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The gaze of the gatekeeper: Unpacking the multi-level influences and interactions of household food waste through a video elicitation study

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ABSTRACT

Changing the household food waste related behaviours of consumers vital to the sustainable transformation of the global food system. This study utilised a video-elicitation methodology to explore the different factors that influence the food provisioning practices of the household dietary gatekeeper from a multi-level perspective, and to consider their food waste implications. Key findings included the central role of the household level in influencing food provisioning practices, the conditions imposed on households by the food industry, and the different trade-offs that are negotiated when shopping or cooking. Household food waste emerges from the gaps, cracks and compromises that dietary gatekeepers are forced to make between interacting factors at multiple levels. This study supports a move an exclusively individual level focus in food waste research to include greater consideration of the entire household, as well as the external conditions imposed upon them.

1. Introduction

There is growing recognition that the modern-day food system is a threat to human and planetary health and requires urgent transformation to avoid large scale environmental collapse (HLPE, 2014; Willett *et al.*, 2019). The extraordinary levels of loss and waste currently inherent in the food system are part of this challenge (FAO, 2011, 2019; FUSIONS, 2014). Food that is produced, but never consumed, is associated with a broad spectrum of social, environmental and economic costs (FAO, 2014). These include greenhouse gas emissions, land degradation, unsustainable resource-use, increasing production costs, and threats to the long-term security of food production (HLPE, 2014; Neff *et al.*, 2016).

The mounting sustainability implications of food waste have increased policy and research attention to this issue (Parfitt *et al.*, 2010; Porpino, 2016; Young *et al.*, 2017). However, despite substantial volumes of food waste from the domestic sector, research attention to the behavioural antecedents of household food waste is still relatively recent (Boulet *et al.*, 2021; Schanes *et al.*, 2018; Stangherlin and de Barcellos, 2018). To date, a range of consumer food provisioning behaviours (from purchasing to cooking to disposal) have been associated with food waste. In turn, a growing body of factors, such as demographics, attitudes, household dynamics and food packaging, have been identified as

potential influencers of these behaviours and of household food waste (Principato, 2018; Secondi *et al.*, 2015; Stangherlin and de Barcellos, 2018).

The relationship between household food waste, behaviour, and influencing factors is complex, multi-facted and resists simple explanatory models. Pioneering conceptual frameworks from Roodhuyzen *et al.* (2017) and Quedsted *et al.* (2013) attempt to model this complexity by framing multiple, contextually sensitive, causal pathways from which behaviour and food waste emerge.

Adding to these efforts, we recently developed a multi-level framework (see Fig. 1) of household food waste and consumer behaviour that recognizes the nested relationships between different context (or levels) and their associated factors (Boulet *et al.*, 2021). Based on an extensive systematic review, the framework organizes known influencing factors at individual (micro), household (meso), and external to household (macro) levels (see Fig. 1). The general food provisioning practices (and their specific associated behaviours) of a consumer are the emergent property of interactions between different factors depicted across the levels in the framework. Household food waste is then the final outcome of the different behaviours enacted.

While the range of influencing factors on household food waste have been comprehensively explored (Boulet *et al.*, 2021; Roodhuyzen *et al.*, 2017; Schanes *et al.*, 2018), much less attention has been given to the

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levels at which factors are located and their relative influence on food waste. Do particular levels exert a higher degree of influence on consumer behaviour and household food waste than others? Reid et al. (2010) have theorised that the household (meso) level is the ‘crucible’ of pro-environmental behaviours, mediating influences between different levels. Is this the case for food waste related behaviours? Do food waste policy makers and practitioners need to pay attention to particular levels (rather than single factors) to effectively tackle the problem?

The nested hierarchy in our framework also illustrates that influencing factors can be moderated, or even cancelled out, by factors that exist at other levels. For example, an individual may have particular food-related attitudes that would predict minimal amounts of food waste, yet this factor can be subsumed by the food related tastes and preferences of others in the home, leading to more food being wasted at the household level (Cappellini, 2009; Evans, 2011). Other studies and frameworks have addressed the possible interactions between factors (see for e.g. Aschemann-Witzel et al., 2015; Roodhuyzen et al., 2017), however, to the best of our knowledge, none have been empirically investigated from a multi-level perspective. Greater understanding of these relationships, as well as the relative influence of different levels, will assist food waste policy makers and practitioners in designing effective interventions that target factors and levels ‘that matter’ in order to influence consumer behaviour change.

This study explores the relevance of our conceptual framework for empirical research by conducting a multi-level investigation of household food waste factors, and interactions, from the perspective of the individual consumer. Our research asks: *which factors and levels are relevant to an individual’s behaviour and decision-making during household food provisioning practices?* In addition, we consider what interactions between factors and levels are also evident.

We utilized a qualitative video-elicitation methodology to explore food provisioning from the perspective of the household member most responsible for shopping and cooking, i.e. the household’s ‘dietary gatekeeper’ (Reid et al., 2015; Wijayaratne et al., 2020). Factors identified were then organized from a multi-level perspective to the relevant micro, meso and macro levels in the framework above. We focus on household food provisioning practices, and their associated behaviours, because as previously discussed, it is from these practices that household

food waste emerges (Boulet et al., 2021; Principato, 2018; Roodhuyzen et al., 2017). Understanding the influencers of household food provisioning gives greater insight into the background conditions that generate food waste.

