FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

From Gardens to Fridges:

Technology Design Considerations for Less Food Waste

DISSERTATION

zur Erlangung des akademischen Grades

Doktorin der technischen Wissenschaften

eingereicht von

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Matrikelnummer 0125620

an der
Fakultät für Informatik der Technischen Universität Wien

Betreuung: o. Univ.Prof. Geraldine Fitzpatrick, PhD

Diese Dissertation haben begutachtet:

(Prof. Liam Bannon, PhD) (Prof. Volker Wulf, PhD)

Wien, 03.11.2014

(Eva Ganglbauer)

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to the Faculty of Informatics
at the Vienna University of Technology

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Erklärung zur Verfassung der Arbeit

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(Wien, 3. Nov 2014) (Unterschrift Verfasserin)

Published Work

Elements of my PhD research have been presented in journals, conferences, and extended abstracts over the past three years.

Journal Paper

(1) Ganglbauer, E., Fitzpatrick, G., and Comber, R. 2013. Negotiating food waste: Using a practice lens to inform design. ACM Transactions Computer- Human Interaction (TOCHI). 20, 2, Article 11 (May 2013), 25 pages. ACM link

Peer-reviewed conference papers

(2) Ganglbauer, E. and Fitzpatrick, G. 2013. Think Globally, Act Locally: A Case Study of a Free Food Sharing Community and Social Networking, In Proc. of Computer Supported Cooperative Work Companion (CSCW '13). ACM, New York, NY, USA. ACM link

(3) Ganglbauer, E., Reitberger, W., Fitzpatrick, G. 2013. An Activist Lens for Sustainability: From Changing Individuals to Changing the Environment. Persuasive Technology '13, pp. 63-68. Springer link

(4) Ganglbauer, E., Fitzpatrick, G., and Molzer, G. 2012. Creating visibility: understanding the design space for food waste. In Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia (MUM '12). ACM, New York, NY, USA, Article 1, 10 pages. ACM link

In review

(5) Ganglbauer, E., Fitzpatrick, G., Güldenpfennig, F. 2014. Why and what did we throw out? Probing on Reflection through the Food waste diary. submitted to CHI' 2015.

Extended Abstracts

Ganglbauer, E. 2013. Towards Food Waste Interventions: An Exploratory Approach. 2013. To appear in Extented Abstracts of the ACM Conference on Ubiquitous Computing (UbiComp

'13), ACM, New York, NY, USA. ACM link

Clear, A. K., Comber, R., Friday, A., Ganglbauer, E., Hazas, M. and Rogers, Y. 2013. Green food technology: Ubicomp opportunities for reducing the environmental impacts of food. In Ext. Abstr. Ubicomp '13. ACM, New York, NY, USA. ACM link

Comber, C., Ganglbauer, E., Choi, J. H., Hoonhout, J., Rogers, Y., O'Hara, K., and Maitland, J. 2012. Food and interaction design: designing for food in everyday life. In CHI 2012 Extended Abstracts CHI EA '12. ACM, New York, NY, USA, 2767-2770. ACM link

Workshop paper

Ganglbauer, E. 2014. One day in the future, there will be no food wasted. 2014. Worhshop paper at "Alternate Endings: Using Fiction to Explore Design Futures" at CHI '14.

Details of publications reworked in this thesis

Parts of the published papers were reworked into chapters and sections in this thesis.

"Chapter 1: Introduction" was in parts taken from the Introduction ofthe TOCHI journal paper (1).

"Chapter 2: Literature Review" was for some sections informed by (1), (2), (3) and (4).

"Chapter 4: Everyday Food Practices" relies on the TOCHI journal paper (1) until the section design proposals.

"Chapter 5: Food waste diary" was submitted to CHI '15 (5) and is in review.

"Chapter 6: Fridge cam" was part of the study presented in the TOCHI paper (1).

"Chapter 7: Foodsharing" was in parts taken from the paper at CSCW'14 (2).

Abstract

Consumer food waste in industrialised countries is an ethical, social and ecological dilemma requiring an understanding of existing practices and sensible interventions. This topic has received little attention in HCI yet, and the question where and how to intervene with digital technologies is a challenging endeavour. This PhD research contributes to an understanding of everyday food practices and informs possible ways of technology interventions towards reduced food waste.

To understand everyday food and waste practices, I conducted an interview study with in-home tours in fourteen households. The analysis, oriented by social practice theory, points to food waste emerging as a later consequence from multiple other moments of consumption within practices of planning, shopping, (over-)buying, storing, cooking, gardening or socialising. These practices are embedded in the social and material organisation of everyday life and make it demanding for technologies to intervene or support. The findings of the interview study inspired and informed six design proposals for digital technologies potentially supporting #1 reflection; #2 informed choices; #3 communities of alternative practice; #4 re-connection to food sources; #5 promotion of public interest; and #6 activism;

To learn from technology use embedded in people's everyday food practices, I draw upon three technology case studies. I designed, developed and studied the mobile Food waste diary application and Fridge cam to probe deeper into #reflection and #informed choices. The findings of the two case studies point to the usefulness for some participants, and everyday life as being dominated by social and material circumstances where it is difficult for technologies to intervene. The third case study on the existing Foodsharing platform uncovers the aspects of a #3 community of alternative practice, and the promoting of new narratives and practices that technologies and media are involved in.

The empirical findings of the interviews and case studies, reflected along social practice theory, draw out the main contribution as technology design considerations for social change. These considerations highlight the significance of understanding and designing technologies for the messiness of everyday life, and being sensitised towards social organisation and materiality. Positions of how solutions and problems are framed, a critical enquiry into interventions, and the politics inherent to design are finally discussed.

Kurzfassung

Lebensmittelabfall von KosumentInnen ist ein ethisches, ökologisches und ökonomisches Dilemma, welches ein Verstehen existierender Praktiken und sinnvolle technologische Interventionen erfordert. Die Thematik zu Lebensmittelabfall erhielt in Human computer Interaction bis jetzt wenig Aufmerksamtkeit, und die Frage wo und wie Interventionen erfolgreich sein können ist ein anspruchsvolle Aufgabe. Diese Dissertation trägt dazu bei, alltägliche Praktiken im Zusammenhang mit Lebensmittelabfall und mögliche technologische Interventionen zu verstehen.

Ich führte dazu ich eine Interviewstudie in vierzehn Haushalten durch. Die Analyse aus einer praktischtheoretischen Perspektive weist auf Lebensmittelverschwendung als einen Moment, welcher das Resultat von Alltagspraktiken wie Einkaufen, (Über)kaufen, Lagerung, Verarbeitung, Gartenarbeit, aber auch durch soziale Interaktionen innerhalb des Haushaltes entsteht. Diese Praktiken sind wiederum in die soziale und materielle Organisation des Alltags eingebunden, und machen technologische Interventionen zu einer fordernden Angelegenheit. Die Ergebnisse der Interviewstudie informierten sechs Designvorschläge zur digitalen Unterstützung von #1 Reflexion, #2 informierte Entscheidungen, #3 Gemeinschaften alternativer Praktiken, # 4 Rück-Bindung zum Nahrungsursprung, #5 Förderung von öffentlichem Interesse, und #6 Aktivismus.

Um vom Umgang mit technologischen Interventionen zu lernen, habe ich drei technologische Fallstudien näher beleuchtet. Die mobile Applikation Lebensmitteltagebuch und eine Kamera für den Kühlschrank wurden designt, entwickelt und im Feld untersucht um #Reflexion und #informierte Entschiedungen besser zu verstehen. Die Ergebnisse der beiden Fallstudien weisen auf die Nützlichkeit für einige Teilnehmende hin, deuten aber auch auf die Schwierigkeit für Technologien einzugreifen, da der Alltag von sozialen und materiellen Umständen dominiert ist. Die dritte Fallstudie über die Foodsharingplattform als #3 Gemeinschaft alternativer Praktiken, deutet auf die Wichtigkeit von Technologien und Medien zur Kommunikation neuer sozialer Narrative und Praktiken hin.

Die Reflexion auf die empirischen Ergebnisse der Interviews und Fallstudien, präsentiert als Hauptbeitrag Technologie- und Designüberlegungen für den sozialen Wandel aus einer praxistheoretischen Perspektive. Diese zeigen auf die Bedeutung des Verstehens und Respektierens von komplexen Abläufen, sowie eine Sensibilisierung für soziale Organisation und Materialität im alltäglichen Leben. Weiters werden Positionen zur Konzeptionierung von Problemen und Lösungen, ein kritisches Bewusstsein zu Interventionen, sowie politische Implikationen im Design diskutiert.

Acknowledgements

This thesis substantially owes most to my supervisor Geraldine Fitzpatrick, thanking her for mentoring, knowledge and thoughts, support and patience with my PhD work. We had interesting discussions and coaching-like sessions through which I could develop my PhD research. Much could I learn from her in terms of qualitative research and understanding users, interpreting data, the art of writing and academic thinking and doing, whilst being very patient with me.

Many thanks also go to my great friends and colleagues at the HCI group at the Vienna University of Technology. Özge Subasi, who is always helpful in providing different perspectives and have theoretical chats with. My office room mate Florian Güldenpfennig, who is a great motivator in reminding to get stuff done and always helping out in technical issues. My other office room mate Francisco Nunes, for assuring me that things are easy and encouraging me repeatedly to finish my work. Petr Slovak, for challenging my assumptions, making me think and reflect about them and proof-reading papers last minute.

Thank you to the individuals who agreed to be participants in the process of my research. They were generous providing their time, sharing their stories and experiences with me.

Thank your to Christiane Floyd, who taught me philosophy of science, and to whom I owe the inspiration and formulation of my constructivist research approach.

Thank you to my partner Stephan to support and endure my emotional ups and downs coming with life and a PhD, baking awesome pies, helping me out in programming this one method for the Fridge cam code, and talking about my PhD work and life whilst this thesis was taking shape.

I also want to thank Rob Comber, Matt Fielding, Ashur Rafiev, Irene Posch, Susanne Oechsner, Patrick Olivier, Peter Purgathofer, and all the people I might have forgotten here.

Contents

CHAPTER 1

Introduction

1.1 Preamble

This thesis is about understanding food practices and intervening towards reduced consumer food waste. When embarking on my PhD program in June 2010, I had a dedicated year to explore which research focus I want to take in terms of area, contribution, ontology, epistemology, and methods. From the beginning it was clear to me that I wanted to work in the area of sustainability and at the same time follow my personal passion for useful technology interventions. While making my path through my PhD, finally arriving at finishing this piece, I realise how challenging it is to productively combine sustainability and sensitised and useful technologies.

The biggest challenge at the beginning was to focus on a specific area within ecological sustainability, as well as seeing that environmentalism cannot be viewed without considering also social and economic perspectives. My PhD allowed me to develop a deeper critical awareness on the implications of technology and sustainability in terms of the impact of technology on our environment, such as resource consumption in technology mass production. I have also become sensitised to the still eminent approach of addressing individuals as responsible for systemic issues such as sustainability, and treating them as rational agents being able to make 'wise' decisions.

I have always loved to engage with food and find it important to treat it respectfully, which I was told already when I was a child. Both my parents grew up on farms a few years after World War 2 in Austria, at times where resources were not as abundant as they are nowadays. This milieu was still perceptible when I was raised from child to young grown-up. I did not grow up on a farm but was at times visiting relatives who are farmers and this way was exposed to and indulged in experiences of where and how food was sourced. My socialisation was to respect and specifically use up and eat up provisioned food. This together with a personal environmentalist value-set, and my interest in a more nuanced and sensitive use of technology was definitely part of why I chose to work on understanding food practices interventions towards reduced consumer food waste for my PhD.

Despite the ambiguous nature of technology and sustainability, and as a hopeless optimist, I wanted to understand sustainable practices intertwined with food waste to explore possible technology interventions. Doing my PhD in HCI it is usual to narrow the focus down to interventions within computational technologies, being critically aware that non-computational interventions might provide more effective and radical approaches. But seeing that computation pervades ever more aspects of our everyday lives, I could not resist being inspired by the possibilities that may lurk out there, undiscovered. Technologists have a tendency to innovate technologies on issues where technology was first, such as smart meters and eco-feedback for electricity consumption. I wanted to start the other way round, looking at the societal issue first and then the ways how technology might intervene, emphasising social innovation rather than technology innovation.

Given that food waste has an enormous impact on ecological sustainability as well as ethical conditions of hunger and economics, the topic was timely but also a personally controversial and non-trivial endeavour for me. Throughout my PhD work I repeatedly thought about the boundaries of the usefulness of digital interventions and the immanent boundaries of HCI and CSCW for policy making. My design proposals in chapter 4 and final considerations in chapter 8 shall provide a set of orientations for within HCI and CSCW being sensitised toward everyday life and systemic implications.

1.2 Original motivation

Issues of ecological sustainability are becoming of increasing concern worldwide and this is paralleled by a growing interest in HCI to support more sustainable practices [DiSalvo et al., 2010], technology and interaction design [Blevis, 2007]. To date this has largely played out in relation to energy consumption [Fitzpatrick and Smith, 2009, Pierce and Paulos, 2012], transportation choices [Froehlich et al., 2009], biking [Rowland et al., 2009], or air quality sensing [Aoki et al., 2009]. However, the sustainable impact of food is another area of growing concern for ecological sustainability [Clear et al., 2013], especially considering an increasing population and its demand for both food consumption and production [Gustavsson et al., 2011]. What is produced, what we eat, and how much of the food is thrown away in production and consumption greatly affect greenhouse gas emissions, which in turn will have almost unpredictable impacts on our climate, fauna and flora [Intergovernmental Panel on Climate Change, 2014].

Sustainability in relation to food can be considered around four main issues. First an animal-based diet causes more greenhouse gas emissions compared to a more plant-based diet [Eshel and Martin, 2006, Weber and Matthews, 2008]. Second, organic farming, and associated organic food consumption, has very positive effects on the environment and on public health [Pimentel et al., 2005] as synthetic chemical fertilizers and pesticides are not used in organic food production. Third, a local and seasonal diet supports local business, regional food cultures, and food security [Kaiser, 2011], hence supports values beyond ecological sustainability towards local sustainable cultures. From an ecological sustainability perspective local food consumption does not necessarily entail less resource-intensive farming methods, as the transportation of food contains only a small portion of 11% of the total life-cycle green

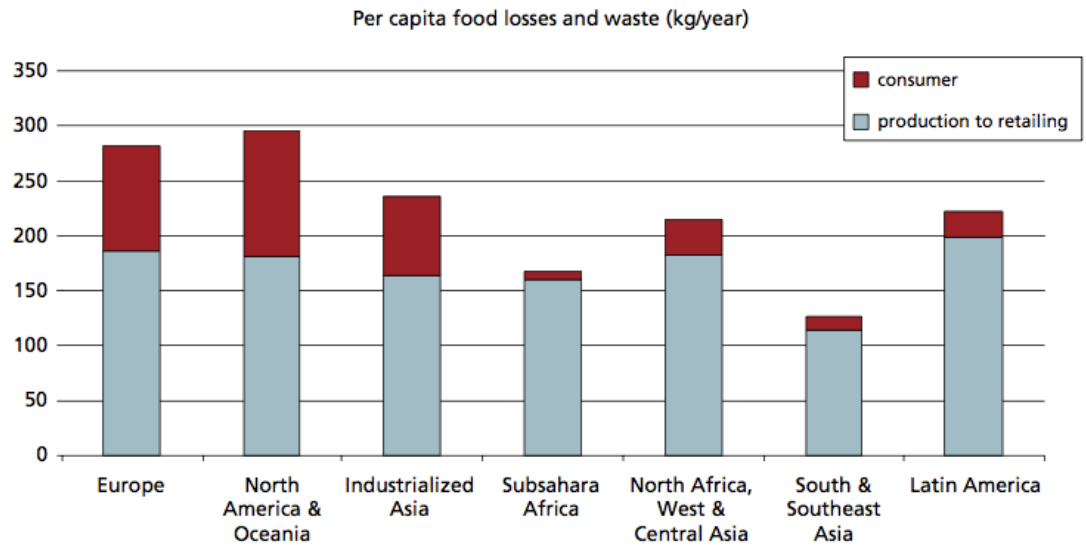

Figure 1.1: Per capita food Waste in different regions of the world, with red (dark grey) areas indicating consumer food waste from [Gustavsson et al., 2011, p. 5]

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house gas emission of food [Weber and Matthews, 2008]. Fourth, and the key motivation for my PhD, is the environmental and ethical impact of food waste.

According to a report by the Food and Agriculture Organization of the United Nations (FAO) [Gustavsson et al., 2011], around a third to half of the food we produce is wasted worldwide by agricultural production, postharvest handling and storage, processing, distribution by food retailers and consumption (consumers). Food waste by consumers presents a different picture depending on high and mid- income countries or low-income countries. Figure 1 presents data per capita food losses and waste at consumption and pre-consumption stages in different regions in the world. In North-America and Europe consumer food waste amounts up to 95-115 kg per person, while in sub-Saharan Africa and South/Southeast Asia it is only 6-11 kg per person. 30% of the world's agricultural land area (1.4 billion hectares) is occupied to produce food that in the end is uneaten and wasted [Gustavsson et al., 2011]. Similar to the numbers by the report of the FAO, a study in the UK revealed that up to 30% of food waste is wasted by consumers at home rather than in agriculture or retail [Ambler-Edwards et al., 2009]. According to a study in Austria, avoidable food waste in residual waste amounts up to 13% [Schneider and Lebersorger, 2009]. Hence food waste, for example, through overbuying or letting food spoil, unnecessarily contributes to greenhouse gas emissions, which could be easily avoided if we produced and consumed just the food that is needed. Back in 2010, when I started my PhD, I could find many studies on amounts thrown away [Ambler-Edwards et al., 2009, Schneider and Lebersorger, 2009, Weber and Matthews, 2008], but I was not able to find studies pointing towards the everyday practices and qualities in planning, shopping, storing cooking or social life connected to consumer food waste.

An exception here was the pioneering work of WRAP (Waste and Resources Action Program) in the UK, who presented a study that consumers themselves often report on costs as a factor when wasting food. The money invested in buying food is thrown away along with wasting the food. The issue is reflected by a study where they found a reduction of consumer food waste of 13% between 2006/7 and 2010 in households in the UK. It is not clear though if the reduction comes from rising food and drink prices and reduced incomes, or the awareness campaigns that were run by WRAP or a combination of these. However this study provides evidence that food waste practices can change. Still it is estimated that about one-fifth of all food and drink purchases goes to waste in the UK [Quested et al., 2011]. So it might be possible that the perceived household's benefit of less wasted food in this case can be seen in changed shopping habits and more frugal handling of food.

Apart from these more rational and quantified accounts of wasted food by individual households, there is a quality to waste that raises ethical, economic and material aspects of food characteristic for a society.

> *"But there is only so far that you can get decoding a culture by going through the garbage [...]. The mountains of cheap and broken consumer durables signify an economy utterly dependent on disposability. [...] Waste is reduced to a culturally and historically variable human practices; what we want to get rid of tells us who we are."* [Hawkins, 2006, p. 2]

Hawkins (2006) refers to a social, cultural and historical dimension of waste and what the micro-practices of everyday life reveal of the politics of waste. Micro-practices of everyday life are shaped by macro-economical and political circumstances of food production and consumption. However, it was unclear how micro-practices relate to the social and material aspects involved in consumer food waste and where and when one could intervene.

The consumer as focus of analysis

The main focus of this thesis is on the exploration of interventions for households and consumers as they constitute the biggest portion of food wasters. A critical account would argue why it is again the consumer being addressed [Evans, 2011b], and truth is, at the start of my PhD I did not ask myself this question as everybody in the field of HCI seemed to address individuals and households, and so do policy making and governments, such as in the report by the FAO that suggests policies of raising public awareness:

> *"Education on these matters in schools and political initiatives are possible starting points to change people's attitudes towards the current massive food waste."* [Gustavsson et al., 2011, p. 14]

Interestingly the FAO points to public awareness only, leaving out structural interventions such as avoiding over-production at the agricultural level or legislations for grocery stores in how food is presented. As a matter of course the field of HCI has a focus on the interaction between humans and computers, so often approaches for interventions are focused on this level and I also draw a line here. This thesis solely focuses on interventions within

computing technologies, being aware that a wider ecology of interventions exists. However to inform interventions, they shall be conceptualised more broadly. This necessitates a theoretical understanding of (i) behaviour change and motivational theories (ii) social practice theory, (iii) communities, and (iv) social movements. These will be presented in the next chapter 2.

1.3 Research questions and contributions

An overview of my thesis research is presented here enabling the reader to contextualise research questions, studies and contributions into the bigger picture, presented in Figure 1.2 on page 6. This Introduction provides a motivation why food and waste has sustainable and ethical implications, laying out a foundation to explore design proposals, interventions and finding considerations. As mentioned in the introduction, consumers are responsible for the biggest share of food waste in industrialised countries. The broad main research question is, how design considerations for less food waste interventions can be motivated from a theoretical and empirical understanding. The main contribution in chapter 8 are design considerations informed by a theoretical and empirical understanding of theories (chapter 2), food practices (chapter 4), and case studies of interventions (chapter 5, 6 and 7). The main research question is approached by three sub-research questions and the main contribution emerges of three sub-contributions:

- *Main Research Question:* Which design considerations for food waste interventions can be recognised from a theoretical and empirical understanding?
  - *Research Question 1:* What are the qualities of everyday life that are embedded in the social practices around food and wasted food?
  - *Contribution 1a:* Food practices embedded in social and material organisation of everyday life and food waste as unintended moments of non-consumption (chapter 4).
  - *Contribution 1b:* Food practices understood through technology interventions (chapters 5, 6 and 7).
  - *Research Question 2:* How can we make technology interventions sensitive to the social practices around food and wasted food?
  - *Contribution 2:* Design proposals suggesting orientations of how interventions can be conceptualised (see chapter 4).
  - *Research Question 3:* What can we learn from specific illustrative example interventions, in the field?
  - *Contribution 3:* Empirical understanding of how interventions act within everyday life of people (see chapters 5, 6, and 7).
- *Main Contribution:* Design considerations for interventions informed by a theoretical and empirical understanding of food practices and interventions (see chapter 8).

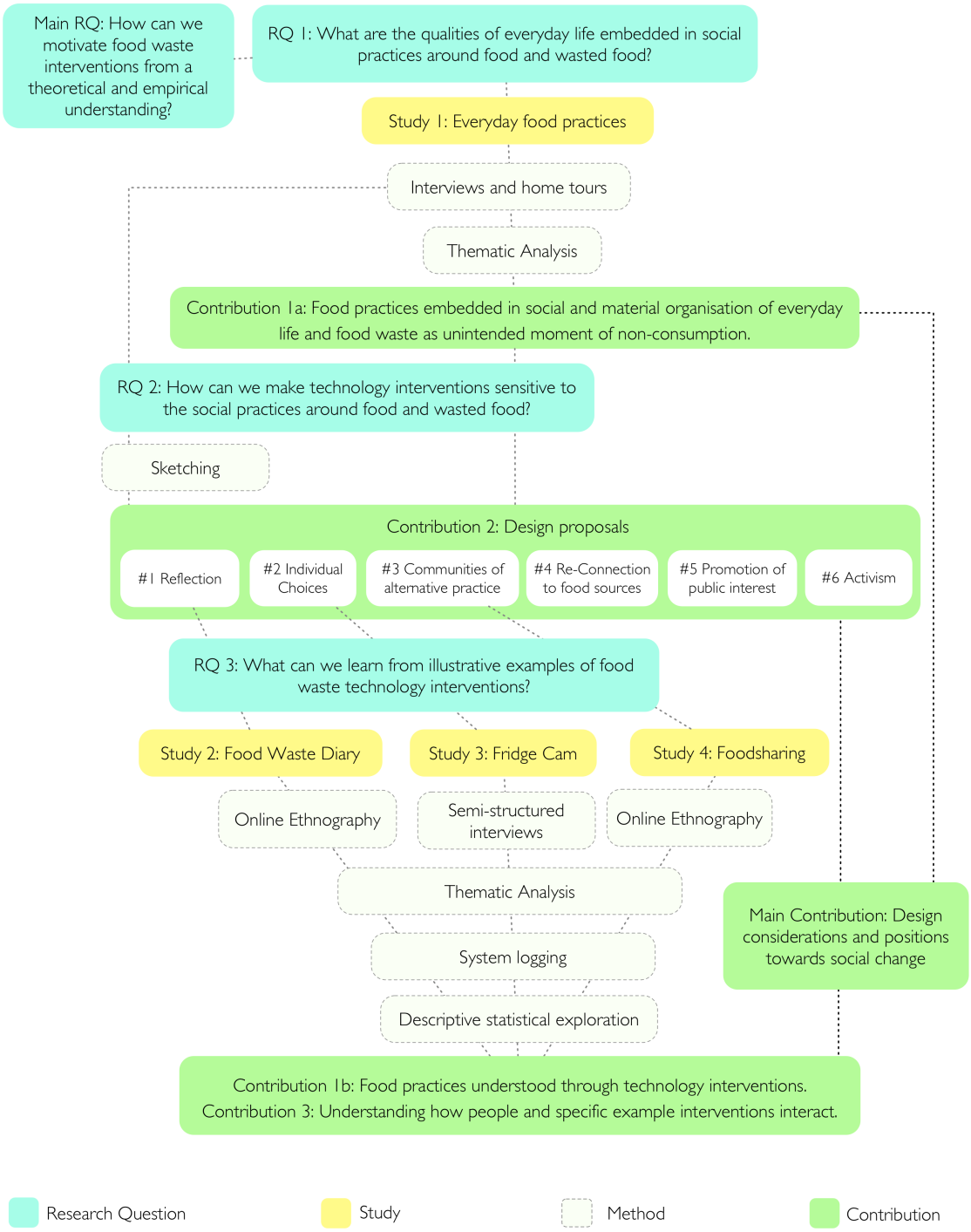

Figure 1.2: Overview of research questions, studies, methods and contributions of my PhD.

A diagrammatic presentation of how my research questions, studies, methods and contributions relate to each other is depicted in Figure 1.2 on page 6. It explains which studies and according methods were applied to answer my research questions.

1.4 Thesis overview

What began roughly as an interview study as to understand everyday food practices and intervening towards reduced food waste, ended up being an attempt to represent a considerations for technology interventions towards change guided by a social practice theoretical lens. Below is a brief summary of the nine chapters.

Chapter summaries

Chapter 2 is a review of the various literatures used to inform this PhD research. Initially, food and food waste practices in everyday life will be discussed from a psychological and sociological perspective, moving on towards literature from HCI on existing technologies in that area. The chapter will engage with different approaches: Starting with a widely used approach of (i) individual behaviour change and their limitations to a presentation of (ii) social practice theory. The chapter engages as well with theories and models of inter-linked individuals, specifically (iii) communities and (iv) social movements to enrich the understanding of how interventions can be conceptualised. I will also present an activist perspective to engage with approaches aiming to change wider circumstances to be addressed instead of behaviour.

Chapter 3 is a description of the constructivist philosophical background of my PhD research. I engage with methodology and methods used, as well as the criteria of usefulness, credibility and transferability of findings. The first two sections in this chapter are discussing the constructivist ontological, epistemological and the axiological approach of my thesis. As HCI is a discipline of understanding people's present values and needs for possible technology as well as a discipline designing technologies for the future, the method section is structured into an overview of the data collection and analysis methods to understand the present, namely interviews and in-home tours, online ethnography, thematic analysis, and research through design. Sketching is presented as a method turning out to be useful in envisioning and reflecting about possible future technologies.

Chapters 4, 5, 6, and 7 are the empirical chapters of my thesis. They represent a subsection of approximately three years of fieldwork with interviews, the design, development and deployment of interventions as well as field studies of them in use.

Chapter 4 is concerned with answering research question 1, the question of how everyday food and food waste practices are organised in everyday life and how technologies can be made sensitive towards a practice-oriented approach. For the in-home interviews and home tours, 17 participants in 14 households were recruited. The collected and analysed material pointed to food and waste practices being embedded in the environment rather than the attitude or motivation of participants. Occasions for waste emerge as a later consequence from multiple other moments of consumption within practices of shopping, storing, cooking, or gardening. Consumption or non-consumption of food is embodied and enacted within the

conditions of the moment, and is the outcome of multiple negotiated concerns. While none of the participants wanted to waste food, waste was still an almost unconscious result of previous discretionary decisions, bound within practices. The findings of everyday food practices inspired and informed six design proposals, namely #1 reflection; #2 informed choice; #3 communities of alternative practice; #4 re-connection to food sources; #5 promotion of public interest; and #6 activism;

Chapter 5 presents the first of three case studies of technology probes and interventions, the mobile Food waste diary case study. The concept of #1 reflection is presented and how the Food waste diary, a mobile phone application enabling to enter data about food waste, might support the process of reflection. Second, the interface and interaction design of the technology probe is described to picture how the application works and what type of contents it invited. Third, the 843 entries that were submitted from users worldwide during a duration of 18 months are quantitatively explored and qualitatively analysed to discuss the findings more broadly and specifically towards reflection.

Chapter 6 focuses on Fridge cam as a technology probe that investigates the approach of supporting transparency and recall during consumption and enabling consumers to make #2 informed 'choices'. The concept of individual choices is explained and how Fridge cam, a probe that automatically takes pictures of the inside of the fridge and makes them accessible to household members, acts within everyday life of participants. The system and interaction design of the technology probe is described. The findings from five households that used Fridge cam for a period of one month are presented in narrative stories and discussed towards everyday practice and individual choices. The study aims to understand if and how informed choice can be supported by technologies.

Chapter 7 focuses on understanding implications from Foodsharing, a #3 community of alternative practice. At first the mechanics of the community and its origin are described, and how the actual food sharing is facilitated with digital technologies. Foodsharing.de is a platform that enables consumers, farmers, organisations and retailers to offer and collect food online, meet offline to hand it over and thus save it from being wasted. The findings present an interplay between a number of issues for communities: individual, community, and organisational levels; public relations and media, the operational platform Foodsharing.de that enables local communities and the Facebook group where global ideological framing of the community takes place.

Chapter 8 works to pull the preceding four empirical chapters together, as a means of reflecting on their larger themes, their interconnectedness and what this might imply for design considerations concerned with social change. First a discussion of the six design proposals and of the phenomena observed in the case studies in connection with them is presented. The final reflections on all empirical and theoretical accounts of this work resulted in design considerations. Here I present a set of overarching concerns for designing interventions that have been informed by both the empirical interview study, the three design case studies and social practice theory along with research literature from HCI.

Chapter 9 is the conclusion, which ties together the contribution of the thesis and its constructive research categories. I discuss the limitations of my work and the challenges I faced during this PhD process being concerned with a systemic issue such as consumer food

waste. I also discuss how this research might be further developed, and the shape it might take in the future. I conclude with a summary of the PhD research and the contributions made in this thesis.

CHAPTER 2

Literature Review

2.1 Introduction

As previously stated, most of the food waste in industrialised countries is wasted at the consumer level [Ambler-Edwards et al., 2009, Gustavsson et al., 2011]. The focus of this PhD thesis is on understanding everyday practices to get inspirations for design proposals and inform design considerations towards interventions for HCI, guided by a social practice theoretical lens. This chapter will start with food and food waste practices in everyday life and existing studies with technologies in this area. Moving on to the design arena for conceptualising interventions, this chapter will engage with different approaches: Starting with a widely used approach of (i) individual behaviour change and their limitations to a presentation of (ii) social practice theory, as a theory supporting the encompassing nature of food practices. The chapter engages as well with (iii) communities and (iv) social movements to enrich the understanding of how interventions can be conceptualised. I will also present an activist perspective on interventions as well as a reflection on the limitations of technologies in societal issues.

2.2 Everyday food and waste practices

> *"Food is a cultural and social concept, what constitutes food is determined by the social and cultural milieu of the potential consumer."* [Belton and Teresa, 9, p. 1]

The social and cultural milieu includes external factors such as the food itself, its material, time, space, and the social context as well as internal factors specific to the individual [Belton and Teresa, 9] such as sensory, psychological, and physiological factors which can influence food 'choices' and intake. But activities around food are also inherently connected with social practice as an everyday routine we have to engage with. Food practices are involved in orchestrating matters of being with and preparing for others [Comber et al., 2013] as well as self-presentation as we are judged and judge others on the food preferred, bought,

cooked, eaten and consumed [Conner and Armitage, 2002]. Hence food 'choices' are more than a rational account of nutrient intake or calorie counting. Cooking and/or eating are activities that connect family members or let friends have a great time together [Grimes and Harper, 2008]. Food practices are also influenced by the socio-cultural experiences through which we develop our life history and the orientation of our norms, values, attitudes, and expertise. In relation to sustainable practices around food, several factors have been identified by Brunner et al. as having a positive influence, namely higher education, availability, price, female gender, gardening, and growing up in a family that already has a lifestyle towards sustainability [Brunner et al., 2007].

Figure 2.1: Historical comparison of the recommendations of how to avoid consumer food waste. Left: Poster from 1883 by US Food Administration. Right: recommendations in the year 2013 by A-Z solutions

.

The question of how to facilitate change is then quite difficult, especially for individuals embedded in systems that influence how they routinely can act or decide. Even if values, intentions, and attitudes are positive towards sustainable food consumption and peoepl would like to avoid waste, it does not imply that this is always reflected in everyday life. Also the fact that food is being wasted by consumers, is historically not a novelty, it is the vast amounts that

call for action. Figure 2.1 on page 12 presents tips from 1883 and 2013 being quite similar even though 130 years have passed: E.g. *"buy it with thought"* in a poster from 1883 vs. *"shop wisely"* on a tip collection in 2013 from A-Z solutions[1]. Technologies, here I add materials, such as freezers have come into use and changed food practices, visible on the comparison of the tip collections from 1883 and 2013. Where the freezer naturally does not play a role in 1883, it is recommended freezing lefovers in the year 2013, where almost every household in an industrialised country has its own freezer.

The materials involved to source, prepare and store food are changing over time and in different contexts, and our practices are a mirror of how our lives are materially organised. Evans (2012) pointed out in his sociological study of domestic household food waste

> *"that food waste is a more or less mundane consequence of the ways in which domestic practices are socially and materially organised."* [Evans, 2011a, p. 42]

The study by Evans revealed that participants were caring about the food waste they produced. For various reasons such as a housewife wanting to please every taste within the family, food was frequently over-provisioned. Throughout the study participants mentioned that they do not want to throw away but it still happened. Similar results were obtained in a survey, of why people do not like to waste, namely that it constitutes a *"waste of money and good food"*, *"makes them feel guilty"*, *"cannot afford to throw away"* and that it is *"bad for the environment"* [Quested et al., 2013]. However, as the study was carried out in a questionnaire with pre-defined conditions and not in the field, it doesn't capture the complete experiences and social and material processes people undergo when buying at a grocery store or enact in food practices such as storing food, cooking and eating while staying at home.

In summary, while the Quested (2013) study points out the various factors and influences, it isn't clear how they practically translate into the routine of everyday practices and choices people make around food, and how this is embedded in the social and material context of everyday life. Evan's study is helpful to understand some of the material and social contexts how food and its passage to waste is embedded in everyday life. Studies reveal that the majority of over-provisioned food ends up in the bin, but is not put there directly. The process of food, when finally thrown out, contains an ambiguous phase before where food is stored to be eaten later, addressing its residual value and aspirations for use [Evans, 2012].

While Evans provides a fruitful analysis of the social and material context of why food is wasted, a different focus for a study to inform interventions is necessary. My studies were conducted in the same period than Evan's and I was additionally emphasising an understanding on how to intervene [Ganglbauer et al., 2012, Ganglbauer et al., 2013], also discussed later in chapter 4. First I will continue to present research on interventions from the broader area of HCI, sustainability, food and wasted food in the next section.

2.3 Food and waste: towards technology interventions

Food practices and ecological sustainability have started to gain some attention in HCI [Comber et al., 2012, Clear et al., 2013] and are often described in terms of supporting local and al-

[1] `http://atozsolutions.com/21-shocking-u-s-food-waste-facts-statistics-infographic`

ternative movements and communities. These could be, for example, interactive technologies for small-scale food producers [Light et al., 2010], farmers' markets, food co-ops, urban gardens [Odom, 2010], locavorism[2], freeganism[3], permaculture, or slow food communities. These described alternative food movements could be supported by technologies to promote local food production, more sustainable food consumption, and sustainable land use [Blevis and Morse, 2009]. Existing practical applications in the area of ecological sustainable food culture often aim to achieve sustainable food purchasing habits, such as providing communities with information about how to buy locally [Li et al., 2009], enhancing the transparency of the supply chain [Bonanni et al., 2010], or supporting information on food miles during shopping [Kalnikaite et al., 2011]. For designing such interactive systems it is necessary to involve users during this process enabling to anticipate some of the *"technology's socio-cultural, health, and environmental impact"* [Choi and Blevis, 2010].

However, while food and sustainability are topics of concern in all this work, the focus is more on where the food comes from and not where it goes to. An exception is the BinCam work, a two-part persuasive system where a mobile phone embedded in a kitchen bin uploads images of domestic waste to a Facebook page, enabling reflection on 'inappropriate' waste disposal practices, including the creation of food waste [Thieme et al., 2012]. Another work on food waste uses an analogue intervention, the colour coding of a fridge, to explore how such an intervention changes routines of storing in a fridge [Farr-Wharton et al., 2012]. Other domestic research has looked at 'waste' in the home, but in the form of reusing and reacquiring objects in the home [Pierce and Paulos, 2011].

Other food-related work in HCI is concerned with promoting healthy eating [Grimes et al., 2008, Maitland and Chalmers, 2011, Comber et al., 2013] often with an emphasis on choice of foods or on social support through communities. While there are many parallels between an ecologically sustainable diet and a healthy diet, in the sense of motivating 'good' individual choices, the problem space around sustainable food consumption is very different from health-related food issues. The impetus for healthy eating is more likely to be immediately evident to the individual, such as feeling better or losing weight, even if the long-term benefits, for example, reduced risk of various cancers, may be less evident. Sustainable food practices do not typically afford this immediacy, either as a perceived or actual 'benefit', even though financial savings can be made with using the food that is bought and is often named as a reason in wanting to avoid food waste.

Since 30% of food waste is created by consumers at home [Ambler-Edwards et al., 2009], it is reasonable to think of the home as a target domain for HCI interventions around food waste, hence recent 'smart home' advances are also of interest here. These include interactive fridges [Bucci et al., 2010], kitchen appliances for energy feedback [Kirman et al., 2010], and fully equipped smart kitchens [Olivier et al., 2009], for example, to enable nutrition-aware cooking [Chi et al., 2007]. These pervasive sensor-based approaches open up new possibilities for supporting processes around food to potentially reduce waste. Non-digital technologies such as colour codes in the fridge can intervene as well to categorize food according to type (diary, fresh produce, etc.), an approach that may lead to a reduction of waste [Farr-

[2]Term to describe the practice of eating food harvested within an area mostly bound by a 100-mile radius.
[3]The practice of collecting and eating food that has been discarded.

