables and fruits, fiber, and oil-rich fish (Food Standards Scotland, 2018)... The fact that it has not changed over the last 20 years can be explained by the convenience, the ubiquity, and the excessive advertising and promotion of over-processed food, but also by the heavy nature of the traditional Scottish diet, which was once necessary to live in the highlands, and more recently completed with very frequent consumption of fried food (Blades, 2004) and of sugary drinks. This poor diet is responsible for 65% of adults being overweight in Scotland, including 29% being obese, in 2016 (The Scottish Government, 2018). «Obesity is the second-biggest preventable cause of cancer, behind only smoking», and «the most significant risk factor for developing type 2 diabetes» (ibid, p5). Malnutrition, therefore, causes deaths from various types of cancers, coronary heart disease, and strokes, but also leads to children's dental decay and adults' high blood pressure (The Scottish Government, 2018). This obesity epidemic is estimated to be responsible for approximately 33,000 deaths per year in the UK (Scarborough, 2010), with Scotland having the highest overweight and obesity levels of any UK nation (The Scottish Government, 2018).

But the effects are not only physical. Obesity also impacts psychological wellbeing, due to weight-related discrimination and stigma (Ciciurkaite & Perry, 2018) which can cause low self-esteem, long-term depression, and anxiety (Walter et al, 2015), which can even conduct to suicidal ideation (Goldney et al, 2009). In addition to this, more and more research on the gut-brain connection shows that the gut's microbiome impacts the brain's health (Lucas, 2018) and that obesity, thus «has a significant role in cognitive dysfunction and aging-associated cognitive disorders including dementia», like Alzheimer's and Parkinson's diseases (Martin-Jiménez et al, 2017).

Because these health issues ask for regular and sometimes intensive care and medicine, «the total annual cost to the Scottish economy of overweight and obesity, including labour market-related costs such as lost productivity, is estimated to be between £0.9 billion and £4.6 billion» (The Scottish Government, 2018, p6). This important economic cost has its part to play in the fact that social protection and health represent the biggest shares of Scotland's total public sector expenditure (Scottish Government, 2019).

2.1.2. Environment

Scotland's unhealthy and unsustainable food behaviours also play a role in climate change. Consequently to the increase of population and of food demand, in addition to capitalism's dependency on economical growth, Scotland's food system deeply relies on industrialised intensive farming and production of over-processed food, mass transportation and cooling of international products, and excessive plastic packagings around fruits and vegetables... These are all factors that show and perpetuate the fact that the current food system's vicious cycle causes humans to distance themselves from the environment. Indeed, human activity has gradually become seen as external to the environment, and people now exclude non-human actors from their decision-making processes (Dasgupta, 2021). While exploiting the Earth's natural resources like what Heidegger calls a standing reserve (1977) at our service, we do not recognise these resources' life-supporting value, and we allow «the 'market' to define what we value», enriching «the sellers while impoverishing the soul and the earth», without even being grateful or feeling indebted (Kimmerer, 2013, p307). This anthropocentric mindset results in high greenhouse gas emissions (Garnett, 2011), an important use of water and energy, the sterilisation of soils, water pollution, irreversible biodiversity loss, and quantities of non-biodegradable waste (Dasgupta, 2021)...

Health systems have also an important impact on the environment. Climate change's consequences on humans' and the world's health can now be viewed as another side effect of occidental modern medicine. Indeed, despite the small number of case studies on the subject, a 2019 study calculated that the health sector «accounts for 2-10% of national carbon footprints across all OECD countries, China and India» (De Decker, 2021), with Great Britain's healthcare-related footprint representing 5.9% of its national carbon footprint in 2014 (Pichler, 2019). This can be explained by the high energy consumption of medical devices (like MRI scanners and hospital ventilation...), the industrialised production of pharmaceuticals, the greenhouse gas produced by inhalation anesthetics, and the manufacturing and waste management of medical single-use disposable material (De Decker, 2021). Considering the survival of the human species and of the environment instead of the survival of individual patients, De Decker therefore writes:

«Industrial society has given us effective medical treatments, but it's also making us sick. [...] As medical treatments become increasingly resource-intensive, the chances grow that the public health damage

of a treatment outweighs the individual gain of a patient, especially at old age. [...] A health care system that is more focused on preventive medicine, and which operates outside the logic of the market, could reduce emissions without negatively impacting health, maybe even improving it.» (De Decker, 2021)

This described alternative health system introduces the «one-health» concept, which recognises that the health and wellbeing of humans and of the environment are intrinsically linked (American Veterinary Medical Association, 2008). Therefore, it is suggested that more sustainable food and health systems can largely benefit humans.

2.1.3. Social

The state of the food and health status quo has both social causes and social consequences. The first reason for Scotland's unhealthy and unsustainable food behaviours, is the subjectivity of «good food»'s definition. Indeed, healthiness is not necessarily part of a «good food»'s criteria, as this term is embedded in socio-cultural, economic, and even political environments. A major criteria is also the food's ability to provide emotional and psychological comfort (Freeman and Gil, 2004). The manichean nature of this term also suggests that if someone's diet does not include «bad food», like the cliché «Scottish diet» (made of chips, pies, deep-fried Mars bars, and curries), this diet can then be considered as «good», regardless to how diversified it is. By disengaging themselves from this stereotyped unhealthy diet, people might not feel concerned by expert food advice (Fuller, 2003), which can also often feel contradictory and confusing. This is a major cause of the failure of the «five a day» intervention (ibid).

Other social factors to these behaviours, are the perceived obstacles to improve them. The perceived time and monetary constraints to better food habits, especially prevalent in populations with a low socio-economic position (SEP), invite people to eat frozen pre-made meals (Van der Heijden et al, 2021). Although this unhealthy practice is less time-consuming than cooking from scratch, it can in fact be more expensive, according to a Scotland-based study (Whybrow et al, 2018). But while this study found that «healthier diets were not necessarily more sustainable» (with low greenhouse gas emissions), sustainable diets were generally more expensive than unsustainable ones. These concerns are thus partly founded, and populations with low SEP have therefore fewer chances to adopt healthier and more sustainable food behaviours.

Another perceived obstacle is the lack of «ideas, knowledge and menu-planning skills necessary to organise a meal» (Bosley 1999 cited in Caraher et al. 1999, p.595). A 2002 UK-based survey found that, of the respondents, 60% of females and 27% of males considered themselves as confident cooks (Beardsworth et al. 2002, p.482). This lack of confidence largely results in gendered expectations about the cooking responsibility. More recent time-use data confirms that women in Scotland still do most of the unpaid care work: 68% of the housework and childcare is done by women (Scottish Government, 2019).
The burden of this Gender Care Gap on women's shoulders is even heavier when food-related unpaid work is expected to be healthy and sustainable. Therefore, if domestic work is not more equally distributed among genders, food behaviours will remain difficult to change.

By comparing empirical world data against The Limits to Growth's societal collapse scenarios (Meadows et al, 1972), a very recent study confirmed the prediction of a major decline during the 2040 decade if the «Business as Usual» scenario persists, when industrial growth will finally stop and pollution will exponentially rise, affecting food production, health and standards of living (Herrington, 2021). In order to mitigate this collapse, future generations must urgently be prepared for food and health resiliency, and be able to challenge the health, environmental and social status quo.

2.2. Previous interventions

2.2.1. The Scottish Government's intervention

Policies are key drivers for change in food and health systems, as they can have a significant impact through public regulations. On a world scale, the United Nation's set of Sustainable Development Goals (SDGs) addresses the described problems in many ways. For example, the SDG2 which aims for food security, improved nutrition, and sustainable agriculture, through its target 2.2, plans to, «by 2030, end all forms of malnutrition» (United Nations, 2020). The SDG3, which aims for healthy lives and well-being for all, introduces target 3.4: «By 2030, reduce by one-third premature mortality from non-communicable diseases through prevention and treatment» (United Nations, 2021). Even if these goals suggest indicators to measure the change, they remain only vague guidances, to initiate countries' concrete action. On its side, the Scottish government has published in 2014 a national food and drink policy which envisions that by 2025, Scotland will be «a Good Food Nation» (The Scottish Government, 2014a), setting out in 2018 a range of measures across the areas of health, social justice, knowledge, environmental sustainability, and prosperity. In this framework, to allow nation-wide change across different socio-economic areas, the government initiated a series of food education interventions, like the «Better Eating, Better Learning» program (The Scottish Government, 2014b), and the introduction to Scotland of the international Eco-schools program (Keep Scotland Beautiful, 2021). The government is also funding the Education Scotland organisation «to support effective teaching about food as part of the school curriculum» and their Food for Thought Education Fund (ibid). Another intervention benefiting from the government's funding is the Soil Association's Food for Life catering mark program, which certifies school restaurants with health and sustainability conditions (ibid). Finally, more sustainable public procurement practices are initiated through a combination of eco-labels, standards, life-cycle assessment, and costing, with the «Catering for change» guidance (The Scottish Government, 2011). But again, knowledge can be a real obstacle for schools' catering managers to make more sustainable and healthy choices (Sönnichsen, 2020).

2.2.2. Food and health education

There is indeed a real lack of food and health education across generations, resulting in all the problems mentioned above. Because it is particularly challenging to efficiently share knowledge once norms and behaviours have been integrated as habits, children are the major targets of food education programs. But neuroplasticity is not the only reason children can better learn new food habits (Masten, 2011). We can also talk about taste plasticity, since «dietary patterns establish early» (Lumeng and Fisher, 2018, p27). Through repeated exposure and taste experiences (Holley, 2015), a new food becomes familiar, therefore «appropriate, and what is appropriate is accepted and preferred» (Lumeng and Fisher, 2018, p27; Mennella, 2016). This exposure influences the taste but also the gut microbiome and thus the body's biological acceptance of the food (Saavedra et al, 2013).

Schools are also largely targeted by food education because they provide a unique inclusive framework when people from a large range of socio-economic positions meet and learn the same content. To expand these equal chances to access to food education to access to healthy food, the Scottish Government has also committed to providing Universal Free School Meals (UFSM) for primary school children as of 2022 (The Scottish Government, 2021). Thanks to the benefits of peer-modeling (Topping, 2005) and of commensality in building a common identity (Masson, Bubendorff and Fraisse, 2018, p. 109), school meals are indeed a key food education tool. Encouraging further action to the «whole-school approach» to food, which values lunchtimes as learning times too, a working group made of the main Scottish food organsiations (Nourish Scotland, Scotland Excel, The Food Foundation, The Soil Association Scotland, Zero Waste Scotland...) suggests to also «raise the profile of the catering profession by developing career paths and opportunities for professional development» (Nourish Scotland et al, 2021).

When cooking something themselves, it is estimated that people feel more pleasure in eating it (Bech-Larsen and Tsalis, 2018). Because

eating healthy thus depends on cooking healthy, food education programs also introduce cooking practices to schools, like the Chefs@ School intervention (The Scottish Government, 2014a), or like special occasion cooking workshops and home economics classes. These are largely appreciated by all participants. Still, this might also be a stressful experience because of the lack of guidance actors have when developing programs (Asher et al, 2020).

The previous study on lack of food knowledge and attempts to address this gap has shown the potential of cooking and eating activities in schools but also underpins the remaining challenges to overcome.

2.3. Discussion about the background

2.3.1. Design for behavioural change

Because these previous interventions, as well as this work, try to reshape behaviours, they could benefit from the use of the methods of Behavioural Design, which aims to influence human behaviour (Lockton et al, 2010). The Fogg Behavior Model suggests that behavioural change can only occur depending on a person's ability and motivation to take action (Fogg, 2009). Triggers for change should therefore act within this balance, which can evolve with time. But the fear of being imposed limited ways to behave can cause psychological reactance, and the holistic Embedded Design methods suggest shifting the real persuasive intent of a trigger (Gilliam et al, 2018) through Game and Narrative Design. An example of this is how the gamification of learning experiences can boost children's motivation to learn (Prensky, 2006).

2.3.2. Challenging the gender care gap

Childhood is a major identity-building period, and if children mostly see women cooking, this activity will continue to be associated with «being a good mother» (Fuller, 2003) and will therefore remain «women's duty». On the other side, the identities of cooking men are still largely reduced to professional chefs, recreational cooks, or «gastrosexuals» (heterosexual men who use cooking skills only to impress friends and partners) (Lewis, 2020)... But, new paradigms slowly emerge, through for example the popularity of Jamie Oliver, who manages to incorporate «what have traditionally been seen as elements of feminine domestic practice into a domestic culinary masculinity» (Hollows, 2003, p. 237), which means cooking every day for friends and family and rejecting elite cuisines.

