UNSUSTAINABLE CONSUMPTION: EXAMINING MANAGERIAL ACTIONS THAT

INHIBIT SUSTAINABLE BEHAVIOR

by

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(Under the Direction of Sarah C. Whitley and Julio Sevilla)

ABSTRACT

Addressing the gap between consumers' concern for the environment and the impact of their actual behavior has been a key focus of marketing researchers seeking to better understand sustainable actions in the marketplace. This attitude-to-behavior gap is well-studied with an emphasis on personal characteristics and messaging techniques that help predict or nudge sustainable behaviors such as purchase and disposal. Informed by my managerial experience in a consumer goods manufacturing environment, I believe there are practices related to packaging and labeling that while well-intended, may have unintended negative consequences in terms of their ultimate environmental impact. Essay 1 examines the role of density on a consumer's decision to trash or recycle product packaging, a timely topic given manufacturing trends that reduce the amount of raw material used to produce packaging. The findings show that consumers are more likely to dispose of low-density recyclable packaging in the trash, rather than appropriately recycle it, due to their perceptions of the material's usefulness. Essay 2 examines the topic of retailer food waste by evaluating the role of individual differences on consumers' likelihood to purchase perishable goods approaching expiration. Specifically, I evaluate the likelihood to buy an expiring good as a form of sustainable consumption and find consumers

with high green consumption values are more likely to do so. By unpacking why these

individuals are more likely to prevent expiring perishables from going unsold, I seek to identify

labeling and retail tactics that can reduce food waste across the general population. Together,

these essays explore how managerial practices around packaging and labeling contribute to waste

generation, identifying opportunities for further research into the role practitioners play in

inhibiting sustainable consumer behavior.

INDEX WORDS: Sustainability, sustainable behavior, packaging, retailing, recycling, waste
generation, food waste

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A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial

Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2024

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December 2024

DEDICATION

To Drew, who has never doubted my potential and whose support made this possible. You are the type of partner I dream of for our girls. To Alice, Maggie, and Birdie, who have been my motivation and cheerleaders in ways they cannot yet understand. To Woody, who has no idea what's going on. I love you all.

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CHAPTER 1

INTRODUCTION

"This discrepancy between what consumers say and do is arguably the biggest challenge for marketers, companies, public policy makers, and nonprofit organizations aiming to promote sustainable consumption."

White, Katherine, Rishad Habib, and David J. Hardisty (2019), "How to SHIFT Consumer Behaviors to Be More Sustainable: A Literature Review and Guiding Framework," Journal of Marketing, 83(3), 22–49.

Reflecting on my journey as a doctoral student, I can distinctly remember the roller coaster of emotions when delving into academic research for the first time. Coming from a background in consumer goods manufacturing, I had firsthand experience with the challenges of predicting consumer behavior. However, my understanding of these issues was limited to one specific industry and anecdotal in nature. It was not until reading my assigned research papers that I began to appreciate the depth and complexity involved in understanding why consumers behave in the ways that they do. I would encounter research explaining a phenomenon I had experienced in industry and be flooded with inspiration for ways to expand on those findings, often to find the idea to be small in contribution or too close conceptually to existing work. I spent my first year of the PhD program riding the highs of idea generation that were inevitably followed with the lows of feeling all the good ideas were gone. The above quote from White, Habib, and Hardisty's SHIFT framework (2019) represents one of the earliest moments from my doctoral studies that I felt a promising connection between my past professional experience in industry, my personal concerns for the environment, and my future aspirations as a researcher. In

my managerial role, I had to face the disconnect between a consumer's voiced intentions and their ultimate behavior as it related to topics such as purchase intent or willingness to pay, but the attitude-to-behavior gap was not a phenomenon I had seen so rigorously analyzed, nor had I seen it applied to the context of sustainability. This introductory chapter aims to summarize my inspiration for researching these topics, the pressing nature of research that addresses ways to minimize marketing's impact on climate change, the growing awareness among consumers about their environmental impact, and how my specific areas of research contribute to the body of knowledge on sustainable consumption.

I was drawn to research on environmentally-friendly consumption such as the SHIFT framework (White, Habib, and Hardisty 2019) due to my own personal interest in sustainability, but reading the barriers to sustainable behavior identified in extant research heightened my awareness of the role manufacturers were playing in contribution to this issue. In the manufacturing environment, managers are making marketing decisions that impact consumption under financial and production constraints, fighting for outcomes that align with consumer psychology but are sometimes in direct conflict with the priorities of cross-functional stakeholders. With some research suggesting the marketing function is losing influence within the firm (e.g., Verhoef and Leeflang 2009; Homburg et al. 2015), it should not be surprising that those fights with cross-functional partners were sometimes lost by me and my colleagues. It is how those conflicting priorities influence outcomes related to disposal and may have unintended negative consequences in terms of sustainability, that I was motivated to research during my doctoral studies.