Wharton et al., 2012]. Another intervention is a leanpad where service-workers in a restaurant have to weigh the food that is going to the bin. This simple intervention supports big restaurants to track what they throw away, how expansive it was and with which type of foods they should be careful. Reportedly the challenge was to integrate the leanpad into existing working practices [Rubin, 2013], a challenge existing for many interventions in other contexts.

However, to understand what technologies might be useful and to realise any potential of technology, an understanding about the everyday domestic practices associated with food waste is necessary (Research question 1). While food and sustainability have been of concern to HCI more generally [Choi and Blevis, 2010], an understanding about the specific issue of food waste and technological interventions has yet to be directly addressed. Interventions and the approaches that have been taken and can be taken are the focus of the next section, where the social practice theoretical approach in this thesis discussed.

2.4 Theories and models for interventions

Since sustainability has received major attention in HCI [DiSalvo et al., 2010], different theories and models[4] inspired the design, development and evaluation of technology interventions. Policy making as well as HCI interventions often target individual behaviours, being informed and inspired by behaviour change and motivational theories and models. Hence, this literature review will first describe theories of individual behaviour change as an established approach to conceptualise interventions in the domain of sustainability [Brynjarsdottir et al., 2012, Hekler et al., 2013] and outline the limitations of this approach.

Secondly, social practice theory is described as another theoretical and methodological approach to conceptualise interventions, also called the practice turn in HCI [Kuutti and Bannon, 2014]. Social practice theory allows looking at 'unsustainable' practices as a shared social convention in a historical and cultural context, shaped by institutions and infrastructures. This shifts the focus from individual behaviour change to a cultural perspective where interventions are designed for cultural transformations, as our 'behaviour' is embedded in the culture we live in [Shove et al., 2012].

Thirdly, this literature review is concerned with communities as sites for change. As we are inherently social beings also in terms of food practices [Conner and Armitage, 2002], we are not acting alone but act inter-linked with other people in a community. The potential of communities was already identified by Woodruff and Hasbrouck (2008) in one of the first very influential papers in the area of sustainability and HCI, namely that addressing communities provides a different angle than addressing individuals, who can only change what they can easily 'control'. In their paper they identified 'choices' as being constrained by the

[4]The theories and models presented here arise from the experiences, reflections and gained knowledge of my PhD research in the last 4 years. Models of behaviour change were the starting point and I soon discovered that these do not grasp the complexity of everyday food practices and interventions towards reduced consumer food waste. The account you find here is a more developed version of my thinking already. For this reason the theories inspiring my work were extended to other frames and perspectives such as social practice theory, and interventions used by communities and social movements.

infrastructures we live in and propose a focus on digital technology interventions to support protest-oriented forms.

Fourth, a protest-oriented approach (social movements) is taken up in this literature review and argued in the next section. The notions of *intrasomatic* and *extrasomatic* interventions is a helpful perspective to understand what a technology intervention aims for [Latour, 1992]. Whereas individual behaviour change theories emphasise what Latour (1992) terms the *intrasomatic* aspects such as raising awareness, the focus on a protest or activist approach aims at influencing the *extrasomatic* reality, institutions and circumstances for interventions to target. So instead of changing behaviour, the idea is to change the institutions and infrastructure that our behaviour is embedded in.

Behaviour change and motivational theories

Behaviour change models and motivational theories are widely used and prominent in HCI [Brynjarsdottir et al., 2012, Hekler et al., 2013]. These approaches are based on models of behaviour change developed in the fields of psychology, to inform the design of technologies and a desired behaviour that should be achieved. A model which is widely used is the transtheoretical model of behaviour change [Prochaska and Velicer, 1997, He et al., 2010, Consolvo et al., 2009]. The transtheoretical framework is a rational model describing the process around precontemplation, contemplation, preparation, action and maintenance. This model was for example used to translate the stages into energy feedback to change individuals behaviour to waste less energy [He et al., 2010]. Most models dealing at the individual level assume a (multi)linear process of how people make choices rationally based on calculations of cost and benefit. The theory of planned behaviour, takes into account attitudes, norms and agency, habit and emotions [Ajzen, 1991]. More complex models also take into account macro-level societal factors such as economy, demography, culture and institutions, such as Vlek's model presented in Figure 2.2 on page 17. Even though Vlek's model takes into account these macro-factors, behaviour is mainly linked to motivation, behavioural control and intention. Taking inspirations from behaviour change models and motivational theory implies, that researchers focus on a certain desired behaviour they want to support, which, from a critical point of view, leaves out the complex practices of our everyday lives.

Individual behaviour change approaches are intended to identify certain 'triggers' that could be supported by a specific intervention. It is unterstandable that HCI favours such approaches because such models are well-defined and simplify the complexity and messiness of everyday life to achieve a desired behaviour through technology intervention. Within HCI such interventions are intended to be enablers supporting rational 'choices' through provision of information or feedback [Froehlich et al., 2010]. For some instances this approach is also successful, as evidenced by an energy use reduction of 3.7% in private households due to an energy feedback intervention. Though the authors of this randomise controlled field study conclude that more than 3.7% would require a change of culture on a broader scale [Erickson et al., 2013].

Critiques on these approaches and awareness of the shortcomings of behaviour change approaches have increased within HCI, either on a systematic analysis of how much energy can be saved by private households in total [Mankoff, 2012] considering the US electricity

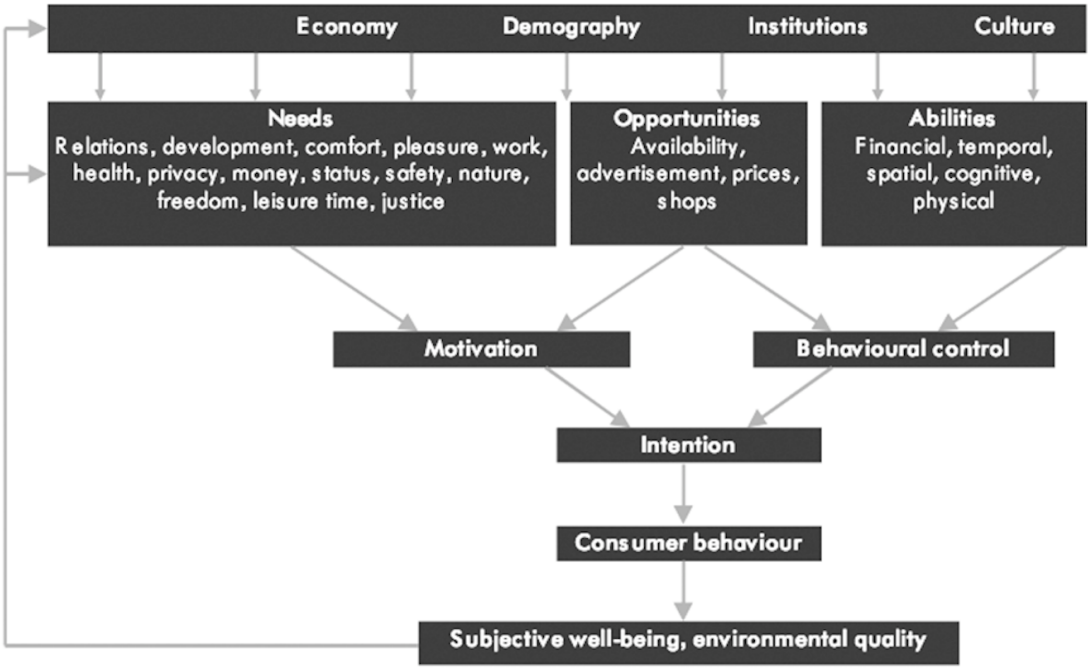

Figure 2.2: Vlek's model for behaviour change around needs and opportunities. Figure from [Darnton, 2008]

consumption in total, or as a critique on the politics of making individuals responsible rather than governments or institutions [Dourish, 2010]. Brynjarsdottir et al. (2012) argue, based on an extensive literature review on behaviour change technology in sustainability and HCI, how

> *"the focus on individuals and their responsibility to make wise choices with respect to sustainability neglects the ways in which social dynamics outside the system condition what is possible."* [Brynjarsdottir et al., 2012, p. 952]

Even researchers using behaviour change models are very careful and critically remark:

> *"Behavioural models can appear to present factors as buttons to be pressed, in the expectation that the behavioural outcome shown will result. This is a misleading interpretation, not only because other factors which are 'off the model' may also need to be accounted for, but because the mechanistic assumptions underpinning such a view are inadequate to explain the nature of change, and to support individuals in that process."* [Darnton, 2008, p. 20]

What Darnton intends to explain is that behaviour change models have limitations insofar as they are rather concepts than real representations of behaviour. Such models are intentionally simple, work only in a certain context, do not differentiate between people and

identified triggers will not always precede behaviour [Darnton, 2008]. This reflects Suchman's notion of situated action and plans, where she found that human action is not determined by certain factors but recognized to be constantly constructed and reconstructed from dynamic interactions with the social and material organisation of life [Suchman, 1987].

Taking food waste as an example, cooking up the food that has been provisioned before is a desired behaviour that could be supported by technology, e.g. an appropriate online recipe for cooking up leftovers, displayed on an interactive fridge door. Even if displaying the appropriate recipe on the fridge door supports using up food, social circumstances might be quite different. The preference or decision might be to go out and spend time and eat with friends.

As a reaction to these critical perspectives, it is useful to take a different perspective and look at social practice theory, where behaviour is not seen as deterministic, but embedded in a cultural, historical, social and material context and named 'practice'. Behaviour and practice though could never be named interchangeably, as they have very different meanings in each school of thought. Having explained the limitations of behaviour change approaches, the unit of analysis for this thesis is beyond behaviours towards the more encompassing concept of social practice theory.

Social practice theory

Theory of social practice is an approach looking at practices rather than isolated behaviours. It provides a lens to understand and interpret practices in the

> *"routinized way in which bodies are moved, objects are handled, subjects are treated, things are described and the world is understood."* [Reckwitz, 2002, p. 250].

As this theory is concerned with holistically understanding and describing the *"nexus of doings and sayings"* [Schatzki, 1996], it is very useful to use it on issues of sustainability and computational interventions to specifically go beyond interactions between individuals and computers [Pierce et al., 2013]. This theory enables an understanding of how certain practices evolve, are orchestrated over time and in different spaces. A motive for practice-oriented approaches and the inherent potentials of this frame to understand, intervene and support sustainability, was presented in a special issue in the journal 'Transactions on Computer Human Interactions (TOCHI)' [Pierce et al., 2013] and in a paper at CHI 2014, named *"The Turn to Practice in HCI"* [Kuutti and Bannon, 2014].

I go on here to make a distinction between practices for later analysis and discussion. It is beneficial for a practice-oriented approach to operate on the differentiation between integrative and dispersed practices [Schatzki, 1996] to understand the essence of practices and their interrelatedness to domains, space and time.

Integrative practices are those most commonly understood and described as practices: the *"doings and sayings"* of a variety of actions in routinised performances in specific contexts; embodied routines that are core to everyday practices [Reckwitz, 2002]. Examples related to food and waste would be cooking or shopping practices, where the embodied actions

of a person who goes shopping are often habitual, informed by histories and cultures of competence, but also adapted to an unfolding social, material and environmental context. A person going shopping might, for instance, have a set routine for shopping, but can also adapt the competence to particular contexts (e.g., plan shopping more carefully if s/he has time to do so). As such an integrative practice does not describe a particular set of actions, but rather the coordination of action in a meaningful process and typically towards a particular goal. Such practices are specific to particular domains and spaces. For instance, shopping for food at the supermarket is different from shopping for food at the local farmer's market.

Dispersed practices, on the other hand, are the *"doings and sayings"* that occur in different ways in different domains and so are both common to and transcend any particular integrated practice. These practices typically centre on a single type of action [Schatzki, 1996, p. 91] such as *"describing, ordering, explaining, questioning, reporting, examining, imagining"*, caring, or wanting to use up food. Like integrative practices, they involve the routinised performance of basic doings and sayings. But unlike integrative practices, they are not guided by rules or particular ways of negotiating performance of the practice. Another example of a dispersed practice is consumption [Warde, 2005]. Consumption can involve very different "doings and sayings" in different domains. People 'consume' across any number of domains, e.g. consuming media, consuming energy resources, consuming food, often without awareness or reflection. A dispersed practice is enacted in moments of everyday integrated practice and takes different forms in different domains.

The concepts of integrative and dispersed practices became very useful in the analysis of the findings in chapter 4, as they described moments of food waste interconnected with integrative practices of shopping, storing, cooking, gardening, etc. Consumption or non-consumption of food is the outcome of multiple negotiated concerns and dispersed practices.

Social theories such as social practice theory are useful in providing a lens to focus research on practices, rather than individuals and technologies and the interactions between them. A practice lens emphasises a consideration of practices as a

> *"shared social convention, emergent, embedded in the systems of practice it seeks to influence and limited by historical cultural specificity"* [p. 143] [Shove et al., 2012]

.

To inform policies, Shove et al. (2012) are not only analysing existing practices but also proposing practice-oriented policy making for cultural change. They propose to change meanings and competences for people, e.g. with showing and telling with narratives, configuring the elements of practice, the materials, meanings, and competences, instead of behaviours and therefore addressing the extrasomatic domain. As such this proposition is going beyond behaviour change programs. This implies changing infrastructures and configuring connections of which more sustainable practices could be made [Shove et al., 2012]. These suggestions point to the limits of where HCI can or cannot intervene. The strategies that Shove suggests are, as practices themselves, embedded in broader interventional strategies

where technology is used as a tool being part in the intervention, but not as a unique intervention alone.

Summing up, a social practice lens is useful to look beyond isolated behaviours and focus on the social, cultural and historical context our practices are embedded in. The implications for interventions provided by Shove et al. (2013) are a useful theoretical input for describing how interventions under a practice lens could be informed. This theory is also useful in thinking beyond individuals into larger systems where individuals are embedded such as communities. Technology can act as enabler for communication, cooperation and collaboration in communities as sites of change, as another direction and dimension for interventions.

Communities

Communities are based on membership and can take many forms and variations [McMillan and Chavis, 1986]. People can form communities based on mutual interest, communities of practice with shared activities, communities of place, of action, or of purpose. What communities have in common though and what matters most for conceptualising interventions, are shared values and goals that concern communities of social change and sustainability, such as the Foodsharing community (chapter 7). The values and goals are forming a community identity through sharing of episodes and experiences, supported by participation and engagement.

A typical structure within a community is characterised by members who are more active than others participating more 'passively' [Shirky, 2008]. Communities also have different agendas and aims, some communities exist solely *online* while others share activities and ideas online as well as exist *offline* in a geographically bounded area such as a neighbourhood (community of place). An integral part of communities is communication, as it is only through communication that the interior values and motives can be exteriorised [Godemann and Michelsen, 2011]. It is also communication that enables cooperation and collaboration [Lozano, 2007] between members, which is central to a community.

To understand different natures of a community and potential technologies, the next section is first going to engage with the term 'social networking' as a technology enabling communication, sharing, cooperation and collaboration. Second, communities of practice are presented as a specific type of community as they provide inspiration to support communities of sustainable practice facilitated with computational technology. Community informatics is introduced as a term to describe the inherent participatory approach to support communities with technology.

Social networking is an umbrella term for the infrastructures where people with similar interests can meet, interact, create, share and exchange information online. Platforms like Facebook provide the possibilities to connect, investigate and network socially to share identities, content and statuses [Joinson, 2008]. The members of such online communities are often geographically distributed and independent as a common interest acts as social lubricant. Such social networking sites can also be used in local geographical areas to build social relationships [Lewis and Lewis, 2012], negotiate local events and services, and share information and advice [López and Butler, 2013]. In this case interactions happen online as well

as offline. Communities can be described as 'physical', 'geo-local' or 'place-based', where interaction happens offline. These are different to 'virtual' or solely online communities, like a community of interest might be.

Communities of practice have an agenda beyond sharing their interests and places. Key to communities of practice is that their shared element is an interest and embodiment of a certain practice and learning from each other. The key premise is that we are social beings and learning constitutes a social practice. Hence knowing is a matter of participation as a social practice, and learning through active engagement in the world [Wenger, 1998]. Communities of practice might not be of an activist nature by definition, but communities actively engaging in the world and wanting to change their immediate environments, such as claiming a public space for gardening, have activist elements to it. These communities are complex in their interactions and new methods as well as digital technologies are beginning to emerge as an instrument to support these groups [Aoki et al., 2009, Kuznetsov et al., 2011].

Community informatics describes a participatory approach to understand values and needs of a community and support them with appropriate technologies [Gurstein, 2007, Carroll and Rosson, 2013]. According to Gurstein, community informatics is

> *"a recognition that the 'lived physical community' is at the very centre of individual and family well-being — economic, political and cultural; a belief that this can be enhanced through the judicious use of ICT"* [Gurstein, 2007, p. 12]

Community Informatics, is a research approach that is done in relation to a specific aim in the real world, similar to action research[5]. This could be for instance to enable and empower community processes for communication, or enabling and supporting local innovation. The non-researchers who are participating in the community are acting as peers, equal partners or co-researchers that have their role in shaping the research outcome. Decision making within a community is a collaborative process emerging from the bottom-up instead of a top-down approach.

Research in HCI within communities is often participatory, and the role of researcher is to support the values and needs of the community to support its goals [Balestrini et al., 2014, Heitlinger et al., 2013, Light et al., 2013]. Computing and communication technologies can support the forming of a community identity through sharing joint values and experiences through social networking, enable participation and awareness through making community interactions visible.

Research in community and technologies is also characterised as a process rather than an artifact that comes out as a result. Community informatics lends itself also to an 'activist involvement' [Gurstein, 2007]. For this thesis, I wanted to understand in more detail how communities concerned with change and activist involvements can be characterised, as supporting such communities with technology might be one strategy for reduced food waste. The umbrella term that is used for such communities in this thesis is 'social movements'.

[5] Research initiated to solve an immediate problem or support an agenda with other individual actors, where researchers are aware of entering the field with their personal value-set.

Social movements

Beyond influencing individual behaviour, interventions can empower inter-linked individuals, communities or movements to influence the circumstances that people live in, within an activist frame. Interventions could be conceptualised to provide information to the decision makers who control the circumstances people live in, as these circumstances can promote, hinder or completely disable sustainable practices. Computational and communication technologies have a particular role to play in enabling social movements, who have an activist element to it. For promoting social, political, economical and environmental change, computing and communication technologies potentially play crucial roles within these processes of change in mediating the values, language and narrative within a social movement [Crivellaro et al., 2014]. These narratives and media are also characteristic for volunteer-driven, non-hierarchical bottom-up forms of activism such as *grassroots movements*. These are often characterised by a lack of funding, spontaneous in its formation, using and demanding computational technologies to support these processes [Kuznetsov et al., 2011].

One example where technologies play central roles beyond communication in collective, de-hierarchical and de-centralised movements is *citizen sensing*. With new advances in low-cost sensor technology, citizen sensing is the act of collectively sensing environmental data to share with others. Aoki et al. (2009) explored data from air quality sensors on public street sweepers to reflect on the role this data can have in pro-environmental discourses with stakeholders. Kuznetsov et al. (2010) researched participatory citizen sensing and how participants engage with space, the placement of sensors and the use of the collected data for broadcasting, sharing and activism. Such collections can be seen as 'social currencies' or 'techno-political tools', data that can be used to share and negotiate collectively with policy makers [Aoki et al., 2009, Kuznetsov and Paulos, 2010]. The bottom-up approach of citizen sensing can change power relations in empowering citizens to act as agents of change.

Change does not necessarily always come from the bottom. Different to citizen sensing, data can also be sensed and provided by governments through *open data initiatives* to raise new potential for participation and activism starting with a top- down approach. The democratisation of data gave rise to many initiatives [Kalampokis et al., 2011] that provide data and information to the public for free. These initiatives can potentially enable citizens to participate in decision-making because they can process and present data in creative forms, and allow decision makers to understand this data to anticipate next steps.

2.5 The nature of interventions and policies

I have presented different approaches towards change in this thesis chapter, from behaviour change to social practice and communities to social movements. All of these approaches have different theoretical backgrounds, assumption, methodologies and produce different knowledge. The table in figure 2.3 on page 23 describes different theories and their approach to interventions. The approaches are described in more detail in terms of the basis of action, the process of change, positioning of technology, and transferable lessons. The table

is derived from [Shove et al., 2012, p. 143] for the first 2 columns of theories of behaviour and social practice. Providing a broader context, the 3rd and 4th column of the table in Figure 23 were conceptualised in the course of this literature review to provide an additional perspective on communities and social movements as further areas for interventions. They are again compared against basis of action, the process of change, positioning technology interventions and transferable lessons.

	Theories of Behaviour	Theories of Practice	Theories of communities	Theory of social movements
Basis of Action	Individual choice	Shared social convention	Shared community values and goals	Shared social and political goals
Process of change	Causal	Emergent	Emergent and disappearing	Emergent and disappearing
Interventions	External influence by technology on the factors and drivers of behaviour	Interventions are embedded in the systems of practice it seeks to influence	Interventions are embedded in the collective values and practices of the community.	Interventions support the collective activist values and goals of the movement.
Transferable lessons	Based on universal laws	Limited by historical and cultural specificity	Limited by specificity of cultural, local and community aspects.	Limited by specificity of cultural, political and community values.

Figure 2.3: Theories and models from literature review and how they relate to action, change, technology interventions and transferability of findings, derived from [Shove et al., 2012, p. 143]. The yellow area in the 3rd and 4th column were added to provide a holistic overview of approaches presented in this chapter.

Given the environmental impact and contribution of food waste to greenhouse gas emissions and the ethical implications of food waste, this PhD thesis was motivated by the potential of technology interventions to make a difference and to encourage a change of practices that might result in less food waste. It is important, however, to design such technologies carefully with a view to how they are integrated in everyday life. Warde (2005) argues that theories about social practice imply that policies (here technologies and interventions are added) have to consider how individuals are situated within the practices in which they are engaged:

"Policy must be sensitive to the everyday contexts, in which individual intentions

and actions are constrained by socio-economic and political institutions." [Blake, 1999, 274]

In Brynjarsdottir et al.'s (2012) paper, the provided alternatives to behaviour change interventions are presented as *"include users in the design process"*, *"move beyond the individual"*, *"shift from prescription to reflection"*, and *"shift from behaviours to practice"* (ibid, p. 953-954). These can act as first pointers and are in many parts also suggested by literature that presents a policy-orientation for HCI [Grimpe et al., 2014]. These authors propose reflective practice, though as reflexivity for researchers and not for recipients of interventions. They share the proposition of participatory approaches to move from a researcher-centric perspective to a people-centric perspective about certain values. Similar concerns are advocated in emphasising an understanding and inquiry into the contexts and practices in which technologies may play a role [Suchman, 1987, Dourish, 2010].

It is critical for this PhD research to understand what are the everyday practices around food and how these are implicated or not in food waste to in turn be able to inform the design of interventions supported by social practice theory. Looking at different perspectives of how interventions can be conceptualised a broad understanding of interventions is necessary. That is why the notion of behaviour change and social practice theory was extended by theories and concepts of communities and social movements, as this is also a potentially fruitful arena for design.

One additional perspective I want to present isare interventions aimed towards changing circumstances addressig activism, and later on a critical reflection on intervening with digital technologies.

An activist and extrasomatic lens

An activist lens is useful to inform the conceptualisation of technologies to influence the extrasomatic social and political circumstances individuals and communities live in. Latour (1992) talks about the *extrasomatic* domain as changing materials or legislations and explains the *intrasomatic* domain to similar raising awareness. Sustainbale actions, even though intrasomatic positive intentions exist, are not possible if the extrasomatic circumstances do not allow them. Even the best designed and most well intended application to foster sustainable behaviour cannot persuade users to engage in the desired behaviours if the circumstances are not allowing to engage in them. Vice versa, in cases where circumstances and infrastructure for a sustainable culture exist, 'sustainable behaviours' do not follow automatically [Darnton, 2008] and could be addressed by intrasomatic interventions.

Instead of addressing the intrasomatic domain through Activism is defined as taking actions to promote social, political, economical and environmental change. People need to be discontented about certain circumstances to become agents of change. The definition of an activist used in this thesis is not only a person who engages in short term physical protest, but one who takes any form of action, ranging from digital to physical acts with the aim to not only to change individual consumer behaviour, but also to change extrasomatic circumstances such as laws, infrastructures, and institutions. Technology interventions can support

activists with computational technologies on an individual level, but also support communication and cooperation among individuals for social movements [Wulf et al., 2013b].

To inform how technology interventions could be conceptualised, literature from sociology, communication and political science that address these issues is relevant and addressed here. Van Laer and Van Elst (2009) for example describe different *"action repertoires"* and use the dimensions of high vs. low thresholds for participation and ICT-supported vs. ICT-based. *Consumer behaviour*, *donating money* and *demonstrations* are described as repertoires with a low threshold and being supported by ICTs. Occupations or transnational demonstrations are also supported by ICTs, but have a high threshold for participation. There are as well repertoires solely based within ICTs, such as *online petitions* with a low participation threshold and more based on the individual, whereas *culture jamming*[6], *email-bombs, protest websites* or *hacktivism*[7] have higher thresholds to participate [Van Laer and Van Aelst, 2009].

Critical perspectives on technology intervention

For all approaches presented here , from individual behaviour change towards social movements, computing technologies are not necessarily a panacea for change. Hence a more critical and reflective stance on the role of digital technologies for interventions is provided here. In particular two general pitfalls are presented, first the 'evidence' of change through computational technology in interventions and second the 'digital divide'. A short discussion of these should lead to a more nuanced understanding of the potential of interventions.

The first issue is about if, and to what extent, technology promotes effective change:

> *"Evidence that ICT use is producing significant social change does not mean that the changes identified are inherent to the technology. Used in different contexts, technologies yield different effects."* [Garrett, 2006, p. 217]

Without question, forms of activism have changed along with the technological tools and actions: action can now be carried out globally, or be mobilised more quickly. But the data on this is open to dispute, with some claiming that digital technologies increase participation, while others finding it has no effect [Garrett, 2006].

The same applies for interventions for behaviour change in sustainability, where there is an ongoing debate within HCI that researchers often do not evaluate their interventions for behaviour change. Half of the papers reviewed in [Brynjarsdottir et al., 2012] reported an evaluation, but only one paper reported on an evaluation for as much as 5 months and then did not report what effects were measured. [Erickson et al., 2013] carried out an empirical study about the effectiveness of eco-feedback technologies for electricity consumption and found a 3,7 % decrease in energy consumption during a field study that lasted for 5 months. This study is rather the exception than the rule within HCI.

The second issue concerns the digital divide, with those on the disadvantaged side of the divide being unable to participate in interventions thattechnology use which requires skills

[6] A form of resistance to disrupt big mainstream institutions e.g. by subverting corporate advertising campaigns.

[7] The use or attack of ICT infrastructure in pursuit of political protest that may be legal or illegal.

and the resources many people are deprived of. Generally a gap between digital technology users can be observed globally, with more users in industrialised countries and fewer in less industrialised countries. The digital divide also applies within nations as the socially underprivileged tend to have poorer access to, and lower skills to engage with, digital technologies and the Internet. Therefore they are more likely to be excluded from participation with technologies [Chen and Wellman, 2004].

The literature suggests that an intervention alone cannot trigger change or activism, as it is the people behind who drive change, institutions and infrastructures that form our practices. Another issue concerning activism is that people often just engage in the online world without engaging in the real and offline world. A weak spot of digitally-based activism can be that the engagement is just online, referred to as 'slacktivism' or 'clicktivism'; activism that makes it very easy for users to participate online and to declare one's opinion but not engage in the activist movement offline [Christensen, 2011].

2.6 Summary

In this chapter I have reviewed the literature pointing to different and broad areas of interventions, from individual behaviour change and its limitations to social practice, and communities to social movements. There was a stronger emphasis on social practice theory in this chapter as it is the guiding lens of my PhD research. I have discussed the necessity of understanding the qualities of everyday life around food and waste practices (research question 1) described ion on page 13. Research so far has addressed a quantitative account on food waste in households [Quested et al., 2013]. While sociological studies have tried to understand some of the material and social context of food and waste practices and were published during the course of my PhD [Evans, 2011b, Evans, 2011a], a different understanding is necessary to understand and inspire technology interventions that are embedded in qualities of everyday life.

This chapter was also concerned with describing technology interventions in the area of sustainability, food and wasted food in HCI, learning from existing interventions and extending the notion of interventions to inform research question 2, how interventions and specific design proposals be conceptualised towards less food waste. Therefore this chapter engaged with theories and models from different areas, from individual behaviour change to social practice, community and social movements.

CHAPTER 3

Methodology

3.1 Introduction

This chapter is a description of the methodological and constructivist philosophical background of my PhD research. The first two sections in this chapter are discussing the constructivist ontological[1] and epistemological[2] approach, along with the axiology of my thesis. Intervening in the area of food waste necessitates an understanding of people's present values and needs for possible technology as well as envisioning future interventions. For this reason the method section is structured into an overview of the data collection and analysis methods to understand the present, namely interviews and in-home tours, online ethnography and thematic analysis, and research through design. Sketching is presented as a method proven to be very useful for me to envision and reflect about possible future technologies. My PhD research is grounded in the real world of everyday life. Hence, the methods that were used aim to focus on a rich understanding of the everyday practices that are involved in food being wasted. The details of the actual mechanics of the methods, the when, who, where and how of the study, will be described in the respective chapters 4,5,6 and 7 where also the results of the findings are described.

3.2 Ontological and epistemological approach

The philosophical and methodological scientific approach of my thesis can foremost be described as constructivist. Constructivism is a school of thought having an interpretivist frame of understanding, where the knowledge generated by the observer/ knower is constructed in a certain context. The context depends on the life history and the experiences of the observer,

[1] Ontology is the philosophical question about the nature of reality and being. In terms of philosophy of science, the question what is or what exists, what all the things there are have in common, appears.

[2] Epistemology is concerned with the question what can be known and how it can be acquired. It is also concerned with the relationship between observer and of what is observed.

as well as on the situation, the place and the context of the studied object. Philosophically constructivism supports the belief that all human knowledge is socially constructed as an interaction between observer and observed object. As a logical consequence of social construction, objectivity or universal truth is not possible, more extreme positions taking even an anti-realist[3] position. Learning and knowing is considered to be personal and contextual. Constructivism as a school of thought exists in fields such as educational sciences (Piaget), psychology, psychotherapy, mathematics, architecture, art, feminism or cultural theories.

Constructivist ontology assumes that reality consists of mental constructions that are socially and experientially based [Guba and Lincoln, 1994]. Mental constructs are of multiple, intangible nature, local and specific. Hence a constructivist approach neither aims to generate the objective truth nor the successful right solution, but to understand and explain, as well as to suggest. The absence of objective universal truth does not imply that results are arbitrary results free for interpretation. Although this school of thought does not aim for universal truth, some results can be shared among individuals or cultures, also referred to as transferability. Criteria are used to compare and reflect on the trustworthiness of results in a study. Guba and Lincoln (1994) name transferability and credibility as criteria for trustworthiness, Charmaz (2006) names credibility, originality, resonance and usefulness. I will summarise the criteria of Guba and Lincoln (1994) and Charmaz (2005) next, where credibility is named in both works.

- *Transferability* parallels external validity and acts as a criteria to describe if knowledge can be transferred to another setting, provided by vicarious experience such as numerous case studies [Guba and Lincoln, 1994].

- *Credibility* parallels internal validity, being concerned with the evidence to make claims and the familiarity with the topic [Guba and Lincoln, 1994]. A constructivist research study is credible if the presented data is linked to the arguments and enough evidence is presented. Readers should be able to form an independent opinion and be able to agree and judge the soundness of results [Charmaz, 2005].

- *Originality* is a criteria to assess if the gained insights are novel and fresh. Originality also refers to the social and theoretical significance of the contribution and how the research extends on current ideas, concepts and practices [Charmaz, 2005].

- *Resonance* describes the fullness of the studied experiences. The results include uncovering hardly perceptible meanings, as well as questioning taken-for granted meaning. For readers or people who share similar circumstances and context, the results should offer deeper insights about their lives and their world [Charmaz, 2005].

- *Usefulness* is a criteria assessing the interpretations that can be used in the people's everyday world, if the research can inspire further research in other areas and how the work contributes to making a better society [Charmaz, 2005].

[3] A position involving the denial of an objective reality.

These criteria are used for constructivist grounded theory and are useful as well for constructivist thematic analysis, which is a similar method for qualitative analysis. Thematic analysis consists of six steps described in this chapter's section on thematic analysis. The criteria of transferability, credibility, originality, resonance and usefulness will act to describe and evaluate the findings of my PhD results in the final conclusion chapter 9 on page 123.

Epistemologically constructivism assumes that the observer and the observed object are interactively linked. The philosophical assumption is, that the inquiry is influenced by the values of the observer and the context of the inquired object or situation. Findings therefore are value-mediated, subjectivist and transactional [Guba and Lincoln, 1994]. As knowledge from a constructivist perspective evolves from the interaction between observer and inquired object, the methodological approach is of a hermeneutical and dialectic nature. A hermeneutical method is based on the in-depth understanding and interpretation of a situation forming a construction, which in turn is compared and contrasted through a dialectical interchange (see Figure 3.1 on page 31). The aim is to reach a consensus construction that does not claim to be objective, but more informed and sophisticated than a previous construct [Guba and Lincoln, 1994].

3.3 Axiological and personal approach

From an axiological[4] perspective, values are intrinsic within a constructivist approach. The values that a researcher brings towards its constructivist research are shaping the outcome of the constructed knowledge. Charmaz (2006) describes the advantages of a constructivist research approach that embraces rather than negates values and the passion for the research subject:

> *"Topics that ignite your passions lead you to do research that can go beyond fulfilling academic requirements and professional credits. You'll enter the studied phenomenon with enthusiasm and open yourself to the research experience and follow where it takes you. The path may present inevitable ambiguities that hurl you into the existential dislocation of bewilderment. Still, when you bring passion, curiosity, openness, and care to your work, novel experiences will ensue and your ideas will emerge."* [Charmaz, 2006, p. 185]

I could find many parallels from this quote to my personal approach to this topic. From the beginning of my PhD I wanted to work in HCI and sustainability exploring the role of interventions to waste less food with the intention of research that impact the everyday world we live in. As Charmaz (2006) points out, a topic that a researcher personally cares for enables you to bring 'passion, curiosity, openness and care to your work'.

Often technology is developed for scenarios where it is easily possible to 'measure' certain parameters, be it electricity consumption in a household to provide feedback [Froehlich et al., 2010] or sensing air quality [Kim et al., 2013]. Measuring food waste is definitely a more complex technical challenge in terms of the practicalities for measurement, as food waste has

[4] The study of values, ethics and aesthetics

very different material aspects, e.g. starting with the question of when waste is considered to be waste. In one of my interview in-home studies I talked to a farmer, and for her food waste was not an issue at all, as surplus food fed to chicken and pigs was just part of the natural lifecycle on her farm. Hence the question of 'measuring' food waste in a quantified approach starts already with the definition of what is constituted as waste for individuals.

The other question is whether informative feedback is or could be a useful intervention [Fitzpatrick and Smith, 2009]. This stresses the qualitative constructivist approach I was taking for this thesis and that I found very valuable: The approach of taking the societal challenge first rather than looking at what is technologically possible [Bannon, 2011]. This approach opened up new and more critical perspectives on technology development.

Construction of knowledge in my PhD research

Reflecting on my PhD research approach under a constructivist hermeneutical and dialectical approach, I want to engage here with the question of how knowledge was constructed. I want to stress that knowledge is generated not only by the studies that I carried out and the results I obtained, as depicted in Figure 3.1 on page 31. This process is in addition to the studies I undertook influenced by my personal values, my motivation and background of life history. Another researcher with different experiences and a different value-set would have constructed different knowledge than what I have constructed. Hence I aim to describe the generated knowledge in a way that it can be accountable for other people. Besides I want to stress that a constructivist research process, is not in any way linear, but foremost an ongoing iterative circle (see Figure 3.1 on page 31). In this interconnected circle, reading theories and papers, thinking, acting in the world, and reflecting are interrelated processes that happen alternately and iteratively.

3.4 Understanding the present - data collection and analysis

An eclectic use of methods was chosen to collect data (interviews, home tours with taking pictures, online ethnography, quantitative system logging) and thematic analysis was used to analyse collected qualitative data. All of the audio recordings of the home tours and interviews from chapter 4 and 6 were transcribed. These transcripts, besides the photographic record of food items captured on the home tours, were used as the primary source of evidence in my analysis. From iterative sampling of these data, I was able to construct an understanding of the everyday life and food and waste practices of my participants, and how technology might intervene. I will describe now the most important methods aunder a constructivist perspective, namely interviews, the implications of data for online ethnography, recruitment, thematic analysis. I continue to describe the ethical implications of my work.