This gender-task association has ruled for centuries in most of the world, largely based on the woman-nature and man-culture dualisms, which underline the links between women's oppression and humanity's domination of nature. In order to empower women and the environment, both working hand-in-hand, ecofeminist activists and thinkers seek to reclaim this imposed dualism. Cherishing women's embodied link to Mother Earth by developing a spiritual but still grounded dimension to it (through rituals to food, menstruations and birth...), some of them call themselves witches (Hache, 2016). This comes with no surprise, as the estimated 35,000 to 100,000 women who were sentenced to death for practicing witchcraft (Wolfe, 1997) during the major witch-hunts (between the 15th and the 18th century), were in fact often healers, or women who earned their living thanks to indigenous knowledge of nature and the mastery of natural chemical transformations (Chollet, 2019). One of these mysterious processes was fermentation, and women were the ones practicing it daily, as, worldwide, «women are recognized as the original brewers of fermented drinks from fruits, roots, leaves, bark, and grains» (Grahn, 1993). In pre-Reformation Europe, the beer industry, which depends on the controlled decay of malted grains, was thus largely managed by women, the alewives. But when being a financially independent woman by using this «obscure» process became associated with making a pact with the devil, their pointy hat became the witches' hat. Because unmarried alewives could not compete with couple-led or man-led businesses anymore, the beer industry became dominated by men (Bennett, 1991) and industrialised. Today, challenging the gender care gap can imply disrupting the narratives about food-related work, by empowering a daily cooking practice that allows both embodied and spiritual relationships to food.

2.3.4. Fermentation as a driver of change

Fermentation is, without coincidence, a powerful opportunity to address the challenges of Scotland's food beahviours. This low-tech preparation and preservation method is estimated to be one of the factors that enabled settled agriculture, with archeological evidence, remains of oral, drawn, and written storytelling or ceremonies showing the importance of fermentation all over the world (Katz, 2017). In Scotland, fermentation is now mainly used for the preparation of many of Scotland's daily diet's food (cheese, yogurt, pickled food, alcohol...) but also for the industrialised manufacturing of probiotic medications. As one more link between witchcraft, food, and health, and as another evidence of the one-health concept (Bell, 2018), the regular consumption of fermented products helps balance the gut microbiota and preventing obesity and its related diseases (cancer, type 2 diabetes...) (Dahl, 2017). This is due to the presence of prebiotics and probiotics, which are created by the metabolic process in which an organism (bacteria or yeast) converts sugars into alcohol or lactic acid. Consuming enough probiotics can also benefit children's mental health and behavioural disorder issues (like ADHD (attention deficit or hyperactivity disorder), or Aspergers syndrome), as they are often connected to the digestive system's health (Fernandes, 2018). But instead of taking probiotic pills, the potential of fermentation as a resilient preventative medicine would only be fully explored if the fermentation process is made by the «patients» themselves. Indeed, the rituals that this process demands can introduce a sense of mutual care into the practice of cooking, creating a new human-food paradigm (Vansintjan, 2018). In addition to this, fermentation can facilitate distributed sustainable food systems, as, «because of its low investment costs, fermentation lends itself well to supporting small businesses, allowing them to take advantage of seasonality while practicing a time-tested low-tech method» and reducing food waste (Vansintjan, 2017). Fermentation's benefits are therefore multiple and could help to prepare for a potential soon societal collapse.

But while the individual practice of fermentation is very popular in Asia or South America, it is nowadays quite underused in Scotland. This is partly due to the fear of bacteria and fungi that developed consequently to Pasteur's work and the advent of microbiology, which, by scientifically explaining fermentation, destroyed the «prayers, rituals, and offerings» (Katz, 2017, p34). This also «gave rise to a sort of colonial outlook toward microorganisms, that they, like other elements of nature and other human cultures, must be dominated and exploited» (ibid), and thus, industrialised (which distanciates consumers from the food). Other reasons are that, although it can save money, it needs knowledge and time to start fermenting. People also usually do not know the infinite number of possible recipes: sauerkraut, kefir, kombucha, kimchi, miso, tempeh... Finally, the strong taste of fermented food can be another reason. Indeed, «'sour' is an important flavour that is not usually given to little ones in western cultures», a cause to people's preference for sweet food.

2.3.5. Conclusion of background

Two main objectives can be identified thanks to this review. First, a holistic re-proximity to food is needed, to allow people in Scotland to (re-)become native to their land (Kimmerer, 2013). This can be achieved thanks to food education and cooking practices. Secondly, children can be key actors of behavioural change, if they are provided with the tools to challenge the status quo, which can be massively distributed through schools. Because fermentation seems to represent a powerful tool to achieve this, a more specific research question can now be asked: how might we promote healthier and more sustainable food habits in Scotland through the introduction of the practice of fermentation to children? To determine how this work can address this question, its methodology and methods will first be described.

3. Methodology

3.1. Vision and objectives of methodology

This work is first a design-led project. Its methodology is therefore deeply based on design methodologies and the research methodology is part of them. The changing and complex nature of wicked problems (Rittel and Webber, 1973) such as health and food issues in Scotland demands to address them with a highly agile and holistic approach. Therefore, this work's outcome is to be considered as a non-final version, one iteration among many past and future iterations. It is also part of a «larger network of initiatives» (Design Council, 2021), where the interconnections between different interventions enable long-term change.

Corresponding to these objectives, the British Design Council's Systemic Design Framework was used throughout the entire project. Created to make design processes more sustainable and systemic, this framework guides towards people and planet-centered, inclusive, and regenerative approaches while promoting collaborative, testing, and «zooming in and out» practices (Design Council, 2021, p43). It is based on the Double Diamond model which guides the design process through divergent and convergent thinking (Ball, 2019). In opposition to the traditional linear Double Diamond, the Systemic Design Framework allows constant iteration, while working through its four steps: exploring the problem, reframing the brief, ideating and creating, and catalysing (see figure 3.1).

3.2. Design and research process

3.2.1. Explore #1: qualitative and quantitative secondary research

The first diamond of the Systemic Design Framework can be seen as exploratory research. Indeed, it seeks «orientation in a new field in order to give the field of study a thematic structure and to generate hypotheses» (Flick, 2009, p166) and allows great freedom to reorient and narrow the research down, depending on its ongoing findings (Saunders et al, 2012).

This exploration starts by determining the root causes of the issue and the theories and actions that already try to address them, to gather knowledge from varied perspectives, map the connections and flows of power, relationships, and purposes within the system, and identifying potential opportunities and works that have previously «been forgotten, overlooked or underused» (Design Council, 2021, p51). The first exploration round was conducted through the secondary research synthesised in chapter 2, with an inductive reasoning process, which generates theory «out of specific instances of observation and experience» (Johnson and Duberley, 2000 p16).

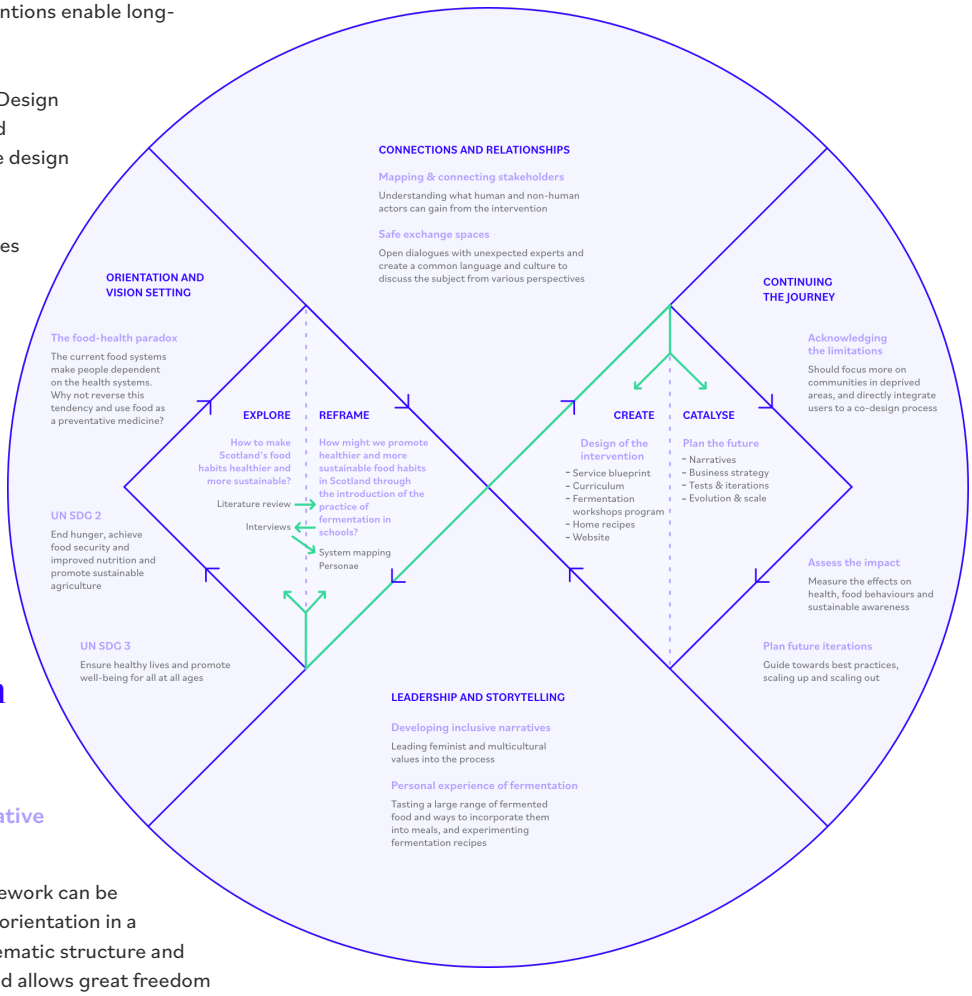


Figure 3.1: The design methodology, in the light of the Systemic Design Framework

3.2.2. Reframe #1: redefining the research question

The collected findings led to new topics which needed to be mapped too, in order to identify specific opportunities. Once they were investigated and their possibilities were explored, a more specific research question emerged, which led to reframing the design brief, introducing new actors and dynamics into the system's mapping, with new perspectives, hypotheses, opportunities, and challenges. One major opportunity that emerged from this process was the potential of fermentation workshops in schools to introduce healthier and more sustainable food behaviours across Scotland. However, this hypothesis needed to be tested to support it further.

3.2.3. Explore #2: qualitative primary research

This is why an exploration of the reframed problem was necessary. Although the inductive reasoning process enables a broad understanding of the studied subject, the «inductive verification of a theory is inevitably based upon a finite number of observations» (Johnson and Duberley, 2000, p28). Therefore, in order to challenge and explore the emergent hypothesis, this second exploration round was conducted with an inductive but mostly deductive approach. It took the shape of a series of problem-centred expert interviews. This qualitative interview method merges the problem-centred interview (PCI) method with the expert interview method. The PCI method presents itself as an «egalitarian dialogue between the interviewer and interviewee in which the research question or the 'problem' is refined jointly» (Döringer, 2021, p268), allowing an iterative process that combines inductive reasoning as the interview starts with a narrative beginning, with deductive reasoning through a series of precise questions. Expert interviews are semi-structured interviews with experts, individuals who carry certain expertise, which can be defined as a «technical process-oriented and interpretive knowledge referring to their specific professional sphere of activity» (Bogner and Menz, 2002, p. 46). The flexibility of such interviews was chosen to create a safe space for an honest exchange for the participants and to avoid directing them towards a limited choice of answers, which could be biased by the interviewer's assumptions. Still, the interviews' structure was designed in a way that guided the conversation towards the specific hypothesis to test, while allowing the interviewees to introduce new sub-hypothesis.

Interviewees were recruited depending on their expertise's relevance to the tested hypothesis. They were contacted by email or were directly introduced by other contacted persons. The interviewees can be categorised in five groups depending on their domain of expertise and on the interviews' covered topics: health, food policy, education, cooking, and business strategy (see figure 3.2). The «health» group was composed of a Scotland-based nutritionist and a Scottish holistic health coach, the «food policy» group consisted of a food justice project officer and a policy and project officer at the national charity Nourish Scotland, and the «education» group included a food advisor at the English school and education catering service Chartwells and a teaching intern in a Montessori school in France. The «cooking» group was composed of a Scottish veg advocate and organiser of webinars for parents to learn to cook healthy food with children, and of a sustainable food coordinator at Arran Eco Savvy. To finish, the «business strategy» group was made of the business development director at Tefal's cookware unit in France and of the personal chair of Food Marketing and Society at the Business School of University of Edinburgh, and member of the Food Researchers in Edinburgh (FRIED).

Within one topic group, the interviews' questions were often similar, to make the comparison of the collected qualitative data possible. Still, as the participants all had different experiences and knowledge to share, and as the questions were usually open-ended to allow great freedom to share personal insights, the conversation often led to more specific questions. Therefore, every interview was unique and offered diversified findings. The first part of the interviews focused on the precise domain of expertise of the interviewees and on their personal experience in this domain. The second part started by exposing the project's intention to the participant and continued by asking a series of pre-written questions which applied the research question to the interviewees' domain of expertise. The intention of this straightforward and transparent strategy was to enable the interviewee to give specific feedback and advice on the subject of fermentation workshops in schools (which are exposed in chapter 4).

