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Article

# Re-Introducing Consumption to the ‘Circular Economy’: A Sociotechnical Analysis of Domestic Food Provisioning

Josephine Mylan \*, Helen Holmes and Jessica Paddock

Sustainable Consumption Institute, The University of Manchester, 188 Waterloo Place, Oxford Road, Manchester M13 9PL, UK; helen.holmes@manchester.ac.uk (H.H.); jessica.paddock@manchester.ac.uk (J.P.)

\* Correspondence: Josephine.Mylan@manchester.ac.uk; Tel.: +44-161-275-0189

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**Abstract:** The paper makes two contributions to the advancement of the ‘circular economy’ as a blueprint for a more sustainable society. The first is to highlight the importance of understanding the dynamics of consumption and waste in the domestic sphere. The second is to illustrate two ways in which using insights from socio-technical literature on sustainable consumption, in combination with the sociology of food, could contribute to redressing this shortfall. This includes understanding why people use or consume particular goods or services, and how this might be altered; and what drives the production of waste and the adoption of strategies for its reduction by consumers. We mobilise insights from a socio-technical perspective on consumption, which highlights the importance of everyday interactions between routine activities, mundane technologies and cultural meanings in (re)producing patterns of consumption. These insights are illustrated with reference to domestic food provisioning, using empirical data generated through twenty semi-structured interviews with consumers in relation to meat consumption and thriftiness. Two suggestions for the development of the ‘circular economy’ to better take account of consumption within the domestic sphere are made. The first is a shift from imagining consumers as ‘users’ of particular products or services, to conceptualisation as ‘doers’ of everyday activities. The second is a broadening of the principle of ‘eco-effectiveness’ to take account for the social value of consumption.

**Keywords:** circular economy; food; consumption; sociology of food; social practice; meat; thrift; food waste

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## 1. Introduction

The ‘circular economy’ (CE) is presented as a more environmentally sustainable alternative to the existing ‘linear’ economy, in which materials flow in one direction—through production, use, and, finally, to be discarded. As a blueprint for a more environmentally sustainable economy it is gaining some traction. The European Commission presents CE as a pathway to achieving a ‘resource efficient Europe’, serving as both a metaphor for reimagining flows of materials within the economy, and as a guiding principle toward engendering new relationships between nation-states, firms and consumers within the EU [1]. In 2015, the European Commission announced a policy package designed to replace waste reduction targets with a plan to promote the transition to a more circular economy [2]. The new approach promises a more comprehensive, ‘systemic’ approach to reducing waste and resource consumption. According to the Ellen MacArthur Foundation [3], the systemic approach of CE is based on a few core principles. These include ‘designing out waste’ by creating opportunities to cycle materials through multiple ‘cascading’ uses, thereby extending the potential to generate economic value. This is in contrast to approaches which aim to address environmental impacts through ‘dematerialisation’, which are dependent on *reducing* material flows.

The principle of 'eco-efficiency' is thus replaced with 'eco-effectiveness' [3], highlighting the potentially infinite contribution of materials to the generation of value, to be harnessed rather than minimised. Various strategies for achieving 'circularity' are proposed, including: the adoption of new technologies, production practices and organisational arrangements through which 'material loops' are closed; the re-design of products to extend their lifetimes and facilitate reuse of components; and the shift from product-based, to service-based business models to fulfil consumer needs [1,3,4]. The circular economy is thus no less than a 'transformational agenda that aims to redesign production and consumption systems' ([5], p. 19).

While the promise of a more systemic approach to waste is appealing, it is our assessment that current applications fall short in regard to the conceptualisation of 'consumption' and 'consumers'. In particular, we note the lack of attention paid to the domestic sphere, an important site and space for the enactment of practices which shape how and why consumers use particular products and services, how 'waste' is generated, and ultimately how this might be changed. This is particularly relevant for CE solutions which require consumers to incorporate new products, use existing infrastructures in new ways, or to become enrolled in entirely different ways of meeting needs, such as required by the adoption of consumer-facing product-service systems [6–8].

We suggest that progress could be made in addressing the shortfall by adopting a 'socio-technical' perspective to understanding what sustains current patterns of how and why consumers use particular goods and services [9–12]. The perspective is illustrated with reference to the case of domestic food provision, which serves as a useful domain to illustrate our broader point for several reasons. Firstly, because the food sector is subject to a degree of scrutiny with respect to waste generation and reduction, and has featured in accounts of the circular economy [3,13–15]. Secondly, because of the significant implications of the domestic sphere in the production and consumption of food. Thirdly, because of the significant proportion of 'waste' in the food chain which is attributed to domestic activities—in the UK an average of 25% of food waste is estimated to occur within homes, although this varies according to food type [16,17].

