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Consumer Food Waste: Understanding Why Consumers Do Not Eat the Food They Acquire

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Marit Drijfhout

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Consumer Food Waste: Understanding Why Consumers Do Not Eat the Food They Acquire

Proefschrift

ter verkrijging van de graad van doctor aan de
Rijksuniversiteit Groningen
op gezag van de
rector magnificus prof. dr. C. Wijmenga
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op

donderdag 5 november 2020 om 16.15 uur

door

Marit Drijfhout

geboren op 2 juli 1990
te Harlingen

Promotores

Prof. dr. J. van Doorn
Prof. dr. ir. K. van Ittersum

Beoordelingscommissie

Prof. dr. B.M. Fennis
Prof. dr. E.M. Steg
Prof. dr. ir. J.C.M. van Trijp

Voorwoord

Na vier jaar werkzaam te zijn geweest als promovendus binnen de vakgroep Marketing op de Rijksuniversiteit Groningen rond ik met trots mijn promotieonderzoek af. Hier ligt ze dan: mijn proefschrift.

Toen ik in 2012 begon met studeren aan de RUG ontdekte ik al gauw dat mijn interesse lag bij het doen van onderzoek. Waar het tijdens mijn Pre-Master begon met een research paper over het consumeren van Cola Light, heb ik het onderzoeken van (voedsel)consumptie onder consumenten vervolgens niet meer losgelaten. Ik kijk terug op mijn PhD als een bijzondere ervaring waarin ik niet alleen alles heb geleerd over onderzoek doen (o.a. kritisch literatuur bestuderen, experimenten uitvoeren met studenten en consumenten, data analyseren, artikelen schrijven en mijn werk presenteren op conferenties) en onderwijs verzorgen (colleges geven, een bachelorvak met 500+ studenten coördineren en scripties begeleiden), maar waarin ik mijzelf ook als persoon heb kunnen ontwikkelen. Mijn hoogtepunten waren het in ontvangst nemen van de ACR Best Working Paper award tijdens een conferentie in Texas, mijn eerste reeks lunchexperimenten met studenten (met na afloop elke keer een overvloed aan broodjes kroket voor de vakgroep) en het daadwerkelijk verzamelen en meten van voedselverspilling in het lab—veel realistischer kan experimenteel onderzoek niet worden. Het behalen van mijn PhD was niet gelukt zonder de steun en adviezen van de mensen om mij heen. Ik wil daarom graag een aantal van hen in het bijzonder bedanken.

Allereerst richt ik me tot mijn promotoren Jenny van Doorn en Koert van Ittersum. Jenny, ik kijk met een glimlach terug op onze zes jaar samenwerking. Wij hebben elkaar ontmoet tijdens het schrijven van mijn masterscriptie en het klikte meteen tussen ons. Ik heb veel van jou mogen leren, zowel op academisch als persoonlijk vlak. Je altijd constructieve, pragmatische feedback en je ervaring met onderzoeksmethoden heeft mij en onze projecten een enorme boost gegeven. Je nuchtere kijk op ons werk heeft mij soepeler leren omgaan met de zogenoemde ‘werk-leven’ balans. Daarnaast waren onze spontane kantoormomentjes om de gang van zaken door te spreken altijd een plezier. Koert, ik denk met een glimlach terug aan onze meetings waarbij we alle drie onze hersenen oneindig lieten kraken over analyses (voor hoofdstuk 3...) en het vele samen sparren om de onderzoeken naar een hoger niveau te tillen. Jouw passie voor het welzijn van consumenten en het stimuleren van een gezonde leefstijl werkte voor mij aanstekelijk. Jullie steun en geloof in onze projecten en in mij, heeft mij enorm geholpen en heeft mijn ontwikkeling gestimuleerd zodat ik dit niveau kon bereiken.

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Tot slot, Willem, mijn liefde, bedankt dat je er altijd voor me bent, al sinds de tijd voordat ik aan mijn PhD begon. Jouw nuchtere kijk op zaken hield mij tijdens mijn promotieonderzoek (met tenminste één been) op de grond. Wij hebben samen tijdens mijn PhD mooie hoogtepunten beleefd, waaronder onze verloving. Ik kijk uit naar onze toekomst samen.

Marit Drijfhout
Groningen, juli 2020

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Chapter 1 | Introduction

"Imagine walking out of a grocery store with four bags of groceries, dropping one in the parking lot, and just not bothering to pick it up. That is essentially what we are doing."

This quote from the food waste documentary *Just Eat It* (2014) illustrates the seeming indifference consumers have toward wasting food. Every year, an estimated 1.3 billion tons of food produced for human consumption—about 33% of all food by weight—is lost or wasted within the supply chain (Gustavsson, Cederberg, and Sonesson 2011). As a consequence, food waste is associated with multiple negative environmental, economic, and social outcomes.

1.1 Magnitude of the Food Waste Problem

Environmental Impact

As the production of food is resource-intensive, food losses and waste are accompanied by high environmental costs. For example, food waste results in a significant loss of valuable resources such as water, soil, and energy used during the production, processing, marketing, transporting, and refrigeration of the food (Parfitt, Barthel, and Macnaughton 2010; Thyberg and Tonjes 2016). Moreover, food waste is a major source of greenhouse gas emissions. If food waste were to be considered a country, its carbon footprint would rank as the third top global carbon-emitting country after the U.S. and China (Beretta et al. 2013; FAO 2013).

Economic Impact

Food waste also represents tremendous economic losses. At the European level, along the entire supply chain around 88 million tons of food waste are generated annually, causing a monetary loss of €143 billion (Stenmarck et al. 2016). From a consumer perspective, the financial losses caused by wasting food are about 10% of a consumer's food spending (Buzby, Wells, and Hyman 2014), or approximately €300 to €400 per year for an average four-person household (Buzby et al. 2014; Quested and Johnson 2009).

Societal Impact

At the societal level, food waste leads to food safety concerns, an increase in food prices, and a reduction in consumer well-being (Van Doorn 2016). According to FAO et al. (2019), the total amount of food waste generated every year could feed more than four times the 800+ million people—11% of the global population—who currently suffer from hunger. Food insecurity is even an issue in developed countries. For example, approximately 12 to 15% of U.S. households face food insecurity (Coleman-Jensen, Gregory, and Singh 2013; USDA ERS 2017), and the number of European households that need support from food banks is steadily increasing (Tyler 2019; Voedselbanken Nederland 2018). Given the malnutrition in both developing and developed countries and taking into account the world's increasing population with its corresponding demand for food, reduction of food losses and waste will be even more important in the future (Gustavsson et al. 2011).

Magnitude of Consumer Food Waste

In developed countries, consumers are the single biggest producers of food waste (Beretta et al. 2013; Buzby et al. 2014; Parfitt et al. 2010; Priefer, Jörissen, and Bräutigam 2016). Consumer food waste is generated both in-home and in out-of-home contexts such as restaurants, canteens, and care institutions. Within Europe, individual consumers are responsible for over 50% of the total amount of food waste (Stenmarck et al. 2016; Xue et al. 2017). Estimates are that consumers waste around 10-30% of the food they acquire (Buzby and Hyman 2012; WRAP 2017; Yu and Jaenicke 2020), which translates to an average of over 200 kilograms of food waste by an average household per year (Parfitt et al. 2010; Quested and Johnson 2009). Hence, consumers are literally wasting their own money by squandering the food they acquired themselves.

Up to 57% of household food waste can be considered avoidable (WRAP 2017), as consumers often throw away food that is still suitable for human consumption (Foley and Hilton

2011; Gustavsson et al. 2011; Quested et al. 2013). Given the large amount of food waste occurring at the consumer level and the extent to which this waste could be avoided, the United Nations (2016) declared the reduction of consumer food waste a top global priority. Among the UN's 17 Sustainable Development Goals is to "halve per capita global food waste at the retail and consumer level, and to reduce food losses along production and supply chains by 2030." The final stages of the supply chain represent a crucial leverage point for increasing global environmental sustainability and reducing negative social and economic impacts of food waste (Parfitt et al. 2010; Schmidt 2019).

1.2 Research on Consumer Food Waste

In recent years, consumer food waste has attracted growing interest from industry stakeholders, organizations, consumers, public policy makers, and scientists. However, research regarding consumers' food disposal practices, which occur in the last stage of the goods trajectory in consumer behavior (Cappellini 2009), is still rather limited (Graham-Rowe, Jessop, and Sparks 2014; Porpino 2016). Research on food waste predominantly presents descriptive findings (Cox and Downing 2007; Evans 2011; Parfitt et al. 2010) and has only recently started to focus on developing a theoretical understanding of the underlying processes that contribute to food waste. Notably, finding attainable ways to decrease consumer food waste requires establishing a fundamental comprehension of the underlying consumer decision-making process that drives food waste (Block et al. 2016; Porpino 2016), especially the factors that encourage, drive, or impede food waste behaviors and practices among consumers (Graham-Rowe et al. 2014). In this process, the decisions and actions that long precede actual disposal—starting at the very moment when consumers plan and acquire food—need to be considered to distinguish the antecedents of consumer food waste and formulate solutions to decrease waste.

The aim of this dissertation is to increase the theoretical understanding of the complex issue of consumer food waste. The fundamental research question concerns why consumers acquire food that they ultimately do not consume, but waste. Chapter 2 comprises an extensive literature review with theoretical and empirical findings that result in promising future research directions. Chapters 3 and 4 then draw on two theoretical mechanisms to explain what drives consumer food waste. Building on construal level theory (Liberman and Trope 2000; Trope and Liberman 2003), I argue and demonstrate that the temporal distance between a consumption decision moment (e.g., when making food purchases in the grocery store or when deciding what to pack for lunch) and the actual moment of consumption is critical to an understanding and explanation of why consumers acquire food that ends up being wasted. Chapters 3 and 4 report on behavioral experiments that include actual consumption and disposal behavior of real consumers and offer robust evidence for my conceptual frameworks. Chapter 5 presents a general discussion of this research and its outcomes, explores both managerial and practical implications, and offers suggestions for future research.

Box 1.1 Food waste classification

Three types of consumer food waste

Avoidable food waste = avoidable food and drinks thrown away that was, at some point prior to disposal, edible in the vast majority of situations.

*****57% of the total amount of waste is considered avoidable*

Possibly avoidable food waste = food and drinks that some consumers eat, and others do not (e.g. bread crusts), or food that can be eaten when it is prepared in one way but not in another (e.g. potato skins).

*****23% of the total amount of waste is considered possibly avoidable*

Unavoidable food waste = unavoidable waste arising from food that is not, and has not been, edible under normal circumstances.

*****20% of the total amount of waste is considered unavoidable*

(*Parfitt et al. 2010; Quested and Johnson 2009; WRAP 2017*)

1.3 Definition of Food Waste

When discussing consumer food waste, I focus on "avoidable consumer food waste." Avoidable food waste refers to food that at some point was perfectly edible (e.g., spoiled food) or was discarded because the consumer no longer wanted the food (e.g., leftovers of a meal) (Parfitt et al. 2010; Quested and Johnson 2009) (see Box 1.1). I do not

consider "unavoidable food losses," which refers to items that are discarded because they are inedible by nature, such as coffee grounds or banana peels (Quested and Johnson 2009). In other words, I follow the definition proposed by Lipinski et al. (2013): "Food waste entails food that is of good quality and fit for human consumption but that does not get consumed because it is discarded, either before or after it spoils" (p. 1). This type of food waste arises at the retail and consumption stages in the food supply chain (Gustavsson et al. 2011) and can be viewed as the discrepancy between the amount of food acquired and the amount consumed by the consumer (Van Doorn 2016). Avoidable food waste occurs in both the out-of-home (Chapter 3) and in-home contexts (Chapter 4) (Van Geffen, van Herpen, and van Trijp 2016) (see Box 1.2). As mentioned, up to 57% of consumer food waste can be avoided, as up to some point the food could have been consumed, but instead is wasted (WRAP 2017).

Box 1.2 In-home vs. out-of-home consumption

In-home consumption	- Food is mainly acquired via the grocery store and mainly prepared and/or in part consumed in the household (Van Geffen et al. 2016). - Consumers waste between 10–30% of the food they acquire within the household, with up to 57% being labeled avoidable (Buzby and Hyman 2012; WRAP 2017; Yu and Jaenicke 2020). - Financial losses caused by the wastage of food at home are about 9.2% of a consumer's food spending (Buzby et al. 2014).
Out-of-home consumption	- Consumption outside the household, with food obtained via food service outlets (e.g., restaurants, canteens, schools, hospitals, transport hubs) (Xue et al. 2017). - In Europe, 1 in 5 meals is consumed outside home (ERS Food Expenditure Series 2016; Iri 2018). - In the UK, 0.92 million tons of food are wasted annually in food service outlets, of which 75% is avoidable (Parry, Bleazard, and Okawa 2015).

1.4 Outline of the Dissertation

The focus of this dissertation is on the psychological and behavioral processes that affect consumer food waste behavior. The main contribution of the investigation is a fundamental theoretical understanding of the mechanisms that drive consumer food waste, first by contextualizing previous findings and current knowledge (Chapter 2) and second by expanding

the understanding of food waste by offering theoretical and empirical evidence of the unconscious influences driving food waste behavior (Chapters 3 and 4), resulting in suggestions for consumers, retailers, and policy makers that help reduce food waste. The dissertation ends with a general discussion (Chapter 5).

Figure 1.1 Outline of the dissertation

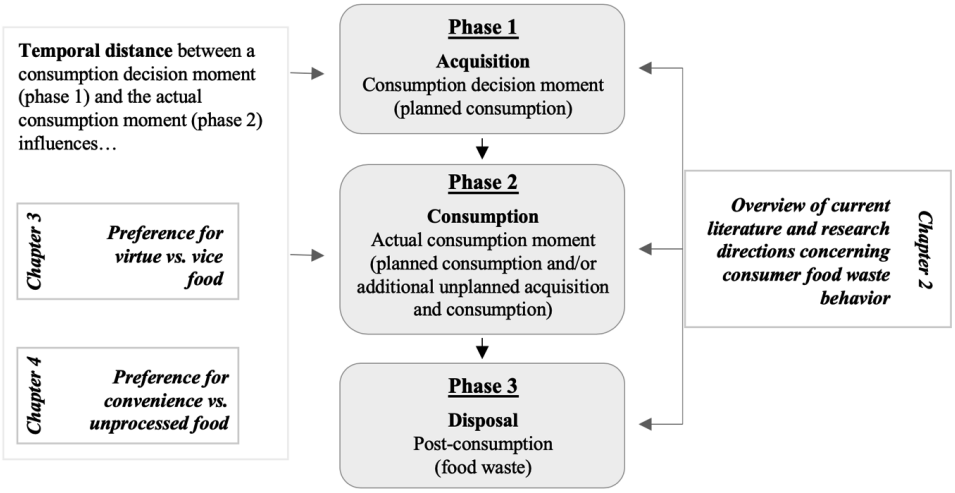


Figure 1.1 shows the conceptual framework, which covers the entire consumer decision-making process from planning and acquisition to consumption and disposal, and divides this process into a series of three sequential, interrelated stages. As the aim of the dissertation is to broaden the theoretical understanding of what drives consumer food waste, the focal point of attention is the actions and decisions that take place *before* consumers actually dispose of their food (phases 1 and 2 in the figure) rather than on when food is already in the state of becoming wasted (phase 3 in the figure).

Previous research acknowledges that actions and decisions made long before food is actually wasted may be the root cause of the problem, such as choosing what food and how much food to buy (Hebrok and Boks 2017; Moskalev 2013; Quested et al. 2013; Setti et al. 2018). Analysis of practices relating to the acquisition and consumption of food therefore leads

to a better understanding of the antecedents of consumer food waste. In line with the research question of why consumers do not eat the food they acquire, food waste refers to a discrepancy between what consumers intend to eat and thus acquire (phase 1) and what they actually end up consuming (phase 2). Conceivably, the temporal distance between this planned consumption decision and actual consumption is fundamental to understanding the origin of food waste and is related to the three phases of acquisition, consumption, and disposal, which are considered in all chapters.

In Chapter 2, the phases of acquisition, consumption, and disposal are used to structure an extensive literature review on consumer food waste. This chapter provides an outline of current empirical findings, including a description of the theoretical frameworks that help explain the antecedents of consumer food waste behavior. Through the structuring of current knowledge, research gaps emerge that offer directions for future research regarding consumer food waste behavior. Chapters 3 and 4 address the knowledge gaps identified in Chapter 2. These chapters are empirical and consist of experimental research aimed at better understanding the consumer decision-making process that leads to food waste. Table 1.1 presents an overview of the dissertation, including the contributions, theoretical foundations, and an overview of the methodology per chapter.

Building on construal level theory and focusing on a single, out-of-home consumption context, the study in Chapter 3 proposes that temporally separating a planned consumption decision from the actual consumption moment creates a mismatch between the two, with the result that the temporal distance between planned and actual consumption is a critical determinant of consumer food waste. Empirical results demonstrate that while consumers make more virtuous choices (i.e., healthy but less tasty food) in advance, at the moment of consumption a desire to indulge makes them more likely to impulsively acquire and consume vice food (i.e., tasty but less healthy food). This impulsive behavior results in a surplus of food,

with the vice foods being consumed and the virtue foods being wasted.

Chapter 4 discusses consumer food waste from an in-home perspective and demonstrates that acquiring and consuming convenient substitutes of unprocessed food items (e.g., pre-sliced vegetables versus raw, uncut vegetables) can decrease food waste by up to 65%. A possible explanation, again building on construal level theory, is that when thinking of their future meals, consumers focus on desirable features such as a home-cooked dinner prepared from scratch. Consequently, consumers purchase raw, unprocessed foods. However, at the moment of consumption, consumers more strongly consider the time needed and the ease or effort of preparing the meal. Moreover, consumers may experience feasibility constraints, such as busy lifestyles that do not allow the time and effort required to prepare a meal from scratch. As a consequence, the unprocessed foods may not be prepared and instead end up in the trash. Owing to the decreased time and effort needed, minimally processed convenience foods such as pre-sliced vegetables offer a solution. Four studies confirm that a longer time between food purchase and consumption reduces consumers' inclination to make use of these convenient substitutes.

Chapter 5 summarizes the study's main findings, reiterates theoretical and practical implications, offers suggestions for consumers, public policy makers, manufacturers, and retailers, acknowledges the study's limitations, and provides directions for future research.

Table 1.1 Overview of the dissertation

	Chapter 2	Chapter 3	Chapter 4
Objective	• Improve our understanding of consumer food waste by outlining theoretical and empirical findings on the antecedents of consumer food waste • Future research directions for consumer food waste	• Offer theoretical and empirical evidence regarding the unconscious influences driving food waste behavior • Enhance understanding of the theoretical drivers behind consumer food waste • Offer suggestions to decrease consumer food waste based on empirical evidence • Focus on the out-of-home context • Focus on health versus indulgence as leading motives in food choice	• Offer theoretical and empirical evidence regarding the unconscious influences driving food waste behavior • Enhance understanding of the theoretical drivers behind consumer food waste • Offer suggestions to decrease consumer food waste based on empirical evidence • Focus on the in-home context • Focus on desirability versus feasibility as leading motives in food choice
Methodology	• N/A	• Experimental research	• Experimental research
Data sources	• N/A	• University of Groningen students (>500)	• University of Groningen students (>750) • Households from the North Netherlands area (200)
Theoretical foundation	• Various	• Construal Level Theory: Influence of temporal distance between consumption decision moment and actual consumption leading to a preference for virtue food versus vice food	• Construal Level Theory: Influence of temporal distance between consumption decision moment and actual consumption leading to a preference for convenience food versus unprocessed food
Empirical contribution	• N/A	• While advance ordering leads to healthier choices, consumers are more likely to make unhealthier impulsive choices at the moment of consumption. The desire to indulge at the moment of consumption leads consumers to replace pre-planned healthy virtue food with less healthy vice food, resulting in a surplus of food and therewith waste • Advance ordering leads to both healthier food choices and less waste only when no opportunity emerges to acquire additional food at the moment of consumption	• Convenience foods are a promising way to reduce food waste by providing consumers with a more feasible meal preparation task. • When making planned consumption decisions (e.g., in the grocery store), consumers focus on the desirable end states of their more distant consumption. As a consequence, consumers tend to acquire unprocessed foods that enable them to prepare a meal from scratch. However, consumer preferences shift to a focus on the feasible aspects of meal preparation when consumption approaches, ultimately leading to food waste. • Highlighting feasibility considerations at the decision moment makes consumers opt for more practical, convenient substitutes for unprocessed foods, even if the moment of consumption is temporally distant

The overall goal of this dissertation is to contribute to the limited but growing body of research concerning consumer food waste by providing new insights into consumers' underlying decision-making process. The results within this dissertation offer an explanation of why a mismatch occurs between what food consumers acquire and what they eventually consume—in other words, why consumers waste so much food—and demonstrate how making more balanced food choices and selecting food for convenient solutions may both decrease food waste and increase consumer well-being. As all chapters are written to support independent reading, some overlap occurs in the content of the chapters.

Chapter 2 | Consumer Food Waste: Current Knowledge and Research Directions

Abstract

One-third of all food suitable for human consumption is wasted or lost in the supply chain, with substantial negative social, economic, and environmental consequences. In developed countries, consumers are the single biggest producers of food waste. Up to 57% of consumer food waste can be considered avoidable, as consumers often throw away food that is still suitable for human consumption. Although a growing body of research is investigating consumer food waste, understanding of the underlying reasons remains modest at best. This chapter presents an overview of the theoretical and conceptual models used to understand the origin of consumer food waste, as well as specific empirical findings of the drivers of food waste. On the basis of this knowledge, we identify gaps in the literature that suggest directions for future research regarding consumer food waste.

This chapter is based on Drijfhout, M., van Doorn, J., and van Ittersum, K. (2020), "Consumer Food Waste: Current Knowledge and Research Directions," working paper.

2.1 Introduction

Food and food consumption are essential to any individual's life. In addition to being a source of nutrition, food is a critical contributor to physical well-being. Furthermore, food nourishes a sense of identity, lies at the heart of most social interactions, and stimulates our chemosensory, visual, thermal, and tactile senses (Rozin 1999, 2005; Wilcock et al. 2004). Today food is easily accessible (Sobal 1999), and on average consumers in the developed world make over 200 food decisions every day (Wansink and Sobal 2007). Those food-related decisions are often complex, as they involve multiple considerations regarding whether to eat, how much to eat, what to eat, where to eat, and possibly with whom to eat (Hock and Bagchi 2017; Sobal, Bisogni, and Jastran 2014). Moreover, busy lifestyles induce changes in the regularity of eating patterns, the time available for meal preparation, and the increased consumption of foods prepared out-of-home (Mancino, Todd, and Lin 2009; Thyberg and Tonjes 2016). Owing to the multifaceted, complex, and recurrent nature of decisions related to food consumption, consumers often engage in unpredictable choice behavior that leads to wasting a tremendous part of the food they acquire each day (Quested et al. 2013).

The overall amount of food wasted is astonishing. One-third of all edible food produced for human consumption is wasted or lost in the supply chain (Gustavsson, Cederberg, and Sonesson 2011), leading to a multitude of negative environmental, economic, and social consequences. In developed countries, consumers are the single biggest producers of food waste (Beretta et al. 2013; Buzby, Wells, and Hyman 2014; Parfitt, Barthel, and Macnaughton 2010; Priefer, Jörissen, and Bräutigam 2016). Within Europe, consumers are responsible for over 50% of the total amount of food waste (Stenmarck et al. 2016; Xue et al. 2017) and discard an estimated 30% of the food they purchase (Buzby and Hyman 2012; Yu and Jaenicke 2020). A considerable amount of food is wasted at home: households produce an average of over 200 kilograms of food waste per year per household (Parfitt et al. 2010; Quested and Johnson 2009),

with perishable products such as vegetables, fruit, bread, and meat being the most likely to be wasted (Buzby et al. 2014; De Laurentiis, Corrado, and Sala 2018; WRAP 2012)—some studies report that up to 60% of the food wasted is generated by these categories (Vanham et al. 2015). Also contributing to food waste is consumers' growing practice of eating meals away from home, such as in restaurants or canteens (Thyberg and Tonjes 2016): out-of-home consumption is responsible for the second largest amount of food waste at the consumption level (Bräutigam, Jörissen, and Priefer 2014; Monier et al 2010).

Importantly, up to 57% of consumer food waste can be considered avoidable as the food is still edible before it is disposed of (WRAP 2017). The substantial unnecessary food losses that consumers produce on a daily basis has led the United Nations (2016) to declare the reduction of consumer food waste a top global priority. Among the UN's 17 Sustainable Development Goals is to "halve per capita global food waste at the retail and consumer level, and to reduce food losses along production and supply chains by 2030." To meet this goal and reduce consumer food waste, a better understanding of the underlying consumer decision-making process that drives food waste is essential (Block et al. 2016; Porpino 2016).

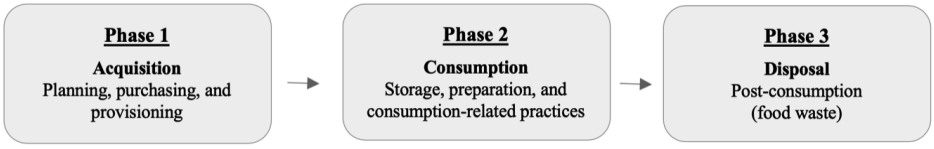
The first objective of this chapter is to synthesize and integrate current knowledge on the antecedents of consumer food waste in correspondence with the main theoretical and conceptual models that offer explanations of consumer food waste. We start by reviewing the literature stream that approaches food waste from a conscious consumer perspective.

The stream of literature that approaches food waste from a conscious consumer perspective is reflected in theories such as the theory of planned behavior, which consider how consumers' attitudes and perceived behavioral control affect consumer food waste (Graham-Rowe, Jessop, and Sparks 2015; Stancu, Haugaard, and Lähteenmäki 2016; Stefan et al. 2013; Visschers, Wickli, and Siegrist 2016). However, recent literature argues that food waste often happens unintentionally and unconsciously (Block et al. 2016; Porpino 2016; Schanes,

Dobernig, and Gözet 2018; Stöckli, Niklaus, and Dorn 2018) as a result of consumers' complicated, often unpredictable and unconscious decisions regarding food acquisition and consumption. Theories such as social practice theory emphasize that food waste should be viewed as a complex issue that is an outcome of many unconscious practices related to the planning, purchasing, storage, and consumption of food (Evans 2012; Koivupuro et al. 2012; Quested et al. 2011; Stancu et al. 2016; Stefan et al. 2013). Hence, consumers' decisions and actions long before actual disposal are of utmost importance in attempting to better understand the causes of consumer food waste.

We therefore take a broad stance and examine the drivers of food waste according to the literature that (often implicitly) views food waste as a function of unconscious consumer behavior. As Figure 2.1 shows, by focusing on the full cycle of acquisition, consumption, and disposal, we provide an overview of the research on how consumers—often unconsciously and rather mindlessly—acquire, consume, and dispose of their food. In line with prior research, we consider examining these activities essential to gaining a better understanding of why consumers waste food (Evans 2012; Koivupuro et al. 2012; Quested et al. 2011; Stancu et al. 2016; Stefan et al. 2013). Finally, to further categorize prior literature, we discuss the insights that emerge with each consumer decision-making phase—acquisition, consumption, and disposal—and we distinguish between situational, individual, and social causes.

Figure 2.1 The phases of consumer food waste behavior



The second objective of this chapter is to identify gaps in the literature that offer directions for future research. We first explain our definition of consumer food waste and discuss the challenges associated with measuring food waste.

2.1.1 Defining Consumer Food Waste

When discussing consumer food waste, we focus on the avoidable and potentially avoidable wasting of edible food. We exclude non-edible food such as bones, shells, and peels that derive from the preparation of food (Parfitt et al. 2010; Quested and Johnson 2009). As noted in Chapter 1, we follow the definition proposed by Lipinski et al. (2013, p. 1): "Food waste entails food that is of good quality and fit for human consumption but that does not get consumed because it is discarded, either before or after it spoils." In other words, we view food waste as the discrepancy between the amount of food acquired and the amount of food ultimately consumed by the end consumer (Van Doorn 2016). Avoidable food waste occurs in both out-of-home and in-home contexts (Van Geffen, van Herpen, and van Trijp 2016).

2.1.2 Investigating and Measuring Consumer Food Waste

Accurately measuring how much food is wasted by a consumer or household presents a critical challenge. To date, rather than measuring the actual amount of food wasted, most scholars have used self-reported waste measures. Moreover, most scholars study intentions to lower waste rather than actual waste behavior. However, as scholars have concluded that intentions to waste less food are a poor predictor of (self-reported) food waste behavior (Stancu et al. 2016; Stefan et al. 2013), measuring actual waste behavior may be critical when the aim is to better understand consumer food waste.

In measuring the amount of food wasted by consumers, researchers have used multiple methods, such as surveys, self-reported kitchen and food waste diaries, waste composition and leftover analyses, observational studies, and collecting and weighing garbage, and by drawing from food waste statistics and records from public authorities (Stöckli et al. 2018; Van Herpen et al. 2019a; Xue et al. 2017). This variety of direct and indirect measures yields largely inconsistent results that cannot be compared (Parfitt et al. 2010; Porpino 2016; Van der Werf, Seabrook, and Gilliland 2019).

Moreover, each measurement method to measure the amount of food wasted has its own peculiarities (Table 2.1). Weighing and garbage collection provide the most objective and accurate information on food waste (Van Herpen et al. 2019b; Xue et al. 2017), but these methods are time-consuming and expensive, and are impractical to apply to a large sample of households (Van Herpen et al. 2019b). Other types of measurement methods, such as keeping kitchen diaries and records, are less time-consuming and expensive but depend largely on personal perceptions and the observer's subjectivity, which may reduce the accuracy of the data. Survey measures can be subject to social desirability (Van Herpen et al. 2019b), and directly asking consumers about their waste behavior may make them more conscious of their behavior (Parizeau, von Massow, and Martin 2015), possibly leading to underreporting of the amount of food wasted (Neff, Spiker, and Truant 2015; Van der Werf et al. 2019).

Table 2.1 Overview of measurement methods to quantify consumer food waste

Type of measurement	Advantages	Disadvantages
Drawing from secondary sources	- Time-efficient and inexpensive	- Lack of knowledge regarding details of the data - Difficult to compare multiple sources owing to the variety of measures used, leading to inconsistent and incomparable results
Self-reported consumption and food waste diary	- Time-efficient and inexpensive - Insightful as respondents can report food waste in multiple food categories in detail	- Relatively high respondent effort (possibly causing higher dropout rates) - Questions can be ambiguous or unclear - Dependent on personal perceptions or memories - Subject to social desirability - May cause changes in consumption and waste behavior owing to consciousness - Underreporting is highly likely
Survey	- Time-efficient and inexpensive - Useful when investigating consumer attitudes and effects of household-specific characteristics - Useful when investigating differences between and within households across time	- Dependent on personal perceptions or memories - Subject to social desirability bias - Possibly causes changes in consumption and waste behavior due to consciousness - Underreporting is highly likely - Lack of detailed food waste assessment
Waste composition and leftover analysis	- Waste can be collected without making respondents aware of their consumption and waste behavior	- Time-consuming and expensive - Dependent on the observers' subjectivity - Owing to anonymous data collection, no possibilities to collect data on household characteristics, motives, or purchases

Garbage collection and weighing	- Preferred method to measure food waste - Provides the most objective and accurate information on food waste - Ability to match with household characteristics or purchase data	- Time-consuming and expensive - Dependent on the observers' subjectivity - May cause changes in consumption and waste behavior owing to consciousness

Questionnaires are useful when the aim is to investigate consumer attitudes and effects of household-specific characteristics or to investigate differences between households and within households across time rather than attempting to accurately estimate the amount of food waste (Van Herpen et al. 2019b; Yu and Jaenicke 2020). Hence, when the aim is to obtain accurate waste amounts, expending extra resources and applying actual garbage collection and weighing to measure food waste may therefore be most constructive. Using quantifications for analysis results in measurement of actual food waste in terms of the grams, milliliters, or calories wasted, or as a percentage of the total number of grams, milliliters, or calories acquired but not consumed (Parfitt et al. 2010; Yu and Yaenicke 2020).