3.2.4. Reframe #2: evaluation of findings

After this second exploration of the problem, a second reframing of the research question was needed in order to lead to a more specific design brief. This reframing was based on an analysis of the interviews' findings. To lead this analysis, the interviewees' insights were first collected in the form of virtual cards (see appendix A) which were then organised using a card-sorting method. To categorise insights into themes, a deductive thematic coding method helped to identify the problem's relevant themes and to assign them to the insights. Boyatzis describes a theme as «a pattern in the information that at minimum describes and organises the possible observations and at maximum interprets aspects of the phenomenon" (Boyatzis, 1998, p. 161). Sorting the insights into such themes allowed to juxtapose similar and contradictory collected qualitative data. The findings of this activity, summed up in appendix B, confirmed and developed the tested hypothesis, by further mapping the problem and identifying opportunities. This reframing allowed to create a final system map of the food and health education systems in Scotland, and informed the persona-building method that was used to define the system's main stakeholders' frustrations and expectations.

3.2.5. Create: iterative ideation

Continuing to follow the Systemic Design Framework (figure 3.1), the design process entered a phase of ideation addressing the reframed design brief. This phase was highly iterative, as the «explore» and the «create» phases overlapped, and the ideation thus continued to be informed by the ongoing interviews' findings. As the Design Council suggests it, this phase created «a portfolio of interventions», generating «ideas on different layers of the problem», from different strategic perspectives, and was made of «specific products, service and places», «policies», and «narratives or cultural mindsets» (Design Council, 2021, p51). Indeed, the design intervention that resulted from this phase is a coherent and interconnected system composed of a service, a website, a workshop program, and a narrative (exposed in chapter 5). To deliver a clear understanding of the whole process that this intervention goes through, a service blueprint was designed, as it is «an effective tool for modeling the service system describing the activities and time for the service system» (Geum and Park, 2011).

By adopting a circular mindset throughout this phase, it was assured that this intervention is easily implementable to the present context and is sustainable on long-term from a material and organisational point of view. Indeed, it fills in the gaps of the existing systems and therefore connects to the current interventions, taking profit from the existing innovation adoption channels.

3.2.6. Catalyse: planning the next steps of the journey

Because things constantly change in dynamic systems, arising new challenges and opportunities at all times, this work's outcome is not meant to be finite (Design Council, 2021, p49). Therefore, a major step of this project was to assure its open-endedness, providing it with the necessary autonomy to adapt to future changes in the system. It was also made sure that future similar work could benefit from the knowledge that was collected throughout this project. This involved giving guidance on measuring the potential impact of the intervention on the addressed problem, but also the side-effects on any other contexts that might also be transformed by the intervention. In this way, the benefits and limitations of the intervention could be acknowledged, in order to finally plan the next iterations of the journey (chapter 6). The importance of the «catalyse» phase is to consider the project from a big picture perspective, to understand how it can forge

«connections, ideas and initiatives into a stronger network», becoming part of a bigger system of change (Design Council, 2021, p53).

3.3. Challenges of methodology

3.3.1. Challenges of design methodology

One of the main design challenges that this work needed to overcome was to find a methodology that offered a balanced and flexible mindset to switch between the micro and macro levels of the project, by focusing on its specific people and places and on its wider system at the same time. The Systemic Design Framework was precious guidance in this exercise, as this methodology is, by essence, based on holistic and systemic approaches.

Another strength of the Systemic Design Framework was that it invited to dedicate time to focus on the background of the problem to totally understand its context and to challenge the brief before trying to address it. Nonetheless, a consequence of this, considering the limited time frame imposed by the dissertation format, is that it leaves less time for the «catalyse» phase, which is meant to further challenge the outcome. Therefore, this work may present a strong mapping of the problem but does not provide highly accurate prototypes of the outcome that could have been carefully tested and iterated as much as it needed. This is why further work would need to be done on this last phase to push this project's outcome beyond a speculative proposal, towards a realistic service that can really be implemented in the present context, and which known effects are all positive.

3.3.2. Challenges of research methodology

Concerning the research methodology, challenges could first be faced regarding the selection of participants. First, the interviewees were almost all based in Scotland, and their knowledge of the problem was mainly focused on the Scottish context, which enabled accurate insights. But as they were chosen for their expertise, regardless of their gender, age, ethnic group, or socioeconomic position, it resulted that the panel of interviewees was not very diverse. Indeed, only 2 of the 13 interviewees could be identified as men, and all were White, according to the national list of ethic groups (UK Government, 2011). As this work aims to address food-related and health-related social issues like the Gender Care Gap or non-inclusive health care programs and nutrition recommendations (chapter 2), the lack of diversity in the interviewees' panel can allow biases to interfere in the interviews' findings, and therefore represent a major limitation to the outcome of this work. For example, collecting findings from women about food-related activities can be very insightful, these tasks being predominantly conducted by women. But because an important aim of this project is to promote a more balanced distribution of domestic work among genders, insights coming from men would indeed help to better understand the diversity of relationships between genders and food.

Secondly, the design of the interviews effectively followed the structure of the problem-centred expert interview method, but was limited to one understanding of what an expert is. Indeed, a participant was mainly considered as an expert in a certain field of study because their profession consisted in having a strong knowledge about this field, not necessarily because their profession was a part of this field, as it could be the case for an end-user. For example, instead of interviewing a school catering manager, an academic expert in sustainable school catering and public procurement processes was interviewed. In this way, instead of collecting insider or immersed insights, it was sometimes only global overviews that were being collected. Although this can allow a systemic understanding of the field, this understanding can lack depth and pragmatism. This should be complemented with more user interviews, with Scottish schools workers, parents, children, and food supply chains actors, in diverse socioeconomic areas. The main reason why this work did not benefit from these user interviews, is that it was conducted during the schools' Summer break, and therefore, the schools' staff and the related services were not receptive when contacted. Another reason for their silence might also be the additional workload that the Covid19 pandemic inflicted on these actors.

If this project was to be pursued, a more collaborative approach to qualitative research would be meaningful to explore. Papanek, who described the designer's role as the cement between the multidisciplinary members of a design team, suggests that «the people for whom the design team works must have representation on the team itself» (Papanek, 1971, p296). A participatory workshop with the different actors of the system would have indeed offered meaningful insights by directly confronting and completing different perspectives. Because this could not be achieved during the work's limited time frame, a collaborative problem-framing and ideation workshop was still designed, and would have gathered experts and users to map the problem's system and generate ideas. The program would be balanced between whole group conversations and breakout rooms, dividing the group into «expertise teams», that would focus on one specific aspect of the system in order to then present their work to the other teams (appendix C). Ideally, a co-design cooking workshop could also be organised with the different users and experts participating in the design of recipes and activities of fermentation workshops in schools. By co-design, we refer here to the participation of people from various domains and levels of expertise in a creative process (Sanders & Stappers, 2008). Co-design would help this project to become more adaptable over time and therefore more resilient, also self-sustained through a community identity, as the actual co-authors of the project would be the actors of the studied system.

To conclude, this project's methodology benefited from various tools that helped to map the problem and ideating ways to address it. The Systemic Design Framework provided the project with a highly iterative design process and a systemic approach. The problem-centred expert interview method led the research methodology through organised qualitative data collection and a deductive thematic coding method facilitated a strong analysis of collected insights. Finally, further iterations would need more collaborative tools and more diverse participants, in order to assure that the project's outcome is not designed for the users, but with the users.

Topic	Interviewee	Bio	Interview's subjects	Interview's type	Interview's method
Health	Magdalena Seganova	Nutritionist, worked in secondary school, mother of young children	Holistic nutrition, health and wellbeing, fermentation practice with children	Semi-structured interview	Personal interview
	Lilia Sinclair	Holistic health coach, co-writer of Scotland's Wild Medicine	Kefir workshops in Dunoon's primary School, health and wellbeing through connection to the environment	Semi-structured interview	Telephonic interview
Food policy	Simon Kenton-Lake	Policy & Project Officer at Nourish Scotland	Food systems, supply chains, policy, stakeholders' values and relationships, Universal Free School Meals, food information, Peas Please advocate	Semi-structured interview	Personal and e-mail interview
	Diana Garduño Jiménez	Food Justice Project Officer at Nourish Scotland	Right to Food issues, decolonial approach to food insecurity, participatory research and design, disruptive narratives	Unstructured interview	Personal interview
	Valeria Skafida	Senior Lecturer in Social Policy, co-founder of the Food Researchers in Edinburgh group (FRIED)	Childhood and family food practices, social inequality	Semi-structured interview	E-mail interview
	Ann Bruce	Senior lecturer for an Innovation in Sustainable Food Systems course (University of Edinburgh)	Food systems and innovation, agriculture, food ethics, policies and regulations	Semi-structured interview	E-mail interview
Cooking	Morven Summers	Veg advocate, launched FED, a method and online workshops to teach parents to cook healthier food with children	Children-friendly cooking activities and recipes	Semi-structured interview	Video interview
	Jessica Wallace	Sustainable food coordinator at Arran Eco Savvy	Fermentation practice, fermentation workshops for adults	Semi-structured interview	Telephonic interview
Education	Sarah Thomas	Food advisor at the school and education catering service, Chartwells, England	Catering systems for schools, cooking workshops in primary schools, inclusive diets	Semi-structured interview	Telephonic interview
	Sarah Legoupil	Teaching intern in a Montessori school, France	Alternative pedagogies, autonomous learning methods for young children	Semi-structured interview	Telephonic interview
	Kay Tisdall	Chair of Childhood Policy (Moray House School of Education and Sport, University of Edinburgh)	Children's Rights, research methodology with children	Semi-structured interview	E-mail interview
Business strategy	Mary Brennan	Personal Chair of Food Marketing and Society (Business School, University of Edinburgh), member of the Food Researchers in Edinburgh group (FRIED)	Sustainable food systems, school catering and public procurement processes, food behaviours at home	Semi-structured interview	Video interview
	François S.	Business development director at Tefal's cookware unit, France	Business strategy, food-related marketing	Semi-structured interview	Video interview

Figure 3.2: Presentation of research participants and format of interviews

4. Findings

From the synthesis and analysis of the interviews' insights, emerged five major themes: (1) the health and safety challenges of fermented food in relation to children and schools, (2) the education guidelines of the intervention, (3) the socialities and practicalities of cooking and eating fermented food, (4) the intervention's business strategy, (5) and its communication strategy (see figure 4.1).

4.1. Summary of the findings

4.1.1. Health and safety

The first question that was discussed, is the benefits of fermented food in children's diet. The health coach Lilia Sinclair confirmed that «fermented food would benefit the children's health and wellbeing, but also their concentration and learning capacity», through the action of the gut-brain connection. The conditions for fermented food to be nutritionally healthy in children's diets were explained by the nutritionist Magdalena Seganova as follows:
«If little children eat too much fermented food, the result may be diarrhea [...] That could be part of their diet and nutrition, but they should not overdo it, just because there is a risk of bowel movement to be often and to be loose, which could be a concern if that continues for a longer time, because of dehydration».

She added that this was the same for adults and that if overdone, any food can be harmful. Therefore, she said that fermented food should be regularly part of meals, in small quantities, like a starter, a pudding, a sauce, or as sides.

About the standards in schools, food advisor Sarah Thomas explained how the school menus were designed, always providing alternative menus in case of allergies and special diets. The food and hygiene restrictions that she mentioned were that no food must be provided outside lunch, except yogurt and fruit-based desserts, no salt can be made available in school restaurants, and only food that is labeled and provided by the supplier can be stored in the school kitchen's fridges. Nevertheless, she specified that this rule does not apply to the teacher room's fridges. We also discussed the security issue of introducing knives in classes, as some schools do not allow pupils to use knives outside the canteen. She suggested that a grater or child-safe knives might be preferred in these schools.

In addition to this, a more recent challenge emerged, due to the Covid19 pandemic, as reported by Valeria Skafida, co-founder of the Food Researchers in Edinburgh group (FRIED): «equally access by third parties in schools [...] is more complicated now than before due to a desire to minimise the number of people mixing with pupil bubbles». Thus, various conditions need to be respected to make this intervention safe from a health and security perspective.

4.1.2. Education

Among the various interviews, many insights concerned the educational dimension of the intervention. First, the children's ideal age range for it was identified by the interviewees to be between 8 and 10 years old. This can be explained by the fact that around 9 years old, children are in P5 level, and «there is no major pressure of a national exam during this year» (according to Mary Brennan, Personal Chair of Food Marketing and Society at the University of Edinburgh), leaving more time and freedom to teachers to deal with the curriculum's program.

A series of educational methods were then mentioned. It was acknowledged that through a «learning by doing» approach, fermentation workshops could indeed enable children to take ownership over their cooking practice, as it gives responsibilities to pupils to take care of the live process of fermentation, like caring for a pet. It was also commented that giving pupils certain freedom in the way they follow the workshop's instructions could offer them guided autonomy. But «autonomy needs a framework: choices can be up to the children, but they need to know what the options are.» Therefore, «the rules' clarity is the key to autonomous learning» (Sarah Legoupil, intern in a Montessori school). The same participant also referred to a Montessori learning tool, the «sensory objects», which help children to learn through their senses, by focusing on one sense at a time. Following the idea of learning through repetition, it was also suggested that, through a regular practice of fermentation, children can accept it as a routine while learning and rehearsing it at the same time. Finally, it was widely encouraged to link the workshops to the curriculum to enhance the schools' acceptance and assure the learning outcomes of the intervention. Following these findings, the educational framework became therefore clearer, transforming fermenting food into a sensory learning tool.

