Bearing an open "Pandora's Box": HCI for reconciling everyday food and sustainability[1]

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The sustainability of food is a significant global concern with drastic change required to mitigate complex social, environmental and economic issues like climate change and food security for an ever increasing population. In this paper, we set out to understand the place of food in people's lives, their mundane yet surprisingly complex ways of sourcing their food, and the processes of transition, past and ongoing, that shape these choices. Our goal is to understand the potential role for digital interactions in supporting the various ways that food consumption can be made more sustainable. To inform this exercise, we specifically set out to contrast the journeys of committed sustainable 'food pioneers' with more conventional mainstream consumers recruited in branches of a UK supermarket. This contrast highlights for both groups the various values, and 'meaningfulness' attached to foods and meals in people's lives; and suggests ways in which food choice and pro-sustainable practices can be supported at least in part by new digital technologies.

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1. INTRODUCTION

It is widely recognised that dominant patterns of consumption in industrialised nations are ''unsustainable'' [Crocker and Lehmann 2013; Jackson 2009]. In Europe, food consumption has a strongly negative impact in relation to a range of environmental indicators [Tukker et al. 2006]. Hinrichs [2014, p. 114] suggests that a confluence of intensifying circumstances in the early twenty first century, including climate change and energy security, gives rise to new urgency and challenges for food systems, leading her to argue that we 'should be concerned about what present trends mean for the future'. While technological 'solutions' are suggested to help mitigate some of these challenges, social and cultural

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elements of practice that shape what and how we eat represent a significant opportunity to effect greater change [Crocker and Lehmann 2013].

Historically, food was largely produced and consumed locally, and within a specific set of biophysical and cultural constraints [Atkins and Bowler 2001]. In developed countries after World War II, a more complex, integrated system evolved, where food production and consumption became increasingly spatially and culturally independent. For the majority, certainly in the UK, household food is bought in at supermarkets as part of a sizeable weekly or monthly shop by car [Blake et al. 2010]. This 'mainstream' food system sees food products that are more highly processed, and food which is accessed predominantly through vertically-integrated, global supply chains—in 2014, 90% of UK food came from twenty two countries; one of these twenty two was the UK itself, which supplied 53% of its own food [DEFRA 2016]. Although, visiting one or more supermarkets for a 'weekly shop' is the dominant shopping paradigm for many, online bulk purchasing supplemented by top up shops of fresh items from local shops and smaller 'metro' supermarkets is rapidly gaining in popularity - although, perhaps surprisingly, online food shopping in UK currently accounts for less than 5% of the market[2] [ibid].

Within and beyond the supermarket, a growing number of people are looking for more sustainable and ethical food sources. So called ethical purchasing of fairtrade and rainforest alliance foods is on the increase year on year, suggesting that this trend is wider than pioneer shoppers [DEFRA 2016]. As part of shifting practices in relation to food consumption, there has been a growth in interest relating to alternative and local food systems [O'Neill 2014], such as farmers' markets, farm shops, producer cooperatives, community supported agriculture (CSA) [Holloway et al. 2007], vegetable box schemes (where fresh fruit and vegetables are delivered direct by the producer to the consumer), and the Local Food Assembly[3], whereby consumers make commitments to local producers who then come together at a digitally mediated market rendezvous to collect their shopping, thus making shopping with multiple local providers more convenient.

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[2] http://www.igd.com/About-us/Media/IGD-speaks/Joanne-Denney-Finch-speaks-at-The-Big-Debate/ accessed 22 April 2016.

[3] The Local Food Assembly, https://thefoodassembly.com/en, accessed 6 February 2015.

In this paper, we investigate the food practices of two specifically identified and recruited groups of participants: one group drawn from a panel of supermarket shoppers intentionally selected for their unremarkable 'mainstream food practices'—this group provides insight into the everyday concerns of typical patterns of food consumption in UK, and hence the context for thinking about design for social change; the other, self-professed practitioners of 'sustainable food'—this group has, to some extent, intentionally found alternative ways to source food that they believe to be more sustainable or ethical. This separation is necessarily somewhat simplistic given the complexity of food in everyday life. Yet, as we will see, what drives each set of participants in sourcing and choosing their food varies enormously. In this explicit contrast we find inspiration from the real work and deep meaning involved in food practices of all of our participants.

Inspired by previous work in sustainable HCI, one of our purposes in this paper is to understand how participants in the latter group think about 'sustainability' and operationalise it in practice in relation to everyday food. The complexity of the term 'sustainable' was recognised and deeply considered by this group. There are precedents for studying such communities in HCI: Håkansson and Sengers [2013] wrote about families who strove to live simply and ethically, "*we believe that this [sustainable pioneers] group, who has thought consciously and at length about what it means to live sustainably holistically, provides a valuable lens to illuminate issues in HCI research and design.*"

Drawing on these understandings, we derive insights into opportunities and approaches to design to support more sustainable food acquisition a) learning from sustainability 'pioneers' about the lived experience of sustainable food and their appreciations of alternative consumption practices, and b) questioning how sustainable practices, and the process of routinising them, might be made more widely accessible and valuable for more mainstream consumers.

Fully recognising that in both participant groups we will find a wide range of concerns influencing food choice, a further contribution of our work is toward unpacking the various values people bring to food (e.g. related to economy, health, ethics, ecological), what they mean by sustainability when they talk about food, and the barriers they face in making their food more or less sustainable.

2. RELATED WORK

Those living ostensibly more sustainable lives have previously been studied as a means of informing sustainable HCI design. Woodruff, Hasbrouck and Augustin [2008] explored the practices of people who made significant alterations to their homes in the interests of the environment. In contrasting these practices to the wider population, they point to the need for HCI not just to focus on changes by individuals, but also that surround individuals e.g., policy and public infrastructure. They conclude by calling for research to study populations with more varying degrees of commitment. Håkansson and Sengers [2013] studied "simple living" families in order to explore how HCI could support such lifestyles. They consider sustainability holistically rather than in purely environmental terms. Here, we take a similar analytical view; focusing on food, we extend our understandings of sustainability to account for its wider place in everyday life, and with those who have varying degrees of 'commitment'. Everyday social practices have also been studied in HCI in relation to food. Clear et al. [2013] examined the cooking practices of university students in shared accommodation, and quantified the direct and embodied greenhouse gas emissions of their diet. Ganglbauer, Fitzpatrick and Comber [2013] specifically examined household food waste, and developed some design strategies for addressing this issue. Food waste is an area that HCI scholars have targeted specifically: Farr-Wharton, Choi and Foth [2014a; 2014b] examined the use of food waste apps (e.g. food swapping practices and fridge colour coding to understand existing food stocks) to influence consumer knowledge of domestic food supply, location and knowledge, while Ganglbauer, Fitzpatrick and Guldpfennig [2015] look at the role of technology in supporting more sustainable food consumption through food waste diaries. They conclude that food shopping, cooking, eating and associated waste are socially situated and that the complex circumstances of people's lives and their food practices are intertwined and this needs to be considered in future HCI work. Tukkinen and Lindqvist [2015] explore the real world deployment of a grocery shopping app in Finland, while Abbar, Mejova and Weber [2015] use the Twittersphere to uncover food consumption practices and in particular health impacts of different food choices.

Despite this work, food has received relatively little attention in HCI compared to other areas of everyday life, like work or entertainment. This is perhaps related to the still relatively sparse (or less prominent) integration of digital technology into

the practice, and the relatively mundane nature of food itself in everyday lives.[4] The few exceptions in HCI literature include instances of technology design for the kitchen [Olivier et al. 2009] and augmentation of specific appliances such as the fridge [Bucci et al. 2010]. And, a large proportion of this research is concerned with energy, health or sustainability. Blevis and Morse [2009] pioneered the domain by suggesting a number of promising directions for sustainable design research. Since then, research has explored how practices like healthy eating [Comber et al. 2013]; local food shopping [Li et al. 2009; Light et al. 2010]; and urban food production [Odom 2010] might be augmented with digital technology. Kalnikaite, Rogers and Bird [2011] investigated how 'nudge' theory might be applied to supermarket shopping by augmenting the shopping trolley with a display indicating the food miles associated with items that were put into it, although the effectiveness of 'nudging' techniques is contested.

In this paper, we put aside the quantitative impacts and examine broadly the range of food practices of two contrasting participant groups to explore how we might design for sustainable food as a transition to different ways of doing.