In- situ Interviews and home tours

In-home and in-situ interviews are a standard method in HCI to better understand user's values [Stringer et al., 2006, Kirk and Sellen, 2010], and acted as basis for understanding people's everyday food and waste practices (chapter 4). This approach is ethnographically informed

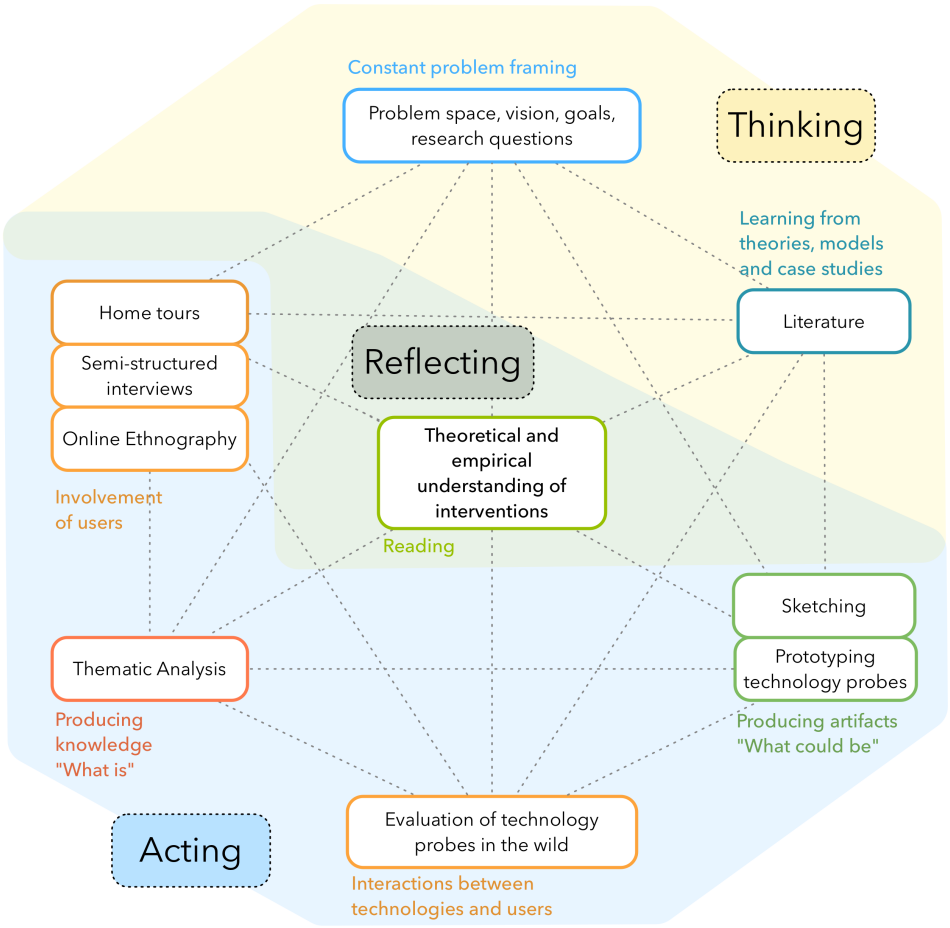

Figure 3.1: Constructivist hermeneutical approach to learning consisting of different activities for thinking, acting, and reflecting.

to not only understand what people say, but also observe how they live and what they do, enriching the context of what people say. Qualitative research interviews and in-home tours are the logical method for an understanding of participants' lived experiences and practices around food and wasted food. With a theoretical perspective on practice theory and the "nexus of doings and sayings", the theoretical background of my PhD research necessitates an approach to focus on the sayings with interviews and the doings with being in-situ in people's homes. Homes are a very sensitive space, but as of most food practices are taking place in this context and food is stored and organised at the home, this was the most fruitful site of my studies.

The interviews were held in an open manner, conducting them like a conversation to provide space for the interviewees to articulate their thoughts. All the interviews that were carried out were semi-structured. An interview guide was used to provided certain themes I wanted the interview conversation to focus on. The participants were invited to speak freely.

More specific questions were asked only if an important theme has not been covered yet. For my personal account I attempted to remain naive in the interview situation in the participant's home, to stay open for unexpected experiences that the participants described, also referred to as *"Deliberate Naïveté"* [Kvale, 1996]. For the interview questions, I tried to elicit specific instances instead of generalised opinions or experiences, as they are often biased towards social and cultural expectations. The design of the interview study can be seen in the Annex in Figure A.2 on 145. Interview guides were not the only documents used to support the studies, participants were also provided an information sheet (Figure A.9 on 152) explaining the background of the study as well as an informed consent (Figure A.7 on 150). Both documents are aiming to support study ethics.

Ethical implications

Thinking and reflecting about ethics is implied in a constructivist research approach. I wanted to take care that ethics is not just an afterthought in my PhD research. Questions a researchers ought to think about before studies involve the beneficial or detrimental consequences of the studies for the participants. E.g., when the study is published, are there any consequences for the participants [Kvale, 1996]? Universities usually require study designs going through an ethic board for investigation. Austrian universities lack such processes (unless for biomedical studies involving humans and animals) but in the UK such ethic boards are standard. As some food interviews and the Fridge cam study were carried out together with Culture Lab at Newcastle University in the UK, my studies went through such processes and were accepted to be carried out.

Much of the responsibility from my personal point of view remains also with the researcher herself and the respect shown to study participants as well as reflecting on the ethical implications of the technologies that are designed and prototyped. For example it involves intrusion into private lives and households, very intimate spaces to talk to people and families going through food items stored and organised in people's homes. Food storage and handling is, as it was perceptible in the interviews, an arena where people enact their social and cultural identities. Fridges were clean and ordered when I came for interviews and home-tours (and was told so by participants, that they cleaned the fridges because a researcher was coming by) demonstrating the cleanliness and orderliness of the person.

The information sheets (see figure A.9 in the Annex on page 152) aimed to inform about the study and about participants' rights for privacy. In the informed consent (see figure A.7 in the Annex on page 150), participants could not only consent to participate in the study but also assess to what extent they agree to the publication of materials collected in the study such as pictures taken in their home.

Recruitment

As homes are a very sensitive space, recruitment was very challenging in terms of finding participants for my studies and not having the resources to offer any form of remuneration. But it was not only difficult to find participants who would welcome me to explain and show how they organise their food and talk about food practices. It was also me who did not feel

comfortable entering people's homes as a complete stranger and, as it turned out to be, encouraging people to talk about sensitive issues of food and waste practices and go through their kitchens and pantries. Hence I used an opportunisitc sampling method through my extended social network. Critics might argue that this type of recruitment was convenient, where the predominant disadvantage of convenience recruitment is the similar characteristics participants would share [Marshall, 1996]. Even though my recruitment was organic for my interview study, participants were highly diverse in occupation, from occupational therapists to farmer or retired housewife; living situations also differed, from one-family dwellings in the country side with garden to small apartment buildings in high density populated cities (see Figure 4.1 on page 41). The most viable argument is that the study did not aim to be generalisable covering all possible food and waste practices, rather to understand the complexities of everyday food waste practices to consider for designing digital technologies.

Online ethnography

Some aspects of our everyday life are more and more enacted in the online social world. This makes necessary an understanding of interactions and cultural framings online. Similar to ethnography, online ethnography allows the researcher to study cultural and social practices. This draws the focus of analysis to various ideas, meanings, relationships, interactions and social practices. What makes online ethnography different from real world ethnography is the digital self-presentation of users in the online world and the imbalance of participation. In case of the Foodsharing online community I have studied presented in chapter 7 and published at CSCW [Ganglbauer et al., 2014], this question is crucial in terms of which people are raising their voices and which remain silent. The participation Internet rule explains roughly that only 1% of an online community actually contributes 90% of the content. Another 9% of users create 10% of the content and 90% of users participate only passively ("lurk") [Hargittai and Walejko, 2008, van Mierlo, 2014]. This inequality in participation has implications on the data that can be collected via passive online ethnography, as only the voices of active online contributors are heard. The online ethnographic studies undertaken for this PhD research are around the Foodsharing community in chapter 7, as well as a thematic analysis of data submitted via the food waste diary application in chapter 5.

The ethics of online ethnography are tricky in the case of the Foodsharing case study: although the data I used for analysis was public, the participants of this passive online ethnographic study did not know that they were studied as I remained a hidden observer. Data may be publicly available, such as in the Foodsharing community Facebook group. Though users, when asked, are hesitant to have their quotes published, even if they are assured that it will be with a pseudonym [Kozinets, 2010]. The same applies for the data from the Food waste diary study presented in chapter 5, where data was to some extent publicly available to all users. Though users could not be informed that their data is used anonymously for a study aiming to understand reflection, as they were not required to register with an Email.

In case of the Foodsharing study, it was practically almost not possible to contact every person behind a quotation on Facebook. The group had 32.000 members at the point where I analysed it. For the publication [Ganglbauer et al., 2014], direct quotes of members in the Foodsharing Facebook group served to underpin the presented themes. Quotations

were translated into English to make it understandable for an international audience. Using pseudonyms and translating the quotes from German into English makes them at least not traceable for search engines to track quotes back to Facebook users. Similar was the approach for the Food waste diary study, but here the data was submitted anonymously, and analysed anonymously.

Thematic analysis

The main method paper that acted as a reference for thematic analysis of the qualitative data is by Braun and Clarke (2006), who describe thematic analysis as a very flexible method. It allows inductive as well as deductive coding, such as content analysis. Thematic analysis is designed to find reoccurring patterns and themes within and across qualitative data sets in a rich and in-depth approach. Thematic analysis allows to interpret qualitative findings and can be used in a realist or constructivist/ interpretative frame, as used in this PhD research.

A constructivist frame assumes that patterns are socially produced by the elements, meanings and experiences being effects of interactions within society. An interpretive frame goes beyond describing and summarising patterns, a step further to theorise about the broader meanings, implications and significance [Braun and Clarke, 2006] as I did with interpreting the values of food practices of people in chapter 4 [Ganglbauer et al., 2013], or the Foodsharing community [Ganglbauer et al., 2014] in chapter 7. For the food waste diary study I adapted an existing framework of reflection [Fleck and Fitzpatrick, 2010] to code the data deductively and with an existing code set, but at the same time stayed open for different interpretations.

Thematic analysis then, according to [Braun and Clarke, 2006], consists of six broad steps. The first step for a researcher is to familiarise with the data, including the transcription of the interview data and other materials. When the researcher is to become familiar with the data set, initial codes are generated. Coding can be done by several researchers independently or codes revisited to increase the external validity of the codes. The next step is identifying themes and adding them to a bigger story, focussing the analysis on the broader meanings that codes construct. The candidate themes should be reviewed and refined, related to other themes, merged, or taken out if there is not enough data to support them. Criteria for themes are to be internally homogeneous and externally heterogeneous. When needed, the material is re-coded to refine the themes. The next logical step is to finally define and name themes. This is specifically important for the last step, which is to produce the report about the data [Braun and Clarke, 2006].

To support the process of analysis I used different tools. The interviews and home tours (chapter 4) and the interviews in the Fridge cam study (chapter 6) were analysed with Tams Analyzer[5], an open source tool allowing open coding. See figure A.8 on page 151 for an excerpt of coding with Tams Analyzer. The data in the Food waste diary study was analysed with dedoose[6], a web-based tool to code data openly. See figure A.4 in the Annex on page 147 for an excerpt of coding with dedoose. The Foodsharing Facebook data from chapter 7 was coded on paper, as it was difficult to prepare the data with pictures and comment hierarchies

[5] http://tamsys.sourceforge.net/

[6] http://www.dedoose.com/

for a digital coding tool. Please see figure A.11 in the Annex on page 154 for an excerpt of coding on paper.

3.5 Designing for the future

Research in HCI is by far not only a case of analysing and understanding present situations and interactions with technologies, but also a field concerned with envisioning future interactions with computing technologies. There are many methods provided to think about possible futures of computing, such as design fiction scenarios [Reeves, 2012, Wakkary et al., 2013], interaction design sketches [Mackay et al., 2000] or imaginary abstracts [Blythe, 2014].

For envisioning futures and future artifacts, the focus is on 'what could be' instead of understanding 'what is'. Envisioning the future is, from a strict scientific perspective, not a scientifically grounded activity, except maybe for extrapolations into the future from an existing present dataset. But the future cannot be foretold.

> *"To design is to plan for the making of something new. [...]Designing entails generating, transforming, and refining images of different aspects of that still nonexistent artifact and making representations of it which enable communication and examination of the ideas involved."* [Goldschmidt, 1991, p. 125]

In the virtual world of testing things out through doing and reflecting to 'examine the ideas involved', sketching is a possible method to overcome the immanent restrictions of the real and current world. Experimenting and testing and probing with pen and paper is indispensable for a design process, as knowing is intrinsically tied to doing [Schön, 1987].

Sketching - reflection in action and on action

One of the basic underlying activities for thinking about future artifacts and scenarios is sketching, a method enabling designers to envision and reflect on artifacts [Buxton, 2010]. Sketching also allows designers to explore and communicate ideas. Sketching done by an experienced designer is a deeply dialogical activity and on that account closes the circle to constructivist research, containing dialectical approaches in its methodology [Guba and Lincoln, 1994]. Sketching is an a-priori creative process to think and reflect about possible scenarios and artifacts and a distinct form of drawing providing a vehicle to explore and communicate ideas for design [Buxton, 2010]. Engaging with the process of sketching more deeply, a designer, while sketching, undergoes a dialogical process between the creation of what the artifact is and interpreting what it could be. Goldschmidt (1991) denotes the dialogical interchange as the process of *"seeing that"* while creating a sketch and *"seeing as"* while reading and reflecting about the sketch (see Figure 3.2 on page 36). This dialogical process serves, in a constructivist perspective, the reconstruction of previously held constructions.

The dialectical process of sketching is described by Schön (1987), from a pragmatist perspective, as how knowledge is constructed. For Schön, sketching is a process of reflection in action with insight that arises out of the action of making a design move – e.g. sketching

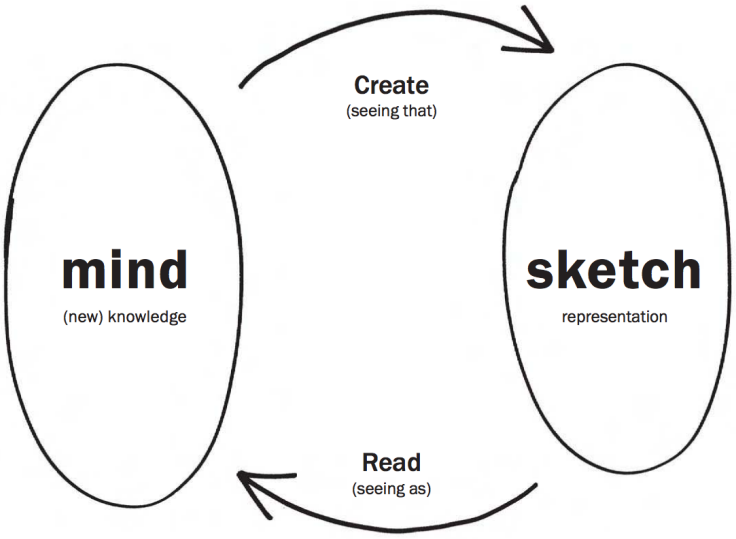

Figure 3.2: Dialectical conversation between what an artifact is (create) and what it could be (read, interpret). The creation of an artifact involves *"seeing that"*, as well reading and interpretation through *"seeing as"* to produce new knowledge. Figure from [Buxton, 2010, p. 114].

a technology idea. Reflection on action is the process where insight that comes from stepping back and contemplating the results of a design move – e.g. critical investigation of the sketched idea. Hence sketching is very close to constructivist epistemology in its hermeneutical approach

> *"Through active sensory appreciation of actual or virtual worlds (especially, in my examples, by drawing), the designer constructs and reconstructs the objects and relations with which [s]he deals, determining 'what is there' for purposes of design, thereby creating a 'design world' within which [s]he functions."* [Schön and Bennett, 1996, p. 4]

Sketching has proven vital to my own PhD thinking and reflecting in several aspects, an excerpt of one of my sketches is presented in Figure A.1 in the Annex on page 144. First, it is an activity that allows me to contemplate on a topic while drawing, letting emerge moments of surprise where ideas can spread (reflection in action). Second, stepping back and reflecting on what has been done allows me to redefine the problem, the understanding and my assumptions (reflection on action). And third, the production of the artifact itself is productive as it permits me to communicate ideas, notions and thoughts to others. Another example here is the idea of Foodsharing as sketch presented in the Annex in Figure A.12 on page 155.

3.6 Methodology summary

Summing up, this chapter provided an overview of the constructivist school of thought that guides my PhD research. Constructivism is an appropriate philosophical background for research that is deeply involved in understanding complex circumstances of everyday life. The underlying historical context of still dominating positivist and post-positivist science is often accepted without questioning, hence I dedicated a portion of this chapter to the social construction of phenomena. Interpretivist qualitative and designerly methods are often used within HCI, yet the underlying philosophical differences from post-positivist research in terms of ontology and epistemology, are often neglected.

The chapter continues to describe methods that were used for understanding the present contexts, as they were: interviews, in-home tours, online ethnography, and thematic analysis in a constructivist and interpretivist frame. The methods are also discussed in terms of ethical implications of the studies. To envision future possible interventions based on computing technologies, the dialectics of sketching were presented as an approach that allows researchers and designers to combine both, ideation in sketching an idea or an artifact and reflecting how the artifact potentially interacts in the real world with people and in specific contexts.

CHAPTER 4

Everyday Food Practice

4.1 Introduction

This chapter is concerned to first provide an answer to research question 1, the question of how everyday food and food waste practices are organised in everyday life. For the in-home interviews and home tours, 17 participants in 14 households were recruited to collect and analyse material. The findings point to food and waste practices as being embedded in the social and material organisation of the environment rather than simplistically being about the attitude or motivation of participants. Occasions for waste emerge as a later consequence from multiple other moments of consumption within practices of planning, shopping, (over-)buying, storing, cooking, gardening, etc. Consumption or non-consumption of food is embodied and enacted within the conditions of the moment, and is the outcome of multiple negotiated concerns. While none of the participants wanted to waste food, waste was still an almost invisible and unconscious result of previous discretionary decisions, bound within practices. The second major part of the chapter's findings move on to research question 2, the question of how technologies can be made sensitive to everyday life from a more systemic view. Based on the findings of everyday food practices and the literature, I derive six design proposals, namely technologies to support #1 reflection; #2 informed choices; #3 communities of alternative practice; #4 re-connection to food sources; #5 promotion of public interest; and #6 activism.

4.2 Methods

As this was an initial study to identify broad practices, I used an opportunistic sampling method through my extended social networks; this resulted in 11 households in Austria and 3 in the UK, with all in all 17 participants varying in background, living situation, age and

housing. We [1] focused on target participants who were mainly responsible for organising and carrying out the shopping and cooking, rather than including all members of a household. Participants varied regarding education, family status, household income, age, gender, ecological attitude, urban or rural living environments and cultural backgrounds. Dwellings varied as well, with apartments, residential houses and single-family dwellings. See Figure 4.1 on page 41 for a summary of the participants, referred to by pseudonyms. In taking such an opportunistic approach in the first instance, we were aiming for breadth and diversity, without any claims to representativeness along cultural or other dimensions. This served to sensitise us to a range of different practices that might be invisible in more homogeneous cohorts. The study design was reviewed and approved by Newcastle university's ethics committee.

The semistructured in-depth interviews with home tours followed a similar qualitative methodology to other in-home research [Kirk and Sellen, 2010, Pierce and Paulos, 2011, Strengers, 2011, Woodruff et al., 2008, Stringer et al., 2006]. For the interviews, an interview guide (see Annex A.2 on page 145) was developed covering the following broad themes, while also leaving the interviewer free to follow other strands in the conversation:

- Aspects that motivate choices around food, such as price, region, season, proximity of food retailer, etc.
- The process of planning, shopping, buying, producing, storing, cooking, eating, and throwing away foods in daily practice, with a particular emphasis on ways of storing and organising food.
- Experiences and reasons why food is spoiling and discarded, identifying the strategies participants use to avoid this and how people perceive food waste itself.
- The role technology played in people's food practices, but are not reporting on these here.

During the interviews I also asked participants to take me on a home tour and show me where and how they store their food, during which I also took photos. All but one of the households agreed to the home tour with photos as we were running out of time the participant reserved for the interview. During the study, I went through food items with participants drawer by drawer, cupboard by cupboard and shelf by shelf to understand the organisation of food and what people stored in their homes, how and why. By doing that, participants often told me what they could already throw out as they would not use it anyway. Data was collected via audio recording of the interviews and via photos taken during the home tour. The interview data was transcribed and analysed by an inductive thematic analysis [Braun and Clarke, 2006] where codes originated from the material and were not defined a priori. Please see section 3.4 on page 34 for more information on the constructivist approach of this

[1] Eva Ganglbauer was conducting all interviews and transcribed and coded them, Rob Comber conducted and coded 3 interviews from UK, analysis was supported by Geraldine Fitzpatrick and Rob Comber.

Name	Gender	Age	Method	Living	Housing	Social situation
Stephen	m	28	I + HT	City, A	Apartment	Single
William	m	37	I + HT	City, A	Apartment	Single
Hanna	f	29	I + HT	City, A	Apartment	Lives with sister
Sandra	f	24	I + HT	City, A	Apartment	Daughter + husband
Yvonne	f	59	I + HT	Village, A	House + Garden	4 grown up children, husband
Ida	f	34	I + HT	Village, A	Apartment	2 children, husband
Jasmin	f	71	I + HT	Small Town, A	House + Garden	Daughter's family lives above
Anna	f	47	I	Village, A	Farm + Garden	3 sons, husband, mother in law
Wilma **Noah**	f m	38 42	I + HT I	Small Town, A	House + Garden	3 children + Wilma's husband
Michael	m	57	I +HT	City, UK	House + backyard	Lives with landlady and another lodger
Victor	m	24	I +HT	City, UK	House + backyard	Lives with 2 other flat mates
Rose **Maria**	f f	24 24	I +HT	City, UK	House + backyard	Both single, live together in a household
Susanna	f	29	I +HT	City, A	Apartment	Has a boyfriend, lives alone in a household
Philip **Frank**	m m	31 26	I +HT	City, A	Apartment	Both single, live together in a household.

Figure 4.1: Summary table of study participants (I=Interview; HT= home tour, A = Austria, UK = United Kingdom

method. Data and codes were then captured in TAMS Analyzer[2], an open-source qualitative research tool. TAMS Analyzer allows open inductive coding without any predefined code lists. Screenshots from data analysed with this tool can be found in the Annex in Figure A.8

[2]http://tamsys.sourceforge.net/

on page 151.

In presenting this data, please note that the direct participant quotes from Austrian participants have been translated from colloquial German into English to make it understandable for an international audience. The participants did not receive any remuneration for their participation.

4.3 Findings

An overall observation is that all of the participants were concerned about food waste; none liked wasting food and some appeared to feel guilty when reflecting during the interview on the food they threw away: *"it hurts me but it happens nonetheless"* (William). The connection between feelings of guilt when food was wasted was found in other research studies [Thieme et al., 2012, Evans, 2011a]. Two participants identified themselves though as being 'eco- warriors', that is, motivated and engaged in sustainable discourses and practices (William as a vegetarian and Greenpeace activist climber, and Anna as an organic farmer with a strong emphasis on regionalism). Discussions revealed other underlying values. One was around ethical issues *"because people are hungry in the world"* (Victor) and participants referred to them as being taught when they were children:

> *"It's just the way I was brought up. You eat what was on your plate. And if you don't, you eat it tomorrow."* (Michael).

Michael also told the history if his family with his mother being brought up in a big family during World War II in the UK, experiences that formed her attitude to food as something that had to be treated mindfully and frugally. This attitude was passed on to Michael and him treating food as valuable and nourishing material. Others mentioned the waste of money that happened along with waste of food: *"And then a month later it is gone off and you are like 'That was a waste of money'."* (Maria). Hence, costs and ethical values like hunger or the value of food were much more prominent than the sustainable implications of food waste. In fact, only one participant (Philip) mentioned food waste as an ecological problem. For the other participants consuming food and the energy embedded in growing and producing food, is not considered as consumption of energy [Warde, 2005] or as implicitly responsible for green house gas emissions. People simply want to eat, enjoy, necessarily needing, or celebrating food.

Continuing with a broad understanding of the participants' feelings around food waste, I go on now to discuss the findings from the perspective of everyday food practices at the home in the context of food waste. I organise this discussion around the broad themes of integrated practices such as shopping, gardening, storing, and specific practices around food waste. The data highlights that while almost all of the participants wanted to engage in sustainable food practices in some way as indicated earlier, people often experience a gap between what they want to and what they actually do in everyday life. The data I present here points to some of the complex and intertwined tensions on the social and material embeddedness of everyday food practices.

Shopping

Shopping is a critical routine means of getting food into the home in industrialised countries such as Austria and the UK. Most people are not directly concerned with food sourcing and farming any more. How that shopping happened though varied across our participants and highlights the ways in which practices of shopping are intertwined with a range of other concerns.

Domestic shopping planning

Planning, or lack of, is one issue that can have later implications for food waste. Our participants reported a variety of strategies around shopping planning. Around half of our participants used shopping lists to think about what they needed to buy. To do their planning, these participants reported that they looked in the fridge and other places where they stored foods at their homes and created their lists before going shopping. The relation of those lists to what was actually bought though varied. For some participants, the list was important for managing the efficiency and experience of shopping:

> *"With a list I simply go there [to the supermarket] and I don't have to think about it, because when I realise that something is not here I write it onto my shopping list. I go there, shop it and go home again, because I hate shopping, shopping for me is something really stressful." (William)*

> *"At the weekend I go shopping more consciously, and then with a shopping list."* (Susanna)

Both, William and Susanna, also report routinely buying more than what is on their list: Susanna continues to say: *"though I often buy more than what is on the list."* (Susanna). And William, at a later point in the interview, also concedes:

> *"Sometimes it happens that I see things there that I didn't think of before, things that I desire at the moment, for example a cup of ice-cream, this happens sometimes."* (William)

So one of the main motivations for using lists was not so much to avoid buying more than they needed but as a reminder.

> *"I don't want to come back and say 'Oh I should have bought this or should have bought that.' Or I have forgotten it. [...] [A list] is quite good for knowing, just getting exactly what you want." (Maria)*

However despite the recognition by many participants that lists were helpful, not everyone used lists. Ida, for whom shopping was something she did almost daily as mother, housewife and part-time occupational therapist, explained:

> *"It sometimes happens, because I don't have a list, that I forget the one thing or the other. Or that I buy something that was already in the fridge and I was thinking is not there."* (Ida)

The reasons for not using lists were often to do with busyness in everyday life. For example, when participants' lifestyles were very busy with work and/or leisure time, they often didn't have, or simply did not want to make time to have a look at the fridge in advance of going shopping. Commonly too, participants often shopped opportunistically, for example, going shopping after work when they could, but without remembering details of what was at home. This was the case for Wilma:

> *"well you never know what there is exactly in the fridge. So shopping is nothing that is a planned act. If there is time after work one grabs something."* (Wilma)

'Not knowing' was further complicated in this household by the fact that both Wilma and her husband worked full time. They shared the shopping activities but without any strong coordination and it happened that sometimes both would have gone shopping on the way home from work so they doubled up, or neither did expecting the other to do so. Wilma and Noah are both very challenged in their jobs, Wilma running a tax consultant office and Noah being a controller in a big company. The quote 'If there is time after work one grabs something' refers to the busyness in their lives, where 'coordinated' shopping is just not as important as fulfilling their professional roles.

Planning however did not always turn out as expected or result in less waste for many participants and a key factor in this was the unpredictability of their lives. This was particularly so for the single participants who often ended up spontaneously going out in response to calls from friends. Hence they were unable to accurately predict or plan when they would be at home and so what food they would need. *"Maybe it is this single life, that one is much more out and about and not so much at home."*. Families also reported issues with unpredictability, albeit for different reasons, and not having regular food habits: *"with my husband eating dinner is very different, he is eating nothing or eating a lot"* (Ida). His quite unpredictable eating habits therefore made shopping planning very difficult for her – even when she thought she had planned she still ended up throwing out food because of his unpredictability of how her husband chose to eat. Summing up shopping is embedded in the social organisation of how busy people's lives are, how many hours they have to work (Wilma and Noah), how their beloved ones choose to eat (Ida's husband), and how they are spending their social lives (Susanna's busy single life).

Shopping routines

Participant's shopping routines, especially in relation to how often they shopped, often depended on factors other than just personal preference or social circumstance. For example, space for storing food at home was an important element, as illustrated by Hanna: *"our fridge here is very small and therefore we need to go shopping quite often"*. Also the more space people had for storing, the harder it was for them to be able to see quickly all that was in the cupboard or keep an overview.

Another element strongly implicated in people's shopping routines was the very functional matter of geographical access. For Sandra, and many of our participants who lived in Vienna, access was easy: *"luckily there are many food retailers around the corner."* This

was more the case for participants that were interviewed in Vienna, where a high density of smaller supermarkets provides easy access to food, though openeing hours are quite restricted with most supermarkets closing at 7:30 pm. However for the participants living in rural areas or a small village in Austria, this was not the case. They often reported having to go by car for grocery shopping or walk a longer distance.

Related to geographical access was also the means of transportation that people used. The frequency and size of shopping trips depended on if they went by car, bike, public transport, or by foot. This in turn highly depended on whether they lived in the city or in rural areas. In the countryside, every participant had a car and most of the participants used the car for grocery shopping. Only one out of 9 of our households in Vienna or Newcastle had a car, and all of them went grocery shopping by foot or bike. Frank, located in the city and a frequent shopper, discussed the importance of 'heaviness' and 'size' of products relative to the type of bag he has with him and what items he could fit into it. Similarly Ida, located in a little village in the countryside, stated:

> *"During the week shopping is daily or every second day. If the yoghurt runs out, or we need some fruits I do grocery shopping that fits well into a bag and which I can carry comfortably."* (Ida)

For these smaller more frequent shopping trips lists were considered to be less important.

Buying and over-buying

With or without planning, many participants mentioned buying more than they intended or really needed when they were shopping. A frequent example was imagining (or wanting) to cook healthy meals and buying foods for this, but then not having any time or energy to actually cook. Wilma described it this way:

> *"It happens frequently with vegetables, e.g. broccoli, because we [Wilma and her husband Noah] don't shop in any coordinated way. And you can feel like you want to cook something healthy and should buy vegetables at the food retailer – well, and then you buy and never cook them."* (Wilma)

Another common example was around 'economy of scale', namely that big quantities were cheaper than small ones, but this often resulted in buying too much and then it being thrown away.

> *"Well if I can have a big package for a little more money, why should I buy the smaller one? But in the end, if I throw away the rest of it, it doesn't add up, so this [buying big packages] is nonsense then."* (Susanna)

Over-buying was also caused by a lack of planning and not knowing what goods were already at home, as reported by Ida: *"I buy something that was already in the fridge and I was thinking is not there."* Over-buying can also happen inadvertently as discussed previously, in the case of unpredictability of presence at home due to spontaneous and busy lifestyles or in Ida's case when she did think she had planned meals and bought accordingly but then found

food didn't get used because of her husband's unpredictable eating habits). There were also occasions of special or 'out of the routine' purchases that could result in waste. For example, Yvonne reported *"when [my eldest daughter] comes for a visit I always buy this kind of cheese she likes so much"*. If not eaten by the daughter though, it would then be thrown out. Over-buying can also happen as a consequence of lack of action, as in William's case. He had a box of vegetables delivered to his home every week but always ended up throwing parsnip which he didn't like. He knew he should have changed the order or cancelled, but avoided it because the interface of the online-shopping homepage of the vegetable box service was very complicated. What becomes apparent in these everyday mundane experiences are the trade-offs that people make when they over-buy. Ida cares for her eldest daughter and wants to please her with buying the favourite cheese she likes so much, even at the expense it goes to waste in the end when not eaten up by the daughter because she herself does not like the cheese so much. Similarly William, who is aware that the parsnip that gets delivered almost weekly does end up in the waste bin in the end, but the process of changing the order is so complicated he does not want to invest the effort.

Organising food at home

The organisation and management of food, once brought into the home entailed another set of routine practices around storing, cooking, processing and gardening.

Storing

Most food brought into the home was not consumed immediately but was instead stored for later use. The routine practices of people around storage, tied up with the space available to them had significant influence on the durability and freshness of food and ultimately on food waste. Participants revealed very different ways of storing certain foods, depending on their living situations. It was obvious that those participants who had more space were also using it to store more food. For example, Jasmin lived in a big house with a big garden, and also stored food in her cellar. She produced jam out of harvested fruits in the summer and stores them in her cellar to eat in winter. All participants had 'systems' of having special places for particular types of foods. For example, many used particular shelves in the fridge for particular items such as vegetables, dairy products and meat. Participants in shared households had particular shelves in the fridge that were theirs to use. Fruits were often kept in a bowl on a table outside of the fridge, and foodstuff with a longer durability such as cereals or cans were grouped together and kept on shelves or in drawers. Some participants also had particular strategies for both making it easier to see what they had and to manage their storage 'aesthetics'. These were particularly important for being able to gain a quick overview of the cupboards, e.g., when planning lists and to keep track of what food is in the house.

> *"There is a ritual that [...] I free them [the cereals] from their packaging and put them into big glass jars. It also looks more fancy that way. [...] I do that deliberately to have a better overview of what I have."* (Susanna)(See Figure 4.2 (left) on page 47).


Figure 4.2: Susanna's aesthetic and practical ritual of freeing food from packaging to store them in "fancy" glass jars for better overview (left). Stephen discussed how to process the old apple because he does not want to throw it away (right).

Susanna brings a rituals to the mundane organisation of food that serves a practical as well as an aesthetic role. Practically organising the food in a "fancy" way in glass jars enhances the visibility and overview of what Susanna has stored, what is readily available and what is staying there already for a while. Aesthetically, freeing the food from its packaging signifies that the unwrapped food is a living material, something that deserves to be freed from packaging to be placed into a more deserving glass jar (see Figure 4.2 on page 4.2).

Cooking/using

Cooking practices varied greatly between participants and, as it happened, between the UK and Austria (with only 3 households from the UK this is obviously not culturally representative, rather just a note of difference as we found it). For Michael who lives in Newcastle, cooking was carried out to live rather than to enjoy: *"to me you eat to live"*. Rose and Maria reported cooking everyday with fresh food at the entrance interview, but seemed to have a great change in lifestyle during the Fridge cam study period and were heating up frozen and tinned food for cooking. Victor, coming from a Greek tradition of cooking with fresh food, tried to re-create certain dishes that reflected his family traditions such as salads and grilled chicken. Families had differently varied cooking practices again, having to deal with cooking for multiple people in the family who often had different routines and preferences. For example, Wilma and Noah's children ate at school so they tended to have simple evening meals during the week and only cooked 'properly' at the weekend when they had more time. Jasmin often cooked for five people, her daughter's family, whom she lived in the same house with, even though she lived alone.

Cooking is not simply an activity that involves processing food into something good to eat. For busy families it is often considered to be a daily burden that has to be done to provide family members with food. When time allows, cooking can be a celebration and a pleasure. Likewise it depends on available time and trade-offs with with other activities, such as going out a lot for Rose and Maria, and in turn not having time or the energy to cook.

Processing available food

Participants had different strategies to first judge if food was still edible or to be wasted. Reportedly, some relied on use-by-dates of products, though for vegetables and fruits the feel and smell was decisive. Food was then considered to be edible in certain ways and processing available foods was particularly important for vegetables and fruits that spoilt very easily. One strategy, discussed by Stephen, was to find alternative ways to cook or eat such food.

> *"I'm thinking about it [the old apple] more or less a week already, that I have to eat it. I reckon that it tastes not bad; I'm eating an apple like that still. I probably wouldn't bite off a piece and eat it but I'd cut it and eat it in a muesli or so, you can perfectly eat that."* (Stephen) (Figure 4.2 (right) on page 47).

Many participants engaged in very pro-active strategies to use the food they had with the aim of wasting less. Maria talked about adding 'mouldy' fruits to her porridge. Several participants described how they would first look in the fridge to see what was available and then decide what to cook and eat. In this regard, Yvonne talked about the differences between her life being employed and being retired, and between having children living in the house or not,

> *"In the past it often happened that I bought something where I thought I am going to cook something with that and then I didn't do it. Now this doesn't happen any more, because now I have a look [into the fridge] and say to myself: 'This is here and I should process it'. And then it is cooked."* (Yvonne)

Time and leisure for cooking was a reoccurring phenomenon in the data, where our participants mentioned how busy lifestyles affect cooking and processing routines or intentions. This becomes even more apparent in Yvonne's case, where she compares her different life situations when being employed and retired and in both phases being the person responsible for food within the household. Making choices about using available food also required energy and effort which for some was very difficult, especially as many had very busy lifestyles:

> *"There is a very tight time frame where I am actually very exhausted coming from work and wanting some rest and then I have to serve food to everybody [my family] and this I find exhausting."* (Ida)

For William time in general and spent at home was intertwined with food spoiling more often in particular weeks when he was absorbed in work and/or being out a lot.

There is also the matter of simply forgetting, often also associated with issues of time. Susanna, for example, talked about her intention not to throw away food.

> *"What I am really annoyed about is, because I think it is a pity, that I really throw away a lot of food - because I totally forget about it."* (Susanna)

Although Susanna is aware of these practices she feels she has no time or energy to do anything about her food waste. When time and energy for cooking was available, the Internet and online recipes was also a source of inspiration for participants trying to use up food and

8 participants mentioned looking up recipes on the Internet once in a while. They often described having food in the fridge that they didn't know what to cook with and putting these as search terms to look for recipe ideas. Another frequently cited strategy to prevent food waste was to buy food with greater durability, e.g. zucchini as a vegetable that is perceived to last longer than others. Another strategy was to process food to extend its use. During the home tour at Jasmin's house, for example, she showed her glass jars filled with jam made from fresh berries she had picked. Processing the berries into jam was a positive strategy to increase the durability of the berries and thus allowing for them to be eaten in winter.

Gardening

An interesting point of contrast among our participants was the different experiences of those who were able to grow some of their own food in some way. Hence, shops were not the only source of food for some of our participants. Brunner et al. (2007) highlight the connectedness of having or growing up with own production or gardening and a tendency towards sustainable food practices. We observed similar patterns with those participants who produced their own food, in the garden of a family house (see Figure 4.3 (left) on page 49), in pots on a balcony or window sill (see Figure 4.3 (right) of an apartment or on a farm. The important factors related to gardening and food seem to be: instantaneous availability and freshness, trust and valuing the food source as being connected to gardening and experiencing the planting, growing, harvesting or foraging for food in the wild.

Figure 4.3: Wilma's fresh and readily available vegetables for the summer (left), William's herbs in pots sitting at the window sill of his apartment (right).

In regard to instant availability and freshness, Jasmin pointed out that the main benefit of having fruits and vegetables readily available in her own garden was that *"I can harvest it when I want to"*, when it is needed and without a long transportation chain. The benefit of instant availability was also connected to freshness, as participants found that the fruits and vegetables not harvested remained fresh for some time in the garden. An added benefit was a decreased demand for storage space. Freshness was an important dimension in talking about gardening and also collecting fruits or mushrooms in the wild, as some participants also did. In addition to freshness as a significant benefit, Wilma pointed out that

self-grown foods tasted much better than products from the food retailer. Wilma's husband, Noah, agreed: *"The other day you made some cauliflower [harvested from the garden] which was just amazing, I've never eaten cauliflower like that before, it was simply so tasty."*

For participants, growing their own food was not only a matter of freshness and instant availability, but also of trust. Self-grown foods provided complete transparency in their origin and the methods and materials of production and harvesting.