The next sections describe this study’s research methodology, present the results, and discuss key emergent themes, including implications for behaviour change interventions that reduce food waste. We finish with a reflection on the pros, cons and opportunities of video-elicitation as a methodology that has not been extensively used in the research field of food waste and consumer behaviour.

2. Method

Our research design is a qualitative observational study, with video-elicitation used as the primary data collection method. Video-elicitation is a *visual method*; incorporating the use of visual materials (such as pictures or videos) in the research process (Basil, 2011; Dodds et al., 2018; Pain, 2012; Patricia et al., 2017). An individual’s memory of past events can be imperfect and biased, and the colour, motion and sound from visual materials such as videos, can trigger a broader spectrum of brain processing and is an effective way to prompt memory and more accurate recall (Harper, 2002; Jarrett and Liu, 2018; Starr and Fernandez, 2007).

Photographs and videos can also capture consumers’ habituated food provisioning behaviours and prompt rich reflection from research participants on influencing factors (O’Connell, 2013; Koenigstorfer and Groeppel-Klein, 2010). They ensure that what participants say about a behaviour is directly informed by the performance of that behaviour. This avoids participant self-reports being based on espoused abstractions, or the motivation to conform socially, as can happen in surveys and interviews (Dodds et al., 2018; Ganglbauer et al., 2013; Keller et al., 2008)

Visual research methods are uncommon to the food waste research field (as opposed to other fields such as food choice, see for e.g. Mills et al., 2017; Alm and Olsen, 2017, 2016; Lachal et al., 2012). As a rare example, Ganglbauer et al (2013) installed cameras in participants’ refrigerators (FridgeCams) to explore food waste in households. Photos of fridge contents were used during interviews to elicit participants’

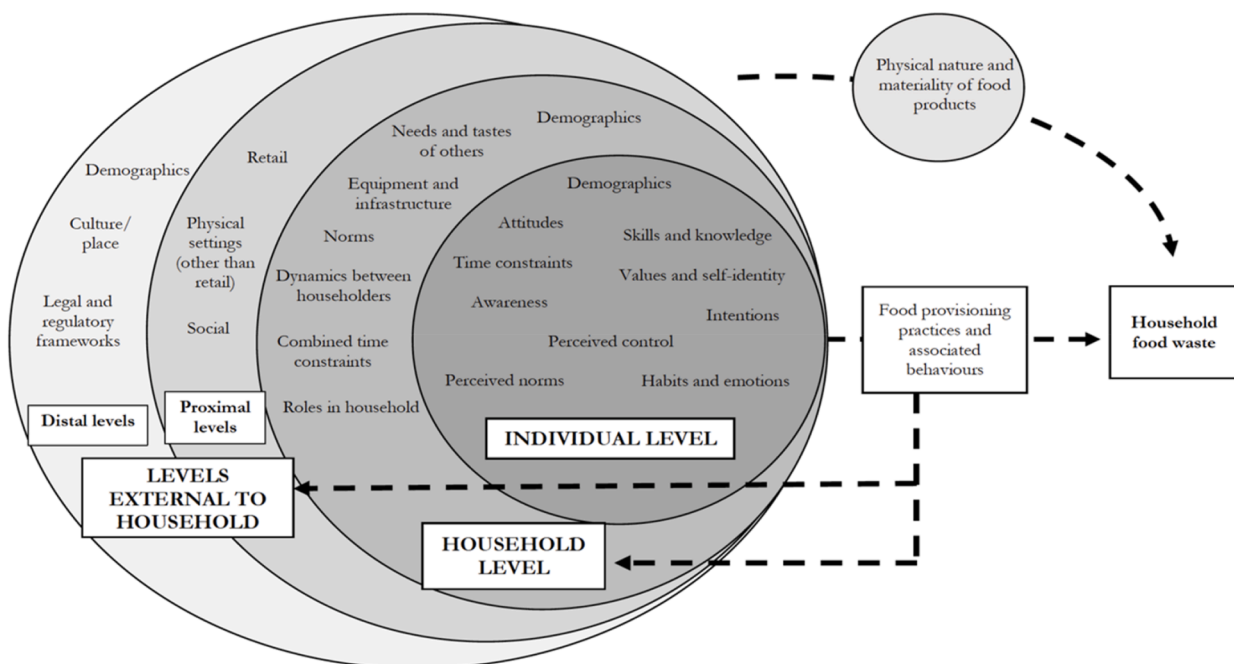


Fig. 1. Our multi-level framework of household food waste and consumer behaviour organizes factors associated with food waste at individual (micro), household (meso) and external to the household (proximal macro and distal macro) levels.

explanations of food purchasing and consumption decisions. The research highlighted the difference between the *espoused*, and often idealized, food waste practices of participants and what actually happens in the complexity of daily life (Ganglbauer et al., 2013; Hebrok, 2018).

2.1. Research participants

A market research company that specializes in video-based methods was engaged to assemble a panel of participants from their existing membership data-base. This company trains panel members in smartphone-based video recording techniques and manages an online platform to which participants upload videos for researcher access. Participants are financially incentivized by the panel company to take part in research projects.