3. METHODS AND PARTICIPANTS

This research involved two distinct participant groups chosen intentionally for their markedly different approaches to food acquisition. We first recruited a panel of shoppers from three branches of a regional supermarket chain in small towns and cities in the North West of England. Participants were chosen at random using opportunity sampling. We administered a short in-store survey to 124 shoppers involving six short questions related to food purchasing habits and household size, which we later used to select participants for follow up interviews. We did not mention sustainability at the point of recruitment or in the survey questions asked. Respondents were asked if they would be willing to be involved in a telephone interview. Given the large geographical area served by these supermarkets, follow up interviews were conducted by telephone. We chose 24 participants from our panel to ensure a balanced representation of age, gender, experience with digital technologies, and living circumstances; and explicitly excluded participants who did not buy most of their food from the supermarket.

[4] Although we should recognise that in the future smart cookers and fridges, recipe and food websites, electronic loyalty card systems and online shopping may well come to market and become significantly more widely adopted, we found little integration of digital technologies in the food practices of our participants.

Telephone interviews ranged from 20 to 60 minutes in length. In these interviews we deeply explored issues relating to shopping practices, information looked for when choosing foods including country of origin, production practices (organic, fairtrade), nutrition and so on. We also discussed how foods were cooked in the household and the rhythms of food (meals, snacks) in the home. We asked participants about the concerns and values that influenced their food practices. If 'sustainability' was not reported as a particular concern, we did not ask about it because we took its omission to mean that it was not an influential consideration. As solicited, these shoppers typically purchased their food via supermarkets, but we found that many used more than one supermarket with specific criteria for what was purchased from where.

Our second participant group, which we term 'pioneers' of food sustainability, were recruited from a UK University city via local food sustainability and sustainable transitions interest groups (see breakdown of participants in Table 1). These participants were intentionally selected to be those who appear to have embraced (varying definitions of) sustainability in their food shopping, preparation and eating. This group were self-selecting in that they were contacted via existing initiatives such as Transition Towns, Incredible Edible[5], a local organic vegetable box scheme, and through flyers distributed to various city centre shops. Our flyers asked, for example, "Are you conscious of the environmental impact of what you eat? Does it affect your shopping? What challenges and limitations do you face?" None of the participants had been previously recruited for research studies by the authors, nor, to our knowledge, for any other University research projects.

This process attracted 27 participants in total. Each took part in one of a series of two-hour focus groups; one at the University and two at a city-centre location. We chose focus groups with these participants to elicit richer accounts of values, practices and experiences, through their discussions in groups of like-minded people on topics that they were passionate about. Common interest meant that we could let participants direct discussions according to their own interpretations of 'sustainability'.

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[5] Incredible Edible is an initiative started in Todmorden in the UK whereby food is grown in public places such as parks, and people are encouraged to pick the herbs or vegetables for consumption.

Each focus group was arranged into three sets of activities:

I. to elicit information relating to how they currently incorporate issues of food sustainability;
II. what motivates them to do so; and finally,
III. what could be improved in the future to make their sustainability practices easier.

The focus groups resulted in lively and engaged discussion. Participants reported enjoying reflecting upon sustainability and their food practices, and sharing opinions and experiences with others on subjects that were of common interest. Some participants already knew each other through their involvement in various food and/or sustainability communities and groups in the City, but for many, this was the first opportunity to discuss their attitudes and choices toward sustainability, without fear of being criticised for their choices.

Focus groups with early adopters of food sustainability – May 2014 (each lasting 2 hours)	
Focus group 1: University, lunch time	Age: 20s to 60s; Mix of people from urban and rural areas; Students, academics, and support staff that responded to call for participation through university mailing lists. Participants: William (O), Shane (O), Joyce (O), Margaret, Philip (Vgt), Liz (Vgt), Chloe (O), Isabella (V)
Focus group 2: City centre, evening	Age: 30s to 70s; Mostly live in city centre; People involved in voluntary sector initiatives on local food; 2 university students and an academic; 2 live in local sustainable co-housing development[6]. Participants: Michelle (Vgt), Jane (Vgt), Gerard (O), Sally, Cynthia (V), Luke (V), Katie (Vgt), Gillian (O), April (V), George (Vgt), Faye (O)
Focus group 3: City centre, evening	Age: 20s to 50s; Mix of people from urban and rural areas. Two university students (not from UK) and one researcher; others recruited through veg. box scheme, flyers in an ethical convenience store; and community food groups. Participants: Maria, Lucy (O), Dave (O), Theo (Vgt), Jacinta, Melissa (Vgt), Melanie (Vgt), Kelly (O)
Values noted in relation to food practices included seasonality (17), local sourcing (15), organicity (14), cost (14), animal welfare (12), food miles (11), social injustice (11), economic security (9) environmental stewardship (5), and climate change (3).	
Telephone Interviews with mainstream supermarket shoppers	
24 telephone interviews (20 - 60 minutes)	Geographically varied, covering most of a UK region, urban and rural. Mix of retired and working, male and female. Age: 30s to 70s; Four participants were vegetarian.
Values noted in relation to food practices included cost (10), local economy (7), health (6), local sourcing (5), organicity (2), social justice (2), and animal welfare (1).	

Table 1: Description of research participants. Vegetarian (Vgt), Vegan (V), and Omnivore's (O) are listed if known.

Informed consent was secured during each stage of the research process. Both the telephone interviews and the focus groups were recorded using a digital audio

[6] A housing development designed with ecological values that promotes social interaction with a combination of individual home ownership and shared common facilities like laundry, a kitchen, and a children's play room.

recorder. Recordings were then transcribed. Two researchers independently coded and analysed the transcripts using Nvivo for food practices i.e., enactments of shopping, cooking, planning, and so on. Each author reviewed a selection of transcripts to ensure consistency in the interpretation of the data and a coding framework that was developed, which reflected an interactive engagement between the research questions and the data, as well as the literature. All participants received a £10 voucher for taking part. We have assigned each participant a pseudonym and use this consistently throughout the paper. Pseudonyms are suffixed with a letter in parentheses to indicate which panel they were recruited from; 'M' for mainstream, or 'P' for pioneers.

4. FINDINGS

In this section, we present our findings using quotes from our participants' accounts[7]. In looking at shopping and the meal, we uncover understandings of the significance and meanings held around everyday food and how it, and sustainability, are enacted in busy lives. We deliberately maintain a separation between the groups in the presentation of our findings to expose a dissonance between their food practices that we believe sustainable HCI may contribute towards bridging.

We first discuss food procurement and knowledge and competencies around this; then the significance of food to our participants; and finally, explore what has caused transitions in practice—and to what extent these practices were disrupted and reformed in more or less sustainable directions.

4.1 Food procurement: new skills, complex practices

As Blake et al. notes, for many, the broad foodscape in the UK is dominated by supermarket chains [Blake et al. 2010]. For many, and especially in a time of global recession, this foodscape is currently driven by market competitiveness. With the rise of discount supermarkets like ALDI and LIDL, the UK supermarket context is changing, and the most common ways that businesses distinguish themselves is through 'value for money' [ibid]. As a result, the main context in which food is presented to consumers relates to price and value to the pocket:

[7] We indicate the number of participant accounts in parentheses to show the level of support for each of the points where it makes sense to do so. However, given the semi-structured nature of our interviews, and informal design of the focus groups, these may be supported but unreported by other participants, so these figures should be treated as an indication of agreement only.

marketing campaigns focus specifically on price comparisons, buy-one-get-one-free (BOGOF) promotional offers, and various special offers and incentives encouraging purchasing in bulk.

4.1.1 Typical food

In the case of our 'mainstream' participant group, the 'big shop' (usually driving to an out of town supermarket and buying fresh, dry and frozen products that cover a week's shopping needs all in one go) is often carried out across more than one supermarket. Some supermarkets were thought preferable for certain foods, and this could be related to factors like perceived quality (e.g. especially in relation to meat), but is quite often related to cost (i.e. a particular supermarket supplying a product at lower cost, or running a special offer).