> *"I never peel my own cucumbers from the garden, but when I shop them at the food retailer I peel them, as you never know how they were treated"* (Jasmin)

. The experience of handling food from source, through cultivation or collection, enhanced connectivity to and appreciation of where and how food is grown and sourced. Noah stated, *"if one harvests on his/her own, for example mushrooms or so, it tastes especially good somehow"*. Susanna adds more detail and explains,

> *"the own harvested vegetables are much less likely to be thrown away because you can see and feel how much work it is to grow and harvest them."* (Susanna)

This illustrates a close connection between the experience of growing and harvesting food and attributing more value to it. Having outdoor space to grow food can raise new relationships and meanings of waste. Anna, for example, was an organic farmer for whom regional values and sustainability were important. For her, food waste was not a 'problem' or connected with feelings of guilt, as food was simply passed on in the lifecycle, where leftovers and peelings were fed to her chicken, cows and pigs. Two other participants with a garden also had compost heaps where they transformed fruits, peelings and vegetables into compost that they would then use to fertilise the vegetable garden bed. Gardening is a contrasting experience to e.g. sourcing food at the supermarket, where gardening was not described as being a necessity that required planning or a discipline in not buying too much.

4.4 Discussion of everyday food practices

In the studies presented here we have been particularly concerned to gain a broad understanding of the everyday routines and practices around food and related food waste. From the interview and in-home tour data of 17 participants in 14 households, we identified rich and varied practices around shopping, organising, storing, gardening cooking, and processing. Across all of our households, we saw a similar overarching pattern where none of our participants liked to throw food away and they all reported having certain 'good' intentions, Philipp motivated by sustainability and other participants by ethical concerns, Victor in telling me that there is hunger in the world, or costs and Maria reporting about having to be careful with spending money on food. Most prominent was my understanding that the participants felt it was inherently wrong to waste food and it was hard for them to explain why it happened. The value or intention that waste should be avoided if possible was not reflected in everyday practices. While none of our participants wanted to waste food, all had occasions of food waste in some form or other. What was also clear was that food waste accrued through

practices happening at points of time often long before disposing the food and resulted from the social and material organisation of everyday life: buying big packages with the intention to save money as advertised at the grocery store; not planning, forgetting what was at home or not coordinating with a partner and so doubling up on buying (Wilma and Noah); having good intentions to use food bought but going out instead and having busy and unpredictable lives mostly due to working. Shove et al. (2012) provide an interesting theoretical perspective from social practice theory on the busyness and the intricate circumstances of everyday life.

> *People are somehow captured by the arrangements [circumstances] they sustain and to which they devote finite amounts of time, attention and resources.* (ibid, p. 162)

An example here is Ida having to cook for her family and at the same time being exhausted coming from work. Notable here again is also the quite restricted opening hours of grocery stores in Austria, where people cannot shop every time they want to as shops usually close at 7:30 p.m.

The study also uncovered the positive strategies people engage in to avoid waste such as: planning before shopping (William's shopping list), storing in ways that make it easy to see what is available and needed (Susanna's glass jars), being creative and frugal in using available food, processing food to extend its durability (Jasmin's jam made out of berries), buying less or the right amounts or growing their own foods in the garden. The closer people live with sourcing of food, the less food waste seems to be a problem, Anna as a farmer is not aware of food waste as she simply would reuse it in feeding it to her animals. In a similar vein I saw how the practice of gardening created very different relationships to food and waste. When participants grew and sourced their own food, they placed greater value on the food and reportedly discarded these food items less often since it could be picked freshly (Jasmin). It also changed their relationship to waste. This heightened an awareness of, and deep engagement with, the full pathway of food from production to either consumption through eating or consumption through recycling in a compost or in Anna's case, feeding it to animals. This is in contrast to other contexts where the physical engagement with food for the participants was from the supermarket shelf where food is consumed without any form of prior engagement or experiences, it is sitting there to be bought, either being consumed as food or not consumed and put into the bin. This is similar to what Strengers et al. (2011) report in relation to energy and water in the home, where water is carried invisibly into the home with a *"crucial material and perceptual disconnection between domestic water use and its ecological consequences"* (ibid, p. 197).

That food is wasted (or not), and that people have good intentions that are then not enacted are not new findings, of course [Vermeir and Verbeke, 2006]. What is more interesting is how these gaps play out in practice. The findings from this study point to some of the everyday inter-related factors contributing to this gap, some of which were also noted by Evans (2012). There is no simple path leading up to the act of throwing away food nor is it something taken lightly or planned for by the participants. Rather food waste is an often unintended and unwanted outcome of the negotiations between practices that are deeply embedded in everyday social, material and practical contexts [Blake, 1999] that create competing concerns.

Social circumstances

Broader contextual elements of organisation of life influenced and shaped practices and routines in interesting ways. The social context mattered and practices around planning, shopping, cooking, and eating were highly influenced by who else was in the home, such as partners' tastes, family members, or flatmates. This could be in terms of changing or competing preferences influencing what was cooked, or in terms of communication and coordination around what was bought or not, or in terms of social lives and prioritising opportunities to get together with friends over staying home and cooking available food. Even when significant or close others were no longer in the home they still had an influence, such as Susanna reporting that she still cooks vegetarian because her ex-boyfriend was vegetarian and she was used to cooking vegetarian only.

Busy lives through work have been reported by participants to play out in terms of energy and effort to invest in careful planning, shopping, buying and processing available food items. Social circumstances also play out in terms of the life histories, cultures and education of the participants, such as Michael's story of his mother, growing up in WW2 in a big family, who treats food very carefully and frugally. This family characteristic was passed on to him.

Material circumstances

Geographical and material context also shaped and constrained practices, such as participants in the countryside having access to a garden being more likely engaged in gardening activities than participants living in an apartment in a bigger and denser city with apartment buildings such as Vienna. The same geographical and material context played out regarding transportation in the countryside, where we could observe people going shopping by car more often. So it mattered what means of transport they had available (Ida: *"during the week I do shopping that fits into a bag"*), what supermarkets were accessible, how much storage space they had, how their working hours coincided with shop opening hours, and so on. One interesting difference between the UK and Austria in regard to accessibility was that supermarkets stayed open much longer in the UK and so simply created different opportunities for people to shop.

The prominent theme of over-provisioning was often connected to big packages of food offered by the grocery store. Hence the materiality of food itself and in which quantities it is available later on also is connected with its wastage. If the package is too big for a single household, and often grocery stores sell only bigger packages being less expensive (Susanna: *"If I can have a big package for a little more money, why should I buy the smaller one"*), it potentially ends up being wasted. These contextual factors, many of which participants had little control over, all impacted on where, when, how, and how often people could go shopping or engage in producing their own food.

Food waste as product of competing concerns

It is possible to frame the negotiations in everyday practices around food and waste as, in Schatzki's reference to Oakeshott, a *"set of considerations that governs how people act"* (ibid,

page 96). That is, for many of the participants in our study decisions had to be made across a number of concerns, for example, for the available time to shop or cook, the other people and family members who would eat the meal, or the storage space available to store ingredients. However, it is clear, as Schatzki (1996) points out, that these 'considerations' do not exist outside of the practices in which they are concerned. Instead, these considerations take on their meaning as embodied and enacted in the everyday practices around the organisation of food. Moreover, we note from the data that these considerations are most evident in the moments of discretionary consumption that are produced as dispersed practices and are transformed in the enactment of integrated practices.

Through a practice lens, the final action of throwing food away is not itself an integrated practice but a final act in a dispersed practice of consumption or, to be more precise here in relation to food waste, of discretionary non-consumption. Warde (2005) argues that *"all integrative practices require and entail consumption"* in some way. He defines consumption as

> *"a process whereby agents engage in appropriation and appreciation [...] of goods, services, performances, information or ambience, whether purchased or not, over which the agent has some discretion"* (ibid, p. 137)

and suggests that *"consumption could be considered a dispersed practice"*. Wasting food then is a moment interwoven into other practices and itself arises from multiple other moments of consumption across multiple other practices, for example, shopping, storing, cooking, processing, etc., that take place both inside and outside the home.

Shopping, as an integrated practice, for example, was conducted by some participants in the context of another dispersed practice such as 'living on a tight budget' (i.e., dispersed across any practices that entail spending money), leading people to choose larger packages that were perceived as less expensive but also increased the likelihood that they would later be thrown away as unused extra, as noted by Susanna. The dispersed practice of 'having a social life' often took higher priority than staying at home to cook food that had been bought, with all good intention to use it, but the discretionary choice to go out instead of cooking again increased the likelihood of the food not being used, as with William. And the dispersed practice of 'caring for the family' often resulted in taking more concern for the unpredictable eating preferences for the day than strictly using what was bought for cooking, as with Ida and her husband.

Busy lives and working practices were also entailed in moments of consumption in numerous ways: Wilma and Noah, who were very busy and for whom shopping became an incidental activity on the way home from work, often shopped without much forethought or without communication or coordination with each other, and William's busy weeks coincided with him throwing out more food. The efficiency of shopping, as managed by creating lists beforehand, was a trade-off between having the time to create the list, being organised enough to do so, and being able to easily see what was needed. While, for instance, shopping might be supported as an isolated, integrated practice, it is important to recognise that integrated practices also serve as a nexus for diverse dispersed practices. For our participants dispersed practices, such as 'living on a tight budget' or 'managing time', are intertwined

with integrated practices such as shopping. These integrative practices entail complex interrelationships and negotiations around competing values and circumstances.

The moments of discretionary consumption were often framed then by both the everyday practices and routines of life and these broader contextual factors. Further, some of the practices were perceived as the *non-negotiable* [Pierce et al., 2010, Strengers, 2011] and mundane parts of managing everyday life, such as balancing tight budgets and needing to eat. Thus, any design-intentions to support a reduction in food waste must respect the values and concerns of the individual as they negotiate these different relative priorities in situated moments of practice. This is particularly so given that for participants it feels already wrong to throw out food, and experiences around food waste are negative, except for Anna the farmer.

Food waste, then, is a complex issue when it comes to design. There are opportunities for interactive technologies to support and bridge spatial, social, or temporal constraints even though the majority of possibilities lie outside of the field of possibilities within HCI [Håkansson and Sengers, 2014]. Issues of being busy with other aspects of everyday life and the lack of energy that people experience in their daily lives that become implicated in food waste, are almost impossible to tackle as these issues dominate the social and material organisation of everyday life, being determined by the system people live in. These interrelationships among everyday practices, contexts, and values and the dispersal of moments of consumption across time and space (that can eventually lead to the final act of throwing out food) suggest that there is no simple or single design implication to draw out. It also seems clear that focusing design interventions specifically on reducing food waste is missing the point that participants were already very aware that their intentions not to waste food did not always translate into practice and were not comfortable about that.

Limitations of the study

The analysis of the material exposed competing concerns and the embeddedness of food practices in social and material circumstances as a critical in the process of food slowly transforming into waste. However, the practice of shopping incorporates sites and spaces outside of the home that were not covered with this study design. Instead, we focused on the home where the food is in the end discarded of. The challenge in studies concerned with food practices lie mainly in the pervasiveness of the topic itself. Food practices are a daily activity that pervade almost every aspect of our lives. We eat not only in the home but also at work and we consume food not only at the grocery store but also in the restaurant or the take away. Hence, a study covering every site of food practice is almost impossible to do. However, the study points to the complex interactions and negotiations people make when it comes to food and identifies over-buying as connected to broader issues of material organisation in the supermarkets or gardening being connected to values of freshness and instant availability. These examples are evidence that there are many competing concerns when people shop, buy, organise, cook, garden and eat.

4.5 Discussion of findings towards design proposals

Social practice theory provides an understanding frame to investigate the broader system of food waste and how it is embedded in the social and material organisation of everyday life, though its potential to think about *"radical ways of intervening for sustainable change"* [Pierce et al., 2013, p. 7] is less obvious. Maybe the issue is the limit of the field of HCI, where interactions between people and technology are naturally at the centre, and shaping non-technology materials and systemic change are beyond the core realm of HCI. Social practice theory is a social scientific theory and as such geared towards understanding and shifting towards the *"perspective on body, mind, things, knowledge, discourse, structure/process and the agent"* [Reckwitz, 2002, p. 252]. This theory is constructive in providing a lens to understand the social and material organisation of the present everyday life, rather than imagining and understanding interventions of future possible everyday life. Though for imagining a desirable future, we need to understand the present as a frame of reference.

To link to future design possibilities I drew on the collected interview material, literature as well as sketching ideas and thoughts. Please see Figure A.1 in the Annex on page 144 for an example sketch of such thoughts. The design proposals orient themselves to designing for an alternative future, a process accompanied through sketching. Sketches can provoke reflections and discussions about the social, cultural and ethical implications of technologies. I consider sketching out ideas that leave agency to the people as an arena to generate and play with artifacts taking a more uncritical as well as utopian rather than dystopian stance. Sketching supported the process of moving on from the problematising aspects of social practice theory.

I will present 6 design proposals, namely technologies to support #1 reflection; #2 informed choices; #3 communities of alternative practice; #4 re-connection to food sources; #5 promotion of public interest; and #6 activism. In doing so I do not claim or assume that all areas for consideration as well as proposed artifacts will lead to less food waste, or that every possible interventional strategy is covered. Instead, the emphasis in this section is on exploring possibilities taking a designerly perspective.

#1 Reflection

The potential consequences of the moments of consumption, and equally important, moments of non-consumption, with the unintended result of food waste are almost *"inescapable, momentary and occurs often without mind"* [Warde, 2005, p. 150]. Participants reported how routines with food were often determined by contextual factors and the wastage of food an unintended outcome. Connecting the moments of throwing out food with previous experiences can instigate reflection across these moments. This is the point where the first design proposal sets in: Digital technology does have potential to record aspects of everyday life, supporting users in understanding aspects such as experiences, behaviours, patterns, habits or emotions [Baumer et al., 2014, Fleck and Fitzpatrick, 2010]. As noted in the literature review in chapter 2, a proposition for moving beyond behaviour change technologies is to is to move from prescription to reflection [Brynjarsdottir et al., 2012]. A more specific example for food waste can be reconnecting the moments where food is wasted to previous experiences

and dispersed practices, e.g. in form of a diary. This design proposal is also connected to the case study in chapter 5, which engages with the question of how 'thinking about' enables an understanding of the experiences that led to food waste and to develop knowledge for further change through reflection. Reflection was also visible in other instances of my case studies, e.g. in the Foodsharing case study in chapter 7.

#2 Supporting informed choices

In the data, there were the obvious moments of discretionary consumption. These happened when people were at the shops buying food, or in the kitchen deciding what foods to eat. But what happened in that moment of discretionary choice was often in a chain of choices and the final outcome of complex negotiations and trade-offs between other concurrent practices and as well as practical constraints and values. The study material points to frequent over-provisioning of food through over-shopping or uncoordinated shopping. Seeing the lack of overviews participants had, positive practices such as planning can be of importance in getting an overview and making informed choices for purchasing groceries. Very organised households, in our case Ida, had an analogue way of placing food items in her freezer that need to be used up first ensuring that they are eaten up, a habit enabling to informing her choices more easily. A similar instrument could be reinterpreting the history tablecloth [Gaver et al., 2006] for a cupboard to transmit the temporal aspect of food and how long it stays there. Hence, being able to retrieve information in the moment of consumption (buying, shopping, preparing) can be beneficial and be supported through technology. To enable informed choices, technology can probably provide an overview of what food items are already provisioned in the home. This technology may become true in the near future through RFID tags on food items ('smart fridge'), and is studied at the site of the fridge through Fridge cam in chapter 6.

#3 Communities of alternative practice

Studying a community of alternative practice in this third case study is motivated by two findings from the interview material. First, the data suggested alternative practices such as processing old food or gardening/ foraging as practices being connected to valuing food sources. The value of alternative practices to mainstream food provisioning has to be highlighted here. Second, food waste is often the unintended result of the social and material organisation of everyday life, hence can be lessened substantially in changing social and material aspects. Being able to become active in a community of alternative practices can be key to such changes. Digital technologies are excellently qualified to connect individual consumers, households, farmers and retailers in a geographical area to share resources such as skills, food and gardens. Such communities can enact in local collaborative consumption in a shared 'economy' or thrive for shared experiences such as cooking or dumpster diving. Such communities are geographically bounded (community of place) and require a dense network of participants. People are also connecting widely over social media and social networking nowadays, and digital technologies provide and can provide accustomed platforms for users to communicate and share. Such technologies rise and fall with the initiative of en-

gaged community agents and members, as such sharing communities can only exist with a critical mass of active members. The third design proposal therefore focusses on communities enacting in digitally enhanced food sharing, as a counter movement to the predominant consumer culture. The case study around foodsharing[3] presents the mechanisms of such communities enacting and engaging in alternative practices and how they can be supported by digital technologies in chapter 7.

#4 Re-connection to food sources

The gardening related findings and how it changed the relationship to food points to interventions being potentially fruitful here. As we saw in the interviews, when participants grew and sourced their own food, they placed greater value on it. Historically, the material and social organisation of everyday life has changed substantially since industrialisation of food production and retail. Farming has become a profession that not many people carry out nowadays because of division of labour and more diversified fields of professions. This has implications for how close people live to food sourcing in everyday lives. The mainstream way of organising food is the grocery store, where food is readily prepared and available and no prior experiences and connections are made. Being closer to sourcing food can have an added benefit for valuing it more and, as a result, treating it frugally and probably less likely wasting it. Hence technology could intervene and facilitate re-connecting and engaging with food and food experiences. By some means the Foodsharing community addresses this design proposal and the case study in chapter 7. Other studies of re-connecting people to sources of food are concerned with community gardening and the values such communities impose on technologies to support them [Avram, 2013, Odom, 2010].

#5 Promotion of public interest

The interview data revealed that our participants despised wasting food and that it occurred inadvertently. Participants mentioned feelings of guilt when talking about food waste. However only one participant told me about systemic implications, from over-production of food waste to its ecological implications. Computing technologies do not necessarily have to serve functionality or provide a 'solution' to the wicked problem of food waste, they can *"function as a means of articulation towards the public"* [DiSalvo et al., 2014, p. 2404]. Without making issues public, they remain untold, unrevealed and unknown. Artifacts that engage the public can have the form of information visualisations, media, speculative and critical design [Dunne and Raby, 2013], or participatory design projects where the public is engaged in the design of an artifact, documentaries or storytelling. Policy makers can make the sustainable, ethical, agricultural and economical impacts of food waste more visible and public

[3] Foodsharing is a platform where, in contrast to case studies of food waste diary and Fridge cam, I was not involved in the process of designing and building the technology to facilitate foodsharing. I had, amongst others, the fiction of such an intervention (see Annex, Figure A.12 on page 155) before this community was born in Germany. Hence this case study is concerned with an existing community and technology using online ethnography. I am glad that this community was formed around such active community members as it allowed me to study such a productive and flourishing community

through using e.g. citizen sensing, interactive technologies in media campaigns or public installations. Social movements, activists, artists and NGOs use such interventions to raise awareness and engage with the public. As HCI has started to tackle bigger issues such as sustainability and health that have systemic implications, arguments to include such practices within HCI are well grounded. The promotion of public interest plays a key role in the Foodsharing case study in chapter 7.

#6 Activism

The findings of the interviews and home-tours point to the social and material circumstances that direct how people enact in food practices in everyday life. The social organisation of food practices not only depends on whom we share our lives with but have first and foremost a cultural and historical component. The material organisation of everyday life is visible in looking at the home of people and how they organise their food but even more when looking at grocery stores and how food items are sold (best before dates, big packages, etc.). Computing technologies can facilitate processes where activism is involved in changing these material and cultural circumstances and raise awareness similar to design proposal #5 where making things public is proposed. Digital technologies can support activists on an individual level, but also support communication and cooperation among individuals for collective action. Changing environments, instead of behaviours [Ganglbauer et al., 2012], requires several people acting together for e.g. physical protest, online petitions, lobbying at local supermarkets and any other form of action, ranging from digital to physical acts facilitated by social networking [Wulf et al., 2013b]. With social media becoming ubiquitous in today's society social and activist movements use these technologies to support communication, awareness-raising, collaboration, protest [Wulf et al., 2013a] and making things public in pursuit of the same goal. Notions of activism were visible in the Foodsharing case study to be presented in chapter 7.

From design proposals to case studies

These design proposals are very broad in their application areas, as well as in terms of the methods that they require. Technologies for reflection and informed choices are centred around individuals and hence require studying individuals' choice making and reflection, even though they can be embedded in collectives such as households or communities. There are connections between design proposals #1-#3 to case studies 1-3: the food waste diary as a first case study is connected to #1 reflection, the Fridge cam study as a second case study is connected to #2 individual choices, and Foodsharing as a third case study is connected to #3 communities of alternative practice. The connections here are more orienting rather than strictly guiding, as I intended to stay open for other phenomena studied in my case studies.

The choice on #1 reflection, #2 informed choices and #3 communities of alternative practice reflects my own learning process during my PhD research, where the case studies around the food waste diary, Fridge cam and Foodsharing appeared appropriate at the time where I started the interventions. #1 Reflection was studied because it is the basis of all other changes; without people being critically reflective they would not engage in a change of prac-

tices, alternative communities or activism. #2 Informed choices was chosen as a reaction out of studying and talking to individuals or household collectives and what they would need, where technology can provide information easily if people want to make choice. Foodsharing as a #3 community of alternative practice was studied as an approach beyond the individual, and was quite eye-opening and fruitful for seeing what is possible within communities.

Constraints of time and resources did not allow me to follow up with every design proposal, but I will discuss them more deeply in chapter 8, the final reflection chapter. The last case study on Foodsharing also incorporates ideas of the other design proposals of #4 Re-Connecting to food sources, #5 Promotion of public interest, and #6 activism. In fact, the design proposals are interrelated and occasionally hard to disambiguate. The Foodsharing community for example can be viewed mainly as a community of alternative practice, but also has activist elements in the ideology that matters to people. Beyond the ideology Foodsharing encourages people to engage with food sourcing and hence re-connects them to sources of food. People also need to be reflective and make informed choices if they are members of this community. These labels for my design proposals can hence be understood as proposals meant as suggestions rather than rigid structures of what levels of interventions are possible.

4.6 Summary of everyday food practices

In the study presented here I have been particularly concerned to gain a broad understanding of the everyday routines and practices around food and related food practices. The findings suggest that choices about food and waste are often determined by or embedded in the environment rather than the attitude or motivation of the participants and in diverse integrated practices of shopping, storing, cooking, gardening, etc. Moments where food is discarded emerge as a later consequence from multiple other moments of consumption, or respectively non-consumption, within practices. Participants negotiate between different concerns when they are shopping, storing, organising, planning, cooking and eating up.

While none of our participants wanted to waste food or intended to waste, waste was still an almost invisible and unconscious result of previous discretionary decisions, bound within practices. Based on the findings of everyday food practices, I have derived six design proposals which are taken further to case studies. The next three chapters will each provide a deeper engagement mainly with reflection, moments of consumption and communities of alternative practice. Reflection can be enabled by a mobile food waste diary and is presented in the next chapter 5. An intervention enabling informed choice is Fridge cam presented in chapter 6. Communities of alternative practice such as Foodsharing and the technologies this community uses are presented in chapter 7.

CHAPTER 5

Case study 1: Food waste diary application

5.1 Introduction

This chapter presents the first of three case studies of technology probes and interventions, the mobile food waste diary application. This study is motivated by the findings from the interview study, where participants were aware that they throw away food, but often could not report on why they threw away, which types, amounts or the frequency. To probe deeper on enabling such a reflection with the starting point of food waste, the mobile food waste diary application is intended for participants to capture and reflect back on reasons, experiences and occurrences connected with food waste. This chapter will at first describe the motivation of this case study and the intervention in more detail, and why the mobile food waste diary application was intended to support #1 reflection. Second in this chapter, the concept of reflection in digital technologies such as personal informatics is introduced along with a framework that describes different levels of reflection.

The third section will present the elements and interaction design of the food waste diary application, which enables people to capture various data about food waste: It will describe how the application works and what type contents it invites. The diary application was put online to Google Play (Android) and Appstore (iOS) for free to attract genuinely interested people to download, install and use the application. The findings of the food waste diary presented here are based on the data submitted by users worldwide. 843 entries were submitted during a duration of 18 months. These entries were quantitatively explored and qualitatively analysed. Both quantitative and qualitative findings will be presented and discussed more broadly as well as specifically towards #1 reflection.

5.2 Motivation for Food waste diary case study

As observed and described in chapter 4, throwing food away is just a moment embedded in food practices entangled with the circumstances of everyday life. Thus food waste is often described as an unintended outcome. More critically, people often feel inherently 'guilty' about wasting food [Evans, 2011a, Ganglbauer et al., 2013], but cannot often say why or from where these feelings emanate. As food waste is not simply the result of one occasion, person, or behaviour, it can be hard for people to understand the aspects leading to waste and therefore identify issues they can do something about. This points to an opportunity to think about how to support people reflecting on and understanding their own routines around food waste. In the case study presented here I explore the role of digital technology and its potential in recording data to reflect on previous experiences, habits and patterns [Baumer et al., 2014, Fleck and Fitzpatrick, 2010]. To this end we[1] developed a mobile food waste diary application for iOS and Android smart phones. This case study is intended to mainly look for reflection supported by technology, though at the same time stays open for different interpretations such as social and material cicumstances. The mobile food waste diary application was intended for participants to record instances of food waste enabling later reflections, as well as explore the rationales and experiences people would provide when throwing out food. We aimed to bridge the gap between the moment of throwing away food and the connection to previous experiences before that led to the food turning into waste. The intention was to support reflection both during the recording what food was wasted, as well as when revisiting the recorded data.

5.3 On Reflection

Reflection is a core element to many interactions being studied in HCI, from providing increasing self-knowledge through personal informatics, or changing behaviour through persuasive technologies. Digital technologies for reflection can record data automatically or require manual capture as in case of the food waste diary. In this chapter, the term 'reflection' can refer to an individual mental cognitive activity in examining previous occurrences that lead to food waste. But reflection can also be thought of as social activity, e.g. examining a household's collective data about food waste together in a group [Baumer et al., 2014]. Both, individual and collective approaches to reflection, are included in the definition of reflection here. What both approaches of individual and collective reflection have in common, is the purpose that reflection could possibly provoke critical thoughts or alternative actions through data examination or discussion:

"Sometimes the goal of reflection is not only to increase self knowledge but to take

[1] The team developing the application consisted of myself (conceptual idea, interaction design, logo design, product owner) and the bachelor students Georg Molzer (graphic design, iOS programming and server backend) and Christoph Fischer (Android programming). The interaction design was done in group meetings where concepts and suggestions were discussed iteratively towards user experience as well as feasibility for programming. We had several meetings discussing interaction design until the programming started.

action based on this increased awareness. Systems of reflection vary as to the extent that they support taking such action." [Baumer et al., 2014, p.96]

This level of reflection is also described as *"transformative reflection"* in Fleck and Fitzpatrick's [Fleck and Fitzpatrick, 2010] research, specifically reflection revealing an intent to change. They note that different definitions of reflection serve different purposes and present a framework for levels of reflections. These levels are presented as a means to identify reflection occurring and also to evaluate reflection later on in the findings [Fleck and Fitzpatrick, 2010, p.217 ff.].

Reflection in Personal Informatics

The food waste diary can be seen as related to personal informatics, where different areas of everyday life can be recorded for reflection. Personal informatics systems are interactive applications that support users in understanding various aspects of their life, such as experiences, behaviours, patterns, habits and emotions. Advances in new sensing technologies made personal informatics a popular topic for HCI research [Li et al., 2010] as it incorporates vast amounts of collected data for providing the user insights on their daily life. Li, Dey, and Forlizzi (2010) summarized four primary life domains and information sources for personal informatics systems, namely *exercise*, *general health*, *finance* and *journaling*.

Food waste is quite different to those areas and might concern only a certain set of interested people. While many such applications automatically gather user data, for instance, by actvitiy trackers [Epstein et al., 2014], other systems strongly rely on manual user input. Pirzadeh et al. researched journaling tools as a means to improve self-knowledge and propose a diary application as *"support tool to help individuals record and reflect on their experiences"*. These authors stressed that many factors are involved in the process of gaining self-knowledge including factors such as the clarification the own feelings [Pirzadeh et al., 2013]. The food waste diary connects to this research by the shared assumptions that the application takes advantage of manual data input for an in-depth *engagement* of the users with their own experiences, occurrences and feelings as opposed to more convenient but maybe unreflected automatic tracking. This deeper commitment would be helpful in uncovering *sensible* reasons people provide for food waste.

The role of data mining algorithms behind the scenes of personal informatics systems can be approached from a critical perspective and provoke participants to critically *reflect* about the influence of these computational mechanisms [Khovanskaya et al., 2013]. The effects of reflection in most research projects were described as *"universally beneficially"* and *"wholly good"* [Baumer et al., 2014, p.98]. Reflection on food waste adds an interesting instance potentially evoking negative feelings or emotions such as felt guilt (see chapter 4), as the Food waste diary encourages users to reflect on a rather 'uncomfortable' issue, namely own experiences and patterns that lead to wasting precious resources like food.

- *Description (R0):* Reportive account or statement about experiences and things without further explanation or reflection.

- *Reflective description (R1):* Reportive in nature with explanation or justification of reasons and experiences, without further reflection.
- *Dialogic reflection (R2):* Exploring different relationships between experiences and knowledge and considering different explanations or other viewpoints.
- *Transformative reflection (R3):* Revisiting experiences with the intention to change, reorganise or do something differently. Challenging personal assumptions and practices.
- *Critical reflection (R4):* Reported experiences are related to wider social and ethical implications. Considering the bigger picture and implications.

Different levels of reflection play out in different domains, and reflection is by far not only a core element to increasing self-knowledge or changing behaviour but also a crucial element for reflective design practice unfolding differently [Schön, 1987]: Reflection on materials and design processes incorporates the processes of *"reflection-in-action"* and *"reflection-on-action"*. Reflection-in-action supports people while they are completing a task, finding out what is different and how it can change thinking and doing. Reflection-on-action supports a process that happens after something has been done, e.g. a final reflection on an artifact where the own processes are evaluated and reflected upon.

The data submitted via the food waste diary was coded according to the presented levels of reflection (R0 - R4) to understand if the diary was used towards reflection.

Before moving on to the findings and elements of reflection in the data, the elements and the interaction of the food waste diary are described to provide an understanding what kind of information the food waste diary application invited.

5.4 Food waste diary application

Food waste diary[2] is a mobile application that allows people to capture occasions of waste. It encourages them to reflect on moments of waste and to connect to earlier experiences of discarding valuable food. The application has been developed to a stable prototype and has been freely available at Google Play[3] (Android) and the Apple store[4] (iOS) since 7 Dec 2012. People who are genuinely interested in their food waste can download this application. Indeed, the food waste diary was installed on 1065 devices and 843 entries have been submitted in the 18 months up to 5 June 2014.

The design of the food waste app was inspired by a paper version of a similar food waste diary offered on the homepage of the Waste Resources Action Program in the UK (WRAP) as a PDF to download for this purpose[5]. Consumers who are aware of the issue of food waste and want to collect information about how much food they actually waste and why, can do so by

[2] https://igw.tuwien.ac.at/foodwastediary/info/English.html

[3] https://play.google.com/store/apps/details?id=com.main.foodwastediary#?t=W251bGwsMSwxLDIxMiwiY29tLm1haW4uZm9vZHdhc3RlZGlhcnkiXQ..

[4] http://itunes.apple.com/en/app/id554162013?mt=8

[5] http://england.lovefoodhatewaste.com/sites/files/lfhw/2013%20-%20Love%20Food%20Hate%20Waste%20food%20waste%20diary.pdf

Figure 5.1: First screen when application has started (left) to insert reason, category, optionally picture, comment and price. Users can also enter the reasons why food was thrown away (right) and choose from a predefined list or generate personalised and customised reasons.

writing this information into the diary. It was also important for the mobile food waste diary to reflect sustainability values, as I approached the issue of food waste itself from a sustainability perspective. For this reason, food waste diary is designed to be used on smart phone technologies that people already own. The intention was to not introduce new devices or technologies, which would consume even more resources. Hence we use the most common platforms Android and iOS to offer a technology that can scale. The application is also made available in English and German.

The application offers the possibility to record information and to review a history of information. To record information, the obligatory fields for an entry are the reason why food ended up in the bin and the 'type' of food. Figure 5.1 (right) depicts how users can choose between 5 predefined reasons why they throw away:

- *"Visibility of food stock is missing"*
- *"Over-buying"*
- *"No shopping list"*
- *"Change of cooking plans"*
- *"Special offer"*

These categories are motivated by a questionnaire study that identified the most common reasons of disposed food in households [Glanz, 2008]. As we assumed during the design process that the mentioned reasons are not exhaustive for most users, the interface also offers the possibility for a user to specify their own explanation to capture the multifaceted nature of waste (see Figure 5.1, left). This provides a compromise between ease of use (through the pick list) and openness for interpretation (by enabling their own comments if they wish). The other obligatory field to be entered is the type of food, e.g. *"Dairy"*, *"Bakery"*, *"Fruits and vegetables"*, etc.).), drawn from standard food categories.

Then there are a number of other non-madatory fields of 'costs' and 'comment form' for free notes and the possibility to add a 'picture' (see figure 5.1). Enabling costs to be entered is motivated by my interview study [Ganglbauer et al., 2013] and other studies which indicate that costs are an incentive for consumers to waste less [Quested and Parry, 2011]. The comment form for free notes was motivated simply to enable people to add more content or stories to a food waste entry. Enabling pictures was motivated because, once included, it could be used for open engagement with the topic and further elaboration. Pictures were not part of the analysis as the emphasis was on reflective processes and text allows better to understand these. The location of the user is automatically detected with the in-built GPS sensor, if users allow the application to do so.

After a user has submitted an entry, the screen changes to the history of submitted food waste entries, with the option of seeing just personal entries or the entries of all people using and submitting to the food waste diary. Figure 5.2 presents an overview of three different views for history of food waste entries as:

- Consecutive list of entries ordered by time, Figure 5.2, left.
- Pictures that have been taken from food being wasted, Figure 5.2, middle.
- Chart with most common reasons why food has been wasted, Figure 5.2, right.

People can toggle between the individual or collective data by tapping the individual or collective icon on the top left of the History screens (see upper left of screens in Figure 5.2). To consider privacy aspects, the location of submitted entries is not visible in the collective history view. The identity of the person who submitted the entry is not visible, as data is anonymised in terms of the personal details.

The trigger for people to submit entries is the incident of food being thrown away [Bolger et al., 2003]. The event-triggered nature of the application means that users have to invest additional time and energy for the mobile food waste diary in case they want to capture their waste. The assumption at the start of the project was to provide people with a tool to support the reflective process with the mobile food waste diary application.

5.5 Methods in food waste diary case study

To understand real world use by people who are genuinely interested in an application that facilitates reflection on food waste, I chose to distribute food waste diary online at the Google

Figure 5.2: Collected food waste entries can be viewed as list (left), as collected pictures of food waste (middle) and as chart graph with most popular reasons (right).

Play and App Store on iTunes where the app could be downloaded, installed and used for free. In the study that I describe next, I was curious whether people would download and use such a tool, and if they did, how participants would describe their waste and whether these would prompt further reflections on everyday food practices. The data presented here is a result from users who might already be aware of food waste, hence motivated enough to install the app, and possibly want to know more about the whys and hows of their waste.

The choice of app store distribution as the basis for study and data collection is becoming increasingly common [Boll et al., 2011]. It was particularly appropriate for the food waste diary as it was important for me to target people who would be genuinely self-motivated by a concern for this issue; the app store route was also informed by the experiences reported in chapter 4 around the guilt associated with this issue. In the case of the data in the diary study, I can be confident that all instances of use were authentic. As also noted by [Cramer et al., 2011], there are methodological adaptations, as I did not have access to participants to complement the data collected via the app with qualitative interviews. Hence there are limits to what I can claim about the actual reflection and/or changes enabled by the diary, rather I focus instead of indicators that might suggest possible reflection.

To study the use of the food waste diary I focus on the analysis on the 843 submitted entries using a quantitative as well as qualitative approach. The data submitted via the food

Country	Reason	Type	Comment	cost	curre	ID
it_IT	Over-buying	vegetables	no waste		0 EUR	8d15f817d04a3b19c4e95e3b3dddd964
en_GB	was unwell	Fruits and vegetables	orange juice opened before ill. when well again had gone off. guessed cost		1 GBP	00a828affd838f66f62b84dd39716354
en_GB	Over-buying	Dairy products and eggs	bought box of 6 as 4s not available option. Cooked a quiche and a cake but unable to use last two.	0.56	GBP	00a828affd838f66f62b84dd39716354
en_GB	Visibility of food stock is missing	Drinks	last of bottle of lemon cordial open long time rediscovered in fridge	0.3	GBP	00a828affd838f66f62b84dd39716354
en_GB	was unwell	Dairy products and eggs	half carton lactofree milk. unable to finish as unwell and expired by time well again	0.5	GBP	00a828affd838f66f62b84dd39716354
en_GB	was unwell	Meat, fish and tofu	remains of roast chicken - by time was ill was not poss to freeze	0.75	GBP	00a828affd838f66f62b84dd39716354

Figure 5.3: Excerpt of data entries submitted via food waste diary.

waste diary was exported to a .cvs file and processed using SPSS[6].

As the application requires users to provide a 'rationale' and 'type' related to a food item, the most popular rationales and types of food thrown away, along with other quantitative data, is collated and presented. This quantitative analysis enabled me to get a broader picture about the most prominent reasons for and types of food thrown away, or how many entries were submitted with free comments.

Of the 843 entries, half (49,8%) have been submitted with a comment, a field that was optional and not required. Even though most of the comments were brief, they offered interesting insights and were qualitatively analysed using thematic coding [Braun and Clarke, 2006]. A representative excerpt of entries is provided as data evidence in Figure 5.3.

Concerning the data it is also important to note that users of the food waste diary did not have to register with an email to use the application as they were identified with a unique ID that is submitted along with an entry. The analysis is therefore based on public and anonymous data where links to individuals cannot be made. Due to technical reasons 182 entries were submitted without unique ID, hence they could not be mapped to a specific user. This only impacted the analysis of how many entries were submitted by the same user and how many entries were submitted from different countries. Otherwise the data is included in all other analysis.

The next section focuses on the qualitative thematic coding of these entries as well as counting occurrences of specific instances. The codes for the qualitative coding are based on the framework for reflection [Fleck and Fitzpatrick, 2010], where the data was coded for different levels of reflection previously described, namely *"R0: description"*, *"R1: reflective*

[6] http://www-01.ibm.com/software/analytics/spss/

description" , *"R2: dialogical reflection"*, *"R3: transformative reflection"*, and *"R4: critical reflection"*. During the process of coding an additional level of reflection emerged from the material that I name:

- *R5: Emotional reflection.* Emotional reflection reports on and connects specifically feelings with experiences, such as feeling guilty for throwing food away.

Besides the codes for reflection, I also identified instances of social and material circumstances in user's comments about wasted food. The qualitative data was analysed using Dedoose which allows for free coding as well as using existing codes and therefore met my needed requirements [7]. Figure A.4 in the Annex on page 147 demonstrates a screenshot from coding the material.