Panel participants ($n = 13$) in this study were middle-income earners from a mix of regional and metropolitan locations along the Australian east coast (see Table 1). They were the main person in their household responsible for cooking and shopping (the dietary gatekeeper), were all women (except one), and their ages ranged from 30 – 45 years. All were parents in family occupied households with at least two children, representing the most common type of Australian household.¹ Food waste was not mentioned when recruiting participants, only the aim to understand particular food provisioning practices from their perspective.

While there have been issues of representativeness and self-selection identified with panels that are deliberately assembled through specialist companies (Pennay et al., 2015; Yeager et al., 2011), this is of less concern for this study. Our focus here is to explore the socially constructed experience and perspectives of our research participants with regards to food provisioning practices, rather than make claims about trends or patterns that are representative of the broader population. This point is also relevant to address the potential self-selection bias that comes from panels in which participants are provided a financial incentive to take part.

2.2. Research protocol

Over a two-week period, each participant was asked to record one instance of themselves performing one of three activities associated with common household food provisioning practices:

- Unpacking at home after a major food shopping trip ($n = 7$)
- Preparing to cook a normal main meal at home ($n = 7$)
- Cleaning up after a main family meal ($n = 2$).²

Table 1

Description of study participants ($n = 13$).

Demographic		#
Gender	Female	12
	Male	1
Age	30 – 34 years	5
	35 – 34 years	4
	40 – 45 years	4
Number of children in household	2 children	10
	3 children	3
Location	Metro	10
	Regional	3

¹ Australian Bureau of Statistics, 2016 Census Quick Stats. http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/036?opendocument accessed 12/02/2020

² Two participants were involved in more than one task, hence the discrepancy between the overall panel sample size, and the sample sizes for the tasks.

These activities were chosen as they enabled insight into several household food provisioning practices at once (Roodhuyzen et al., 2017). Unpacking from a shop highlights the decisions made during the planning, shopping and storage phases, while preparing to cook a meal also shows choices made during shopping, as well as portion control, family consumption patterns, and leftover re-use. Cleaning up after a meal allows participants to reflect on portion control, how much is eaten and what happens with leftovers. These activities were also chosen based on how easily they could be explained to participants and recorded by them.

Participants were not given direction on how they positioned their phones to record their performance. Some placed their phone in a fixed position, others choose to move the phone a number of times to capture particular elements of their activity, while others had a family member record them. This mixture of researcher-initiated design, and participant-generated materials, is common in video-elicitation studies, and ensures the research process is appropriate to the unique home contexts while still being conducted within a common structure (Dodds et al., 2018; Keller et al., 2008; O'Connell, 2013)

Once they completed the first recording (each usually between three to eight minutes long), participants then recorded themselves again, this time watching their initial recording of their task. This was made possible through the panel company's online platform. During this second recording, participants verbally responded to a number of reflective prompts, pre-set by the research team, on what may have influenced their particular actions and decisions in the first recording. These second recordings were usually longer than the initial ones (5 – 15 minutes). Both recordings were combined in the platform into a single dual-frame video made available to the research team (see Fig. 2). A transcript of the participants verbal reflections in the second recording was also generated.

2.3. Data analysis

We received one dual-frame video from each participant, with a total of 16 videos. Two types of data emerged from this research design: i) the video recordings of participants performing their set tasks and, ii) the audio transcript of the video elicitation element of the study, namely the participants' reflections while viewing their initial recording.

We were primarily interested in participants reflections, perspectives and self-reports of their food provisioning practices as elicited by watching their original videos. What participants described in their second video, and the associated audio transcript therefore formed the main basis of our analysis. The more material aspects of the participants' physical environment and of the food itself that could be seen in the videos by the researchers was not a major focus, unless specifically referred to by participants.

We used the multi-level framework of household food waste and

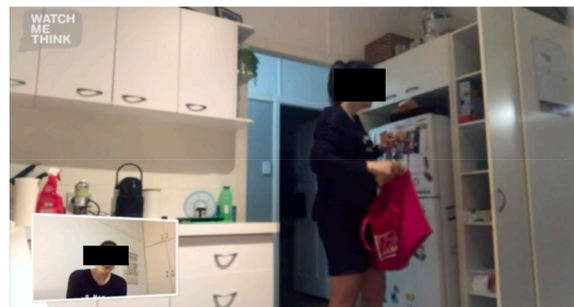


Fig. 2. Example of the dual-frame videos created in this study. The main image is from the first video the participant records of their performance of a provisioning practice (unpacking from a food shop here). The smaller image is from the second video the participant records while watching the first video and reflecting on their actions. Face blocked for participant privacy.

consumer behaviour (Fig. 1) to drive a primarily deductive thematic analysis of the audio transcripts (Braun and Clarke, 2006; Cho and Lee, 2014; Ritchie et al., 2014). The codes used for the analysis were based on the different food waste influencing factors identified in our recent systematic review (Boulet et al., 2021). and organized into different levels, as seen in Fig. 1 (the full codebook can be viewed in the Supplementary Materials). This allowed us to interpret the reflections of the participants on their practices through the lens of different factors related to food waste, as well as through a multi-level perspective. Interactions between different levels and factors were primarily identified when participants either discussed competing factors they needed to compromise between or mentioned a number of different reasons at the same time to explain an action or decision evident in the initial recording.