4.1.3. Cooking and eating with children

Another main question that was raised during the interviews is the practicalities of cooking and eating with children during the workshops. The needed equipment and environment were listed by the participants (see figure 4.1). The main types of ingredients that were viewed as essential to a fermentation workshop were seasonal, fresh, and local vegetables and fruits (organic being better for fermentation), unprocessed sea salt, clear water, spices (anything the children like), herbs, and seeds. It was suggested by the participants who practice fermentation that the workshops' program should evolve throughout the year, as changes in temperatures and the seasonality of ingredients affect the fermentation process.

Some interviews adopted a special focus on the possible recipes for the workshops, considering the preparation of the food, its fermentation

period, and the way to serve it. It was recommended by participants to prioritise easy and quick recipes in class to teach the basics of the fermentation concept and to leave recipes that need more equipment or time for home. Concerning the integration of the workshops' outcome into school meals, many interviewees also advised that the recipes should be coordinated with the school's menus program and look familiar and easy to eat with daily meals: kefir Orangina, fermented ketchup, probiotic chocolate bars...

4.1.4. Business strategy

The interviews with food policy and food business experts brought out substantial insights about the nature and purpose of the intervention's organiser and the concrete service it offers. It was said that, in the light of the current system's organisation, the intervention's entity should acts like an organisational facilitator between the intervention's stakeholders. Policy Officer at Nourish Scotland Simon Kenton-Lake suggested that the organiser should be external to the school's primary activities, like «a private business, NGO, social enterprise, community group...» Mary Brennan estimated that «a middleman approach is appropriate [...] as wholesalers provide most food and drink ingredients and products to schools.» She added that the intervention's food supply chain would work as a mix of public/national and private/local procurement systems, as ingredients like spices and sea salt were too specific to order on a very local scale, but fresh

Figure 4.1.: Synthesis of the interviews' findings

vegetables would be easily ordered locally, creating new business opportunities for local farmers and wholesalers. Still, experts' answers to the question of the intervention's business model remained slightly vague, and seemed to suggest that the only way to sustain it, would be through public and private funding programs, as they believed parents should not be charged.

With these same experts, it was also discussed how to approach the different stakeholders and users, and how to build up a supportive network with individuals and organisations that already work for the same values and similar activities. This led to the idea that the adoption of the intervention would be progressive, starting local, small, targeting receptive specific communities, and after measuring the impacts and collecting proves, it would evolve towards other schools and councils, scaling up and out. This guidance helped defining the concrete form of the service and its strategy.

4.1.5. Communication strategy

The last main theme of findings that was identified is the communication strategy of the intervention, and how to challenge the narratives about fermented food, cooking, and even health and education. First, for children to want to do the workshops, it should not look like another lesson, but an opportunity to experiment with textures, colours, and other senses, while learning to create valuable food for their body and obtaining empowering knowledge. Although Sarah Thomas intimated that «parents will always complain», it was also asserted that parents would largely accept the intervention if they are not charged and their children bring healthy food home. Still, as Valeria Skafida puts it by referring to the pandemic context, «parents (and mainly mothers) have had a very tough time in the last 1.5 years often taking on additional roles (home schooling) on top of existing demands». The home activities should therefore be very simple and not depend on parents' participation. Regarding the schools' and teachers' acceptance of the intervention, it was suggested to work with key opinion leaders (doctors, education experts, school nurses…) and allow a trial period. There was an important emphasis on the need to make the intervention's adoption as guided and transparent as possible. As the general biased idea of what fermentation is can raise scepticism among the various actors, some participants tried to imagine a more positive image of fermentation, linking it to the Scottish traditions and environment, as well as to the experimental aspect of a chemistry lab.

When trying to define the general pitch with the experts, four main points were highlighted: the health, wellbeing and education benefits of fermenting food, the convenience of the fermentation technique, the fun dimension of the workshops, and the inclusive and sustainable purpose of the whole intervention.

4.2. Discussion of the findings

Multiple interpretations of these findings can be drawn, with subsequent implications for the intervention's design. First, a call for resiliency seems to be reflected in most of the participants' insights, encouraging children's emancipation from alienating and unhealthy food and health systems, but also from the dogma of schools and parents, which might not accept change as much as children can. This can be shown by the fact that the ideal age for this intervention coincides with the age that marks the beginning of children's gain of independency from their parents, and children's quick development of mental and physical skills (Centers for Disease Control and Prevention, 2019). This age is therefore the perfect age to provide children with the tools and mindset to start critically reflecting on their lifestyle and change it.

Based on the interviews' findings and secondary research on the status quo (chapter 2), the intervention's related systems, or Scotland's food and health education system, could be mapped (see figure 4.2.). This map depicts this system's stakeholders, policies, funds, existing interventions, and biases… It also underscores this system's main cores (or ecosystems): primary schools, households, farms, the web and the Scottish government. The multiplicity and interconnectedness of these ecosystems throughout Scotland enable the intervention's systems to be distributed, enabling knowledge and products to be locally exchanged. By targeting these main ecosystems, the intervention can be resilient and self-sustaining in long term.

Based on the system map of food and health education in Scotland, the assets and interactions of this system could be identified, highlighting the opportunities for the intervention to integrate this system. Indeed, by pinpointing the actors that play central roles in the system, it was possible to define who the main users of the intervention are, and how they relate to each other. A series of personae was then created (figure 4.3), based on the interview findings, the system map's analysis and on the case study of the Cradlehall Primary School, in Inverness (Cradlehall Primary School, 2016). Indeed, the collected information about this school's staff helped to develop personae's profile as close as possible to reality and avoid the personae to be built on personal biases and idealised clichés. Thus, complex profiles were described, having motivations and frustrations related to their theoretical and practical concerns (values and practicalities).

To conclude, the interviews' findings helped to inform the intervention's system's mapping and its main actors' expectations and constraints, which in turn, challenged, developed, tested, and iterated the intervention's purpose and shape.

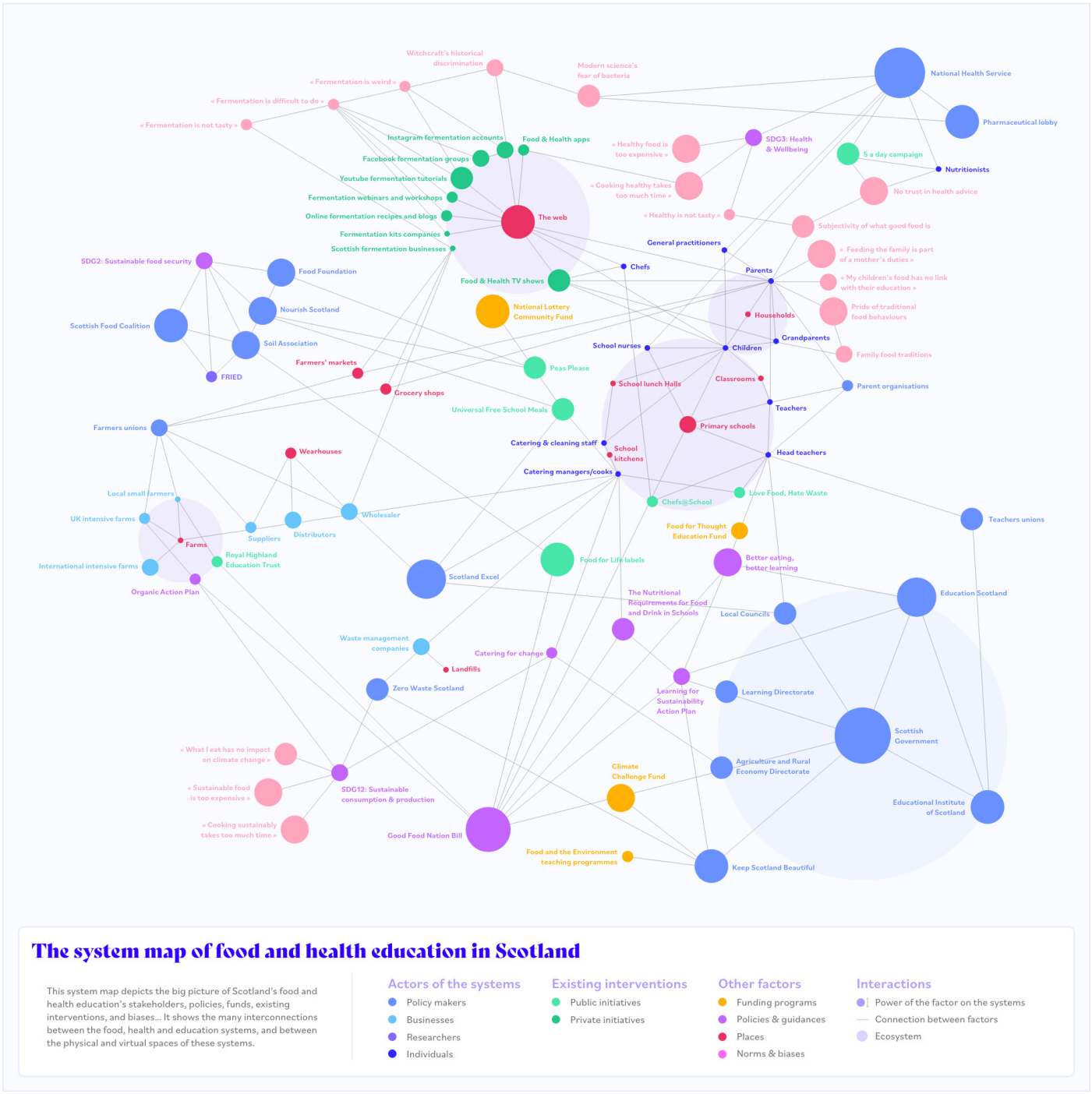


Figure 4.2.: The systems of food education and of the introduction of fermentation workshops in primary schools in Scotland

Teacher

Mhairi S.

Inverness

Teaches P5 classes at Cradlehall Primary School for many years. Is appreciated by her colleagues, the pupils and their parents.

Motivations

- Feels concerned by her pupils' future and looks for ways to raise their awareness to more sustainable and healthier lifestyles.
- Would like to do more hands-on workshops as it is a more efficient way to learn.

Values

Sustainability	●●●●○
Health	●●●●●
Children's Rights	●●●●●
Education	●●●●●
Local economy	●●●○○

Frustrations

- Struggles to educate pupils on food and health, as she has no time to take part in their lunch break.
- Has no time or budget to prepare a cooking workshop in class on her own.

Practicalities

Available time	●●●○○
Available mental load	●●○○○
Available budget	●○○○○
Food system knowledge	●●○○○
Cooking skills	●●●○○

« I would love having more cooking workshops with the children, but I have no time and budget to organise this alone... »

Cook-in-charge

Angela M.

Inverness

Manages a team of 8 catering and cleaning staff at Cradlehall Primary School. Orders, prepares and serves school meals in the gym hall.

Motivations

- Tries to provide satiating, tasty and healthy food that fit to different diets.
- Would like to involve more food education during lunch time.

Values

Sustainability	●●●○○
Health	●●●●●
Children's Rights	●●●○○
Education	●●●○○
Local economy	●●●●○

Frustrations

- Is dependent on the local wholesaler's products and contract so there is limited freedom to introduce healthier food.
- Lunch time is still seen as a break, not a learning opportunity, so doesn't know how to raise pupils' awareness on healthy food.

Practicalities

Available time	●●●○○
Available mental load	●●●○○
Available budget	●●○○○
Food system knowledge	●●●●○
Cooking skills	●●●●●

« There is currently limited freedom to bring the canteen to the classroom and vice versa... »

Head teacher

Lawrence S.

Inverness

Guaranties the quality of the pupils's education and experience, thanks to a strategic vision and relationship with the parents and the local authority.

Motivations

- Aims to provide pupils with direct interactions with food, by planting vegetables in a recently built polytunnel.
- Is interested in leading the school and the pupils towards a sustainable path.

Values

Sustainability	●●●●●
Health	●●●●○
Children's Rights	●●●●●
Education	●●●●●
Local economy	●●●●○

Frustrations

- A framework to make children grow and eat the school's vegetables is still lacking, as it is difficult to integrate them to the meals.
- The whole curriculum needs to be redesigned in order to promote sustainable and healthier practices at school.

Practicalities

Available time	●●○○○
Available mental load	●●●○○
Available budget	●●○○○
Food system knowledge	●●●●○
Cooking skills	●●●○○

« As an Eco Green Flag School (...) we are keen to promote the links between sustainability and citizenship. »

(Cradlehall Primary School, 2021)

Parent

Susan L.

Inverness

Working mother of 3 children. She and her partner both have time consuming jobs.

Motivations

- Tries to provide her children with a diversified diet, in the limits of the family's limited budget.
- Is sensible to her children's food requests but tries to keep it healthy when possible.
- Trusts the teachers and values their knowledge.