A recent study by Yu and Jaenicke (2020) combines accurate waste measurements and household-specific factors with survey research to explain consumer food waste. In a novel approach, the authors use purchase data and measurement of food waste as an input inefficiency. Purchase data from a U.S. nationwide survey are combined with biological measures and socio-demographic variables to estimate the amount of consumer food waste. By modeling food consumption as a process that converts food into chemical energy required for individuals' metabolic processes, the researchers treat input inefficiency as an end result of uneaten food. According to the authors, this method results in indirect but quite accurate and efficient measurement of food waste. Reported estimates of food waste are on average 30% of all purchased food per household, an estimate that appears to be in line with research that employed actual waste collection at the aggregate level.

2.2 Approaching Consumer Food Waste from a Conscious Consumer Perspective

In the next sections, we first discuss the stream of literature that approaches food waste from a conscious consumer perspective. This literature assumes that consumers behave consciously, basing their behavior on their knowledge, beliefs, and attitudes, and hence can be persuaded to reduce food waste by offering them more knowledge or by changing their beliefs and attitudes. We then examine the literature that (often implicitly) approaches food waste from a more unconscious consumer perspective. This second stream of literature acknowledges that food waste often occurs as a result of psychological and/or environmental factors that unconsciously influence consumer decision-making processes.

2.2.1 Consumer Awareness

Reduction of food waste requires that consumers not only be aware of the amount of food they are wasting but also be convinced that this waste is undesirable owing to negative consequences indirectly flowing from it. At the same time, consumers must be aware of what can be done to prevent food waste.

Previous literature has shown that despite the seriousness of the food waste issue, a general lack of awareness prevails among consumers concerning how much food waste is generated (Quested et al. 2011; Graham-Rowe, Jessop, and Sparks 2014) and the negative consequences of household food waste (Cox and Downing 2007). For instance, in survey research that assessed respondents' perceived knowledge about consumer food waste, almost a quarter of the sample described themselves as "very knowledgeable," with age having a considerable impact (older consumers were more knowledgeable). Interestingly, when asked to compare the amount of food they discard to that disposed of by others, 73% of respondents reported discarding less than the average American household (Neff et al. 2015). Hence, only a minority of consumers realized that their household is generating more food waste than expected (Neff et al. 2015; Van Geffen et al. 2016), although a segment of consumers is

increasingly aware of behaviors and routines that have the potential to reduce food waste (Neff et al. 2015).

Up to a point, greater awareness of the negative consequences of food waste is linked to consumers' intention to reduce food waste (Quested et al. 2011; Stancu et al. 2016; Stefan et al. 2013). Although awareness and the provision of information are important steps in tackling the issue of consumer food waste, awareness by itself is insufficient to elicit a change in consumer behavior (Quested et al. 2011; Stefan et al. 2013; Stöckli et al. 2018).

2.2.2 Consumer Motivation

Prior literature argues that awareness should be paired with a certain level of motivation to actually change behavior and decrease food waste (Stefan et al. 2013; Van Geffen et al. 2016). Interestingly, when consumers become cognizant of food waste and are motivated to reduce their waste behavior, awareness of economic consequences—particularly individual monetary losses—is more motivating than awareness of environmental or social consequences (Graham-Rowe et al. 2014; Neff et al. 2015; Stancu et al. 2016; Van Geffen et al. 2016). One study found that nearly all participants perceived food waste as a waste of money, and some households adapted their lifestyle to behave less frivolously with food (Graham-Rowe et al. 2014).

Besides being moved to stop squandering money, consumers are inspired to reduce their waste behavior to set a good example for their children (Neff et al. 2015) and to lessen feelings of guilt (Cox and Downing 2007; Graham-Rowe et al. 2014; Quested et al. 2013; Stancu et al. 2016). The need to decrease feelings of guilt by doing "the right thing" originates from either childhood family experiences or a more recent awareness of the negative environmental and social consequences of food waste (Graham-Rowe et al. 2014).

While awareness and motivation are important first steps in lowering waste behavior, these constructs are in themselves not sufficient for actual behavioral change. The outcomes of

interventions that focus solely on consumer motivation reveal that consumers need additional support, such as training in food management skills, and that targeting modifiable determinants of intentions, such as perceived behavioral control, can be helpful for behavioral change and hence waste reduction (Graham-Rowe et al. 2015).

2.2.3 Using the Theory of Planned Behavior to Explain Consumer Food Waste

To better understand food waste behavior, scholars have frequently applied the theory of planned behavior (Ajzen 1991; Graham-Rowe et al. 2015; Stancu et al. 2016; Stefan et al. 2013; Visschers et al. 2016). The theory of planned behavior posits that behavior can be determined by a consumer's intention to perform a respective behavior—in this case, the intention to not waste food. These intentions are driven by the consumer's motivation and willingness to perform the behavior, which depend on the consumer's attitude (e.g., "wasting food is undesirable"), moral norms (e.g., "wasting food makes me feel guilty about malnourished people"), and perceived behavioral control (e.g., "wasting food is avoidable") (Stancu et al. 2016). For instance, Graham-Rowe et al. (2015) demonstrate that favorable attitudes, positive norms, and the presence of perceived behavioral control of food waste reduction are associated with greater intentions to reduce food waste in the fruit and vegetable categories. Stefan et al. (2013) find that moral aspects related to wasting food have a significant positive impact on the intention to waste less food. However, Stancu et al. (2016) find no significant association between moral norms and intended food waste behavior. Other researchers find that perceived behavioral control, which is linked to feelings of having the ability or the opportunity to perform waste-reducing behavior, is a key determinant of reduced food waste (Stancu et al. 2016; Visschers et al. 2016).

As mentioned, scholars who have applied the theory of planned behavior to consumer food waste have concluded that the intention to waste less food is in itself a poor predictor of (self-reported) food waste behavior (Stancu et al. 2016; Stefan et al. 2013). The concern that

intention appears to be a non-significant driver of actual behavior raises doubt as to whether the theory of planned behavior is suited to explaining or changing consumer food waste behavior (Hebrok and Boks 2017; Ilyuk 2018; Stöckli et al. 2018). That intentions do not equate with actual behavior is generally known (Hochbaum 1981), and this gap between intentions and behavior is especially wide when it comes to environmental behavior (Carrington, Neville, and Whitwell 2014; Vermeir and Verbeke 2006).

Another concern with the theory of planned behavior is that this theory approaches food waste as being under consumers' volitional and conscious control and largely ignores that food waste often happens unintentionally and unconsciously (Block et al. 2016; Porpino 2016; Schanes et al. 2018; Stöckli et al. 2018). Moreover, many other factors affect consumption and waste behaviors, often unconsciously, including cultural background, experience, situational factors, and an individual's understanding of food (Evans 2011, 2012; Ganglbauer, Fitzpatrick, and Comber 2013).

Combining both situational and psychological influences into one model appears to improve the ability to explain consumer food waste, leading scholars to add constructs such as routine food-related practices when applying the theory of planned behavior to consumer food waste. Practices related to planning and purchasing, being a good provider, and the use of routines regarding leftovers were employed to better predict consumer food waste behavior (see sections 2.3.1 and 2.3.2) (Stancu et al. 2016; Stefan et al. 2013; Visschers et al. 2016). More recent research extended the theory of planned behavior framework by including factors that unconsciously influence behavior, such as personal norms and habits (Schmidt 2019). Although that research focuses on the prevention of disposing of expired food rather than preventing food waste in general, the study does demonstrate that the extended version of the framework, which includes factors that unconsciously influence behavior, is better able to explain consumer food waste. Hence, the findings from the literature on the theory of planned behavior acknowledge

that cognitive aspects such as attitudes and intentions are not sufficient to understand or predict consumer food waste behavior (Schanes et al. 2018).

In conclusion, since the theory of planned behavior is in itself insufficient to explain consumer food waste behavior, research that approaches food waste from a more unconscious consumer perspective is important to acknowledge. For example, one stream of literature builds on social practice theory and emphasizes that food waste is an outcome of all practices relating to the acquisition and consumption of food. This theory supports the view that consumers' complicated, often unpredictable, and unconscious decisions regarding food acquisition and consumption eventually contribute to food waste.

2.3 Approaching Consumer Food Waste from an Unconscious Consumer Perspective

Social practice theory attributes food waste to the complexity of daily routines and activities within households (Schanes et al. 2018). For instance, food waste arises as "a consequence of households negotiating the contingencies of everyday life" (Evans 2011, p. 438). Social practice theory proposes that consumers' busy and unpredictable lifestyles interact with complex household dynamics, as when multiple household members have different food preferences, responsibilities, and schedules, making it impossible to match food acquisition, consumption, and disposal (Evans 2011, 2012). Situational factors beyond the individual's control are central to social practice theory, and would unconsciously influence the extent to which consumers perform food-related practices and, by extension, their waste-reducing behavior. Consumer decisions on what food to acquire, consume, and dispose of can be viewed as being embedded in "a complexity of social and cultural relations" (Wilcock et al. 2004, p. 64). As a consequence, food waste behavior should be approached as a complex, multi-faceted issue being influenced by situational, individual, and social components (Evans 2011, 2012; Quested et al. 2013; Southerton and Yates 2015).

One way to approach food waste is by looking at it as the result of a lost battle between other competing goals. Consumers can be overwhelmed by the demands of everyday life, with multiple life pressures leading to food waste (Evans 2011; Ganglbauer et al. 2013; Southerton and Yates 2015). For instance, a lack of time, ability, or motivation often leads consumers to unconsciously replace already acquired healthy food with convenient and often less healthy substitutes (Evans 2011). Hence, prevention of food waste is not necessarily consumers' main motivation for their food-related practices.

Within the field, researchers generally agree that food waste is not the result of a single element happening in an isolated context, nor is it an activity based on uniform, rational principles (Evans 2011, 2012; Quested et al. 2013). Rather, food waste is the result of several interrelated conscious and unconscious decisions made in the consumer decision-making stages— acquisition, consumption, and disposal —that together influence how much food will eventually be discarded. As Figure 2.1 shows, we approach food waste as the result of these interrelated and often unconscious decisions, as together, the decisions made during these phases influence how much food will eventually be discarded.

In focusing on the full cycle of acquisition, consumption, and disposal, we consider the activities related to the planning, purchasing, storage, and consumption of food important to the understanding of consumer food waste (Evans 2012; Koivupuro et al. 2012; Quested et al. 2011; Stancu et al. 2016; Stefan et al. 2013). We therefore provide an overview of the research on how consumers—often unconsciously and rather mindlessly—acquire, consume, and dispose of their food. In the next sections, we structure findings from previous literature by categorizing common practices based on situational, individual, and social determinants in each decision-making phase. Table 2.2 lists a summarized overview of the determinants of consumer food waste.

Although we include the disposal stage in our literature review, we focus mainly on food-related practices that are performed during acquisition (phase 1) and consumption (phase 2), to expand understanding of why consumers end up wasting so much food (phase 3). We focus on the actions and decisions that take place long before consumers actually dispose of food, rather than on when food is already in its transition into waste.

2.3.1 The Acquisition Phase

The acquisition phase covers all consumer behavior during the planning, purchasing, and provisioning of food. Planning refers to the extent to which consumers deliberately plan their consumption. Food purchasing and provisioning refers to all possibilities in which food can be acquired. Notably, research attributes 50% of consumer food waste to poor purchasing decisions (Moskalev 2013; Setti et al. 2018), making the acquisition stage of utmost importance as an antecedent of food waste. Below, we describe the most common acquisition practices consumers engage in—often unconsciously—affected by situational, individual, and social causes of food waste.

Situational Causes of Consumer Food Waste in the Acquisition Phase Apparently, marketing is (unintentionally) at the core of many waste-related behaviors (Aschemann-Witzel, de Hooge, and Normann 2016; Gruber, Hollweg, and Teller 2016), as *in-store promotional activities* are a major factor leading to poor purchasing (Cox and Downing 2007; Evans 2011; Mallinson, Russel, and Barker 2016). To encourage impulse buying and overbuying, retailers constantly expose consumers to marketing actions such as advertising promotions and sales offers (e.g., “buy one, get one free”), discounts, special volumes (e.g., lower prices for larger packages), or product bundles (Aschemann-Witzel et al. 2015; Evans 2012; Mondéjar-Jiménez et al. 2016). These marketing offers tempt consumers and trigger unconscious overbuying that contributes to food waste (Aschemann-Witzel 2015; Aschemann-Witzel, Giménez and Ares

2018; Cox and Downing 2007; Farr-Wharton, Foth, and Choi 2014; Qi and Roe 2016; Schmidt 2019).

Large package sizes contribute to food waste particularly in small households. Consumers tend to purchase larger package sizes because of the low price perception (Evans 2011; Koivupuro et al. 2012; Williams et al. 2012), but for smaller households large packages are often too large, and lead to waste (Evans 2011; Graham-Rowe et al. 2014; Koivupuro et al. 2012; Williams et al. 2012). A third situational factor at the acquisition phase, the *location of the grocery store*, unconsciously influences consumers' shopping behavior and hence food waste. A longer travel distance to the grocery store has been found to result in a lower amount of food waste (Yu and Jaenicke 2020), as consumers seem to be better organized in terms of planning and provisioning.

Individual Causes of Consumer Food Waste in the Acquisition Phase Research has demonstrated the link between consumers' skills regarding *food provisioning activities* and reduction of food waste (Cox and Downing 2007; Watson and Meah 2012). Before going to the grocery store, consumers may anticipate waste if they do not control the quantities of food needed (Evans 2012; Farr-Wharton et al. 2014; Jörissen et al. 2015; Parfitt et al. 2010; Stancu et al. 2016; Stefan et al. 2013), but often simply forget or do not know what food they currently have in stock (Kantor et al. 1997). Writing a shopping list and checking inventories before shopping helps to prevent overbuying (Evans 2011, 2012; Farr-Wharton et al. 2014; Parizeau et al. 2015), and recent research has found that shopping with a list reduces food waste by 1.5% (Yu and Jaenicke 2020). In addition, specific and mindful day-to-day meal planning before shopping may prevent overbuying (Farr-Wharton et al. 2014; Mallinson et al. 2016; Stefan et al. 2013; Van Geffen et al. 2016). In a study of the effects of preparation before shopping, 12% of respondents visited the grocery store while being unprepared, leading to difficulty in meal planning during the week and, as a result, increased food waste. Educating consumers in meal

planning skills led to a decrease in food waste (Romani et al. 2018)—a result in line with other research that stresses the importance of consumers' (perceived) planning skills to reduce food waste (Stancu et al. 2016; Watson and Meah 2012).

Regarding purchasing, previous literature has emphasized the strong influence of *in-store grocery shopping behaviors* on food waste (Cox and Downing 2007; Evans 2011; Parfitt et al. 2010). Consumers often purchase more food than they need, especially when they mindlessly engage in impulse buying, which is often a response to in-store temptations presented by promotional marketing activities (Parfitt et al. 2010; Parizeau et al. 2015; Stefan et al. 2013). Consumers also tend to overbuy when they want to provide their household with a variety of foods. We elaborate on this "good provider identity" in the social causes section.

When consumers follow a *healthy diet*, they tend to buy up to 60% more fresh vegetables and fruit than consumers with lower quality diets (Yu and Jaenicke 2020). Importantly, these products are in the categories most prone to wastage (Buzby et al. 2014; De Laurentiis et al. 2018; WRAP 2012; Vanham et al. 2015). Consumers acquire lots of healthy food products with the intention to consume these foods, but often have to discard the food when actual consumption does not match intentions (Evans 2011; Graham-Rowe et al. 2014). Hence, when buying healthy but perishable foods in bulk, it is important for consumers to stick to their planned consumption to avoid waste.

Perhaps not surprisingly, households *spending more money* on groceries per person tend to produce more food waste per person (Parizeau et al. 2015; Setti et al. 2018). Less budget-constrained consumers, such as those with a higher income, tend to be less efficient managers of food purchases, and hence waste more (Cox and Downing 2007; Koivupuro et al. 2012; Yu and Jaenicke 2020).

Frequency of shopping is another unconscious driver of increased food waste. Shopping more often than once a week, for instance by following one main shopping trip with multiple

top-up trips in the same week, has been found to result in a larger amount of food wasted at home. In this case, “any gains made through being able to buy just what is needed for the day are outweighed by spontaneous shopping” (Cox and Downing 2007, p. 24), which can be thought of as impulse buying, with consumers purchasing more than they planned to purchase than when buying groceries on a day-to-day basis.

Social Causes of Consumer Food Waste in the Acquisition Phase An intent to provide an appropriate and varied amount of food for the family is a major unconscious social cause leading to the wasting of food. Consumers tend to take on the identity of *being a good provider* by purchasing a variety of food for the household, especially for households with children. This goal results in a surplus of food at home, leading to food waste (Evans 2011; Graham-Rowe et al. 2014; Porpino, Wansink, and Parente 2015; Visschers et al. 2016).

In general, *households with children* waste more food owing to time limitations and the difficulty of correctly estimating food portions for their children (Evans 2011; Tersptra et al. 2005; Tucker and Farrelly 2016). Smaller households also create greater food waste—one-person households waste up to 40% of the food that is acquired (Yu and Jaenicke 2020), partly because situational factors such as the lack of suitable package sizes available in the grocery store. Smaller households have difficulty finishing food in time (Quested et al. 2013; Yu and Jaenicke 2020).

2.3.2 The Consumption Phase

Even when consumers have proper skills for planning and acquisition, much acquired food remains uneaten, often owing to a lack of energy, ability, time, or motivation to actually cook the planned meals (Evans 2012)—or because of suboptimal food storage, a lack of cooking skills, or preparation of too much food.

Situational Causes of Consumer Food Waste in the Consumption Phase As numerous food waste studies indicate, *suboptimal food storage* at home is a common reason for food

waste (Evans 2012; Farr-Wharton et al. 2014; Van Geffen et al. 2016). Appropriate food storage leads to more accurate food acquisition and an extended time frame for food so that it can be eaten safely over a longer timespan (Van Geffen, van Herpen, and van Trijp 2020). For example, a correct setting of the refrigerator temperature avoids waste by increasing the shelf life of food (Aschemann-Witzel et al. 2015).

The misunderstanding and lack of knowledge concerning *expiration date labels* is a major issue relating to food waste (Graham-Rowe et al. 2014; Quested and Johnson 2009; Wilson et al. 2017). Consumers often interpret these labels incorrectly, making erroneous inferences about the time available for consumption. For instance, consumers tend to confuse best-before labels with use-by labels. While best-before labels explain food quality (i.e., after the best-before date, food is still safe to eat, but may not be at its peak in terms of flavor, texture, and appearance), use-by labels explain food safety (i.e., beyond the use-by date, food may be hazardous to eat) (Aschemann-Witzel et al. 2015). Because of this confusion, consumers tend to throw out expired but still edible food. Correcting the misperceptions regarding date labels, for instance by improving the clarity of these labels, is likely to lead to lower waste levels (Quested et al. 2011; Wilson et al. 2017).

Consumers also often fail to consume their food in time owing to *a lack of time* to actually cook the planned meals (Evans 2012). Actual or perceived time scarcity and time pressure can lead to food waste (Godbey, Lifset, and Robinson 1998) by reducing the time dedicated to food preparation and cooking (Daniels et al. 2012; Möser 2010). Research has shown that less time devoted to food preparation increases the amount of food waste (Buchli, Lucas, and Cox 2001), partially because when consumers lack the time to cook properly, they tend to replace food that requires preparation time with more convenient alternatives, leading to wastage of the former (Evans 2011, 2012).

In the out-of-home context, *portion sizes* are a major cause of food waste (Parfitt et al. 2010). Increased portion sizes lead to both increased food intake and increased food waste (Freedman and Brochado 2010; Wansink and van Ittersum 2013). When being served, out-of-home portion sizes are difficult to adjust individually, resulting in a large amount of plate waste (Giorgi 2013).

Individual Causes of Consumer Food Waste in the Consumption Phase At the time of consumption, many consumers *focus on what they desire to eat* (Kirby and Herrnstein 1995; Read, Loewenstein, and Kalyanaraman 1999) rather than what food has been acquired and should be consumed. As a result, food on hand goes moldy or looks, smells, or tastes bad and thus is inedible (Kantor et al. 1997; Parfitt et al. 2010; Quested and Johnson 2009; Wiliams et al. 2012). Over half of the food wasted by consumers is the result of not being used in time (Quested and Johnson 2009).

When consumers perceive their *cooking experience* and *cooking skills* as adequate, less food is wasted (Van Geffen et al. 2016), and fewer cooking accidents may occur, such as food becoming burned (Evans 2011). However, a lack of cooking skills may result in less tasty meals. Dissatisfaction with the taste of prepared food is another cause of food waste (Graham-Rowe et al. 2014).

As a further cause of waste, consumers may unconsciously *prepare too much food* for consumption (Graham-Rowe et al. 2014; Porpino et al. 2015), often owing to the fear of not having enough food available for the family (Evans 2011, 2012). Even when consumers aim to control portion sizes (Graham-Rowe et al. 2014; Mallinson et al. 2016), estimating what household members (e.g., children) will consume can be difficult (Evans 2011; Porpino et al. 2015), and consumers may experience a conflict between finishing all prepared food to avoid waste and avoiding overeating to maintain a healthy body weight (Robinson, Aveyard, and Jebb 2015; Robinson and Hardman 2016).

A lack of knowledge regarding how to handle food is another driver of consumer food waste. As mentioned, the misconstruing of *expiration date labels* is a major issue (Graham-Rowe et al. 2014; Quested and Johnson 2009; Wilson et al. 2017). A growing body of research explores the role of date labels on consumer food waste, and reports increased perceived safety issues and changes in perceived food quality owing to the presence of a date label (Roe et al. 2018; Wilson et al. 2017). Waste levels will likely be lowered by interventions that make consumers aware that they need not fully rely on these labels and that improve consumers' skills to estimate food safety based on their own senses (Quested et al. 2011; Schmidt 2019; Terpstra et al. 2005), for instance by relying on food's smell, taste, or appearance to assess whether food is still appropriate for consumption (Schmidt 2019).

Even without the presence of date labels, consumers often make a trade-off between avoiding food waste and protecting themselves from *food-related health risks* (Evans 2011; Neff et al. 2015; Schanes et al. 2018). Various studies highlight consumers' lack of competence and confidence to assess a food's edibility, which foster their concerns about safety and health risks that outweigh concerns about wasting food (Graham-Rowe et al. 2014; Watson and Meah 2012). Again, improving consumers' ability to estimate food safety by using their own senses is likely to lower waste levels (Quested et al. 2011; Schmidt 2019; Terpstra et al. 2005).

One other major category of food that is often wasted even though it is still edible is that of *suboptimal foods*. Suboptimal foods are close to their expiration date or have deformities or dents (Tsalis 2020). During in-store shopping, consumers reject unattractive food items such as oddly shaped produce, resulting in unsold products unless these items are sold at a discount (Aschemann-Witzel et al. 2017; De Hooge et al. 2017; Grewal et al. 2019). At home, consumers mindlessly throw away food as soon as it begins to look unattractive despite still being edible—suboptimality of food influences consumers' perceptions of taste, attractiveness, and safety, even though the objective quality of the food has not changed (De Hooge et al. 2017).

Importantly, consumers' intolerance of suboptimal foods results from negative self-perceptions: choosing or consuming unattractive food items leads consumers to make negative inferences about the self (Grewal et al. 2019). These negative self-perceptions then drive consumers' diminished purchases and consumption choices of suboptimal foods.

Social Causes of Consumer Food Waste in the Consumption Phase Consumers who tend to shop and cook with the aim of being a good provider like to cook with ingredients from scratch. Cooking from scratch is more likely to lead to over-preparation and results in leftovers of both prepared and unprepared food. Both over-preparation and leftovers indirectly and often unconsciously lead to increased food waste (see section 2.3.3).

Many studies have also investigated the effects of social influences on eating behavior. Some studies report that in the presence of others, consumers unconsciously eat more food than when eating alone (Clendenen, Herman, and Polivy 1994; De Castro et al. 1990), whereas other studies have demonstrated that people unconsciously limit their intake in the presence of others as a means of making a good impression (Roth et al. 2001). Research has also shown that consumers tend to match their eating behavior with that of others, even to the extent of ignoring their own internal states of hunger and satiety (Herman, Roth, and Polivy, 2003). Hence, findings on consumers' food consumption in social settings are mixed. In their literature review, Herman, Roth, and Polivy (2002) conclude that consumers are frequently unsure of how much they should eat in a given situation. The amount of food eaten also depends on many other factors, such as the familiarity of the group, whether the setting is formal or informal, and whether others are also eating or solely observing (Pliner and Mann 2004; Roth et al. 2001). To the best of our knowledge, the effects of social influences during consumption have not been investigated with respect to food waste.

2.3.3 The Disposal Phase

While unconsumed food enters an in-transition-to-waste phase, situational, individual, and social factors can still entice consumers to consume the food that has not been eaten so far. For instance, consumers could finish leftovers even though they have already eaten enough, or for food ordered but not finished outside the home they can make use of take-home boxes for the leftovers. Nevertheless, consumers are often not aware of the possibilities to avoid waste after the first opportunity for consumption, and rather mindlessly throw out food that is still edible.

Situational Causes of Consumer Food Waste in the Disposal Phase While taking leftovers home is an option to reduce waste after consumption, many consumers feel embarrassed to ask for a box (Giorgi 2013; Sirieix, Lála, and Kocmanová 2017). Motivating consumers to ask for boxes appears to be most effective when promoting economic incentives (Mirosa, Liu, and Mirosa 2018), and consumers are more inclined to take home leftovers when boxes are proactively offered by the food service outlet (Van Geffen et al. 2016; Giorgi 2013). However, whether the food will eventually be consumed is unknown, as consumers are often reluctant to consume leftovers. Possibly the waste-related problem simply moves from the out-of-home context to the in-home setting—with the addition of packaging waste (Martin-Rios et al. 2018).

Individual Causes of Consumer Food Waste in the Disposal Phase Reusing ingredients and consuming *leftovers* is one of the most effective strategies to decrease consumer food waste (Principato, Secondi, and Pratesi 2015; Stancu et al. 2016; Stefan et al. 2013; Van Geffen et al. 2016). The leftover category comprises food waste that consumers are the least aware of (Cox and Downing 2007). Leftovers often remain uneaten owing to concerns regarding increased food risks, partly because consumers feel insecure about assessing the durability of leftovers (Evans 2011; Farr-Wharton et al. 2014; Graham-Rowe et al. 2014). Moreover, some consumers

find eating the same meal repeatedly unappealing and refuse to eat leftovers (Cappellini and Parsons 2012; Porpino et al. 2015). Proper handling of food leftovers, for instance by correct storage and assessment of edibility (see section 2.3.2) may extend the freshness of the food and reduce waste after the initial consumption.

Social Causes of Consumer Food Waste in the Disposal Phase In a social setting, *leftovers* are often wasted because the person responsible for cooking may put the family's preferences first (Cappellini 2009). Consumers tend to avoid offering leftovers because of feelings of guilt for not taking proper care of their family, and prefer to provide fresh food instead (Cappellini 2009; Neff et al. 2015). This behavior is related to the *good provider* identity.

While empirical insights are lacking with respect to the social causes of consumer food waste in the disposal phase, we suspect that *image and impression management* may play a role. As mentioned, consumers may limit their intake of food in the presence of others to make a good impression (Roth et al. 2001) or refuse to eat leftovers to avoid being viewed as overly prudent or frugal. Research with regard to the use of take-home boxes has shown that consumers avoid using boxes because of feeling embarrassed (Giorgi 2013; Sirieix et al. 2017). The same may hold for eating leftovers when this behavior is visible to others. Hence, empirical investigation is warranted.

Table 2.2 Situational, individual, and social determinants of consumer food waste

Stage	Antecedents for consumer food waste	Key references
Acquisition phase	**Situational**	
	- Marketing promotions (e.g., advertising and price promotions)	Aschemann- Witzel 2015; Cox and Downing 2007; Farr-Wharton et al. 2014
	- Suboptimal package sizes	Evans 2011; Koivupuro et al. 2012; Williams et al. 2012
	Individual	
	- Lack of meal planning and shopping without a shopping list	Evans 2011,2012; Farr-Wharton et al. 2014; Parizeau et al. 2015
	- Impulse purchases	Parfitt et al. 2010; Parizeau et al. 2015; Stefan et al. 2013
	- Healthy intentions that do not translate into actual behavior	Evans 2011; Graham-Rowe et al. 2014
	- Frequency of shopping	Cox and Downing 2007

	Social	
	- Good provider identity	Evans 2011; Graham-Rowe et al. 2014; Visschers et al. 2016
	- Households with children	Evans 2011; Tersptra et al. 2005
	- Smaller (one-person) households	Quested et al. 2013; Yu and Jaenicke 2020
Consumption phase	**Situational**	
	- Sub-optimal food storage	Evans 2012; Farr-Wharton et al. 2014; Van Geffen et al. 2016
	- Unclear expiration date labels	Graham-Rowe et al. 2014; Wilson et al. 2017
	- (Perceived) time scarcity and time pressure	Godbey et al. 1998; Daniels et al. 2012; Möser 2010
	- Too large servings (i.e., portion sizes)	Freedman and Brochado 2010; Wansink and van Ittersum 2012
	Individual	
	- Lack of cooking skills	Evans 2011; Van Geffen et al. 2016
	- Preparing too much food	Graham-Rowe et al. 2014; Porpino et al. 2015
	- Intolerance toward suboptimal food	De Hooge et al. 2017; Grewal et al. 2019
	- Lack of knowledge or misinterpretation concerning expiration date labels	Aschemann-Witzel et al. 2015; Graham-Rowe et al. 2014
	- Food freshness or safety fear	Graham-Rowe et al. 2014; Watson and Meah 2012
	Social	
	- Good provider identity (i.e., cooking and serving too much food for the family)	Evans 2011; Graham-Rowe et al. 2014; Porpino et al. 2015
Disposal phase	**Situational**	
	- Refusing a take-home box	Giorgi 2013; Mirosa et al. 2018; Sirieix et al. 2017
	Individual and Social	
	- Not using leftovers	Cox and Downing 2007; Principato et al. 2015; Stancu et al. 2016; Stefan et al. 2013
	- Image and impression management	Giorgi 2013; Sirieix et al. 2017; Roth et al. 2001

2.4 Future Research Directions

Drawing on our structured literature overview, we set the second objective of this chapter as identification of areas that require additional research regarding consumer food waste behavior. We combine insights from previous literature streams in the consumer decision-making phases—acquisition, consumption, and disposal—to provide a structured overview of promising future research directions. Most suggestions originate from the view that consumer food waste results from unconscious food-handling practices. While the literature so far has approached the phases of acquisition and consumption separately, we suggest linking the two to improve the understanding of consumer food waste.

2.4.1 Measuring Consumer Food Waste

Our first future research recommendation relates to the overarching measurement issue. As mentioned in section 2.1.2, studying consumer food waste raises the challenge of how to actually measure it. The variety of direct and indirect measures scholars currently use yields results that are generally not comparable (Parfitt et al. 2010; Porpino 2016; Van der Werf et al. 2019).

In particular, a need exists for comprehensive food waste measurements at the individual or household level (Yu and Yaenicke 2020). We recommend that future research investigate universal estimation techniques that can be applied across a large group of consumers, while at the same time being cost-effective and time-efficient to employ. Moreover, as the growing out-of-home sector is presently responsible for the second largest amount of food waste at the consumption level (Bräutigam et al. 2014; Monier et al 2010), we stress the need for better food waste measurements outside the home, as little is known about food waste in the out-of-home sector.