MB and AH viewed the combined videos and audio transcripts. MB then coded each audio transcript and the themes that emerged were reviewed by AH to add to the analysis as necessary and to discuss particular interpretations. An inductive element was retained in the analysis by creating new categories for data that could not be coded into predetermined ones. The visual data from the original videos provided a useful way to 'sense-check' the reflections of participants against what could be seen in the videos. This enabled any differences or disconnects to be detected between what participants said (and didn't say) about their behaviours and what they were actually seen to do.

3. Results

Our coding procedures identified two thematic categories from the video recordings and audio transcripts. The first category concerns the *key influencing factors, and their relevant levels*, while the second category was about the *trade-offs and negotiations based on multiple factors* that participants needed to make when carrying out different food provisioning practices. These categories are detailed below together with illustrative quotes.

3.1. Key influencing factors and their relevant levels

Individual (micro) level factors: The factor most apparent at the level of the individual were the *various food related skills and knowledge* that participants mentioned or engaged in. These ranged from discussions of the tools, experience and knowledge they drew on to prepare meals to various food management and storage actions, tips and tricks.

"... I do follow some recipes and some things you can just make easily without even really having to think about it. So like the pizzas, you don't need a recipe, that's pretty simple and basic. ... [for] things that you need help with that's when I tend to use my recipe book or Google or whatever ..."

We also observed the well-rehearsed, and *habituated*, nature of the different behaviours evident in the videos. Participants sometimes looked like dancers deep in a flow, with the sure and practiced actions of those who perform these activities multiple times per day or week.

"I didn't realise how deep in concentration I am when I'm actually cooking, it's quite funny actually."

Household (meso) level factors: The greatest range of factors identified through the coding process were at the household level. It was very noticeable how frequently the dietary gatekeepers in the videos spoke of the others in the family as opposed to themselves, and how the factors at this level were the primary concern over those at other levels when food provisioning.

A common thread across all the videos were factors to do with the *food related norms and routines* that drive household food provisioning. Participants often described typical meal repertoires that repeated each week:

"So tonight, before I even came home from work, I knew that we were having spaghetti bolognese"

In addition, particular items are routinely purchased because they were considered to be 'the usual' staples in the household:

"Most of these things are staples, like our tunas are staples, the Weet-Bix are staples, breadcrumbs. They're just things that we use all the time..."

Indeed, these staple items were often are bought as 'back-up' without any particular plan for when, or how, they might be used, other than to have a replacement ready when an item in-use was finished.

"... in this image are things that I don't actually need right now, but that's stock that we keep on hand. That we're running low of, so that's just back up stock."

Another common group of meso level factors were the *food needs and tastes of household members*, including different dietary requirements, particular tastes and desires. The needs of the participant were also included these decisions.

"I've got people that some like meat; I don't eat meat, some like bacon. My daughter doesn't eat the bacon, so I end up cooking in several different pots"

In addition to factoring in the needs and tastes of others, participants were frequently working around the different schedules and plans of those that they lived with (as well as their own). Cooking decisions in particular were determined by these combined *time constraints*, with leftovers being seen as a practical way of being ready for busy weeks in a household.

"... I am making quite a big batch ... I'm making enough for my kids to have, I made enough for my husband to have lunch tomorrow ... and also there's enough for my daughter to have in a thermos every day... at school and also my son needs a snack when we get home on Thursdays before we go out for after-school activities."

While household *food-related equipment and infrastructure* were not often discussed by participants, an observation by the research team was how large and varied household food storage spaces were in many of the videos.

"...there is my butler's pantry [where] I have a store for onions and potatoes ... here I've opened up both the fridges... we have the double fridges side by side.... down beneath those ... are two small freezers, they are usually my quick go-to freezers ... for anything that requires bigger space or ... aren't quick use items, we have a freezer down in the laundry."

Participants could often be seen shuttling between a number of different spots in the kitchen (and other parts of the house) to put food away after shopping or to take it out for cooking. In their videos, a number of participants were almost dwarfed by the size of their fridges and pantries, all of which were filled with food (see Fig. 3).

Beyond the size and number of food storage options seen in many participant homes, also noticeable were the differing levels of organization and tidiness of these spaces. This was a frequent topic of reflection, with participants either proudly showing off how organized they were and how this allowed them good overview of their food stocks, or ruefully acknowledging their lack of structure in food storage and how this impacted their awareness of what available food they may have.

"I'm just checking if there is any tomato paste actually leftover in the fridge. But my fridge is that unorganized, there probably is some at the back but I couldn't be bothered ..."

External to the household (meso) level factors: Participants only mentioned a relatively small number of different factors external to their



Fig. 3. Example of size and variety of household food storage spaces.

household that influenced their shopping and cooking practices. While some acknowledged the influence of social networks and extended family members on food that was bought or cooked, the factors most commonly identified at the macro level were associated with *food retailers*. Participants were often required to negotiate particular conditions, such as a package sizes, imposed on them by retailers (and food manufacturers) which were out of their individual control.

“Spaghetti pack sizes do not work for me very well. They don’t work for me because they’re the wrong size for my family, I always end up wasting a whole heap.”