Given the dominant framing of food and value in UK supermarkets, it is not surprising then that this participant group described their motivations in terms of economy or getting value for money: such consumption practices exist in the wake of a major economic downturn, but are perhaps exaggerated through supermarket marketing campaigns and the proliferation of different supermarkets. They also exist within cultural norms and expectations around lifestyle; that basic costs of living, including food, might be minimised to allow for more luxurious materials and activities, like owning a car, or holidaying abroad. A consequence of this for sustainability is that choices are negotiated relative to the monetary cost of products in other supermarkets, and in such negotiations, food is generally detached from the way it has been produced and supplied, and the effect of this on the natural environment.

Four of the 'mainstream' group were vegetarian, but for the majority, meat was a feature of most meals. Meat was frequently bought in supermarkets as part of BOGOF deals or 'three for two' offers. In comparison, some respondents such as Carol (M) were more critical and reflected on the quality of meat bought for, say, "*£1.50 from Tesco"* – she preferred to:

"*eat meat less often and buy good quality meat rather than buying cheap meat and eating it every day."*

Seasonal and local food was an area that some 'mainstream' participants (4) were also concerned about; this, in part, explains their use of the regional supermarket where we encountered them, which has a specific ethos of differentiating itself

from competitors in this regard. Tomatoes and meat were mentioned frequently as having to be as local as possible: one participant, Bonnie (M) notes:

"*they do promote and advertise that they're selling local stuff that's in season. So I think it's at that particular shop I would be more aware of it. I think at other supermarkets there's…there's less advertising of the fact that these apples are British or this is produced in [UK county]*."

Some other participants (4) were aware of the need to analyse what food labels were and *were not* saying. For example, Catherine (M) felt that she had to:

"*be careful when you look at [the label] because…some of it is packaged in England but…the actual meat isn't English. The stuff that's ready made […] you've got to be careful there that you've got the English meat because the dish being made in England and the meat being produced in England is two different things. Sneaky!*"

This contrast shows the effects of supermarket and packaging design on the practicalities of making sustainable choices.

4.1.2 Engagement in alternative food cultures

In contrast, a notable feature of the 'pioneers' participants' food practices was that almost all of them (24) regularly shopped or acquired food from places *other than supermarkets*. Most talked about getting food from independent stores specialising in ethical and organic food, and vegetable box schemes[8]. Many (13) grew some fruit and vegetables at home or on an allotment, some (2) kept hens for eggs, and some (5) frequently went foraging locally for wild food, like elderberries, wild garlic, or blackberries. In general, and in contrast to much of the UK population, a number of these participants purposely do not own a car, and do not work full time so as to have time to participate in activities that they enjoy, like growing food and caring for family members.

On the whole, 'sustainability' in their everyday shopping practices did not only relate to whether they should buy specific food items; for them, the sustainability

[8] A scheme whereby a commitment is made to a producer to take regular delivery of a box of mixed fruit and vegetables. Often associated, but not limited to, ethical, local and seasonal production of foods using organic farming methods.

of their food practices was better reflected in where they shopped or acquired food from. In fact, even when supermarkets were used, for reasons of convenience, cost, or poor availability of alternatives, care was taken in deciding which shop was most suitable, for example based on its environmental policy.

Some pioneer participants (7) reported boycotting certain producers or countries of origin that were associated with unethical practices, ranging from unfair conditions for small farmers and producers, to the export of food from countries that suffer chronic food poverty. Other dominating influences were locally sourced food (15) and economic security (9). A few participants (5) were strongly guided by notions of environmental stewardship connected to their religious or farming backgrounds. This resulted in strong appreciations of nature and 'natural' foods, and also sometimes in a responsibility not to interfere with natural processes, such as seasonal growing cycles or fish stocks. Related to this, a smaller proportion (3) of participants were highly motivated by climate change issues and minimising the greenhouse gas externalities of their food practices.

Most of the 'pioneer' participants' interactions with local, seasonal food stemmed from both a desire for meaningful connections with what they consumed, as well as reinforcing these. In particular, it connected them to the natural cycles of seasonal growing and provided them with confidence that the agricultural practices involved were healthy and sustainable. As well as this, their participation in their own food production drew awareness to the amount of time, effort, and resources required—like space, seeds, water, compost, and money—and the fragility of the system; sometimes crops fail, and not everything can be grown naturally, everywhere, all of the time. But, being in tune with this process led to strong appreciations of these foods, not only in terms of their consumption, but also of food more generally.

"we've planted fruit trees, I've got potatoes now, I've got courgettes …it's really important to me and I think some of that is the fact that I'm vegetarian and actually when you've grown it and there's that whole time thing and it costs a lot more to have one of my courgettes but at least I know I've grown it and I know what's gone onto it and actually when you come to eat it, not only does it taste really good but…it's just kind of a nice cycle I think" (Liz, P)

Here, we see very different values and meanings associated with food and how these are intertwined with food practices: values and meanings inspire practices,

and participation in practices, like growing your own food, can reinforce these. What was clear from the pioneer participants is that the source of food, and its richer provenance, was extremely important in adhering to the set of values, including sustainability, that they ascribed to. This connection to the food at source, and greater awareness of its seasonality and availability, is also something typically abstracted away from in more mainstream supermarket food provision. We consider roles for HCI in both of these in the Discussion.

4.1.3 An ongoing and gradual labour

The shopping practices that have emerged to negotiate the complex and dynamic landscape of food supply are, unsurprisingly, complex and often onerous themselves. While some might argue there is a deskilling in cooking [Giard 1998: 212, in Meah and Watson 2011], the opposite is often the case for food procurement. Shopping and planning have become increasingly skilled, as George's (M) detailed account of financial decisions and food preferences illustrates well:

"*I think people are more discerning now… like there's only [regional supermarket] do certain things. I could go in there for [brand] ice cream, for example, which I like. Now, that's quite expensive: in a big litre thing they're £6.77…I know it's good and I can't buy it anywhere else. But if Lidl did it for £4.30, I'd go to Lidl.*"

Erica (M) also talked in detail about the skills she and her mother used in buying their food – she had observed "*baby sweet corn and mangetout …are miles cheaper in Sainsburys than they are in [regional supermarket]. I sound like a shopping geek, don't I?*"

Thus, there is significant skill, knowledge and effort required to manage the cost of household food consumption across a number of different supermarket suppliers, within a dynamic special offer scene, while also taking into account a range of other, often lower priority factors such as household tastes, schedules, local economy, and so on. It requires substantial knowledge of the costs of products across various stores, and considerable planning according to changing household needs. Nevertheless, shopping for our 'mainstream' participants is a practice that only a small amount of time is allowed for each week. This is so that other, higher priority practices can be made to fit into busy lives. As such, the knowledge and skill drawn on to enact shopping practices is the product of

incremental experiences and interactions with food and supermarkets, built up over, potentially, many years of shopping trips and meals.

Digital technologies did sometimes play a role in research and planning. One of our participants devotes time to navigating the less predictable special offer scene each week to achieve good savings:

"*It can be a chore because prices, the way that they are at the moment, you have to look around a lot of different shops seeing who's got the best prices and quality … I write a list through the week of what I need and we usually go online or look at the magazines that they produce and see who's got the best offers on.*" (Rita, M)

This investment in knowledge and skills distributed over long periods calls attention to the challenge of changing practices. Shopping in non-mainstream places often requires significant effort on the part of the shopper to evaluate new or unusual items for the many factors that we have described, and the greater the number of items up for renegotiation, the more burdensome this becomes. Cyril (M) recounts the information challenge of switching to a cheaper supermarket:

"*It's a very, very reasonable price [in Aldi]. And the quality is comparable …I'm a label reader and …they have the same standard and they contain what they should do and a percentage of this, that and the other is right …it's ok saying your pot of jam might be 50p cheaper but if it's all full of sugar it's not what you want."*

An array of past ethical food choices (e.g. choice of supplier, or avoiding a brand) shaped current practices of the pioneer participants, but this was also an ongoing process. Many participants (14) saw the sustainability as a gradual process. This related to the multiple complexities associated with 'sustainable food' that are difficult to comprehend and negotiate; and the challenge of integrating alternative food choices into new meals (i.e. what to cook and how to cook it). This gradual process was usually initiated and then shaped by distinct points of transition where an event, experience, or exposure to pertinent information (for example through media stories, reading books, watching documentaries, or talking to others) would serve to bring aspects of existing food practice up for reflection. Despite this challenge, changes were made over time, in response to critical points of transition; and these changes might become habitual.