Further, insight is presently lacking into consumers' complete food waste behavior, as no study so far has successfully measured specific consumers' combined in-home and out-of-home consumption and food waste. While Yu and Jaenicke (2020) attempted to combine the two contexts, their model worked only in the absence of the out-of-home data owing to the difficulty of comparing the food groups used to analyze the data. Future research could seek solutions for estimating food waste for combined in-home and out-of-home contexts, perhaps by combining all acquisition, consumption, and disposal data or by using smart techniques in which food waste can be mechanically measured both inside and outside the home.

Relatedly, large organizations have begun using smart cameras that detect the type and amount of food waste (e.g., Winnow Solutions; www.winnowsolutions.com). Using technological applications that provide insights into what food is regularly wasted can allow

organizations to adapt their food offerings and reduce waste. The validity and reliability of using similar systems remains to be empirically investigated. For consumer food waste purposes, installing smart scanners or cameras among a large group of households would make longitudinal tracking possible and provide both accurate waste measurements and possibilities for interventions.

2.4.2 Future Research Recommendations for the Acquisition Phase

Online Grocery Shopping. In recent years, the landscape of food acquisition has evolved rapidly. While the majority of consumers still acquire groceries in retail outlets, online ordering of groceries has increased exponentially. For instance, one in five households within The Netherlands engaged in online grocery shopping in 2019 (Smart Food Monitor 2020). A shift to online shopping presents consumers with contextual surroundings that differ from the traditional grocery store. Online shopping represents lower search costs but higher perceived risks (e.g., privacy, order fulfilment) and is considered less enjoyable (Huyghe et al. 2017) than shopping in a physical store. Notably, impulse buying is less pronounced in the online channel (Ramus and Nielsen 2005), but the effects of online grocery shopping on the amount of consumer food waste are unknown. Since impulse buying is a major driver of food waste (Parfitt et al. 2010; Parizeau et al. 2015; Stefan et al. 2013), future research could investigate whether the absence of physical temptations when purchasing groceries online could lead to a decrease in food waste. Future research could also investigate whether and how online shopping changes consumers' food acquisition, consumption, and waste.

Related to the changing ways in which consumers acquire food is the change in timing of when food is moved from the retailer to the consumer. Currently, consumers tend to shop for groceries once a week, and as a result of inappropriate storage, products are often kept in suboptimal conditions (see section 2.3.2). Moving to a system in which food is provided to consumers more frequently, closer to the time of actual consumption, or even directly from the

producer to the consumer, could diminish food waste. Online grocery delivery services might act upon these possibilities, allowing consumers to reap the benefits from improved knowledge of how to properly store food. For instance, researchers could conduct point-of-purchase interventions to educate consumers and support the battle against food waste.

Meal Box Services. A further interesting venue for research could be investigation of food waste from the use of convenient meal solutions delivered to the home. Services such as HelloFresh (www.hellofresh.nl) provide foods in appropriate quantities and include recipes to further increase the ease of meal preparation and consumption. Moreover, meal box services can "push" certain food items such as healthy local and seasonal produce, increasing healthy consumption and diminishing food waste. Meal boxes require a more thorough investigation.

Acceptance of Suboptimal Food. A major category of food that is wasted is suboptimal foods—products that are close to their expiration date or that have deformities or dents (Tsalis 2020). Although consumers have been found to vastly prefer purchasing "optimal" food (Aschemann-Witzel et al. 2017), research has shown that consumers are willing to purchase suboptimal food when it is offered at a reduced price (Aschemann-Witzel et al. 2017; De Hooge et al. 2017), which could lead to a decrease in food waste. Instead of offering discounts, retailers could use in-store messaging to increase consumers' positive self-perceptions and, subsequently, their willingness to choose unattractive, suboptimal food (Grewal et al. 2019). Future research could, for instance, test interventions focused on creating tolerance of suboptimal foods, both in-store and at home.

2.4.3 Future Research Recommendations for the Consumption Phase

Consumer Perceptions of Expiration Dates. The lack of understanding concerning expiration date labels is a major contributor to food waste (Graham-Rowe et al. 2014; Quested and Johnson 2009; Wilson et al. 2017). Interventions aimed at making consumers aware that these dates are not absolute, and at improving consumers' skills in estimating food safety on

the basis of their own senses, are likely to lower waste levels (Quested et al. 2011; Schmidt 2019; Terpstra et al. 2005). In a more disruptive approach, researchers might enlist the help of the government or the food industry to investigate whether and how to change the current system of best-before and use-by dates to improve understandability and reduce waste.

Making Food More Convenient. Consumers often fail to eat their food in time owing to a lack of time to actually cook their planned meals (Evans 2012). The past decade has seen a trend toward making food more convenient to accommodate time-constrained lifestyles (Buckley, Cowan, and McCarthy 2007; Evans 2011). Convenience food products are prepared and packaged in a way that reduces the energy, time, and effort—mental and physical—required for preparation, consumption, and disposal (Brunner, van der Horst, and Siegrist 2010; Buckley et al 2007). Making food preparation more convenient and decreasing meal preparation time may be have the potential to reduce food waste (Buckley et al. 2007; Evans 2011). A few scholars have investigated the link between convenience and food waste, with results remaining inconclusive. While Buckley et al. (2007) associate convenience with less waste, other scholars report that households most positively disposed toward convenience provide the largest amount of waste (Brunner et al. 2010; Mallinson et al. 2016).

Future research could investigate whether the lack of time, ability, or motivation—which often leads consumers to replace their already acquired healthy meals with convenient and often less healthy substitutes (Evans 2011, 2012)—could be addressed by providing convenient solutions featuring healthy food. While we are cognizant of the higher packaging-to-product ratios for convenience foods, packaging helps to ensure long-term preservation of food and offers protection during transport and storage (Han 2014). Moreover, research has shown that packaging altered to reduce food waste can lessen the total environmental impact and lead to environmental gains, even while increasing the environmental impact from the packaging itself (Williams and Wikström 2011).

2.4.4 Future Research Recommendations for the Disposal Phase

Stimulating the Consumption of Leftovers. As mentioned, consuming leftovers is considered one of the most effective strategies to decrease consumer food waste (Principato et al. 2015; Stancu et al. 2016; Stefan et al. 2013; Van Geffen et al. 2016). However, leftovers constitute the food waste category that consumers are the least aware of (Cox and Downing 2007). Future research could test interventions at this stage, for instance by increasing the attractiveness of eating leftovers. Since motivating consumers to reduce waste appears to be most effective when promoting economic incentives (Graham-Rowe et al. 2014; Neff et al. 2015; Stancu et al. 2016; Van Geffen et al. 2016), scholars could promote consumption of leftovers as a means to save money.

Smart technologies may offer opportunities as well. For instance, the recently launched Ovie Smarterware food storage system uses colored light ring clips (in green, amber, and red) that can be attached to any kind of storage container that contains food (www.ovie.life). When consumers digitally describe the type of food in the container, Ovie can keep track of edibility and safety through visual indicators. In addition, via the Ovie app, consumers receive recipes based on the stored ingredients to make using the leftovers easier.

Stimulating the Use of Take-home Boxes. Another problem that arises primarily when eating out-of-home relates to plate leftovers (Wansink and van Ittersum 2013). Taking leftovers home is an option to reduce waste, but many consumers feel embarrassed to ask for a box (Giorgi 2013; Sirieix et al. 2017). Economic incentives appear to be most effective in motivating consumers to take home a box (Mirosa et al. 2018). Future research could investigate how to increase the attractiveness of take-home boxes, for instance by promoting economic incentives or by changing the design of the packages.

2.4.5 Future Research Recommendations by Bridging Acquisition and Consumption

Smart Technologies at Home. In the current digital era, consumers increasingly seek to improve their quality of life through smart technologies such as robot vacuum cleaners (Euromonitor 2017). Developers of smart-home technologies are increasingly designing tools that offer food management systems at home. For instance, smart internet refrigerators can communicate what kinds of products are stored inside the refrigerator and are able to keep track of the stock. Consumers can manage this information via their smartphone and can receive and send notes that will appear on the screen of the refrigerator (Prospero 2019). Research might investigate whether and how these digital solutions support consumers in reducing food waste by better matching acquisition and consumption.

Temporal Distance and Healthiness. A time gap often occurs between food acquisition and consumption. For instance, consumers usually purchase food in the grocery store some days in advance of the anticipated consumption. As a result, they must make consumption decisions based on predictions about how they will feel at a time in the future (Hamilton 2014). The temporal gap between acquisition (phase 1) and consumption (phase 2) may lead to incongruence between decisions made at phase 1 and those made at phase 2. A promising research direction is study of temporal distance as a key driver of the mismatch between planned and actual food consumption, leading to waste of the acquired food.

According to construal level theory, for temporally distant events consumers use abstract mental models that lead to higher-level construals (Liberman and Trope 2000; Trope and Liberman 2003). This abstract thinking about an event entails reasoning about the big picture while possibly overlooking some details. In contrast, when the outcomes of decisions are realized soon rather than in the distant future, consumers think in more concrete terms of the event, and often place disproportionate weight on the short-run utility, such as satisfying immediate pleasures (Kirby and Herrnstein 1995; Read et al. 1999).

Prior literature has shown that consumers who focus on their long-term health goals make healthier, more virtuous (i.e., healthy but less tasty) choices when planning for future consumption than for immediate consumption (Milkman, Rogers, and Bazerman 2010; Read et al. 1999; VanEpps, Downs, and Loewenstein 2016a). Since intentions (e.g., to eat healthy, to not waste food) do not always result in corresponding behavior (Hochbaum 1981), consumers may acquire healthy foods with the intention to consume these, but with actual behavior diverging from these intentions. Future research could investigate whether consumers impulsively acquire additional unhealthier food that can satisfy their desire to indulge at the time of consumption, and thus deviate from the food choices made previously. The result could be a surplus of food, with the unhealthier foods ending up being consumed and the healthier foods ending up wasted.

Feasibility, Desirability, and Convenience Food. Another interesting research direction combines construal level theory and the use of convenience food. Prior literature argues that consumers tend to be more optimistic and confident about the distant future than the near future (Liberman and Trope 1998). Besides making healthier choices for future food consumption, consumers focus on the desirable end states of events when mentally representing these as being in the distant future (Liberman and Trope 1998). When contemplating a future consumption moment, for instance when grocery shopping and having to decide on what to eat for dinner later in the week, consumers focus on the desirable features of their dinner. As a consequence, they intend to increase the value of the meal, for instance by putting effort into meal preparation (Festinger 1962), which leads to acquiring unprocessed foods (e.g., raw produce such as broccoli) to support this desired end state.

However, consumers may largely ignore the feasibility of actually preparing the meal when purchasing groceries in-store, and then be confronted with feasibility constraints at the

time of preparation, such as busy lifestyles that restrict the time and effort available for meal preparation. Consequently, the likelihood of preparing the purchased, unprocessed food decreases and the propensity to waste it may increase. Convenience substitutes of unprocessed food (e.g., pre-sliced vegetables) may be a solution, as these foods require less time, energy, and effort to prepare (Brunner et al. 2010; Buckley et al. 2007; Candel 2001; Darian and Cohen 1995). Scholars might investigate whether making food preparation more convenient could reduce the mismatch between planned and actual consumption, with the result of less food waste.

2.5 Conclusion

This chapter has provided an overview of the relevant literature on consumer food waste. Drawing from previous literature, we presented a summary of the theoretical and empirical findings on consumer food waste. We first discussed the stream of literature that approaches avoiding food waste from a conscious consumer perspective, drawing especially on the theory of planned behavior. As mixed findings and the argument that food waste often happens unintentionally and unconsciously (Block et al. 2016; Porpino 2016; Schanes et al. 2018; Stöckli et al. 2018) called for further investigation, we took a broader stance and examined the drivers of food waste according to the literature that approaches food waste from an unconscious consumer perspective. We stress the importance of consumers' unconscious or rather mindless decisions and actions that are taken long before actual disposal. Taking into account all three phases of consumer behavior—acquisition, consumption and disposal—and categorizing the causes of consumer food waste as arising from situational, individual, and social influences, we elaborated on the most common practices causing food waste as described in previous literature.

More research is needed to advance understanding of the antecedents affecting consumer food waste. On the basis of the current literature, we have provided multiple

directions for future research regarding consumer food waste. Table 2.3 lists promising avenues for future research to tackle the food waste issue.

Table 2.3 Research Recommendations and Questions

Domain	Suggested issue	Possible research questions
Measuring consumer food waste	Measuring food waste within and outside the household	- Can we develop universal estimation techniques for measuring food waste that can be applied across a large group of consumers but are not too expensive or time-consuming to employ? - How can we capture the complete picture of consumer food waste by combining in-home and out-of-home contexts?
	Using smart technologies	- Are smart cameras and scanners accurately measuring consumer food waste?
Acquisition phase	The changing acquisition landscape (e.g., online ordering)	- What are the effects of online grocery shopping (compared to visiting the physical grocery store) on food waste? - What is the effect of the lack of in-store marketing promotions in the online shopping environment on food waste? - What is the role of suppressed impulse buying behavior in the online shopping environment on food waste? - Can changing the timing of when food is moved from the retailer to the consumer (e.g., closer to the time of actual consumption or directly from the producer to the consumer) diminish food waste?
	Lack of knowledge regarding appropriate storage	- Could education regarding how to properly store food increase consumption and decrease waste? - How do meal box services affect food waste?
	Meal box services	- Can meal boxes be a possible solution to increase healthy consumption and diminish food waste?
Consumption phase	Confusion regarding expiration date labels	- How can we improve consumers' skills to estimate food safety to reduce unnecessary waste levels? - How would an improved system of best-before and use-by dates look and to what extent would it reduce food waste?
	Acceptance of suboptimal foods	- How can consumers take a more nuanced approach to the allowance of suboptimal foods, both in-store and at home, to reduce waste? - How can we further stimulate consumers' purchases of suboptimal foods to reduce their unnecessary waste?
	Lack of time, ability, or motivation to cook acquired food	- Can convenience food be a solution for food waste since it mitigates time pressures perceived by consumers? - Can making healthy food more convenient prevent consumers from replacing their healthy meals with less healthy (but often more convenient) substitutes?
Disposal phase	Leftover consumption	- How can we increase the attractiveness of using leftovers? - Would smart technology that provides consumers with information concerning food edibility motivate consumers to actually consume their leftovers?
	Use of take-home boxes	- How can we increase the attractiveness of using take-home boxes? - Would changing the design or stressing economic incentives increase the use of take-home boxes?
Bridging acquisition and consumption	The development of the digital era	- How can digital solutions (e.g., smart refrigerators) support consumers in matching their acquisition and consumption to reduce their food waste?

	Healthy intentions that do not translate into actual behavior Moving from acquisition to consumption, consumers must make decisions based on predictions about how they will feel at a different time in the future	- How can we support consumers in making consistent food choices that lead to healthier food intake and a reduction in food waste? - Could the temporal distance between planned and actual food consumption drive unconscious food waste behavior? - When having made healthy consumption choices for future consumption, are consumers more likely to impulsively acquire additional unhealthier food that can satisfy their desire to indulge at the time of consumption, deviate from the food choices made beforehand, and thus waste food? - Would making food preparation more convenient possibly reduce food waste since it makes meal preparation feasible?

In the next chapters, we continue to build on our suggested future research directions. We particularly stress the importance of studying the acquisition and consumption phases integrally instead of in isolation, which appears to be the most common approach up to now. In addition, we discuss the theoretical framework of construal level theory as one of the promising research directions that also provides the basis for the upcoming chapters of this dissertation. As a result, we continue to focus on the acquisition and consumption phases and posit that acknowledging the temporal distance between planned and actual consumption may be critical in understanding the behavioral decision-making process that drives food waste. In Chapters 3 and 4, building on construal level theory, we investigate whether the temporal distance between acquiring food and actually consuming the food would result in a mismatch between planned and actual consumption, with the result of increased food waste. With this, we attempt to provide a theoretical basis for better understanding the consumer decision-making process that drives food waste. Drawing on insights from prior literature, in Chapter 3 we demonstrate that the conflict between consumers' long-term health goals and their desire to indulge at the actual moment of consumption forms a critical antecedent driving food waste. In Chapter 4, we investigate the effect of using convenience foods, which reduce the time and effort to prepare food for consumption, on food waste. We take into account both the out-of-home context (Chapter 3) and the in-house consumption setting (Chapter 4) when investigating consumer food waste.

Chapter 3 | What A Waste: Effects of (Un)planned Consumption on Consumer Food Waste

Abstract

One-third of all edible food produced for human consumption is wasted. As consumers are the biggest producers of food waste, the United Nations has declared the reduction of consumer food waste a top global priority. As the fast-growing out-of-home consumption sector generates a relatively large amount of waste, it is the focus of our study. Building on construal level theory, we approach food waste as a discrepancy between planned and actual consumption and propose that the temporal distance between the two is a critical determinant of consumer food waste. Three studies confirm that while consumers make more virtuous (i.e., healthy but less tasty) choices in advance, at the moment of consumption their desire to indulge entices them to acquire and consume vice (i.e., tasty but less healthy) food, resulting in the vice foods being consumed and the virtue foods being wasted. We caution that advance ordering can increase food waste if consumers have the opportunity to acquire additional food at the time of consumption. Emphasizing the (un)healthiness of food by using traffic light labeling dampens impulsive vice food consumption but results in greater virtue food waste.

Keywords: Food waste, pre-ordering, construal level theory, virtue and vice food, nutrition labeling, sustainability

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3.1 Introduction

One-third of all edible food products for human consumption is wasted or lost in the supply chain (Gustavsson, Cederberg, and Sonesson 2011), resulting in a variety of negative social, economic, and environmental consequences. At the same time millions of tons of food are wasted worldwide, 1 billion people are food-insecure (Block et al. 2016). Moreover, the carbon footprint of food waste ranks as the third top global emitter (Gustavsson et al. 2011). Given that consumers are the single biggest producers of food waste in industrialized countries (Beretta et al. 2013; Parfitt, Barthel, and Macnaughton 2010; Bräutigam, Jörissen, and Priefer 2014), reducing their food waste has been declared a top global priority by the United Nations (2016).

At the same time, one of the major shifts in lifestyles over recent decades is the increasing consumption of food and drink out of home—in restaurants, canteens, schools, hospitals, care centers, military institutions, transport hubs, and in-flight catering (Thyberg and Tonjes 2016; Xue et al. 2017). In the US, almost half of the total food and beverage spending occurs out of home (Rhodes et al. 2015). In Europe, one in five meals is consumed outside the home (ERS Food Expenditure Series 2016; Iri 2018), and this fast-growing sector is in Europe also responsible for monumental food waste at the consumption level (Bräutigam et al. 2014; Monier et al 2010). For example, in the UK, 0.92 million tons of food are wasted annually in food service outlets, of which 75% is avoidable (Parry, Bleazard, and Okawa 2015). In Italy, the restaurant sector is responsible for 21% of the total amount of consumer food waste (Pellegrini et al. 2019). These numbers reflect the relevancy of out-of-home consumption and an opportunity to reduce the amount of food wasted away from home.

An important trend in the out-of-home consumption sector is pre-ordering of meals. For instance, through an app Allset offers customers not only table reservations at a restaurant but also the ability to order their meal and pay in advance (Gould 2017). Disney World offers pre-

ordering of meals so customers can spend more time in rides and attractions. Starbucks and Chick-Fil-A have integrated pre-ordering into their mobile applications, with pre-ordering representing 10% of total transactions at high-volume Starbucks stores (Kelleher 2019; Wong 2014; Business Insider 2016). Forecasts expect mobile pre-ordering to account for almost 11% of all quick-service restaurant sales by 2020, translating to a $38 billion industry (Business Insider 2016). Given evidence that pre-ordering leads to healthier choices (Stites et al. 2015; VanEpps, Downs, and Loewenstein 2016a), organizations with a particular interest in the well-being of their clients, such as hospitals and company canteens, are implementing advance ordering to foster healthy choices. However, whether advance ordering is suited to combat food waste in the context of out-of-home consumption is unclear. Therefore, the first goal of our paper is to examine how food waste occurs when food is consumed out of home, including the effect of advance ordering. In our examination we also investigate the behavioral decision-making process that drives food waste (Block et al. 2016; Porpino 2016).

Building on construal level theory (Liberman and Trope, 2000; Trope and Liberman 2003), we propose that food waste could be an unintended consequence of making food choices in advance because pre-ordering introduces a temporal distance between planned and actual food consumption. While planning their future food consumption, consumers may make relatively virtuous (i.e., healthy but less tasty) choices motivated by their long-term health goals (Milkman, Rogers, and Bazerman 2010; Read, Loewenstein, and Kalyanaraman 1999; VanEpps et al. 2016a). Allowing consumers to pre-select their meals before mealtime has shown to result in the selection and consumption of more healthful food (Miller et al. 2016; Stites et al. 2015). However, when the actual moment of consumption arrives, consumers may experience a conflicting desire to indulge, which entices them to impulsively acquire and consume tasty but less healthy food (Read et al. 1999; Wertenbroch 1998). Since food is often

accessible throughout the day, consumers can easily substitute "vice" food for their planned "virtue" food. The result is that the vice foods are consumed, and the virtue foods are wasted. The second goal of our paper is to explore how nutritional labeling on menus affects the process of food choice becoming waste. Ironically, nutritional labeling makes the healthiness of the available options more salient and may entice consumers to make even healthier choices that are even more likely to be wasted.

In summary, we propose that the conflict between consumers' long-term health goals and their desire to indulge at the actual moment of consumption forms a critical antecedent driving food waste. Given that vice foods are generally preferred over virtue foods, and that vice foods satisfy consumers' desire to indulge (Kivetz and Simonson 2002), we propose that consumers who have planned to eat healthily but fail to resist vice food at the moment of consumption are more likely to consume the unhealthy vice food and waste the virtue foods, and that this process could be aggravated when nutritional information is provided.

We test our framework with three experimental studies conducted outside the lab. In Study 1, we corroborate previous findings in the literature that consumers make healthier choices when they order food ahead of the moment of consumption—they acquire a higher share of virtue foods and fewer calories. Study 2 offers strong empirical evidence for our proposed substitution mechanism. Impulsive vice consumption indeed causes virtue food waste if consumers initially had planned to eat healthy virtue food. Furthermore, Study 2 reveals that advance ordering can indeed have food waste as a negative side effect if consumers have the opportunity to impulsively acquire additional food. While advance ordering can decrease waste, this decrease occurs only when the opportunity to impulsively acquire extra food is absent. Study 3 corroborates these findings. Using traffic light labels—green, amber, or red labels indicating a food's low, medium, or high amounts of fat, saturated fat, sugars, and salt—Study 3 demonstrates that highlighting the healthiness of food choices via these labels dampens

impulsive vice choices, but at the same time results in a higher share of virtue waste. The presence of traffic light labels leads to a greater proportion of virtue food ordered, seemingly over-encouraging consumers to order (too) much virtue food. As a result, a higher share of virtue food becomes wasted.

We contribute to the literature in various ways. First, we offer a novel fundamental understanding about the consumer decision-making process that leads to food waste. Second, we empirically show that consumers intend to eat healthily when they choose food for future out-of-home consumption, but their desire to indulge can entice them to impulsively acquire vice foods at the time of consumption. This choice results in a surplus of virtue food and ultimately waste. The advice from previous literature to increase healthy consumption behavior by planning future consumption in advance (Milkman et al. 2010; VanEpps et al. 2016a) may therefore generate food waste as an unintended negative side effect. Third, we show that highlighting the (un)healthiness of food dampens impulsive vice choices at the moment of consumption but does not significantly reduce the amount of food waste, only its composition.

The remainder of this manuscript is organized as follows. The following section presents our theoretical framework and is followed by a description of the experiments to test our hypotheses and a discussion of the results. We conclude with theoretical and managerial contributions.

3.2 Theoretical Framework

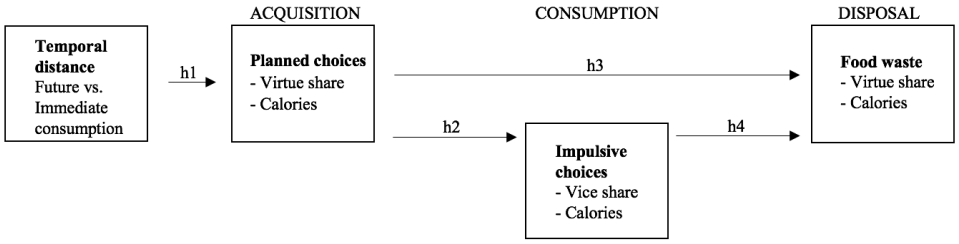
Reduction of food waste requires a fundamental understanding of consumers' underlying behavioral decision-making process. However, prior research on food waste predominantly presents descriptive findings (Cox and Downing 2007; Evans 2011; Parfitt et al. 2010). The few studies that take a more theoretical approach to explain food waste have relied primarily on the theory of planned behavior (Graham-Rowe, Jessop, and Sparks 2015; Stancu, Haugaard, and Lähteenmäki 2016; Stefan et al. 2013; Visschers, Wickli, and Siegrist 2016), but

food waste often happens unintentionally and unconsciously, which is not considered by the theory of planned behavior (Block et al. 2016; Sheeran, Gollwitzer, and Bargh 2013). Building on construal level theory (Liberman and Trope 2000; Trope and Liberman 2003), we uniquely approach food waste as a discrepancy between planned and actual food consumption. We propose that the temporal distance between the planned and actual moment of consumption is a critical determinant of consumer food waste.

Accordingly, our conceptual framework covers the entire consumer decision-making process, from planning and acquisition to consumption and disposal, and divides the process into a series of three sequential and interrelated consumption decisions: planned choices, impulsive choices, and food waste. Figure 3.1 shows an overview of the process. We use the term "planned choices" to refer to decisions for a planned future consumption moment, such as when deciding beforehand on what to have for lunch. "Impulsive choices" refer to decisions made impulsively at the actual moment of consumption. Impulsive choices thus comprise additional food chosen for the same consumption moment, and are expected to be dependent on previously made, planned consumption choices. The food waste stage entails all of the food that is chosen but not consumed and is thereby wasted.

Given that we approach food waste as a result of consumers consuming unhealthy vice food instead of healthy virtue food, the healthiness of food is central to our theoretical reasoning. In line with previous literature, we define the healthiness of food as the proportion of healthy virtue food versus unhealthy vice food, and the number of calories chosen (Finkelstein and Fishbach 2010; Milkman et al. 2010; VanEpps et al. 2016a).

Figure 3.1 Conceptual model for consumer food waste behavior



3.2.1 Construal Level Theory and the Preference for Virtue versus Vice Food

Most of the food we consume has been planned and purchased at an earlier time (Laran 2009). For instance, we choose what and how much to pack for lunch, what snacks to bring along for a long car drive, and what to eat for dinner over the coming week. In the out-of-home consumption sector that is responsible for almost half of the food and beverage spending in the US (Rhodes et al. 2015), pre-ordering meals is an emerging strategy (Stites et al. 2015). Apart from large corporations like Disney World, Starbucks, and Chick-Fil-A, which offer the option to order food in advance, conferences often allow attendees to decide on their dishes ahead of the conference and hospitalized patients must choose what food to consume the next day. These food-related decisions often entail the questions of not only how much to eat but what to eat (Hock and Bagchi 2017).

Approaching food waste as a discrepancy between planned and actual food consumption, we pose that acknowledging the temporal distance between the moments of planned and actual consumption is critical for understanding the behavioral decision-making process that drives food waste. In accordance with construal level theory, research has demonstrated that consumers focus more on their long-term health goals and hence make healthier choices when planning for temporally distant, future consumption than for immediate consumption (Milkman et al. 2010; Read et al. 1999; VanEpps et al. 2016a). These healthier choices reflect either a relatively larger share of virtue food or fewer calories that consumers

consume when planning for a future consumption moment versus for immediate consumption (Milkman et al. 2010; VanEpps et al. 2016a). Empirical evidence reveals that allowing consumers to pre-select their meals before mealtime may result in the selection and consumption of more healthful food (Miller et al. 2016; Stites et al. 2015)

Conversely, consumers tend to make relatively unhealthy choices when the moment of consumption approaches and find resisting their desire to indulge to be difficult (Kirby and Herrnstein 1995; Read et al. 1999). Previous research has shown that when faced with an immediate consumption choice, consumers tend to prefer vice over virtue foods, and are more inclined to indulge by consuming more calories (Milkman et al. 2010; Read and van Leeuwen 1998; Sadoff, Samek, and Sprenger 2015; VanEpps et al. 2016a). On the basis of the existing literature, we formally hypothesize the following:

> **H_1:** The healthiness of food choices is higher when choosing for future versus immediate consumption in terms of (**a**) a higher virtue share and (**b**) fewer calories.

H_1a and H_1b suggest that when the moment of consumption arrives, consumers' desire to indulge becomes more salient, directly conflicting with their long-term health goal, which was salient during the planning stage. As a result of the healthy nature of the planned choices, consumers may have a hard time satisfying their desire to indulge with the choices previously made (Hoch and Loewenstein 1991). Hence, if they have the opportunity to do so, they may impulsively acquire additional (vice) food that can satisfy their desire to indulge, and thus deviate from the food choices made beforehand.

Research has shown that despite having chosen a healthy snack (e.g., an apple) in advance, when given the opportunity to reconsider choices at the moment of consumption, consumers' conflicting desire to indulge leads them to impulsively opt for more desirable vice food (i.e., a chocolate bar) (Read and van Leeuwen 1998; Weijzen, de Graaf, and Dijksterhuis 2009). Further, participants who had already chosen vice food are less likely to deviate from their choices, suggesting that when consumers have already made relatively unhealthy choices

for planned consumption (i.e., high in vice share and high in calories), the desire for impulsively acquiring more vice food at the moment of consumption is not as strong (Read and van Leeuwen 1998). Other work has shown that engaging in a prior choice task in which consumers already impulsively indulge leads to a reduced likelihood of making additional impulsive choices in a follow-up choice task (Dholakia, Gopinath, and Bagozzi 2005).

We therefore expect that when an opportunity arises to impulsively choose additional food at the moment of consumption, the healthier the planned choice is, the more likely the additional food will be vice food. Specifically, the healthier the initially planned choices are, the less likely the food will satisfy consumers' desire to indulge, and the more likely consumers will be to complement their initially planned choices with additional impulsive choices (Hoch and Loewenstein 1991). Accordingly, we hypothesize:

H_2a: The healthier the planned choice in terms of more virtue food, the higher the vice share of the food chosen impulsively.

H_2b: The healthier the planned choice in terms of fewer calories, the more calories are chosen impulsively.

3.2.2 (Over)consumption versus Waste

As noted previously, we propose that food waste arises from a discrepancy between planned and actual food consumption. We differentiate between the type of food (virtue vs. vice) as well as the number of calories chosen. First and foremost, we expect that with the planned virtue share, the share of virtue waste increases, as overestimating virtue intake is a big issue in the food waste domain (Conrad et al. 2018). Since virtue food is less likely to satisfy consumers' desire to indulge, in contrast to vice foods virtue foods rarely get (over)consumed after the consumer feels full (Kivetz and Simonson 2002). Therefore, we expect that the share of virtue food waste increases with the share of virtue food consumers plan to eat.

H_3a: With a higher *planned* virtue share, the share of virtue waste increases.

The amount of virtue food wasted will also depend on the extent to which vice food is impulsively added at the moment of consumption. As argued, one reason for food to be wasted is that other food is purchased and consumed in its place (Conrad et al. 2018). H_2a posits that owing to the desire to indulge, consumers are likely to substitute planned virtue food with impulsive vice food at the moment of consumption (Read and van Leeuwen 1998; Weijzen et al. 2009). Since vice food is preferred over virtue food at the time of consumption, we propose that this substitution mechanism will lead to increased waste. More specifically, with the share of impulsively chosen vice food, virtue food waste is likely to increase. Accordingly, we hypothesize:

H_4a: With a higher *impulsive* vice share, the share of virtue waste increases.