Participants were also very deliberate in their selection of particular items available from food retailers based either on the type of food, or for whom in their families it was for.

“I do prefer multipacks really ... but then some items are for single serve, so things like tomato paste. I prefer single serve because I find that if I was to buy a big jar, I just wouldn’t use it all. But for the kids, certainly where they’re eating it a lot multipack is definitely the way to go.”

Participants were sensitive to retailer specials and discounts, which at times determined the type, and amount, of food that was purchased. One participant mentioned that despite writing a list before she went shopping, seeing her favourite cheese on sale led to off-list purchases in bulk, which she then had trouble fitting in her fridge.

“Speaking of not buying certain things, bocconcini is my weak point. And it was on special for 10 cents and I might have bought six [tubs] of them. With fridge space at a premium, I didn’t really think that through.”

While not included as a macro level factor in our framework, the influence of the *physical materiality of food* is worth mentioning here, as it is a factor beyond the control of the dietary gatekeeper. A number of times participants explained particular actions driven by the desire to prevent food items from spoiling or that were imposed on them when particular items perished earlier than planned.

“I try to use food before it goes off, obviously with things like veggies and stuff, it doesn’t work and sometimes you have to get rid of it sooner than you would like to. Because it perishes quickly.”

This section highlights the multi-level mix of influencing factors that were identified when participants showed off, and discussed, their food provisioning practices. It shows in particular how certain conditions are imposed on the household by food retailers at the macro level and the diversity of household (meso) level factors that participants at sensitive to when provisioning for their families.

3.2. Trade-offs and negotiations based on multiple factors

The second category that emerged was related to the trade-offs and negotiations required by participants when provisioning for their households.

When discussing their initial videos, a number of participants were very concerned about wasting food and described different actions (when shopping or cooking) that they take to avoid food waste.

“Which breaks my heart, it breaks my heart because of the amount of money food costs, and it breaks my heart because of the amount of time I spend cooking”

“And I do like to try to rotate things out to make sure that everything is used or older stuff is used first.”

At the same time, it was clear that food provisioning practices had to satisfy a number of different demands, in addition to avoiding food waste, that were being juggled by the dietary gatekeeper. When describing the reasons behind particular behaviours in their initial recordings, participants often mentioned a number of factors within the same breath and it was evident that what could be seen on the screen had emerged from the complimentary, or competing, interactions of these factors.

Of the factors described in Section 3.1, ones that were often mentioned at the same time by participants when explaining a behaviour included *time constraints*, and the *food related needs and preferences of others*. These were often accompanied by the requirement to use up foods or to generate left-overs to plan for a busy week ahead.

“And it’s a good meal, it’s healthy, I’ve used up everything at home, it’s a quick meal.”

“This evening’s meal was decided because ... everyone is feeling a bit tired after a big weekend ... it’s a quick easy meal and it’s one that I know the kids will eat. It’s also one that with the portion that I’ll prepare this evening, it will feed us for dinner and also for lunch-boxes the next day”

As already described, interactions between food package types from retailers, and who in the household the food is for, were also considered by participants.

“But for the kids, certainly where they’re eating it a lot multipack is definitely the way to go ... if I was trying a product for the first time ... I’d buy single serve because they may just try it and not like to eat it and refuse to eat”

At times, it was also clear that participants’ behaviours and decisions came less from a happy synergy of different factors, but rather the result of having to compromise between different demands and desires. This was especially evident when issues to do with health, packaging, food waste, and ‘eating fresh’ were considered and it was clear that gatekeepers had to choose between competing priorities and could not, to their mind, satisfactorily address all.

“one of our sons is pretty fussy. So it’s about buying little tubs if they’re on special, which we don’t like doing I guess, because of the wastage involved... it gets him to eat yoghurt so it’s ... the lesser of the two evils I suppose.”

“And I have taken to buying carb free zucchini and cauliflower ... I know is much cheaper to just buy the natural stuff and zoom it up myself. But I end up wasting it, so I’ve started to buy packaged vegetables which I hate the idea of. But at least I’m not throwing out half of a cauliflower and a few zucchinis every week.”

These trade-offs and compromises underscored many of the food provisioning practices that participants discussed and demonstrate that there was often no one single factor that motivated final behaviours.

Rather, these behaviours emerged from the interaction of many factors at once, often across multiple levels.

4. Discussion

We began this paper by asking which factors, at what levels, were relevant to an individual's behaviours and decision-making during common household food provisioning practices? In addition, we were also interested in the interactions that might be evident between factors and levels. Food waste emerges from food provisioning practices, and a better understanding of their influencing factors helps to trace out the pathways that generate household food waste (Boulet et al., 2021; Quested et al., 2013; Roodhuyzen et al., 2017).

Utilising a video-elicitation methodology we explored different influencers of household food provisioning practices (and by extension, of food waste) from the perspective of the household dietary gatekeeper. Our newly developed multi-level framework of household food waste and consumer behaviour then provided a unique lens through which to analyse and conceptualise study data. In contrast to many studies in the food waste domain that focus on factors of food waste and behaviour without considering their contexts or interactions (Roodhuyzen et al., 2017), the multi-level perspective afforded by our framework makes these aspects explicit and offers relatively novel insights.