"and I suppose all of us are describing, do a little change and embedding it, do a little change and embedding it, and it's growing and growing..." (Kelly, P)

Reflection on food ethics required interactions beyond the supermarket as the information available on food items in store (product labels and supermarket literature) was limited (e.g. organicity or country of origin) relative to participants' interpretations of sustainability; and foods with packaging were perceived to be intrinsically less natural and sustainable.

For some participants, like Kelly (P) and Theo (P), sustainable food practice was a more integral process, underpinned by long-held values, or a 'moral compass'. In their case, ethical values stemmed from a religious background, and they responded to food information that resonated with these. Other participants more actively informed themselves about food sustainability through their own research.

"we found it was a bit of a Pandora's box ... as soon as you start asking questions you…there's no stopping point, you have to keep asking more questions! So you either just deny it altogether and shut the box and ignore it, or you have to keep unpacking it, and I suppose that's where the gradual process comes out, you have to just keep asking questions!" (Jackie, P)

4.2 The various significances of food

Murcott [Murcott 1995, p228-229] describes how a 'proper' meal for British people is epitomised by the Sunday roast. She details how people know and understand the tacit 'rules' for its composition and preparation. This 'properness' is part of the cultural significance of certain meals in British society, linked to family life, the role of women in the home, caring responsibilities, healthy and nutritious food. 'Proper' meals also help to structure the day and reinforce routine [Meah and Watson 2011].

4.2.1 Proper, normal and convenient

With our mainstream participants, 'proper' food was sometimes linked to tradition and what families had 'always done', but some foods like soup, although recognised as being 'good for you' were not seen as 'proper' food. Joan (M) associates 'proper' with traditional, homemade, and fresh food:

'*Proper food, what it used to be like. None of this, how can I put it, these ready meals. I have bought an odd ready meal at [regional supermarket]…usually I make all the meals fresh. It's how you've been brought up, I've been brought up on meat and potato pies, and shepherd's pie.*'

Like Joan (M), some other participants described 'proper' food as antithetical to pre-prepared convenience ("ready") meals, and so a diet dominated by such "ready" meals would be considered a kind of food dystopia. Practices of shopping, cooking, and eating often have significance beyond conveniently satisfying hunger pangs and bodily energy requirements. This significance of food is to a large extent brought out in the social interactions involved in food practices. Delivering a 'proper' meal for household members can be a cornerstone of family life.

In contrast, ready meals were perceived as overly processed and something to be cautious of. This relates to perceptions of 'junk' food [Meah and Watson 2011], associated with a mistrust of modern methods of food production. Despite these views on 'proper' food, many participants deviate from such 'properness' on a regular basis.

Whilst many (10) of our telephone interviewees occasionally bought a ready meal for convenience, there were some respondents who described a rather different picture: for them, ready meals were a source of emancipation, and offered what they saw as the same type of food they would cook themselves. This was something that had changed within people's lives over time as more variety became available, in particular relating to ready meals that are vegetarian or gluten free:

"There are that many things available these days that we don't see the point of my wife being in the kitchen an hour and half tied to the stove and preparing things… food products and the way they're presented… has changed so much over the last two decades that it's almost unrecognisable to what was available at one time… there's so much available these days that we've changed our mode of doing things." (Steven, M)

George (M) reflected that, "*things have moved on a long way since my mother was alive and she made all things fresh*". In contrast, he and his wife "*buy a*

couple of chickens for £5-6, chickens with cheese on… and you can buy other ready stuff like sautéed potatoes to put in the oven as well. So it's not a big deal." George normalised the extent of this practice by saying "*we do tend to eat convenience food, which I think a lot of people do nowadays.*"

Bonnie (M), in contrast to Steven (M), felt that vegetarians were not well catered for, especially with regard to convenience foods. She described how she does not "*buy many ready meals because the quality and the standard and the portion size, there's very little available I would say for vegetarians that is really worth buying*."

4.2.2 A different 'normal'

In contrast to our 'mainstream' participants, food held a significance for our 'pioneer' group beyond family, sharing and nourishment. The pioneers' food practices were all ethically guided in some way, but their interpretations of, and commitment to, sustainability varied. Factors related to sustainability that they reported taking into account included animal welfare (12), organicity (14), local sourcing (15), food miles (11), seasonality (17), social injustice (11), and affordability (14). Although many participants reported the influence of more than one of these on their food practices, usually one or two factors featured more prominently than the others. The significance of these dominant factors was linked to strong feelings about the morality of a particular issue.

For many participants, sustainability had evolved beyond making a simple ethical choice between more or less equivalent items or diets. Ethical foods were perceived as superior and desirable; dishes and diets were slowly shaped to incorporate items that could be ethically sourced. As well as quality and taste, these foods were appreciated for their authenticity above, say, non-organic or non-local alternatives. For this reason, they were worth paying higher prices for and/or spending the time personally to produce them.

4.2.3 The sociality of food

What was bought, and the work involved in its consideration varied considerably between participants in both groups. There was a marked contrast between family life, and those living on their own, for example. Some families took a collective responsibility for what was bought, cooked and eaten, but this was less common. For example, Louise's (M) children particularly like accompanying her to do the shopping. She thought that they:

"*like seeing all the options and they like talking through how we make decisions about what we're having during the week. They love picking the fruit and veg …and…comparing prices and all that kind of stuff, they really enjoy doing that side of the shopping.*"

However, for some, food was more a necessity than something to be enjoyed or lingered over. Mary (M) responded:

"*Well you have to eat food haven't you?*" while another participant suggested:

"*food isn't a big thing...We're not gourmet eaters or anything like that. We like our food, but it's not a big priority for us*" *(Steven, M).*

Sometimes this occurred because living alone meant that food was less of an occasion. For Nancy (M), "*when the family were all at home you [did] a big shop. But when you're on your own you don't need things hanging around or storing them too long.*" And for Dorothy (M) living alone meant that having "*a takeaway would be once in a blue moon. There's no fun in a takeaway on your own*."

For some (3/7) whose children had left home, cooking for two was seen as "*just a meal*" and, for Rita (M), there was "*no point getting too excited over it.*" In response to being asked about whether she tries new recipes, Dorothy (M) says that she "*might but when there's one of you, you can't scale some things down necessarily [and] I can't always be bothered.*" Once the social aspect of food became absent for these participants, the significance that food holds at a personal level is greatly reduced, meaning that less consideration is given to its content or structure.

For some pioneer participants (6), there was a social value to producing or foraging for their own food, too. It enabled them to sustain a way of life outside of institutional food supply. Instead, 'raw' foods that were self-grown or foraged were swapped with other members of the community. For Sally (P), this practice provided the scale required to sustain a varied diet that was rich in non-commercial ("jam cupboard") foods:

"I just live off all kinds of bits and bats that people leave in my house, 'would you like a slice of something or other?' 'would you like eggs?', I love all that 'cos I

just swap stuff all the time, 'would you like a jar of jam instead?' …but that's why I forage and grow stuff on an allotment so I can live in a jam cupboard economy…"

This significance of food also included ideas connected to sharing. Some people (7) reported enjoying cooking if it was for other people, and being able to create meals that they liked. Michelle (P), who cooked as part of her care job responsibilities, spoke about how she used to envy people that 'understood' ingredients; she subsequently taught herself to cook creatively and produce vegan and gluten-free dishes that had "*amazing flavours.*" She was proud of what she accomplished. Some of our focus group participants saw an important role for themselves in sharing food practices with others. Shane (P) related the pleasure he got from sharing meals with his flatmates, introducing vegetables to them, and teaching them how to make these meals for themselves. Sally (P) had committed herself to "*moving the philosophy forward*" by passing on her knowledge and skills to others:

"*I want people to be able to do things, I want them to try growing three lettuces in a window box, in their backyard or just come out with me on a forage walk and I'll show you one fabulous thing that you can do when you go home.*"

In this case, social interactions are key to dispersing new skills and competences for food practices. But, close social relations were sometimes very powerful in engaging participants in different (often ethical) perspectives on food consumption, for example becoming vegetarian or vegan.

"*one of my kids became a vegetarian before I did, he …erm…, he was only 3, when he found out what lamb was he suddenly made this connection between nice little animals and then something on the plate and getting killed, so that was it, he kind of set an example to me and then I set an example to my mum so it went up the generations! And anyway he's 19 and he's still a vegetarian." (Melanie, P)*

The role of social influence, and the level of competence, particularly around creating fresh and tasty food from available ingredients, was a recurring theme in our focus groups (see Bartiaux [2008] for similar findings relating to energy use). Some participants already used social media to scaffold their experiences by sharing recipes and their experiences with new ingredients.