While the type of food—virtue versus vice—is a critical driver of food waste, we believe that the total calories chosen also contribute to food waste. The number of calories chosen for a consumption moment has been identified as a major antecedent driving food waste (Block et al. 2016; WRAP 2012). Consumers usually stop eating after feeling satiated, and satiation depends in part on the caloric content of food (Johnson and Vickers 1993). With more calories chosen, consumers are more likely to feel satiated before finishing a meal, and hence they are more prone to wasting the remaining food (Abe and Akamatsu 2015; Conrad et al. 2018; Roe et al. 2018). We therefore predict that acquiring more calories—whether when making decisions for planned consumption or when impulsively acquiring additional calories at the moment of consumption—is likely to result in increased food waste. Therefore:

H_3b: With the number of *planned* calories chosen, the number of calories wasted increases.

H_4b: With the number of *impulsive* calories chosen, the number of calories wasted increases.

3.2.3 Nutritional Labeling and Waste

In the US, restaurants and retail food establishments with more than 20 locations are required to provide customers with calorie and other nutritional information (FDA 2018). In Europe, despite extensive discussions, nutritional labeling in the out-of-home sector is still restricted to information about allergens (European Commission 2019). From a theoretical perspective, providing nutritional information should make the healthiness of the available options more salient and entice consumers to make healthy choices when consuming food away from home. However, evidence regarding the effectiveness of such labeling is mixed (VanEpps, Roberto et al. 2016). While some studies find that providing consumers with nutritional information is associated with a lower caloric intake (Ellison, Lusk, and Davis 2013; Lowe, de Souza-Monteiro, and Fraser 2011; Thorndike et al. 2014), other studies find no effects from providing nutritional information (Elbel et al. 2013). The only study examining the effect of adding color-coded and numeric caloric information to an online order menu found that total calories ordered reduced by about 10% when participants were provided with traffic lights (VanEpps et al. 2016b).

To the best of our knowledge, the effect of providing nutritional information on food waste in the out-of-home consumption sector has not yet been researched. Within our conceptual framework, nutritional labeling can affect both planned and impulsive consumption choices. Nutritional labels can prompt consumers to order greater amounts of virtue foods, but if consumers subsequently fail to resist acquiring vice food at the time of consumption, vice food is likely to be preferred over the planned virtue food consumption, resulting in virtue food waste. However, owing to the salience of health goals, nutritional information can also lead to decreased impulsive behavior at the moment of consumption. As consumers may be less inclined to give in to their desire to indulge, a surplus of food and thus waste become less likely. Since the effect can go both ways, we do not formulate formal hypotheses.

Summing up, we posit that inconsistencies between planned healthy and actual unhealthy consumption drive food waste. We test our hypotheses in three experimental studies conducted in an out-of-home lunch setting, where participants chose lunch for either future consumption (i.e., in a few hours' time) or immediate consumption. This setting not only has ecological value and relevance; it allows us to measure actual consumption and food waste. In Study 1, we first verify that the temporal distance between planned and actual consumption influences the healthiness of lunch food orders (H_1a and H_1b). In Study 2, we test the entire conceptual model and associated hypotheses, measuring actual consumption and food waste behavior. Finally, in Study 3 we investigate the effects of providing nutritional information, in particular traffic light labels, revealing the (un)healthiness of food choices on food choice and waste.

3.3 Methodology

3.3.1 Study 1: Effect of Temporal Distance on Planned Consumption Choices

Study 1 was designed to verify that the temporal distance between food choice and consumption influences food choices in a lunch-ordering context (Milkman et al. 2010; Read et al. 1999; Read and van Leeuwen 1998; VanEpps et al. 2016a). As in all three studies, participants were drawn from subject pool of students at a large public university.

3.3.1.1 Design, Procedure, and Stimuli

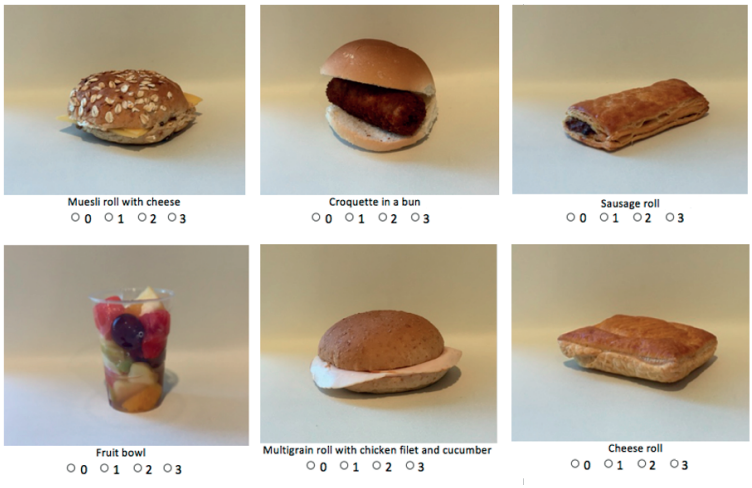
The setting for this experiment was a small counter in the hallway near a canteen within a university building. Over three days, we assessed the influence of time elapsed between planned and actual consumption on consumption choices of 217 university students. The key independent variable was manipulated temporal distance (consumption in 2–3 hours vs. immediate), and we were interested in the choice share of virtue versus vice food and the total number of calories ordered.

Participants who walked through the hallway were asked to fill out a short paper-based survey that took approximately 5 minutes to complete. As a cover story, participants were told that the assortment of food currently offered by the university canteen was under review, and that we were interested in students' preferences. The participants were also told that the choices they made were hypothetical, meaning that they would not actually receive their preferred choices. As an incentive, participants were enrolled in a lottery to win €20. In the future consumption condition, participants walking by between 9:30 a.m. and 10:45 a.m. were asked to participate and choose their lunch for eating 2–3 hours later. In the immediate consumption condition, participants who walked by between 11:30 a.m. and 12:45 p.m. were asked to choose their lunch for immediate consumption. Participants could choose from a randomized order menu that included pictures and descriptions of three virtue foods—a multigrain roll with ham, a muesli roll with cheese, and a fruit bowl—and three vice foods—a sausage roll, a cheese roll, and a croquette in a bun (see Figure 3.2), and were asked to indicate the quantities they would want to order for lunch. By offering all food items pre-prepared and hence ready-to-eat at the time of consumption, we control for the fact that some food items are more effortful to prepare than others. This may otherwise possibly lead to a reduced appeal under low construal level conditions.

A summary of our measures appears in Appendix A. To quantify the amount of food ordered, we calculated the number of calories of each individual order. The caloric values of the six food items are derived from the calculation tool provided by The Netherlands Nutrition Centre (2017) (see Appendix A for details). We also elicited participants' socio-demographics and hunger levels. Gender and hunger are included as control variables in all three studies, as males often choose higher-calorie food and focus less on healthy consumption (Chambers et al. 2008; Patterson, Haines, and Popkin 1994; Wardle et al. 2004). Moreover, experienced hunger positively influences the selection of unhealthier vice food (Loewenstein 1996; Read and van

Leeuwen 1998). All results in this investigation remain stable when the control variables are excluded.

Figure 3.2 Order menu for Study 1



3.3.1.2 Results

Summary Statistics

Four participants were removed, as the calorie content of their orders exceeded three standard deviations from the sample mean. The final sample consisted of 213 participants (56% male, $M_{age} = 21.79$).

Planned Consumption Choices

To test the influence of the temporal distance between planned and actual consumption on food choice, we conducted two separate linear regressions with planned virtue share (i.e., ordered virtue calories divided by total calories) and calories of the order as dependent variables[1], and temporal distance as the predictor variable.[2] Consistent with H_1a and H_1b, the results reveal that advance ordering leads to healthier choices: when ordering 2–3 hours in

[1] The planned virtue share is operationalized as the sum of calories ordered from the three virtue options (i.e., the multigrain roll with ham, the muesli roll with cheese, and the fruit bowl) divided by the total calories ordered. The calories of the order results from adding up the caloric values of all items ordered per respondent.
[2] We require regression models for the analysis of Studies 2 and 3. For reasons of consistency, we therefore use linear regression rather than an analysis of covariance (ANCOVA).

advance of the actual moment of consumption, participants ordered a higher share of virtue food (M_{future} = 52.06% vs. $M_{immediate}$ = 40.87%; B = 11.19, t = 2.30, p = .022) and fewer calories (M_{future} = 593.01 kcal vs. $M_{immediate}$ = 674.95 kcal; B = -.81.94, t = -2.09, p = .038).

3.3.1.3 Discussion

The results of Study 1 confirm H_1a and H_1b and support past work on construal level theory demonstrating that consumers make healthier consumption decisions for future consumption than for immediate consumption (Milkman et al. 2010; Read et al. 1999; Read and van Leeuwen 1998; VanEpps et al. 2016a). Study 1 thus supports part of our theorizing. Next, we conducted an experiment to test the entire conceptual model and associated hypotheses while measuring actual consumption and food waste behavior.

3.3.2 Study 2: Effect of Planned Choices on Impulsive Choices and Food Waste

Study 2 tested whether planned healthy choices increase the impulsive acquisition of additional (vice) food at the moment of consumption. In addition, results offer evidence for our proposed substitution mechanism of planned virtue food with impulsively chosen vice food, with the result of virtue food waste.

3.3.2.1 Design, Procedure, and Stimuli

Two hundred students at a large European university were offered a free lunch they could voluntarily sign up for. The students were recruited in the hallways of the university buildings and the lunch took place in cooperation with the university canteen. The study employed a 2 (temporal distance: future vs. immediate consumption) x 2 (opportunity to impulsively choose additional food at the moment of consumption vs. not) between-subjects design.

We used the same cover story as in Study 1. Participants ordered lunch either in advance (between 9:30 a.m. and 10:45 a.m.) or for immediate consumption (between 11:45 a.m. and

12:45 p.m.). Participants indicated their order on an order menu similar to the one used in Study 1.[3] A pretest among 146 students from the same university corroborated our categorization of virtue versus vice food for the final set of the six food items. Our three vice items scored high on being perceived as vice foods and as being relatively unhealthy choices, and the three virtue items scored high on being perceived as virtue foods and were considered relatively healthy choices (Appendix C). Lunches were held in a customized lunchroom in the university building in two shifts, starting at 12:00 a.m. and 1:00 p.m., in two groups of approximately 30 participants per lunch. Participants indicated their hunger level when ordering the food. In the lunchroom, all participants received a bottle of water and collected their lunch order. Three research assistants served the food from behind a counter on which all six food items were displayed.

Participants were told that they were not allowed to take any food from the lunchroom after they had finished eating, and were asked to put all remaining food back in the lunch bag and leave it on the table.

While collecting their ordered lunch, participants who were randomly placed in the impulsive consumption groups were given the opportunity to order additional food (the same items from the menu) if desired. A research confederate asked the participants whether they wanted anything extra. Participants were not told in advance that they would have this opportunity to order additional food. The process was fully scripted:

> Hi, I am here to fill up your lunch bag with the items you have ordered from the order menu. Please let me check what you have ordered. [*Server looks at the filled-in order menu on the participant's lunch bag. Server fills up the lunch bag with the ordered items*.] We also have extra food available. [*Server shows food items on the shelf*.] Would you like to have anything in addition? [*Server puts additional food item in bag*.] Great, here you go. Let me note that on your order sheet.

[3] The fruit bowl item was replaced with another virtue item—a vegetarian wrap—because unlike the other items, the fruit bowl was not offered at the university canteen at the time of the study and we thought its novelty might influence choices.

Participants in the impulsive consumption groups were further informed and reminded that they could order additional food as long as they were in the room. After lunch, an exit survey assessed participants' socio-demographics. After all participants had left the room, all individual items of food waste were manually weighed.

3.3.2.2 Results

Summary Statistics

Two participants were removed, as the calorie content of their orders exceeded three standard deviations from the sample mean. Thus, the final sample consisted of 198 participants (57% male; M_{age} = 21.67). Of all calories ordered, 4.86% were wasted—an average of 33.98 calories (SD = 85.86) per participant. Of the waste, 53.89% (SD = 48.01) was virtue food. Satisfaction with the lunch did not differ between the experimental conditions ($F(3, 193)$ = .224, p = .879).

Planned Consumption Choices

To test the influence of time elapsed between food choice and consumption on planned choices, we conducted two separate linear regressions with planned virtue share and planned calories as dependent variables, and temporal distance as predictor variable, while controlling for gender and hunger. Table 1 presents the results. The planned share of virtue food differed directionally but insignificantly between the two groups (M_{future} = 38.85% vs. $M_{immediate}$ = 34.79%; B = 4.04, t = .86, p = .392). H_1a was not confirmed. In line with H_1b and Study 1, participants ordered fewer calories for future (vs. immediate) consumption (M_{future} = 590.83 kcal vs. $M_{immediate}$ = 654.28 kcal; B = -63.46, t = -1.73, p = .085).

Impulsive Consumption Choices

To examine the effect of planned choices on impulsive choices at the moment of consumption, we conducted two linear regressions, with impulsive vice share and impulsive calories as dependent variables and planned virtue share and planned calories as independent

variables in both models. Gender, hunger, and temporal distance between the planned and actual consumption moment were included as control variables. Our analysis included only participants who were actually offered additional food in the lunchroom at the moment of consumption (n = 103). Just under half of those participants (n = 47) acquired food impulsively.

We find a positive effect of the planned virtue share on the impulsive vice share ordered, indicating that participants who ordered a higher virtue share for planned consumption ordered a higher vice share impulsively when they had the chance to do so (B = .24, t = 1.88, p = .064). Even though the effect is marginally significant, it suggests that the more participants planned to eat healthily, the more they added unhealthy calories to their order when given the opportunity at the moment of consumption, in support of H_2a. In line with H_2b, the more calories the planned order contained, the fewer calories were impulsively ordered (B = -.16, t = -2.54, p = .013).

Food Waste

To investigate whether and how planned and impulsive choices affect the composition (i.e., vice vs. virtue share) and amount of food waste, we conducted two linear regressions with virtue share (i.e., wasted virtue calories divided by wasted calories in total) and calories wasted as dependent variables, and participants' planned choices (both planned virtue share and planned calories chosen) and impulsive choices (both impulsive vice share and impulsive calories chosen) as independent variables. We included the entire sample (i.e., participants who were allowed to impulsively order additional food as well as those who were not) in this analysis. Gender, hunger, and temporal distance between the planned choice and actual consumption moment were included as control variables. A dummy variable indicating whether participants were allowed to impulsively order food was added to the model to account for the experimental condition. No difference occurred in satisfaction with regard to the lunch—measured on a scale

from 1 (not at all satisfied) to 7 (very satisfied)—between those who did not waste food (M = 5.40) and those who wasted food (M = 5.17, p = .217).

Virtue Share of the Waste

In line with our theorizing, we find that with the planned virtue share, the share of virtue food waste increases (B = .16, t = 2.59, p = .010), consistent with H3a. Although the results are in the right direction, they do not support H4a: the share of virtue waste does not increase with a higher impulsive vice share (B = -.12, t = -1.05, p = .297). The dummy variable accounting for the impulsive ordering condition was marginally significant, indicating increased virtue waste for the participants who were offered additional food (B = 7.94, t = 1.71, p = .088).

Calorie Food Waste

The results also show that both the number of planned calories (B = .13, t = 5.51, p < .001) and the number of impulsive calories ordered (B = .16, t = 1.96, p = .052) increase the number of calories wasted. These results are in line with H3b and H4b, respectively. As expected, ordering more calories for both the planned order and impulsive consumption increases food waste.

The Interplay Between Planned Virtue and Impulsive Vice Choices

We additionally examined whether the effect of the impulsive vice share on virtue waste is magnified with a larger share of planned virtue food. We view food waste as a result of inconsistencies between planned and actual consumption, and research has demonstrated that consumers make more indulgent choices after making a prior virtuous, healthy choice (Read and van Leeuwen 1998; Weijzen et al. 2009). Since vice foods are preferred over virtuous foods at the time of consumption (Kirby and Herrnstein 1995; Kivetz and Simonson 2002; Read et al. 1999), we expect that when consumers initially made healthy choices—and thus have a high virtue share for planned consumption—but subsequently fail to resist acquiring tempting vice food at the time of consumption, the result should be increased virtue food waste. Likewise,

impulsively ordering calories could increase food waste even further when participants had already ordered a large number of calories for planned consumption.

Two linear regressions on share of virtue food waste and calorie food waste were performed, where we additionally considered the interactions between the planned virtue share and impulsive vice share and between the planned calories and impulsive calories ordered. We again included all participants—those who were allowed to impulsively order additional food and those who were not. Owing to high variance inflation factors for our interaction terms—they exceeded the often-used threshold of 10 to indicate multicollinearity (Mason and Perreault 1991)—we mean-centered all predictor variables before conducting this additional analysis. Compared with the analyses without interaction terms included, results for the main effects remain stable (Table 3.1).

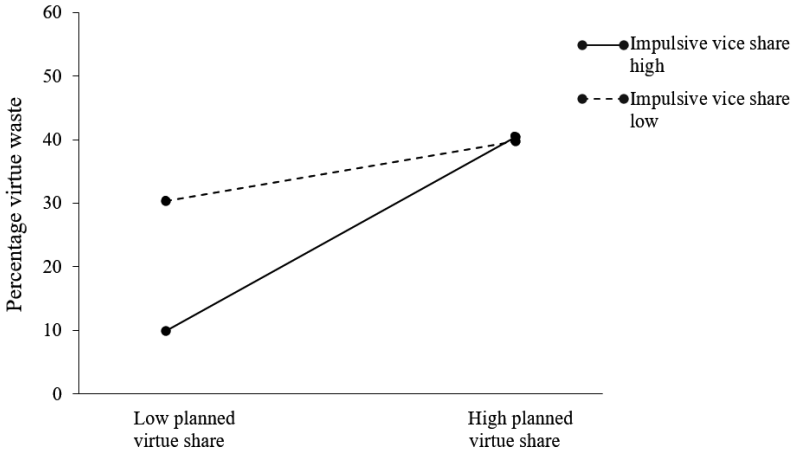
Virtue share of the waste

We find a positive and significant interaction between planned virtue share and impulsive vice share on share of virtue waste (B = .01, $t = 3.02$, $p = .003$), suggesting that the effect of a high vice share of the impulsive order on virtue waste increases with higher virtue shares of the planned order. Figure 3.3 shows the predicted share of virtue waste for a high (+1 SD) and low (-1 SD) virtue share of the planned order, and a high (+1 SD) and low (-1 SD) vice share of the impulsive order, with all of the other variables at their mean. Participants who planned to eat predominantly virtue food but then impulsively add vice food to their order end up with more virtue waste than participants who also impulsively add vice food to their order but had already planned to eat predominantly vice food (i.e., low virtue share). This indicates that the former group of participants decided to eat the vice food they impulsively added to their order and trash the virtue food they planned to eat, providing additional support for the predicted replacement of planned virtuous consumption with impulsive vice consumption.

Calorie Food Waste

We find no evidence that the effect of impulsively ordered calories on calorie waste increases with more planned calories ordered beforehand (B = -4.26, t = -.23, p = .815). We do find that a higher planned virtue share combined with a higher impulsive vice share results in more calories wasted (B = .01, t = 2.05, p = .042), indicating that substituting planned virtue consumption for impulsive vice consumption not only increases virtue waste but also leads to increased overall waste. Taken together, these results suggest that the composition of the food between planned virtue and impulsive vice items is a pivotal factor driving waste.

Figure 3.3 Study 2: Effect of a high (vs. low) planned virtue share combined with a high (vs. low) impulsive vice share on the share of virtue food waste



Notes: Low and high values reflect +/-1 SD from the mean. The virtue share of the waste lies below the average reported in the summary statistics because we assign a virtue share of 0 to participants who did not waste anything.

We conducted mediation analyses to examine whether the temporal distance (advance vs. immediate ordering) affects food waste (i.e., virtue share or calories) via the planned (i.e., virtue share or calories) and impulsive choices (i.e., vice share or calories) that consumers make.[4]

[4] We do not include the effects of the calories chosen in our mediation model on the virtue share of waste, and likewise do not include the virtue and vice shares of the choices in our mediation model on calorie waste, because inclusion of these covariates cannot be restricted to a specific equation of the model.

Table 3.1 Regression results for planned choices, impulsive choices, and food waste in Study 2

	Planned choices: virtue share (n=198)[a]	Planned choices: calories (n=198)[b]	Impulsive choices: vice share (n=103)[c]	Impulsive choices: calories (n=103)[d]	Food waste: virtue share (n=198)[e]	Food waste: virtue share incl. interactions (n=198)[f]	Food waste: calories (n=198)[g]	Food waste: calories incl. interactions (N=198)[h]
Constant	45.08 (9.16)***	422.52 (71.19)***	-15.68 (19.51)	26.72 (75.93)	-5.77 (9.05)	12.09 (8.22)	-60.96 (26.24)	29.42 (24.15)
Temporal distance	4.05 (4.72) (h1a)	-63.46 (36.65)* (h1b)	25.98 (8.31)***	75.77 (32.34)**	-4.08 (3.98)	-2.28 (3.96)	-9.68 (11.53)	-8.32 (11.62)
Planned choices: virtue share	-	-	.24 (.13)* (h2a)	.91 (.50)*	.16 (.06)** (h3a)	.15 (.06)** (h3a)	.22 (.18)	.21 (.18)
Planned choices: calories	-	-	-.01 (.02)	-.16 (.06)** (h2b)	.02 (.01)**	.02 (.01)***	.13 (.02)*** (h3b)	.13 (.02)*** (h3b)
Impulsive choices: vice share	-	-	-	-	-.12 (.11) (h4a)	-.21 (.12)* (h4a)	-.45 (.32)	-.49 (.34)
Impulsive choices: calories	-	-	-	-	.07 (.03)**	.08 (.03)***	.16 (.08)* (h4b)	.15 (.08)* (h4b)
INT: planned virtue share x impulsive vice share	-	-	-	-	-	.01 (.00)***	-	.01 (.01)**
INT: planned calories x impulsive calories	-	-	-	-	-	.0001 (.00)*	-	-4.26 (.00)
Control: impulse offered	-	-	-	-	7.94 (4.63)*	9.19 (4.57)**	16.09 (13.43)	16.82 (13.42)
Control: gender	-6.36(4.70)	109.90 (36.57)**	19.9 (8.5)**	72.04 (33.07)**	-11.49 (4.03)*	-11.30 (3.94)***	-25.88 (11.67)**	-25.03 (11.59)**
Control: hunger	-1.45 (1.73)	36.78 (13.42)**	3.17 (2.93)	22.59 (11.39)**	-.39 (1.45)	.05 (1.43)	1.99 (4.21)	2.54 (4.19)

Notes: *p <.1 **p <.05 ***p <.01
[a]df = 194; R^2 = .02 [b]df 194; R^2 = .10 [c]df = 97; R^2 = .16 [d]df = 97; R^2 = .2 [e]df = 189; R^2 = .2 [f]df = 187; R^2 =.24 [g]df = 189; R^2 = .21 [h]df = 187; R^2 = .23
Standard errors are in parentheses

Virtue Share of the Waste

We examined serial mediational (temporal distance → planned choices → impulsive choices → food waste) for virtue share of the waste for the participants who had the opportunity to impulsively choose additional food (n = 103). We conducted PROCESS model 6 (Hayes 2015; Preacher and Hayes 2004) with a bias-corrected 95% confidence interval based on 5,000 bootstraps. We find no evidence for serial mediation. Of the participants who did not have the opportunity to impulsively order additional food (n = 95), 98.9% did not waste any virtue food. We could therefore not investigate mediation for this part of our sample.

Calorie Food Waste

We examined the serial mediation for calorie food waste for participants who had the opportunity to impulsively choose additional food (n = 103). While we cannot confirm the entire serial mediational path (temporal distance → planned choices → impulsive choices → food waste), we find that the temporal distance between the planned order and the consumption moment affects calorie food waste via impulsive choices (temporal distance → impulsive calories chosen → food waste) at the 95% confidence interval (CI) (effect = 7.06; 95% CIs: .01; 23.94). Our mediation model therefore suggests that advance ordering leads to increased food waste because additional food is impulsively added to the order at the moment of consumption.

For participants who did not have the opportunity to impulsively order additional food (n = 95), we conducted PROCESS model 4 to investigate whether planned calories mediate the relationship between temporal distance and calorie food waste. We find a significant indirect effect of temporal distance on calorie food waste through the planned calories (effect = -12.06; 95% CIs: –39.7; -1.94). This result indicates that advance ordering decreases waste, but only if there is no opportunity to impulsively add extra food.

3.3.2.3 Discussion

Study 2 demonstrates that food waste occurs because of decisions made before and at the actual consumption moment. If consumers plan to eat healthily by choosing more virtue food and fewer calories, they are more likely to acquire additional (vice) food to satisfy their desire to indulge at the moment of consumption. As a result, they are more prone to waste the virtue food ordered in advance. Summing up, food waste arises because consumers replace the virtue food they planned to eat with impulsively acquired vice food at the actual moment of consumption.

In line with Study 1 and earlier findings in the literature, Study 2 provides additional evidence that advance ordering increases the healthiness of food choices (Milkman et al. 2010; VanEpps et al. 2016a). We extend previous literature by showing the effect of advance ordering on food waste. Importantly, Study 2 reveals that advance ordering to increase healthy consumption has food waste as a negative side effect if consumers are able to impulsively choose additional food at the moment of consumption. As the mediation analyses demonstrate, advance ordering can decrease waste, but only when there is no opportunity to impulsively add extra food.

To offer further corroborating evidence for impulsively replacing planned virtue food with vice food, and to research whether the hypothesized effects can be weakened or strengthened by highlighting the healthiness of food, in Study 3 we investigate the effects of nutritional labels that in the US are mandatory for many restaurants and retail food establishments on consumption and waste (Miller et al. 2016).

3.3.3 Study 3: The Impact of Nutritional Labeling on Waste

The basic premise of this research is that the importance of consumer health goals during the planning stage stimulates consumers to make food choices for out-of-home consumption

that do not match their desire to indulge at the actual moment of consumption. The results of Studies 1 and 2 confirm this premise. To further corroborate these findings, Study 3 aims to manipulate the salience of consumer long-term health goals with nutritional labels that are already mandatory for a large part of the out-of-home consumption sector in the US. We use the traffic light labeling system to make the health goal even more pronounced and research whether this labeling affects consumers' decision on what to consume and what to waste. Traffic light labels provide detailed information of a food's salt, fat, and sugar content, by means of a color scheme (i.e., red, orange, and green) and research has shown that the system improves consumers' ability to identify healthy products (Enax, Krajbich, and Weber 2016; Hawley et al. 2013; Roberto et al. 2012).

3.3.3.1 Design, Procedure, and Stimuli

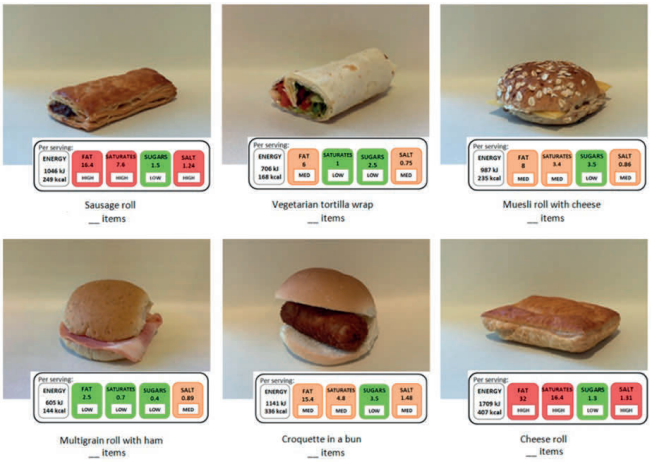
Study 3 employed a 2 (temporal distance: future vs. immediate consumption) x 2 (traffic light labels present vs. not) between-subjects design in which 287 students participated. The study design was similar to Study 2, except that all participants had the opportunity to order additional food at the moment of consumption. Traffic light labeling was also added to the order menu and to displays for the actual food options in the lunchroom for half of the sample. The nutritional information associated with the traffic light labels was derived from The Netherlands Nutrition Centre (2017) and included information concerning sugar, fat, saturated fat, and salt, and calories. The resulting labels were presented numerically (values per serving size), and the displayed colors were based on the guidance values from the Food Standards Agency (FSA) (2016). Calories were not color-coded, as the FSA offers no guidance. Labels of all six food items consisted of a mixture of colors, being dominantly green, orange, or red (see Figure 3.4). The virtue foods consisted of at least one and up to three green labels per item, whereas the vice items had one green label as a maximum and were predominantly red.

3.3.3.2 Results

Summary Statistics

Six participants were removed, as the calorie content of their orders exceeded three standard deviations from the sample mean. Thus, the final sample consisted of 281 students (59% male; M_{age} = 22.09). Of participants in the traffic light conditions, 80% indicated in the exit survey that they had noticed the labeling, suggesting a successful manipulation. Of all calories ordered, 5.37% were wasted, an average of 45.49 (SD = 105.81) calories per participant. Of the waste, 46.39% (SD = 47.88) consisted of virtue food.

Figure 3.4 Order menu for Study 3 with traffic lights



Planned Consumption Choices

As in Studies 1 and 2, we conducted two separate linear regressions with planned virtue share and planned calories as dependent variables. Temporal distance and the traffic light label dummy functioned as predictor variables, including their interaction. Gender and hunger were included as control variables. Table 2 presents the results.

In line with Study 1 and supporting H_1a, participants ordered a higher virtue share for future consumption compared with for immediate consumption (M_{future} = 44.55%, $M_{immediate}$ = 35.11%, B = 12.22, t = 2.32, p = .021; Figure 3.5a). Neither the main effect of the traffic lights

(B = 4.50, t = .81, p = .419) nor its interaction with temporal distance (B = -5.57, t = -.73, p = .467) significantly affected the share of virtue food selected.

In line with Studies 1 and 2 and H_1b, participants ordered fewer calories for future versus immediate consumption (B = -161.50, t = -3.87, p = <.001). However, this main effect is qualified by a significant interaction between the temporal distance and traffic light labeling, indicating that traffic light labels dampen the effect of advance ordering on planned choices (B = 157.69, t = 2.61, p = .010). As Figure 3.5b shows, participants choose about the same number of calories for future versus immediate consumption when traffic light labels are shown.

We conducted an additional 2 (temporal distance: future vs. immediate consumption) x 2 (traffic light labels present vs. not) ANCOVA. Planned contrasts show that advance ordering affects the virtue share of the order only if traffic lights are not shown. The heightened virtue share for advance ordering is driven solely by participants not confronted with traffic lights ($M_{\text{immediate, no traffic lights}}$ = 32.86%; $M_{\text{future, no traffic lights}}$ = 45.08%, F(1, 275) = 5.36, p = .021; Figure 3.5a). Planned contrasts also reveal that ordering in advance as a strategy for making healthier choices seems less effective when traffic light labels are present. Participants in the advance-ordering condition with traffic lights ordered more calories than participants not confronted with traffic lights ($M_{\text{future, no traffic lights}}$ = 543.33 kcal; $M_{\text{future, traffic lights}}$ = 633.72 kcal, F(1, 275) = 4.55, p = .034; Figure 3.5b). Traffic light labels suppress the positive effect of advance ordering for healthier food choices.