Here we discuss the three key observations that emerged from the combined use of video-elicitation and a multi-level perspective in this study. Namely; i) the central role of the household level in influencing food provisioning practices, ii) the conditions imposed on households by the food industry, and iii) the different compromises and trade-offs between factors that consumers consciously, and unconsciously, negotiate when carrying out these practices. We consider the food waste consequences of these themes and their implications for behaviour change interventions, and then conclude with a reflection on the pros, cons and opportunities of the video-elicitation methodology for the food waste and behaviour research field.

4.1. The central role of the household in food provisioning and food waste

The majority of the factors (other than household infrastructure and equipment) we have identified here confirm the results of a number of other studies on food provisioning and/or food waste issues in households (see for example Aschemann-Witzel et al. (2016) or Mondejar-Jimenez et al. (2016) on food retail influences, Abeliotis et al. (2016); or Fanelli (2019) on food skills and confidence, and Mallinson et al. (2016); or Revilla and Salet (2018) on household norms, tastes, and time constraints). It is therefore not our intention here to discuss each factor in detail and consider their possible association with food waste, as this has already been well established in the research field.

We are interested instead in the relative influence of different levels on food provisioning and food waste, as this offers potentially novel insights to the research domain and for behaviour change interventions. Our methodology enabled exploration of food provisioning from the perspective of family household dietary gatekeepers, and it was clear that much of their 'gaze' when shopping or cooking was firmly fixed on the meso level. More specifically, their gaze was on the others (partners and children in this case) that made up their household and their provisioning practices were primarily geared to meet the combined tastes and preferences, schedules and time constraints, and established norms and routines of the entire household. This concern dominated their explanations of the different behaviours evident in their videos, with micro and macro-level factors discussed much less frequently.

The food choice and decision-making literature has numerous examples of how interactions with other family members influence the final behaviours of the dietary gatekeeper, and shows how these are frequently different, or a compromise, to their own preferences (see for e.g. Hartmann et al., 2014; Nørsgaard and Brunsø, 2011; Wenrich et al., 2010). Evans (2012) describes the food provisioning actions of dietary

gatekeepers as *family practice*, as a way of 'doing family'. The gatekeepers (usually women) enact, reinforce and sustain family relations by giving consideration to, and sacrificing for, the food-related preferences of others within the household (Cappellini, 2009; Evans, 2011, 2012).

In this light, the influence of meso level factors on the decisions and behaviours of the gatekeeper is not surprising, as they engage in provisioning activities primarily as 'representatives' of those they live with, rather than from a more individual perspective. Food waste then emerges from the compromises and sacrifices that dietary gatekeepers make between their own preferences, and the requirements of the household; namely, from food that is bought but not used, or cooked but not eaten. A number of the participants expressed strong desires to avoid food waste and discussed different strategies to prevent food being wasted. Yet they ruefully admitted there were days when 'life gets in the way' and the combined needs, preferences, schedules and commitments of their family were the final determinants of food provisioning and that their 'ideal' food waste avoidance strategies had to be put aside in favour of the family (Hebrok, 2018).

The gap between an individual's food waste reduction intentions and their final actions has been demonstrated in various studies (Graham-Rowe et al., 2015; Russell et al., 2017; Stefan et al., 2013; Toma et al., 2017). Graham-Rowe et al (2015) suggest that "it is likely that people may not have complete control over the amount of [food] thrown away, due to the behaviour of other members of the household" (p. 200). The dominant influence of the meso level on food provisioning shown here can help explain this gap between individual (micro) level intention and action. It suggests that in prioritizing the food-related needs of others (in 'doing family' through food), the household's dietary gatekeeper may not just have to sacrifice their own food preferences, but also their intentions to avoid waste. This might include neglecting leftover meals in the fridge in preference for a family takeaway 'treat' or abandoning a weekly meal plan to meet unexpected social, school or work obligations.

Our findings also suggest that the relatively unexplored meso-level factor of food storage infrastructure in a household may support or facilitate particular provisioning practices that run counter to efforts to reduce food waste. Providing plentiful food for the family has been shown to be an important part of the self-identity of the dietary gatekeeper, namely the desire to be a 'good provider' (Graham-Rowe et al., 2014; Porpino et al., 2015). This can lead to over-purchasing and stock-piling behaviours, which increase the likelihood of food not being eaten in time and spoiling (Bravi et al., 2019; Farr-Wharton et al., 2014). The large and varied refrigerators and pantry spaces many of our participants had would support over-purchasing or stock-piling, as they provide space for more food than might be actually be needed by the household. We also wonder if these large storage spaces exert their own unconscious influence on the gatekeeper, with empty shelves suggesting that they are not a good provider, and being therefore kept full for the sake of being kept full. The issue is exacerbated if gatekeepers are too busy, or uninterested, to keep storage areas organized and tidy, leading to stock-piled food items being 'lost from view' and ultimately wasted if more is bought to replace them (Ganglbauer et al., 2013; Hebrok and Heidenström, 2019; Waite and Phillips, 2016).