Although the food system has been highlighted as a potential site for the fruitful implementation of the principles of 'circularity', much of the work engages with food *production*, and the re-use of surplus food with less attention paid to processes involved in food *consumption*, apart from as an end-point of production, or as a source of waste [3,13–15]. A good illustration of the current state-of-the-art in this respect can be found in Jurgilevich et al. [14], which draws from results of an expert roundtable on 'Circular Economy for the Food System', which took place in 2015. This work reviews and assesses current potential for CE strategies, and makes suggestions for how consumers might be incorporated. While it succeeds in taking the first steps in moving beyond the production-biased approach to the food system, by highlighting the importance of domestic consumption in a transition to a circular economy, it is our proposition that the strategies suggested reflect the dominant, implicit (and flawed) conception of 'consumption' in accounts of CE. Specifically, that consumption is a primarily purposive and rational act, which can be altered at will through engendering appropriate desires among individuals and making available appropriate opportunities. As such, consumers appear as the 'purchasers' of food products or 'wasters' of foodstuffs who can be enrolled in new practices through persuasion, primarily by information or education-based intervention. Domestic consumption is problematized as a phenomenon to be 'corrected' through 'top-down' intervention; for example, via more rigid control of food labelling claims, or greater transparency in food production, to enable consumers to make more sound consumption choices. Such an account, we argue, effectively 'black boxes' the domestic sphere—reducing patterns of consumption to the consequence of changes in products or how they are produced and marketed, and failing to account for forces which act to maintain stability in what people eat, use and 'waste', which, as illustrated in our account, lie beyond the influence of 'producers' or individual 'consumers'.

This paper illustrates an alternative account of 'consumption' through the application of a 'socio-technical' perspective to understanding what shapes patterns of resource use in everyday

life [9–12,16]. While considerable variety exists across this broad school of thought, proponents share an emphasis on the importance of routine, often mundane, habitual nature of consumption, which is shaped in significant ways by existing material infrastructures, shared cultural meanings, established normative expectations and the temporal rhythms of everyday life. We adopt this orientation and illustrate how this generates alternative insights into the processes of reduction, reuse and recycling, through discussion of three examples: The reduction of meat consumption, the reuse of leftovers and the ridding of surplus food.

The paper is structured as follows: Section 2 outlines the key features of a socio-technical perspective on consumption, as an alternative for exploring how waste is produced, products are used and patterns of consumption sustained (and therefore might be changed). This section also presents an overview of key insights from the literature on the sociology of food, with relevance for understanding the specific case of domestic food provisioning. Section 3 presents empirical illustrations of how processes which shape consumption within the domestic sphere can be illuminated through the adoption of a sociotechnical perspective, through the discussion of three illustrative vignettes. Section 4 summarises the argument and presents two suggestions for incorporating a better account of ‘consumption’ into CE. In line with Bacchi’s [18] argument that policy gives shape to problems rather than directly addressing them, we suggest this reconceptualization is an important step in promoting ‘circularity’ and the changes in domestic consumption that will accompany it.

## **2. A Socio-Technical Perspective on Consumption: Beyond Individual Choice and the ‘Wasteful’ Consumer**

Attention to consumption gained prominence in the sustainability debate with the Rio Declaration of 1992. The 2002 UN Environment Programme again sought to place consumption centre stage within discussions on how to achieve sustainable development [19]. Concurrently, scholarly attention to consumption and consumers turned to contribute to this endeavour. One outcome of this work has been to identify the domains of consumption that generate the greatest environmental impacts. There is now considerable evidence that the most resource intensive activities associated with ‘final consumption’ are mobility, energy use within the home (heating, cooling and other equipment), and food provision (particularly related to meat and dairy) [20]. Far less well established, however, is how existing consumption patterns in these domains might be changed to render them more sustainable [21].