The findings of this dissertation research represent the intersection of my professional experience in fast-moving consumer goods (FMCGs), personal interest in sustainability, and

academic training in consumer behavior. In fact, the topics of both essays that comprise this dissertation were inspired by manufacturing decisions I observed during my time in industry that ran counter to my instincts as a marketer. Viewing those decisions and their impacts on consumer behavior through the lens of sustainability helped me to better understand the role of practitioners on issues of environmental concern such as waste generation. Examining the resulting consumer behaviors of those decisions using the frameworks and methodologies I learned as a student has enabled me to contribute to this field in a unique and impactful way.

The first essay in this dissertation explores the role of density on a consumer's decision to trash or recycle a piece of product packaging and was informed by my experience with material lightweighting. Lightweighting is achieved by either replacing packaging material with a lighter weight alternative or cutting down the amount of packaging material used, resulting in a less dense and lighter weight packaging (Szaky 2017). During my time managing a bottled water brand, lightweighting the product packaging was identified by our supply chain partners as an effective method to meet the firm's waste reduction goals. My immediate concern was how this reduction in density would impact the perceived quality of our product when consumers held the packaging in their hands, given my experience interacting with competitive packaging that had moved to a lightweight design. I revisited this issue from the point of view of a researcher after learning about the role of these product and packaging perceptions not just on purchase behavior, but on disposal (e.g., Trudel and Argo 2013), and detail the results in Essay 1.

The second essay was influenced by my realization that managerial decisions are sometimes surprisingly arbitrary in nature. Observing the FMCG manufacturing environment as an outside consumer, I naively assumed expiration-dating was based on thorough consideration or even scientifically-based analysis. However, with the exception of infant formula, date-based

labeling practices on food and beverages are unregulated in the United States (USDA 2024), and are decided upon by the manufacturers to indicate peak freshness rather than any kind of risk associated with consuming the product beyond the stated window. I learned it is not uncommon to let product age in a manager's cubicle or cabinet within an R&D facility to be tasted at predetermined intervals and evaluated for qualities such as color, taste, and texture. Rather than representing a measure of safety, expiration dates are more often a safeguard for perceptions of quality and brand equity. Upon learning of the impact of expiration date labels on the issue of food waste as a student, I decided to investigate individual differences that may impact a consumer's likelihood to purchase expiring goods in an effort to prevent food waste, with preliminary work on this topic detailed in Essay 2.

Although initially inspired to research topics regarding sustainable consumption based on my personal interest in issues of environmentalism, I now better understand it as an impactful area for further study. Sustainability has become a critical focus for marketing researchers as the impact of modern society on the environment has never been more apparent. Temperatures worldwide have risen by roughly 1.2 degrees Celsius since the pre-industrial era, leading to more frequent and severe weather events, biodiversity loss, and economic disruptions (Salas 2024). Due to the far-reaching consequences of this temperature increase, climate change is also a humanitarian crisis. According to the World Health Organization impacts of climate change such as malnutrition and excessive heat exposure are expected to cause approximately 250,000 more deaths per year over the next 25 years (WHO 2023). Recent news highlights both the evidence of climate change and the strides being made to improve sustainability efforts in the United States. Hurricane Helene dumped more than two feet of rain on parts of Western North Carolina in late September 2024, with the resulting floodwaters destroying homes and businesses and washing

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away roads (Borunda and Waldholz 2024). Climate researchers examining Helene determined

the unusually high sea surface temperatures in the Gulf of Mexico as Helene was forming

contributed to her intensity and can be directly attributed to climate change (World Weather

Attribution 2024). Due in part to its visible impact on communities in the U.S., climate change

has become a high-profile issue in American politics. The U.S. Inflation Reduction Act allocated

$369 billion to reduce greenhouse gas emissions and support clean energy initiatives (U.S.

Department of Treasury 2023), with this investment expected to cut emissions in the U.S. by up

to 48% by 2035.

Consumer behavior plays a key role in some of this environmental change, and

consumers in the U.S. are becoming increasingly aware of the environmental impact of their

consumption as a result. Since the publication of White, Habib, and Hardisty's SHIFT

framework (2019), which outlined a research agenda for marketers looking to address the

unsustainable consequences of consumer behavior, the change in consumer attitudes toward

climate change has, on the surface, seemed promising. Research conducted by the Yale Program

on Climate Change Communication found that 72% of Americans now say that global warming

is happening, the highest level of agreement amongst participants since the survey began in 2008

(Leiserowitz, Maibach, Roser-Renouf, and Smith 2021). Industry-funded studies over the last

few years indicate similar changes in concern and propensity for action. A 2019 survey

conducted by the marketing research firm Nielsen found 73% of global consumers said they

would change their consumption habits to reduce their individual impact on the environment

(Nielsen 2019). When asked in 2021 in a survey conducted by the consulting firm McKinsey if

they care about buying environmentally-friendly or ethically sustainable products, 57% of

consumers said they were willing to pay a premium for sustainably sourced or produced

products, up from 49% in a similar 2019 survey (McKinsey & Company 2021). Most recently, a study by NielsenIQ revealed that 78% of American consumers say that living a sustainable lifestyle is important to them (McKinsey & Company 2023).