The strongly influential role of the household context, or level, on food waste has significant implications for food waste policy and practice. It is not enough for behaviour change interventions to only target specific factors to do with the individual consumer, be they the household dietary gatekeeper or not. An individual's positive attitudes and intentions to reduce food waste will only go so far when pitted against the combined influence of household level factors and may readily be sacrificed in favour of 'doing family'. The household as a whole unit or group needs to be the focus of interventions that aim to change household level factors such as norms, dynamics and decision making. As possible additions to current efforts to reduce household food waste, we point to experimental work such as the HomeLabs sustainable eating project (Devaney and Davies, 2017), which aims to change household level norms with regards to food practice and engage change within the

entire family, rather than just the dietary gatekeeper.

4.2. Food provisioning conditions imposed by food industry

The mediating effect of food retailers on household food provisioning and wastage has been identified in several studies (Aschemann-Witzel et al., 2016; Graham-Rowe et al., 2014; Williams et al., 2012). As a macro level factor, food retailers, manufacturers and producers (the food industry) impose particular food provisioning conditions on households through the food they have available, through package sizes and discounted or special offer items.

Discounted food influenced a number of purchasing decisions by participants in this study, such as trialling new products that were not normally eaten in the household or the bulk purchase of commonly used or favourite items as ‘stock-ups’. Both of these activities can lead to waste when interacting with meso level factors, with novel foods being rejected by other household members (especially children) who have not yet acquired a taste for them (Daniel, 2016) or facilitating over-purchase and stock-piling by dietary gatekeepers to be good providers for their household (Aschemann-Witzel et al., 2016). As these items were more than likely discounted because they are close to their use-by date, the risk of spoiling, and being disposed before being eaten, is even higher.

In their study of how package design contributes to consumer food waste, Williams et al (2012) estimate that 20–25% of household food waste is associated with food packages either; being too large for consumers’ needs; being poorly designed for keeping food fresh or; failing to communicate use-by-dates appropriately. While participants in our study also discussed how too-large food package sizes led to food waste, we identified an additional nuance to this dynamic. Our participants did not consider large single serve items as appropriate for their children, preferring smaller multi-packs which were better suited for taking to school and for the amount children ate. However single serves items were useful for those times when parents wanted to trial new food types with children and would be wasting a multi-pack if they did not like the food. Food waste can therefore emerge not just from the interaction of package and household size, but also from interactions with particular members of the household and their specific needs.

Dietary gatekeepers are not just required to negotiate the many meso-level factors that influence food provisioning, but need to do this within the conditions imposed on them at the macro level from the food industry (Wikström et al., 2019). As with the meso level, food waste emerges from a set of potentially competing interactions, this time between the requirements, and characteristics of the household and what the food industry provides (Aschemann-Witzel et al., 2016). This also means that, to a degree, household food waste is *out of the control* of the dietary gatekeepers featured in this study. These macro-level conditions therefore deserve greater policy attention than currently given to ensure that they support food waste reduction in households. This might not only include greater flexibility and innovations in food unit and packaging sizes - allowing consumers to purchase according to a wider range of household characteristics and factors than just household size - but also a movement away from discounts and other special offers that encourage over-purchasing and stock-piling (Aschemann-Witzel et al., 2016; Wikström et al., 2019; Zeng et al., 2021)

4.3. Complex negotiations and trade-offs in food provisioning

We have established thus far the strongly influential role of the household (meso) level that, within particular conditions imposed by the food industry, influences the provisioning practices of dietary gatekeepers. We have also discussed how food waste emerges, unwanted, from the interactions between the preferences of the individual and those of their household, as well as those interactions between the requirements of a household and what is provided by retailers.

A final consideration is the complex set of prioritizations and trade-

offs that gatekeepers make between different factors before arriving at final choices about cooking or shopping. Our research participants juggled a large number of, often competing, factors from different levels when providing food for their households. In some cases, they described with great satisfaction how particular behaviours were able to ‘tick off’ a number of factors at the same time, such as cooking a meal that was quick, healthy, enjoyed by family members, met future plans, and used up food that would otherwise go to waste. At other times, particular tensions could not be successfully negotiated and compromises had to be made between different factors, such as a concern for hygiene winning out against the desire to stretch out leftovers for other meals, or worries about package waste being put aside in favour of ensuring children ate healthily.

The interaction of time pressure, food preferences, health concerns, financial considerations, and social obligations form the backdrop against which decisions about shopping and cooking are made. Watson and Meah (2012) describe the ‘mess’ of practices and routines from which food provisioning emerges and which requires both the conscious and unconscious balancing of different factors. “This ... demands coordination of complex flows and relations between foods, products, technologies, skills, meanings, values and purposes, all within the spatial and temporal conditions of people’s lived days” (pg 115). Food waste is the potential ‘fallout’ of the multi-level trade-offs, tensions, and balances between factors, which in certain circumstances can displace concerns about food waste and get in the way of behaviours that aim to reduce it.

In their study of consumer attitudes towards healthy and environmentally sustainable foods, Hoek et al (2017) argue that this complex balancing act of factors can present a barrier to changing the eating and shopping behaviours of consumers, especially where they have become routine. The well-practiced, almost unthinking, food provisioning behaviours we observed of participants in their kitchens have emerged from the interactions discussed and for many would have become habituated. Doing things differently to avoid food waste therefore involves breaking established habits. This requires extra time, as well as additional mental and physical effort, for consumers to negotiate new trade-offs and balances, and they may find it easier to just stick with established food-related routines and habits (Hoek et al., 2017).