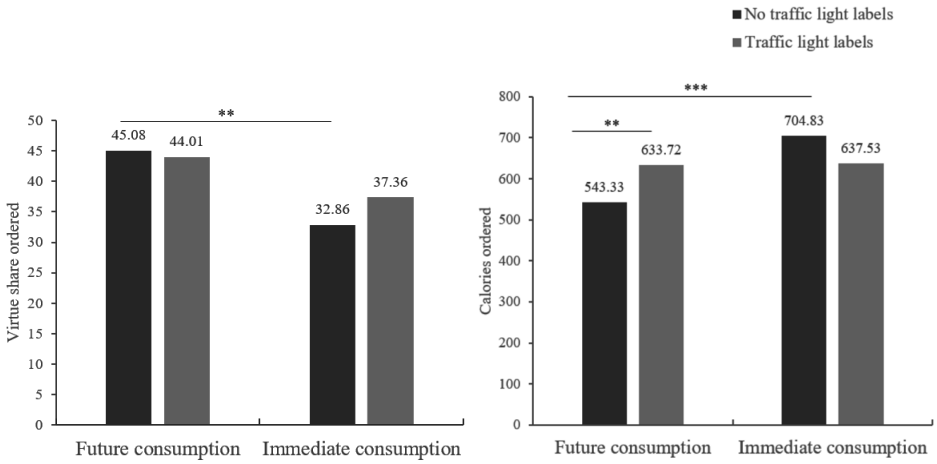
Impulsive Consumption Choices

We conducted two linear regressions to predict the impulsive vice share and the number of impulsively chosen calories, using the planned virtue share, planned calories, and the traffic light label dummy as predictor variables. Gender, hunger, and temporal distance functioned as control variables. While traffic light labels reduce the vice share of the impulsive order (B= -9.69, t = -1.95, p = .052), they do not affect the number of impulsive calories chosen (B = 2.28,

t = .11, p = .911). These results demonstrate that although traffic light labels do not affect the number of calories ordered impulsively, they do steer participants toward more virtuous choices.

Deviating from Study 2 and H_2a, the planned virtue share has no significant effect on the vice share ordered impulsively (B = -.03, t = -.30, p = .765). However, in line with H_2b and Study 2, the more calories the planned order contained, the fewer calories were impulsively chosen at the moment of consumption (B = -.11, t = -2.45, p = .015).

Figure 3.5 Study 3: Planned consumption decisions: traffic light labels suppress effects of ordering in advance



A. Virtue share ordered **B. Calories ordered**

Food Waste

We conducted two separate linear regressions with share of virtue food waste and calorie food waste as dependent variables. Planned virtue share, impulsive vice share, and calories ordered (both planned and impulsive) functioned as predictor variables. Gender, hunger, temporal distance, and the traffic light dummy were included as control variables.

Virtue Share of the Waste

The virtue share of the planned choice significantly influences the virtue share of food waste (B = .17, t = 2.54, p = .012), which is consistent with Study 2 and in support of H3a. Similar to Study 2, the vice share of the impulsive choice does not increase the share of the virtue waste (B = -.04, t = -.52, p = .606).

Calorie Food Waste

The number of calories wasted increases with the number of calories of the planned choice (B = .13, t = 4.60, p < .001), and with the number of calories ordered impulsively (B = .17, t = 2.47, p = .014), which is consistent with Study 2 and in support of H3b and H4b.

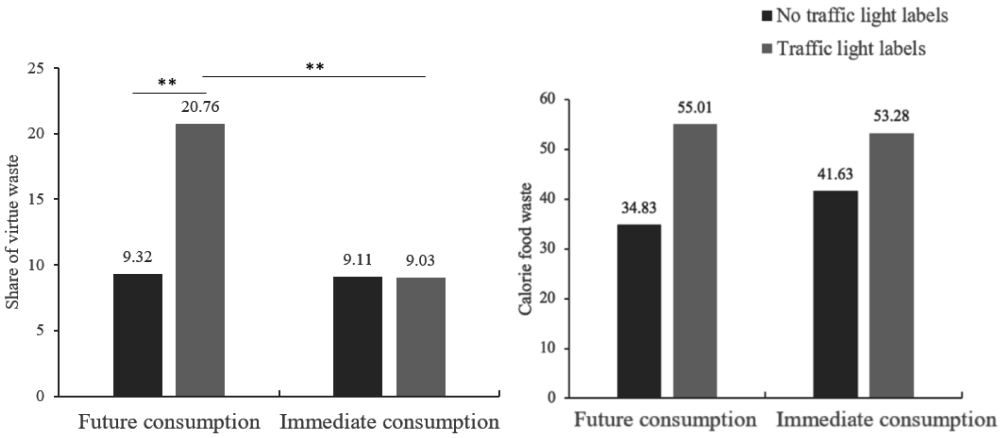
Figure 3.6 depicts the waste per experimental condition. Participants who were confronted with traffic light labels and those who ordered in advance waste a significantly higher share of virtue food ($M_{\text{future, traffic lights}}$ = 20.76%; $M_{\text{future, no traffic lights}}$ = 9.32%, F(1, 271) = 4.57, p = .034; Figure 3.6a) than participants in the other three conditions. For calories wasted, we find no significant differences between the experimental conditions. While we find no main effects of traffic lights on waste, with the help of our conceptual framework we can explain the relatively stronger occurrence of virtue waste for the respondents who ordered in advance and saw traffic lights. Respondents who ordered for future consumption and were provided with traffic lights ordered relatively more calories in their initial choice, and then ordered relatively more virtue food when impulsively ordering additional food. Therefore, these participants ended up with a large order with a lot of virtue food, which translates to a higher share of virtue waste. While the provision of traffic lights neither significantly increases nor decreases waste, it does affect its composition.

The Interplay Between Planned Virtue and Impulsive Vice Choices

As with Study 2, we performed two linear regressions on share of virtue waste and calorie food waste, where we additionally considered the interactions between the planned

virtue share and impulsive vice share and between the calories of the planned and impulsive choice. We mean-centered all predictor variables before conducting this additional analysis. Compared with the analyses without interaction terms, the results for the main effects remain stable (see Table 3.2).

Figure 3.6 Study 3: Effect of traffic light labels and order moment on food waste



A. Virtue share wasted **B. Calories wasted**

Notes: the virtue share of the waste visualized in Figure 3.6 lies below the average reported in the summary statistics because we assign a virtue share of 0 to participants who did not waste anything.

Virtue Share of the Waste

Participants who planned a high share of virtue food and subsequently engage in impulsive vice consumption waste a higher share of virtue food (B = .003, t = 1.68, p = .095). This result replicates the effects found in Study 2 and offers further corroborating evidence for the substitution mechanism of impulsively replacing planned virtue food for vice food.

Calorie Food Waste

We find that the effect of impulsively ordered calories on calorie waste increases with the ordering of more planned calories (B= .0005, t = 2.57, p = .011). Moreover, in support of the proposed substitution mechanism, we find that apart from a higher virtue share wasted, more calories in total are wasted if the planned order consists of a lot of virtue food (i.e., high virtue

share) and the impulsive order consists of a lot of vice food (i.e., high vice share) (B=.01, t = 2.03, p = .044). In line with Study 2, the composition of the food ordered (i.e., vice vs. virtue) is a strong driver of food waste.

Taken together, our studies demonstrate that the interplay between planned and impulsive consumption decisions forms an important driver of food waste. Initially focusing on long-term health goals and choosing a high virtue share for planned consumption but subsequently engaging in impulsive vice consumption increases the virtue share of waste and the total amount of waste. Traffic light labels dampen impulsive vice choices at the moment of consumption. While they neither significantly increase nor decrease food waste, they do influence the composition of waste by steering respondents toward more virtuous choices.

Table 3.2 Regression results for planned choices, impulsive choices, and food waste in Study 3

	Planned choices: virtue share (n=281)[a]	Planned choices: calories (n=281)[b]	Impulsive choices: vice share (n=281)[c]	Impulsive choices: calories (n=281)[d]	Food waste: virtue share (n=281)[e]	Food waste: virtue share + interactions (n=281)[f]	Food waste: calories (n=281)[g]	Food waste: calories + interactions (N=281)[h]
Constant	44.82 (8.40)**	478.58 (66.49)***	23.71 (13.15)*	136.69 (53.64)	-15.46 (10.00)	11.91 (8.68)	-18.89 (32.80)**	84.77 (28.23)**
Temporal distance	12.22 (5.28)** (h1a)	-161.50 (41.79) (h1b)	25.00 (5.09)***	94.26 (20.75)***	5.68 (3.99)	5.64 (4.00)	-2.71 (13.08)	-4.53 (13.01)
Traffic-lights (TL) dummy	4.50 (5.55)	-67.30 (43.96)	-9.69 (4.97)*	2.28 (20.26)	5.73 (3.82)	5.21 (3.86)	15.99 (12.54)	11.71 (12.55)
Planned choices: virtue share	-	-	-.03 (.09) (h2a)	-.31 (.36)	.17 (.07) (h3a)**	.19 (.07) (h3a)**	.17 (.22)	.30 (.22)
Planned choices: calories			-.02 (.01)*	-.11 (.05)** (h2b)	.03 (.01)***	.03 (.01)***	.13 (.03)*** (h3b)	.15 (.03)*** (h3b)
Impulsive choices: vice share	-	-	-	-	-.04 (.08) (h4a)	-.03 (.01) (h4a)	-.23 (.27)	-.19 (.27)
Impulsive choices: calories	-	-	-	-	.02 (.02)	.02 (.02)	.17 (.07)** (h4b)	.17 (.07)** (h4b)
INT: traffic lights x temporal distance	-5.57 (7.64)	157.69 (60.49)**	-	-	-	-	-	-
INT: planned virtue share x impulsive vice share	-	-	-	-	-	.003 (.002)*	-	.01 (.01)**
INT: planned calories x impulsive calories	-	-	-	-	-	.00 (.00)	-	.0005 (.00)**
Control: gender	-10.00 (3.90)**	186.13 (30.86)**	15.46 (5.34)***	46.71 (21.83)**	-5.83 (4.08)	-5.92 (4.08)	-34.03 (13.39)**	-34.11 (13.27)**
Control: hunger	-1.34 (1.41)	25.73 (11.13)**	-.27 (2.00)	-2.03 (8.16)	-.36 (1.50)	-.31 (1.50)	-4.14 (4.93)	-3.88 (4.88)

Notes: *p <.1 **p <.05 ***p <.01

[a]df = 275; R^2 = .06 [b]df = 275; R^2 = .2 [c]df = 274; R^2 = .14 [d]df = 274; R^2 = .11 [e]df = 272; R^2 = .07 [f]df = 270; R^2 = .08 [g]df = 272; R^2 = .11 [h]df = 270; R^2 = .14

Standard errors are in parentheses

Moderated Mediation

As in Study 2, we examine whether temporal distance affects waste via the planned and impulsive orders, additionally allowing for traffic light labels as a moderator (model 7, Hayes 2012). The focal mediators are planned and impulsive choices, the focal predictor is temporal distance (future vs. immediate), the moderator is traffic lights (yes vs. no), and hunger and gender were included as covariates.[5] We can replicate the results of Study 2, but we do not find evidence (index of moderated mediation; Hayes 2015) that the mediation is significantly moderated by the traffic light labels (90% CIs: -6.52; 9.97).

3.3.3.3 Discussion

Study 3 replicates the majority of the results of Study 2 and additionally reveals that making consumers' health goals more salient by adding traffic light labels to food choices diminishes the effect of temporal distance, as advance ordering no longer results in a higher virtue share or fewer calories chosen. The presence of traffic light labels even negatively influences the healthiness of future consumption decisions, as consumers choose more calories than when no labels are shown.

These results are not in line with the results of VanEpps et al. (2016b), who find that providing labels on an online lunch ordering menu reduces the calories chosen by 10%. However, VanEpps et al. (2016b) do not clarify the time frame in which respondents ordered their lunch. Directionally (but not significantly), we also find a reduction in calories chosen when traffic lights are provided and respondents order for immediate consumption, which is in line with the findings of VanEpps et al. (2016b). Therefore, we speculate that the temporal

[5] In line with Study 2, we omitted the calories ordered (planned and impulsive) in the model on virtue share food waste, while the virtue and vice shares were omitted in the model on calorie waste. Consistent with Study 2, we do not find either a direct effect or any indirect effects on the virtue share of food waste when considering the virtue and vice shares as mediators. For calorie food waste, an analysis with a bias-corrected, 95% confidence interval based on 5,000 bootstraps reveals that the effect of temporal distance on food waste is mediated through calories ordered via impulsive choices (temporal distance → impulsive calories chosen → food waste), both for participants not confronted with traffic light labels (effect = 11.53, 90% CIs: 3.59; 22.19)—which is consistent with Study 2—and for participants confronted with the traffic light labels (effect = 12.55, 90% CIs: 3.83; 25.06).

distance between order and consumption moment matters when it comes to the effectiveness of traffic lights. The results of our study suggest that providing consumers with traffic light labels to steer them toward making healthier choices may not be recommended for advance-ordering situations with some temporal distance between ordering and consuming. It might be that the presence of the traffic lights in this situation triggers the "healthy is less filling" paradox: consumers ordered larger amounts of food when it was portrayed as more healthy versus less healthy, a pattern that emerged even after adding caloric information for the food items used in the research (Suher, Raghunathan, and Hoyer 2016).

As expected, owing to the salience of health goals at the moment of consumption, consumers seem more resilient and less inclined to give in to their desire to indulge. Our results show that when food is impulsively offered, traffic light labels steer consumers toward making healthier virtue choices. However, although fewer vice foods are chosen, the presence of traffic lights does not decrease the number of calories chosen. Traffic lights seem to be a tool particularly suited to steering consumers to more healthy decisions for immediate consumption and are less likely to have the desired effect when the moment of consumption lies in the future.

Regarding waste, the virtue share of food waste is higher for participants who ordered in advance and were confronted with traffic light labels compared to all other participants. These participants seemingly overestimated their virtue food intake and ended up with relatively many virtue calories, translating into a high share of virtue waste. However, no significant differences occurred in the amount of food wasted. Therefore, while according to our results traffic lights are not suited to preventing food waste, they can surely affect the waste composition.

3.4 Discussion

One-third of all edible food ends up wasted (Gustavsson et al. 2011). The fast-growing out-of-home consumption sector is responsible for a relatively large amount of waste and is the context for our study. The ubiquity of smartphones and mobile devices allows the out-of-home sector to increasingly introduce pre-ordering to cater to consumers' busy lifestyles (Gould 2017; Wong 2014). At the same time, the obesity epidemic forces the sector to steer customers toward more healthy choices by providing nutritional labeling (Stites et al. 2015; VanEpps, Roberto et al. 2016). Our investigation breaks new ground by examining how these measures affect not only what consumers choose but also what they waste. Table 3 provides an overview of our hypotheses and results from our studies.

This research generates valuable insights that contribute to tackling the issue of food waste in the out-of-home consumption sector. We propose that food waste arises from a discrepancy between planned and actual food consumption and suggest temporal distance as a key driver of this mismatch. In three studies, we demonstrate that making healthy choices in advance can have negative implications for food waste. We therefore not only focus on the quantity of food as a driver of food waste, meaning ordering too many calories; we find that the composition of the food in terms of virtue versus vice food is a pivotal factor driving waste.

Table 3.3 Overview of hypotheses

	Hypothesis	Study 1	Study 2	Study 3
H_1a	The healthiness of food choices is higher	Confirmed**	Not confirmed	Confirmed**
H_1b	when choosing for future vs. immediate consumption, in terms of (a) a higher virtue share and (b) fewer calories.	Confirmed**	Confirmed*	Confirmed*** Traffic lights lead to more calories chosen for future consumption**
H_2a	The healthier the planned choice in terms of more virtue food, the higher the vice share of the food chosen impulsively.	-	Confirmed*	Not confirmed Traffic lights dampen impulsively ordering vice food*

H_2b	The healthier the planned choice in terms of fewer calories, the more calories are chosen impulsively.	-	Confirmed**	Confirmed**
H_3a	With a higher planned virtue share, the share of virtue waste increases.	-	Confirmed**	Confirmed**
H_3b	With the number of planned calories chosen, the number of calories wasted increases.	-	Confirmed***	Confirmed***
H_4a	With a higher impulsive vice share, the share of virtue waste increases.	-	Not confirmed	Not confirmed
H_4b	With the number of impulsive calories chosen, the number of calories wasted increases.	-	Confirmed*	Confirmed**
Additional findings: The interplay between planned and impulsive choices				
	The effect of vice share of the *impulsive* order on virtue waste increases with virtue shares of the *planned* order.	-	Confirmed***	Confirmed*
	The effect of *impulsively* ordered calories on calorie waste increases with *planned* calories ordered	-	Not confirmed	Confirmed**

Notes: *$p < .1$ **$p < .05$ ***$p < .01$

In Study 1, we demonstrate that consumers choose a higher virtue share and fewer calories for planned consumption when ordering in advance. In Study 2, we reveal that consumers are more likely to engage in impulsive (vice) consumption when they have initially chosen a high virtue share and fewer calories. As a consequence, replacing planned virtue food with impulsively chosen vice food turns out to be a main cause of food waste. Moreover, our mediation analyses reveal that advance ordering increases food waste when consumers have the opportunity to behave impulsively. We corroborate these findings in Study 3. In addition, Study 3 demonstrates that nutritional labeling influences both choices and waste. Traffic light labeling leads to more calories ordered for future consumption, but also dampens impulsive vice choices at the moment of consumption itself and steers participants toward more virtuous choices. As a result, consumers end up with a relatively large order consisting of many virtue items and a relatively high share of virtue waste, although calories wasted do not significantly differ. Traffic light labeling therefore seems to particularly affect the composition of the waste and to a lesser extent the amount wasted.

3.4.1 Theoretical Contributions

Our research includes all three pillars of consumer behavior—acquisition, consumption, and disposal. Disposal has been relatively under-studied in the consumer literature, and our results offer novel theoretical contributions in this domain of consumer food waste. Throwing away edible food often happens unintentionally, as a consequence of interrelated, erroneous consumption decisions (Block et al. 2016). With the present research we offer a fundamental understanding of how these inconsistent consumption decisions contribute to consumer food waste. To the best of our knowledge, this study is the first to empirically investigate how unconscious behavior steers consumers toward waste food.

3.4.1.1 Food Waste

Research on consumer food waste is rather limited and has only recently begun to focus on the theoretical explanations behind food waste, and the few studies that take a more theoretical approach to explain food waste have predominantly used the theory of planned behavior (Graham-Rowe et al. 2015; Stancu et al. 2016; Stefan et al. 2013; Visschers et al. 2016). We expand our understanding by offering theoretical and empirical evidence regarding the unconscious influences driving food waste behavior. Building on construal level theory, we stress the importance of temporal distance between consumption decisions as appearing central to explaining the topic of consumer food waste.

3.4.1.2 Temporal Distance

Besides corroborating the findings of past work that has demonstrated that consumers make healthier choices for future consumption, we extend the influence of temporal distance on planned consumption choices to impulsive consumption decisions and food waste. Our second and third studies demonstrate that the desire to indulge at the moment of consumption leads consumers to replace pre-planned healthy virtue food with less healthy vice food. While advance ordering leads to healthier choices, these choices lead to unhealthy impulsive choices at the

moment of consumption, resulting in a surplus of food and therewith waste. While recent literature advises making decisions in advance to stimulate healthy choices (Milkman et al. 2010; VanEpps et al. 2016a), we caution that this practice may generate food waste as a negative side effect when a later opportunity arises to impulsively acquire food. Advance ordering leads to both healthier food choices and less waste only when no opportunity emerges to acquire additional food at the moment of consumption.

3.4.1.3 Nutritional Labeling

Evidence on the effects of nutritional labeling is mixed (Hoefkens et al. 2012, VanEpps, Roberto et al. 2016). When a small delay occurred between the order and consumption moment, our results are directionally (but not significantly) in line with results obtained by VanEpps et al. (2016b), who found a reduction in calories selected when traffic lights appeared on an advance order menu. For a longer delay between order and consumption moment, we find that nutritional labeling leads consumers to choose more calories, potentially because labeling triggers the "healthy is less filling" paradox (Suher et al. 2016). Interestingly, traffic light labels seem to overrule the effect of temporal distance on food choices. Consumers no longer choose a higher virtue share or fewer calories in advance, suggesting that traffic light labels do not support making healthier choices when ordering food for a future moment in time.

However, traffic light labels do encourage consumers to make healthier impulsive choices at the consumption moment, a finding in line with previous findings on point-of-purchase decisions (Ellison, Lusk, and Davis 2013). As a result, in our study participants who ordered in advance and saw traffic lights ended up with a relatively large order consisting of a lot of virtue food that then translated to a relatively high share of virtue waste. Yet, the number of calories wasted was not significantly higher, implying that traffic light labeling particularly affects the *composition* of waste. To conclude, we are the first to offer preliminary insights on the effect of a health intervention on consumer food waste.

3.4.2 Practical Implications

Even though food waste commonly occurs for reasons consumers might not be consciously aware of, we may still be able to influence this behavior. Impulsive choice behavior appears to be a major driver of food waste when consumers initially anticipate consuming a healthy, virtuous meal. However, many situations in daily life provide opportunities for impulsively acquiring additional food—for instance, in the grocery store right before dinner, in the workplace canteen before lunch, through vending machines, or at the gas station. Engaging in impulsive consumption behavior when having initially intended to consume a healthy meal not only causes food waste, it increases unhealthy consumption at the same time. A recommended strategy for avoiding impulsive consumption is avoiding tempting stimuli whenever possible when there are pre-committed consumption plans (Hoch and Loewenstein 1991), and we suggest that this strategy is also suited to reducing food waste. Aiming to reduce waste by avoiding impulsive consumption could be viewed as an additional self-regulatory objective in the food domain (Conrad et al. 2018). Moreover, sticking to planned consumption and avoiding acquiring additional food presents an opportunity to avoid unnecessary expenditure (Stancu et al. 2016), thus functioning as an additional rationale to circumvent impulsive choice behavior.

Alternatively, addressing both health goals and the need to indulge oneself while making planned consumption decisions could prevent impulsive choice behavior at a later moment in time (Dhar and Simonson 1999; Simonson 1989). According to Liu et al. (2005), including both virtue and vice food in a meal allows pursuit of both health and indulgence goals within a single choice and is considerably effective at addressing the taste goal. The authors find that adding a small proportion of vice is considerably effective at addressing the taste goal. As such, when making planned consumption decisions, we suggest that including a minor proportion of vice food could satisfy the desire to indulge at the moment of consumption,

decreasing the need to acquire additional vice food. Consequently, planned consumption becomes actual consumption, and food waste reduces.

Our results also have important implications for the growing out-of-home consumption sector. We show that pre-ordering with a time lag between order and consumption moment fosters healthy choices and prevents waste, but only if consumers do not impulsively add unhealthy items to their order. This finding introduces a dilemma for this sector. Making it easy for consumers to change their order is an attractive strategy for more sales, but it leads to more waste. Restaurants and other food establishments should therefore be cognizant of this dilemma when introducing pre-ordering and design their strategy according to the goal they prioritize. In our research, we find that the participants are equally satisfied with the meal regardless of whether they had the opportunity to impulsively add extra items to their meal, which is an encouraging result for parties who wish to discourage impulsive changes to an order to prevent not only extra calorie consumption but also waste.

Our results also have implications for public policy makers considering the introduction of nutritional labeling, such as traffic lights, for meals consumed out of home. According to our results, traffic lights are particularly suited to steering consumers to more healthy decisions for immediate consumption and have fewer desirable effects when a temporal delay occurs between order and consumption moment. Hence, managers of, for example, health care institutions who strive to let their clients make healthier choices should either adopt pre-ordering with a temporal delay between order and consumption or place nutritional labeling on their menus, but not implement both at the same time.

Finally, managers should be aware of potential effects of nutritional labeling on waste. Although being confronted with traffic lights when choosing food in advance did not significantly increase the number of calories wasted in our study, it did increase the share of virtue waste and therewith affects the *composition* of waste.

3.4.3 Future Research and Limitations

Our work suggests several interesting avenues for future research. First and foremost, our theoretical framework, which we test in the out-of-home consumption sector, is more widely applicable and can be extended to the context of supermarket purchases with an often large temporal distance between purchase and consumption. Applying our conceptual model to such a longitudinal research setting—for instance, by tracking consumers' weekly or monthly cycle of acquiring, consuming, and wasting food—would constitute an interesting avenue for research, and could reveal the harm of substituting planned virtue food for impulsively chosen vice food.

Second, a relevant investigation would be the role of health interventions and nutritional labeling on food waste. Although we found traffic lights to affect only the composition and not the amount of waste, we believe that focusing on a healthy lifestyle accompanies shifts in the way consumers acquire, consume, and eventually waste food. Therefore, public policy measures aimed at widely introducing nutritional labeling also need to be cognizant of generating waste as a potential negative side effect. Future work on this topic could constitute an important contribution to the literature.

Some limitations are worth noting. First, the food was offered for free in our experiments, which might have encouraged over-ordering, over-consumption, or food waste. However, this set-up was necessary to keep participants in a relatively closed system in which choices could be observed and manipulations controlled. Future studies could manipulate costs or conduct a similar experiment in which participants pay for their lunch.

Moreover, the vice foods consisted of heated items (e.g., sausage roll) and those products are often preferred for consumption when still warm. This may have caused a preference in the order of eating (i.e., the heated vice foods first, the virtue foods afterwards) and could possibly have led to an increase in virtue food waste. Future research could control

for this by offering either vice and virtue food items that are both preferred for consumption without heating, or vice and virtue food items that are both preferred for consumption while heated.

Third, the experiments were conducted among students of a European university, and the findings may not be generalizable to all settings. Cultural differences with regard to food consumption and disposal may apply (Parfitt et al. 2010). Moreover, we studied individual consumer choices and their consumption and food waste in a group setting. The presence and behavior of others might have affected individuals' choices (De Castro and Brewer 1992; Herman, Roth, and Polivy 2003; Hock and Bagchi 2017). Nevertheless, as food consumption often takes place in a social setting, both at home and at work, the set-up of the current research can be considered a relevant setting.

Lastly, we did not offer to wrap up any leftovers for possible later consumption, which would have potentially altered our results and also raises the question of whether taking home leftovers is a good strategy to reduce food waste, as previous research indicates that leftovers often remain uneaten (Farr-Wharton, Foth, and Choi 2014). Future research could make an effort to study this aspect in more detail. In all, our research is a first step in uncovering the behavioral mechanisms that lead to food waste. However, more research is needed, given the detrimental societal and environmental effects of wasting food.

Chapter 4 | Easy Eating: Reducing Food Waste Conveniently

Abstract

Consumers waste a quarter of the food they purchase, indicating a change in preferences between the moment of purchase and actual consumption. Building on construal level theory, the authors argue that when thinking of their future meals, consumers focus on desirable features such as a home-cooked dinner prepared from scratch. Consequently, consumers purchase raw, unprocessed foods. However, right before consumption, time constraints may make from-scratch preparation infeasible, leaving the unprocessed foods unprepared and ultimately wasted. Due to decreased time and effort needed, the authors propose minimally processed convenience foods such as pre-sliced vegetables as a solution. Four studies confirm that the time elapsed between food purchase and consumption reduces consumers' inclination to make use of these convenient substitutes. However, the results also confirm that convenient substitutes can decrease food waste by up to 65%. We recommend that food manufacturers and retailers invest in minimally processed convenience food and highlight feasibility considerations in-store to not only reduce food waste, but also prevent consumers from squandering money on unconsumed food—contributing to a better world.

Keywords: food waste, convenience food, construal level theory, temporal distance, desirability, feasibility

This chapter is based on Drijfhout, M., van Doorn, J., and van Ittersum, K (2019), "Easy Eating: Reducing Food Waste Conveniently", currently being revised for the Journal of Marketing

4.1 Introduction

"Imagine walking out of a grocery store with four bags of groceries, dropping one in the parking lot, and just not bothering to pick it up. That is essentially what we are doing."

This quote from the food waste documentary *Just Eat It* (2014) illustrates the careless attitude consumers have toward wasting food. One-third of all food suitable for human consumption ends up wasted each year, and the carbon footprint of food waste actually ranks third globally (Gustavsson, Cederberg, and Sonesson 2011). Consumers are the single biggest producers of food waste (Beretta et al. 2013; Parfitt, Barthel, and Macnaughton 2010). In the US, households waste around 25% of all their purchased food at a cost of $28–$33 per person per month (Buzby, Wells, and Hyman 2014; NRDC 2017; USDA ERS 2012). Fresh vegetables, fruit, and potatoes have a relatively large share among the food categories that are prone to become wasted (De Laurentiis, Corrado, and Sala 2018; WRAP 2012), with some studies reporting that up to 60% of the food wasted is generated by these categories (Vanham et al. 2015). Given malnutrition in developing countries—even in the US, as approximately 12 to 15% of US households face food insecurity (USDA ERS 2017)—and taking into account the increasing world population and thus increased demand for food, the United Nations (2016) declared the reduction of consumer food waste a global top priority.

Yet, insights from the marketing and consumer behavior literature on what causes food waste, and how it can be mitigated, are scarce (Block et al. 2016). While previous literature has shown that marketing measures can curb food waste by, for instance, making ugly produce more attractive (De Hooge et al. 2017; Grewal et al. 2019), insights are lacking on how to improve purchasing decisions, which are responsible for around 50% of household food waste (Setti et al. 2018; Moskalev 2013).

Building on construal level theory (Hamilton 2014; Liberman and Trope 1998; Trope and Liberman 2010), we approach food waste as arising from a discrepancy between

consumers' planned consumption at the point of purchase, for instance in the grocery store, and their actual consumption, and we attribute this discrepancy to the temporal distance between the two moments. We pose that at the time of purchase, consumers focus on desirable features of their meals, such as demonstrating they are a good provider for the family (Evans 2011; Graham-Rowe, Jessop, and Sparks 2014; Porpino, Wansink, and Parente 2015) or simply increasing the value of the meal by putting effort into the preparation (Festinger 1962). Consumers therefore aspire to prepare a home-cooked meal made with effort, for instance with food that has to be prepared from scratch—which we refer to as unprocessed foods. However, at the time of purchase consumers largely ignore the viability of actually preparing the meal from scratch. Subsequently, at the moment of preparation, consumers may be confronted with feasibility constraints, such as busy lifestyles that restrict time and effort. The likelihood of preparing the purchased unprocessed food then decreases and the propensity to waste it increases.

We propose that the availability of more convenient substitutes for unprocessed foods can decrease the mismatch between what is purchased and what is actually prepared and consumed, thereby reducing food waste. We define convenience food as food that is packaged in such a way that, both mentally and physically, it reduces consumers' time, energy, and effort in preparing the food for consumption (Brunner, van der Horst, and Siegrist 2010; Buckley, Cowan, and McCarthy 2007; Candel 2001; Grunert 2003). We focus on minimally processed foods[6] that are fresh, convenient substitutes for their unprocessed counterparts, such as washed and pre-cut potatoes versus whole potatoes, and pre-sliced mushrooms versus whole mushrooms. These types of products presently enjoy growing popularity (Ali et al. 2018;

[6] Ready-to-eat meals are another type of convenience product (Daniels and Glorieux 2015; Halkier 2013; Rogus 2018), often highly processed and high in saturated fat and sugar (Costa et al. 2007; Evans 2012). These products are not the focus of this paper.

Brunner 2013; Sillani and Nassivera 2015; UFPA 2015). In the remainder of this paper, reference to convenience products is to minimally processed foods that can be used for preparing a meal.

This research contributes to the literature by advancing the theoretical understanding of how and why food waste occurs, a very relevant yet under-researched phenomenon. In four studies, including a household field study collecting actual waste, we demonstrate that consumers indeed have a higher preference for unprocessed food when purchasing foods for the more distant versus near future. However, unprocessed food is also more likely to be wasted than minimally processed substitutes. Furthermore, we show that when consumers are choosing groceries for future meals, evoking a feasibility mindset encourages selection of more convenience foods. Aside from reducing food waste, minimally processed foods are likely to improve consumer well-being by preventing consumers from squandering money on unconsumed food—contributing to a better world.

As a next step, we present our conceptual model and outline our hypotheses. We then describe four studies that provide empirical support for the proposed theoretical framework. Finally, we discuss implications for manufacturers, retailers, and public policy makers and offer suggestions for further research.