4.3 Food in the broader context of everyday life

We found that food often had to fit within the constraints of time pressures or dietary constraints arising from activities or lifestyle choices outside the home. Food choice was often compromised due to perceived lack of time.

4.3.1 Time and commitments

Respondents talked about feeling constrained in what they bought and ate due to lack of time. In busy lives, where a range of other everyday practices were prioritised, little time was left for food. Activities like leisure activities, work, coordinating family activities, and so on, all compete for precious time. And, time saved on planning, cooking and eating is gratefully repurposed in other areas of everyday life. This was sometimes in spite of aspirations for the contrary, when food itself was valued as a leisure activity. For Bonnie (M), while she described the food they ate as "*nutritious, all vegetarian, using lots of fresh vegetables,*" she also reported that there was "*not a huge variety because we never seem to have the time to actually focus on looking at different recipes...it's an aspiration to spend a bit more time on food. But yes, life tends to be pretty full with various things…it does tend to be fairly similar."*

As a result, participants found it convenient to routinely prepare the same dishes each week: *"We do say to each other sometimes we ought to be more adventurous with our cooking. We have a whole selection of books but tend to cook the same type of things fairly regularly …it's straightforward to do." (Cyril, M)*

For some (7), food labelling and local food were issues that also required time and dedication: Bonnie (M) argued that "*if you're busy you don't, I wouldn't spend an awful lot of time studying labels and reading things…you'd have to be a bit dedicated to do that*."

Even routine meal planning and eating together was difficult for some families as work commitments, study and revision and visiting friends get in the way, as Erica (M) describes:

"*I wouldn't say I would follow necessarily what's happening on what night. So we don't have fish every Friday and things like that. Sometimes…it's a bit chaotic about what we have. My daughter, she's out at a friends revising, the little one's*

off to Cubs, my partner's off to do his night shift and it's very hard getting everything ready. A lot of it is quite ad hoc."

Planning and helping food 'fit' within such constraints, is an area where ICT can have a role, particularly in a food environment increasingly enabled by online shopping and delivery services. It is worth reflecting however, whether it should be the food that always has to 'give' in busy lives, or whether, quality time with food and taking the time to appreciate this together, also needs to be (re-)valued and prioritised.

4.3.2 Making peace with food

All our pioneers spoke of the tensions between aspects of sustainability and the need to fit within the practical constraints of everyday life. For many, there was a pragmatic need to really focus on the one or two factors that were more significant to them, e.g. animal welfare, the environment. It was perfectly possible to keep digging and learn more about their foods and their origins, but there was soon a limit to how many criteria and how much time they could spend taking all these factors into account in deliberating on what to buy. Compromises often had to be made, which were occasionally uncomfortable, but a degree of resignation was also involved in 'making peace':

"I think it's an evolving system and I have a whole list of things, and if I tick at least one of them then I'm happy with that, I do look at fruit and veg like if it comes from Spain or France or Holland…that's close enough for me, and I make peace with that." (Melissa, P)

It is not only the characteristics of particular products and their provenance that restricted participants' ability to integrate sustainability in their food practices. Some (13) spoke about being constrained geographically in terms of what they could access. This related to what was available in their locality, but also, for some (4), what was accessible without the need of a car for transport.

Many (14) participants spoke about the challenges of eating sustainably in a way that was also affordable. Some of the more sustainable foods were often priced as 'premium products' by supermarkets, or small ethical suppliers were sometimes more expensive and thus not affordable for doing the 'big shop'. Participants also spoke about the challenge of integrating sustainability into everyday meals, noting the challenge of learning new recipes and ways to cook things that were

previously alien to them. Doing so was only manageable as part of a gradual process; over-commitment could be too disruptive to them and their households.

One participant mentioned the challenge of maintaining a sustainable household diet while raising children. Their children's exposure to food outside the home (i.e., at schools and friends' homes) and via television brought challenges to retaining sustainable practices at home:

"I don't know what he's eating [at school], probably a lot of chips, and fish-fingers and baked beans and things… I think when he goes to his friends he gets cheap meat, that is probably easier to eat, whereas I make a point of buying either organic or from local butchers, which are in fact coarser and he takes like half an hour on one little thing! But, he identifies, 'oh I think that's the one I want,' and I'm like, I'm not getting that!" (Isabella, P)

Like the 'mainstream' group, busy lives and unplanned activities sometimes got in the way of sustainability, too:

"*I'm always really conscious of things like, you know, who grew it and I hate buying stuff like pineapples when I see them for a quid. I think I love them but who's grown that and for how much, …and I hate loads of packaging; that's just a big turn off. But having said that I live on my own and I'm not at home all the time and I buy stuff and it goes off, and then I'll go, like last night I was out with [a friend] and I ended up getting a pizza in town…I thought 'great, I don't know what's gone in it.*'" *(Gerard, P)*

4.4 Transitions: Doing food differently

What we have seen so far is a snapshot in time of food practices of our participants, but in thinking about change toward sustainability, it is interesting to consider how these particular 'ways of doing' came to be. Meah and Watson [2011] explore the role of lifecourse transitions: they highlight the absence of linearity in their participants' engagement with cooking as they move between different transitional points in their lifecourse. This is similar for our participants.

4.4.1 Critical transitions

As might be anticipated, many respondents described how their shopping and cooking practices have changed throughout their lives, and especially in response to specific transitional events. For example, having a family (5), children leaving home (6), moving house (16), retirement (10) and death (2), were all described as having affected food practices. For some, retirement offered the time to take up growing food in the garden or on the allotment, whereas the loss of a partner could mean the loss of the skills for growing food and keeping an allotment (Mary, M). For Rita (M), whose husband tends an allotment, this affects what they eat seasonally, and when they need to buy from the shops:

"It gets to be the same items each week in the summer and then change over in winter. Because my husband grows a lot of veg…in the winter months we have to buy from the shops, so it just changes."

Retirement can also free up time to take part in other leisure activities: food shopping and cooking were seen as leisure activities in and of themselves. One of our retired participants, George (M), sees shopping as providing a focus in its own right:

"*I'm retired now and my wife is mostly retired, so it's a trip out. I know it sounds a bit, we sound like old people! But you think yeah we'll have a run to Lidl, you do that and do a couple of other things, go and visit friends as well."*

Carol (M) had recently lost her husband, which, as one might expect, had had a dramatic impact on her life, but also on her eating habits. Immediately following his death, she found that ready meals became more important, as she could no longer face cooking from scratch just for herself. She described a significant shift in what she bought, cooked and ate:

"*I don't cook as often as I did. And we eat a lot more salads and a lot of fresh vegetables [now]. Well we ate fresh vegetables before but they had to be cooked because it wasn't a real meal if it hadn't been cooked!*"

Those with younger families and caring responsibilities described how having children influenced what they bought, cooked and ate, as well as when. Louise (M) had started buying more local and seasonal produce in response to her

children when they had been learning about local food and "*have started taking a real big interest*." Her children were comparing:

"*strawberries from Spain and strawberries in England. They will look at those type of things and make decisions based on where it was grown... [they] like the idea that they're buying locally and supporting local farmers and local producers.*"

4.4.2 Crisis, culture, and competence

Sahakian and Wilhite [2014] argue that a view of agency distributed across people, things and social contexts is fruitful for research, and that learning can be achieved through membership in communities of practice, where people are involved in experiments with or exposure to new practices. For them, transferring knowledge through demonstrations of new practices is a powerful way to stimulate change.

Several pioneer participants (5) reported how a change of cultural context had sensitised them to new issues, for example living in a third world country, or moving to a place where institutions (e.g. supermarkets) better incorporated food sustainability issues. One such issue, animal cruelty, was thought to be particularly powerful as a motivating factor for changing their diets, often influenced by an experience or media awareness of a particular issue, like conditions for battery-caged hens. There were also more mundane accounts of transitions, where participants adjusted their food practices as a result of TV documentaries (2) or reading certain books (2) alerting them to particular sustainability issues.