Many early contributions to understanding ‘sustainable consumption’ have been criticised for their conceptualisation of consumption as an overly rational act [22]. Specific criticisms include an overemphasis on the importance of individuals, whose action is driven by incentives (often financial), mediated through personal attitudes and values, such as their orientation toward environmental issues. This problematic is summed up in Shove’s [23] argument that the sustainability debate needs to move beyond the dominant paradigm of ‘ABC’—or ‘attitude, behaviour, choice’—which assumes that patterns of action are the result of personal attitudes which generate behaviours resulting from the choices made by individuals. Such a conceptualisation suggests that with the availability of environmentally friendly products or services, accompanied with appropriate advertising, the right price, and suitably ‘environmental’ values and attitudes, individuals might choose to adopt pro-environmental behaviours. Behaviour change initiatives thus work upon narrow framings of decision making. Thaler and Sunstein [24] go beyond the framing of the consumer as rational decision-maker by acknowledging the role that habits play in shaping action. However, they do not move beyond the view that interventions should target the habits of individuals. Habits are seen as routinized behaviours that can still be changed through social marketing and some adjustment to the conditions in which consumption takes place, rather than considering ways of changing both the practice itself and the ways in which it connects with other practices—see References [25,26] for a full account.

Socio-technical accounts of what sustains patterns of consumption [9–12] have been positioned as offering a redress to this emphasis upon individual behaviours and habits. Such accounts recognise that alongside personal motivations and decisions, patterns of consumption are a consequence of the material infrastructures and technologies that shape what is possible, alongside the collective shared cultural understandings of what is normal and desirable. From this perspective, change (and stability) in patterns of consumption cannot be understood as arising from the aggregation of multiple individual behaviours but rather as emerging from recursive processes between action in everyday life and broader societal structures. In this way, consumption is social rather than individual. Understanding what sustains patterns of consumption, and how these might be changed, therefore requires attention to factors which exert influence *beyond* individual consciousness. This necessarily shifts attention away from explaining individuals (boundedly) rational behaviour to the understanding of routinized activities, shared understandings, and the material infrastructures that shape how and why resources are consumed as they are. The production of normality and ordinary consumption [27] becomes the focus of explanation.

One strand of research which has gained prominence within and beyond socio-technical debates on how to shift consumption in more sustainable directions has taken instruction from a practice theoretical approach derived from Bourdieu [28], Schatzki [29], Reckwitz [30] and later Warde [31,32], and Shove et al. [33]. Halkier and Jensen [34] argue that the practice theoretical lens invites a methodological approach that allows the researcher to take account of the complexities of consumption as an on-going process situated at the intersection of other connected practices. That is, consumers do not so much consume resources as simply engage in a social life that requires a multitude of material goods and services. This shifts the focus away from the deliberative decision-making, presumed to be the preoccupation of the consumer, towards the situation of the consumer as an agent engaging within and across complex systems. Food practices and food consumption are flagged as one such example of flow and process in the business of carrying out everyday life. Focus on the interconnection of practices, preparing food, eating, looking after children, working and entertaining friends, brings to light the problems that consumers face in changing even quite mundane elements of daily life [35].

A sociotechnical approach to exploring dynamics of household consumption in relation to questions of sustainability has gained traction, most notably in relation to the use of energy (e.g., [10,36–38]) and water (e.g., [39]). New technologies are increasingly noted for their role in transforming everyday life in the domestic sphere. For example, Truninger [40] finds that the ‘Bimby Thermomix’ is more than just a time saver, but facilitates the synchronicity and simultaneity of different practices as it reconfigures the order, scheduling and co-ordination of meals. Food practices can therefore be considered a powerful nexus point at which to understand the dynamics of everyday life; for it is a juncture for many practices [35], particularly where the pressures of meeting demand for ‘proper’ food crosses over with the many varied socio-temporal demands [41]. This is also well illustrated by O’Connell and Brannen [42] in their analysis of the food practices of dual-earner households with children. They pay attention to the constraints and affordances of the daily schedules of parents and children, looking at how these intersect and create patterns of food practices across the life course. Similar to the proposition of this article, they conclude by stating the limitations of interventions guided by a narrow frame of ‘food choice’ that currently dominates public health policy.

Additionally, paying attention to the domestic sphere as a dynamic space in which the demands of daily life are negotiated, several scholars have considered processes through which food becomes waste [43–47]. This work illustrates how the intersection of material, social and cultural conditions ultimately shapes food consumption. It thus follows that any waste arising from such processes might similarly be charged not at the individual but at the social level. That is, food waste results from particular ways of eating which are culturally, socially and materially embedded in day-to-day life. Moreover, domestic technologies, such as fridges, freezers and cooking devices, are figured in the structuring and reproduction of these wasteful practices. For Hand et al. [11], domestic technologies are inextricably interwoven in the choreography of things and people in time and space as the material,

spatial and temporal organisation of the home affects what it is that people come to *do* within it [11]. These processes then shape what becomes normal over time, such as the ability to wash and dry clothes more regularly, or to purchase and store large quantities of foods in fridges and freezers for consumption at a later date.