Values

Sustainability	●○○○○
Health	●●●○○
Children's Rights	●●●●○
Education	●●●●●
Local economy	●●○○○

Frustrations

- Struggles to understand what food is really good for the children.
- Has no time to try new recipes, even if they are healthier or more sustainable.
- Struggles to delegate domestic work and make the rest of the family cook too.

Practicalities

Available time	●●○○○
Available mental load	●●○○○
Available budget	●○○○○
Food system knowledge	●●○○○
Cooking skills	●●●●○

« Healthy recipes take too much time to prepare and sustainable alternatives are too expensive... »

Pupil

Noah L.

Inverness

9 years old P5 pupil at Cradlehall Primary School. Plays in the school's football club. Benefits from free school meals.

Motivations

- Would like to have more hands-on activities in class.
- Likes playing with colourful food.
- Loves growing vegetables in the school's new polytunnel.

Values

Sustainability	●●○○○
Health	●○○○○
Children's Rights	●●●○○
Education	●●●●○
Local economy	●○○○○

Frustrations

- Finds the free school meals sometimes boring.
- Would like to learn how to cook but his parents have no time to involve him in the meals' preparation.

Practicalities

Available time	●●●●○
Available mental load	●●●●○
Available budget	○○○○○
Food system knowledge	●○○○○
Cooking skills	●○○○○

« Why do adults tell me not to play with food? It makes it even tastier! »

Local Council

Sue N.

Inverness

As a catering services manager with Highland Council, she ensures that the schools receive healthy and nutritious meals across the Highlands.

Motivations

- Cares about the origin of the ingredients, their carbon footprint and nutritional value.
- Values the Food for Life award and helps introducing it to more schools.

Values

Sustainability	●●●●○
Health	●●●●●
Children's Rights	●●●●○
Education	●●●●○
Local economy	●●●●●

Frustrations

- Knows that eating healthy does not mean cooking healthy at home and when growing up.
- Would like to bring the school's eating behaviour into households.

Practicalities

Available time	●●●●○
Available mental load	●●●●○
Available budget	●●●○○
Food system knowledge	●●●●●
Cooking skills	●●●●○

« The council has long supported local food and farmers markets and promoted supply opportunities to local suppliers. »

(The Highland Council, 2018)

Figure 4.3.: The intervention's personae

5. The intervention

Figure 5.1.: Visual introduction to the SchoolKraut service

Once Scotland's malnutrition problems were mapped and the food and health education systems analysed, and once the opportunities and challenges of these systems were identified, the final outcome of this work could be formulated. This chapter showcases a suggestion of intervention to the problem and discusses to what extent it can make Scotland's food habits healthier and more sustainable.

5.1. Presentation of the intervention

Although this intervention is above all a rearrangement of the current systems of food and health education and therefore can be described as a system itself, in practice, it takes the shape of a service, named SchoolKraut (referring to the intervention's two main aspects: schools and fermentation, illustrated by the famous fermented food, sauerkraut). This service, funded by public and private funds (see figure 4.2.), provides the framework and the tools to make it very easy for primary schools in Scotland to make frequent fermentation workshops in P5 classes. It elaborates adapted contracts with the local stakeholders to deliver SchoolKraut boxes with ingredients and equipment to schools, prepares fermentation workshops guidance and recipes for teachers, and creates opportunities to continue eating and making fermented food at home through home recipes (figure 5.2). To explain the details of this service, its logistics will first be clarified, followed by its different assets: the workshops' program, its identity and narrative, and its website. Because the intervention is meant to evolve and expand, the description below is to be considered as one of the first iterations of the service.

5.1.1. The service

As shown in the service's blueprint (figure 5.3), the service's activity can be devided in three: adoption, fermentation cycles (repeating over the year) and expansion. The service's adoption consists in approaching a targeted local council in order to collaboratively approach schools and co-pitch the intervention with the council to a

receptive school's head teacher and catering manager (or cook-in-charge). Once the school is onboard, the pupils' parents are required to fill in an «onboarding» form that welcomes them to the SchoolKraut experience in an ethical and transparent way, by informing them about the initiative's objectives and implications, and asking for their consent and about children's special diets. At the same time, the school's wholesaler is also approached to design a contract together. In future iterations, this step can be achieved with the help of Scotland Excel's procurement experts.

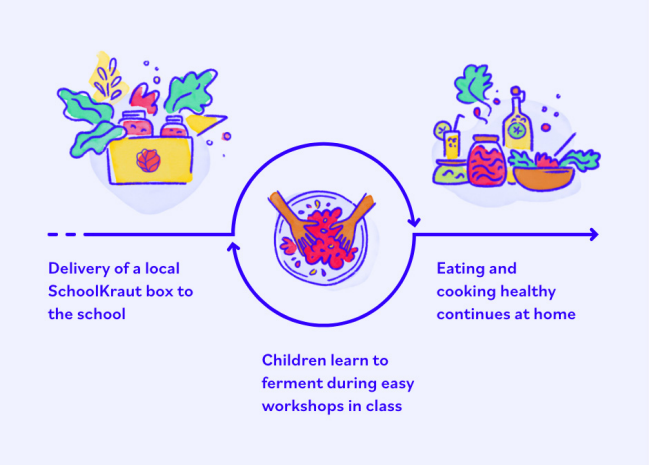


Figure 5.2.: Summary of the SchoolKraut service

A fermentation cycle starts when the order of a SchoolKraut box is being made and ends when the fermented food is taken home. To determine what recipe can be achieved during a workshop, it is necessary to know about the school's equipment and facilities, the wholesaler's capacities, the producer's available ingredients and the pupils' special diets. Therefore, a collaborative online order form is also completed by the catering manager, the head teacher, the teachers, the council, the wholesaler, and the local producers. A general version of this form is completed once, before the school's first workshop, and a more specific and quicker version of the form is then completed before each workshop, to make sure that the workshop's program fits the available ingredients. The ordering process of the SchoolKraut box is divided into three types of orders: (1) the fermentation equipment which is delivered once in the beginning (but can be completed if further equipment is needed in the future) is ordered by the service on a national scale; (2) the spices, herbs and sea salt which are delivered before every fermentation workshop are also ordered on a national scale; (3) the fresh vegetables and fruits which are also delivered for each workshop, are ordered on a local scale. In other words, the SchoolKraut organisation first arranges the delivery to the wholesaler of the jars and other equipment that the school does not already have, as well as the spices, herbs and sea salt, while the wholesaler orders the fruits and vegetables to the producers. Once the three components of the SchoolKraut box are received by the wholesaler, the wholesaler delivers the whole box to the school.

The workshop can then proceed. Because the fermentation process can take from 24 hours to over a month, a fermentation phase of two weeks is planned between two workshops during the winter semester. This timeframe was also determined depending on the fermentation time of easy but varied recipes like sauerkraut and other fermented vegetables using the same technique, which is around two weeks or less. During the summer semester's warmer days, the fermentation process is more unstable and difficult to control, and workshops therefore only happen every four weeks. As fermentation is a preservation method allowing to store fresh food for cold times of the year, autumn is furthermore a perfect time to ferment. During the fermentation phase, a ritual is carried out by the pupils to learn to evaluate when the food is ready. When it is, the children taste the food during lunch, as part of their meal, as the workshop's recipe is meant to make the result easy to implement in their meals. The food is then brought home by the children with clear instructions on how to store it and to eat it. Independently from the fermentation cycles, «home recipes» can be assigned to pupils by teachers.

After a year, to measure the impact of the intervention, qualitative data like user feedback and quantitative data like pupils' grades and weight are collected. This can be done through online or printed surveys that are completed by the different participants, or through individual interviews and focus groups that can collect insights about the challenges that were faced and the ways participants tried to overcome them. These findings can then help the service to be iterated, and better expand to other schools and councils.

5.1.2. The workshops' program

Each workshop lasts between 1 hour and 3 hours, and follows a different recipe, which is designed by the service's organisation collaborating with nutrition experts, chefs, and other experts. The recipes are designed to be easy and quick, demand as little equipment as possible, be fun, and give freedom to express pupils' creativity through experimentation and personal initiative. The recipes' outcome must be balanced and diverse, provide enough probiotics but not too much, be easily implementable in mainstream meals and be inspired by multicultural recipes. Some examples are: variations of sauerkraut, fruit kefir soda, kimchi sides, rainbow-coloured fermented vegetables (by arranging the ingredients according to their colour in a jar), fermented sauces, and raw snacks... As the possibilities are almost infinite, once the process is understood by the pupils, some workshops also give pupils the freedom to create their own recipe.

The first workshop starts with an introduction to fermentation (figure 5.4). First, after the teacher has engaged in a conversation about

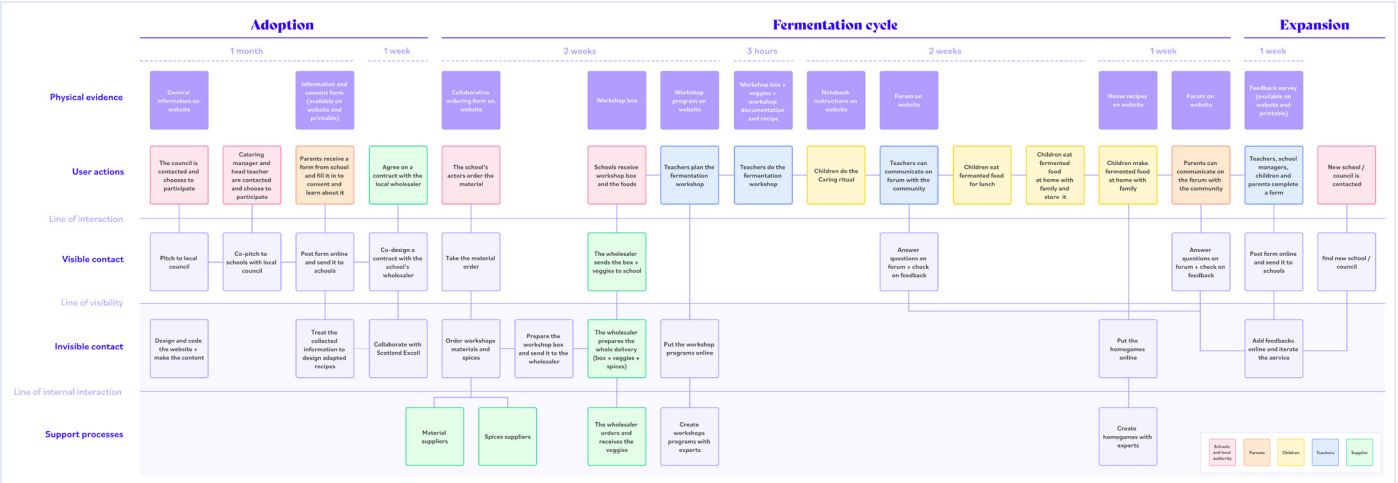


Figure 5.3.: The service blueprint of the intervention

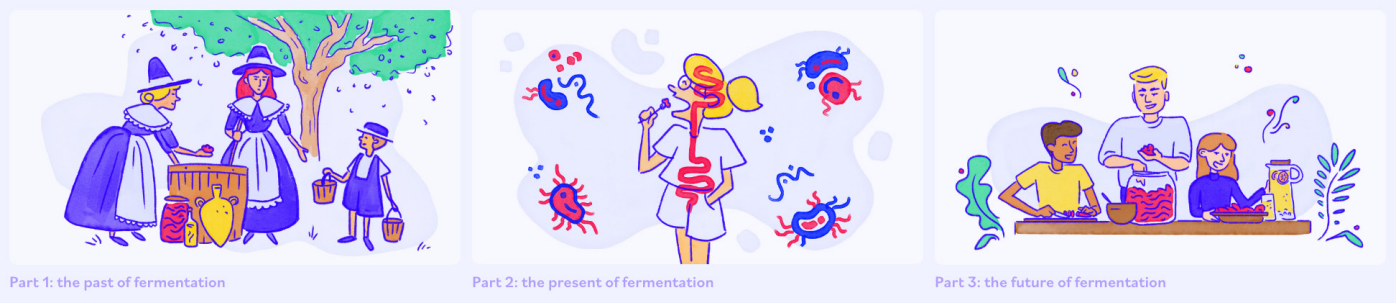


Figure 5.5.: Main parts of the introduction video

what fermentation is with the pupils, the pupils watch a short video provided by the service's organisation. Through animated illustration and a voice-over, this video starts by explaining the past fermentation practices, like the daily routine of alewives. It is then expressed how it became what it is today, mentioning why modern medicine fears bad bacteria, but also informing about the gut and brain benefits of good bacteria. The video ends by suggesting what fermentation can be in the future: a healthy, sustainable, and fun practice to experiment with others (figure 5.5).

The workshop's introduction then continues with the Tasting game. Groups of four pupils receive a fermented food sample (sent with the first SchoolKraut box and ordered from Scottish fermented food small businesses) and taste it. The group that identifies the most ingredients in the sample wins the game and can bring the rest of the samples home. This activity, therefore, introduces fermented food to the children in a sensory and playful way.