The importance of social interaction in establishing and changing practices was clearly evident from our focus group accounts. For some, domestic influences through formative years provided crucial skills, and alternative perceptions of and ways of doing food. Shane (P) associates his cooking competence with the way he was raised by his mother, and Sally (P) spoke about '*channelling her mother*' in the kitchen. It is worth noting that most of the focus group participants regularly cooked for themselves and some enjoyed experimenting with new foods and combinations of ingredients. Experiences of growing food provided a reference point for notions of, for example, naturalness, freshness, seasonality, and taste, from which they could critically evaluate supermarket produce.

"*the expiry date of fruits and vegetables in the supermarket I find very surprising …with the carrots, the expiry date is within two weeks …my family always had a farm you can store them all Winter… what sort of carrots am I buying if it goes off within two weeks?!*" *(Joyce, P)*

As per Sahakian and Wilhite [2014], in Philip's (P) case, living in a vegan cohousing environment was important in developing the skills that he now uses to exercise this diet:

"*they showed you…what are the key tools. So a blender is a really important… if you're going to be vegan, because you can do so much more with raw – you can make your own cashew milk, you can make hummus… and I wouldn't have thought to do that…"*

Not all of our focus group pioneers had integrated sustainability into their food practices to the same degree. Mainstream supermarkets were still used, if to a lesser extent. We found these participants were more likely to consider sustainability in relation to product choice, where suitable information was available in-store, i.e. as to locality, organicity, or food miles. Here, cost or convenience often took precedence in decisions about what to buy. These participants were aware of a broader perspective of food sustainability but acknowledged having to only take a subset of these factors into account. To us, it seemed that these participants had come to consider sustainability much more recently, and were earlier in the process of developing the knowledge, skills, confidence or the motivation to change their practices in more radical ways. Sustainability had not yet become integrated in a new way of life or '*way of thinking*', as Melanie (P) put it:

"it's actually a whole way of thinking… but I'm old and I've had time to learn!"

5. Discussion: Food in Context

At its most basic level, food is fuel for life. For many, food can be mundane: a daily concern to support perhaps more pressing matters in busy lives, like work, entertaining ourselves, and raising a family. But, as our findings have highlighted, for many others, food *is* more significant. It is variously 'situated', and hence, enacted [Comber et al. 2013]. At this extreme, food constitutes everyday life in profound ways: food is a way of life, a central concern that other practices are configured to fit around. One of the more surprising and significant findings that

emerged from our study is the large difference in the importance that food holds in people's lives.

This is not to say that, for some participants, food held no meaning at all. On the contrary, food *was* meaningful but it was more defined by factors like cost and convenience that often seem to be at odds with sustainability as it is variously defined. For some, we see a reliance on ready-made supermarket meals to sustain lifestyles of leisure. But, importantly, the appreciations associated with food at this stage, like getting a bargain or increasing the expedience of shopping and cooking, were not necessarily reflected at the consumption stage, i.e., food also appeared to be less meaningful when consumed.

In sharp contrast, participants who expressed concerns for sustainability described how they gained satisfaction and enjoyment from eating. Aside from the fact that they often perceived sustainable foods as tastier and better quality, this arose with an apparent appreciation of the effort and values at work in their food—living in harmony with natural food cycles, and/or maintaining ethical diets, and the care, time and effort required for this—reinforcing positive feelings like pride and virtuousness.

Another defining element in the meaningfulness of food is the social context in which it is practiced. Living with family members and partners and other social interactions around food gave cause for upholding and sharing notions of 'properness', and for enacting ceremonies around food. Whereas in other situations such as living and dining alone, the value of expending effort on food (or indeed in sharing a takeaway) was often lost. We saw with the pioneer group how food meaningfulness and appreciations can co-develop alongside knowledge and skills through sharing meals, cooking together, passing on recipes, or even simply observing the practices of others and discussing elements of them (e.g. the challenges associated with sustainable consumption).

We saw how shopping decisions related to sustainability issues had already become established and habitual in participants' daily lives. Their choice of where to shop negated the need for making fine-grained decisions about specific products due to their trust in the responsible sourcing/growing practices of the retailer. A responsible brand or supermarket can serve as a proxy to take some of the burden of choosing sustainable foods out of decision making by adopting and adhering to particular supply chain purchasing policies. Perversely, a lack of

transparency of supermarket sourcing policy, and of information on product packaging, can also make evaluations of a given food's impact onerous.

We saw mainstream food practices to a large extent shaped by availability, as evidenced by the significant role of 'ready meals' and convenience foods. Some of our participants' notions of 'proper' food are changing, with requirements of meals shifting in light of convenient or cheap alternatives. Although the ingredients used in ready meals can have high embodied emissions, there might be a sustainability argument to be made for shifting consumption patterns towards 'convenience': bulk preparation reduces direct energy costs, and the responsibility of sourcing ingredients is centralised and, as a result, easier to control [Clear et al. 2013]. Living alone or without the need to provide food for a family seemed to place renewed emphasis on the role of convenience foods. Given the impacts of these kinds of meals, this is concerning from a sustainability, if not a health, point of view – and this trend is set to increase (the number of people now living on their own is predicted to be 41% of all households in England by 2033[9]). Socio-technical interventions toward sustainability might be designed respecting the freedom and virtues afforded by these convenient alternatives. More critical designs might seek to reduce the importance of convenience foods by engaging people in sustainability issues. We draw on our pioneer accounts in the next section to outline what some of these might be.

We saw that major life transition points had very significant effects in terms of reshaping food practice. These transition points often involved significant relationships with others, and the capability and infrastructure associated with them, but also the motivation they provided. It is worth thinking how new information and coordination, brought about by powerful actors and personal relationships, might lead to more, rather than less sustainable food.

5.1 Designing For a Process of Transition

Although here we take a HCI lens in considering sustainable design, we do so with the acknowledgement that the biggest challenge facing food sustainability is cultural (supply shaping consumption, and consumption driving supply), and that what we see emerging with our pioneer participants could be best described as alternative food cultures. The structures that constrain sustainable food practices

[9] Household Projections, 2008 to 2013, England: http://www.kingsfund.org.uk/time-to-think-differently/trends/demography/changing-families, accessed 11 May 2016.

and make them onerous are the structures and institutions that support mainstream practice. We propose that there are broader roles for HCI here in engaging people (and not just the consumer) in cultural changes around food consumption to realign food with its environmental consequences.

	Findings	**Design considerations**
I	The work involved in food practices is significant for both groups (4.1.3). Food has various meanings and significances for participants. For sustainability, we see spectrum of motivations and integrated practice (4.4.2). Awareness and information is hard to find and integrate.	Challenge engagement with sustainability. 1. Draw awareness to environmental impacts of food (4.4.2) 2. Offer alternative supporting/provocative perspectives on products and supermarkets 3. Foster conversations about alternative food cultures and highlight how sustainability can line up with other values (seasonality, locavorism, ethical trade)
II	'Proper' meals are important in thinking about change. Substitution of ingredients with sustainable alternatives may change the validity of the meal (e.g. Quorn for meat). We need to remain sensitive to what constitutes a proper meal.	1. Facilitate the construction of new meals with a variety of recipe ideas meal planning level, possibly drawing on exploration of other food cultures 2. Notions of 'proper' can be challenged when meals/foods fit with other values (e.g. 'convenience').
III	We should not expect that food can be made meaningful for everyone (irrespective of sustainability) and that its meaningfulness will change with life transitions (see 2 also)	1. We should encourage food and sustainability meaningfulness in indirect ways, by better facilitating some of the activities (e.g. growing food) that represented sustainability for our pioneers. 2. Support the mundane and the convenient in sustainable ways: toward a sustainable food production and supply system that is mainstream. e.g. digital civics platforms for collective political action or participation in alternative economies.
IV	Busy lives and time constraints means that food is often a low priority (4.3.1; 4.3.2). Sustainable consumption increases the work involved, necessitating compromises and 'making peace' for pioneer participants (4.3.2).	ICT for planning and organising can help food practices to fit within constraints. 1. better support the work that the pioneer participants do in alternative sourcing of foods 2. eco-feedback will be limited by levels of engagement with sustainability and the pull of the mainstream (see I above), so broader changes in supply (e.g. ethical stores) can take some of the work out of consumption. 3. We might also consider how food might be allotted more 'quality time' in busy lives (challenging values and cultures). This could be a question of engagement (see I above), or of promoting the sociality of food and meals (see V). 4. Technology can enable new business models to lower the cost of sourcing or obtaining sustainable foods (e.g. empowering local