A socio-technical perspective thus considers how technologies and material artefacts shape human activity as well as how actors take-up and create demand for them. Examining this requires attention to the relationship between people and the goods and services they use. We draw on such a framing to underpin this analysis of the case of domestic food provisioning (in Section 3), as characterised by three key notions:

1. The prevalence of habituated patterns of action in everyday life through which consumption occurs (not primarily governed by deliberate calculation).
2. The importance of shared understandings of competent performance and acceptable behaviour (learned through experience and translated into alternative contexts).
3. The role of material infrastructures and cues in prompting, constraining and enabling particular responses.

To apply this perspective to the case of food provisioning we also mobilize ideas established in the sociology of food, a substantial body of work oriented toward understanding the emergence and normalisation of particular ways of eating. Early and influential work in this field, including a collection of essays by Murcott [48], attests to the social significance of foods. From deciphering wedding meals, to the media representation of cooked frozen products, it is clear that ‘goodness’ in food is as much about morality as it is about nutritional value [48]. Foods are laden with meaning about what is natural, proper and virtuous. Such work has served to counter instrumental accounts of food choice and diet emanating from the field of clinical health nutrition, shifting understanding of food choice as based upon individual taste, to take seriously the social and cultural constraints faced by people in maintaining their diet (e.g., [49,50]). In her seminal work on ‘Feeding the Family’, DeVault [51] pays attention to the structural and cultural elements of styling family life around food. She finds that while some women are guided predominantly by traditions and routines learned from their mothers, others use food provision as a platform for sociability and entertainment. Consumption of food in the home is thus far more complex than securing the flow of the ‘right’ goods and disposing of the waste incurred in the ‘right’ way. Feeding the family is as much about the performance of identities, expression of care and negotiating tensions and anxieties.

Such tensions are well captured by Warde’s [52] four ‘antinomies of taste’. These criteria map the competing rationales that pervade the choices made by consumers for one foodstuff over another. The antinomies comprise oppositions between novelty/tradition, health/indulgence, economy/extravagance, care/convenience, and provide a systematic basis for analysing data pertaining to contradictory guidance about food offered by the mass media, social contacts, and government. These categories are suggested to represent ‘the structural anxieties of our epoch: they are parameters of uncertainty, apt to induce feelings of guilt and unease’ (ibid. p. 55) brought about by the plethora of choices made possible by neo-Fordist systems of production and consumption. What each antinomy highlights is the complexity and contradiction that pervades consumption, where we might find it impossible to accuse the consumer of making deliberated and rational decisions, even if they wanted to. The antinomy of care/convenience, which represents a trade-off faced by the modern household with regard to food preparation is perhaps most relevant for our account of domestic food provision. Warde [52] finds that such a trade-off is most likely to be made by women, who in their roles within a domestic division of labour, care for and reproduce ideas of a ‘proper’ family [51]. Moreover, in making the compromise between care and convenience, it is working women who carry the burden of guilt; making choices between the ‘proper’ and the ‘convenient’ meal as the demands of material and emotional labour converge [53,54].

### 3. Illustrating a Socio-Technical Perspective on Consumption: The Case of Domestic Food Provisioning

This section illustrates the usefulness of a socio-technical perspective for understanding consumption (in this case food), with implications for what flows in and what flows out of domestic space. To do so, we offer three vignettes related to the propositions for a circular economy of food [14]. The first empirical example focuses on meat consumption, problematizing the assertion that consumers might straightforwardly replace current 'excessive' meat consumption with smaller amounts of meat produced in more sustainable ways. The example illustrates the wider forces at work shaping the material that flows into domestic space. The second example illustrates the non-linearity which exists in the production of domestic waste, highlighting how materials are transformed by the deployment of domestic skill and social competence in provisioning food and using 'leftovers'. The third example describes the variety of conduits used by people as they effectively manage the amount of waste flowing from the home. The examples illustrate that while conscious efforts by consumers to reduce waste are important, how, and in what circumstances, particular strategies are employed are mediated through efforts to uphold social conventions around proper food and appropriate behaviour.