5.6 Findings: Quantitative exploration and thematic coding

The findings obtained by quantitative data exploration are presented first, followed by the results of the qualitative thematic analysis [Braun and Clarke, 2006] with a focus on the levels of reflection.

Quantitative exploration

The submitted entries (N = 843) reveal trends of people's experiences and 'reasons' why food is wasted. The quantitative data exploration points to *"Over-buying"* (N = 178) as the most prominent rationale, followed by *"Visibility of food stock missing"* (N = 96) and *"Change of cooking plans"* (N = 66). Figure 5.4 provides more details on rationales behind wasted food. Interestingly, 414 entries and accordingly 49,1% of entries showed reasons self-defined by users without the existing categories being used. I will present patterns in these instances in the section of qualitative findings.

Further data exploration reveals that the most thrown away items were *"Fruits and vegetables"* (N = 194), followed by *"Bakery"* (N = 116) and *"Meat, fish and tofu"* (N = 111). A more detailed overview is presented in Figure 5.5. Interestingly here again 27% of entries had self-defined food types submitted by users. These were more specific descriptions of the food types thrown away. For the existing entries with unique IDs it was technically possible to derive the country region of entries being submitted mostly from the US (N = 208), followed by Germany (N = 128), Great Britain (N = 128) and Austria (N = 128). A detailed overview is presented in Figure A.6 in the Annex on page 149. Submitted online content usually shows a pattern from very few active users to many users who are less active [Shirky, 2008]. Such a pattern could be observed with the food waste diary too. The user who submitted most entries had 133, followed by a user with 64 entries, another user with 38 entries, and further down a declining curve where 146 users submitted a single entry only. A detailed overview is presented in Figure A.5 in the Annex on page 148

[7] `http://www.dedoose.com/`

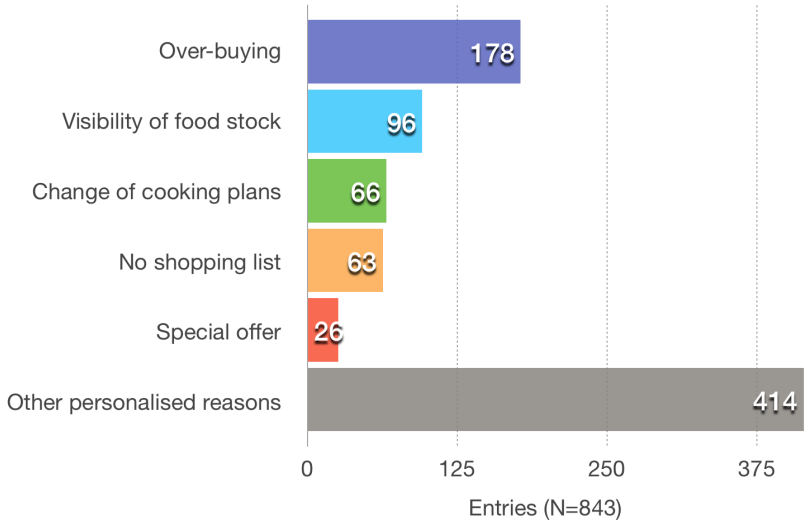

Figure 5.4: 'Reasons' that were most prominent in the submitted entries. 49,1% of entries were self-defined by users and not using existing definitions.

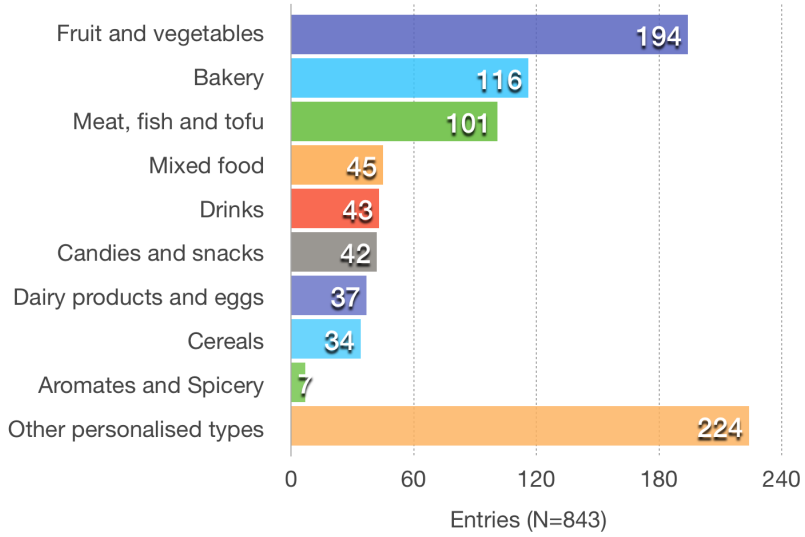

Figure 5.5: Food types thrown away. 27% of entries were self-defined by users naming more specifically what was thrown away instead of using existing categories.

Costs were submitted in 58,5% of all entries. Since this field was not obligatory in the food waste diary application (only 'reason' and 'type' were obligatory), entering costs appeared to provide an added benefit to users. Costs were being mentioned as a reason why

people want to waste less food [Ganglbauer et al., 2013, Quested and Parry, 2011], and this is confirmed here where it seemed to be popular for users to add estimated costs of food waste to an entry.

Qualitative accounts of reflection and circumstances

I will now describe patterns in self-defined food types and reasons, and the results from the thematic analysis of the comments. Submitted text in German has been translated into English to make it understandable for an international audience.

Given that 49,1% of the *reasons* submitted by users were self-defined I want to understand in more detail what users provided in their submitted entries. All were descriptive in nature. For example, there were many instances about the physical state of the food, such as *"leftover"*, *"overcooked"*, *"out of date"*, or *"mouldy"*.

Other submitted reasons mentioned emotions connected with discarding food such as *"don't feel like eating"*, or bodily conditions *"no appetite"* and *"migraine trigger"*. Social circumstances were also mentioned as reasons and submitted as self-defined text such as *"Susie didn't like it"*, or *"procrastinated about cooking"*. Connections between the busyness in life and discarded food were also evident, as time is needed to prepare and consume food at home e.g. *"haven't been at home enough"*. This has also been mentioned in chapter 4 and in [Evans, 2011a]. Similarly, there were comments about not remembering what was there: *"forgot in the fridge"*; cases similar to my studiy were partly attributed to lack of visibility into food storage areas and forgetting generally what food is there [Ganglbauer et al., 2012].

Of the submitted entries, 27% of food types were also self-defined. The analysis of these entries also, expectedly, points to more specific characterisations of items being discarded. Examples are *"fish taco"*, *"rice"*, *"pizza"*, *"chinese"* or *"yogurt"*. What is interesting here is the specificity of the food type and it is interesting to speculate on what memories and meanings are implicitly entailed in these descriptions for people, e.g., remembering the particular meal with the pizza, why it was decided to have pizza, who was there, etc.

Reflection in comments

More detail about experiences was provided in the free comment field, which was used in 414 (49,8%) of all entries. Given that this was a voluntary field, it is a statement in itself that people were prepared to make this effort in nearly 50% of entries. The comments, submitted along with the entries, provide more in-depth understanding of what people submitted in terms of thoughts, experiences, explanations and connec-tions. Of the 414 comments, most were *descriptive (R0)* accounts (173 instances), elaborating on the type of food thrown away, e.g. *"Baked beans"*, *"Remains of roast chicken"* or *"Cheese was moulded"*. This descriptive level is reportive in nature. It may be possible that users reflected on their entries while they were making the note or at a later point when revisiting them, similar to Schön's (1987) notion of reflection-on-action, but the note itself does not provide direct access to evidence of reflection beyond awareness.

There were 58 comments that can be described as *reflective description (R1)*, a description reportive in nature but with an explanation. Illustrative excerpts are

"Didn't agree with me"
"Salad that wasn't eaten for lunch - not hungry"
"Tried gluten free pop tarts - too dry and not sweet"

In these instances explanations about why something was thrown away were provided, from not liking something, to not being hungry, to some experienced aspect of the food item itself (*"too dry and not sweet"*).

Dialogic reflection (R2) was found in 30 instances of the data and suggests deeper reflection involving the exploration of relationships between food waste, previous experiences and other circumstances. One submitted entry for example provided a comment:

> *"Over estimated fruit consumption and ripening times. Did not get to mango or avocado before off."*

The exploration of different relationships here is evident: There is a relationship between buying a product, the estimation of how long it will last and at another point of reflection, the experience that the assessment was not as estimated. Another instance where different relationships were explored is in the following:

> *"I like buying new products. I tend to buy them without shopping list. I didn't like this taste."*

This user reflects on several experiences, habits and food waste. The user reportedly likes to try new products (a salad dressing in that case) and indicates it was an impulsive buy (without a shopping list), reflecting on the connections that this might result in throwing food out and why(*"didn't like this taste"*).

A step on from dialogical reflection is *transformative reflection (R3)*, a level of reflection where the intention to change is articulated. Six instances of transformative reflection were coded in the material, such as

"I don't want to buy so much any more"

This entry alone is very general but was submitted along with the food type *"Candies and Snacks"*, the reason *"Special offer"* and costs of "8 Euro". These fields connected together provide a broader picture on the intention not to buy snacks and candies any more.

The instances of *transformative reflection (R3)* share an intention to change or re-organise a habit or trying to reflect on experiences, patterns or habits that should not be repeated, such as *"Stop putting more on the plate than you can eat"*.

There is a specific instance of transformative reflection that is very interesting in terms of the various levels of reflection that come together:

> *"Wasted 1.5 bunches of kale because heard it's toxic to juice every day. Could have eaten sooner though but bought silverbeet instead and hurt back so stopped cooking etc. Dont buy 3 bunches at once."*

The comment expresses various relationships, between description and knowledge (*"heard it's toxic"*), alternative actions (*"bought silver beet instead"*), unexpected occurrences (*"hurt back"*) towards a transformative reflection (*"Dont buy 3 bunches at once"*). This comment is more like a little story in character, where the person who submitted the comment seems to not only reflect on the circumstances leading to the kale being thrown away, but already provides an alternative future action. This also reflects the complex negotiations people make in their everyday life and that food is not discarded carelessly.

Critical reflection (R4), where social and ethical circumstances are considered, were not traceable in the comments. Such deep reflection could probably be observed if I had been able to interview users of the food waste diary, asking the question if and how reflection was an issue in the use of the diary.

As described in the methods section I added another code to the levels of reflection that I described as *emotional reflection (R5)*, a code emerging out of the material. Studies on food waste have pointed to feelings of remorse and guilt when people talked about discarding food [Evans, 2011a,Ganglbauer et al., 2012], which resonates with the findings from this study. Comments that reflected emotions and feelings were found in 18 instances:

> *"I'm too full to finish all up. Pathetic"*

This comment was submitted along with the reason of *"Mixed food"* and *"Over-buying"*. The user submitting this entry frowns upon the discarded food; other instances even talk about being sorry for having to throw away food. One example is *"I'm very sorry but it was very disgusting and overcooked"*. Emotional reflection itself can be descriptive (R0), reflective descriptive (R1) and in some instances dialogical (R2), where an experience is related to an emotion such as being sorry but it is just not tasty. The emotion in many cases reminds of remorse or an utterance of dislike or tiredness. It suggests that the reflection on food waste triggers uncomfortable feelings when having to discard food. Hence reflection can cause *"inner discomfort"* [Pirzadeh et al., 2013].

Social and material circumstances

The data from the food waste diary also pointed to the social and material organisation of everyday life implicated in food being thrown out. Social circumstances describe broader con-textual elements in the organisation of everyday life that are influenced and shaped by the people we share our lives with. The social context mattered and practices around planning, shopping, cooking, and eating are highly influenced by who else lives in the home. The food waste diary pointed to 13 instances of specific social circumstances such as *"Bad communication/no coking combination found"*. Social circumstances point to communication or throwing out food because of over-provisioning (*"packed too much for Susan's lunch"*) or having bought more than wanted *"My partner bought too much"*.

Additionally there were also material circumstances where a user noted about their egg purchase:

> *"bought box of 6 as 4s not available option. Cooked a quiche and a cake but unable to use last two."*

This quote can be interpreted in terms of the materiality of food packaging and in which quantities eggs are sold in the super-market, as eggs are only available in a pack of six but not four. The quote could as well be interpreted as concerning the social organisation of everyday life, as the user was *"unable"* to use the last two eggs for some reason. Hence the quantities, the material aspects of the package and the norm of having smallest packages of six eggs in the supermarket, also contributed to food being thrown out in the end.

5.7 Discussion

The findings in chapter 4 point to the complexity of food waste and the difficulties people have in accounting for how it comes about. Hence the focus of this first case study is the design and evaluation of a mobile food waste diary to support reflection. In summary, 843 entries were submitted over 18 months and different levels of reflection were visible in the comments submitted with food waste entries. It is interesting to note two levels of effort. Firstly, the entries are not passively measured or automatically added to a database but have to be entered manually, triggered by the event of wasted food, hence requiring initial effort to remember to take out the app to use it. Secondly, and more interestingly, free text was added by participants not only in the comments but also about self-defined food types and reasons, despite the provision of a category list: 49,1% of entries defined their own 'reasons' for wasting food, and 27% of the food types were self-defined. Moreover half of the entries included comments additional to their entries. This points to the significant additional effort people were prepared to put in to personalise and reflect on what and why they throw away food. I suggest that this additional effort might encourage a more active engagement with reflection, as for many entries the predefined options were not used. This supports a design approach to offer *open-ended* and *free interactions* in personal informatics systems that aim to support reflection.

The focus on waste itself, as a result of the socio-technical and the conceptual intention behind the food waste diary, provides a deeper insight about food waste as being strongly connected to the social and material circumstances in which food practices are embedded. Thus the data from the mobile application also enabled me to gain a deeper insight into the issue of food waste. In these instances social circumstances such as 'bad communication' or material circumstances of 'packaging' were reflected upon and presented as rationales for wasted food. These rationales point to the interrelated nature of everyday life and food practices. The rationales that people provided were manifested in the comments and self-defined reasons users submitted. Reportive accounts or descriptive reflections were most common, where users described in more detail what they threw away (*description (R0)*) or why (*descriptive reflection (R1)*). Instances of *dialogical (R2)* and *transformative reflections (R3)* were less often encountered but offered deeper insights about the relationships between food waste, previous experiences, habits, knowledge and intentions to change, e.g. *"I don't want to buy so much any more"*.

Processes of reflecting with technology

Schön's concepts of *reflection-in-action* and *reflection-on-action*, though concerned with design processes, are interesting here as they describe two different processes about when and how reflection can take place. *Reflection-in-action* takes place while people are enacting in an activity and making connections. Reflection-on-action takes place after a process or artifact has been completed, as a reflection on what has happened [Schön, 1987]. I will borrow these concepts for reflection supported by the mobile food waste diary. Reflection can take place at the moment where people are discarding food and reflecting on why they are, as reflection-in-action. While wasting, a user might already reflect on submitting the data to the food waste diary.

Schön's concept of *reflection-on-action* describes final thoughts and reflections enabling one to think about past processes. For reflection-on-action, two different forms of reflection can be discerned in the use of the food waste diary. First I could observe instances of *reflection-through-recording* when manually entering data through making connections between experiences, occurrences and why something is thrown away, how much the food cost, what different actions it might provoke and so forth. The second point of reflection-on-action can take place after an entry has been submitted through *reflection-through-revisiting*.

The speculation here, and evident in instances of the data, is that manually entering the reasons for food waste supports the dispersed reflective process through *reflection-through-recording*. I further speculate that this is likely to lead to increased understanding, addressing the barriers to reflection raised when data is automatically recorded through connecting moments:

> *"Barriers in the Reflection stage prevent users from exploring and understanding information about themselves. These problems occurred because of lack of time or difficulties retrieving, exploring, and understanding information."* [Li et al., 2010, p. 562]

Changing routines

Intentions to change certain aspects to waste less were visible in instances of *transformative reflection (R3)*, where users noted down their thoughts. A critical perspective might argue here that the intention to change does not imply that change is going to develop, and I am only able to study the *intention to change* here.

The food waste diary application was offered to people who were genuinely interested in making visible for themselves certain aspects of food waste. They can search for applications like the food waste diary as an opportunity to change:

> *"Opportunities to break habits have also been utilised: in addition to moments in people's lives where they are more amenable to change, such as retirement [...], increased visibility of food waste in the home is also a good opportunity to change behaviour. Examples include completing a food diary or placing all food waste generated over a week in a separate receptacle."* [Quested et al., 2013, p. 50]

The literature suggests that major life events or a dedicated time to use a diary can elicit transformations. Assuming that inherent motivation is significant, e.g. as a result of life transitions, recruiting people who are genuinely interested is key and was our main motivation for this study. All in all 843 entries emphasise that there are some people who desire to reflect on food waste practices and some of the comments point to deeper reflective processes that have taken place. The entries are a testimony of people's desire and enactment of reflection on discarded food.

Final reflection

I also engage here with the general critique of technology interventions aimed at individuals or households. This is important as behaviour change or motivational theories, where data is presented as feedback in a quantified way, are often critiqued [Strengers, 2014] for singling out specific behaviours, aiming to address it without considering the broader circumstances. These approaches are often too simplistic and treat human beings as being guided by rational choice rather than negotiating the complex circumstances we live in and in which our food practices are intertwined [Strengers, 2014]. A second point of critique is more systemic: Supporting change on any level, e.g.through reflection, carries the critique of not being radical enough for sustained change. Erickson et al. [Erickson et al., 2013] speculate that a radical change in using less energy for example might only be possible through 'crisis or prices' or both at the same time. In terms of food waste, there is data that also points to this argument. For example, the 13% reduction of food waste between 2006/7 and 2010 in the UK can be connected to increased food and drink prices and reduced incomes during that time [Quested et al., 2011].

Nonetheless the fact that the applications was used and seemed useful for some, suggests that we should not entirely abandon individual technology approaches; the food waste diary shows that such approaches can have benefits as well for self-motivated individuals. There is nothing inapt about supporting people who want to reflect on why, how much and which food they waste, being aware this might not lead to fundamental change and might only reach a certain set of people. The users of the food waste diary application submitted entries because they wanted to know how much they throw away and some mentioned the intention to change routines. They did so through manually capturing, making connections and reflecting on those entries.

As designers of interventions we have to be aware of the choices we make; in addressing individuals we should respect people's choices in the complexity of everyday life. The food waste diary application was not designed to recommend any actions, but for enabling people to capture their own connections between experiences, reasons, occurrences, types of food, or optionally costs. I argue for an approach of digital interventions where a holistic and open technology experience such as this is offered to users, where they can creatively define, also in addition to automatic tracking of data, why and what type of data they want to enter for reflection.

Strengths, Limitations and Future work

As noted previously, I made a conscious decision to offer the application worldwide at the Apple and Google Play market to collect data from intrinsically motivated people to use the application. I also intended to keep the threshold to use the application as low as possible, hence users were not obliged to register with email address and password. This came with the trade off though that I was not able to recruit diary users for a more in-depth interview study. Such a study would enable me to gain deeper insights on reflection-through- revisiting and help to understand if a transformation of individual or collective household actions take place after transformative reflections.

I intend therefore to carry out further research on the process of reflection-through-revisiting and as future work I intend to recruit users of the food waste diary for an interview study through a pop-up screen on the mobile application. This will enable me to understand how the diary is used as part of people's broader strategies in addressing food waste and its potential for reflection in a direct conversation with participants.

5.8 Summary of Food waste diary case study

The case study on the food waste diary application probes on people's food waste experiences, reasons and the connections they make. While the design intention is to open the space to instigate reflection, it also informs a richer understanding of the complexity and competing concerns that lead to wasted food. The quantitative findings inform us about 'popular' reasons for food waste ("over-buying") and that interestingly, half of the entries provided a personalised 'reason'. This points to the effort people are prepared to make and the complexity of the phenomenon of food waste, where simplistic answers to where and how something is thrown away do not exist for most cases. The complexity becomes visible in some instances of the qualitative thematic analysis of free comments, uncovering the unintended nature of food waste in everyday life through its social and material organisation and unexpected occurrences. The intention of supporting reflection was visible in some instances of submitted entries where deeper insights about the relationships between food waste, previous experiences, habits, knowledge, occurrences and intentions to change were offered. Qualitative interviews with users of the food waste diary are a subject for future research to better understand the role of reflection and how the diary facilitates it while entering the data manually (*reflection-through-recording*) and revisiting it for reflection (*reflection-through-revisiting*).

CHAPTER 6

Case study 2: Fridge cam

6.1 Introduction

'The' second case study will engage with Fridge cam as a technology probe that probes into the approach of #2 supporting individual choices through providing information and visibility in-the moment. First the motivation for Fridge cam is presented as emerging from the interview material, where participants reported on over-shopping and lack of overview. Second, the concept of individual choices is explained and the necessity of visibility and in-the-moment choices. The working mechanics and interactions of Fridge cam are presented third. Fridge cam is a technology probe that automatically takes pictures of the inside of the fridge and makes them accessible to household members.The findings from five households that used Fridge cam for a period of one month are presented in narrative stories and discussed towards everyday practice, individual choice, and reflection. Time-lapse videos of the Fridge cam images also support #1 reflection on everyday life at the home.

6.2 Motivation for Fridge cam case study

During the interviews I recognised that over-buying was a prominent theme told again and again by participants. I recognised during the in-home tours that the fridge plays an important role in the storage of fresh food in the home. Additionally the interview data pointed to the obvious moments of discretionary consumption and, by extension for waste, of non-consumption. These happened when people were at the shops buying food, or in the kitchen deciding what foods to eat. But what happened in that moments of discretionary choice was often in a chain of choices and the final outcome of complex negotiations and trade-offs between other concurrent practices and as well as practical constraints and values. The interviews as well as the findings of the food waste diary application point to frequent over-provisioning of food through over-shopping or uncoordinated shopping.

6.3 On informed choices

Seeing the lack of overviews participants had, positive habits such as planning can be of importance in getting an overview and purchasing what is needed. Though as the interviews also revealed, not everybody is willing or able to plan. Hence we want to probe if being able to retrieve information in the moment of consumption (shopping and planning) can be beneficial. Fridge cam theoretically enables members in a household to look into their fridge to see what they still need or what is already there.

The basic assumption behind individual and personal choices is that aware consumers can make #2 informed choices. In the context of HCI this approach is well established [Froehlich et al., 2010] and lends itself to measurable results, e.g. people using less energy in their homes after having information feed-backed to them. This approach is also heavily criticised, as such systems often neglect the circumstances of people's everyday lives and do not aim for holistic cultural and social change [Brynjarsdottir et al., 2012]. Yet, thinking of a future where 'smart' fridges might enable people to track their food items automatically, what if people could make informed choices during shopping activities, would they make use of such technologies or not?

Following these motivations and questions, Fridge cam was designed, developed[1] and deployed in five households for the duration of a month. The probe was aiming to stimulate further reflections around informed choices, as well as opening up other possible uses [Hutchinson et al., 2003]. The aim of this study was to focus on informed choices, but at the same time being open to other interpretations such as enabling #1 reflection through time-lapse videos of the fridge or the role of visibility.

6.4 Fridge cam system

Fridge cam enables people to transcend space in looking into their own fridges from other places such as the grocery store or their PCs at the workplace. An estimation based on the fridge cam pictures of what food items are in the fridge aims at supporting in-the-moment shopping planning. The technology behind Fridge cam is a low-cost mobile phone (Android Nexus S) attached to the inside of a refrigerator or 'fridge' door (see Figure 6.1 on page 81) to be able to take pictures of the inside of the fridge. For every second that the fridge door is opened the accelerometer sensor in the phone triggers the camera in the phone to take pictures through an attached fisheye lens (see Figure 6.2 on page 81) and uploads it to a dedicated Web page on a Fridge cam domain. Users could access the latest 15 captured images through browsers on smart phones, tablets or computers.

The study aimed to probe whether participants would pro-actively seek out Fridge cam images when planning for shopping and make informed choices. I was also curious how

[1] Fridge cam was conceptually designed by myself. I was also driving the development of the application and programmed it with kind support from Florian Güldenpfennig (Java code base), Ashur Rafiev (Java support and PHP backend) and Stephan Lohwasser (method for smoothing accelerometer data). Mathew Kipling (industrial design) designed and built the Fridge cam holder.

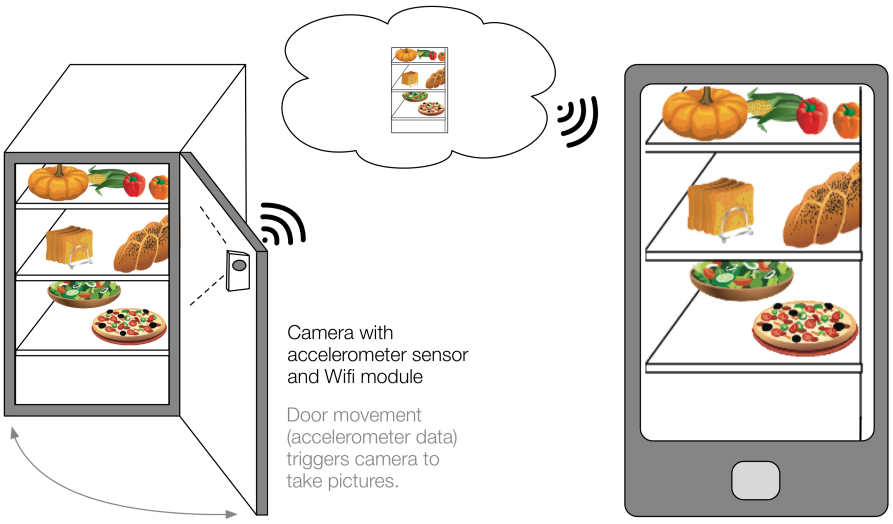

Figure 6.1: Functionality of FridgeCam using movement data to trigger the camera to take a picture of the inside of the fridge. The pictures are sent to a dedicated webpage the participants in a household had access to.

Figure 6.2: Left: Real world implementation with camera. Right: Picture taken by Fridge cam.

participants would access the images and whether these would prompt further reflections on everyday food practices through seeing the contents of their fridge.

6.5 Methods in Fridge cam study

The Fridge cam system was deployed in five participant households for one month: three households in Newcastle, UK, and two households in Vienna, Austria. The households were recruited through my extended social network in Vienna and through Rob Comber's in Newcastle. There was uniformity among the households with all being familiar with technology and smart phone use, see Figure 6.3 on page 82. Fridge cam was installed in participants' fridges directly after the in-home interview and tour (see chapter 4). Participants were given no instructions other than a technical sheet with the link to the web site and instructions in case of technical problems (see Figure A.10 in the Annex on page 153). Participants were asked to use Fridge cam as they desired.

Name	Gender	Age	Living	Housing	Social situation
Susanna	f	29	Vienna, Austria	Apartment	Has a boyfriend, lives alone in a household
Philip **Frank**	m m	31 26	Vienna, Austria	Apartment	Both single, live together in a household.
Rose **Maria**	f f	24 24	Newcastle, UK	House + backyard	Both single, live together in a household
Michael	m	57	Newcastle, UK	House + backyard	Lives with landlady and another lodger
Victor	m	24	Newcastle, UK	House + backyard	Lives with 2 other flat mates

Figure 6.3: Participant table of households taking part in the Fridge cam study in Austria and the UK.

During the one-month study period participants were contacted twice via email or personal visit to elicit reports on their experiences so far. Web site traffic was also captured using Google Analytics[2], to track visits from countries and mobile versus non-mobile browsers. This data was captured at the total domain level not broken down to specific Fridge cam pages. At the end of the month, closing interviews were conducted, exploring questions around technology use, experiences with Fridge cam, and situations when the Fridge cam Web site was looked up. Emails reporting on experiences and use were collected along with logs of all images uploaded to the Web. Time-lapse videos[3] were created (see Figure 6.4 on page 83) from all the taken fridge-pictures of every household. During the closing interviews

[2] http://www.google.com/intl/en_uk/analytics
[3] http://www.youtube.com/watch?v=oJOYo0o_Uz0

the according time-lapse videos were watched together with participants to open up further reflection and discussion.

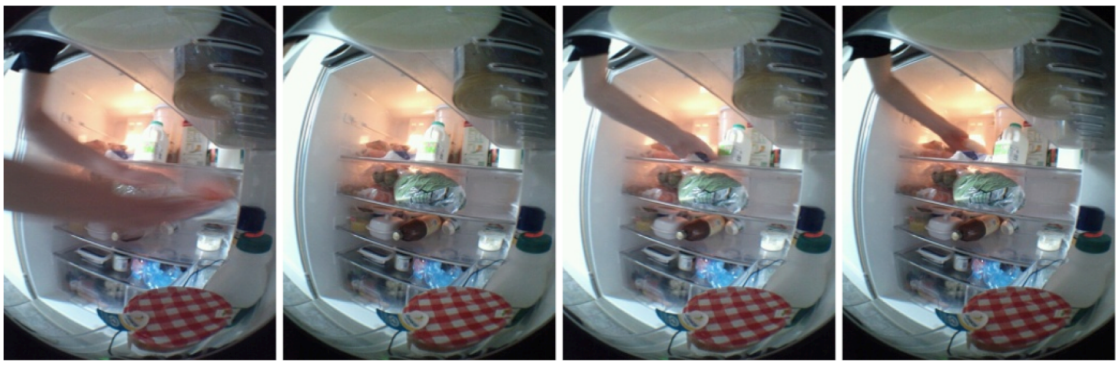

Figure 6.4: Consecutive images of Fridge cam forming a video.

6.6 Findings: Fridge cam stories

The most frequent users of Fridge cam were Susanna, Philip, and Frank (both the Austrian households). In total they made 56 visits (14 from a mobile device), which lasted on average 4:19 minutes, and regularly used Fridge cam to support shopping activities. Other users used it less frequently as they did not go shopping (Rose and Mary), shopping as a process that was already very organised and disciplined in nature (Michael) or Victor, who preferred fresh food over planning and economical use. An overall tendency of the well known novelty effect can be observed, where pictures of the fridge content were visited less over time (see Figure 6.5 on page 83). Though all the participants expressed an interest in keeping the Fridge cam system beyond the period of the study.

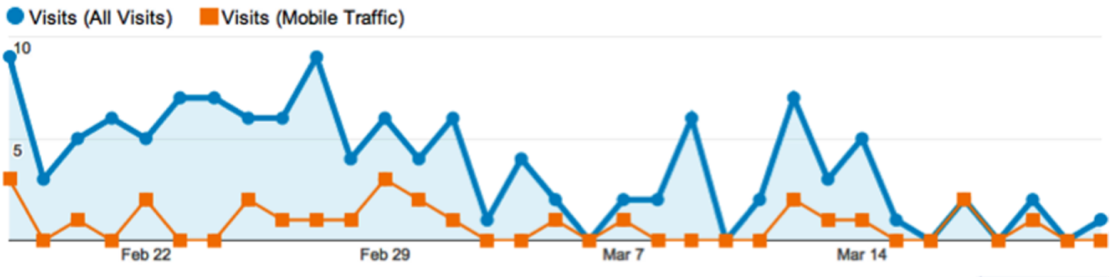

Figure 6.5: Access to all Fridge cam Web sites over the course of the study. Blue (dark grey) dots represent all visits, while orange (light grey) quads show visits from mobile devices.

Susanna — pragmatic use

Susanna lived alone in a flat in Vienna and found the Fridge cam particularly useful for managing the balance between wanting to cook and eat fresh vegetarian food, but not being at home often due to her busy working and social life. Fridge cam enabled her to do shopping planning just as she needed it:

> *"So I often look [at the Web site] from my PC, for example, when I am heading off from work and think: 'Do I have enough to eat at home? Do I have to stop at the supermarket? And then I can have a short look into my fridge."*

Susanna also accessed the site from her mobile while at the shop. She valued Fridge cam's support to only buy what she needed without having to think too far in advance, as she thinks it is a *"pity"* to throw food away. Though at the closing interview Susanna told me how she would still forget about food in her fridge and waste much more than she intended to. That being the case Fridge cam was experienced as being useful by Susanna, but still the interventions was not so radical as to substantially abandon habits around buying, cooking and eating.

Philip and Frank — from quantities to visual images

Philip and Frank both worked in a technical domain and shared a flat together. They tried to coordinate their shopping activities by calling each other or chatting via instant messaging. They consumed large quantities of milk, though the precise volume changed from day to day. Frank did not use the Fridge cam Web site because he wasn't interested. Philip was the active user in the household and placed a preview of the Web site on the starting window of his browser (see Figure 6.6 on page 85, left) so that it was always *"at hand"*. Similar to Susanna, he reported using the Web site to assess what he had to buy (for example, how much milk) at or near the time when he was going to the shop. He accessed the site from different places, for example, from his desk at work and also from his smart phone when travelling by underground train. Using Fridge cam changed his perception of the fridge itself and he now thinks of his fridge as the Fridge cam version of it:

> *"Traditionally I thought about my fridge in terms of quantities like how much milk we have left, but not only that this picture wouldn't have come to my mind previously, when I visualise our fridge now, I can really see the Fridge cam picture in my mind."*

The usage patterns for Michael, Victor, and Rose and Maria (all three households in the UK) were quite different from Susanna and Frank's usage. Here it is not possible to report a lot about informed choice as these households did not really engage with the technology. Though it tells us even more about the dominance of everyday life over interventions. In total they accessed the site 50 times (12 from a mobile device) but in contrast to the Austrian households, their visits only lasted on average 47 seconds. They were all apologetic that they hadn't engaged with the Fridge cam more and in fact said they frequently forgot that the Fridge cam was in their fridge or that the images were available to them on the Internet.

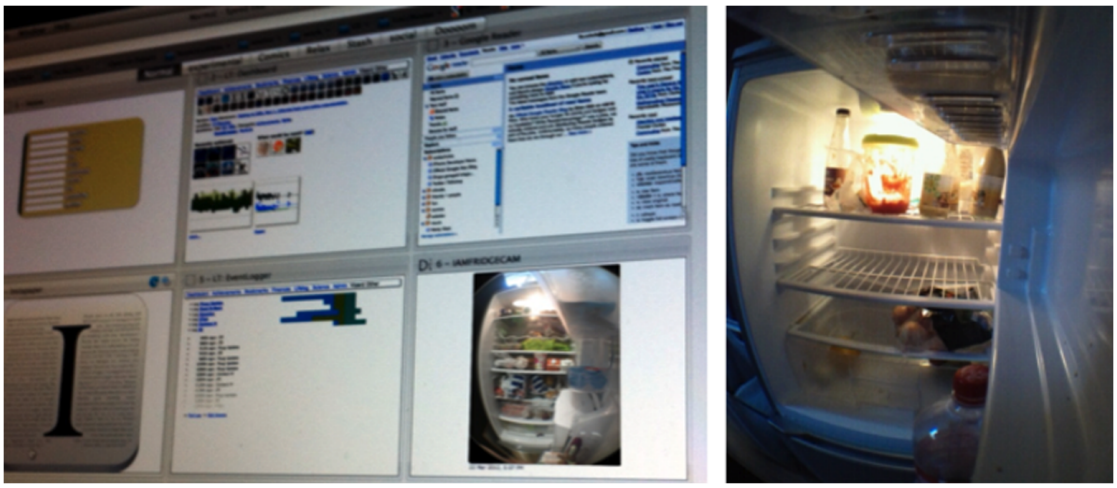

Figure 6.6: image from Maria's and Rose's fridge they thought to be very empty (right). Philip uses a FridgeCam preview at the starting window of his Internet browser (left).

Michael — organization and discipline

Michael lived very healthily, though he had to count costs as he was a *"poor student"*, and he would also calculate his minimum nutritional requirements to support his exercise regime. As such he really needed to be efficient and organised, both with his time and costs, often trading off taste or enjoyment of food and shopping for the same things every week. Being so organised and disciplined, it was understandable then that he didn't use the Fridge cam to support shopping. Michael found, however, that the time-lapse video of the fridge was valuable for capturing people's stories. Watching the video of his own shelf in the fridge, he commented that: *"it tells . . . that my habits are incredibly consistent."* As the fridge was also shared with his housemates, the time-lapse video also showed the shelves and activities of his housemates. Here he reflects:

> *"when you get it [the Fridge cam images] in series it actually tells the story, the problem is trying to understand what the story is."*

While he could understand his own practice, the changing food on his flatmates' shelves described a different set of practices. He said:

> *"quite subtle. It is not like quite, you know, dramatic in any way, but there is a story about something, I suppose food storage. The food storage story."*

During the closing interview, Michael affirmed how consistent his routines around shopping and provisioning were and saw this reflected in the video.

Rose and Maria — reflecting on past food practices

In Rose and Maria's house, it was Maria who took on the responsibility for the food. She reported that she was very conscious of what food they ate and was the one who wrote the shopping lists and was also very careful about costs and not to shop too much. They also reported cooking every day with fresh food at the entrance interview.

After the study period though, their reports and the Fridge cam video painted a very different picture to how they previously reported that they organised their food. Looking at the time-lapse vidoe of the Fridge cam images, they were surprised to see how little food was actually in the fridge over the course of the month (see Figure 6.6 (right) on page 85), leading Rose to wonder, *"How do we live?"* The Fridge cam showed them that the reality of their everyday practices did not reflect their aspirations about appropriate food practice or their perceptions of their own practices. Just as Michael had wondered what the "food storage story" was for his flatmates, so too did Rose and Maria, this time pondering what their own 'story' meant. Here they could reconstruct cooking particular meals, but did not recognise the overall pattern. On reflection they discussed that they had eaten out a lot as they went out a lot and when they did eat at home they ate mostly frozen or tinned food as they were also on a tight budget *"food from the cupboard"* (Rose) as they called it:

> *"It is cheaper to buy frozen food, frozen vegetables"* (Maria); *"tinned things . . . it doesn't go off"* (Rose).

The story of Rose and Maria is again a story of social everyday practices that are crucial, they have to live on a tight budget and surely want to live their social lives. They found their own way of not wasting too much food in buying food that lasts longer and is available when needed, even though it means that it is tinned or frozen.

Victor—a Fridge to Communicate Presence

Victor also did not use the Fridge cam Web site frequently. When asked if he saw any changes in his food practices during the deployment he commented:

> *"I don't see any big changes, I guess my fridge is the same all the time. So that proves what I am thinking about how I am using the fridge. So I am using the fridge just for buying things, just the things for the day. So I guess the [time-lapse] video proves the, this thing that I don't buy many things sometimes. And some other day the fridge is empty."*

Victor's only food waste, based on self-report, was caused by the supermarket not selling smaller packets of food. He could only cook and consume a certain amount of, for instance, chicken, and anything that was packed in quantities beyond that was wasted. The only exceptions to this were special food items, such as olives, that he brought from Greece. These became the focus of a discussion with his parents after he showed them the Fridge cam Web site. When asked about accessing the site, he joked that his parents probably used it more than he did (there were seven Web site visits from Greece). Worried about what he was eating, his parents checked the Web site and quizzed him on what he had in the fridge:

> *"Probably because when they couldn't find me on the phone they asked me, they normally ask me things like what do you have for lunch? Or what did you have for dinner today? And things like that. [. . .] So probably when they don't find me in Skype they were just checking my fridge to see if I'm alright and if I ate something"* (Victor).