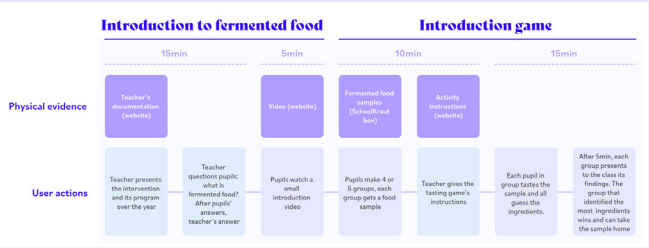


Figure 5.4.: Program of the first workshop's introduction

This Caring ritual consists in observing the fermenting food every two days and verify that there is no decoloration or mold and that the ingredients are still under the surface of the brine (in the case of sauerkraut), and smelling and tasting it every four days to evaluate how much fermented it is. The jars can also be shaken regularly and opened to «burp» it and liberate the gas. This trains the children's senses to learn the language of fermentation and how to keep the food safe from rotting or from turning to vinegar. The observations are written down by the pupils in their notebook: evolution of the food's colour, how acid or sour it is, how much bubbles there are in the jar... Of course this ritual's activities and length depends on the food that is fermenting, as, unlike fermenting vegetables, kefir would only take 24 hours and the ritual can only be done once when the fermenting fruits are floating at the surface.

Because starters like kefir grains or a kombucha scoby need to be stored in the fridge when not used, they can either be kept in the fridges in the teachers' room, or be taken home by children to store them in their own fridge and use them to cook between the workshops. It is then the children's responsibility to keep the starters alive, like caring for a pet.

5.1.3. The identity and narrative

To bring fermentation back into the norm of Scotland's food behaviours, this intervention suggests a new imagery and narrative of what fermentation can be: a gender-fluid balance between science and witchcraft. This is first attempted by framing the workshops around the stories of Eilidh (figure 5.7), a Scotland-based woman who

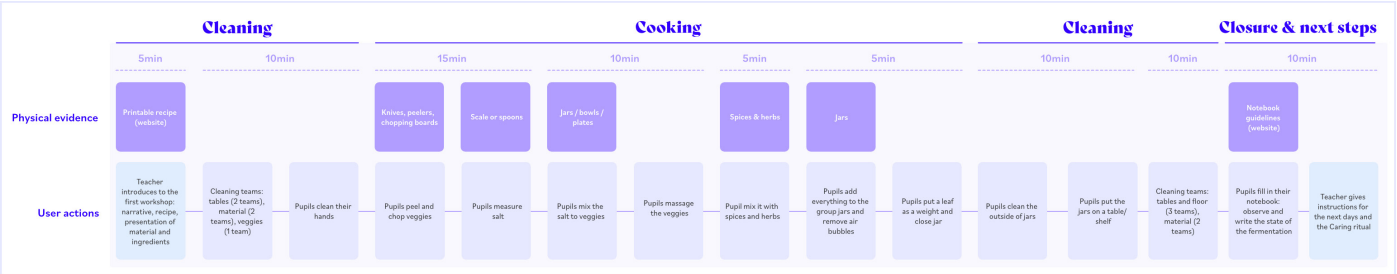


Figure 5.6.: Example of a regular workshop program, following a sauerkraut recipe

The program of a regular workshop can then begin. Before starting, the teacher introduces the fermentation cycle by telling a story that will lead the whole cycle through a fictive mission (see the section below). The cooking activity always starts and ends with a cleaning session (of the classroom's tables, the equipment, and the pupils' hands...) and the tasks are divided into groups of pupils to make it faster. Depending on the recipe, the cooking activity can be followed in small groups or individually. Ideally, everyone should be able to handle the ingredients, by massaging cabbage for example, or filling the jars and removing air bubbles by squeezing the cabbage inside it. At the end of a workshop, the outside of the jars is cleaned and jars are put out of the way on a table or shelf in a dark cool place of the classroom with the lids on. To close the workshop, the teacher continues telling the fictive story to explain the Caring ritual that will punctuate the fermentation phase.

helps her friends and their environment to stay healthy despite the pollution and other threats caused by humans, thanks to fermented potions. Each workshop and story start with a new mission to achieve and continues by following a traditional narrative structure, the climax being the cooking activity which is guided by Eilidh's recipe, and the resolution being the moment when children taste the fermented food, and when Eilidh's friend's problem is solved by eating the fermented food (see an example in figure 5.8). In order to provide a safe and reliable learning environment, the story told by the teacher as a narrator has a cheerful tone while dealing with serious issues like climate change and health, and Eilidh's personality is light-hearted but still rigorous. Moreover, it is voluntarily unclear if Eilidh is a witch, a healer or a regular person who knows the secrets of healthy food, in order to make it easier for children to identify to her.

What is key to the new image of fermentation shared by this intervention, is its ambiguous balance between two worlds that are usually perceived as contradictory: the subjective, mysterious, and

natural world of witchcraft, and the objective, controlled and sterile world of occidental science. By creating this disruptive ambivalence, the service's identity blurs the lines between the rational and the sensorial, uniting the two opposites of the woman-nature and man-culture dualism. With the objective of being as gender-fluid as possible, this service makes it clear that fermentation is meant to be practiced by all genders.

The visual identity plays a major role in this mission (figure 5.9). First, the two main colours are a red-magenta that refers to the vibrant warm colour of fermented red cabbage, and a blue which invokes the colour of science but with a subtle touch of purple, an eccentric colour that can refer to the world of magic. The lively red and the calmer blue create a balanced contrast that sets the service's tone as an educational game. The logo, a hand-drawn cabbage lief with mysterious bubbles also adds to a magical-scientifical iconography. The soft edges of the lineal Tisa Sans Pro font, as well as the rounded buttons and icons, confirm the service's spontaneity.

Figure 5.7.: Eilidh, the main character of the narrative

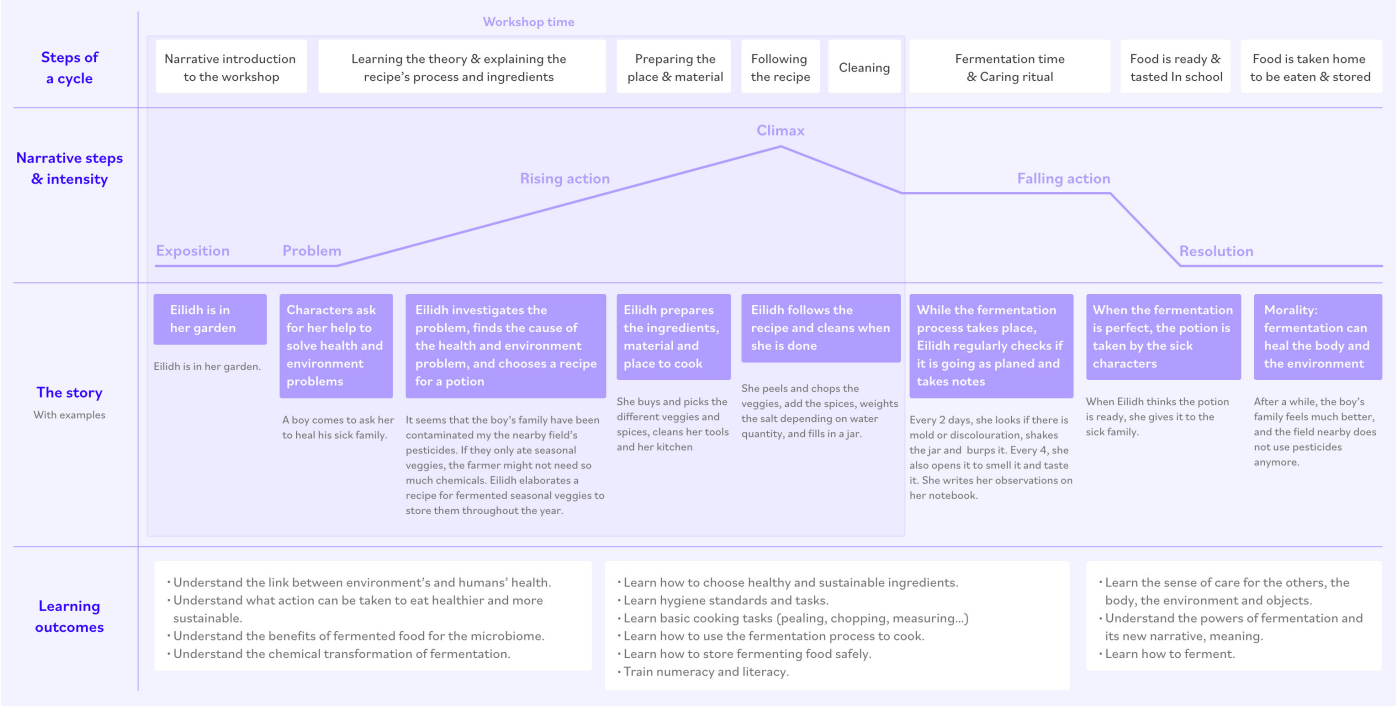


Figure 5.8.: Fermentation cycle's structure in relation to the narrative

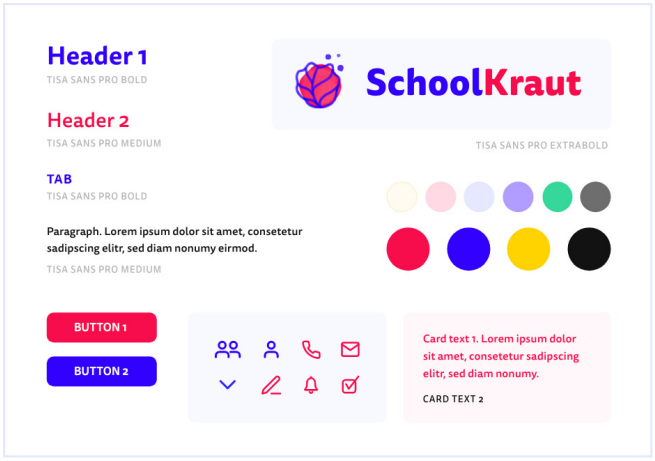


Figure 5.9.: Visual identity of the service

5.1.4. The website

To coordinate the intervention among the different actors, and to expand it to new schools and councils, the SchoolKraut service needs a website (figure 5.10). This website first acts like an information hub (figure 5.11). By explaining the service objectives and features, and by sharing the knowledge about fermentation, it reassures the participants, like parents who could otherwise be skeptical towards its relevance. Therefore, the «Home» page presents informative and concrete content about how a fermentation cycle is organised, and its health and education benefits for the children, the parents, the teachers, the producers, and society in general. By showing user feedback, and the strong relationships with public organisations like councils, Scotland Excel, or the Scottish Food Coalition, the website can show the intervention's achievements and prove its impact. The «About» page answers the potential questions about the service's organisation and why it chose to focus on fermentation, the links with the Curriculum for Excellence, as well as the introduction video about fermentation that is watched by the pupils during their first workshop.

The website also acts like a community platform. It holds a «Blog» page which contains articles about fermentation, health and education, and news about the different schools' participation. A «Forum» page also enables participants to ask questions to other participants or answer them, for example about guidance on recipes' practicalities. The service's organisation can also participate in the discussion and regulate it. This collaborative way to handle issues is also key to another feature, the «My Space» page (figure 5.12), where a participant can have an overview of their SchoolKraut team and finds its members' contact details. This team is composed of all the stakeholders of a

SchoolKraut intervention in a school: teachers, the head teacher, the catering manager, the wholesaler, a local council member, sometimes local producers, and a SchoolKraut referent. This page also shows the team's activity, to alert the user if an action is required (completing the cycle's order form for example). On this page, teachers planning their next workshop can find the instructions and recipes that are provided by the service. The different online forms (collaborative order, parents' consent, feedback...) are available on the «Form» page, under «Community».

A last feature of the website is found on the «Recipes» page (figure 5.13). While the workshops' recipes are private and only available for participating teachers, these fermentation recipes are public and users do not need to create an account to access them so that children and families can continue fermenting at home. These recipes are inspired by both Scottish traditional cuisine and other cultures' specialties. Their vocabulary and pictures are meant to reflect the magic of fermentation, with names like «Wicked Cranachan», «Enchanted Curry», «Sunshine Elixir»... The recipes' health benefits are always explained, and every step is illustrated by clear images, complemented with special «secret» advice. To provide user-friendly offline experiences, recipes and workshop instructions are also printable (figure 5.14).