The empirical data used in these illustrations are drawn from two distinct projects, which formed part of a wider research programme exploring eating practices across three English cities. This programme included a survey ( $n = 1,101$ ) of people across three UK cities (Bristol, London and Preston), in which 750 participants agreed to follow-up interviews. These respondents were distributed between five separate projects exploring different aspects of food and eating. The data used in the paper draws from two of these; the first focused on meat consumption and meat avoidance (among meat eaters) and the second on how thrift and frugality influence domestic food provisioning. Semi-structured interviews were conducted with 20 participants from London and Preston. Interviews were transcribed and thematically coded using etic and emic coding. Collaborative discussion enabled connections between the emerging insights from the two projects' empirical data and its potential for illustrating the dynamics of consumption and waste in the domestic sphere. The empirical data presented here serves to illustrate the conceptual argument being made by highlighting the multiple interacting social, material and cultural forces at work in reproducing patterns of consumption. As such, interviewees were not asked directly about the circular economy, but rather about their everyday experiences of food provisioning. Names have been changed to preserve the anonymity of interviewees.

#### 3.1. *The Foods People Eat: Meat Consumption and Meat Reduction*

One of the examples through which the transition to a circular economy of food could be enacted is through the reduction of meat consumption [14]. This is suggested on the basis of the high environmental impact associated with meat production relative to other foodstuffs. Through the lens of the circular economy, reduction in meat consumption increases the efficiency of material flows within the food system by reducing the amount of energy, land and water used per calorie of food produced. Jurgilevich et al. [14] suggest two pathways for stimulating the required change—the use of "less-but-better" meat and "meatless days" both of which are accompanied by suggestions to educate consumers in order to raise awareness and thereby stimulate consumers to change what they eat. This vignette illustrates how attention to the activities that take place within the domestic sphere, through a socio-technical perspective, can illuminate processes which are likely to shape the success of such an approach. We take Philippa as an example. Philippa is a 30-something Canadian architect who lives in London. She is generally concerned about what she eats and appears knowledgeable and concerned about food provenance and quality. Philippa spends time and effort sourcing and preparing food for herself and friends, and identifies herself as attempting to reduce the amount of meat she eats. She explained that this is primarily due to a desire to be healthy, and, as such, she also endeavours to avoid processed foods. When asked what she ate yesterday she responded:

(For lunch) “ . . . I actually just had frozen dumplings, which I defrosted while steaming, so it was like a Chinese pork and veg dumpling and it’s actually already made, so that’s processed.”

Explaining the circumstances of the meal, she continued:

“I had that at home, because I have the packet frozen from the Chinese grocery store. So that was a fast meal. ( . . . and) Because it’s very tasty, it’s the most authentic tasting dumpling, I find. It’s pork and a bit leeky, the Chinese veg that’s in the dumpling. ( . . . ) It’s the flavours that I grew up with in Hong Kong, so it is very Chinese and I did buy it in a Chinese grocery store, so it’s their recipe.”

Despite attempting to reduce the meat in her diet, Philippa’s lunch included pork. The pre-prepared dumplings were not purchased with consideration of the source of meat, or the farming methods involved. The initial explanation for the selection was made with reference to convenience, as the preparation time was short and the process relatively simple. Further prompting revealed the dumplings were not just a one-off meal, but a routine part of her cooking repertoire. Philippa enjoyed the dumplings in part because the familiar tastes from her childhood (see [55]), in which Chinese dumplings were a traditional staple. Although acknowledging that the experience was “not quite the same” as dumplings produced by family members, the frozen version satisfied her, offering a solution which was at once authentic, while also conveniently fitting into her busy life. The material infrastructure of her home, equipped with steaming equipment, and a freezer, enabled her to happily consume food prepared in a factory containing meat of unknown origins, as part of a satisfactory culinary experience. The amount of meat in the meal and how it was produced was entirely inconsequential, remained unnoticed and unremarked upon. As Eden et al. [56] argue, there is no simple knowledge-fix that will reconnect consumers with food in ways that will facilitate more sustainable or ethical practices, for meat eating is symptomatic of acting upon other concerns or simply getting through the day.

Indeed, Philippa’s evening meal also contained meat, which she recounts as having enjoyed without any attempt to limit the quantities or establish provenance. In this instance, the meal content was constrained by the menu of the restaurant ‘Chicken Chop’, which was selected due to a combination of factors including, the location of her friend’s work, time pressure, and the search for novelty and experience.