4.2 Theoretical Framework

Consumers are the single biggest producers of food waste in industrialized countries (Beretta et al. 2013; Parfitt et al. 2010). Previous literature pinpoints the decisions made at the grocery store as the most critical stage of the consumer food-waste cycle, attributing around 50% of household food waste to poor purchasing decisions (Setti et al. 2018; Moskalev 2013). Various marketing practices have been blamed for causing food waste by encouraging over-purchasing, such as “buy one—get one free” promotion strategies for perishable foods (Cox and Downing 2007; Schweitzer et al. 2018). Moreover, when shopping for groceries consumers

often buy impulsively (Parfitt et al. 2010) and lack clear plans for meals (Evans 2011; Stefan et al. 2013), eventually contributing to waste. We propose that making food preparation more convenient and decreasing meal preparation time may be a marketing measure with the potential to reduce food waste (Buckley et al. 2007; Evans 2011).

4.2.1 Desirability versus Feasibility and the Choice for Convenience Food

Many consumer decisions concern relatively distant rather than immediate consumption. For example, while at the grocery store, shoppers purchase the food they plan to consume at home later in the week (Gilbert, Gill, and Wilson 2002; Hamilton 2014; Laran 2009). According to construal level theory (Liberman, Sagristano, and Trope 2002; Liberman and Trope 1998; Trope and Liberman 2010), such a future consumption moment is mentally construed on a higher, more abstract level, as consumers focus on the desirable end state, or the desirable features, of the event. In the case of a future meal, to achieve a desirable end state and increase the value of the meal, consumers put effort into the preparation (Festinger 1962), such as by displaying their cooking competences (Franke, Schreier, and Kaiser 2010) or by demonstrating being a good provider for the family (Evans 2011; Graham-Rowe et al. 2014; Porpino et al. 2015).

Unprocessed foods, which have to be prepared from scratch, support this desired end state, as consumers can put effort in meal preparation and display their cooking competences (cf. Evans 2012; Moisio, Arnould, and Price 2004). Importantly, research reveals that feelings of guilt and regret, along with the perception of neglecting one's duties such as preparing proper meals for the family, make consumers reluctant to purchase convenience foods (Carrigan, Szmigin, and Leek 2006; Costa et al. 2007; Olsen, Sijtsema, and Hall 2010) and cause them to prefer raw, unprocessed foods instead. Participants in one study framed the use of convenience food as "cheating" (Moisio et al. 2004). In sum, when selecting groceries for a meal in the

distant future, the consumer's focus is mainly on the desirable features of this meal, and consumers are expected to prefer unprocessed foods that need to be prepared from scratch.

However, consumer preferences are likely to change between the moment of purchasing groceries and the moment of food preparation and consumption. Events in the near future are construed on a lower, more concrete level, where consumers are more concerned with feasibility considerations (Hamilton 2014; Trope and Liberman 2010). At the moment of meal preparation and consumption, consumers more strongly consider the time needed and the ease and effort of preparing the meal. As a result, we expect consumers to prefer convenient substitutes of unprocessed food, such as pre-sliced vegetables, for meals that are to be consumed in the immediate future, as these foods require less time, energy, and effort to prepare (Brunner et al. 2010; Buckley et al. 2007; Candel 2001; Darian and Cohen 1995).

In sum, when shopping for groceries for meal preparation in the distant future, consumers prefer raw, unprocessed foods that require more time and effort to prepare (Liberman et al. 2002; Liberman and Trope 1998; Trope and Liberman 2010). However, when the moment of meal preparation and consumption arrives, consumers are more cognizant of the time and effort required to prepare the meal using these unprocessed foods. As a result, consumers' preference for minimally processed substitutes increases. We formally hypothesize the following:

> **H_1:** Consumers choosing groceries for meal preparation in the distant future are less likely to choose convenience foods than consumers choosing groceries for consumption in the near future.

4.2.2 Convenience Food and Food Waste

Research on the effect of convenience food on food waste appears to be inconclusive. Previous research states that convenience products often have shorter shelf-lives than unprocessed foods, increasing the likelihood of food waste (Darlington, Staikos, and Rahimifard 2009). Stronger intentions to avoid food waste are related to (self-predicted)

reduced consumption of convenience products (Brunner et al. 2010), and households most positive toward convenience consumption were at same time most prone to wasting food (Mallinson, Russel, and Barker 2016). However, in the latter research, the authors compiled five household profiles and the two profiles most positively inclined toward convenience products and simultaneously wasted the most food were stressed and pressed for time, neglected meal planning, and disliked grocery shopping—suggesting that other factors could be driving food waste.

Other studies posit that convenience food can help prevent food waste because fewer ingredients for a meal have to be purchased and the meal is consumed immediately, preventing convenience foods from being forgotten in the fridge and left to spoil (Buckley et al. 2007; Stancu, Haugaard, and Lähteenmäki 2016). Participants who tried to avoid waste at the same time displayed higher consumption rates of convenience products (Buckley et al. 2007).

All studies mentioned above included a wide range of convenience foods, from minimally processed foods to highly processed ready-to-eat-meals. In addition, all studies relied on self-reported behavior and did not include measures of actual disposal behavior. With these factors in mind, we offer the following reasoning for the proposal that the purchase and consumption of minimally processed convenience substitutes reduces food waste relative to their unprocessed counterparts.

Consumers do not carelessly waste food. Rather, consumers are overwhelmed by the demands of everyday life, which leads to food waste owing to life pressures (Evans 2011; Ganglbauer, Fitzpatrick, and Comber 2013; Southerton and Yates 2015). Consumers tend to be more optimistic and confident about distant future than near future outcomes (Liberman and Trope 1998), and research demonstrating the so-called planning fallacy cautions that consumers underestimate the time needed for tasks in the distant future and are overly optimistic about their likelihood to complete the tasks (Buehler, Griffin, and Ross 1994; Gilovich, Kerr, and

Medvec 1993). Thus, when purchasing groceries for future consumption, consumers tend to overlook contextual constraints such as available time, motivation, and energy, as well as other activities required for meal preparation, thereby neglecting the concrete steps leading to the finished meal (Hamilton 2014; Trope and Liberman 2010). Although consumers feel that "an appropriate amount of effort and time should be put into meal preparation" (Costa et al. 2007, p. 87), meal preparation may conflict with other activities. While previous literature indicates a perceived lack of time as a main food disposal reason (Brunner et al. 2010; Evans 2011), the effort consumers need to take to prepare meals has also been mentioned as a critical predictor of what food is preferred and how much of it will be consumed (Brunner 2013; Caruso, Klein, and Kaye 2014; Wing and Jeffery 2001). Hence, when effort decreases, the ease with which food is consumed increases, lessening the amount of food wasted.

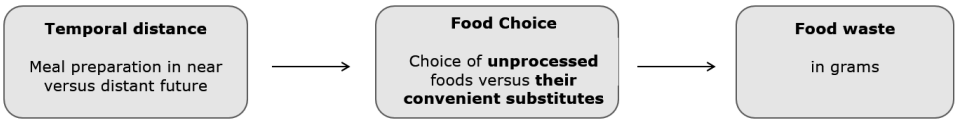
Convenience foods, which decrease the time and effort needed for preparation and consumption, have been cited as a solution for consumers who realize they do not have the time to cook all their meals from scratch every single day (Jackson and Viehoff 2016). Although convenience foods conflict with feelings of being a good provider for the family (Carrigan et al. 2006; Costa et al. 2007; Olsen et al. 2010), these foods are at the same time often incorporated into meal practices to alleviate conflicts over food consumption and promote enjoying meals together with the family in the face of other competing priorities (Jackson and Viehoff 2016). Since convenience foods facilitate meal preparation and consumption, we propose that these foods are a means to reduce the gap between planned and actual consumption, and therewith reduce food waste. Accordingly, we hypothesize:

H_2: Consumers are less likely to waste convenient substitutes than unprocessed foods**.**

Figure 4.1 presents an overview of our conceptual model. Since consumers consider desirability primarily at the time of purchase and consider feasibility only later, we propose that with greater temporal distance between purchase decisions at the grocery store and the time of

consumption, consumers are inclined to purchase unprocessed foods but end up wasting them when they experience a lack of time, effort, and motivation, which lead them to change their intention to prepare the meal from scratch. We therefore propose convenient substitutes of unprocessed foods as a means to decrease the gap between what consumers purchase and actually consume, with the result of decreased food waste.

Figure 4.1 Conceptual model



4.2.3 Overview of Studies

We test our hypotheses in four studies. Study 1 verifies that the temporal distance between grocery shopping and actual consumption influences the choice for unprocessed versus convenience food (H_1). Study 2 tests the conceptual model, measuring food choice and actual food waste behavior (H_1 and H_2). Study 3, a large field experiment, demonstrates that households provided with a convenience food package waste less of this package compared to households provided with an unprocessed food package (H_2). Finally, given that narrowing the gap of psychological distance could optimize the fit between what consumers purchase and actually consume, resulting in decreased food waste, Study 4 examines the feasibility and desirability aspects of meal preparation prior to choosing food, and shows that highlighting these aspects could mitigate the effect of temporal distance on consumption decisions. Study 4 also sheds light on the process through which feasibility and desirability considerations may affect choices for unprocessed foods versus their convenient substitutes. Furthermore, Study 4 shows that retailers can steer consumers toward convenience food by highlighting the feasibility of meal preparation in store.

4.3 Methodology

4.3.1 Study 1: Temporal Distance and the Preference for Convenience Food

Study 1 tests whether the temporal distance between grocery shopping and the actual moment of consumption affects the preference for unprocessed versus convenience food (H_1).

Figure 4.2 Food packages in Study 1 (unprocessed vs. convenience)

4.3.1.1 Design, Procedure, and Stimuli

In a paper-and-pencil questionnaire, 141 undergraduate students (38% female) from a large European university were asked to imagine browsing through the grocery store and to make a choice for a vegetarian pasta dinner, either for tonight or in three days. Participants were shown two food packages with either five raw, unprocessed foods or five minimally processed convenient substitutes, which were similar in price and quantities and varied solely in their degree of convenience (see Figure 4.2). Participants were asked to select their preferred package. The text was fully scripted:

> Imagine that you are browsing through the grocery store. You have to prepare a dinner for you and your friends tonight [in three days]. You have decided to prepare a vegetarian Italian pasta. Please

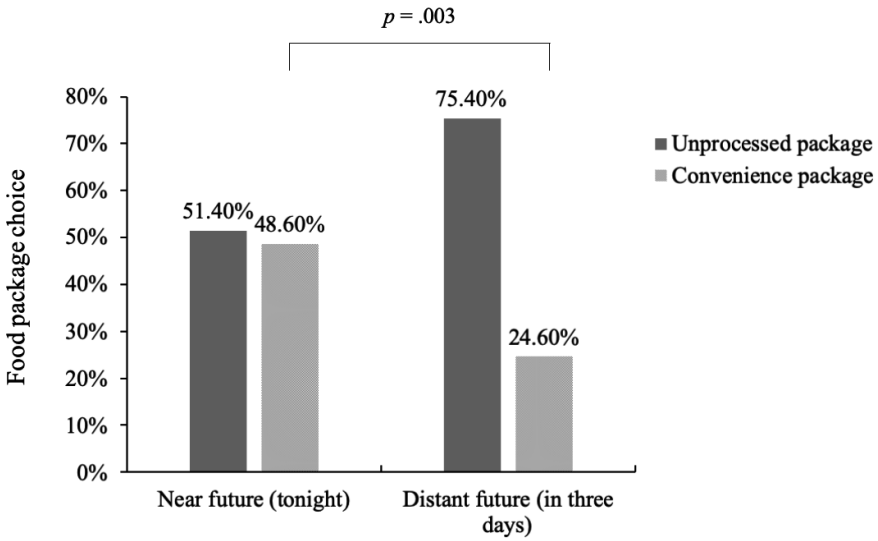
> select the bundle of groceries you would most likely pick for tonight's meal [this future meal] by ticking the preferred package (note that the packages are equal in price and quantities).

Participants were informed that they could win the package that they chose in a raffle.

4.3.1.2 Results

A chi-square test revealed that participants were more likely to choose convenient substitutes when selecting groceries for the near (vs. distant) future (χ^2 (1) = 8.70, p = .003; Figure 4.3). When choosing groceries for consumption taking place that night, almost half of the participants opted for the convenience package. When choosing groceries for three days later, only a quarter of the participants preferred the convenient substitutes.

Figure 4.3 Choice preferences depending on temporal distance in Study 1



4.3.1.3 Discussion

Consistent with our theorizing, Study 1 confirms an increased preference for convenience foods when preparation and consumption are in the near versus the more distant future. In accordance with construal level theory, we attribute this preference to a stronger focus on the feasibility versus desirability of preparing and consuming the meal.

4.3.2 Study 2: Temporal Construal, Consumption, and Waste

Study 2 tests whether the temporal distance between grocery shopping and the actual moment of consumption affects the preference for unprocessed versus convenience food (H_1) and whether convenience foods reduce food waste (H_2).

4.3.2.1 Design, Procedure, and Stimuli

Participants were 224 undergraduate and graduate students (64% female, M_{age} = 22.8) from a large European university who participated for monetary compensation or course credit. In the first part of the study, participants completed a computerized questionnaire where, as in Study 1, they were asked to imagine browsing through the grocery store and making choices for a vegetarian pasta dinner for either that night (near future) or in two days (distant future). In Study 2, we reduced the temporal distance of the future condition from three to two days to obtain a higher choice share of the convenience food package in the distant future condition and achieve a more balanced distribution of the participants over the four conditions to assess the effect of choice on waste. Participants were shown two food packages with either five unprocessed foods or five minimally processed convenient substitutes that were similar in price and quantities and varied solely in their degree of convenience (see Figure 4.4). Participants were asked to select their preferred package.

After finishing the computerized survey, participants were provided with the food package of their choice and were instructed to return the products they did not use a week later. The package contained the five chosen products (either the unprocessed version or its convenient substitute), ten sealable bags to put the leftovers in, and an additional survey including questions concerning the use of the package. The monetary compensation or course credit participants received for participating were provided conditional on the waste being returned. The researcher manually weighed the leftovers and waste on a kitchen scale.

Figure 4.4 Food packages in Study 2 (unprocessed vs. convenience)

For the unprocessed package, *unavoidable* waste occurs during the preparation (i.e., onion peels, bell pepper stalk). Participants were asked to separate this waste from their *avoidable* waste, so that the actual waste in both conditions would consist only of edible food. If avoidable and unavoidable wastes were not separated—for example, if an entire onion was returned—we subtracted the unavoidable waste using a percentage measure, obtained by peeling the item prior to the study, and subtracted this amount from the actual amount of waste for each participant who chose the unprocessed package (Appendix E).

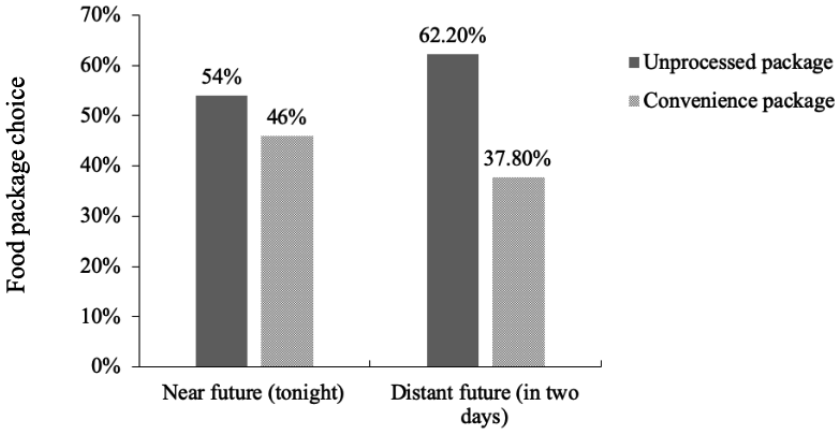
Of the 224 participants, 82% returned the waste and thus fully completed the study. The 39 participants who did not return their leftovers and waste were excluded from the sample. Our sample for further analysis therefore consisted of 185 respondents (65% female). The excluded participants did not deviate from our sample in terms of demographics or food package choice.

4.3.2.2 Results

Temporal distance and the preference for unprocessed versus convenience foods. A chi-square test revealed that students were directionally albeit insignificantly more likely to choose

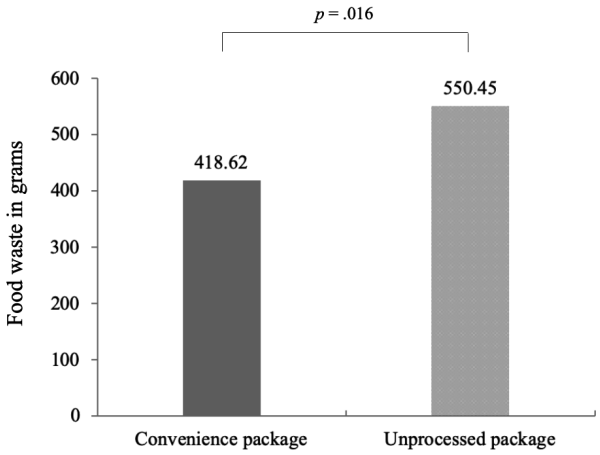
convenience food when selecting groceries for the near (vs. distant) future (χ^2 (1) = 1.28, p = .257). As shown in Figure 4.5, the convenience foods package is more popular in the near future condition (46.0%) than in the distant future condition (37.8%).

Figure 4.5 Food package choices depending on temporal distance in Study 2



Food waste. A one-way ANOVA with food waste as dependent variable and the food package received (convenience vs. unprocessed foods package) as a predictor variable reveals that participants who selected the convenience package wasted less food ($M_{convenience}$ = 418.62 grams food waste, SE = 41.60) than participants who selected the unprocessed foods package ($M_{unprocessed}$ = 550.45 grams food waste, SE = 35.12, F (1, 183) = 5.86, p = .016; Figure 4.6), thereby confirming H_2. Robustness checks in which individual food items were omitted from the analysis (e.g., performing the ANOVA while excluding the onion waste or macaroni waste) revealed stable results.

Figure 4.6 Food waste in Study 2



4.3.2.3 Discussion

Study 2 shows that, consistent with H_2, convenience foods are less likely to be wasted. Participants who selected a convenience package wasted 24% less food compared to participants provided with an unprocessed package. Study 2 directionally corroborated the finding of Study 1 as to the effect of temporal distance on preferring raw, unprocessed foods versus minimally processed convenience food. The insignificance may in part be a result of the intentional reduction in temporal distance from Study 1 to Study 2. Study 3 was designed to find additional and more robust evidence for the proposition that convenience food is less likely to be wasted in a different and more ecologically valid setting.

4.3.3 Study 3: Field Evidence on the Effect of Convenience on Food Waste

To offer more robust evidence for our hypothesis that convenient substitutes are less likely to be wasted, and to verify the ecological validity of our research, Study 3 involved a field study with real consumers shopping in a local grocery store of a large European retailer. In contrast to Study 2, where respondents could make their own choice for a food package consisting of either unprocessed foods or their convenient substitutes, Study 3 randomly

assigned households to one package or the other, thereby further testing the robustness of our findings. Moreover, half of the participants were provided with recipes that complemented the products in the package. The purpose of providing recipes was to increase the ease of food preparation for both the unprocessed and convenience food packages, as an additional stimulant to use the foods. Recipes enhance convenience as they guide consumers with the steps that need to be taken and the necessary quantities that should be used in order to prepare a meal (Carrigan and Szmigin 2006). In the case of both packages (unprocessed vs. convenience), recipes were expected to decrease food waste. Especially for the convenience package, we expected recipes to decrease food waste even further. However, our results showed no difference in the amount of food waste for the households provided with or without recipes. One possible explanation is that only 28% of the households receiving the recipes indicated they had actually used the recipes. Analyses were therefore conducted with and without including a dummy variable to account for the presence of these recipes. We report our findings in the results section.

4.3.3.1 Design, Procedure, and Stimuli

Participants were 200 grocery shoppers who were invited to keep track of their consumption and food waste for a period of ten days and return all waste and unused products from the package afterwards. The packages were distributed during two consecutive days. In the grocery store, a table in a corner near the entrance displayed the packages, and research assistants asked shoppers walking by whether they were interested in participating in the study. As a cover story, participants were told that the purpose of the research was to evaluate grocery meal packages.

After agreeing to participate and giving informed consent, participants received a food package to take home and then continued with their grocery shopping. The packages contained either unprocessed foods or minimally processed foods and consisted of eight food products (e.g., broccoli, potatoes, onions; Figure 4.7) that could be used to prepare several meals.

Because of the so-called unavoidable waste associated with some products, the quantities in the unprocessed package were slightly larger than in the convenience package. We verified that the quantity of food in the two packages was comparable by separating and weighing the unavoidable waste of the unprocessed food package. Additionally, half of the participants were provided with recipes for the products in the package to further increase the ease of meal preparation.

The grocery shoppers were randomly assigned to receive either the unprocessed or the convenience food package, and to receive a food package with or without recipes. Depending on their household size, which was obtained when the participants were provided with the package, they received the version for 1–2 or 3–4 persons. We account for household size in the analyses. More details about the study design can be found in Appendix F.

Figure 4.7 Unprocessed versus convenience food packages in Study 3

Participants were asked to collect all the waste of the products in the food package in sealed plastic bags that were included in the package and return these to the store at the end of the ten-day period. Unused products had to be returned as well, along with unavoidable waste such as potato peels and broccoli stalks in the case of the unprocessed package (Appendix F). Research assistants manually weighed the collected waste. Finally, information concerning demographics was collected in an additional questionnaire. Participants received a chocolate

bar as a thank you if they returned the diary and questionnaire, and were additionally enrolled in a lottery to win one of five coupon cards of €50 for the grocery store.

Summary statistics. Of the 200 households provided with the packages, 62.5% responded after ten days. Our sample for further analysis therefore consisted of 125 respondents (86% female; $M_{age} = 52$, $M_{household\ size} = 3$).

Dependent variable: food waste. For both packages, the researchers manually weighed all waste, including unavoidable waste such as peels from the unprocessed package and including unused and unprepared products and added it up to yield a total waste measure per household.

Independent variables. Whether households received a convenience foods package or an unprocessed foods package was our focal independent variable. In addition, we included recipes in the package as an independent variable. As mentioned, as only 28% of the participants receiving the recipes indicated they had actually used the recipes, analyses were conducted both with and without including recipes.[7]

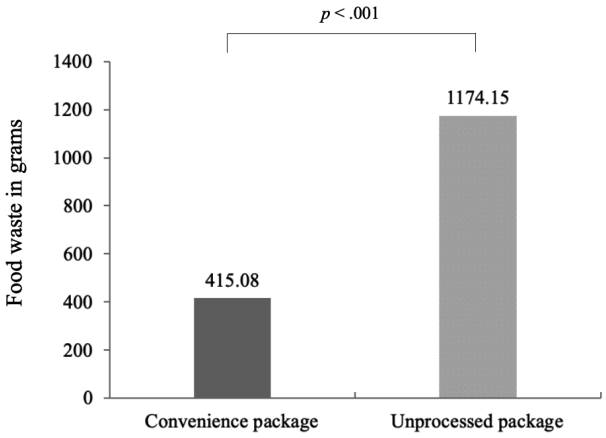
Covariates. We included household size (1–2 vs. 3–4 persons) as a covariate.

4.3.3.2 Results

A 2 (food package received: unprocessed foods package vs. convenience foods package) x 2 (recipe: yes vs. no) between-subjects design with food waste as dependent variable and household size as a covariate reveals that households provided with the convenience food package wasted significantly less food ($M_{convenience} = 415.08$ grams food waste, SE = 77.13) than households provided with the unprocessed foods package ($M_{unprocessed} = 1174.15$ grams food waste, SE = 80.30), $F(1, 121) = 46.11$, $p < .001$; Figure 4.8).

[7] We report the analysis including the dummy accounting for the recipes. Results remained stable for the effect of convenience foods on food waste when excluding this dummy variable.

Figure 4.8 Food waste in Study 3



Recipes did not influence food waste (p = .324). The interaction between the package received and recipes also did not influence food waste (p = .407). Household size significantly influenced the results (F (1, 121) = 4.50, p = .036), with larger households wasting more food.

4.3.3.3 Discussion

The results of Study 3 corroborate the robustness and ecological validity of our theorizing and the findings of Study 2, confirming our second hypothesis: convenience foods are less likely to be wasted. Households provided with the food package comprising unprocessed foods wasted three times as much food as households provided with convenient substitutes. Although the difference in food waste was strongly significant in Study 2, with a 24% reduction of waste for the consumers provided with the convenience package, in Study 3 the difference in amount of waste tripled, with a decrease of 65% of waste for the convenience food package, confirming that consumers waste significantly more unprocessed foods compared to convenient substitutes. Apparently, consumers' busy lifestyles indeed impose a constraint at the moment of consumption, preventing some consumers from spending time and effort on preparing a meal from scratch. As a result, the unprocessed foods end up wasted.

The larger difference in terms of waste compared to Study 2 possibly occurred because we distributed a larger food package to the sample in Study 3, and because we distributed the food packages among "real" households that have more competing priorities in life (e.g., fulltime jobs, partner and kids) compared to the student sample in Study 2.

According to construal level theory, desirability concerns weigh more heavily in decisions about the distant future, and feasibility concerns receive greater weight as distance decreases, implying that highlighting these factors prior to the decision of whether to select the unprocessed or minimally processed convenience food may influence the choice (Hamilton and Thompson 2007). The purpose of Study 4 was to demonstrate that highlighting feasibility (desirability) prior to the choice between an unprocessed or a convenience food package would influence preferences on the basis of temporal distance and thus increase the preference for convenience foods when choosing food for the distant future, and therefore reduce food waste. Study 4 with a moderation-of-process design (Spencer, Zanna, and Fong 2005) also sheds light on the mechanisms underlying the choice for unprocessed food versus convenient substitutes.

4.3.4 Study 4: Highlighting Feasibility Considerations to Lessen Household Food Waste

In Study 4, we aim to design a strategy for both retailers and consumers to facilitate and minimize the gap between planned and actual consumption, and as a result decrease food waste. Given our finding that minimally processed convenience foods are less likely to be wasted than their unprocessed counterparts, we manipulated the mindset of the consumer prior to making a choice with the goal to increase the preference for convenience food (Hamilton and Thompson 2007). That is, we tested whether highlighting feasibility considerations during selection of food for a distant meal increases the likelihood of choosing convenience foods. By encouraging consumers to consider the feasible aspects of their future meals, we expect them to view convenience foods as more attractive and thus be more likely to choose those as ingredients for

a future meal. Hence, for Study 4, we propose that when a feasibility (vs. desirability) mindset is emphasized, consumers are more likely to choose convenience food when shopping for the distant future. With a moderation-of-process design (Spencer et al. 2005) Study 4 also sheds light on how temporal distance between the moment of choice and the time of meal preparation affects the choice for unprocessed foods versus convenient substitutes.

4.3.4.1 Design, Procedure, and Stimuli

This study follows a 2 (temporal distance: near vs. distant future) x 2 (manipulation: feasibility vs desirability) between-subjects design. Through a paper-and-pencil questionnaire, 325 students (32% female) from a large European university were asked to choose ingredients for a vegetarian pasta dinner, for either that night or three days away. The set-up of the study was similar to that of Study 1, using the same food items and task description. Prior to choosing their preferred package, participants were asked to describe in a few sentences either *how* they would prepare the meal (i.e., feasibility manipulation as to the process) or *why* they would prepare the meal (i.e., desirability manipulation as to reasons for preparing the meal (Hamilton and Thompson 2007; Liberman and Trope 1998). The writing task was introduced immediately after the description of the study and was fully scripted:

> Please select the bundle of groceries you would most likely pick for the meal on the back of this form. However, before you do that, please write below a few sentences about how [why] you would prepare the meal. Please imagine the process of preparing a meal for your friends in 3 days [Please think about the reasons for preparing a meal for your friends in 3 days] and describe that in your own words.

4.3.4.2 Results

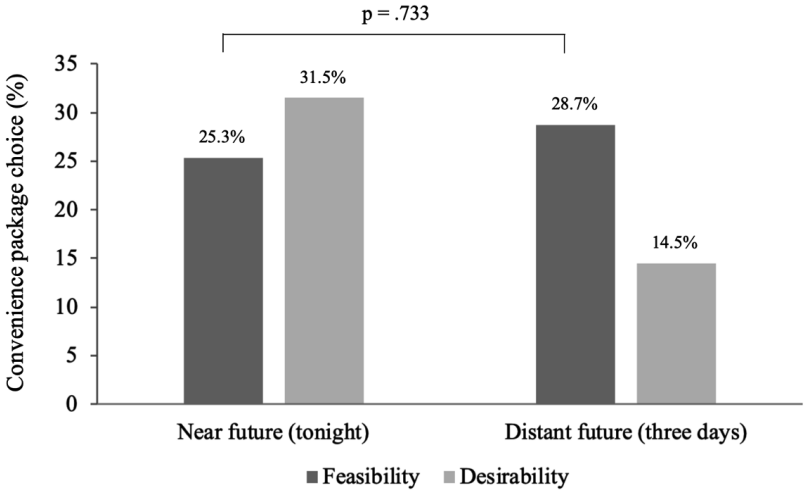
We performed a binary logistic Generalized Linear Model with package choice (unprocessed vs. convenience) as dependent variable and temporal distance (near vs. distant future) and the feasibility versus desirability manipulation as predictor variables. In contrast to the previous studies, we expect a less strong effect of temporal distance on package choice, as

we emphasize a feasibility versus desirability mindset that should influence the choices made. This is confirmed by our results. Neither temporal distance ($\chi 2$ (1) = 2.25, p = .134), nor the feasibility versus desirability mindset manipulation ($\chi 2$ (1) = 1.05, p = .306) significantly influenced the package choice. We do find a significant interaction between temporal distance and the feasibility versus desirability manipulation ($\chi 2$ (1) = 4.57, p = .032). Consistent with our expectations, a chi-square test confirmed that respondents who choose a meal for three days ahead and were reminded about the feasibility of meal preparation were almost twice as likely to choose convenient substitutes than respondents who were reminded of a meal's desirable features (28.7% of the participants in the feasibility manipulation and 14.5% of the participants in the desirability manipulation chose convenience; χ^2 (1) = 4.16, p = .049). Hence, while consumers normally (i.e., when not being presented with feasibility considerations) choose unprocessed foods when choosing for the distant future, making these consumers focus on the feasibility of their actions makes them more likely to prefer convenience foods (e.g., foods which have, in normal circumstances, a higher likelihood to be chosen when choosing a meal for the near future).

The feasibility manipulation seems to override the effect of temporal distance, as the likelihood of choosing convenience does not significantly differ between participants choosing a meal for three days away versus for tonight when participants are reminded of the feasibility of meal preparation (28.7% vs. 25.3% of the participants chose convenience; χ^2 (1) = .26, p = .733; Figure 4.9). When participants are reminded of the desirable features of a meal, temporal distance does affect the choice of convenience versus unprocessed food (31.5% convenient choices for the near future vs. 14.5% convenient choices for the distant future, χ^2 (1) = 5.67, p = .021). The preference for convenience foods is not affected by the desirability versus feasibility manipulation if respondents choose food for tonight (31.5% convenience chosen in the feasibility condition vs. 25.3% convenience chosen in the desirability condition; χ^2 (1) =

.82, p = .406). We did not anticipate any differences when choosing a meal for tonight, as we specifically focus on future meal preparation and consumption.

Figure 4.9 Effect of temporal distance and feasibility versus desirability on convenience choice



4.3.4.3 Discussion

Study 4 identifies a managerially relevant method to nudge consumers to prefer convenience rather than unprocessed foods, with the ultimate goal of preventing food waste. If feasibility aspects of meal preparation are highlighted prior to choosing food for preparation at a distant time, the likelihood that consumers will choose convenience versus unprocessed foods doubles. Results demonstrate that highlighting feasibility considerations in-store seems to be effective in convincing consumers to prefer convenience foods over unprocessed foods. Furthermore, employing a moderation-of-process design (Spencer et al. 2005), Study 4 also shows that feasibility and desirability considerations indeed drive the process through which temporal distance between the moment of choice and time of meal preparation affects the choice between unprocessed foods or convenient substitutes.