		producers to act collectively, c.f. food assemblies)
V	Certain events are critical for changing people's food practices (shopping, cooking and eating), especially Life stage transitions and changes in living situation (4.4) - these events have the potential for shifts towards sustainability, or conversely further towards the mainstream foodscape.	In such situations 1. facilitate social cooking and meals, or growing food that fit within values and circumstances 2. help reconfigure access to food production and supply to help embrace personal significance of food. 3. Allotment sharing, community gardens, and produce sharing can address skill deficits and promote sociality.
VI	The significance of food will vary from person to person, but it is increased in social consumption (4.4). Social interactions are key to dispersing new skills and competences, and engaging participants in different perspectives on food consumption (e.g. vegetarian or vegan) (4.4.2). Communities of practice can serve to share values and are critical to integrating new practices.	1. Integration of sharing of cooking, meals, appliances and materials, and food produce can help enhance the significance of foods but also to share new ways of preparing and new meal ideas. 2. Facilitate discussion/negotiation of food practices at times of change and/or crisis. Programs of support could include a focus on food. 3. Digital tools might facilitate arrangements of social meals (see also V) and serve as aids for shopping/cooking at home, and/or digitally sharing the experience. 4. Considering education more broadly: schools and children can be taught new food practices, and might be better included in household food (growing, cooking, shopping and eating).

Table 2: Consolidation of our main findings and associated recommendations for technology design opportunities encouraging transitions toward sustainable food.

How, then, might sustainable food practices become the mainstream? We must acknowledge the need for engagement and culture change, and our understandings of how food practices evolve give us some insight into where engagement interventions might fit within a larger process of transition to a more sustainable diet (summarised in Table 2). From our pioneers, we see that there is considerable and ongoing work involved in changing food practices. That is not to negate the work our mainstream participants already put into food consumption, but rather to suggest that there is value for design in reflecting on how the work of existing food practices is distributed; it consists of a gradual reskilling that over time shapes weekly shopping practices. And so interventions might target both discrete points of engagement and critical reflection, also ongoing incremental processes of integrating change to support these, but not neglect more systemic changes to the foodscape.

Drawing on understandings from both of our participant groups, we see three important dimensions to this: food perspectives, systemic change, and situated interactions and transitions. In the rest of this section we elaborate on these.

5.2 Offering alternative perspectives on food

First, for food to have sustainable meaning, the relevant dimensions of these meanings (e.g. ethics, greenhouse gas emissions) must be transparent and readily accessible. Our pioneer participants put much time and effort into accounting for these factors and appreciated when some of this work was absorbed by the infrastructure (e.g. when choice of shop negated the need to further scrutinise at the level of individual products). It is perhaps unreasonable to expect this same work to be undertaken on a mass scale, in the context of busy lives and a paucity of convenient information, so technology can have a role in making this information more present and convenient, surfacing potentially inconvenient truths that could impact the dominance of a single dimension of value for money.

Given the sensitivity to price, any technical intervention around sustainability must presumably also acknowledge the framework of offers and 'monetary value'. But, as we've seen, there are clearly other values at work, including 'quality' and what's 'local' or domestically produced, and the wider provenance of food: an information deficit acutely felt by some consumers (particularly the label checkers). This suggests there are opportunities for design of mundane technologies that lend reassurance, or provide more information particularly to more mainstream consumers, as to the provenance and trust in the sources of food. Some apps already exist for things like indicating what foods are currently in season (e.g. Seasons[10]), and providing location-based details of vegetarian and vegan places to eat and shop (e.g. VeggieSpots[11]). The increasing penetration of smartphones and wearables, in addition to 'in store' innovations such as 'scan it yourself' systems [Kalnikaite, Rogers and Bird 2011], may provide a platform for more immediate reflection.

We would reiterate however, that accounts of the use of digital technologies in the food practices we discussed with our participants were rare (8). Where they did arise, it was in relation to finding recipes, searching for special offers, online

[10] https://itunes.apple.com/gb/app/seasons/id300214071 accessed 5 May 2016

[11] https://itunes.apple.com/gb/app/veggiespots/id1093140567 accessed 5 May 2016

shopping, sharing photographs of food with others, or researching the ethical aspects of particular foods (particularly our 'pioneers'), rather than 'in store'—and thus it may be more effective to leverage these more reflective points of interaction outside the store, at the level of meals, weekly or longer term diet planning [Clear 2015].

A key difference between our participant groups was the perspectives on food that were held in each, which were shaped by different experiences and trajectories of food practice: mainstream participants' perspectives were shaped more by special offers (e.g. BOGOF) and identification of which supermarkets tended to sell specific items for a lower price, whereas green values, social networks and significant events or pieces of media shaped pioneer participants' perspectives. In a market defined primarily by economic goals and competition, the mainstream foodscape offers little room for alternative food perspectives, e.g. of farmers or ecologists. But it would be wrong to narrowly characterise all shoppers as economic rationalists. Other values such as fairtrade, organicity, and locavorism were certainly present and valued by shoppers [DEFRA 2016], and stores do recognise and structure their purchasing and brand presentation considering these dimensions. There is potential richness to both shop and shopper of reflecting this richer food provenance more clearly to reinforce these values. Somewhat literally, these values might even translate into new forms of currency, reward and incentive schemes: local currencies have developed to encourage people to spend their money locally [Longhurst 2015; North 2014], and could potentially be adapted to reward more sustainable purchases. North [2014] found that currencies which worked across a wider area (rather than a specific town) worked well, especially when linked to mainstream banking practices like card payment—digital payment and the advent of potentially flexible digital currencies can add a new dimension to this.

Technologies can also challenge the mainstream, both in terms of conveying value, and engaging people in alternative perspectives on food, but also in challenging the mechanisms by which food *is done*. For individuals, independent 'apps' can link from the supermarket to provide layered perspectives on what appears on the supermarket shelves by, for example, augmenting the shopping list with integrated information about greenhouse gas emissions, supply chain ethics, crowdsourced reviews, and perhaps alternative products, or more sustainable foods that are commonly substituted in recipes. The application of these layered perspectives might range from the practical (as in food substitutions or personal

carbon footprinting), to apps meant to provoke critical reflection (e.g. portraying cost in terms of the equivalent number of vegetarian meals that could be produced, or relative climate change effects). The latter may not have direct practical effects but might perhaps stimulate discussion in social networks or change attitudes towards food (as in the case for some of our pioneers), potentially gradually shifting food cultures over the longer term.

5.3 Systematic change

It is important to recognise that diet is rarely an instantaneous choice at the level of a single product, but rather an ongoing and somewhat repetitive endeavour [Clear 2013]. Can technology promote reflection on diet more strategically over longer periods? Can such technologies squarely address the need for convenience, by indexing into potentially disruptive new online delivery paradigms for sourcing sustainable food (somewhat analogous to successful sharing economy platforms in other domains, such as AirBnB)? As online shopping and delivery services grow, might this also offer a platform that can be repurposed to allow the most sustainable basket to be conveniently delivered, even from a collection of providers?

While our fieldwork has concentrated on individuals and the work they put into acquiring food, we should be careful to think more broadly about our potential role in helping other actors and stakeholders create infrastructures and normative meanings that actively facilitate rather than subvert sustainability [Dourish 2010; Shove 2003]. Wider 'normative practices' surrounding food are getting reinforced as often default choices by powerful actors such as institutions like schools and supermarkets, and 'fast' convenient food in our high streets and shopping centres. Only by making the sustainable easier, more acceptable, more 'normal' can we achieve a large scale transition towards sustainable diet. Given the current UK foodscape, which is dominated by large supermarket chains, a competitive alternative is difficult to imagine, so we need to consider alternative models for provision. Can HCI design perhaps hold up a lens to help hasten systematic reflection and change?

The Local Food Assembly is one such alternative model that is made possible by digital interactive tools. Custom for local food producers is generated in advance (through offline and online marketing) and transactions occur online. Purchases are delivered weekly through a local, physical market (e.g. a pub) where

customers collect their purchases directly from suppliers. The digital here acts as an intermediary and facilitator, bringing both necessary scale to producers, but also more convenience and centralisation of sourcing from disparate local providers to consumers. Taking this further, HCI might consider how to support an economy where sustainable food is available more conveniently (i.e. daily in every neighbourhood as opposed to weekly in every town).