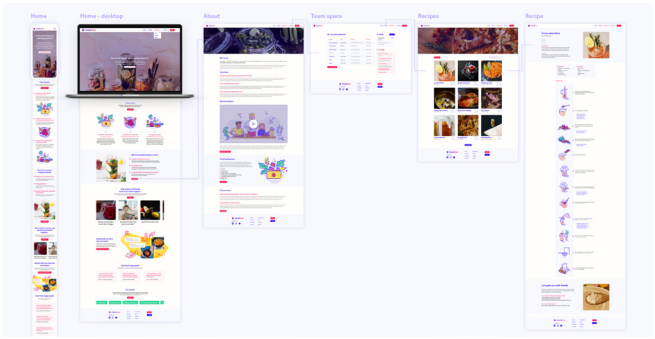


Figure 5.10.: The SchoolKraut website's main pages

Figure 5.14.: Example of a printed recipe

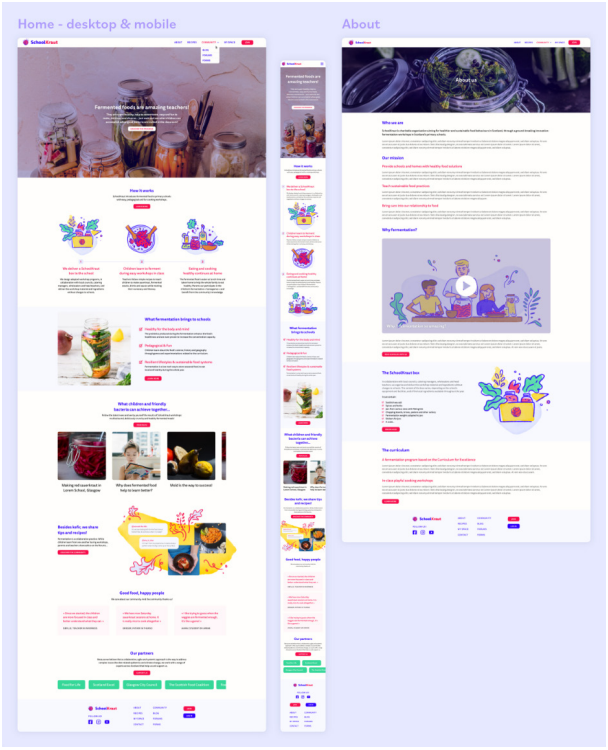


Figure 5.11.: The website's informative role

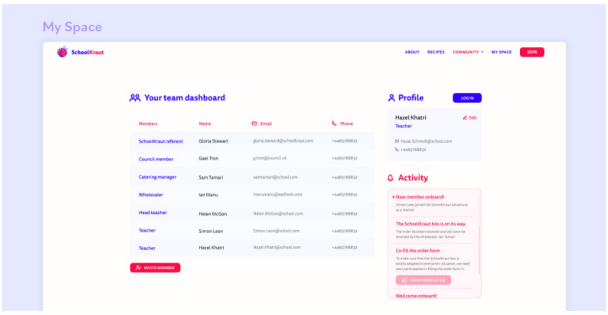


Figure 5.12.: A user's personal space

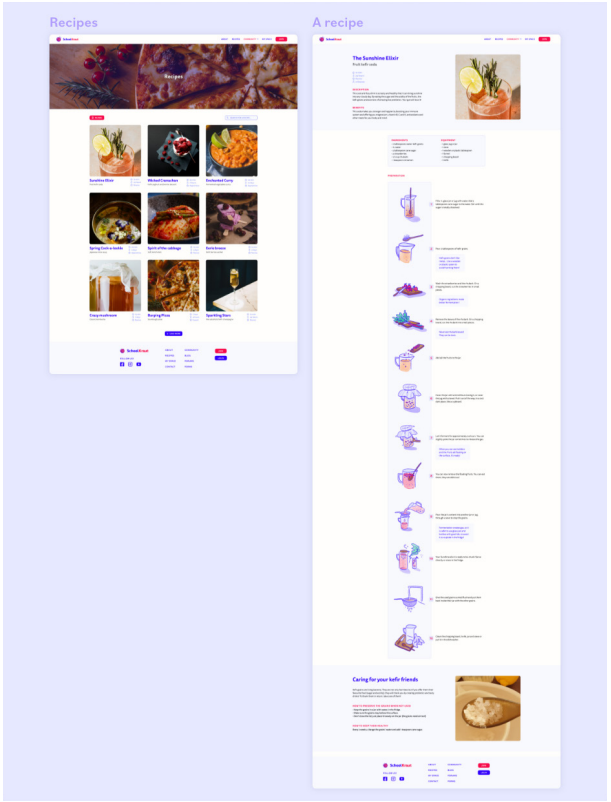


Figure 5.13.: The website's fermentation recipes

5.2. Discussion about the intervention

The main objective of this work is to promote healthier and more sustainable food habits through the practice of fermentation. To evaluate the extent to which this intervention achieves this mission, its theoretical and practical impact will be discussed, as well as its potential to expand.

5.2.1. Behavioural change

As mentioned in chapter 2, behavioural design can challenge normalised behaviours in different ways. First, the «psychologically embedded» behavioural design approach (Kaufman and Flanagan, 2015) encourages to obscure a product's true persuasive intention to avoid reactance, by using fictionalisation and metaphor, as well as game genres' methods. The use of the workshops' storytelling methods, which tell the stories of a relatable fictional character, can thus be particularly impactful, according to the National Storytelling Association: «stories are the building blocks of knowledge, the foundation of memory and learning» (in Manzini, 2015). Moreover, while it is not recommended to introduce fictions to children under 6 years old as it can be confusing (as reported by the Montessori expert interviewee), «fantasy is very interesting to the older child» (Montanaro, 2007). Indeed, helping Eilidh in her missions can make the children feeling empowered during their practice of fermentation while strengthening their bond to the food thanks to the work of their own imagination.

Another strategy that this intervention adopts to initiate behavioural change, is the «seductive interaction design» approach (Anderson, 2011). It consists in integrating an intervention in gameplay, by using the following game mechanics: levels that give a sense of progression (each fermentation cycle is a level, with its own narrative, recipe, learning), reward (the food that is taken home, and the collected knowledge), the appointment mechanic, which asks to do a task at certain regular times (the workshops and the Caring ritual are scheduled on regular bases), limited duration (pupils have a limited timeframe to proceed with each activity), teamwork and group competition... But challenges can arise from this gamification. As Anderson puts it, to make sure that the designed game stays fun, the initial activity should not just be «sugarcoated» with superficial game assets and one should «find the game that's already in [the] design». As fermenting is the very purpose of both the workshop and the game, this gameplay is assured to stay fun in long term. Thereafter, the difficulty of the game's challenge must evolve with the acquired skills of pupils, to maintain a «flow» (Le Breton, 2017), a state of mind of great engagement on a task, inspired by the Fogg Behavior Model (Fogg, 2009). Therefore, each workshop must present a more challenging recipe, to avoid boredom or frustration. In that respect, the intervention's narrative and gameplay can be powerful drivers of behavioural change.

5.2.2. Resilient education

SchoolKraut opens the way to a new education discipline: care education. Indeed, this intervention is about learning to understand the gifts of Mother Earth (healthy food), and how to be grateful and return the gift (caring for the environment). This interspecies reciprocity works the same between the pupils and the bacteria that ferment their food. As a tribute to fermentation as a science and as a magic (both being intrinsically linked), this care education is based on the understanding of the fermentation chemical transformation, and on the learning of empathy towards the non-human. The intervention can thus create healthier and more sustainable relationships between humans and their environment by teaching how to care for food.

The intervention also disrupts the traditional pedagogies' ways of dealing with the pressure of the imposed curriculum. Because pupils train their numeracy while measuring the quantities of ingredients and calculating the needed amount of salt during the workshops, and train their literacy when taking notes for the Caring ritual and when they invent their own recipes, SchoolKraut presents many opportunities to fill the curriculum's requirements. Other topics of the curriculum that are included in the workshops are science, history, and geography (as fermentation recipes come from all over the world), home economics, hygiene, and food safety... But the intervention shares knowledge that goes even beyond the curriculum, as it opens safe in-class conversations about health, gender, culture, and other topics which can usually be sensible and avoided. This care education will eventually be shared by the pupils to the parents.

5.2.3. Towards visibility and replication

The main challenge of this service remains the fact that, despite its user-friendliness and guidance, it still asks more work and time from the different participants. But the more the service spreads, the easier and quicker it will be to participate. To avoid SchoolKraut to stay «below the radar of the general public», it needs «to be acknowledged and [...] 'normalized' to be accepted as valid and desirable» (Penin et al, 2013). For this purpose, Manzini suggests using the «Amplification method» (Manzini, 2015, p125), which aims to expand particular practices. To do this, this practice first needs to be made largely visible, through for example collaborative mapping of the participant schools on the website, which will stimulate strategic conversations and create awareness among a wider public. Then, to enable the intervention's spread to be even quicker and diverse, it can be encouraged to be non-expert-driven, independent from the initial SchoolKraut service. This strategy might ask for a toolkit that can guide anyone to start fermentation workshops in a school, inspired by the SchoolKraut system. Consequently, food habits would become healthier and more sustainable even faster throughout Scotland.

5. Conclusion

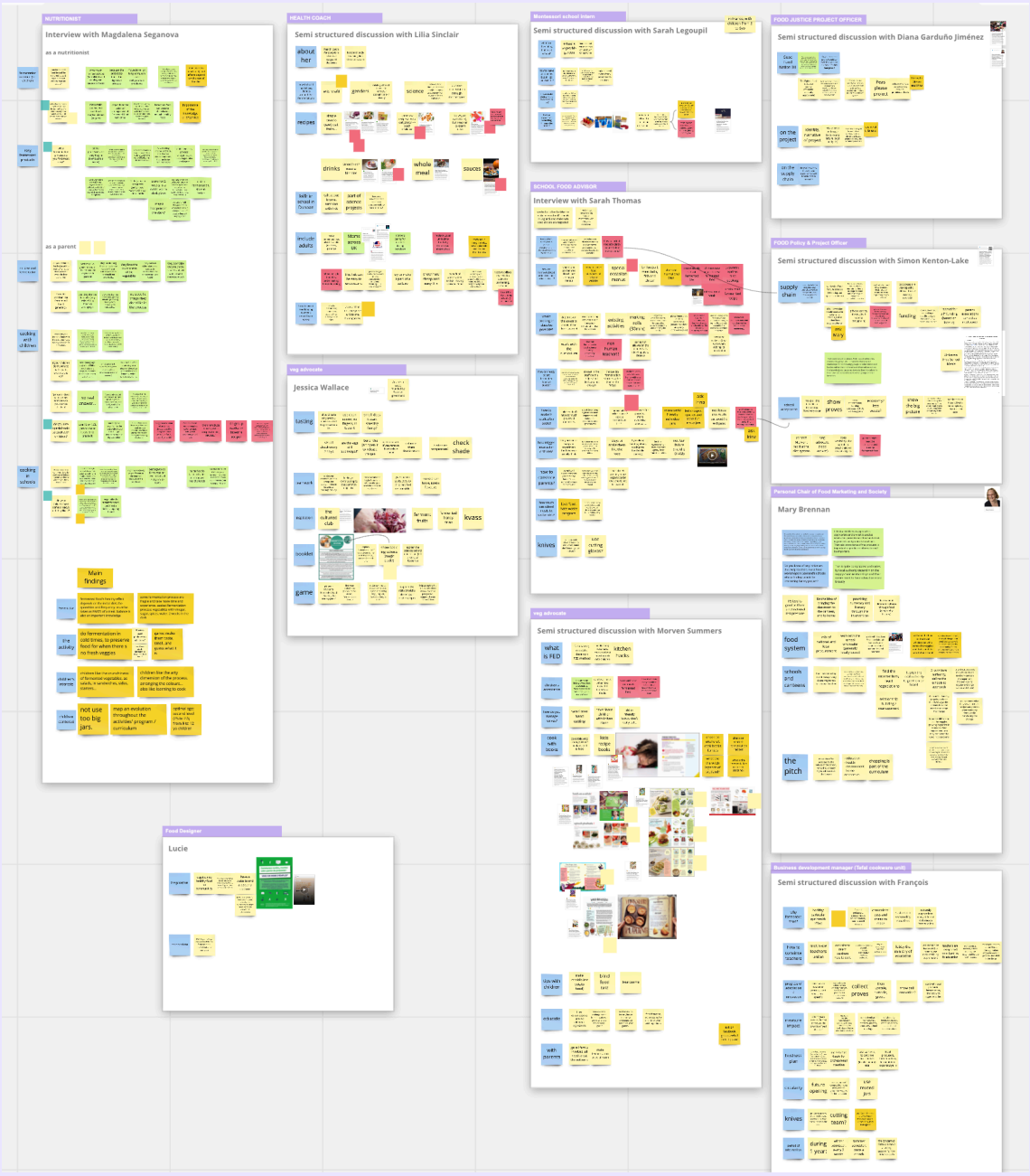
This work is a highly interdisciplinary design project, as it calls for many different design domains, like service design, interaction design, interface design, policy design... But as these design practices are in this case all required to design around sustainable food systems, this project can be considered as a Sustainable Food System Design project (Zampollo, 2016). The use of the Systemic Design Framework allowed to adopt an adapted system-centred approach to the primary and secondary research around Scotland's food behaviours' wicked problems and offered a holistic and agile mindset by suggesting collaborative concrete activities throughout the project's iterative design journey.