Thus for Victor Fridge cam was less about how he monitored his own food and more about how it fitted into his relationship with his parents. Their practices of communicating with him, worrying about whether he was eating well, and keeping up to date with his life were augmented by the view provided by Fridge cam.

6.7 Discussion

The stories from Susanna, Philip, Frank, Michael, Rose, Maria, and Victor reflect the complexities in people's everyday lives and how differently every participant used or did not use Fridge cam in line with their needs. The time-lapse videos allowed them to reflect on what had happened during the last month and discover the "stories" (Michael) behind their fridges and associated practices. The technology probe's intention was to investigate understanding towards individual choices, as well as reflecting on everyday practice through the time-lapse videos that made certain patterns visible. The deployment of Fridge cam as a one-month technology probe allowed us to explore food practices in a different way as well as to try out a technology intervention in five households. While Michael, Rose, Maria and Victor had patterns of organising their lives according to various values, the individual choices where Fridge cam could support were already made: Michael already knew what he would buy as he had a weekly pattern of buying the same food items and cooking them. Rose and Maria were living through a phase where they ate outside most of the time and when eating at home, it was mostly *"from the cupboard"*. Victor valued freshness over conscious shopping and said that big packages are the main cause of wasted food in his home. I do not claim that these findings are representative, but the phenomenon that 'choices' were mostly embedded in the social and material organisation of everyday life were visible in the competing concerns described by participants.

The Fridge cam study made visible how everyday integrated practices (cooking, shopping, exercising, socialising) are implicated with the dispersed practices within which food organisation, consumption, and disposal are performed. Examples of these values for the Fridge cam participants were living healthily (Michael) or wanting to cook fresh food (Victor). It is evident that, in reflecting on their food practices, Fridge cam users drew on 'ways of doing foods', rather than their food values such as cooking healthily and freshly. All participants disliked throwing out food, but other values such as fresh food for Victor are more consequential. Fridge cam as a probe intervention served as a useful point of reflection for some participants through the time-lapse videos to see how their intended lifestyle of cooking and healthy eating did not translate into practice (Maria and Rose).

Fridge cam provided a very practical opportunity to support values around careful food shopping. Having access to the pictures enabled some of the participants to make informed

choices around planning and shopping, where Susanna (*"So I often look [at the Web site] from my PC"*) and Philip (*"I can really see the Fridge cam picture in my mind"*) used Fridge cam as a support for shopping planning, remembering, and checking their foods. However, this was clearly not the case for everyone. The other participants just did not need such an intervention to support everyday practices, as in the case for Victor who shopped every day for fresh food anyway and Michael who had rigid weekly patterns of how he shopped, cooked, and ate. Informed choices were partially supported by Fridge cam and for those participants with values towards food waste as was the case for Susanna and Frank. The interview data and the first period of hits to the website revealed that they fancied the system. The aspirations that Susanna and Frank had and projecting into this technology, to make informed shopping choices and avoiding over and double-buying were more present at the beginning of the study and disappeared towards the end.

The difficulty of informing one's choices is even better illustrated by a deeper look into Susanna's story. In the closing interview she reported still being caught in the routine of overshopping and no time to cook up, even though she was dedicated wasting less food as she repeatedly felt sorry for it. She mentioned her busy everyday life [Håkansson and Sengers, 2013] and social activities were making it impossible for her to make conscious decisions towards less food waste.

Reflection was instigated through the time-lapse videos, and evoked by the setting of the closing interviews. Showing the videos and asking about the participant's thoughts, The reflection on their fridge's life evoked thoughts about the participant's everyday life. Rose and Maria were confronted with a clash of the aspirations of how they thought they should live and the characteristics of their food practices as portrayed in the video. Victor and Michael could not observe anything unexpected, as their fridges' lives were matching what they would expect them to be.

6.8 Summary of Fridge cam case study

Fridge cam is a low-cost mobile phone attached to the inside of a fridge door that allows users to transcend space and inspect their fridges from other places such as the grocery store. The case study of Fridge cam served to probe on people's everyday lives and the potential for supporting individual choices, in this case supporting in-the-moment shopping planning, through accessing current pictures of the fridge online. The results of this study helps further elaborate the potentials and pitfalls of individual choices, and how 'choices' are often determined by the social and material organisation of everyday life. The study also points to the potential to enable reflection about what people think they do and what they actually do through the time-lapse videos. The videos enabled reflection on everyday practice's of people.

Changes can potentially be made, e.g. in the households of Susanna and Philip, where Fridge cam was used to support shopping planning. Though literature critically points towards the fruitfulness and effectiveness of such approaches, as the changes made are very little and not radical enough at often high expenses of technology deployment.

CHAPTER 7

Case study 3: Foodsharing

7.1 Introduction

This chapter presents the last of three case studies of interventions reduced food waste, the existing Foodsharing community[1] as a #3 community of alternative practice. At first the concept of community of alternative practice is motivated and engaged with. Second the mechanics of the community and its origin are described, and how the actual food sharing is facilitated with digital technologies. Foodsharing.de is a platform that enables consumers, farmers, organisations and retailers to offer and collect food online, meet offline to hand it over and thus save it from being wasted. Associated with this is the Foodsharing Facebook group where broader community discussions take place. This third case study presents a qualitative thematic analysis of the Foodsharing Facebook group to understand its role in emerging and sustaining the community and its alternative practice of food sharing. The Facebook group is a place where the individual values and motives, socio-political discussions and mass media interrelate and create new social patterns through narratives and local community building. The findings present an interplay between a number of issues for such communities: individual, community, and organisational levels; public relations and media, the operational platform Foodsharing.de that enables local communities and the Facebook group where global ideological framing of the community takes place.

7.2 Motivation for Foodsharing case study

Studying a community of alternative practice in this third case study is motivated by three findings from the interview data in chapter 4 and the literature review. First, the data suggested alternative practices such as processing old food or gardening/ foraging as activities being connected to valuing food sources and I was curious if the same can apply for sharing

[1] For this case study I chose to study an existing community and according technology. During my design phase I had the idea of

food in a geographically bounded area. Second, food waste is often the unintended result of the social and material organisation of everyday life, hence can be radically changed only in changing these elements and more can be achieved in a collective. Third, the literature points to the shortcomings of interventions targeted at individuals and I wanted to study a setting where a community is engaged.

Digital technologies are excellently qualified to connect individual consumers, households, farmers and retailers in a geographical area to share resources such as skills, food and gardens. Such communities can enact in local collaborative consumption in a shared 'economy' or thrive for shared experiences such as cooking or dumpster diving. This case study focusses on a very specific community enacting in digitally enhanced food sharing, as a counter movement to the predominant consumer culture and is described in more detail in the next section.

7.3 On communities of alternative practice

Communities of alternative practice have an agenda in sharing their interests and activities, often in the setting of geographically bounded area. With alternative practices I mean an activity that might not be a mainstream activity but engage in something that is non-standard and special, such as dumpster diving, urban gardening or foraging in the wild. Key to communities of alternative practice is that their shared element is an interest and embodiment of an alternative practice and learning from each other [Wenger, 1998]. Communities of alternative practice might not be of an activist nature by definition, but communities actively engaging in the world and wanting to change their immediate environments, such as claiming a public space for gardening, have activist elements to it. These communities are complex in their interactions and new methods as well as digital technologies are beginning to emerge as an instrument to support such groups [Aoki et al., 2009, Kuznetsov et al., 2011].

Community members are connecting widely over social media and social networking nowadays. Digital technologies can provide accustomed platforms for users to communicate and share expertise or tools. Such technologies rise and fall with the initiative of engaged community agents and members, as such sharing communities can only exist with a critical mass of active members. One such community of alternative practice is Foodsharing.

7.4 Foodsharing platform

Sharing food in the Foodsharing community involves no transactions of money and attracts all sorts of participants. Foodsharing therefore is theoretically open to all levels of the food supply chain. to understand the context of this community for the purpose of this case study, I will explain the background how the community and the technology were built. The Foodsharing initiative originated in Cologne when several committed people came together to form an Association. It mainly started around Valentin Thurn, a documentary film-maker. Thurn had created a documentary called *"Taste the Waste"*[2] that presented the problem of

[2] `http://tastethewaste.com/info/film`

food being wasted from different perspectives including farmers, wholesalers, food retailers and consumers. He and many other active members were key in actually starting the Association. Following the documentary the newly formed Foodsharing Association started a crowdfunding campaign and raised enough money in Germany to get funding for an online platform, giving evidence that there were already many people who believed enough in the idea to invest money for its development. Foodsharing.de was subsequently released on 12 Dec 2012. While it was started in Cologne, the site now can be accessed by anyone anywhere in Germany and Austria, and actual food sharing can take place wherever people can physically access each other. As at March 2013 the Foodsharing.de community had 17.000 active members distributed over Germany and 1.788 food baskets had been handed over. At 23 March 2013 I downloaded the data for analysis, and there were 271 food baskets on offer to be collected. A food basket is created by someone who has food to offer and the baskets can contain one or more food articles. The food basket page of Foodsharing.de displays all currently available food baskets across a map of Germany and also provides the same information (available baskets) in a list view (please see Figure 7.1 on page 92). Community members can filter on different parameters such as location and adjacency on a map, timeliness of food baskets, content, or ending time for collecting them. If somebody wants to take up the offer of a food basket, s/he can then send a request to the person, organisation or institution offering the basket. The offering side in turn can accept or decline a request. If both sides agree, they then negotiate where and when to hand over the food basket in the offline world.

The Foodsharing Facebook community

The Foodsharing web page also links to a Facebook group called Foodsharing, which will be referred to as the Foodsharing Facebook page or just Facebook page in this case study. The Facebook page was started on 13 September 2012, before the platform itself started, as a forum for interested people. As at March 2013, there were 22.405 'likes' (Facebook's mechanism for showing support for a page), and 1.012 contributing members[3]. Whereas the Foodsharing.de platform is mainly functional, enabling the practical sharing of food, the Facebook page is the place where the emergence of the community can be observed: where broader community discussions take place, and where members are invited to post, comment or 'like'. This case study will therefore focus on the community interactions on the Foodsharing Facebook page (Figure 7.2 on page 93).

7.5 Methods for Foodsharing case study

To understand the mechanisms of this community and the role of the platform the posts of the Facebook community were qualitatively analysed using inductive thematic analysis [Braun and Clarke, 2006]. The data set comprised 3242 contributions, made up by 243 posts contributed from the Foodsharing Association, 401 posts by members and 2.598 comments

[3] by July 2014 there were 65.200

Figure 7.1: Screenshot from Foodsharing.de webpage with map of food baskets and list of food baskets offered enabling the practical and functional aspects of foodsharing.

to posts. Everybody who 'likes' and is subscribed to the page has access to all the posts and comments.

To create the dataset for analysis, I expanded all posts, starting from the beginning of September 2012 until beginning of March 2013, to make all comments visible, and printed out 208 pages of material. Figure A.11 in the Annex presents a page of the thematic analysis on paper on page 154. In this case study two themes are presented that are crucial for communities of alternative practice, namely *"individual values and needs"* and the *"emergence of the community"*. The first theme might answer why people are interested in a community of alternative practice and the second theme how a community can grow and be sustained.

From the first analysis we[4] could see that public relations and mass media played im-

[4]As a first pass in the thematic analysis, two coders, Özge Subasi and myself, made notes on two separate prints-outs, from which we identified and agreed 14 broad types of contributions, such as users requesting help

Figure 7.2: Screenshot from Foodsharing.de Facebook page where broader community discussions take place.

portant roles in promoting the community and engaging new members. Hence, I additionally analysed 11 videos that were still available from the 17 video links that were posted to the site. I watched these 11 videos and made notes of the main content topics. I was also looking for themes in these videos to analyse how they contribute to the emergence of the

or the Foodsharing Association celebrating a milestone. We then started to look for the deeper themes underlying the posts and repeatedly reviewed the material together to draw out important issues. The themes and codes were further reviewed in a collaborative analysis session with Geraldine Fitzpatrick and Florian Güldenpfennig.

community. One illustrative video that was highly influential (surpassing all others by number of comments, likes and shares) was transcribed and thematically coded to uncover the possible new relations of sub-themes to the emergence of the community.

At my request, the Foodsharing Association also gave me 'insight analyst' status for this group, which granted me access to aggregated Facebook data and descriptive statistics behind the group. This provided me with information about basic demographic data of the members and to identify posts that were most 'viral', meaning we could see how many people commented, liked or shared a post.

7.6 Findings of Foodsharing case study

As background to understanding the Foodsharing Facebook community, I first provide a picture of the age group and gender of people engaging in this group, drawn from an analysis of the aggregated data of the Foodsharing Facebook page. More users 'like' the page who identify themselves to be female (69.6 %) than male (27.4 %). This resonates with other reports that women often play *"central roles in shaping and furthering alternative agrifood movements and institutions"* [Allen and Sachs, 2013, p. 12]. The authors discuss the ways in which food practices such as cooking are often still a predominantly female domain, with women being mainly responsible for food-related work at the home as well as at the labour market [Allen and Sachs, 2013]. The most common age group for Foodsharing Facebook 'likers' is between 25 and 34 (39 % of total). Almost a third (28 %) of the users in the Foodsharing Facebook group are female and between 25 and 34 years old. Please see Figure 7.3 on page 94 for more details.

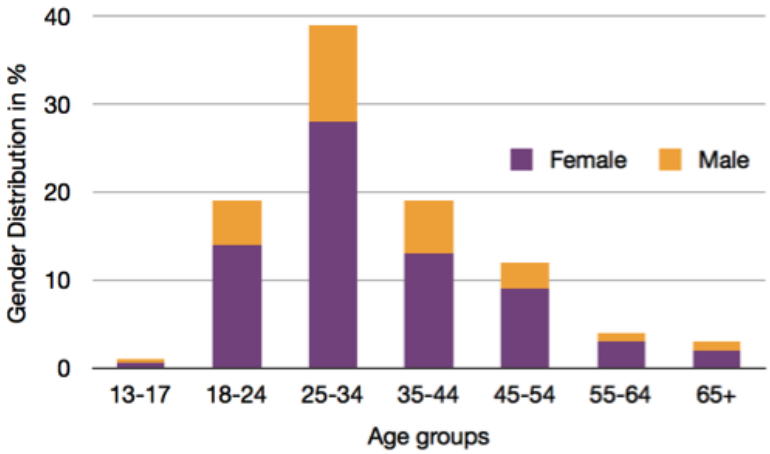

Figure 7.3: Gender and age distribution within the Foodsharing Facebook community.

There were a plethora of issues discussed by the community, ranging from dumpster diving (freeganism), agriculture, gardening, and everyday practices of food and waste, to sharing

experiences offline and online, food waste cooking events and other initiatives. To determine the nature of the information provided and how users engaged with Foodsharing, we categorised different types of contributions from Foodsharing users:

- *Foodsharing experiences:* Experiences, both positive and negative, from online and offline interactions with other members with whom food was shared.
- *Finding a local community:* Requests to connect to/ find others in a specific local area.
- *Calls for internationalization:* Remarks about wanting to have such a community in their country. (Foodsharing.de was provided for Germany only at the time of analysis).
- *Offering help:* Offers not only to share food but also to engage in voluntary work.
- *Plaudit to the Foodsharing initiative:* Appreciation for the initiative and how useful and valuable it is.
- *Discussions about wider systemic implications:* Discussions of the systemic effects of Foodsharing and if individual actions might have consequences if Foodsharing gains a critical mass, what Foodsharing can change, ideological orientation.
- *Links to other initiatives:* The dynamics of Foodsharing seemed to attract users to link to other initiatives with a similar mindset.
- *Everyday practices and food waste:* Discussions about how food waste in private households, food retailers, restaurants or agri-industry emerges.
- *Feedback on the design of the Foodsharing.de platform:* Remarks about what could be improved in the interaction design and which features would be desirable.

The Foodsharing Association also made particular types of contributions:

- *Requesting help:* Asking for help on a range of issues, from asking for legal expertise (e.g., lawyers to consult about food legislation and Foodsharing activities) to asking for volunteers to be interviewed and report about Foodsharing experiences on TV.
- *Providing feedback to members:* Giving answers to questions, contributing to discussions.
- *Showcasing Foodsharing:* Sharing links to media where Foodsharing was presented, ranging from reports on TV to newspaper magazines.
- *Promoting networking:* Providing links to other initiatives with a similar mindset or political intention, such as for petitions, waste cooking events, etc.
- *Celebrating collective community milestones* such as the thousandth food basket that has been handed over.

Within these contributions, we identified emerging themes following the thematic analysis procedure described in the methods section. Here I start with unpacking the underlying motivations and values of individuals to participate in such a community. Posts may also entail a number of other themes, as topics were often discussed in a non-linear way, where personal experiences are mixed with arguments for political perspectives or general expressions of praise or dispraise for the community. Statements of the members have been translated from colloquial German into English to make it understandable for international readers. Pseudonyms of Facebook names are used to refer to members.

Individual values and needs

This community included a highly diverse set of active Foodsharing Facebook members. To enact practices of sharing food requires additional effort in people's everyday lives – to create and/or respond to posts, to negotiate meeting places and times, and to physically meet to exchange the food. This implies that there are motivations and added values beyond the food that is provided to members. I was looking for the motivations that are inherent in the practice of sharing food in such a community. Two underlying and interdependent aspects as incentives to take action in this food sharing community were identified, namely *social and ecological* values and *economical* needs.

Social and ecological values

When people described their experiences on sharing food on Facebook, I often came across statements such as *"gives me a good feeling"* or *"doing a good thing"* in sharing food to save it from being wasted. So there seems to be something in not throwing food away that feels inherently right for these members and gives people an intrinsic reward from being 'socially responsible'. There were also social side effects and some specific instances where people reported that they built new social relationships through Foodsharing activities. This is because the online interaction on Foodsharing.de leads to people actually meeting up, i.e., while the initial contact is made online via the platform, actually meeting and handing over the food has to happen offline at a place users can decide themselves.

> *"Even if it [food] was only a small amount I gave away, it gave me a good feeling. I get rid of my food baskets so quickly and you get to know so many brilliant and interesting people. Next week I have an arrangement with one for dinner . . . it is fun doing good and at the same time making new friends."* (Isabel)

For others, the social motivation was more about wishing to *"do good"*, to help and support people *"who don't have it so easy"* (Sophie). This social motivation in some cases went even further. Michael solely wanted to offer to people who are in need and not those who are economically well off:

> *"Foodsharing is a great idea, I can finally give left over food to people in need of help. [. . .] I just don't see a point in helping people who are NOT in need of it."* (Michael)

This statement was then discussed with other Foodsharing members, questioning who is in need and how one might be sure that only people in need are receiving food. The discussion, along the dimension of who has or has not economic and social need, points to wider systemic discussions we often encountered in the data when members discussed Foodsharing, an aspect which I will address later on.

Given the effort involved in sharing food, it is not surprising to see that people also expressed frustration when members of the community made an appointment to hand over the food but those collecting were not reliable. The Facebook group then acted as a forum for those who had been disappointed by a member who did not show up. It was suggested by members that these happenings should be translated into technological changes insofar that not only members offering food baskets should be rated but also those who collect them.

Besides intrinsic social values that mattered for sharing food, active members also demonstrated ecological motivations. These played out not just in terms of local practices, but connected to broader concerns for societal change.

> *"I hope even more people become enthusiastic about Foodsharing, at least this would be great for humanity and the environment."* (Karoline)

This statement implies the humanistic nature of sharing food and how the social and environmental impacts go together in an idealized account of striving for a better world. This statement also reveals that users think about Foodsharing having systemic effects in a social (humanity) and ecological (environment) way. It is not only about the practice of sharing food on a local micro-level, but, given that more people participate, it will have macro-effects and systemic changes along the food chain. Doris similarly expresses this:

> *"Our resources are limited and we should ALL catch on to this finally."* (Doris)

Such discussions pointed to the importance of getting a critical mass in order to achieve a notable effect on scarce limited resources of the environment. However, these environmentally optimistic posts were often counter-argued by people who pointed out that more than just a critical mass is needed, that it needs interventions from the state to reduce food waste on the agri-industrial side. There were a vast number of posts, particularly during discussions about more systemic and political aspects, that condemned the food industry for resource and food depletion, the state who does nothing against it, and retailers who deliberately prefer to throw away instead of giving to people in need. Those in need refer to the next motivation observed, which is an economical as well as social one.

Economic need

It is clear from other posts the economic need played a big part in food sharing, given how often people in the 'giving' position commented about people in need. However there was only a minority of posts to the Facebook group from users who were in need of food support to make or improve their living. Of all the 3242 posts there were only five instances where people explicitly articulated their own economic need. This points potentially to feelings of shame that might go with social and economical needs of sharing food and discussing this publicly.

> Tory: *"If I go to the food bank twice a week already and cannot give a lot [of food] myself . . . can I still get any?"*
> Anna: *"Just register online and have a look if somebody has to give something away. I don't think that it is about 'who collects also has to give' but rather those who have, give, and those who need, just take."*

Though we could not find many posts from users who collect food baskets, the free-rider phenomenon that is criticised in many other communities is actually welcome for the Foodsharing community. Tory is seeking help and asking for the conditions under which she can get food, and is encouraged and supported through Anna, telling her it is endorsed if *"those who need, just take"*. Michael's social motivation to share food (noted previously) was even to give only to people who are socially disadvantaged. We could not find at any point a member complaining (at least on Facebook) about people who only seek and not give food.

In summary, in this case study of my thesis I was looking for the motivations that are inherent in the practice of sharing food in such a community. Social, ecological as well as economic values and needs are incentives to take action. The motivations between and within participants are manifold, some emphasizing a general *'doing good'*, some writing more about their social, ecological and/or economic motives. Help-seekers, help-givers, social, ethical ecological and economic values and engagements are all able to co-exist and in some cases mutually re-enforce each other. These values are reflected and made visible by the various discussions at the Facebook community. What is interesting to note too is that while the different roles of giving and receiving make this sharing community work, since both roles are needed for any food exchange, the discussions on the Facebook community are largely presented from the activists and giver perspective. Regardless of the discourse around motivations, the most important result is that food was saved from being wasted in this community.

Emergence of the Community

We can see the emergence of Foodsharing at both local and global levels, with the public media also playing a key role. I define the term 'global' in this chapter to have a non-local, geography-independent and issue-based connotation. This section is started with the initial role of the media.

Creating visibility and narrative through media

Public relations and mass media played an important role in the emergence and sustainability of the Foodsharing community. Specifically I focus on the emergence of the Facebook community through the inter-relation between Facebook and public relations and mass media, and how members support local community building through advertising and pro-active appeals. Emphasis is also on the development of critical awareness through community interactions and the emergent narratives that are used to communicate the values and practices of the Foodsharing Association.

As noted previously, Foodsharing started off with a crowdsource campaign to attract funding for the development of Foodsharing.de, at a point where the Facebook group already existed to promote and discuss Foodsharing.de's development. The platform was released on 12 Dec 2012 with a press conference, accompanied by local strategies such as posters, flyers and billboards close to food retailers. Foodsharing has since had significant media interest, with a very frequent presence on prominent TV news, newspapers and online news. The Foodsharing Facebook page links to: 17 reports about the community on TV channels, 3 of those channels being the biggest in Germany who broadcast about Foodsharing in their main evening news; 44 newspaper articles, with 6 of those being amongst the biggest national newspapers or magazines in Germany; and 3 links to radio entries and 2 mentions on blogs. This mass media coverage served as a starting point for motivating people to get active themselves in Foodsharing and posting this to the Facebook page. The activating potential was visible on the Facebook page with 31 posts where members got to know Foodsharing through a TV report in the main news on a prominent German TV channel and were encouraging about the initiative.

> *"We just watched it on TV, tried it out and classify it as PERFECT! Great idea :D"* (Pam)

Media coverage not only prompted people becoming actively engaged in food sharing, but also to actively talk to other people who had more power and control over the distribution of food and so try to change their instant environment.

> *"Just watched it on TV ... it's a great thing ... I am working in a big supermarket chain and will talk about it with my boss"* (Cora)

The various responses showed how media coverage could have important effects on awareness with follow-up actions, moving from watching TV reports to actively engaging in the community or their specific local environment. In fact so many people tried to visit the Foodsharing website after one broadcast report about it on one of the major German TV news shows, that the Foodsharing.de page was accessed unexpectedly often and was not reachable for days. This also resulted in numerous posts on the Facebook page remarking on the unattainability of Foodsharing.de.

To understand the nature of these reports with their activating potential, I observed recurring issues across these reports: Stories started with presenting the problem space of food waste to raise awareness, presented Foodsharing.de as an alternative, and showed role-playing and exemplifying how the platform can be used. To understand the way these TV reports encouraged interested members, we analysed the narrative content of an illustrative example of the TV report that Facebook users 'shared' the most (most viral) on Facebook; 29.3 % of all users who saw the post with the TV report also reacted (liked, shared or commented) to it.

The TV report starts off with the overall story of wasted food and introduces Foodsharing.de as a platform that enables individuals to waste less through the new evolving practice of meeting online to share offline. The main narrative behind the report told an individual story to *"show how it works"* (speaker announcing the TV report). The report then depicted

a woman to show online interactions with the platform Foodsharing.de as well as offline interactions when another woman comes by with her children to collect the offered food. She says:

> *"One has to bring the right attitude to this, others would throw it away, and that you can accept Foodsharing confidently and don't have to feel weird doing this."* (Woman appearing in the 'show and tell' story of TV report)

The content of this TV report[5] (images of the TV report in Figure 7.4 on page 100) serves to attract people who want to engage in food sharing and directly addresses stigmas that could potentially be attached to it. This is illustrated in the remarks *"don't have to feel weird about doing this"* and *"accept Foodsharing confidently"* about collecting food baskets. That such social stigmas might otherwise exist is suggested by the fact that only five people posting to the Facebook page identify themselves as being in economic need. The TV report also serves to practically demonstrate sharing food and how this constructs and narrates a new social pattern, potentially aiming to achieve cultural change (*"bringing the right attitude to this"*) for TV audiences. The moderator's words to announce the report, *"show how it works"*, point to the demonstration and play-acting of the new social pattern.

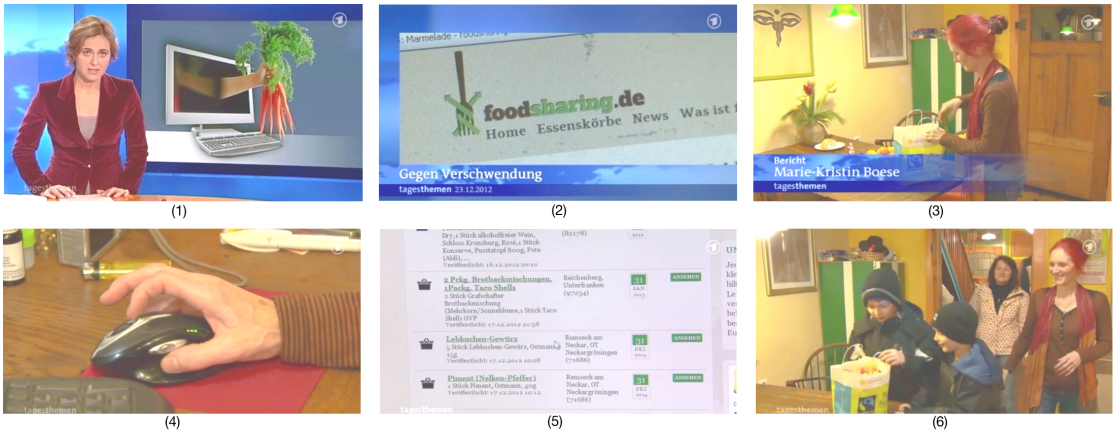

Figure 7.4: Frames of Foodsharing TV report describing the storyline: (1) Announcing the report (2) the showing online platform of Foodsharing, followed by offline interactions such as (3) packing the food basket and (4) interaction with the platform, (5) displaying food baskets online and (6) handing food basket over.

In sum, the values of Foodsharing and its social patterns are narrated and exteriorised through broadcasting and at the same time promote acceptance of it. The Facebook page played a critical role in a) keeping the report alive by linking to it and b) keeping the issue alive and being able to mobilise the energy, concerns and debates arising from the report by providing a focal point for people to gather, discuss and learn. The linking though of different

[5] http://www.youtube.com/watch?v=CYmKCWv7wdQ

media contributed to awareness and the visibility of possible alternative practices through narratives.

Building local communities

While the media played a role in making Foodsharing an accepted social pattern globally in a cultural, societal, and political way, local communities are still needed to make Foodsharing productive and sustainable. Active agents, enabled through the global Facebook page, promoted local community building and Foodsharing members engaged in broadcasting, advertising strategies and local interactions.

> Dora: *"Is there a possibility to advertise for Foodsharing in your own town? Ideas anybody? It just works if enough people participate..."*
> Carla: *"It depends how you imagine advertising, you can have advertising material sent to you, I have done that too and was sent posters, stickers and flyers in different sizes. There is an email address I forgot that you can write to"*
> Foodsharing: *"info@foodsharing.de"*

This conversation shows that to make Foodsharing reach enough people it is inherently dependent on local communities and pro-actively engaged members such as Dora. Therefore public relations and the organisational means of a community play a crucial role on a local level to advertise offline with flyers and posters, both of which can be ordered from and sent out by the Association. This conversation also points to online-offline interactions in advertising online and offline, similar to the practice of sharing food itself. Building and instantiating local communities are necessary to make the community as a whole work, to reach a critical mass, as Dora remarked. Such interactions on the global Foodsharing Facebook page resulted in 17 new local Foodsharing Facebook groups being founded to enable local interactions and food sharing. Online support in the community did not necessarily come from the Foodsharing Association itself and often happened between members. Support often takes the form of encouraging statements or pro-active appeals.

> Sandra: *"I really love the idea, unfortunately there are no food articles provided in my city."*
> Kathy: *"Sandra, offer food articles yourself, mine have been requested and collected within minutes! If everybody just waits until others are offering food articles, it will not work."*

There were many other instances where community members supported each other. Examples include: advice on how to use the platform; how to initiate a local community; and discussing relevant food topics such as how to start dumpster diving. Pro-active appeals were not only exchanged between members of the community to form bottom-up local Foodsharing communities, but also from the active agents behind the Foodsharing Association in a top-down manner. Hence it is also the pro-active involvement of the Foodsharing Association that matters, such as in Dora's and Carla's case where the exchange of information is

accompanied by someone from the Association actively providing information. The Association also repeatedly posted pro-active top-down appeals for engagement to the Facebook community members to offer foodstuffs which members not need any more.

> *"Dear Friends, holidays are coming soon and everybody still has foodstuffs at home that could be offered on Foodsharing.de before they spoil. Take part and comb through your pantry, fridge and kitchen. Now is the right time! Over 15.000 Foodsharing members are waiting for your food basket."* (Foodsharing)

The role of the remark *"over 15.000 Foodsharing members are waiting for you"* is to communicate to interested members that they are part of a bigger movement and story, that another 15.000 active people have already adopted the practice of sharing food. This pro-active call also provides direct instructions (*"comb through your pantry"*) to engage potential or existing members in sharing food and avoiding food waste.

Creating critical 'global' awareness

Accompanying the emergence of the community was also the development of critical awareness at a more general level, through which people developed a critical understanding of the socio-political sphere their community moves in. Members regularly engaged with topics on the Facebook page that were actively discussed, questioned and negotiated, such as hunger in the world and the context of wasted food, genetically modified organisms, the role of marketing at food retailers, product packaging or practices of the agri-industry, etc. The vast numbers of topics, though not directly associated with Foodsharing, were actively discussed and provide evidence that food practices are inherently cultural and political. Discussions also allowed members to develop critical awareness towards potential systemic impacts of Foodsharing and often took place within the context of discussed topics. An illustrative instance for the ongoing development of critical awareness was Tom and Hannah discussing the wider systemic impacts of Foodsharing:

> Tom: *"Foodsharing cannot change the throw-away practices of agriculture and industry. Foodsharing can also not contribute to reduce hunger in the world. Foodsharing should then only communicate what it can do: Saving food at the consumer level. Not more, not less."*
> Hannah: *"But Foodsharing connects people with each other – and this is the basis for all other changes, because enterprises will not change their strategies voluntarily, together we are strong. Foodsharing raises awareness, and awareness is the key."*

Here Tom and Hannah discuss their individual belief of what Foodsharing can achieve, where Tom questions and negates wider systemic implications, and Hannah argues that people together can achieve change though raising awareness and collective action (*"together we are strong"*). It is this interaction between members - where they provide different critical perspectives, the debate between them - which potentially contributes to raising critical awareness of individual members. The Facebook page offered the medium through which

people could engage critically with the community, its purpose, its aims, its attitude, its technologies and systemic consequences. Through this critical process people acquire a greater understanding of the cultural and social circumstances that shape their lives.

7.7 Discussion

In this case study I have been concerned with understanding a community of alternative practice around the issue of food sharing and its use of digital technologies, drawing particularly on contributions from the first 19 months of its Facebook page. I was also interested to observe how new practices were promoted in public and taken up by new members. Overall, what is impressive across the data is how quickly this community grew over a short period of time and, by definition, how engaged so many people needed to be. The very emergence of Foodsharing as a grassroots initiative and the growing levels of activity both on Foodsharing.de in the food baskets exchanged, and on the Facebook page in the number of 'likes' and the active contributions and discussions, give evidence of people feeling and being empowered to act. Empowerment links to levels of individual, community and organisational empowerment [Rappaport, 1987]. The Facebook group has been a key focal point and enabler at the levels of the individual, community and organisation (here, the Association) as well, along with key roles of Foodsharing.de and public media, in enabling the emergence of a community that engaged in intertwined 'global' thinking and local acting.

Think globally, act locally

As for many communities the principle of *'think globally, act locally'* is a valid description of the interactions between individuals, the community, the Association and across the data. There were strong patterns of *global-local* as well as *online-offline* interactions. The Facebook page, representing the online world, provided the basis to form global identities and ideas that guide and frame this community. Various discussions, links to similar interventions, the links to mass media where Foodsharing is portrayed, all act as *ideological framing* processes for the community. The Facebook page also has a global-local dimension as people there connect with each other to build new local communities, which resulted in 17 new local Facebook groups. The platform Foodsharing.de acted on a national level and is provided for all Germany as a functional and operational tool. But there is also a strong local element that is the lifeblood of Foodsharing. First users search, request, accept and meet online to negotiate where and when to meet. It is then at the offline local place where the act of handing over of food takes place.

Apart from the overarching patterns of global–local, and offline–online, interactions can be described to be *top-down* as well as *bottom-up*. This was most visible for e.g. local community building which was a bottom-up approach by engaged community members, at instances supported top-down by Foodsharing through providing advertising material. Proactive appeals were used as encouragement between members as well as top-down by the Foodsharing Association as posts to all members of the Facebook community. This was, for example, the case at the instances where they pro-actively promoted Foodsharing with mass

media. Mass media presented narratives of *new social patterns* how the community works and direct instructions and encouragements to engage in sharing food. Thus actions happen at multiple levels, by local agents as well as the Association.

Individual, community and association/ organisational levels

Individuals of the community enact through social, ecological and economic motives, to save food from being wasted. Through the social networking platforms, they are enabled to translate needs, values, and 'good intentions' (around eco-beliefs, concern for environment, social good, etc.) into practical offers or collection of food. They are also able to connect with others to exchange food in local geographical areas. It was also the belief in a wider systemic change and being part in a bigger intervention that encouraged people to participate. The relationship of individuals to the narratives told via various (mass) media was, according to our data, very influential. Not only the guiding values of the Foodsharing community were shown, but also how the new social pattern of meeting online to share food offline is played out in very explicit and explanatory ways. This had impact on individual encouragement to pro-actively engage in the community. It is the Facebook page that makes this engagement visible and notions of *empowerment*, the process of being motivated to act [Rappaport, 1987] were visible - such as for Michael who reported to *"finally give left over food to people in need of help"* or Cora who watched a report about Foodsharing on TV and felt encouraged to talk to her boss in the supermarket to actively change her environment. Individuals saw stories where they could identify themselves as part of a bigger movement able to change their circumstances that empower them to act. This was also discussed by [Dimond et al., 2013] who described the positive impact of collaborative storytelling online. Overall it is the individuals who can realise an emerging and sustained community only, individuals that need to feel agency to change their respective environments according to their values, needs and beliefs.

The *community* itself lives and is enlivened by the various interactions between individuals that fulfil different roles. Mutual understanding, helping behaviours between and within community members, engaged voluntary action, and receiving help add up to collective problem solving. The Facebook group of the community acts as a forum for direct encouragement (pro-active appeals) to act, to post questions, find answers, get support, connect to others and being pointed to most relevant resources in a just-in-time way by other people in the community responding to questions and comments. This is accompanied by tensions and hot debates about political and cultural implications of food and waste practices that characterise this community. Interactions between community members can shape the nature of debates and support the development of *critical awareness*. Members discuss wider possible or non-possible systemic change through the community or question the systemic impacts of Foodsharing, as illustrated in the conversation between Tom and Hannah. Moreover the Facebook page provided a platform for people to form a community of interest, passion and activism around the issue of food waste and sharing food. It enabled people to mobilise and to act as a 'global-issue-based' community, to seed new local communities, while Foodsharing.de enabled people to form a local community of practical action to hand over food between the members.

The Foodsharing Association provided *organisational* means and technological resources to enable the emergence of this community. They provided the development and maintenance of the operational platform Foodsharing.de that made this free food sharing community possible. Through the Facebook group they were able to provide the information, materials, resources and respond directly to people, to point them to these resources, contribute to conversations, discussions through their posts, and make more powerful use of public media by linking stories through to Facebook. They could effect change, both by empowering individuals to act locally and form local food exchange groups, and empowering people more generally, even if they didn't have a local group, to change thinking, to be more aware and to act politically through giving information, stimulating discussions, pro-active appeals and establishing public discourses. From a design perspective, there were two key characteristics that made this particular type of local-global, online-offline community work. Firstly, the platform Foodsharing.de enabled practical and operational local community exchanges for communities of place. Secondly, the Facebook page facilitated broader discussions and framing processes for the community. These sites of inter-dependent global interactions then also facilitated the development of local interactions and communities, which is a crucial aspect for distributing power to local agents of change, such as the instances where local communities were built and advertised by local agents to initiate their own local Foodsharing Facebook page.