“Suzanne is very busy and she’s almost directly diagonally opposite that place and she hadn’t been there so I thought ‘you’ll have to go to the Chicken Chop’. So we were having a catch-up. ( . . . ) And it was rotisserie chicken, that’s all they have on the menu, they just do chickens on spits or rotisserie.”

Despite endeavouring to reduce her meat consumption, Philippa described several instances of eating, cooking and enjoying meat throughout the interview. When asked about the last time she cooked for other people, she explained her choice of dish. Again, the dish described is meat-based:

“When I’ve done meals for friends often it’s either roast chicken or roast beef, and I’ve done roast lamb as well. Often I find roasting things is a really good way to serve larger quantities of people. So because it’s worked well for some other dinners that I’ve held I just thought this would be easy, and it’s only the three of us, so I just picked that, knowing that they would also enjoy it.”

Offering meat to guests was considered a ‘safe bet’, and a relatively straightforward way of meeting guests’ expectations a satisfying meal. The choice of meat in this context offers an enjoyable and convenient option. It is a core element of a ‘proper’ meal [51,57]. The skill of selecting an appropriate dish for a dinner party has been acquired through experience, and having previously succeeded in generating enjoyment, is enacted again. Meat is chosen not only for sensorial reasons,

constraints of a restaurant menu, or for convenience or novelty, as was the case for lunch and dinner, but is explained as a learned response to providing a satisfactory social occasion and thus maintaining social relationships—A core concern for those entertaining others with food in their home [51,58]. This example then suggests the importance of established routines and learned behaviours about what is appropriate to do, and which products or foods are suitable on particular occasions. This insight, that particular products (such as meat) are used within and for the sake of established routines, is far from trivial. Rather, it has consequences for understandings of how change might take place or consumption of particular products might be reduced. Much consumption of food occurs within previously established routines, which themselves generate stability in what and how people eat, despite awareness and good intentions to alter their eating habits, as in Philippa's case:

"I think the habit of actually liking to eat and trying to eat well, that definitely comes from my mum. ( . . . ) I'd say with roasts, whenever sometimes I wasn't sure I would sometimes call my mum and say 'how do you do . . . ?' and she would give me advice, like 'you could actually put garlic into the sides of the meat before you roast if you want to tenderise it like you're baking', so little tricks."

Meat is associated with eating well, learning how to eat well (and cook well), and is passed on through experience. It can also explain the stability of patterns of eating in a family context and family eating routines [59], as well as the difficulties faced negotiating new routines in the early days and years of marriage and cohabitation [60]. How we eat depends on how those around us eat, demonstrating that transition is no simple feat.

### 3.2. *The Transient Nature of Waste: Using and Reusing Leftovers*

The following two examples illustrate several points which emerge from the adoption of a sociotechnical perspective on the production and reduction of waste within the home. The examples of leftovers and ridding strategies illustrate that while waste reducing strategies are adopted, these are not solely with the aim of reducing waste. Rather waste reduction emerges from and is shaped by the wider food provisioning practices within the home. Many sociological studies of food and eating describe how leftover food is 'revalued and reused' within the home [44,46,61]. In other words, food is given a 'second chance' ([61], p. 121), in which it moves back into the realm of raw material to be reproduced as something new for further consumption. The idea that the contents of one meal have implications for the next, was a common theme amongst interviewees, as explained by Heather, a retired woman in her sixties living alone:

Interviewer: Do you plan much in advance what you'll be eating?

H: Well things just always flow from one thing to another . . . there's always something which goes into the next meal and then a bit of that goes into the next meal. Like I've made enough sauce now and that will keep until Saturday so I'll do something else with that.

Several interviewees in addition to Heather exhibited considerable skills and knowledge in transforming materials from one meal to the next. Food preparation, cookery techniques and repertoires of dishes were drawn upon to create satisfying dishes from available ingredients [46]. As Heather noted, 'I must have a million recipes, I am always printing stuff off the Internet'.

The material infrastructure and technologies of the home also feature in accounts of how transformations of food between states of waste, and raw material were managed. The fridge featured heavily in accounts, acting as a conduit for extending the life of leftovers. Technologies such as the freezer, the microwave and the slow cooker were also prominent, for their abilities to preserve and transform left over food.

The extent and ways in which leftover foods were reused, depended not only on the material infrastructures and competencies of those involved in preparing food, but were also shaped by a variety of cultural norms and conventions governing not only what food was 'proper' food to eat, but wider

conventions relating to giving care and presenting a particularly personal identity to others outside the household. As one participant, Haadiya, a working mother of four, in her mid-thirties, noted:

Guests I know very well I might give leftovers to . . . ..but no I wouldn't give it to just any guests. I would have to do something from scratch, something fresh.