The habituated nature of food provisioning for dietary gatekeepers might lead to more food waste when dealing with unexpected changes (an ill child, an emergency at work etc.) that challenge established routines (Evans, 2012; Quedsted et al., 2013). Hoek et al (2017) also argue that this has implications for the type of interventions needed to change household food provisioning behaviour (and by extension, food waste related behaviours). Awareness raising and information provision for the individual consumer (dietary gatekeeper or otherwise) might change their intentions with regards to food waste, but food industry changes at the macro level and whole of household changes at the meso level are also needed if habitual behaviours are to be altered.

We have already suggested what food industry and household-level food waste interventions might look like in previous sections and advocate that ‘joined up’ interventions across micro, meso and macro levels would help consumers negotiate the complexity shown in this section and facilitate behaviour change. This might include a focus on ensuring there is increased flexibility in supermarket packing options while at the same time providing dietary gatekeepers with new knowledge and skills to manage, without waste, household food provisioning in the face of busy, fluid and dynamic household schedules. At the same time, other members of the household, such as children, could be targeted by interventions in other physical settings, such as schools, that encourage the uptake of behaviours at home that support the dietary gatekeeper in reducing food waste (see for e.g. Boulet et al., 2019 on food waste interventions in schools).

4.5. Reflections on methodology

This study was interested in the gaze of the household dietary

gatekeeper when making decisions related to food provisioning and our video elicitation methodology was very appropriate to this focus. We are excited by the potential of the approach and urge for its expanded use in the food waste research field. The visual medium, and participant control of the camera, gave the research team a strong sense that we were 'looking at' what participants found important when explaining particular actions and choices, rather than imposing our assumptions of what motivated them.

Unlike interviews or surveys, this methodology gave us greater confidence that participants' reflections and insights were grounded in the day-to-day reality of their lives, and was an effective way to prompt memory and accurate recall (Jarrett and Liu, 2018; Starr and Fernandez, 2007). It allowed us to get one step closer to consumers food provisioning behaviours in context, and to observe the complexities, trade-offs and messiness that accompanies household food provisioning. This would have been missed if we had relied on traditional survey or interview formats which can lead to more 'sanitized' accounts from respondents (Dodds et al., 2018; Ganglbauer et al., 2013; Keller et al., 2008).

A study of this type could be strengthened from a food waste perspective by including measures of participants food waste, allowing us to tie conclusions about food provisioning to actual food waste outcomes. There is also an opportunity for researchers to use the videos recorded by participants to explore the physical aspects of kitchens and food in greater detail beyond what was elicited from participants in the second recording.

A potential concern is that participants' awareness of being recorded for a research project might alter their behaviours in some way or could still elicit socially desirable explanations for what was evident in the initial recording. The latter issue was partially avoided in this study by not revealing the underlying focus on food waste to participants, while to the first point we would argue that the use of mobile phones to record, and share, images is so ubiquitous to modern day life that the videos in this study give a much more naturalistic representation of household practices than would have been the case 10 or 20 years ago (Hein et al., 2011).

While participant placement of cameras meant that we could appreciate the direction of their gaze, it did make us wonder what we may miss or was 'glossed' over by participants. We were also conscious that only asking participants to record a single instance of a particular provisioning practice only provides a limited 'snapshot' compared to if multiple instances and variations of the practice had been recorded. Utilising a visual ethnography approach such as that championed by Sarah Pink and colleagues (see for e.g. Pink, 2013; Pink and Leder Mackley, 2016), in which the researcher is embedded with participants for an extended period of time, and films a number of instances of a practice as it is enacted (followed by a series of video-elicitation interviews), might be one way around this issue.

5. Conclusion and future research

Our study aimed to identify the relevant factors and levels, and their interactions, to an individual's household food provisioning practices, and to consider their food waste implications. Taking the perspective of the household member most responsible for cooking and shopping (the dietary gatekeeper), the central role of the household (meso) level on food provisioning was identified, as were the conditions imposed on households by the food industry (macro level) and the different compromises and trade-offs between factors from which these practices emerge.

Household food waste comes from the gaps, cracks and compromises that dietary gatekeepers are forced to make between interacting factors at multiple levels. Food waste policy and practice needs to account for this complexity and develop joined-up behaviour change interventions that don't just target an isolated factors such as individual's awareness and intentions, but also take into account macro (food industry) and

meso (household) levels and contexts.

We note that despite the influence of the meso and macro levels demonstrated in this study, much of the food waste research domain still focuses on individual level factors of consumer behaviour (Boulet et al., 2021; Jorgensen et al., 2020). While individual level factors are important, we are left with an incomplete picture of household food waste and behaviour if there is not equally detailed attention to meso and macro level factors. Greater research focus on these levels will also assist in the development of more effective food waste reduction interventions that move away from a purely individual focus to include the whole household, as well as the external conditions imposed on it.

CRedit authorship contribution statement

Mark Boulet: Conceptualization, Methodology, Funding acquisition, Formal analysis, Writing – original draft, Visualization. **Annet Hoek:** Conceptualization, Methodology, Funding acquisition, Formal analysis, Writing – review & editing, Supervision. **Rob Raven:** Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

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