Foodsharing provides intersections with the other design proposals of #4 re-connection to food sources, #5 promotion of public interest and #6 activism, which will be discussed in the next chapter 8, the overall discussion and reflection of empirical findings.

Limitations of this case study

While this study had access to a large number of posts starting from the beginning of the Facebook group of the Foodsharing community, the findings might not reflect all members. This is because I only analysed material about those members who post to Facebook. This case study did not include the voices of members who are using Foodsharing.de but do not engage with the Facebook group. Conversely, we might also have heard voices that engage with the Facebook group but do not actually engage in food sharing.

7.8 Summary of Foodsharing case study

The last of the three case studies presents Foodsharing as a vibrant active community of members engaging in very practical ways at local levels to share food as an alternative practice. Foodsharing is mediated by Foodsharing.de, and in more political and mutually supportive ways at a global level, using the Foodsharing Facebook group for getting the public interested and creating new alternative practices reducing food waste. The focus is on the role of the Facebook group and how the discussions and links provide a means for the values, motivations, growth and activist notions of the Foodsharing community to play out and evolve. I also showed how the Facebook page and the platform enabled fluid transitions between online-offline and local-global interactions and the empowering aspects of these.

The key contribution of this case study is showing how new alternative practices can emerge, be sustained and expanded within a community. The observations draw out the interplay between individual, community, organisational levels; public relations and media, the operational platform Foodsharing.de that enables local communities and the Facebook group where global ideological framing of the community takes place. The study also points to the relationship between mass media coverage and the follow up public communication on the Facebook page, which proved to be of central importance for establishing cultural change, new alternative practices and social patterns that are oriented towards sustainability and social values.

CHAPTER 8

Discussion and Final Reflections

8.1 Introduction

In this chapter I present first a discussion of the six design proposals from chapter 4 towards their general approaches along the dimensions *individual - collective - societal* and *intrasomatic - extrasomatic*. Second, the design proposals are further discussed in terms of how they are reflected in the three empirical case studies from previous chapters 5,6 and 7 on Food waste diary, Fridge cam and Foodsharing. This will serve a broader understanding of food waste interventions and the role of interventions targeted at individuals, collectives and society. The main contribution of this thesis are the final reflections on empirical studies of this work resulting in eight design considerations for social change. These considerations are drawing out some broader implications and overarching concerns. They highlight an understanding for designing technologies for the messiness of everyday life through ethnographic and participatory approaches. They also postulate supporting change emanating from people, and discuss design from a practice-oriented perspective with the roles of materiality and social organisation. Positioning the design considerations involves discussing how 'problems' and 'solutions' are framed, a critical awareness of interventions and the politics of design.

8.2 Revisiting design proposals

This section revisits contribution 1 in answering the first research question of the qualities of everyday life embedded in practices around food and waste. It contributes as well towards an orientation of technology interventions in the area of food waste (contribution 2), reflecting on the design proposals (#1-#6) explored in the empirical case studies as contribution 3. Please see Figure 1.2 on page 6 in the Introduction chapter 1 for an overview of research questions and contributions.

The design proposals are very broad in their application areas and share various aspects. Technologies for reflection and informed choices are centred around individuals and hence require studying individuals' choice making and reflection, even though they can be embedded in collectives such as households or communities for social reflection and collective decision making. The design proposals can also be viewed along an *individual - collective - societal* dimension where reflection and informed choice are more on the individual side, communities of alternative practice on the collective side. Figure 8.1 presents an overview where different design proposals can be oriented within these dimensions.

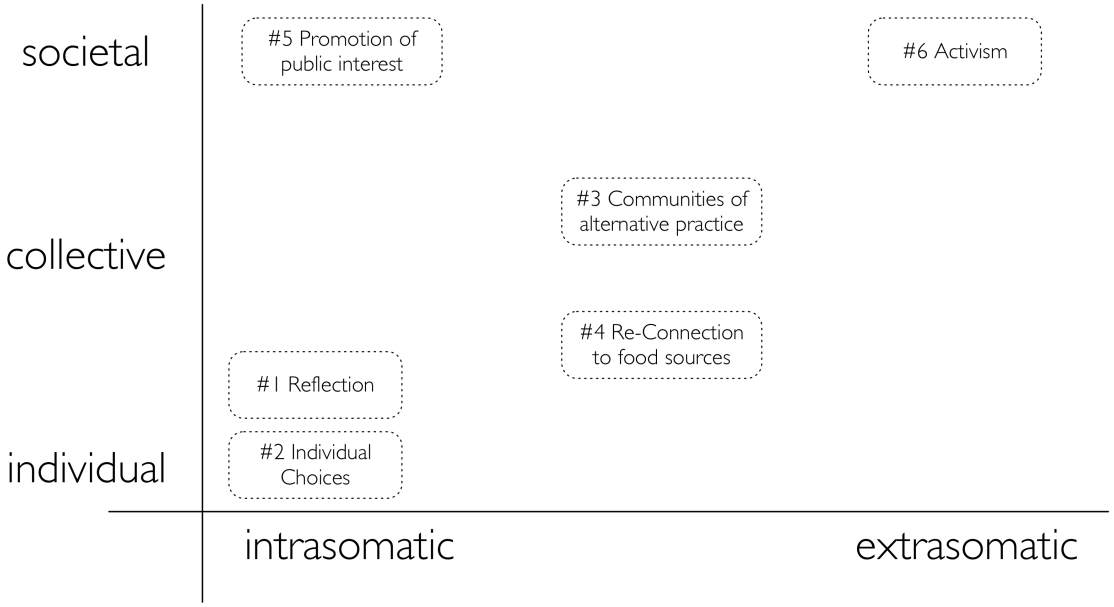

Figure 8.1: Design proposals along an *individual-collective-societal* dimension as well as an *intrasomatic-extrasomatic* dimension.

Reflection and informed choice can be seen in the *individual* and *intrasomatic* area, while communities of alternative practice can be localised in the *collective* area. As with other proposals, #4 re-connection to food sources is hard to determine where it should be oriented in figure 8.1, as for example the activity of foraging can be an individual as well as a collective activity. It is also visible that the potential for societal and more radical change in the *extrasomatic* domain originates either from collectives of people as #3 communities of alternative practice, or addressing the public through #5 promotion of public interest or #6 activism.

The Food waste diary application mainly pointed to #1 reflection. The Fridge cam case study pointed to #2 Informed choice. The findings and discussion of the Foodsharing case study explored the aspects that this specific #3 community of alternative practice shares with #4 re-connection to food sources, #5 public interest and #6 activist notions.

The interview data inspired and informed six design proposals, instantiations of which are explored in real world settings as case studies in chapter 5, 6 and 7. #1 Reflection was visible in all three of the case studies but to a large extent in the Food waste diary study in

chapter 5. #2 Informed choices were explored particularly in the example study of Fridge cam in chapter 6. The Foodsharing case study from chapter 7 can be mainly mapped to the proposal of #3 communities of alternative practice, but also to #4 re-connection to food sources, #5 promotion of public interest and #6 activism were visible.

Design proposals in case studies

I start here to engage with the design proposals seen as phenomena in the case studies. The discussion engages with reflection and informed choices as individual approaches, grappling with its critique, and argues that designing for individuals is not 'wrong' but may not lead to radical change and should be carried out sensitive to the qualities of everyday life.

#1 Reflection

The data from the Food waste diary consists of submitted entries with comments and enabled me to explore #1 reflection facilitated by technology. The data was analysed openly and with an existing framework for reflection based on Fleck and Fitzpatrick (2010). The findings from this study show that people who are aware of an issue are making an effort to submit entries manually. The submitted comments not only point to #1 reflection, but also to the complexity of the phenomenon of food waste, where simplistic answers to where and how something is thrown away do not exist for most cases. The intention of supporting reflection is visible in some instances of submitted entries where deeper insights about the relationships between food waste, previous experiences, habits, knowledge, occurrences and intentions to change were offered.

Reflection can be observed in the other case studies, where the discussions on Facebook of the Foodsharing community point to very high levels of reflection, e.g. critical reflection when Tom and Hannah are discussing wider systemic changes of the community (please see page 102 for direct quotes). Reflection is also a vital element in the interviews of the households using Fridge cam, where deep reflection was visible in terms of the internal negotiations people make in food practices to organise everyday life, e.g. Susanna discussing her difficulties with using up food because she is out and about enjoying her life instead of cooking up previously provisioned food.

Reflection is a necessary element for all interventions concerned with change and has been observed in all three case studies. This means creating interactions and infrastructures where reflection is invited can be a fruitful approach, e.g. through discussions, diaries or promotion of public interest of critical issues through technology mediation.

#2 Informed choice

Informed choice was empirically studied with Fridge cam. The case study provided a technology probe to support the process of individual consumers informing themselves before or during shopping, e.g. in terms of which food items stored in the fridge are needed or not. Such a process of informed choice requires reflection together with awareness and intention to change a behaviour. I cannot claim that the results are representative with five households

using Fridge cam for a month, though the findings uncovered the social and material circumstances of everyday life as dominating or impeding 'informed' choices. In both households of Susanna as well as Frank and Philip good intentions to use Fridge cam existed, though it had reportedly a limited influence in their everyday food practices. The aspirations that Susanna and Frank had and projecting into this technology, to make informed shopping choices and avoiding over and double-buying, were more present at the beginning of the study and transformed into less engaged interactions towards the end of the study, probably due to a novelty effect of the technology.

As a concluding remark on informed choices I could observe how good intentions for 'wise' choices existed for participants, but were constrained by various circumstances people live in. Designers and researchers intending technologies to support informed and 'wise' choices, should be accepting that people are not governed by rational choices [Strengers, 2014], e.g. when going shopping. Technology supporting informed choices should be sensitive to the circumstances of everyday life as 'choices' are embedded in the negotiations made within dispersed and integrated practices.

#3 Community of alternative practice

The design proposals stated in chapter 4 were concerned to broaden the area of possible interventions beyond the individual towards #4 communities of alternative practice. The key contribution of the Foodsharing case study shows Foodsharing members' values that motivate and encourage them to engage in such a community. The study also shows how members use the social media and web platforms to facilitate fluid transitions between online-offline interactions, as they enable meeting online to meeting offline and handing over and collecting food.

The observations draw out the interplay between individual, community, organisational levels. Public relations and media played important roles for promoting and sustaining the community. The operational platform Foodsharing.de that enabled local communities and the Facebook group where global ideological framing of the community takes place. Technology enables interactions, communication and cooperation, but technology can be also the main avenue used e.g. by communities concerned with citizen sensing [Aoki et al., 2009, Kuznetsov and Paulos, 2010]. At the same time technology can support active agents of change participating in communities as main drivers for change. The main drive for change in communities of alternative practice is emanating from the people and technology is merely a tool in these processes.

#4 Re-connection to food sources

The Foodsharing case study was not only useful in showing how a community of alternative practice uses digital technologies to facilitate interactions, but also how it played out in other design proposals. The practice of sharing food illustrates proposal #4 re-connection of people to food through bodily and mental investment. The bodily and mental investment is made when the offerer has to choose and prepare food for a 'basket', and put the information online. The investment is also made in searching for food baskets online, as well as offering

and collecting them offline in the real world. The collector has to make her/his way to the place where food is gathered and examine the basket. Investment is made in the haptic and sensual examination of food items as a closer engagement with food as in 'sourcing food' and assessing if it is still edible. Hence Foodsharing re-connects people closer to food sourcing, not meant in the 'natural way' of food sourcing through gardening or foraging, but in a considerate and appreciative way through the bodily and mental investment to prepare, offer and collect already processed foods.

Another example of technology enabling a re-connection to food sourcing is mundraub.org[1] where publicly accessible fruits, berry bushes, trees and vegetables can be located and pushed online to a map, making it accessible for everyone. Technologies re-connecting people to sources of food can be interpreted in various ways, from connecting people through food sourcing, e.g. a platform for sharing and taking care of gardens, to technologies re-connecting people to food sources from food retailers or restaurants wanting to pass it on instead of wasting[2]

#5 - Promotion of Public Interest

The role of public media was, according to responses on the Foodsharing Facebook page, crucial in attracting, engaging, motivating and sustaining its members. Publicity and narratives of the alternative practice of foodsharing (play-acting) through TV reports acted as enabler for motivating new community members to engage in the community. Play-acting in TV reports was also crucial in creating narratives of the new social pattern of foodsharing. These articles and TV reports not only reached beyond the Facebook page, they were linked through the Facebook page for members who already 'like' a page and as such *motivated public interest*. The key player here was the Association who was taking care of the maintenance of the Facebook page in linking Foodsharing related posts but also initiatives with a similar mindset to keep it alive for members and the public.

#6 - Activism

Notions of activism were visible in terms of the active agents within the community being concerned to change and discussions around the ideology of foodsharing. Some Foodsharing members see the practice of Foodsharing as a contribution to wider systemic impact. If enough people participate in foodsharing, less will be thrown away, less will be bought and in turn less should be produced. *Activist* notions are visible in terms of raising awareness of the public to the topic, critical awareness about systemic impacts and the organisation of offline events such as waste cooking events or demonstrations organised and linked through social digital technologies such as Facebook.

[1] `http://mundraub.org/map`
[2] `http://lebensmittelretten.de`

8.3 Reflecting on Design Proposals

Reflecting on the design proposals and case studies, I notice an immanent technological optimism that I want to reconsider. A general remark is that all of the proposals were optimist and utopian (in reference to Dunne and Raby (2013) *"preferable"*) and practicable, oriented towards the present or near future. Being aware that the focus available in Human *Computer* Interaction are people's interactions with computers, this is the frame of reference and a techno-centric perspective emerges naturally. Nonetheless it is important to look beyond interactions between humans and computers when societal issues such as sustainability are the motivation of the research, as was the case in my thesis.

Opposition and synthesis on informed choice

Singling out a specific behaviour to be supported or enforced is enticing, such as supporting shopping and planning with Fridge cam. As technology and sensors 'measuring' the world are an abstraction of reality, presenting a simplified real world is tempting as well as necessary when technology comes in. Literature and research about energy feedback critically point towards the fruitfulness and effectiveness of such approaches. The empirical work of Erickson et al. (2013) found in a real world field study with an electricity consumption feedback system that people are ready to use less energy and adapt their behaviours, e.g. shorten the time they are taking a hot shower, but would not abstain from the ritual of the daily shower. Even though people are ready to make changes, the critical argument is that these changes are not radical enough to move the direction towards less energy consumption [Mankoff, 2012]. The speculation is that a more radical change might only be possible through 'crisis or prices' or both at the same time. In terms of food waste, there is data that points to this argument: The 13% reduction of food waste between 2006/7 and 2010 in the UK might be connected to increased food and drink prices and reduced incomes during that time [Quested and Parry, 2011].

There were similar findings in terms of informed choices with my research, where for example Susanna used Fridge cam to support her shopping planning. But when buying zucchini, they were only available in big packages at her grocery store. So even if she was aware that half of the zucchini package might end up being wasted, she would not have abstained from buying it at all due to the material circumstances of how packages are sold, constraining the possibilities of her choices.

Even though the 'effectiveness' of technology informing choices is criticised here, I do not want to suggest the entire abandonment of this approach. There is nothing inapt about singling out a single behaviour, such as shopping coordination, and supporting this specific behaviour with technologies. Research into technologies supporting a certain behaviour can have a value when fitting into people's everyday life or satisfying a necessity, an aspiration, or an intention to change. Similarities of positive aspirations can be found in the Fridge cam case study where Susanna and Frank fancied the idea of transcending space when looking into their fridge. As reported in chapter 5, users of the Food waste diary application submitted entries because they wanted to know how much they throw away and some mentioned

the intention to change their certain aspects such as over-buying through recording and reflection (transformative reflection).

To date much HCI sustainability research focuses on individual behaviour change, an approach that is critically considered in terms of the fixed set of 'solutions' and choices imposed to the consumer [Brynjarsdottir et al., 2012]. The lens of social practice theory is quite the contrary to theories of behaviour change [Reckwitz, 2002, Shove et al., 2012] as the consumer is not seen as an agent embedded in the social and material organisation of everyday life. Moreover sustainable 'choices' often require additional time and resources [Håkansson and Sengers, 2014]. Though when taking a different perspective, the one of a designer wanting to constructively intervene, a critical perspective may be obstructing. E.g. some consumers see a benefit for themselves in integrating a tool into their dispersed practice for supporting coordinated shopping. A purely social-practical perspective might suggest that coordinated shopping within a household is mainly influenced by social and material organisation. Behaviour change approaches on the contrary would identify triggers and norms affecting coordinated shopping. But there is something in between designing for behaviour change to *"improve measurement"* or *"enhance early-stage theory fidelity testing"* [Hekler et al., 2013, p. 3314] and social practice theory. The compromise suggested here is designing technologies being sensitive to the qualities of everyday life wherever in the spectrum they are targeted.

Designing for individuals is neither the golden path nor is it an argument to not follow it as an interventional approach. The argument is that changes addressing individuals might not be as radical as wished for, but there is still fruitful potential in digital technologies to support everyday life. For example the findings from chapter 4 pointing to some households needing tools for better coordination of shopping activities, why not address this as a research topic?

8.4 Value of a practice lens

The lens of social practice theory is productive in understanding everyday life and the complex nexus of doings, sayings, knowledge, routines, social fabrics and materials being involved. It is shifting the focus beyond users and technologies in considering everyday life and how it is organised. People are engaging in all kinds of dispersed practices such as wanting to provide good food for the family, wanting to spend time with friends, wanting to eat healthy, or wanting to not forget food items in the supermarket. On this account integrated food practices are carried out intertwined in dispersed practices and food waste emerges inadvertently. It was very valuable for me to see the complex negotiations people are making in everyday life and how the moment of food waste is an unintended occurrence within the practices people are engaging.

The understanding of practices is necessary and valuable for conceptualising future interventions, though the complexity and critical systemic implications of social practice theory can make the productive and inspirational process of conceptualising and designing interventions more difficult. A social-practice-theoretical lens uncovers how our practices are embedded in wider systemic circumstances. The next logical conclusion is that changing the elements of wider systemic circumstances could possibly transform practices. Though these

elements are hard to change, and being aware of these circumstances can leave a researcher in a powerless morale.

Shove et al. (2012) discuss the necessity of changing elements, materials, competences, meanings, carriers of practice to enable cultural transformations when intervening from a practice-oriented perspective, but the question where HCI can intervene here remains open. Designing with a social practice theoretical lens is a challenge, as also noted by Shove et al. (2012).

> *It is important to remember that social theories do not lead directly to prescriptions for actions. In allowing us to understand the world in a particular way, they are nonetheless relevant for how policy agendas and problems are defined and framed and for the kinds of intervention that are deemed possible, plausible or worthwhile. [...] Taking practices rather than the individuals who carry them as the core unit of analysis makes sense in terms of social theory, but what does it mean for policy?* (ibid, p. 139)

This also applies to design where the endeavour of answering this question of policy-making is even more challenging when there is the additional constraint of digital technologies as immanent to the fields of HCI and CSCW. I aim to provide considerations for social change from a practice-oriented perspective here. Intervening from a practice-oriented perspective should support change emanating from people and institutions concerned with change through *participatory approaches* and *supporting communities* [Wulf et al., 2011]. These approaches may not be new in the fields of HCI and CSCW, but are ever more important given that a majority of sustainability research in HCI adopts behaviour change approaches, treating humans as being able to make rational choices [Brynjarsdottir et al., 2012]. In configuring connections between stakeholders such as policy makers, state actors and people interested in social change to, more sustainable practices could be made.

Supporting people with technology and studying the interactions with them in the wild provides insights and design considerations for other case studies. Though the processes of innovating and dreaming about such technologies require a different approach. Imagining different interventions can be described as a way of social dreaming about different futures, futures which can be possible, plausible or probable in nature [Dunne and Raby, 2013]. This is important insofar as it also needs the social dreaming and ideas for possible interventions in complement to analysing the present situation with a practice-theoretical approach.

Summing up, social practice theory is productive for understanding present practices, connections, routines, patterns, habits and social and material circumstances. However, it was difficult for me to inform interventions with this theory. Changes under a practice lens are requiring changes of cultures or material elements [Shove et al., 2012] on all possible levels from agriculture, to food retailers and consumers. But how can we design for change within the limits of digital technology interventions?

I will endeavour to answer some aspects of this larger question in the next section, where I am concerned with providing considerations to design interventions from a practice-oriented perspective as part of the main contribution of my thesis.

8.5 Design considerations for social change

In summary the proposals and case studies provided a broad exploration of areas to open up the design space in the field. These areas range from supporting individual reflection and choices to supporting communities towards changing the environment. These different approaches, from individual to collective and societal interventions, imply and require different methods and perspectives towards technology development. While technologies targeted at individual choices lend themselves to more 'established' HCI methods, supporting activist grassroots movements requires more participatory approaches.

The discussed design proposals and case studies are not meant to be a panacea for interventions that guarantee less food waste, the challenge was to explore what is possible within the limits of HCI. This section is dedicated to think beyond 'solutions' and more widely to transfer knowledge informing interventions on a broader perspective. These points reflect my constructivist research approach, where I attempt to inform transferable considerations to other areas such as interventions for electricity or water consumption, but some thoughts and considerations might also be applied for health and well-being. The design considerations resulted out of a reflection on my empirical findings, social practice theory and research literature.

1. Interventions sensitised towards the messiness of everyday life.

I have drawn out the unintended momentum of wasted food, as a result of interconnected food practices embedded in the social and material organisation of everyday life. This in turn highlights the significance of considering the qualities and practices being involved in moments of food waste.

In understanding everyday life around food practices, qualitative and naturalistic methods used in HCI and CSCW are perfectly suited for the question of how an intervention could be embedded in everyday practice. Here ethnography has a distinctive role in studying social settings. Ethnographically inspired methods in HCI draw from ethnography, but often have shorter time frames and are not as extensive as 'real' ethnographies due to production cycles of technology products [Millen, 2000]. Technology probes [Hutchinson et al., 2003] enable researchers to observe people's interactions with technology in the field to understand existing practices and inform further development. In a different direction are cultural probes [Gaver et al., 1999], here the focus is less on understanding, but more on provoking inspirational responses from participants.

A majority of work in sustainability is based on behaviour change theories, assuming people are making rational choices isolated from what else is going on in everyday life [Brynjarsdottir et al., 2012, Strengers, 2014]. Proposing ethnography in HCI is therefore not a novel or radical approach, but it is ever more important from a practice-theoretical perspective.

What ethnography can also provide is an entry point to a field where computational interventions are not already at the centre as was the case in my thesis. This serves an understanding of everyday life without technology interventions. Conversely, methods inspired by ethnography are significant in terms of understanding how technologies interact, provoke or fit within the social and material organisation of everyday life and communities of alternative

or practice or activist nature. Studying technologies in the field to understand experiences and asking the right questions is fundamental to understand technology in use as a holistic phenomenon [Bødker, 2006].

2. Considering materiality.

In studying food practices food waste was identified as the unintended product of the material organisation of everyday life. This is described as practices inscribed by the design of our everyday lives, e.g. the material organisation of supermarkets. Big packages and special offers encourage a culture of over-consumption, as they invite people to buy them through economics of scale. When designing interventions, the material aspects can be addressed in e.g. re-designing the elements that play crucial roles in inscribing our everyday practices [Shove et al., 2012]. An example intervention here is a change in packaging of food; where options for smaller packages exist or the packing itself allows for better shelf life [Plumb et al., 2013], policies for changing materiality of elements emerge.

Moreover the materiality of food and hence interventions for less food waste are specific, as the nature of food and food waste is a tangible, graspable and visible one. It starts with the investment of going grocery shopping. This routine people engage in involves food being brought to the home as a bodily investment. This is opposed to the invisibility of electricity or water [Strengers, 2011], resources that are implicitly and invisibly delivered to the household. Electricity and water are never experienced before they are used to turn on devices or cleaning bodies or cooking. Food is, also as opposed to electricity, susceptible to spoilage and decay. From an historical perspective (see Figure 2.1 in chapter 2 on page 12), food waste is probably something that will always exist as part of our everyday life and it will never be possible to avoid it entirely. Food practices are, from the process of sourcing to processing and eating, a haptic, sensual and embodied material process.

The notion of materiality also extends to engagement with food, where findings in chapter 4 point to food grown and harvested by people themselves was reported to be treated more frugally and respectfully. Hence technology interventions could focus more on the processes that re-connect people to food sourcing, instead of tracking food and feeding back to people in the home.

Materiality also plays a role in terms of the possible quantification of food waste that technology interventions can exploit and feedback to users. Something that is easy with electricity or water, is a complicated endeavour with food and food waste. An attempt to quantify food waste would start with the definitional challenge whether peelings count as food waste or not, and end with the practicalities of requiring people to use a 'smart' bin for all their food waste. Food waste is not as easily measurable as electricity is, and the same applies for still edible food items being tracked in a 'smart' fridge [Bucci et al., 2010]. Smart fridges still have to rely on RFID, barcode technologies or rely on manually entering actual food items to detect and track them[3].

[3]'Smart' fridge from LG based on entering food items through touch interface attached to fridge door and connected with mobile applications `http://www.lg.com/us/discover/smartthinq/refrigerator.jsp`

The materiality of food cannot be measured easily by technologies. In case of RFID technology it would mean that every product would have to have an RFID tag. In case of barcodes it means that every time a package is put into or taken out of the fridge it has to be scanned by the barcode reader. And food items without codes or RFID tags would not be traceable in such systems. Manually entering food items is a big effort that probably not many household members would routinely include. The same applies for assessing if food is still edible and the question of standardised best before dates. People can assess this using all their senses of looking, touching and smelling, abilities that technologies do not offer (yet). And even if the materiality of food would allow easy recording and tracking, the question whether this information could be useful for e.g. shopping planning, and if food could be saved from being wasted through technology supported shopping planning, still has to be explored.

3. Considering social organisation

Social practice theory is not only a useful theoretical lens to point to the materiality involved in processes and systems of provision in everyday life, but also points to the social organisation our everyday life is embedded within. The findings from the interviews and in the case studies point to instances where social organisation is tightly intertwined with food practices and, as an unintended outcome, food waste. Instances of this were described by William, who traded cooking up previously provisioned food from the home to engage in social activities, going out and spending time with friends. Another instance is provided as submitted entry to the food waste diary, where a user said that *"Susan didn't like it"*, hence pointing to the social dependence if somebody else will eat what has been prepared or shopped.

Food practices are not only inherently social, but are embedded within the social organisation of everyday life, also in terms of how we want to be seen by others. We are constituting and living our identities through food [Fischler, 1988] influencing if e.g. activities of food sharing could be frowned upon by others. This instance was reported in the TV report, where the woman collecting the food reassured the audience that food sharing is nothing people have to be ashamed of. Social organisation and representations of self are therefore not only an individual endeavour, but also supported where practices are negotiated, narrated and constructed and transformed through discussions in the public [Ganglbauer et al., 2014].

The Foodsharing case study pointed to people as the main agents, technology being a tool in the process of social change. Consequently a bottom-up approach with intentions for change emanating from people is crucial if a community should be sustainable [Crivellaro et al., 2014, Light et al., 2013].The Foodsharing case study made evident that community members and agents of the Foodsharing association were the drivers for developing and maintaining the platform and keeping discussion alive. Participatory approaches include stakeholders that engage in change, supporting, understanding and generating knowledge with individuals, collectives, environmental organisations, political activists and NGOs. Research literature about policy making within HCI provides a stance to engage in participatory design and action research [Grimpe et al., 2014], a methodological proposition shared by practice-oriented approaches [Kuutti and Bannon, 2014]. Action research is a class of participatory approaches that aims to bring change together with stakeholders, addressing the prac-

tical concerns of stakeholders and scientific rigour in generating transferable results [Hayes, 2011].

Ownership of the technology intervention is key in having a sustained engagement of a community, where ownership entails identification with the technology, taking responsibility, and perceiving efficacy and meaningfulness through technology support [Light et al., 2013]. Ownership is also crucial in terms of appropriation of technologies, which may include support through plugability and configurability [Dix, 2007], e.g. facilitated by off-the shelf technologies as they work more reliable and people know how to use them [Balestrini et al., 2014].

Case studies such as Foodsharing were able to expand the social space where people with similar interest, in terms of the social motivation wanting to help others, or avoiding feelings of guilt when saving food from being wasted, are coming together and form a productive community connected through the practice of sharing food. This expands social organisation towards different roles that people enact in and considering food waste not only as dilemma, but as social possibility to help others in saving food from being wasted.

8.6 Positioning design considerations

1. Problem and solution framing.

The previous chapters have highlighted the complexity and interconnectedness of the 'problem' of wasted food, and shares challenges and framing of *problems* and *solutions* with other areas such as electricity consumption [Strengers, 2011, Dillahunt et al., 2010] or healthcare [Fitzpatrick and Ellingsen, 2013]. It is obvious that there is no single computational solution to a world without consumer food waste, hence an important process in design is to explore the solution space, i.e., to investigate the realm of possible approaches that will satisfactorily address a given problem. Conversely, one may explore the problem space, i.e., consider different approaches to defining and framing the very problem being addressed [Baumer and Silberman, 2011].

Problem-framing emphasises a focus on the problem definition, e.g. in this PhD's research on the sustainbale implications of food waste. So the original motivation or 'problem' was focussed on the unsustainability of consumer food waste. But in my studies, more specifically through the interviews and in-home tours, the findings pointed to people's values being centred around ethics of food waste with feeling inherently guilty about it, as well as economic considerations of not wanting to spend money on food that in the end is thrown away. Similarly were my case studies the 'solution' provided was not only about saving food from being wasted, but also helping other people. The Fridge Cam case study revealed the individual differences of households, where some reported interest in using technology enabling them looking up food in their fridges when in grocery stores, and others not needing such an intervention or 'solution'.As different as people and households are living everydayness, interventions have to meet the different values and aspects of everyday life. The Food waste diary case study revealed that some people want to reflect on specific practices and technologies can facilitate these processes.

Technology interventions should be conceptualised as offerings, designed for sense-making and open interpretation and not provided as fixed solution to a problem. Technologies can also serve the role of understanding or re-conceptualising a 'problem', such as the data submitted via the Food waste diary having uncovered more about food waste itself, but at the same time facilitating reflection for people.

2. Enquiring into interventions.

Being concerned with societal and ecological systemic challenges requires the ability to think beyond computational interventions. As with many societal challenges, most power in terms of food waste interventions would surely be in interventions by the state through legislations. This is not an argument to abandon computational interventions entirely, but being aware of other levels such as sensing through citizens or activism. Baumer et al. (2011) are concerned to be self-critical of design's propensity to implement sophisticated technological 'solutions' when perhaps a low-tech, or even no-tech approach could be more productive or appropriate. This can be applied to the area of food waste, where non-technological suggestions for interventions addressing the issue on a much broader level can be influential. These include reducing over-production in the agricultural industry or selling of 'misfit' (out of norm) fruit and vegetables [Gustavsson et al., 2011].

This design consideration is not an argument against building technologies, but an argument for being critical and reflective about why and how something should be built. Ideally, technology only intervenes where appropriate and fruitful. Another point of critique is inherent in the non-sustainability of computational technology. The toxicity, energy intensiveness, labour conditions and wastefulness in the production and consumption of computing technologies may counteract any well-intended interventions towards less food waste. E.g. if it is a mobile application such as the Food waste diary that is designed and implemented, used by people who already own smart phones, the application still requires electricity to be downloaded and used. This is not an argument that we should not use computational technologies for interventions at all, as technology is a crucial part of our everyday lives, but an argument to enquire into the sustainability of an intervention itself.

3. Politics inherent to design.

Sustainability issues and also those concerned with wider social change are inherently political as sustainability and social change are embedded in society, culture and economy. This concerns HCI insofar as being aware of socio-political circumstances allows us to broaden the levels of interventions to think of political alternatives, or *"designing against the politics of the already designed"* [Kiem, 2012]. Politics addresses the dimension of looking at extra-somatic circumstances that dominate people's lives, as well as intrasomatic awareness about these circumstances. Becoming active and addressing politics in HCI through citizen sensing [Aoki et al., 2009, Kuznetsov and Paulos, 2010], or infrastructures supporting communication and collaboration of communities, provide the opportunity to adopt activism or communities of alternative practice as sites of productive political engagement.

Specifically the Foodsharing community case study points to ideological and political values that drive community members to adopt and see the sharing of food as a political and ideological practice. Therefore community policy and framing also includes rather than excludes ideological and political issues and values that are or should be addressed [DiSalvo et al., 2010, Dourish, 2010, Le Dantec, 2012, Parker et al., 2012]. The Foodsharing community is also an example where technology enables *"connecting people through their actions and their consequences"* [Dourish, 2010, p. 7]. Minding politics of design empowers researchers to think beyond established approaches and be inspired to think on broader and more systemic levels [Knowles et al., 2014].

8.7 Summary

This final reflection chapter first focussed on reflecting on the design proposals and how they can be viewed along the dimensions *'individual - collective - societal'* and *'intrasomatic - extrasomatic'*. Second, the discussion of all three case studies raised issues about reflection as part of other design proposals, the effectiveness and sensibility of individual interventions, as well as techno-determinism immanent to designing for change. The main contribution of this thesis is presented in the section *"Design considerations for social change"*, where final reflections discuss issues around technologies fitting into the messiness of everyday life through ethnographic and participatory approaches. The chapter also explains why interventions coming from the people who are using technologies are better suited for a practice-oriented perspective and engages with the importance of materiality and social organisation. Moreover it is suggested to enquire into interventions, consider how problems and solutions are framed and the politics of design are highlighted.

CHAPTER 9

Conclusion

9.1 Introduction

This chapter ties together all the contributions made. My contributions will be discussed in terms of the constructivist research categories of usefulness, transferability, credibility, resonance and originality correspond to my approaches, methods and findings. This chapter engages also with the limitations of my contributions being connected with the challenges faced during my PhD process. Here I will discuss the challenges of attempting to tackle a societal issue such as food waste as something that cannot be intervened in isolation of phenomena but only more holistically. The chapter continues how this research might be further developed with future work. It considers as well the areas not answered or not addressed. Finally, I will end this chapter with a concluding section reflecting on the research undertaken and the contributions made.

9.2 Contributions made

To recap, one of the main goals of this thesis was to draw attention to the issue of food waste in HCI as a site for research relatively understudied compared to other topics in sustainability. The constructivist, qualitative and designerly approach was based on social innovation as opposed to technology innovation. It was not important to use the newest technologies but to understand and transform the social context facilitated by technologies. In addition to this, I was interested in uncovering the ways that everyday life and household routines contribute to food waste and consequently understand where and how to intervene.

As stated in the Introduction on page 5, the main research question aimed at generating design considerations from a theoretical and empirical understanding for interventions towards less consumer food waste. This question necessitated the uncovering of three sub-research questions and contributions.

The *first contribution* in chapter 4, further explored and elaborated through case studies, explained how everyday life is socially and materially organised in terms of food waste. It highlights the competing concerns people have and the negotiations they make in everyday food practices. Food waste is then the unintended result of these negotiations and uncovers that practices are dominated by systems of social, cultural and material interdependencies.

The six design proposals provide suggestions to intervene and are the *second contribution*, conceptualised from a designerly perspective and imagining alternative and preferable futures with less food waste: Here I have contributed an understanding of the phenomenon of wasted food, specifically proposing technology interventions for #1 reflection and #2 informed choices as individual approaches. The other design proposals link the findings and literature to support #3 communities of alternative practice, #4 re-connection to food sources, #5 promotion of public interest and #6 activism. The proposals are quite broad and not every HCI researcher and designer may feel comfortable in supporting activists such as dumpster divers with an action research approach. I also highlighted that individual approaches are still useful, not framed as behaviour change but as technologies being sensitive to the messiness of everyday life.

To understand how technologies interact with everyday life, the three case studies in chapter 5,6 and 7 were empirically explored making the *third contribution*. The Food waste diary, Fridge cam and Foodsharing aimed to inform how such interventions were used, what people experienced with them in their everyday lives and what motivated people to use them. Individual approaches are, besides the critiques they can raise, identified to be useful for some people who are concerned about food waste. The effort that users of the Food waste diary invested in creating these entries and submitting comments was considerable. The Fridge cam study showed that people had positive aspirations in using technologies to support planning and shopping. The findings from the Food waste diary as well as the Fridge cam study made visible though how our 'choices' are influenced by circumstances or values rather than based on rationality. The findings from the Foodsharing community implied that motivations beyond saving food from being wasted are at work. Foodsharing members discussed their motivations in being altruistic towards others in giving them food or engaging in environmental activities in saving food from being wasted.

The *main contribution* pulls all empirical and theoretical strands together for a final reflection in providing a set of 8 design considerations for interventions for social change. These considerations were drawing out some broader implications and overarching concerns such as designing technologies to be sensitive to the messiness of everyday life through ethnographic inspired approaches, participatory design, action research and fictions conceptualising future interventions. The considerations include supporting people or collectives concerned with change. I also highlighted the significance of critical awareness of interventions and the possible implication of digital technologies and technologies might not providing one 'solution' to social complex problems such as the vast amounts of consumer food waste. The last design consideration is an invitation to reflect on the politics of design when designing for sustainability and social change.

9.3 Results discussed towards constructivist criteria

Here I want to come back to the criteria of constructivist research discussed in chapter 3 on page 28, and examine my findings towards them: Namely usefulness, transferability, credibility, originality and resonance.

Overall, the criteria of *usefulness* was one of the main motivations of my thesis. From the beginning I was aiming to generate results that could be used in people's everyday world. With the Food waste diary I also attempted to provide a reflective intervention available to people using smart phones, providing a technology that would scale. My passion fot contributing to research into a social matter was immanent in my PhD and I intended to gain deep understanding about how social change can be approached within HCI and CSCW. Usefulness was also shown in providing the Food Waste diary as an application that scales for people with Android or iOS phones. Moreover my orienting set of design considerations are intended to provide useful information for designers and researchers in HCI.

However, good intentions and usefulness alone do not suffice a constructivist research approach, and findings are intended to be *transferred* from one context to another to provide knowledge. What I found in the 14 households in Austria and UK is in parts shared by Evans' ethnographical work in the UK. Specifically uncovering household food waste as a product of how we live our everyday lives, dominated by social and material circumstances, is a finding that has been found in all studies of [Evans, 2011a, Evans, 2011b, Ganglbauer et al., 2012, Ganglbauer et al., 2013]. Hence one could claim that there is the constant of competing concerns in people's everyday lives and food waste an unintended result. These studies were also carried out in Austria and UK, two industrialised countries that showed similar tendencies in over-buying [Ganglbauer et al., 2013] and over-provisioning [Evans, 2011a]. Additionally to understanding everyday food practices, my aim was not only to understand, but also to conceptualise possible interventions within HCI in this thesis.