The importance of maintaining such shared conventions became visible in the context of anxieties regarding caring for others within the household or presenting a particular identity of the home to the outside world. As Cappellini and Parsons ([61], p. 129) note, guest meals are deemed more 'extraordinary' events from which leftovers are absent and special purchases, such as an expensive bottle of wine or a specific cut of meat, are present. Thus, food provisioning and decisions regarding who eats what are very much entwined with the specific culture of the home [44].

Furthermore, the re-evaluation of leftovers reveals the influence of household choreographies on food waste practices. Food provisioning practices have to be scheduled with others in the household, as explained by Jenny, a woman in her mid-forties with two grown up sons and a husband living at home:

We will sort out what we're doing when I'm working, whether I'm working overnight, so I'll make the meal the night before it's ready for them [two sons] when they come in from work. So they're sorted. Because there's nothing worse, is there, than trying to find something that you'd not thought about? So if there's a meal there, they're sorted and then the next day when I come home, I'll sort that meal out.

As Jenny's explanation illustrates, providing food for her family involves a complex process of co-ordinating and scheduling meals around the personal, institutional (work, school) and calendar (appointments, plans) rhythms of each household member [41,62]. Surplus food becomes 'embedded in the flow of everyday life' ([44], p. 1134). These complicated strategies of ensuring that suitable and convenient food is available to those at home also illuminates the ethics of care involved in food provisioning [63].

### 3.3. Multiple Pathways for Ridding

Our final illustration describes the variety of strategies employed by people in their homes to get rid of unwanted food. These examples illustrate that the pathways through which food flows from the home are sustained not only by the availability and access to waste infrastructures, such as appropriate conduits—bins, food waste caddies and so forth, but also by deeper held cultural conventions. Indeed, as sociological studies on food waste concur, careless profligacy with food is a misplaced assumption (see References [44,46]). Rather, households will go to great lengths to avoid waste. Yet, avoiding waste is underpinned by a variety of social norms, behaviours and conventions, including, amongst others: sharing, caring, gifting, re-use and recycling. There is a growing body of literature exploring food sharing practices, from 'pot-luck' arrangements and commensality [64]; to community food gardens [65], organised food swapping events as part of local sharing economies [66], and those noting the rise of the food banks in the UK [67,68]. However, other than Julier's [64] work, such studies focus on organised, collective arrangements, rather than small scale, domestic practice. As we illustrate in this section, everyday food sharing can and does take place within the home as an ad hoc, informal practice. Although not the focus of this paper, this potentially opens up the everyday mundanity of domestic practice to the realms of the sharing economy, as well as the circular economy.

Illustrating the informality of everyday food sharing arrangements, Heather conveys not only her desire to ensure that food is not wasted—giving Derek the '*bit extra which needs eating up*'—but also illustrates care and reciprocity.

Me and Derek [neighbour] share food quite a lot. He was in London last week and he only got back last night, so I've just taken him some soup. When I was having the work done in the kitchen . . . oh it was filthy . . . and he made me a meal. And if I've got a bit extra which needs eating up I'll take it and he always gives me his food when he goes away.

Furthermore, and as discussed in the previous example, Heather's account illuminates the complex temporal rhythms in which food provisioning is interwoven—as portrayed by Derek's job and how Heather becomes the conduit for his uneaten food. Other similar pathways for ridding mentioned by interview respondents, involving family, friends and neighbours included giving away food that was due to go out of date; or sharing multi-buy offers as there was not the time to eat them or the space to store them.

Another pathway for the ridding of unwanted food was through alternative means of recycling and re-use; the most obvious of which is composting, a well-known strategy for dealing with household food waste both at the household level and through municipal household waste collections. As other studies have concluded, participants deemed composting a means of getting rid of unwanted food without feeling quite so anxious or guilty that it was being 'wasted' by simply being thrown into the bin [44]. Other smaller-scale alternative strategies of recycling and reuse are also worth mentioning. Jane, a woman in her late sixties, living on her own provided one such example:

On that side where the ivy is I had some potatoes which were sprouting and I bunged them in there in that tub, and each year I think I've got them all out and each year they keep coming back [laughing]!