The work's outcome, a service that rearranges the current food and health education systems in Scotland by providing primary schools with the framework to hold fermentation workshops with children, represents a real potential for behavioural change. By introducing new narratives about food-related practices, this intervention can indeed initiate more sustainable and healthier food behaviours not only for children, but also for their family, and even reduce the Gender Care Gap. Considering fermenting food as a non-human teacher also challenges traditional education methods. The intervention's limitations can be linked to its capacity to be widely adopted, depending on the stakeholders' remaining perceived socio-economic constraints. It can also be argued that the service should not only induce sustainable behaviours, but also be more sustainable itself, for example by using recycled jars for the workshops, or by restricting the carbon footprint of its website by adopting the Green IT rules (De Decker, 2021). Nevertheless, as this intervention might first need to prove its impact to be able to expand, the aesthetic constraints of these more low-tech web design rules could be an obstacle in the service's acceptance and can rather be part of future iterations.

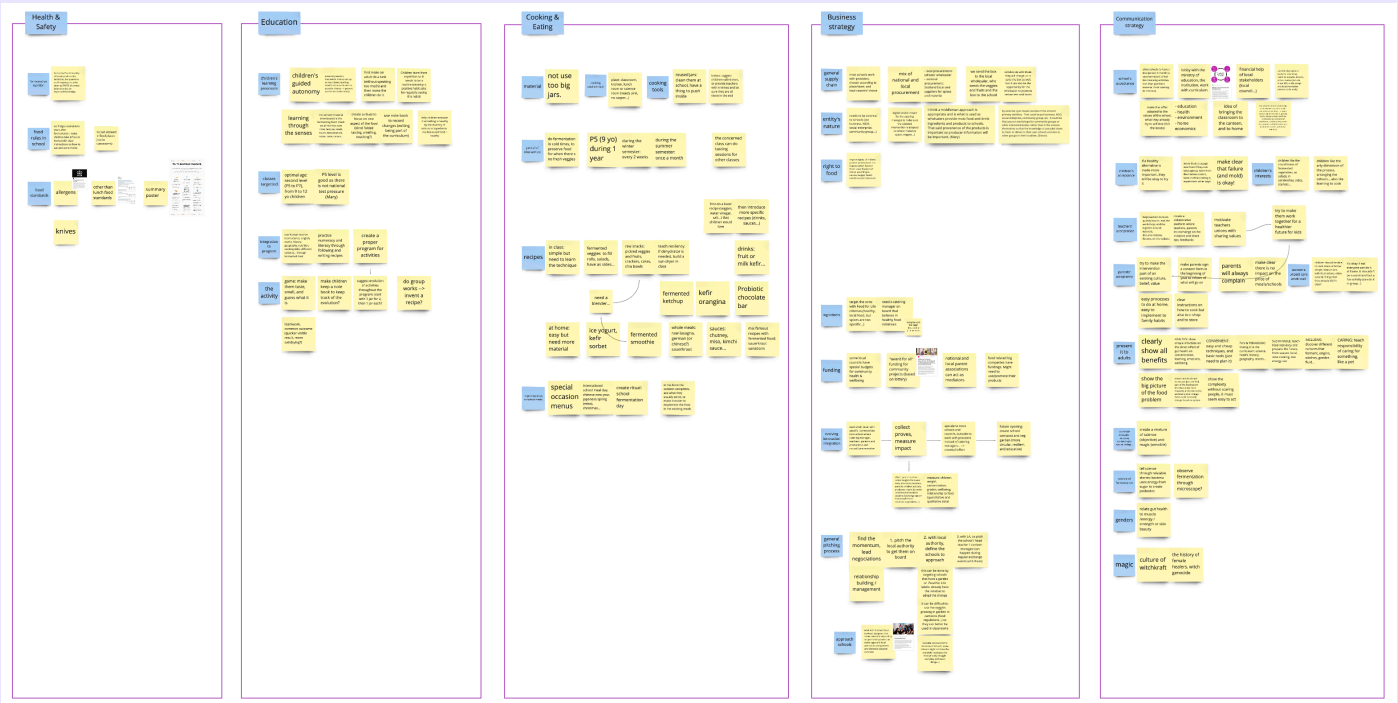
Finally, this work participates in the construction of a more sustainable practice of design, by testing recent methodologies and informing future work about Scotland's food behaviours, promoting design-led change.

Appendix

Appendix A: Collection of interview insights into virtual cards

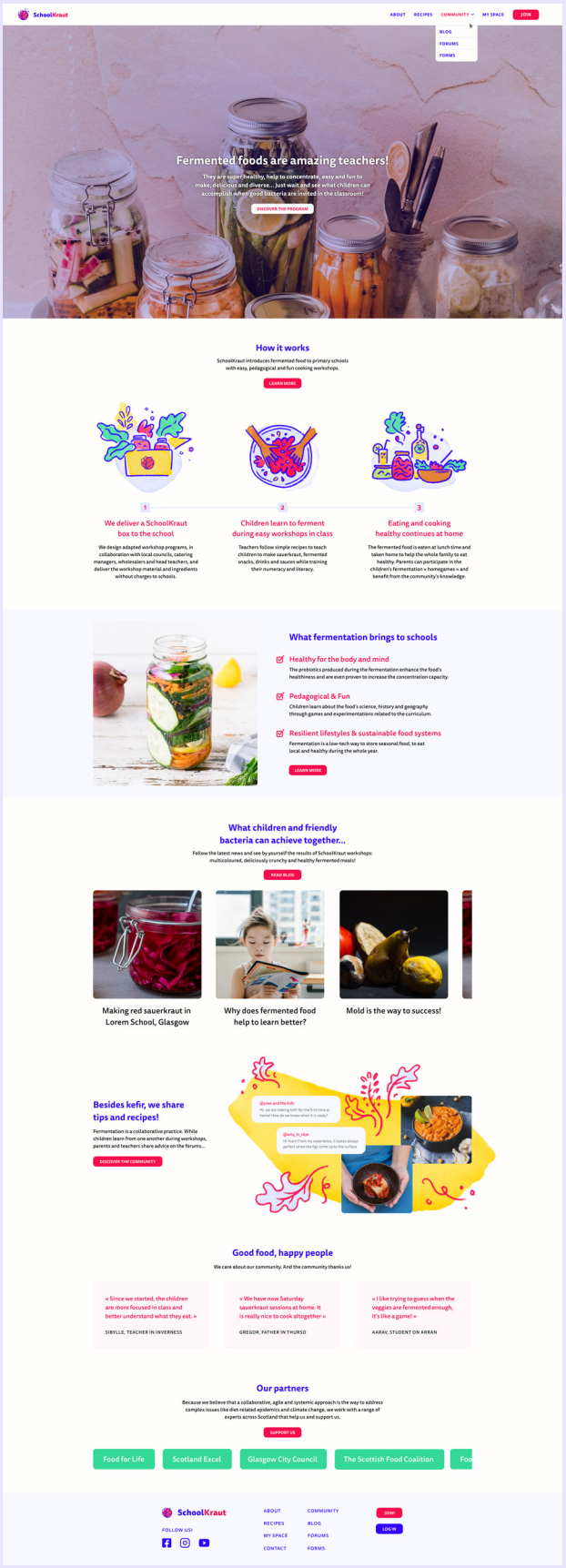


Appendix B: Result and summing-up of the interview card sorting

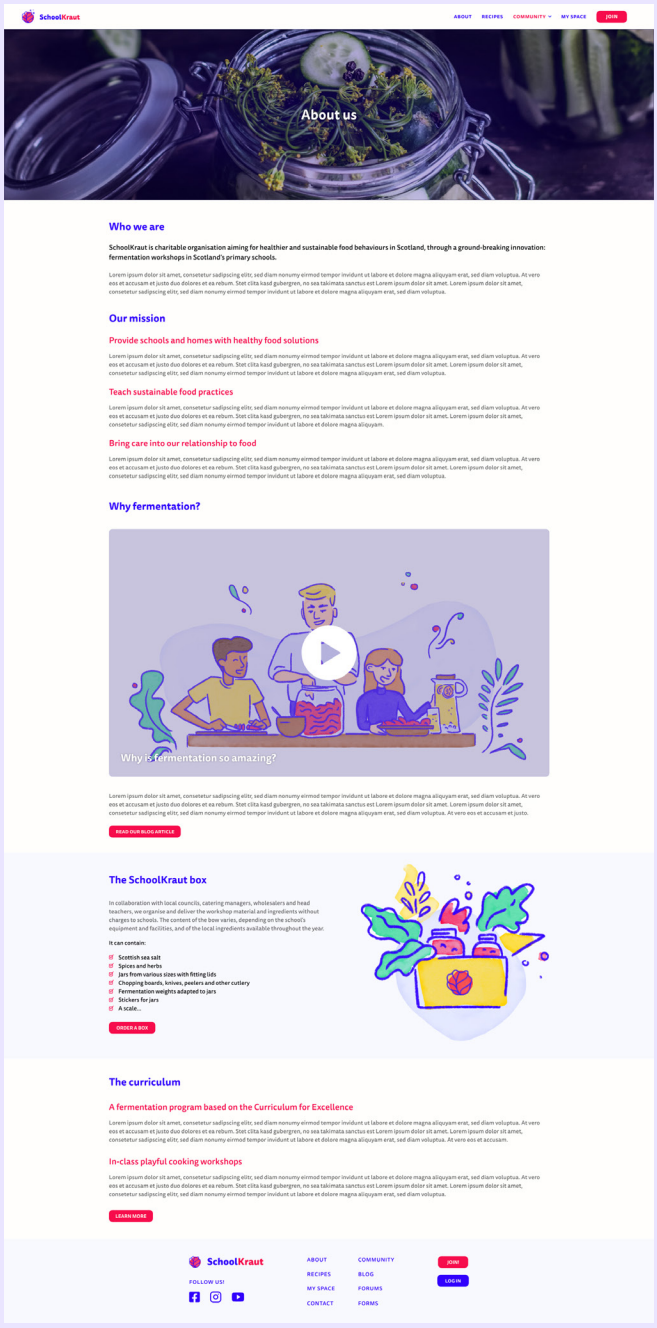


Appendix C: Suggestion for a future collaborative workshop's program

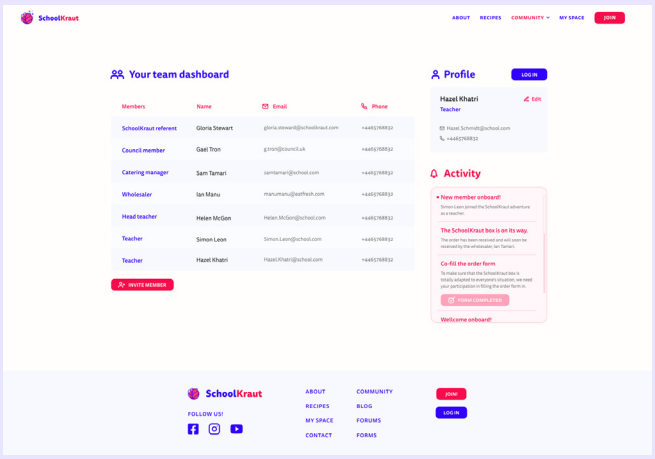
Appendix D: Website Home page



Appendix E: Website About page

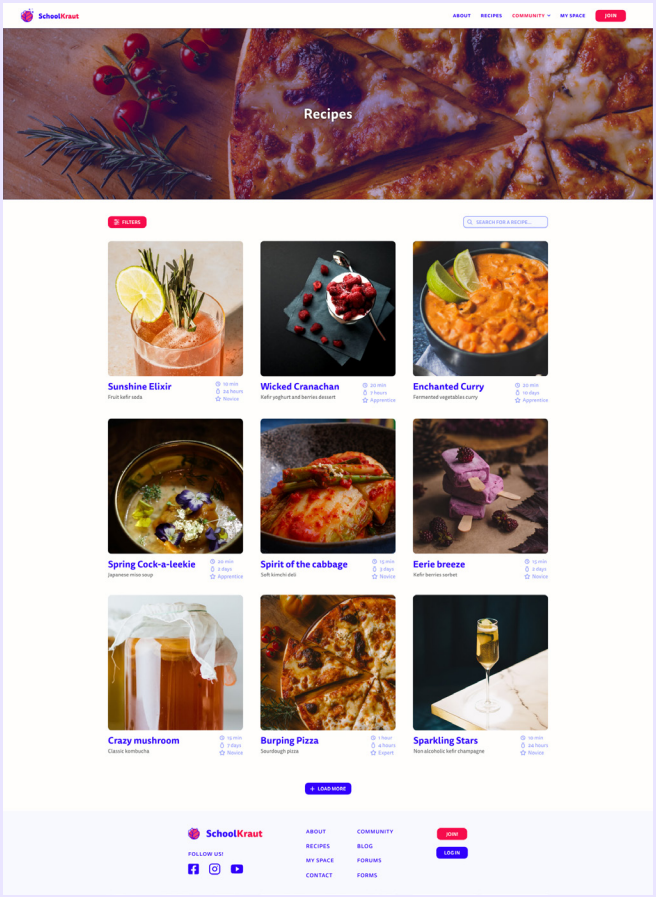


Appendix F: Website My Space page



Appendix G: Website Recipe page

Appendix H: Website Recipes page



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