As well as this, HCI design might look to stimulate and disseminate sustainable social practices through design in public spaces or digital civics platforms [Olivier and Wright 2015], for example that exhibit and promote critical reflection on local food consumption (e.g. grown, imported, supermarket provision) and provide a platform for collective action (e.g. participating in alternative local food economies). We might also promote and make accessible practices like growing collectives [Norton 2014], and scaffold building of knowledge and engagement around growing, for example in urban growing spaces [Heitlinger 2014].

5.4 Situated interactions and transitions

There is considerable variation in how food is done, both across our participant set but also within each individual's life. As Meah and Watson [2011, p. 20] suggest, this points to the complex ways that individuals' practices are socially and culturally embedded, and emergent from a range of factors, including exposure to external influences, time and space, and a range of lifecourse transitions which might rupture existing patterns and behaviours. For our sustainability pioneers, what we see is a continual *process of becoming* whereby practices are altered in response to recurring interrogations and reflections on what is ethical, affordable, and healthy. To design for sustainable food is to design for a course of change.

Significant life events

Aside from the obvious design contexts of sustainability 'novices' and 'pioneers', we saw significant events or stages in people's lives where food practices are broken down and then slowly rebuilt, e.g. family members leaving home, retirement, or loss of a life partner. Support processes already exist for the newly retired and bereaved, which might represent levers for sustainable food interventions, a domain that HCI has not previously explored in this respect. The role of design would be to explore how these life transitions could be meaningfully supported—developing new leisure activities or replacing lost

cooking skills—in a way that is also positive for food sustainability. As food is highly situated, a promising role for digital technology might be in supporting how such transitions are enacted in the home, and in helping broker access to knowledge, skills and support in the local area.

Doing your best at doing good

But a more important implication that is connected to the concept of 'transition', and echoed by the Sustainable HCI community's call for more consideration of longer-term processes in design [Silberman et al. 2014], is that design should be contextualised within and as part of the whole process of sustainable food. This represents a significant challenge for HCI in that it requires a shift from designing for particular contexts like shopping or enhancing technologies in the kitchen, toward thinking about how interactions with food and technology must evolve in a way that is compatible with transitions in practice. It requires that design supports users in undertaking and embedding meaningful changes in preparing or acquiring food over time, like we saw with our sustainable food pioneers. But, importantly, and related to designing for the concept of 'enough' introduced by Håkansson and Sengers [2013], design must equally consider how to avoid feelings of powerlessness and despair, and support people in being happy with 'being good enough' even while maintaining a trajectory of continual improvement. As Håkansson and Sengers suggest, this requires recognising that digital technology opens up a world with few barriers, which is perhaps adverse to *gradual* change in the physical world.

Learning from and sharing with others

We have seen that the importance of social interactions in motivating and facilitating changes in food practice should not be underestimated. We, like Comber et al. [2013], saw that for many people, eating with others was more enjoyable than eating alone, and provoked greater reflection on what was or what could be consumed. We saw through these social encounters how people discovered new dishes, foods and ways of cooking that were more sustainable, but also developed confidence that they could sustain an alternative way of doing food, despite the challenges. We also saw the role that children (and second-level learning) can play in integrating sustainable practices at home and creating more meaningful interactions around food. For our sustainability pioneers, opportunities were highlighted for sharing homemade and homegrown foods, as well as costly 'materials' required for processing (e.g. a blender for vegan food). To enhance collectivism and community [Comber et al. 2013], HCI might explore

technologies for the sharing of materials, foods, and, importantly, individual experiences with food (e.g. pictures of a self-created recipe or dish). Some of our participants already used a private Facebook group for sharing images of their experiments with new vegan dishes. But sharing food experiences is worthy of further attention: even when practices are carried out alone, sharing an account of them (e.g. a picture) makes the process so much more meaningful.

Designing for more meaningful food

Food represents an opportunity for sustainable HCI because it is an area of everyday life where sustainability can move from being an abstract, obscure concept to a more tangible, embodied one. The challenge for design is to move beyond food as just a commercial product or a recipe with ingredients, to a process with meaningful and sustainable outcomes.

We saw how the concept of 'proper' food had taken on new meanings for the sustainability pioneers, from what is traditionally considered a proper British meal to appreciations of nature, personal accomplishments, and ethics. Practicing proper food had become associated with special occasions, rather than the everyday, for the mainstream participants. Significantly, where food was more meaningful for this group, it was linked to wider food processes and practices, like growing on allotments and shopping for leisure, or information brought in by children from their education, enhancing the enjoyment of making decisions in the supermarket. So whilst our emphasis was clearly on food sustainability (incorporating growing, shopping, cooking and eating) this palpably linked to other practices such as those related to children, socialising, and leisure. Sahakian and Wilhite [2014] caution against excluding these wider aspects of practice from food sustainability. We have already highlighted the importance of designing for sharing and social interactions around food, but some other design spaces that warrant attention are: 1) exploring how children might be better included in family food. As Grimes and Harper note, 'it is in part through these patterns and eating norms that families define their identity' [2008]. And, perhaps as an extension of this, 2) growing and processing as a leisure activity might enhance connections to, and appreciations of, wider food processes, like seasonality, and food provenance.

Celebratory food

Many of our participants were not 'creative' cooks, generally not having the confidence to veer beyond tested recipes. But, in some cases creativity was

valued—the challenge associated with putting ingredients together according to taste, intuition, and what is available, to create a satisfying meal. This was an enjoyable practice, but it had the added value of increased appreciation of particular foods, low food waste because uses for leftovers came easily, flexible dishes whereby ingredients that were unavailable (or unsustainable) could simply be replaced with something else, and confidence to find a use for new foods, for example, that were grown themselves or acquired from a sustainable vegetable box scheme.

New technologies could support cooking in a way that brings these important concepts of celebration, transition, skill and improvisation together, focusing on the development of cooking competencies rather than facilitating the execution of well-defined recipes. The basis for such cooking activities might be the set of ingredients that a user already has to hand, or ingredients that already are or could be responsibly grown and produced in their locality.

Related to these considerations is the concept of 'celebratory food' [Grimes & Harper 2008] which highlighted the value for our participants in things like creativity, motivating challenges, fun and enjoyment in food. Might we develop designs that augment these creative and celebratory aspects—especially as they are connected to another central finding of our work, the importance of the process of 'transition' in the movement towards sustainable consumption?

6. CONCLUSION

In our research, we set out to understand food practices for a particular set of UK participants from perspectives of 'mainstream' food shopping, and 'more sustainable' food acquisition. This was an exercise in both exposing what sustainable food actually means for our participants and how it is enacted, but also in exposing the gaps between sustainable and mainstream consumption. We sought sensitivities of what everyday food entails to think about how design might narrow this gap by transitioning practice in new ways at one end, and supporting existing transitions at the other. A more significant defining characteristic that emerged is the meaning associated with food, with interesting chasms both within, and between, our two participant groups, for example around the perception of ready meals (Section 4.2.1), or the practices involved in procurement (Section 4.1.2). There are some clear opportunities for HCI to help bridge the food sustainability gap by designing for life transitions and related practices, and by leveraging important notions of 'celebration', 'properness', and

sharing of practices and experiences with others. Given the varying place food has in people's lives and considerable greenhouse gas and waste impacts associated with it, we hope to see follow on studies in other countries and cultures, in order to expand our knowledge in this important area for sustainability.

Relating the need for transitions in practice and consumption to climate change can be "*especially difficult because global climate change is perceived as spatially and temporally distant*" [Slocum 2004, p. 413]. As a result, engaging people in climate change mitigation and adaptation is problematic—as Giddens [2009, p. 2] argues, no matter how much people are told about the threats of a changing climate, it is "*hard to face up to them, because they feel somehow unreal and, in the meantime, there is life to be lived, with all its pleasures and pressures*." In a sense, therefore, the future is an active presence for some people, but for many others such a future may be a presence that they prefer to keep absent from their everyday consciousness [Philips and Dickie 2014, p. 80]. In this paper, we explore food consumption practices with those that keep sustainability 'present' in their food consumption consciousness. While we in no way suggest that technology offers a panacea that can necessarily bring sustainability to the forefront of everyone's lives, we draw inspiration from the meaning, values and social qualities associated with food in the lives we observed, and hope that this opens up the design space more broadly from a more conventional and narrow consideration of purely economic value and convenience.

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