Jane's example highlights the resourcefulness and adaptability of strategies for dealing with unwanted food, however partial or small scale they may be. A similar example was the practice of leaving out stale bread or cereal for wildlife. Nevertheless, such strategies do require specific knowledges and competencies, not just regarding what can be composted, replanted or what is suitable for wildlife to eat, but also making judgements about the value of food. As other studies have noted, the recycling of food, especially via composting, conjures up a plethora of social concerns and anxieties regarding having the appropriate skills, the right equipment, enough space, and, most of all, dealing with the material agency (smell, consistency) of food deemed inedible for human consumption [44,45]. Despite these limitations, the occurrence of these alternative strategies illustrates the plethora of pathways through which 'circularity' is enacted within the domestic sphere.

#### 4. Conclusions

The paper has illustrated how the adoption of a sociotechnical perspective on consumption generates new and important insights for the transition to a circular economy, specifically those that imply the need to 'design out waste' in the domestic sphere. Our key contention is that consumption in the home is far more complex than securing the 'right' flow of goods and disposing of the waste in the 'right' way. This point has been illustrated with reference to the everyday experiences of domestic food provisioning. The analysis suggests that both the quantity and type of materials which enter domestic space, and how they are used, transformed, and ultimately leave the home are sustained and shaped by the social relationships and material infrastructures available for provisioning and preparing food; and the shared expectations and normative conventions of what makes a proper meal, and an appropriate route for the ridding of surplus food. These insights suggest the need to move beyond the conception that what (and how much) is consumed, or how reuse and recycling takes place can be significantly altered through the provision of new business models and accompanying marketing to consumers, as often implied in accounts of the circular economy (e.g., [1,3,4]).

Specifically the paper provides two key insights. The first relates to how and why people use particular resource intensive products. This was explored using the example of meat consumption and the experience of meat reduction, the possibilities of which were shown to be influenced by factors which extend far beyond individuals and their values or intentions. Rather, meat eating is deeply

embedded in the routines and expectations of daily life. Consequently, even those individuals who endeavour to reduce meat consumption struggle in a context where the inclusion of meat is expected and desirable, and its absence challenges the conventions surrounding providing care, entertainment, and maintaining social relationships with friends. The second relates to the production of waste, and its conceptualisation as a distinct stage of 'consumption'. In contrast to this, through examples which illustrate the transient nature of food waste and the multiple pathways for ridding, we have shown that the production of waste is just one facet of the multiple, interdependent activities both within and connected to the domestic sphere; whereby the demarcation between production, consumption and waste is dynamic. We suggest that this is contrary to the dominant conception presented in accounts of the circular economy which view 'waste' as the end point of the process of production and consumption, which in turn serves to sustain the very linear thinking that the circularity project aims to replace. In other words, the domestic sphere is not simply a site through which goods and services flow in and out. Rather, goods and services are implicated in multifarious ways in the performance of practices. This has implications for the design of efforts to stimulate changes in domestic consumption.

The paper has highlighted the significance of the domestic sphere as a key site in the enactment of a transition towards the circular economy. The importance of paying attention to the practices that constitute domestic life is bolstered by the observation that various strategies toward achieving 'circularity' are already underway within people's homes. Examples of food sharing between friends and neighbours, and repurposing food as it travels from one meal to the next, are illustrations of why understanding what sustains flows of materials must include consideration of social networks, normative conventions, and existing routines as they are enacted in everyday life.

Building on these insights, we make two concrete suggestions toward the incorporation of a better account of 'consumption' in the 'circular economy'. The first is a shift from the conceptualisation of consumers as 'users' of particular products and services to imagining them as 'doers' of particular activities during which resources are consumed. As our examples illustrate, people do not 'use' 'reuse' or 'recycle' food. Rather, they 'do' the activities that constitute daily life (such as looking after family, working, socialising with friends), incorporating food as part of these activities. The second suggestion is a broadening of the principle of 'eco-effectiveness', which underpins the design of propositions to enact the 'circular economy'. Specifically, a move beyond the current focus on economic value and environmental costs produced by material flows, to also consider the social value generated through processes of 'consumption'. As we have illustrated, the value generated alongside resource consumption in the domestic sphere extends beyond those measurable with economic or material calculations, including provision of care, enjoyment, maintenance of traditions and connections with personal histories. The expansion of 'eco-effectiveness' beyond specific measurable functional needs of consumers (such as nutrition in the case of food), offers an opportunity to better account for the value generated by 'consumption'. Taken together, these two suggestions offer an opportunity to incorporate a more nuanced account of consumption into the 'circular economy'.

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