Notably, in Study 4, overall the preference for the convenience package seems to be somewhat lower than in the other studies. We can only speculate as to why this is the case. The

most obvious explanation is that in Study 4, we asked respondents to actively think about their meal preparation and therewith made this factor more salient to them. Anticipation of preparation could have triggered thoughts of meals being an important part of daily life, worth investment of time and effort, steering more respondents toward choosing unprocessed food.

4.4 Discussion

Consumers discard 25% of the food they purchase at a yearly cost of $360 (USDA ERS 2012; Buzby et al. 2014; NRDC 2017). Research attributes 50% of consumer food waste to poor purchasing decisions (Setti et al. 2018; Moskalev 2013), suggesting that consumers need help with making better purchasing decisions to decrease food waste. Previous literature has already shown that marketing measures can curb food waste by, for example, making ugly produce more attractive (De Hooge et al. 2017). We demonstrate another way in which marketing can contribute to food waste reduction: by making food preparation and consumption more convenient.

Building on construal level theory (Liberman and Trope 1998; Trope and Liberman 2010), our research suggests that since desirability has the strongest influence on plans for the distant future (i.e., at the grocery store), whereas feasibility has a strong impact only later (i.e., when meal preparation and consumption take place), consumers are inclined to purchase unprocessed foods that need intensive preparation before consumption. However, consumers often end up wasting these foods because they lack time, effort, and motivation to actually prepare the meals and they start looking for convenient alternatives when the time for preparation arrives. We propose convenience substitutes of unprocessed foods, such as minimally processed vegetables that are pre-sliced or pre-cooked, as a solution to narrow the gap between what consumers purchase and what they actually consume.

Aside from improving the environment by decreasing food waste, purchasing minimally processed convenience foods will improve consumer well-being since consumers can more easily consume healthy foods and no longer squander money on unconsumed food—contributing to a better world. Prior literature has suggested that a strategy of making consumption of unhealthy foods more effortful might be superseded by a strategy of making consumption of healthy foods less effortful (Brunner 2013). Our findings support the latter approach, which at the same time facilitates the ultimate goal of reducing food waste.

In support of our propositions, we demonstrate that consumers indeed prefer unprocessed foods to convenience foods when making decisions for consumption in the distant future, yet that convenience foods become more popular closer to the time of meal preparation (Study 1). We also show that convenience foods decrease food waste, both in a laboratory study (Study 2) and in a field study among real households (Study 3). In our field study, households that were provided with the package containing convenience food wasted 65% less food than households provided with the package of unprocessed food. Importantly, we also show that reminding consumers of the feasibility of preparing their food choices is a managerially relevant method to nudge consumers to prefer convenience over unprocessed foods (Study 4). Consumers reminded of the practicality of their choices were twice as likely to opt for convenience foods—a response that should decrease the gap between consumers' purchases and their actual consumption and thus lower food waste. Study 4 also demonstrates that feasibility and desirability considerations drive the process through which temporal distance between the time of choice and that of consumption affects preference for convenience foods.

While we see convenient substitutes of unprocessed foods as a promising way to reduce food waste, we are at the same time cognizant of limitations and potential drawbacks. Convenience products consist of higher packaging-to-product ratios than their unprocessed counterparts (Schweitzer et al. 2018). Stakeholders worry about plastics affecting biodiversity

and bringing significant socioeconomic costs. However, plastics help to ensure long-term preservation of food and offer protection during transport, storage, and end use (Han 2014). Food waste can therefore be reduced through the use of packaging (Verghese et al. 2015). Packaging altered to reduce food losses can lessen the total environmental impact and lead to large environmental gains, even while increasing the environmental impact from the packaging itself (Williams and Wikström 2011). In addition, companies are currently trying to make plastics thinner and packages generally simpler, helping to achieve a more efficient recycling process (Hopewell, Dvorak, and Kosior 2009). We are aware of the impact of packaging waste and acknowledge the wider need for an absolute reduction in the use of all resources. Furthermore, we again stress that in our definition of convenience foods we focus on minimally processed foods, such as pre-cooked or pre-sliced vegetables and products with reduced cooking time to make them convenient substitutes of unprocessed foods. Our intention is not to steer consumers toward choosing highly processed convenience food, such as ready-made meals, given that these are often problematically high in terms of calories and salt intake (Kanzler et al. 2015).

4.4.1 Theoretical Contributions

This research contributes to the under-researched topic of food waste in multiple ways. Our first theoretical contribution consists of advancing theory on food waste. Research on food waste predominantly presents descriptive findings (Cox and Downing 2007; Evans 2011; Parfitt et al. 2010), and the few studies that take a more theoretical approach have mainly used the theory of planned behavior (Stancu et al. 2016; Stefan et al. 2013; Visschers, Wickli, and Siegrist 2016). However, food waste often happens unintentionally and unconsciously—an outcome not considered by that theory (Block et al. 2016; Sheeran, Gollwitzer, and Bargh 2013). By building on construal level theory, we incorporate the unconscious elements that lead consumers to waste food and thus contribute to the literature by filling this gap in research. We

posit that the change in psychological distance from making decisions in the grocery store to actual meal preparation and consumption causes a change in consumer preferences, ultimately leading to food waste. This change in preference is caused by consumers' altered focus, away from the desirable end states of their more distant consumption and onto the feasible aspects of meal preparation as the consumption moment approaches. We propose that a greater availability of convenient substitutes of unprocessed food can increase the consistency of consumer preferences over time.

As our second contribution, we show that convenience foods, such as minimally processed, pre-sliced or pre-cooked vegetables, can be a way to reduce food waste by providing consumers with a more feasible meal preparation task.

As our third contribution, we show that highlighting feasibility considerations at the decision moment may make consumers opt for more practical, convenient substitutes for unprocessed foods even if the moment of consumption is temporally distant. Since consumers are often overly optimistic about the distant future (Liberman and Trope 1998) and also about the likelihood of completing tasks (Buehler et al. 1994; Gilovich et al. 1993), we stress the importance of emphasizing the feasible aspects of meal preparation. This emphasis may encourage consumers to opt for convenient substitutes of unprocessed foods that are easier to prepare and less likely to compete with other priorities in life at the moment of consumption.

4.4.2 Practical Implications

To mitigate food waste, we suggest that manufacturers and retailers steer consumers toward convenience by offering minimally processed convenience food solutions. While many manufacturers are already responding to the market by packaging minimally processed and pre-cut vegetables and fruits in convenient serving sizes (Rekhy and McConchie 2014), a larger assortment of these convenient food solutions seems warranted. At the same time, manufacturers and retailers should strive to minimize the environmental impact of the

packaging of convenience food solutions (Hopewell et al. 2009).

Importantly, this research identifies an effective marketing strategy for retailers to drive the sales of convenient substitutes of unprocessed foods: highlighting the feasible aspects of consumers' future consumption. We recommend that policy makers and retailers stimulate consumers to consider the practical aspects of their meal preparation and consumption during their grocery shopping trip, and with that effort increase the preference for convenience over unprocessed foods. Retailers could nudge consumers toward making the right purchases by highlighting feasibility considerations attached to the preparation of future meals. This may make people more time-conscious (Jackson and Viehoff 2016) and thus could function as an effective strategy to reduce the gap between planned and actual consumption.

Effectively highlighting a feasibility mindset in-store would help decrease the gap between food purchases and actual consumption and thus decrease food waste. Retailers can drive the sales of convenience foods while at the same time help improve the environment. In addition, pushing the sales of convenience foods supports consumers in making equally nutritious and tasty meals compared to meals using unprocessed foods, while consumers no longer squander money on the food they purchase but end up not eating. In other words, we present a win–win approach that contributes to a better world while at the same time improving firm outcomes.

4.4.3 Future Research and Limitations

This research has several limitations that may be addressed in further research. One limitation related to Study 2 is that participants were asked to select their preferred package (convenience vs. unprocessed) rather than being assigned to receive one of the two packages. We are aware of the possible selection bias, i.e., there may have been significant differences between the participants that preferred the convenience package vs. the unprocessed package. For instance, in terms of cooking skills or enjoyment. We assessed these skills in an additional

survey and did not find any significant differences between the groups. In Study 3, we did randomly assign our participants to different package options. The results of Study 3 did not differ from those of Study 2, which is why we assume that the self-selection bias has not influenced our results. Future research could account for this by randomly assigning participants to the conditions.

Second, due to the intensity of our studies in terms of time and effort, we dealt with relatively high attrition rates in Studies 2 and 3. For instance, 18% of the participants in Study 2 did not return their waste and 37.5% of the participants in Study 3 did not return their waste and hence did not finish the study. The excluded participants did not deviate from our samples in terms of demographics or conditions, which is why we assume that the attrition rate has not influenced the results and conclusions. For future research, we recommend to carefully consider the study design in order to keep attrition rates low. For instance, by increasing the incentive to return the waste, or by offering to pick up the garbage bags at the respondent's home.

Third, some participants noted that the relatively higher price of convenience foods prohibits them from purchasing these foods. However, recent literature mentions that prices of unprocessed foods have increased at a faster rate than prices of ready-to-cook products, with the result that over time, convenience foods have become relatively cheaper than unprocessed foods (Rogus 2018). Our results support this finding, as in Study 2, for instance, the price of the convenience package was only 45 cents more than that of the unprocessed package. The costliness of convenience foods may be more of an image issue than a factual issue.

Many packages that contain fresh food include visible expiration dates. In Study 2, the expiry dates of the products varied a little (e.g., the pre-cut mushrooms were about to expire three days after handing out the packages, while the uncut mushrooms lasted one day longer) or were absent for one of the two items (e.g., unprocessed bell pepper vs. pre-cut bell pepper). Due to the large orders placed via the retailer, it was impossible to receive matching expiration

dates for all products. However, follow-up analyses showed that these differences did not influence our results or conclusions. Future research could investigate the effect of visible expiration dates on product perceptions (e.g., quality, freshness), product usage and possible product acceleration. Research reports increased perceived safety issues and changes in perceived food quality owing to the presence of a date label (Roe et al. 2018; Wilson et al. 2017), which asks for a more thorough investigation and an opportunity for future research.

Moreover, in real life, the dichotomy of desirability and feasibility is at the core of many everyday decisions. However, the contrast between "home-made food" and "convenience food" is easily overdrawn, as consumers frequently combine different kinds of food and different cooking practices (Halkier 2013). Combining unprocessed with convenience foods could help consumers adhere to planned consumption and decrease food waste. In our studies, we completely separated unprocessed foods from convenience foods. Future research could investigate whether an optimal balance exists, for instance by using convenient substitutes for foods that are time-consuming while using unprocessed versions of other foods. Thus, combining the two approaches could be a solution for consumers who view the use of convenience foods as "cheating." Research among households in the UK and France has demonstrated that using a mix of convenience and unprocessed food products has increasingly become the norm (Gatley, Caraher, and Lang 2014).

Finally, future research could consider other strategies to promote the advantages and drive the sales of convenience foods. Our results suggest highlighting practicality to promote convenience foods. Future research could investigate the effectiveness of various types of advertising, discounts, or promotions for convenience foods.

Chapter 5 | General Discussion

5.1 Introduction

With one-third of all food destined for human consumption being lost or wasted (Gustavsson, Cederberg, and Sonesson 2011), reduction of food waste has become one of the United Nations' (2016) global top priorities. A considerable part of food waste happens at the consumer level, with up to 57% of this waste considered avoidable (WRAP 2017), and successful reduction of food waste requires a better understanding of the consumer decision-making processes that drive food waste (Block et al. 2016; Porpino 2016).

This dissertation is intended to offer a fundamental theoretical understanding of and empirical evidence for the mechanisms that drive consumer food waste by offering insights into consumer decision-making processes that contribute to food waste. Guided by the central research question of why consumers do not eat all of the food they acquire, this dissertation examines the actions and decisions that take place *before* consumers dispose of food, rather than examining the moment when food is already in its transition to waste. I approach food waste as the result of a mismatch between the two phases in the food consumption process that are often studied in isolation—acquisition and consumption—and this investigation links these two phases.

I first offer an extensive literature review with recommended future research directions (Chapter 2). I then expand insights into the determinants that drive consumer food waste by empirically demonstrating that certain consumer decision-making processes drive food waste (Chapters 3 and 4). Drawing on the empirical results, I present suggestions for reducing consumer food waste in both the out-of-home context (Chapter 3) and the in-home setting (Chapter 4). In this final chapter, I discuss the main findings of the investigation.

5.2 Main Findings

5.2.1 Findings from Prior Literature

An important stream of literature approaches consumer food waste from a conscious consumer perspective. This perspective (implicitly) assumes that consumers will reduce their food waste when their knowledge increases or when their beliefs or attitudes change. Within this stream of literature, the theory of planned behavior is the theoretical model most frequently applied to explain consumer food waste, as it suggests that attitudes, moral norms, and increased perceived behavioral control can drive consumers' intentions to reduce food waste (Graham-Rowe, Jessop, and Sparks 2015; Stancu, Haugaard, and Lähteenmäki 2016; Stefan et al. 2013; Visschers, Wickli, and Siegrist 2016). However, measuring consumers' intentions to reduce waste appears to be unsuitable for predicting actual behavior (Stefan et al. 2013; Stancu et al. 2016). The gap between intentions and actual behavior has been documented extensively by prior literature, and it is especially broad with respect to environmental behaviors (Carrington, Neville, and Whitwell 2014; Hochbaum 1981; Vermeir and Verbeke 2006).

Importantly, consumers' complicated, often unpredictable and unconscious decisions regarding food acquisition and consumption eventually contribute to food waste (Block et al. 2016; Porpino 2016). Many factors are influential, including cultural backgrounds, experience, situational aspects, and an individual's understanding of food (Evans 2011, 2012; Ganglbauer, Fitzpatrick, and Comber 2013). To acknowledge the potential impact of these influences on consumer food waste, scholars have extended the original theory of planned behavior by studying practices related to planning and purchasing, the aim of being a good provider, and routines for using leftovers as predictors of consumer food waste behavior (Stancu et al. 2016; Stefan et al. 2013; Visschers et al. 2016). Taken together, findings from the literature on the theory of planned behavior support the view that cognitive aspects such as attitudes and intentions are not sufficient to understand or predict consumer food waste behavior (Schanes,

Dobernig, and Gözet 2018). A broader research perspective is required—one that includes research that views food waste as resulting from consumers' unconscious decisions and actions.

The unconscious consumer perspective acknowledges that consumers often are not fully conscious of their decision process and its outcomes—that is, consumers frequently do not realize that their decisions and behaviors contribute to food waste. This perspective closely aligns with social practice theory, which emphasizes that food waste is a complex issue and is an outcome of all practices relating to the acquisition and consumption of food. Consumer decisions on what food to acquire, consume, and eventually discard are viewed as embedded in a complexity of situational, social, and cultural relations (Evans 2011, 2012; Quested et al. 2013; Southerton and Yates 2015; Wilcock et al. 2004). Consumer food waste arises as "a consequence of households negotiating the contingencies of everyday life" (Evans 2011, p. 438). Social practice theory thus approaches consumer food waste as a multi-faceted issue with multiple interrelated and dependent causes. In line with this view, scholars have investigated common daily routines and food-related household practices that demonstrate why consumers do not use all their acquired food in time and hence waste food. The investigation in this present dissertation has categorized these findings on consumer food waste within the acquisition, consumption, and disposal phases, further distinguishing between situational, individual and social causes.

Factors that unconsciously contribute to consumer food waste during the acquisition phase include poor planning before visiting the grocery store (Cox and Downing 2007; Watson and Meah 2012), responding to tempting in-store marketing actions (Aschemann-Witzel, de Hooge, and Normann 2016; Cox and Downing 2007), impulse buying (Parfitt, Barthel, and Macnaughton 2010; Parizeau, von Massow, and Martin 2015; Stefan et al. 2013) and the desire to be a good provider for the family (Evans 2011; Graham-Rowe, Jessop, and Sparks 2014; Visschers et al. 2016). Moreover, at the time of consumption, consumers may lack the

motivation, time, or appropriate cooking skills necessary to cook a meal (Evans 2011, 2012; Van Geffen, van Herpen, and van Trijp 2020). When consumers are too time-constrained to cook their meals properly, they tend to substitute more convenient alternatives, leading to waste of the food that requires more preparation time (Evans 2011, 2012). Other major unconscious causes of food waste are preparing or serving too much food (Graham-Rowe et al. 2014; Mallinson, Russel, and Barker 2016) and the refusal of many consumers to eat leftovers (Principato, Secondi, and Pratesi 2015; Stancu et al. 2016; Stefan et al. 2013; Van Geffen, van Herpen, and van Trijp 2016). Additionally, some consumers are hesitant to consume suboptimal food (De Hooge et al. 2017; Grewal et al. 2019) or lack a full understanding of expiration date labels (Roe et al. 2018; Wilson et al. 2017).

The literature overview revealed several directions for future research, and studying the acquisition and consumption phases integrally instead of in isolation seems particularly important. Moreover, the theoretical framework of construal level theory is an especially promising research direction. In the chapters that follow, I propose that the larger the temporal distance between acquiring food and actually utilizing the food for consumption, the larger the mismatch between planned and actual consumption, with the result of increased food waste.

5.2.2 Bridging Acquisition and Consumption to Explain Consumer Food Waste

As mentioned, the research question of this dissertation concerns why consumers do not eat all the food they acquire. To answer this question, it is critical to view food waste as the result of several interrelated decisions made in the consumer decision-making phases of acquisition, consumption, and disposal. As a consequence, I approach consumer food waste as originating primarily from the decisions that consumers make when they plan their meals and acquire food (e.g., in the grocery store, or when packing food at home for lunch). Since most consumption decisions are made some time before actual consumption, consumers must make decisions based on predictions about how they will feel at a different time (Hamilton 2014;

Laran 2009). In Chapters 3 and 4, building on construal level theory, I propose and demonstrate that much food waste arises from a discrepancy between planned and actual food consumption. On the basis of this evidence, I conclude that the temporal distance between planned and actual food consumption is a key driver of consumer food waste. In other words, consumers' inconsistent consumption decisions conceivably explain why they end up wasting so much food. I therefore suggest that, to match their consumption levels and decrease food waste, consumers need help with making better acquisition decisions.

5.2.3 Temporal Distance and the Preference for Virtue and Vice Foods

Prior literature has demonstrated that while planning future food consumption, consumers motivated by long-term health goals make relatively virtuous choices of healthy but less tasty food (Milkman, Rogers, and Bazerman 2010; Read, Loewenstein, and Kalyanaraman 1999; VanEpps, Downs, and Loewenstein 2016a). However, when the actual moment of consumption arrives, consumers experience a conflicting desire to indulge, which entices them to impulsively acquire and consume vice food, which is tasty but less healthy (Read et al. 1999; Wertenbroch 1998). Drawing on these insights from prior literature, in Chapter 3 I demonstrate that the conflict between consumers' long-term health goals and their desire to indulge at the actual moment of consumption forms a critical antecedent driving food waste.

More specifically, I show that consumers are more likely to engage in impulsive (vice) consumption when they have initially chosen food with a high virtue share and fewer calories. Advance ordering leads to food waste when additional (often unhealthier) food is acquired at the moment of consumption when consumers have the opportunity to behave impulsively. Advance ordering can be a fruitful way to decrease waste, but only if no opportunity arises to impulsively add extra food. Additionally, I demonstrate that the salience of a health goal influences consumption decisions and food waste, as using the traffic light labeling system steers consumers to order more calories for future consumption. These calories are mainly

derived from virtue foods because traffic lights increase the acquisition of relatively healthy food items and dampen impulsive vice choices at the moment of consumption itself. As a result, consumers end up with a relatively large order consisting of many virtue foods and a relatively high share of virtue waste, although calories eventually wasted do not significantly differ compared to when no nutritional labels are displayed. Traffic light labeling therefore seems to particularly affect the composition of the waste—toward more virtue waste—owing to differences in food acquired, and to a lesser extent the quantity of food wasted.

5.2.4 Temporal Distance and the Preference for Convenient vs. Unprocessed Foods

When planning future food consumption, consumers not only make relatively more virtuous choices but are also more optimistic and confident about events and actions in the distant future compared to the near future (Liberman and Trope 1998). Prior literature has demonstrated that consumers tend to focus on the desirable outcomes of their actions taking place the distant future, whereas they consider the feasibility of their actions only at a later point in time (Liberman and Trope 1998; Trope and Liberman 2010). Applying these findings to food acquisition and consumption leads to the expectation that consumers focus on the desirable outcomes of their meals (e.g., making a healthy home-cooked meal) when considering meals to be prepared in the distant future. At the same time, while shopping for groceries consumers appear to disregard the feasibility of actually preparing the meal. By the time they are ready to actually prepare the meal, the final decision is whether to prepare the home-made meal or, instead, opt for a more convenient solution.

In Chapter 4, I demonstrate that owing to the preference for and focus on a desired outcome—a home-cooked, healthy meal to be prepared in the future—consumers are inclined to purchase unprocessed foods that need intensive preparation before consumption. However, consumers often end up wasting these foods because, when the time to prepare the meal arrives, they lack the time, energy, and motivation to actually prepare the meal (Evans 2011, 2012) and

start looking for convenient alternatives. I propose and demonstrate that convenient substitutes of unprocessed foods, such as minimally processed vegetables that are pre-sliced or pre-cooked, are a solution to narrow the gap between what consumers acquire and what they actually consume, and hence to reduce food waste.

With multiple studies, I demonstrate that while consumers prefer unprocessed foods to convenience foods when making decisions for consumption in the distant future, convenience foods become more attractive closer to the time of meal preparation. I also show that using convenience foods decreases food waste. In my field study, households that were provided with a package containing convenience foods wasted 65% less food than households provided with a package containing the same foods in their unprocessed form. As an implication, I suggest that reminding consumers at the point of purchase of the feasibility of preparing their food choices can be a promising method to nudge consumers to prefer convenience over unprocessed foods. In my research, consumers who were reminded of the practicality of their choices were twice as likely to opt for convenience foods—a response that could decrease the gap between consumers' purchases and their actual consumption and thus lower food waste. Finally, I demonstrate that feasibility and desirability considerations drive the process through which temporal distance between the time of choice and time of consumption affects the preference for convenience foods.

5.3 Theoretical Contributions

The present dissertation expands understanding of food waste by offering theoretical and empirical evidence that unconscious decisions drive food waste behavior.

5.3.1 Consumer Food Waste

As a first theoretical contribution, the findings of this research advance theory on food waste. As disposal has been relatively under-studied in the consumer literature, results of this investigation offer a novel theoretical contribution in the domain of consumer food waste.

While the main contribution of Chapter 2 is to contextualize previous findings and current knowledge, Chapters 3 and 4 expand understanding of consumer food waste by offering theoretical and empirical evidence relating to unconscious decisions and actions driving food waste behavior. Discarding of edible food often happens unintentionally, as a consequence of interrelated, erroneous consumption decisions (Block et al. 2016). Results of this study offer a fundamental explanation of why and how these inconsistent consumption decisions contribute to consumer food waste. To the best of my knowledge, this study is the first to empirically investigate how unconscious decisions steer consumers toward wasting food.

5.3.2 Construal Level Theory

Drawing on construal level theory, this research contributes to the literature by being the first to examine the unconscious processes that lead consumers to waste food and to investigate the impact of temporal inconsistencies of consumption decisions on food waste. Study results demonstrate the importance of temporal distance between two phases of consumer behavior—acquisition and consumption—in the consumption process that have been studied in isolation until now. Study findings highlight the importance of the temporal distance between consumption decisions, which appear to be central to consumer food waste.

Temporal Distance: Healthiness. While findings of past work have demonstrated that consumers make healthier choices for future consumption, I show that this mechanism may also drive food waste. The studies in Chapter 3 demonstrate that the desire to indulge at the moment of consumption leads consumers to replace pre-planned healthy virtue food with less healthy vice food. While advance ordering results in healthier choices, as prior literature shows, these choices lead consumers to impulsively acquire additional, unhealthier vice choices at the moment of consumption. As a result, a surplus of food arises, resulting in food waste. While recent literature advises making decisions in advance to stimulate healthy choices (Milkman et al. 2010; VanEpps et al. 2016a), the results of the present dissertation indicate the need for

caution, as this practice may generate food waste as a negative side effect when an opportunity arises to impulsively acquire food at the moment of consumption. Advance ordering leads to both healthier food choices and less waste only when no opportunity emerges to acquire additional food at the moment of consumption.

Temporal Distance: From Desirability to Feasibility. Another theoretical contribution of this dissertation is the application of psychological distance and the focus on desirability versus feasibility for food consumption in relation to food waste. I posit that the change in psychological distance from making decisions in the grocery store to actual meal preparation and consumption causes a change in consumer preferences, ultimately contributing to food waste. As my studies in Chapter 4 reveal, this change in preference is caused by consumers' altered focus—away from the desirable end states of more distant consumption and onto the feasible aspects of meal preparation as the moment of consumption approaches. Moreover, I demonstrate that highlighting feasibility considerations at the decision moment (e.g., at the grocery store) may make consumers opt for more practical, convenient substitutes for unprocessed foods even if the moment of consumption is temporally distant.

5.4 Practical Implications

Even though food waste commonly occurs for reasons consumers might not be consciously aware of, this behavior may still be subject to influence. Previous literature has shown that marketing measures can curb food waste by, for example, making ugly produce more attractive (De Hooge et al. 2017; Grewal et al. 2019). This research demonstrates other ways in which marketing can contribute to food waste reduction. I provide managerial implications for retailers and policy makers and offer suggestions for consumers.

5.4.1 Steering Consumers Toward Consistent Choices

Consumer Implications. As shown in Chapter 3, impulsive choice behavior appears to be a major driver of food waste when consumers initially anticipate consuming a healthy,

virtuous meal. However, many situations in daily life provide opportunities for impulsively acquiring additional food—for instance, in the grocery store right before dinner, in the workplace canteen before lunch, through vending machines, or at the gas station. Engaging in impulsive consumption when initially having intended to consume a healthy meal not only causes food waste, it increases unhealthy consumption at the same time. A recommended strategy for avoiding impulsive consumption is to stay away from tempting stimuli whenever possible when there are pre-committed consumption plans (Hoch and Loewenstein 1991). This strategy is also suited to reduce food waste. Avoiding impulsive consumption to reduce food waste could hence be viewed as an additional self-regulatory objective in the food domain (Conrad et al. 2018). Furthermore, sticking to previously made consumption plans and not acquiring additional food avoids unnecessary expenditure (Stancu et al. 2016), thus functioning as another rationale to circumvent impulsive choice behavior.

As a recommendation, in practice, consumers could make a personal challenge out of finishing all the food available at home before acquiring new foods. When visiting the grocery store, consumers could make a challenge out of sticking to their grocery list. Another strategy to avoid tempting stimuli and reduce waste is the online ordering of groceries, as consumers purchase fewer vice foods when shopping online than when shopping in a physical store (Huyge et al. 2017). Impulse buying is also less pronounced in the online channel (Ramus and Nielsen 2005). Hence, online grocery shopping could narrow the gap between acquisition and consumption, resulting in less food waste.

Addressing the health goal and making room for indulgence while making planned consumption decisions could prevent impulsive choice behavior at a later moment in time (Dhar and Simonson 1999; Simonson 1989). Including both virtue and vice food in a meal allows pursuit of both health and indulgence goals within a single choice and is considerably effective at addressing the taste goal (Liu et al. 2015). Including a small portion of vice food could satisfy

the desire to indulge at the moment of consumption, decreasing the need to acquire additional vice food. Consequently, planned consumption becomes actual consumption, and food waste is lessened.

Managerial Implications. The findings of this dissertation also have important implications for the growing out-of-home consumption sector. I demonstrate that pre-ordering with a temporal gap between ordering and consumption fosters healthy choices and prevents waste, but only if consumers do not impulsively add unhealthy items to their order at the moment of consumption. This finding introduces a dilemma for the food retail sector. Making it easy for consumers to change their order is an attractive strategy for encouraging more sales, but at the same time leads to more waste. Restaurants and other food establishments should therefore be cognizant of this dilemma when introducing pre-ordering services and design their strategy according to the goal they prioritize. This research shows that consumers are equally satisfied with the meal regardless of whether they had the opportunity to impulsively add extra items. This is an encouraging result for parties who wish to discourage impulsive changes to an order to prevent not only extra calorie consumption, but also waste.

5.4.2 Nutritional Labeling

The findings of this research on the effects of nutritional labels on food waste behavior have implications for public policy makers who consider the use of nutritional labels, such as traffic lights, for meals consumed out-of-home. According to the results of this research, traffic lights are particularly suited to steer consumers toward more healthy decisions for immediate consumption, and have fewer desirable effects when a temporal delay occurs between the order and consumption moments. Hence, managers of, for example, health care institutions who strive to let their clients make healthier choices should either adopt pre-ordering with a temporal delay between order and consumption or place nutritional labeling on their menus, but not implement both at the same time.

Moreover, managers should be aware of the potential negative effects of nutritional labeling on waste. Although being confronted with traffic lights when choosing food in advance did not significantly increase the number of calories wasted in our research, it did increase the share of virtue waste. Using nutritional labels may therefore have negative consequences for the quantity of food waste in the long term. In most contexts, virtue foods (e.g., fruits and vegetables) are often more perishable than vice foods (e.g., cheese, pastries) (Buzby, Wells, and Hyman 2014; De Laurentiis, Corrado, and Sala 2018; WRAP 2012), and promoting virtue foods with the use of nutritional labels such as traffic lights may result in increased waste. If consumers acquire a bulk of virtuous foods, they may end up wasting more than when acquiring a reasonable virtue–vice balance owing to the flexibility and ability of consuming vice foods over a longer time span.

5.4.3 Promoting the Use of Convenience Food

Consumer Implications. This research demonstrates that acquiring convenience foods reduces consumer food waste. Implications for consumers are threefold. Aside from decreasing food waste, acquiring minimally processed convenience foods may improve consumer well-being, as consumers may increase their intake of healthy food. Owing to the ease and decreased effort of preparing a healthy meal with convenience foods, these foods may lower the barrier to consuming a healthy meal when consumers lack the time, energy, and motivation to cook for themselves, and avoid the temptation of looking for unhealthier but faster alternatives. Lastly, consumers save money as they no longer squander their money on unconsumed food.

Managerial Implications. To mitigate food waste, manufacturers, public policy makers, and retailers should steer consumers toward convenience foods by offering a wide assortment of minimally processed convenience food solutions. While many manufacturers are already responding to the market by packaging minimally processed and pre-cut vegetables and fruits in convenient serving sizes (Rekhy and McConchie 2014), a larger assortment of these

convenient food solutions seems warranted. As a side note, when implementing a larger assortment of convenience food solutions, manufacturers and retailers should also strive to minimize the environmental impact of the packaging of these convenience food items, for instance by using thinner plastics and simpler packages to help achieve more efficient recycling (Hopewell, Dvorak, and Kosior 2009).

Importantly, this research identifies an effective marketing strategy for policy makers and retailers to drive the sales of convenient substitutes of unprocessed foods: highlighting the practical aspects (e.g., the feasibility of actually preparing and consuming the meal in terms of time, motivation and effort) of consumers' future consumption. Grocery retailers could, for instance, stimulate consumers to consider these practical aspects during their grocery shopping trip. Considering the feasible aspects of consumption may make people more time-conscious (Jackson and Viehoff 2016). In the present research, consumers reminded of the practicality of their choices were twice as likely to opt for convenience foods—a response that should decrease the gap between consumers' purchases and their actual consumption and thus lower food waste. In practice, retailers could for instance promote convenience foods by reminding consumers of their busy lifestyles and hectic family schedules, and promote convenience foods as their "little helpers." In general, retailers could stress that convenience foods offer an easy and time-saving way to prepare meals, increase healthy food consumption, and eventually save money, as consumers no longer squander money on time-consuming foods that often remain uneaten.