In terms of interventions I suggest that my design considerations are transferable to other areas in sustainability, such as supporting existing communities with approaches of participatory design and action research as fruitful. This learning is an outcome of the reflections on my PhD process where the starting point was different from participatory approaches and users were included with interviews and home-tours. As technologies are tools we use, approaches supporting change emanating from people and collectives is a conclusion derived from the Foodsharing community case study. Though I have to notice that this did not only emerge from my findings, but was also derived from literature in the field [Brynjarsdottir et al., 2012, Grimpe et al., 2014, Håkansson and Sengers, 2014, Kuutti and Bannon, 2014, Woodruff et al., 2008, Wulf et al., 2011].

Study findings should not only be transferable to other settings, but be harmonious within themselves, meaning that the material and the findings should be well linked and credible. My presented results are *credible* as they are well reasoned and discussing together with the presented material, allowing others to . The provided arguments and interpretations ought explain how the findings were acquired and understood. Here it is also important to note that the interpretation is, as inherent in constructivist research, also based on my personal value-set. However, I endeavoured to approached the field with *"deliberate Naiveté"*

staying open for various interpretations. Evidence is provided insofar that readers can form a distinct opinion and interpretation of the results based upon the presented material.

My findings are *resonant* intending to present full and rich phenomena: I presented existing practices in-depth along with phenomena of contexts. I was also concerned to understand interventions in the field (Food waste diary, Fridge cam and Foodsharing) and stayed open for interpretation. However, I do not claim that I captured every phenomenon. A different researcher, following a constructivist perspective, might have found different qualities of everyday life and different technology interventions. From the experiences I have gained in presenting my research and the responses I received, it is a topic everybody can share personal experiences with: the aim was to offer deeper insights about people's personal experiences with food, their practices and food waste.

Originality of the findings describes if the gained insights are novel and fresh: Beyond the significance of bringing forward the importance of food waste and its ecological impact, the ethical and social implication that come with it for people are another original contribution of my findings. Additionally looking at everyday life from a social practice theoretical perspective as a pioneering approach in HCI and is just starting to receive more attention [Pierce et al., 2013, Kuutti and Bannon, 2014]. With technologies moving more and more into the space of everyday life, social practice theory has just been discovered as a useful lens, also called the practice turn. My design considerations and their positioning provide an original approach of how we can design for sustainability within HCI from a practice-theoretical perspective.

9.4 Challenges faced

The motivation to do useful research in studying and designing for a societal and ecological issue such as food waste, is enriching as well as challenging. It is on the one hand worthy and rewarding doing research for a social challenge, but on the other hand I had to attend to several issues: First, food waste is a phenomenon that is multi-sited and multi-faceted and of complex nature. The negotiations people make around food practices are entangled with social and material circumstances, routines, knowledge and cultural specificities and not easily graspable. Also I have had no considerable experience in qualitative as well as ethnographic informed methods when I have started my PhD. To translate the findings into design proposals was a considerable challenge: It is hard to map the complexities of everyday food practices to a technology. As technologies are discrete systems, there is only a small part of the complexities of everyday life I was able to map onto an intervention. As food waste is a systemic issue the design proposals took the shape of a more holistic approach, including e.g. the proposition to support food waste activists such as dumpster divers as a community of alternative practice.

My PhD also reflects my learning process of where I started, namely with individual approaches, behaviour change and motivational theories, realising that these were not sufficing to meet the multi-sited and multi-faceted phenomena of wasted food. These models were reducing the complexity of everyday life to something that was not able to describe it [Bannon, 1995]. Social practice theory was a useful theoretical lens to think about food waste on a

broader level, even though it made coming up with design proposals even more of a challenge. The one 'simple solution' does not exist for the amounts of food being thrown away. Social practice theory proved to be very useful in becoming aware of certain aspects, but made it even more difficult to productively conceptualise interventions.

At the time where I started my PhD individual and behaviour change approaches were still and are the standard in the field of sustainable HCI and more critical stances appeared through my empirical experience and related literature. It is actually the process of learning and reflecting that makes a PhD a valuable process in uncovering, understanding, reflecting and learning of what is going on and imagining what might be.

9.5 Limitations

The research was situated in a complex setting as consumer food waste is a complex phenomenon spanning aspects of everyday life influences by diverse circumstances. In understanding the qualities involved I could study only small numbers of people and households being situated in certain contexts. Food practices are pervading every aspect of our lives, we do not eat only in the home but also at work and outside of the home. This is a complex setting and challenging to study. I was therefore not able to study every possible phenomenon in consumer food waste. Moreover, the set of participants for the interview and home tour study were not representative for all people in Austria and the UK.

My case studies with technologies used in the field were as diverse as the topic would suggest. The Food waste diary study had access to people who were interested to use such an application worldwide. I intended to keep the threshold of using the diary as low as possible so users were not obliged to register with email address and password. This came with the trade off that I was not able to recruit diary users for a more in-depth interview study. Similar limitations can be stated for the Foodsharing study, where I received deep insights about the interactions between the Foodsharing association, engaged collectives and individuals, but I was only able to study those who were actively contributing online. The Fridge cam study elucidated the interactions with a technology informing planning and shopping choices. Even though the richness of findings was interested, I cannot claim that the findings were representative.

Oftentimes during the process of my PhD I found myself bound to digital technology as the natural element in Human *Computer* interaction, where digital interventions are the tools at hand. This was the case for many cases relating to behaviours that could easily be changed through a different material organisation of food industry, such as avoiding big packages or legislations advocating the sale of 'misfit' (out of norm) fruit and vegetables.

Even though my studies have limitations, my findings coincide in parts with Evans's (2012) for the interview study and home tours. The six design proposals were found as reoccurring patterns in all case studies and I would expect them to do so in future food waste interventions.

9.6 Areas for future research

Opportunities for future work would include working with the Foodsharing community and probe on different interventions. The community declared to be need of a mobile application to support the platform, and much could be learned and gained from designing and developing it with a participatory approach seeing how it might be used in the everyday life of food sharers. In talking to a Foodsharing member, I also realised that the concept of the Fridge cam could be useful for the public fridges they are using to share food. They most often do not know how much food and what is in there for people wanting to come by and collect food. Hence Foodsharing members often take photos of the inside of the fridge to post to their local Facebook group to raise awareness that something can be taken from there. Hence I see an opportunity here to install fridgecam and see how it might be used within the community and study interactions with it.

Another area for future research is further studying the process of reflection facilitated through technology in an interview study with users of the Food waste diary application: Different levels of reflections were found in the material, but I was not able to observe whether there were reflective processes beyond the interaction with the application, and most important, whether the reflection enabled by the mobile application inspired any change in habits or patterns. Hence this is another area of practical future work that could be continued.

One area that would be beneficial for the field of HCI in general is to become familiar with approaches and literature in social change that deal with more systemic approaches than behaviour change. The existing literature provides critiques on behaviour change and individual approaches [Dourish, 2010, Brynjarsdottir et al., 2012, Pierce et al., 2013], but were often not productive in answering how interventions could be conceptualised from an intervening and designerly perspective. A few exceptions here are [Håkansson and Sengers, 2014, Kuznetsov and Paulos, 2010, Woodruff et al., 2008, Wulf et al., 2011].

9.7 Final conclusion

In summary, I began this work in a period when food waste was relatively understudied and underrepresented in HCI and CSCW. Consumer food waste was identified to be an ethical, social and ecological challenge at the beginning of my research. To understand everyday life of people's food practices and the passage from food into waste, an interview study with in-home tours of everyday routines was presented. The findings pointed to occasions for waste emerging as a later consequence from multiple other moments of consumption within practices of planning, shopping, (over-)buying, storing, cooking, or gardening. Consumption or non-consumption of food was identified as the outcome of multiple negotiated concerns in everyday life, embedded in wider social and material circumstances. The findings also inspired six design proposals towards less consumer food waste, namely technologies to facilitate #1 reflection, #2 informed choice ,#3 communities of alternative practice, #4 reconnecting to food sources, #5 promoting public interest and #6 supporting activism.

To understand how digital technologies might intervene, three case studies were carried out with example interventions of Food waste diary, Fridge came and Foodsharing. The stud-

ies were analysed with qualitative as well as quantitative methods such as thematic analysis, online ethnography or system logging of technologies in the field. The main contribution of my thesis, the design considerations for social change in sustainability, emerged as an analysis of my empirical findings and theories. Here I highlighted the importance of understanding and designing technologies for the messiness of everyday life through ethnography, supporting change emanating from people, participatory design and using design to imagine future interventions. A more critical stance towards digital interventions reminds one to enquire into the usefulness of an intervention, the possible implication to not use digital interventions, and the politics of design.

I hope that this work will inspire further work towards tackling societal challenges, designing and conceptualising technologies putting social innovation beyond technology innovation. Additionally I am looking forward to see more research and case studies of interventions in the areas of food waste, as well as social practice theory and social change as emerging in the field of HCI and CSCW.

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APPENDIX A

Annex

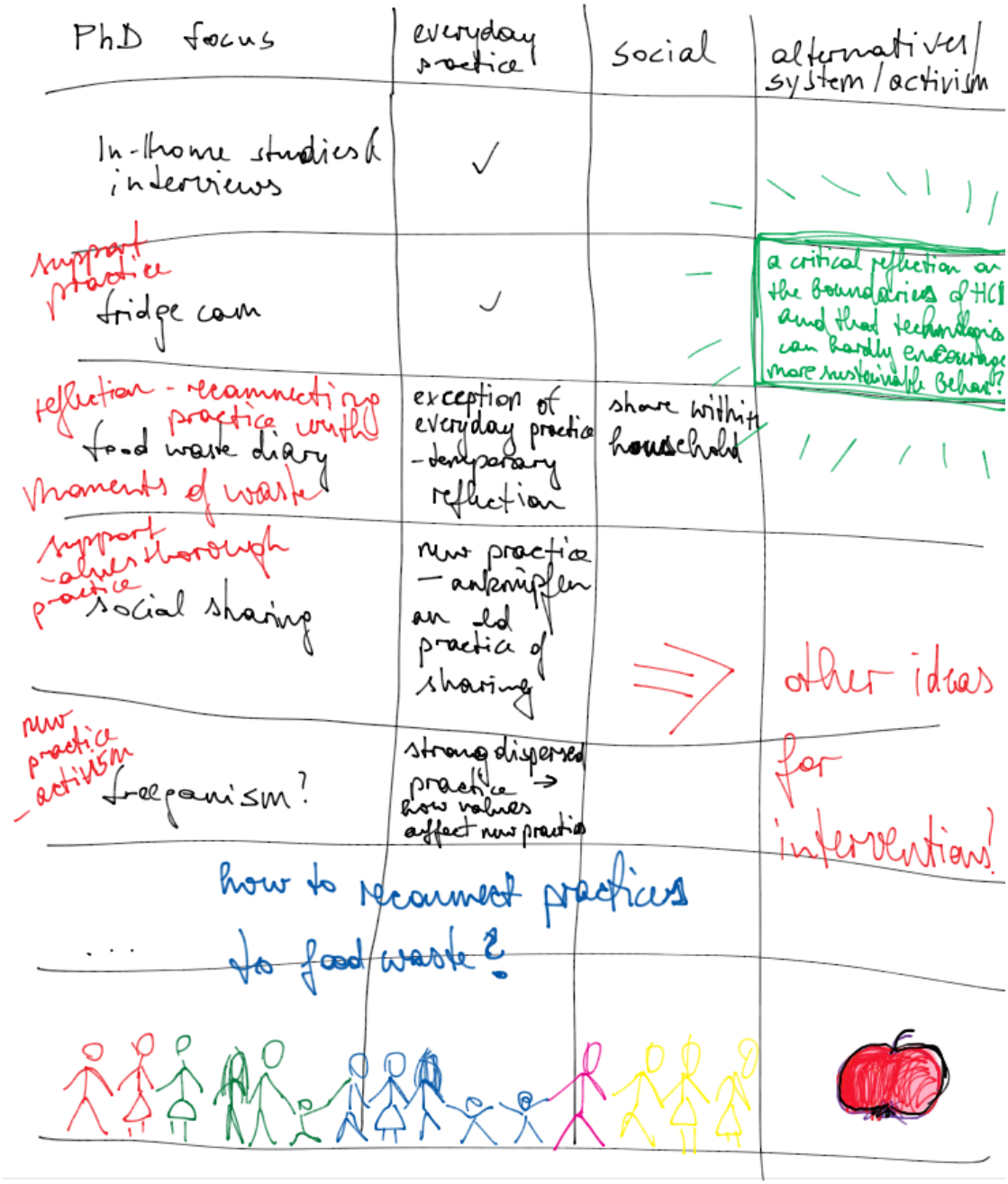

Figure A.1: Sketch to explore different possibilities for interventions and trying of categorisation

Food research - Interview outline plan

Begrüßung und Vorstellung

Ich bin Doktorandin auf der TU Wien. Im Moment versuche ich mehr darüber zu erfahren, wie Menschen in Ihrem Leben und Ihrem Zuhause mit Nahrungsmitteln umgehen. Deswegen bin ich heute hier und möchte ein Interview durchführen.

Einverständniserklärung – mündlich

Darf ich das Interview auf meinem Audiorekorder aufnehmen? Ich kann mir leider nicht alles merken und deswegen ist das als Erinnerungsstütze wichtig für mich. Und eine andere Frage auch gleich noch, darf ich später Photos vom Wohnraum und da wo Lebensmittel aufbewahrt werden, machen (ohne Personen darin)? Die Photos und Audioaufnahmen werden nicht irgendwo direkt veröffentlicht. Die Daten werden anonymisiert und nur für analytische wissenschaftliche Zwecke verwendet. Falls ich ein Photo für eine wissenschaftliche Publikation gerne verwenden würde, dürfte ich das? Soll ich einfach noch mal nachfragen?

Hintergründe zur Person, Werte der Person - Allgemeine Lebenssituation

Erzähle mir bitte einfach von dir und deiner Lebenssituation. Ich habe genug Zeit für das Interview. Während dem Interview mache ich manchmal kurz Notizen. Ich werde Dich nicht unterbrechen während Du erzählst. Im Anschluss werde ich dann noch einige einfache Fragen stellen.

- Lebensumstände, Familienstand, Technikverwendung, Wohnsituation, Alter, Arbeit, Ausbildung,

Wertigkeit von Lebensmitteln und Nahrung, Ablauf vom Kaufen, Aufbewahren bis zum Essen?

- *Möchtest du mir erzählen wie/was/wann du letzte Woche mit Nahrungsmitteln, also vom Einkaufen, Aufbewahrung, (eventuell) Kochen bis zu Essen gemacht hast?*
  - Kaufen: welche Lebensmittel, wie oft, viel, wo
    - Wie: mit einer Einkaufsliste oder spontan? Alleine oder gemeinsam?
    - Was: z.B. das Billigste, Luxuswaren, biologisch, saisonal, lokal, traditionell, exotisch, ...?
    - Wo: Supermarkt, Markt, Bauernhof, ...
  - Kochen: wie, was, wann - alleine oder gemeinsam
  - Essen: zuhause oder auswärts (Restaurant, Markt, Bistro, Schnellkochrestaurant, Kebab- Würstelstand, ...) - alleine oder gemeinsam?
- *Was ist bei diesem Ablauf einfach/schwierig?*

Aufbewahrung – Werte

- *Möchtest du mir bitte zeigen wo alles in der Küche oder im Abstellraum oder wo auch immer aufbewahrt wird?*
  - Kühlschrank, Abstellraum, Kästen, Regale, Mistkübel, Gefrierschrank, Vorratsspeicherung, große oder kleine Gefriertruhe, ...

Umgang mit übriggebliebenen Lebensmitteln, Abgelaufenem

Was ist dann letzte Woche passiert in dem Falle dass Lebensmittel übriggeblieben sind?

- *Warum? Welche? Wie oft?*
- *Was passiert mit abgelaufenen oder übriggebliebenen Lebensmitteln?*
- *Was müsste gegeben sein dass das weniger passiert?*

Figure A.2: Interview guide for understanding everyday food practices of people used during the interviews and in-home tours, page 1.

Auswahl und Motivation

- *Wie wählst du aus was wo gekauft/gekocht/gegessen wird?*
  - Kennt man schon, Werbung, Nähe, die Leute mit denen man unterwegs ist, ...)
- *Was beeinflusst dich dabei was du kaufst, wie du etwas aufbewahrst, wie du kochst/ wie gekocht wird, was du isst, ...*
- Was wäre wenn

Verwendung von (Informations-)Technologie, mobile Geräte, ... im Zusammenhang mit Nahrungsmittel/ Ernährung

- *Du hast ja einen Computer/ ein Handy. Kannst du mir BeispielE geben, wie du diese Technologien im Zusammenhang mit Ernährung verwendest? Oder gerne verwenden würdest?*
- *Steht für dich (Computer)Technologie mit dem großen Thema Essen in einem Zusammenhang?*
  - Stammkundenkarte, Rezeptseite, mobile App, ...?

Ende

- *Gibt es noch etwas dass du mir erzählen möchtest?*
- *Hast Du Bemerkungen oder Feedback zum Interview selbst?*
- *Wärst Du bereit eine Cultural Probe für mich zu machen? Das ist etwas wo du einfach Dinge aus deinem Leben dokumentierst/Zeichnest/Schreibst, mit einer Fragestellung von mir. Mir dient das dann als Inspiration.*
- kleines Dankesgeschenk

Figure A.3: Interview guide for understanding everyday food practices of people used during the interviews and in-home tours, page 2.

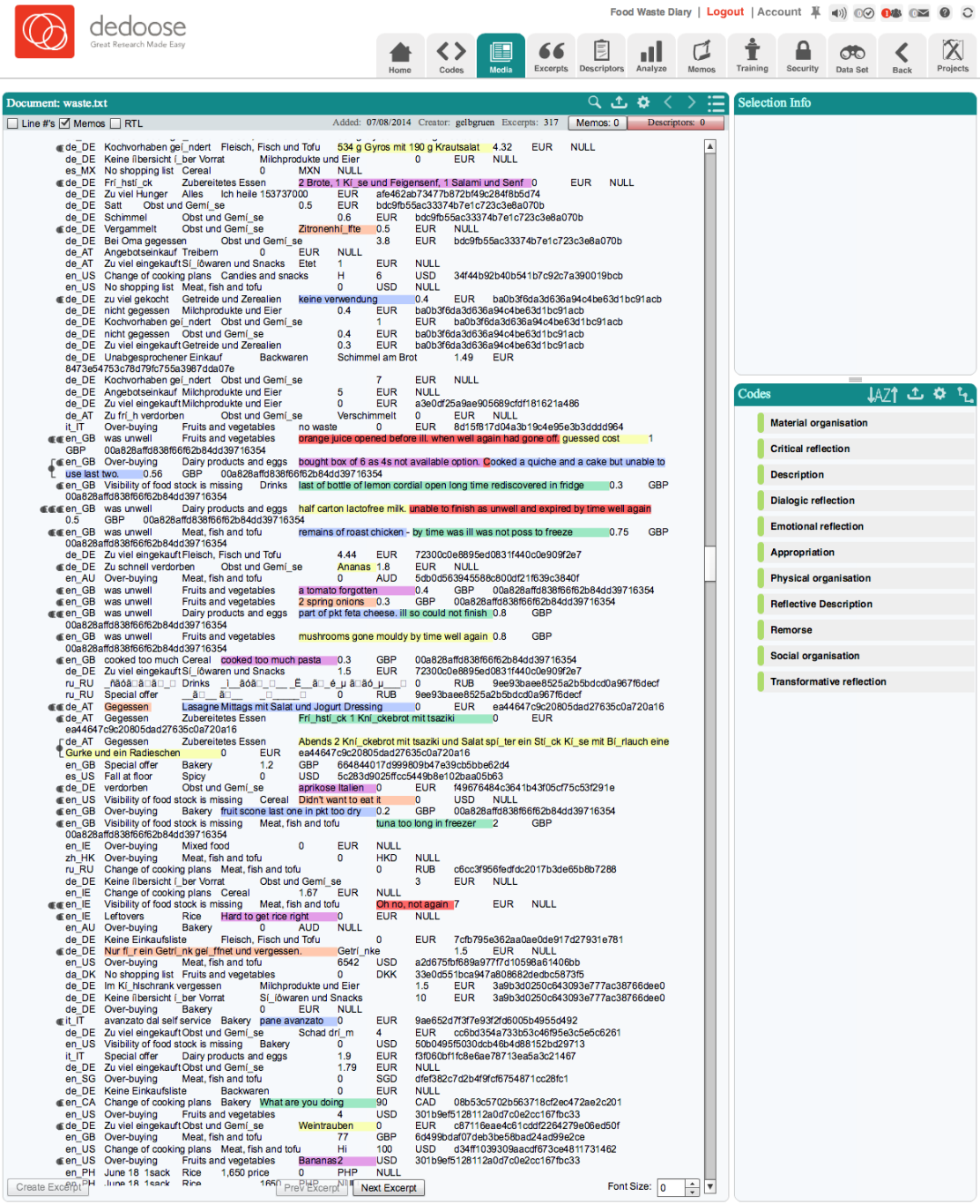

Figure A.4: Analysis using online platform Dedoose.

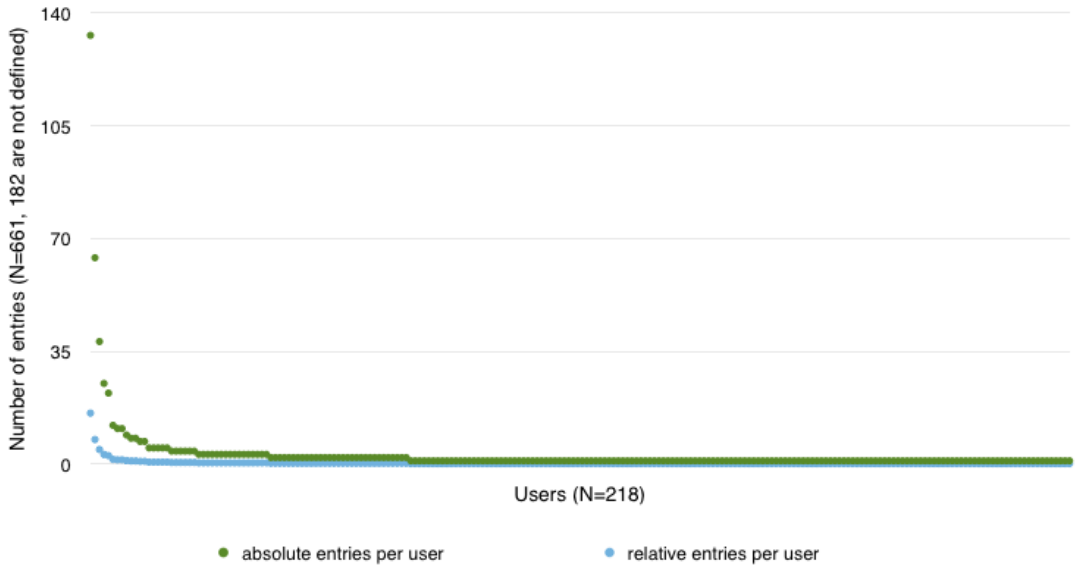

Figure A.5: Entries per user, with one user having 133 entries followed by another with 64 entries, 32, 23, and down to most users submitting one entry.

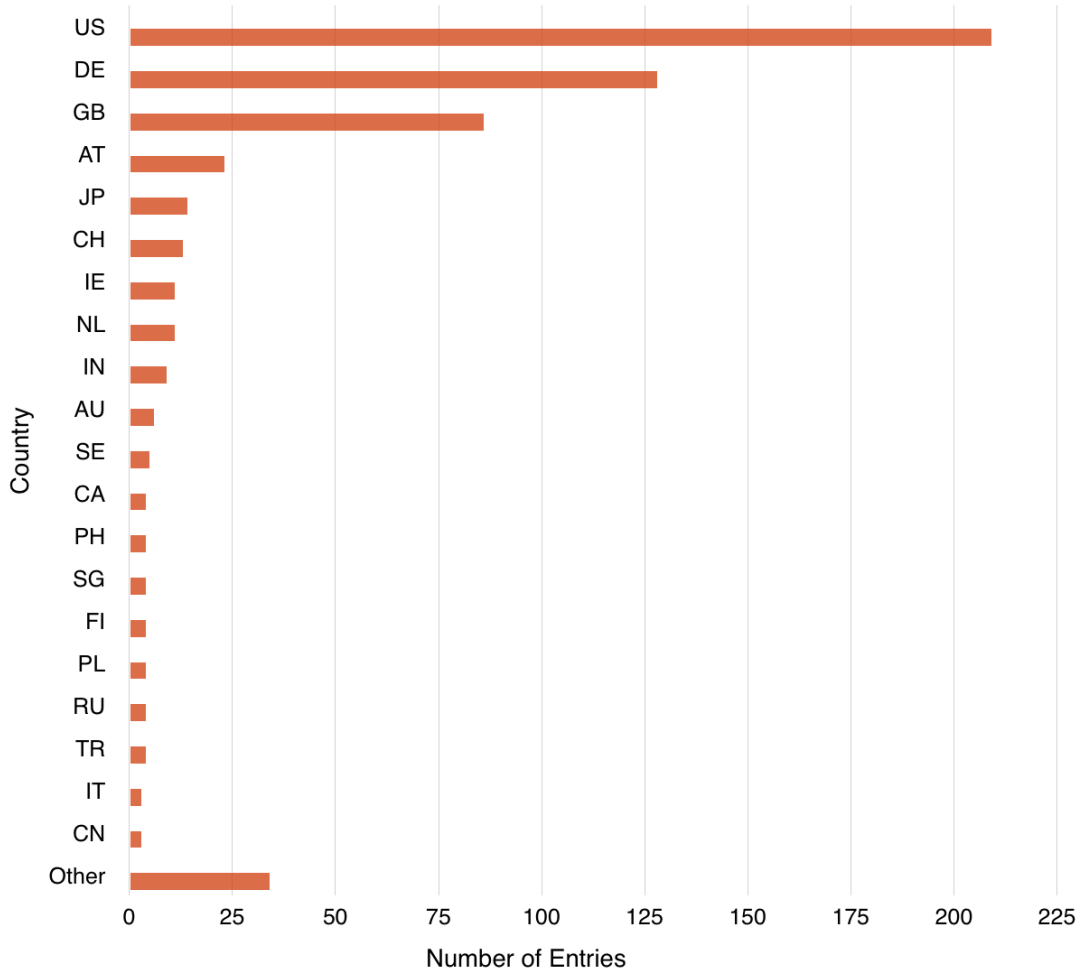

Figure A.6: Entries by country with US being most prominent followed by Germany, Great Britain and Austria.

Informed Consent Form

Newcastle University

I, the undersigned, confirm that (please tick box as appropriate):

1.	I have read and understood the information about the project, as provided in the Information Sheet dated February 2012.	☐
2.	I have been given the opportunity to ask questions about the project and my participation.	☐
3.	I voluntarily agree to participate in the project.	☐
4.	I understand I can withdraw at any time before February 2012 without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.	☐
5.	The procedures regarding confidentiality have been clearly explained (e.g. use of names, pseudonyms, anonymisation of data, etc.) to me.	☐
6.	The use of the data including photos from food in research, publications, sharing and archiving has been explained to me.	☐
7.	I understand that other researchers will have access to these data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form.	☐
8.	I, along with the Researcher, agree to sign and date this informed consent form.	☐

Participant:

_____ _____ _____

Name of Participant Signature Date

Researcher:

_____ _____ _____

Name of Researcher Signature Date

Figure A.7: Informed consent for interview and home-tour study.

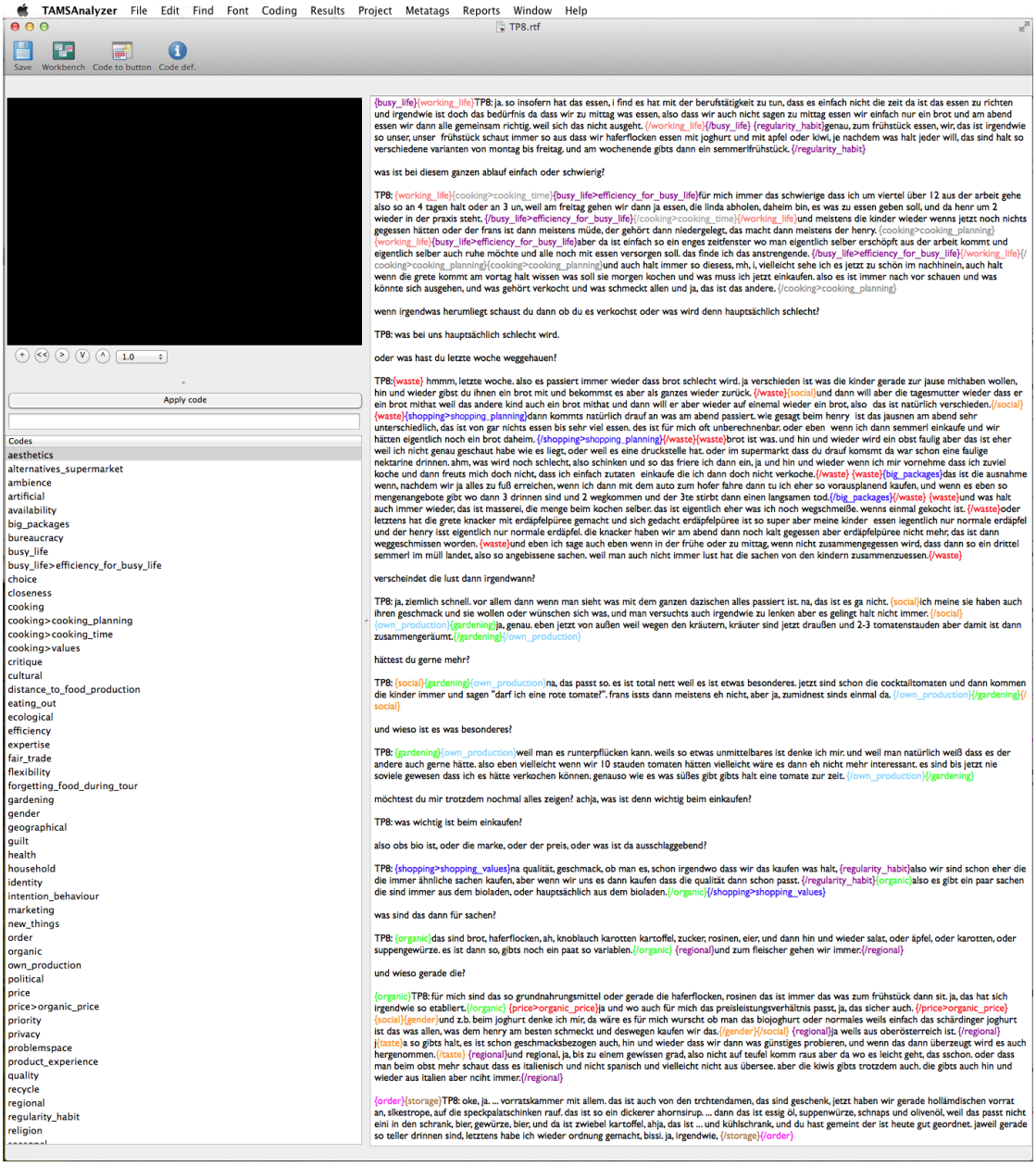

Figure A.8: Screenshot from Tams Analyzer, the software used for inductive thematic analysis of the interview material

Information Sheet

Culture Lab, Newcastle University,
NE1 7RU
Feb 2012

Dear Sir/Madam,

Thank you for agreeing to participate in the Fridge-cam study. This sheet describes the purposes of the study and what you will be asked to do if you take part. You may find it useful to retain this information sheet for future reference.

The Fridge-Cam Study
This study aims to explore people's perceived usefulness and experiences with fridge-cam. Fridge-cam is a prototype that takes a picture of the inside of your fridge every time the door is opened and uploads it to a website. You can then access this website from everywhere and every time you want to. Your participation in our study will help us to identify the factors involved when using fridge-cam in your household. From this information we will get to know if this application is useful and if not, how it can be improved.

What will taking part involve?
We would like to visit you in your home to ask you some questions about daily activities around shopping, planning, cooking, throwing away food and, if you agree, would like to do a little home-tour with you to see where and how you store your foods and take photos of your food storage places. This would take approximately half to one hour of your time. Then we would like to deploy the fridge-cam in your fridge and tell you the website where you can assess the pictures it takes. For the one-month period where fridge-cam is installed, we would like to text you once a week to ask about your experiences. After one month, we will come again to remove fridge-cam from your fridge and ask about your experiences with it. Your participation is completely voluntary and you are free to withdraw from the project at any time in the one month following your participation. If you decide that you are not happy taking part you can contact me at any of the addresses provided below before March 19th 2012 and your details will be removed from the study.

What happens with your data?
Ideas that arise from the information you give us may be used when designing applications. We will type up a transcript of the conversation we have with you but will remove any information that could identify you. Parts of this transcript may be used later in a PhD thesis, in presentations or in publications to present the findings, but you will not be personally identified. If extracts of the data are to be used for publication a pseudonym will be used to identify your data to ensure confidentiality. Other researchers may use the data, provided the conditions of confidentiality and anonymity are met.

If you have any further questions about the project or your participation please do not hesitate to contact us at any of addresses provided below.

Thank you for your time,

_____

Eva Ganglbauer and Dr. Rob Comber Culture Lab, Newcastle University,
E-mail: eva.ganglbauer@tuwien.ac.at or robert.comber@ncl.ac.uk
Phone: 0191-2464635

Figure A.9: Information sheet for interview study in Newcastle, approved by ethics board at Newcastle university.

Fridge-cam study: Technical details

Thank you for participating in our study! That's awesome!

This is the link that where you can access the pictures of your fridge, whenever you want:

http://di.ncl.ac.uk/fridgecam/?id=cam5/

WiFi

Please try not to change your WiFi settings during the one-month the study is running as fridge-cam will only remember the WiFi it was first connected to. If possible, please try to keep your modem running.

Troubleshooting

In case the **fisheye-lens** falls off the phone, just attach it to the phone again; it is fastened with a magnetic ring. →

Normally the application should work reliably. In case there are any problems, please follow these instructions:

1. Tap on the "Exit Fridge Cam" Button.
2. Connect to your WiFi
3. Tap on the "Fridge Cam" icon to re-start the application again.
4. Hold the door still for 2 Seconds

Contacts

If you experience any problems or want to tell us something, you can email Rob Comber (robert.comber@newcastle.ac.uk) and/or Eva Ganglbauer (eva.ganglbauer@tuwien.ac.at) and we will try to give further answers or send somebody around to fix the problem.

Figure A.10: Information sheet for Fridge cam study participants.

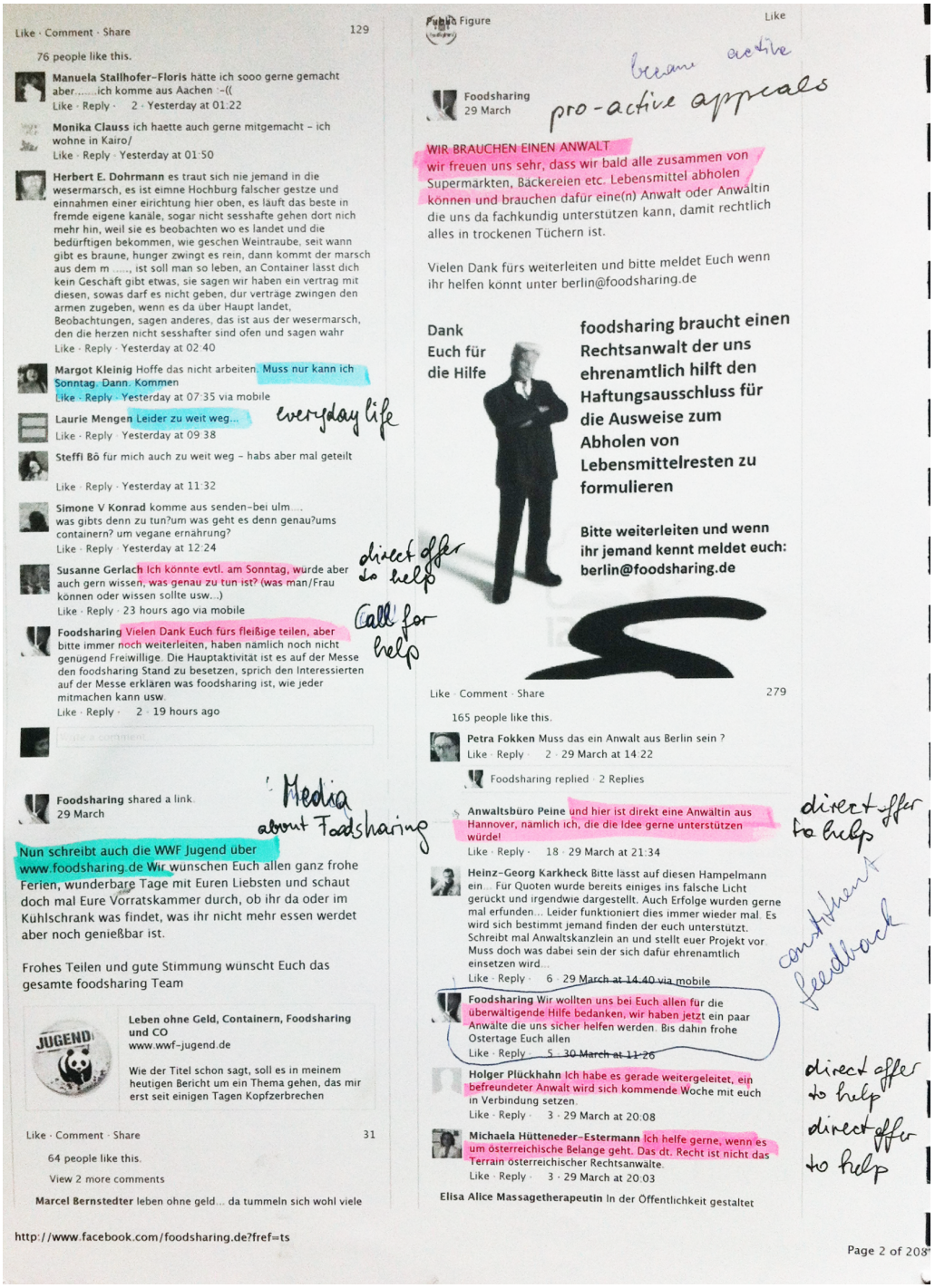

Figure A.11: Thematic analysis of Foodsharing Facebook group on paper.

Figure A.12: Foodsharing design proposal before the actual community in Germany started.