In sum, effectively highlighting a feasibility mindset in-store would help decrease the mismatch between food acquisition and actual consumption and thus decrease food waste. Retailers can drive the sales of convenience foods and at the same time help to improve the environment. In addition, pushing the sales of convenience foods supports consumers in making equally nutritious and tasty meals compared to meals using unprocessed foods.

5.5 Limitations and Future Research

To further increase understanding of consumer food waste, the stream of literature on consumer food waste should be extended. Future research should continue to develop and investigate methods that could reduce or even prevent consumer food waste to align with the United Nations Sustainable Development Goals, which aim for a 50% reduction of food waste at the retail and consumer levels by 2030 (UN 2016). While attempts to change consumer behavior may reduce food waste in developed countries, more drastic changes in legislation, such as government interventions and support and cooperation from the business community and the food industry, are needed to reduce waste more drastically.

Like most research, this investigation was subject to some limitations. Importantly, the food offered to the study participants was provided for free. While this set-up was necessary to keep participants in a relatively closed system in which choices could be observed and manipulations controlled, free food might have encouraged over-ordering and hence food waste. I compared the results of the present study with the study results of Roe et al. (2018), which involved food that participants had to pay for. In their studies, 3.3% of all food acquired was returned as plate waste. In my studies involving actual consumption and waste (Chapter 3), the average amount of plate waste was slightly higher, at 5.4%. In a study by Just and Wansink (2011), participants who paid a higher price for their food on average ate more and ended up with more plate waste than participants who paid the regular price. That finding demonstrates that increasing the price for food does not necessarily result in more controlled consumer behavior in terms of acquisition, consumption, and disposal. To rule out the issue and create a setting that more closely imitates real life, future studies should manipulate costs or conduct a similar experiment in which participants pay for their food choices.

Another limitation of this research is that participants were not offered the opportunity to take away any leftovers for possible later consumption. Offering a take-home box could have

potentially altered our results, although it also raises the question of whether taking home leftovers is a good strategy to reduce food waste. As previous research has indicated that leftovers often remain uneaten (Farr-Wharton, Foth, and Choi 2014), taking home leftovers may simply transfer the waste problem from the out-of-home context to the household setting, with the addition of packaging waste (Martin-Rios et al. 2018). Future research could make an effort to study this aspect in more detail.

As a further consideration, the dichotomy of desirability and feasibility is at the core of many everyday decisions. However, the contrast between "home-made food" and "convenience food" is easily overdrawn, as consumers frequently combine different kinds of food and different cooking practices (Halkier 2013). Combining unprocessed and convenience foods could support consumers in adhering to planned consumption and decrease food waste. In the studies reported here, I completely separated unprocessed foods from convenience foods. Future research could investigate whether an optimal balance exists, for instance by using convenience substitutes for foods that are time-consuming to prepare while using unprocessed versions of other foods. Thus, combining these two types of food could be a solution for consumers who view the use of convenience foods as "cheating." Research among households within Europe has demonstrated that using a mix of convenience and unprocessed food products has increasingly become the norm (Gatley, Caraher, and Lang 2014), making investigation of this topic relevant.

Finally, since the use of convenience foods significantly lowered food waste in this research (by up to 65%), future research could consider other strategies to promote the advantages of convenience food and drive its sales. This research suggests highlighting the practicality of convenience foods at the point of purchase to promote acquisition of these types of foods. Future research could investigate the effectiveness of various types of advertising, discounts, or promotions for convenience foods.

5.6 Concluding Remarks

Consumer food waste is clearly a complex issue, with a multitude of factors interacting with each other and affecting food waste. This investigation reveals the need to take into account the decisions and actions that take place *before* consumers actually discard their food and focuses on the way in which consumers acquire and consume food. All practices relating to the acquisition and consumption of food are characterized by a complexity of conscious and unconscious factors, such as habits, rituals, trade-offs and many other competing goals, not to mention the (perceived) unpredictability of daily life (Aschemann-Witzel et al. 2015; Evans 2011; Quested et al. 2013). As a consequence, these interrelated factors make studying the topic of food waste quite challenging. Although food waste cannot be avoided completely, it can be minimized.

The results of this investigation provide new insights into underlying behavioral mechanisms that may lie at the heart of consumer food waste. Decreasing consumer food waste calls for consumer behavior such as making realistic and smart decisions in the grocery store and sticking to previously made consumption plans. I propose multiple tools to influence consumer behavior with the aim of minimizing the amount of food wasted—and with that, hopefully contribute to a better world.

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Appendices

APPENDICES CHAPTER 3

Appendix A. Overview of Measures in Studies 1–3

Variable	Included in	Description
Temporal distance	All studies	Temporal distance between planned and actual consumption (dummy variable, 1 = future consumption [ordering 2–3 hours in advance] 0 = immediate consumption [ordering < 30 minutes before]).
Planned choices: virtue share	All studies	Virtue calories of the planned order divided by the total number of planned calories (0–100%).
Planned choices: calories	All studies	Calories of the planned order from the order menu.
Impulsive choices: vice share	Studies 2 & 3	Vice calories of the impulsive order divided by the total number of impulsive calories (0–100%).
Impulsive choices: calories	Studies 2 & 3	Calories of the additional items ordered at the time of consumption.
Food waste: virtue share	Studies 2 & 3	The number of virtue calories wasted divided by the total amount of calories wasted (0–100%).
Food waste: calories	Studies 2 & 3	Calories wasted measured by manually weighing individual waste.
Traffic lights (TL) dummy	Study 3	Dummy variable indicating whether participants were confronted with traffic-light labels on the order menu and in the lunchroom (1 = yes, 0 = no).
Control variables		
Impulse offered	Study 2	Dummy variable indicating whether participants were offered additional food at the moment of consumption (1 = yes, 0 = no).
Gender	All studies	Gender dummy indicating whether the participant was male (1) or female (0).
Hunger	All studies	"How full does your stomach feel right now?" (1 = "not at all full", 7 = "very full"). In studies 2 and 3, it was measured before taking the planned order and before actual consumption when entering the lunchroom.

Overview of Calories per Item in Studies 1-3

Item	Caloric content
Multigrain roll with ham	144 calories
Muesli roll with cheese	235 calories
Fruit bowl (Study 1)	150 calories
Vegetarian wrap (Studies 2 and 3)	168 calories
Sausage roll	249 calories
Cheese roll	407 calories
Croquette in a bun	336 calories

The caloric value of each food item is derived from the calculation tool provided by The Netherlands Nutrition Centre (2017).

Appendix B. Control variables Study 1 (not mentioned in text)

Males ordered more calories (B = 87.21, t = 2.35, p = .020). Hunger level decreased the virtue share (B = -4.97, t = -3.04, p = .003) and increased the number of calories chosen (B = 51.03, t = 3.88, p < .001).

Appendix C. Pre-study Assessment of the Food Items for Studies 2 and 3 (N=146)

Category	Item	Healthiness (1- unhealthy to 7- very healthy)	Vice score (1- not at all vice food to 7- definitely vice food)	Virtue score (1- not at all virtue food to 7- definitely virtue food)
Vices	Sausage roll	2.1 (1.2)	5.1 (1.9)	2.2 (1.4)
	White bun with a croquette	2.3 (1.3)	5.4 (1.9)	1.9 (1.3)
	Cheese roll	2.9 (1.5)	4.8 (1.8)	2.5 (1.5)
Virtues	Multigrain bun with ham	4.4 (1.5)	3.0 (1.5)	4.4 (1.7)
	Muesli roll with cheese	5.0 (1.4)	2.7 (1.4)	5.0 (1.6)
	Vegetarian wrap	5.9 (1.1)	3.3 (1.9)	5.5 (1.5)

**Standard deviations are reported in brackets*

Appendix D. Maintaining Participants' Rights

Participation was anonymous in all studies. In Study 1, we did not ask for identification except for an email addresses for the lottery. We did not pair the questionnaires with the email addresses in the data file. For Studies 2 and 3, we collected and handed out the lunch bags, and needed to be able to match the food choices (i.e., the order items and quantities written on the order menu attached to the bag and the food waste that was left in the bag) with the questionnaires. We did so by asking participants to write the first five digits of their phone number on both the lunch bag and the questionnaire. During the ordering process for planned consumption, we also handed out a small card on which participants wrote the same number. When entering the lunchroom, participants handed in their small cards to the research assistants, who retrieved the matching lunch bag. When creating the data file, to ensure no personal identities could be obtained, we used the specific numbers to match the orders, food waste, and questionnaires of each individual participant.

APPENDICES CHAPTER 4

Appendix E. Information concerning the data collection of Study 2

The collected data comprised (1) the actual waste; (2) a questionnaire to obtain additional information about the use of the products and the study participants. The questionnaire can be found in the web appendix.

Unavoidable Waste in Study 2. We took into account the weight of the unavoidable waste for the bell pepper and onions in the unprocessed package and distributed these items in slightly higher weights so that the amount of avoidable waste would be similar for both packages. Owing to the natural shapes of the unprocessed items we could not provide exact same-weight products, but we aimed to provide bell peppers that weighed 120–150 grams in the unprocessed package (vs. 100 grams in the convenience

package) while unavoidable waste (i.e., the bell pepper steel) accounted for 21 grams of the weight. The onions weighed 150–170 grams in the unprocessed package (vs. 150 grams in the convenience package) while their unavoidable waste (i.e., the peels) accounted for 16 grams of the weight.

Appendix F. Information on the study procedure of Study 3

***Additional information regarding the study design*.** Researchers distributed 200 food packages, half of which contained convenience products and the other half whole food products. Of the packages, 60% were suited for 1–2 person households and 40% for 3–4 person households, in line with the population of the village where the grocery store was located. The packages contained eight products (see Table 1 for full list), provided in either a convenience or an unprocessed foods version. The products and quantities were identical in both conditions and varied solely in their degree of convenience.

Overview of distributed food packages

1–2 person household:	**1–2 person household:**
Unprocessed foods product package:	*Convenience product package:*
□ 4 onions	□ 300 gram chopped onions
□ 600 gram floury potatoes	□ 500 gram pre-cut and washed floury potatoes
□ 330 gram carrots	□ 300 gram peeled carrots
□ 500 gram risotto rice	□ 350 gram quick-boiling risotto rice
□ 1 small broccoli	□ 300 gram pre-cut and washed broccoli sprouts
□ 125 gram mushrooms	□ 125 gram chopped mushrooms
□ 600 gram waxy potatoes	□ 500 gram pre-cut and washed waxy potatoes
□ 500 beetroot	□ 400 gram grated beetroot
3–4 person household:	
Unprocessed foods product package:	**3–4 person household:**
□ 8 onions	*Convenience product package:*
□ 1 kg floury potatoes	□ 600 gram chopped onions
□ 500 gram carrots	□ 900 gram pre-cut and washed floury potatoes
□ 500 gram risotto rice	□ 500 gram peeled carrots
□ 1 big broccoli	□ 350 gram quick-boiling risotto rice
□ 250 gram mushrooms	□ 300 gram pre-cut and washed broccoli sprouts
□ 1 kg waxy potatoes	□ 250 gram chopped mushroom
□ 500 gram beetroot	□ 900 gram pre-cut and washed waxy potatoes
	□ 400 gram grated beetroot

The food packages were distributed on a Thursday, Friday, and Saturday in November 2015. On Thursday the food packages were distributed from 2 p.m. onwards and on Friday and Saturday from 10 a.m. onwards. We chose this schedule because according to the store manager, these days were the most popular shopping days and the days on which the most different age groups and different household sizes showed up.

On Thursday, 23 food packages were handed out, on Friday 90 food packages were handed out, and on Saturday the remaining 87 packages were handed out. On each of the days, an equal number of convenience and unprocessed food packages were distributed. Additionally, the study entailed a second experimental condition by giving half of the participants three recipes (i.e., a stew recipe, a risotto recipe, and a recipe for potatoes and red beets) within their food packages: 100 households were provided with recipes, which were equally distributed among the convenience and non-convenience packages. Most participants who received recipes used these. The returned diaries showed that 53.6% of participants used the stew recipe, 64.3% used the risotto recipe, and 50% used the potatoes with red beets recipe.

The food packages contained eight food items and a letter explaining the study in detail, as well as an e-mail address for further questions. Also included in the packages were the diary and questionnaire as well as 10 sealable plastic bags for the waste collection. Respondents were asked to fill in the questionnaire and the food waste diary over a period of 10 days and to put their waste (including products they did not consume and unavoidable waste such as potato skins) in the sealable plastic bags. We asked for both a diary and the actual waste since the waste in the diary was self-reported—participants weighed the products without supervision, which raises questions as to the accuracy of the reported amounts. By additionally collecting the waste, we were able to weigh the waste ourselves, yielding a more precise and accurate database. The questionnaire could be filled out either on paper or online via the survey platform Qualtrics. To preserve respondents' anonymity, each food package, questionnaire, food diary, and sealable plastic bags were marked with an individual respondent number ranging from 1 to 200. Hence, participants were identifiable only by their unique respondent number. To attract participants, a sign stating "Help us graduate and get a free food package" was displayed at the stand. Additionally, the grocery store posted a picture of the study setup and the four researchers on its Facebook page, encouraging customers to drop by and learn more about the study. Interested customers were approached by one of the researchers and asked whether they were willing to participate in the study and receive a package of free groceries for this purpose. After the participants had signed the informed consent form, based on their household size they were randomly assigned to either the convenience or unprocessed foods condition. At the end of the ten-day period, participants handed in their waste, diary, and questionnaire at the grocery store and received a chocolate bar as a token of appreciation for their participation. If the actual waste was returned, participants were additionally enrolled in a lottery with the chance to win one of five grocery shopping discount coupons. Participants were told that the local food bank would receive a donation if at least 75% of the participants brought back their waste.

The collected data comprised (1) a food waste diary; (2) the actual waste; and (3) a questionnaire obtaining additional information about the study participants. The questionnaire can be found in the web appendix.

Unavoidable Waste in Study 3. The waste measure of the unprocessed food package condition was adjusted for unavoidable waste, such as peels and broccoli stalks, using a measure obtained from the researcher who weighed the items separately (397 grams for the 1–2 person household package, 567 grams for the 3–4 person household food package; see below). As in Study 2, we calculated a percentage measure for the amount of unavoidable waste per individual and subtracted this amount from the amount of waste for each participant who chose the unprocessed package.

	1–2 person household	**3–4 person household**
Broccoli 378 gram	Stalk = 49 gram	65 gram
Potatoes waxy 600 gram	Peels = 77 gram	128 gram
Potatoes 600 gram	Peels = 99 gram	128 gram
Red beets 500 gram	Peels = 98 gram	98 gram
Onions 4 pieces	Peels = 44 gram	88 gram
Carrots 350 gram	Peels = 30 gram	60 gram
TOTAL	397 grams	567 grams

+ 150 grams of risotto rice for both packages

**Weighing session by researcher to calculate unavoidable waste (peels) (March 3, 2019)*

Nederlandse Samenvatting

Wereldwijd wordt een derde van al het voedsel dat geproduceerd is voor menselijke consumptie weggegooid. Dit is genoeg om twee miljard mensen mee te voeden. Voedsel wordt door de hele leveringsketen heen verspild: tijdens productie, verwerking, distributie, binnen de retail, en uiteindelijk door de consument. Voedselverspilling heeft negatieve gevolgen voor de economie, het milieu, en de samenleving. Als we de wereldwijde voedselverspilling als een apart land zouden zien, zou het na de VS en China de grootste producent van broeikasgassen op aarde zijn. De Verenigde Naties (VN) willen daarom wereldwijd voedselverspilling met 50% verminderen in 2030. In ontwikkelde landen is aangetoond dat consumenten de grootste producenten van voedselverspilling zijn. Naar schatting verspillen consumenten tussen de 10% en 30% van hun gekochte voedsel. Het terugdringen van voedselverspilling onder consumenten is daarom belangrijk om bij te dragen aan de wereldwijde milieuduurzaamheid en het doel van de VN. In dit proefschrift wordt vanuit verschillende invalshoeken gekeken naar het beslisgedrag van consumenten omtrent aankoop, consumptie en verspilling van voedsel. Het kerndoel is antwoord geven op de vraag waarom consumenten voedsel kopen dat zij niet opeten, maar in plaats daarvan weggooien. Beter inzicht omtrent dit vraagstuk kan voedselverspilling onder consumenten terugdringen en zo de negatieve gevolgen van voedselverspilling verkleinen.

In het eerste hoofdstuk van dit proefschrift wordt de definitie van voedselverspilling toegelicht. Als er in dit proefschrift gesproken wordt over voedselverspilling, gaat het om vermijdbare verspilling die voorkomen had kunnen worden. Vermijdbare voedselverspilling omvat voedsel dat niet langer eetbaar is (e.g., bedorven voedsel) of voedsel dat onnodig weggegooid wordt omdat het ongewenst is (e.g., kliekjes). Dit betekent dat onvermijdbare verspilling zoals schillen, botten en graten niet meegerekend wordt omdat dit niet voor menselijke consumptie is bedoeld. Binnen dit proefschrift wordt voedselverspilling onder

consumenten benadert als '*het verschil tussen de hoeveelheid voedsel dat gekocht en geconsumeerd wordt'*. Tot 57% van dit type voedselverspilling kan voorkomen worden (WRAP 2017). Daarnaast benadrukt het eerste hoofdstuk dat er binnen dit proefschrift de nadruk gelegd wordt op de psychologische gedrags- en beslisprocessen van consumenten die uiteindelijk bijdragen aan voedselverspilling. Het gehele beslisproces van de consument—van aankoop en consumptie tot verspilling—wordt hierbij meegenomen en benadert als drie opeenvolgende, met elkaar verbonden fasen. Deze drie fasen lopen als een rode draad door het gehele proefschrift. Gezien het doel van dit proefschrift—het terugdringen van voedselverspilling—is het van belang om met name te kijken naar de acties en gedragingen van consumenten die ver *voor* de verspilling plaatsvinden; in plaats van te focussen op het moment waarin voedsel het stadium van verspilling al (bijna) heeft bereikt. Met andere woorden, het gedrag van de consument tijdens aankoop en consumptie zijn belangrijk om beter te begrijpen hoe en waarom consumenten hun voedsel verspillen. We stellen hierbij dat voedselverspilling zowel binnenshuis (i.e., binnen het huishouden) als buitenshuis (e.g., in restaurants, kantines en andere openbare omgevingen) plaatsvindt en dat er in beide gevallen winst te behalen valt met betrekking tot het terugdringen van de verspilling.

Het tweede hoofdstuk van dit proefschrift is een overzichtsstudie naar wat er op dit moment bekend is over de oorzaken van voedselverspilling onder consumenten. In dit hoofdstuk worden de bestaande theoretische kaders en empirische bevindingen geïdentificeerd en besproken. Alhoewel er voornamelijk beschrijvend onderzoek over het onderwerp voedselverspilling beschikbaar is, wordt recent de nadruk gelegd op de onderliggende psychologische processen die tot voedselverspilling kunnen leiden. Het vinden van haalbare manieren om voedselverspilling te verminderen vereist een helder begrip van de onderliggende besluitvormingsprocessen van consumenten.

Een bekende stroom literatuur veronderstelt dat consumenten minder voedsel verspillen als ze meer kennis over het onderwerp hebben of hun overtuigingen of attitudes ten opzichte van voedselverspilling veranderen. Binnen deze stroom wordt minder rekening gehouden met de vaak onvoorspelbare en onbewuste beslissingen van consumenten met betrekking tot de aankoop en consumptie van voedsel. Vele factoren zijn van invloed op verspillingsgedrag, waaronder culturele achtergronden, ervaringen, situationele aspecten zoals de omgeving en het individuele begrip over voedsel, maar ook vastgeroeste gewoonten. Juist deze onbewuste factoren lijken uiteindelijk bij te dragen aan voedselverspilling. Doordat de desbetreffende stroom literatuur hier minder rekening mee houdt, lijkt de benadering minder geschikt om feitelijk voedselverspillingsgedrag mee te kunnen voorspellen.

Een andere belangrijke stroom literatuur erkent dat consumenten zich vaak niet volledig bewust zijn van hun besluitvormingsproces en de resultaten ervan—dat wil zeggen, consumenten realiseren zich vaak niet dat hun beslissingen en gedrag bijdragen aan voedselverspilling. De literatuur binnen deze stroom benadert voedselverspilling onder consumenten als een veelzijdig probleem met meerdere onderling samenhangende en afhankelijke oorzaken. Dit hoofdstuk beschrijft de bestaande empirische bevindingen binnen deze literatuurstroom die aantonen waarom consumenten niet al hun gekochte eten op tijd gebruiken en dus verspillen. Dit resulteert in een overzicht van de verschillende en veelvoorkomende oorzaken van voedselverspilling onder consumenten. De oorzaken worden gecategoriseerd in de aankoop-, consumptie- en verspillingsfasen, waarbij onderscheid wordt gemaakt tussen situationele, individuele en sociale oorzaken. Hieronder zijn de veelvoorkomende oorzaken van voedselverspilling binnen elke fase opgesomd:

- Factoren die onbewust bijdragen aan voedselverspilling bij consumenten *tijdens de aankoopfase* zijn onder meer een slechte planning voordat consumenten de supermarkt bezoeken, te veel kopen door verleidelijke marketingacties in de winkel, het doen van

impulsaankopen, en de wens om goed voor het gezin te zorgen en gevarieerd voedsel in huis te halen.

- *Op het moment van consumptie* missen consumenten vaak de motivatie, tijd of kookvaardigheden die nodig zijn om een maaltijd te bereiden. Wanneer consumenten te weinig tijd hebben om hun maaltijden te bereiden, hebben ze de neiging om hun geplande maaltijd door een makkelijker en sneller alternatief te vervangen, wat leidt tot verspilling van voedsel dat meer voorbereidingstijd vergt. Andere belangrijke onbewuste oorzaken van voedselverspilling zijn het bereiden of serveren van te veel voedsel.
- *Na het consumptiemoment* zijn consumenten vaak terughoudend om overgebleven restjes voedsel (i.e., kliekjes) te consumeren. Bovendien aarzelen sommige consumenten om suboptimaal voedsel (e.g., beschadigd voedsel of voedsel dat uiterlijk gezien afwijkt van de norm) te consumeren en heerst er een gebrek aan begrip van houdbaarheid labels.

Het literatuuroverzicht brengt verschillende richtingen voor toekomstig onderzoek aan het licht. Het tweede hoofdstuk binnen dit proefschrift sluit daarom af met een overzicht met suggesties voor toekomstig onderzoek met betrekking tot voedselverspilling onder consumenten. Hierbij wordt het belang van het integraal bestuderen van met name de aankoop- en consumptiefasen benadrukt. Dit is in tegenstelling tot de bestaande literatuur waarbij deze fasen voornamelijk onafhankelijk van elkaar zijn onderzocht.

In de empirische hoofdstukken van dit proefschrift worden alle fasen van het beslisproces van de consument—van aankoop en consumptie tot verspilling—belicht. Voortbouwend op *construal level theory* en gericht op een enkel consumptiemoment dat buitenshuis plaatsvindt, wordt in hoofdstuk 3 aangetoond dat de tijdsdiscrepantie—*temporal*

distance—tussen een geplande consumptiebeslissing (aankoop) en het daadwerkelijke consumptiemoment significant bijdraagt aan voedselverspilling. De empirische resultaten tonen aan dat consumenten voor consumptiemomenten verder in de toekomst relatief gezonde, maar minder smakelijke voedselkeuzes maken. Echter, op het moment van consumptie geven consumenten toe aan de verleiding en consumeren impulsief relatief smakelijke maar minder gezonde voedselkeuzes. Dit impulsieve gedrag resulteert in een overschot aan voedsel, waarbij het relatief ongezonde voedsel wordt geconsumeerd en het relatief gezonde voedsel wordt verspild.

Het onderzoek binnen dit hoofdstuk laat zien dat consumenten eerder geneigd zijn tot impulsieve consumptie wanneer ze in eerste instantie hebben gekozen voor relatief gezond voedsel met relatief weinig calorieën. We kunnen daardoor concluderen dat vooraf voedsel kiezen of bestellen kan bijdragen aan het ontstaan van voedselverspilling wanneer *extra* (vaak ongezond) voedsel wordt aangeschaft op het moment van consumptie. Vooraf bestellen kan een goede manier zijn om verspilling terug te dringen en relatief gezonde voedselkeuzes te stimuleren, maar alleen als er *geen* gelegenheid is om op een later moment impulsief extra voedsel aan een maaltijd toe te voegen. Veel situaties in het dagelijks leven bieden echter mogelijkheden om impulsief extra voedsel te kopen; bijvoorbeeld in de supermarkt vlak voor het avondeten, in de kantine vlak voor de lunch, via snackautomaten, bij het benzinestation of door het spontaan bestellen en laten thuisbezorgen van maaltijden. Impulsief ongezond voedsel consumeren wanneer het aanvankelijk de bedoeling was om een gezonde maaltijd te consumeren, veroorzaakt zowel voedselverspilling als een verhoging van de inname van relatief ongezonder voedsel. Een aanbevolen strategie om impulsieve consumptie te vermijden, is om waar mogelijk uit de buurt te blijven van verleidelijke prikkels wanneer er vooraf vastgelegde consumptieplannen zijn.

Bovendien demonstreert het derde hoofdstuk dat de aanwezigheid van een voedingslabel (in dit geval het *traffic lights* of *verkeerslichtensysteem*, een voedingsetiket met kleurcodering dat de hoeveelheid verzadigd vet, suiker en zout in een product aangeeft) de beslissingen over consumptie en voedselverspilling beïnvloedt. In de laatste studie van dit hoofdstuk wordt aangetoond dat het gebruik van een voedingslabel consumenten ertoe aanzet meer calorieën te bestellen voor toekomstige consumptie. Deze calorieën zijn voornamelijk afkomstig van relatief gezond voedsel. Dit komt doordat het voedingslabel gezondheid saillant maakt en daardoor de aankoop van relatief gezonde voedingsmiddelen stimuleert en tegelijkertijd impulsieve en ongezondere keuzes op het moment van consumptie zelf dempt. Als gevolg hiervan kiezen consumenten wanneer zij vooruitbestellen een relatief grote bestelling bestaande uit veel gezond voedsel, wat logischerwijs ook leidt tot een relatief hoog aandeel aan verspilling van dit gezonde voedsel. Het uiteindelijke aantal verspilde calorieën verschilt niet significant in vergelijking met wanneer er geen voedingslabel wordt weergegeven. Het verkeerslichtensysteem lijkt daarom met name de *samenstelling* van afval te beïnvloeden—namelijk, een groter aandeel relatief gezond voedsel wordt weggegooid—als gevolg van het verschil in aankoopgedrag, en in mindere mate de *hoeveelheid* verspild voedsel. Volgens de resultaten van dit onderzoek zijn voedingslabels zoals het verkeerslichtensysteem daardoor geschikt wanneer consumenten beslissingen nemen voor onmiddellijke consumptie, omdat consumenten met een voedingslabel direct gezondere keuzes maken. Voedingslabels hebben minder gewenste effecten wanneer er vooraf besteld wordt.

Het vierde hoofdstuk van dit proefschrift kijkt naar voedselverspilling onder huishoudens. Consumenten verspillen 25% van het voedsel dat ze kopen (Buzby, Wells, en Hyman 2014; Natural Resources Defense Council 2017) en onderzoek toont aan dat de helft van de voedselverspilling onder consumenten het resultaat is van slechte aankoopbeslissingen,

bijvoorbeeld in de supermarkt (Moskalev 2013; Setti et al. 2018). Dit hoofdstuk laat zien dat het kopen en consumeren van minimaal bewerkt gemaksvoedsel kan dienen als handige vervanger van onbewerkte voedselproducten en verspilling kan terugdringen. Volgens het onderzoek in dit hoofdstuk kan het vervangen van bijvoorbeeld ongesneden groenten voor voorgesneden groenten voedselverspilling tot zelfs 65% verminderen.

Een mogelijke verklaring, wederom gemotiveerd door *construal level theory*, is dat consumenten bij het denken aan toekomstige maaltijden focussen op de wenselijke kenmerken van de maaltijd of het gewenste einddoel, vaak een zelfgemaakte maaltijd op basis van onbewerkte ingrediënten. Als resultaat kopen consumenten rauwe, onbewerkte voedingsmiddelen. Op het moment van consumptie beginnen consumenten echter meer rekening te houden met de benodigde tijd en moeite die nodig is voor het bereiden van de maaltijd. Bovendien kunnen consumenten erachter komen dat het bereiden van de geplande maaltijd niet haalbaar is omdat ze door hun drukke levensstijl te weinig tijd hiervoor hebben. Als gevolg hiervan wordt het onbewerkte voedsel mogelijk niet bereid en eindigt het als afval. Vanwege de verminderde tijd en moeite die nodig is, bieden minimaal bewerkte gemaksvoedingsmiddelen zoals voorgesneden groenten een mogelijke oplossing.

Om dit te onderzoeken zijn er in dit hoofdstuk meerdere studies uitgevoerd, waarvan twee met daadwerkelijk consumptie- en verspillingsgedrag onder consumenten. In samenwerking met supermarktketen Albert Heijn is bijvoorbeeld een studie onder tweehonderd huishoudens uitgezet. Binnen deze studie ontvingen de deelnemende huishoudens voedselpakketten met ofwel ongesneden voedselproducten of voorgesneden voedselproducten. De respondenten werden verzocht om de overblijfselen van het pakket na tien dagen te retourneren, zodat het afval gewogen kon worden. Naast dat binnen dit hoofdstuk wordt aangetoond dat gemaksvoedsel bijdraagt aan verminderde verspilling, wordt gedemonstreerd dat als er meer tijd tussen aankoop- en consumptie ligt, consumenten minder geneigd zijn

gemaksvoedsel te kopen. Een oplossing hiervoor is consumenten in de supermarkt al na te laten nadenken over de *haalbaarheid* van hun maaltijden—zoals de tijd, motivatie en energie die nodig zijn om een maaltijd te bereiden—zodat zij eerder geneigd zijn om minimaal bewerkte gemaksvoedingsmiddelen te kopen en te gebruiken.

Dit proefschrift onderzoekt waarom consumenten voedsel kopen en dan weggooien in plaats van opeten, en hoe we dit kunnen beïnvloeden. De hoofdstukken binnen dit proefschrift tonen aan dat de beslissingen die de consument neemt tijdens de aankoop en consumptie van voedsel vaak onbewust leidt tot voedselverspilling en dat er mogelijkheden zijn om deze vermijdbare verspilling terug te dringen. Op deze manier leidt dit proefschrift tot nieuwe inzichten voor het verminderen van het wereldwijde voedselverspillingsprobleem.

De resultaten van dit proefschrift bieden nieuwe inzichten in onderliggende gedragsmechanismen die mogelijk de kern vormen van voedselverspilling bij consumenten. Het verminderen van voedselverspilling bij consumenten vraagt om rationeel consumentengedrag, zoals het nemen van realistische en slimme beslissingen in de supermarkt en het vasthouden aan eerder gemaakte consumptieplannen. Ook het kopen van minimaal bewerkte gemaksvoedingsmiddelen die tijd en energie besparen, lijkt een veelbelovende manier om voedselverspilling onder consumenten terug te dringen.

Voedselverspilling is een zeer complex en veelzijdig probleem, gedreven door een variëteit van factoren die met elkaar in wisselwerking staan. Dat maakt het bestuderen van voedselverspilling behoorlijk uitdagend. Hoewel voedselverspilling niet volledig kan worden voorkomen, hoop ik met dit proefschrift een bijdrage gedaan te hebben om dit probleem met een klein stapje terug te kunnen dringen.