But despite these self-reported concerns and intentions, the actions of individual consumers tell a different story, as waste generation rates both in the U.S. and worldwide continue to rise. Data from the U.S. Environmental Protection Agency (EPA) shows year over year increases in waste generation, while recycling rates have plateaued, indicating a ceiling effect in terms of sustainable disposal (EPA 2021). Similarly, research from the World Bank found that global waste generation is expected to increase by 70% by 2050, from 2.1 billion tons to 3.4 billion tons (2020). This discrepancy between what consumers say they care about and what they actually do, referred to by researchers as the attitude-to-behavior gap, is well known and has been extensively studied, with extant research emphasizing the role of personal characteristics and messaging techniques that help predict or nudge sustainable consumer behavior (Kollmuss and Agyeman 2002; Young et al. 2010; Johnstone and Tan 2015, White et al. 2019). Where I aim to differentiate my work is by focusing on the actions of manufacturers, specifically how the practices relating to packaging and date labeling I observed during my time in industry impact sustainable consumption.

Manufacturers, particularly in the fast-moving consumer goods (FMCG) sector, have a significant environmental footprint due to the nature of emphasizing convenience over sustainability. In addition to the production and distribution of goods, FMCGs represent a significant contribution to greenhouse gas emissions and waste generation due to the amount of plastic used in packaging. Plastic is made from fossil fuels, and half of all plastic products produced every year are single-use plastics, such as those used in FMCG packaging, grocery

bags, and to-go containers (Vasarhelyi 2023). The greenhouse gasses emitted as part of the extraction and transportation of these fossil fuels, combined with the gasses emitted as a part of the plastic refinement process, are estimated to total more than 220 million metric tons per year (Bauman 2019). But the environmental impact of the production process is only half of the problem.

Containers and packaging associated with consumer products account for more than 82 million tons of waste entering U.S. landfills annually (Environmental Protection Agency 2019). Additionally, it is estimated that approximately 10 million metric tons of this consumer waste can be attributed to as few as 100 fast-moving consumer goods (FMCG) manufacturers (Resource Plastic 2020). Although many manufacturing firms are adopting sustainable packaging solutions, such as biodegradable materials, this work identifies one environmentally-motivated manufacturing process, material lightweighting, that runs counter to principles of consumer psychology and contributes to the attitude-to-behavior gap. In Essay 1, I explore a previously unexamined factor manipulated by material lightweighting that may be unknowingly contributing to the disposal rates of product packaging: density. Specifically, my research finds consumers are more likely to trash recyclable packaging that is manufactured to be low in density compared to similar packaging that is higher in density. In addition to identifying this unintended negative consequence of lightweighting, I identify tactics to mitigate its environmental impact through priming and on-pack messaging.

In addition to waste generation that results from consumers' perceptions at the time of disposal, this dissertation research explores waste generation as a result of consumers' perceptions at the time of purchase, specifically, how expiration date labeling practices contribute to pre-acquisition food waste. Understanding the drivers of food waste is a significant

issue facing researchers of sustainable consumption. A joint report from the Natural Resources

Defense Council (NRDC) and the Harvard Food Law and Policy Clinic found that U.S.

consumers throw away 52 million tons, or $165 billion worth, of food every year (NRDC 2013).

This volume of waste not only has environmental consequences in the form of greenhouse gas

emissions (EPA 2020), but also humanitarian consequences in the form of missed opportunities

to address food insecurity (Coleman-Jensen et al. 2020). While the balance of marketing research

on food waste is focused on waste that takes place by households (Porpino 2016), food waste

that takes place in the retail environment, pre-acquisition, represents an opportunity for further

exploration. Pre-acquisition food waste, when perishable products go unsold by retailers and

must be discarded, accounts for roughly one-third of all food waste in the United States each

year (USDA 2023). Retailers, including grocery stores and restaurants, must discard

approximately 43 billion pounds, or $161 billion worth, of food annually, costing the retail sector

$18.2 billion every year (ReFED 2016).

The issue of food waste is another area of sustainable consumption where the attitude-to-

behavior gap is visible based on statistics. According to a report from research firm Capgemini,

72% of consumers are aware of their own food waste and want to change their behavior, but only

39% say retailer labels are helpful in improving their behaviors. Further, 57% of respondents in

the same study voiced disappointment that retailers and manufacturers are not doing more to

address pre-acquisition food waste (Capgemini 2022). Looking at the psychological drivers of

food waste sheds light on why this significant gap between beliefs and behaviors may exist.

According to Block et al.'s 2016 research on the squander sequence, in which the authors

identify factors that impact food waste from production to disposal, one of the main drivers of

food waste in the retail environment is an aversion to items approaching their expiration date.

Impending expiration dates are a known driver of pre-acquisition food waste, with consumers less likely to purchase perishable goods approaching their expiration date due to factors such as perceived risk (Tsiros and Heilman 2005).

The aversion to these goods is rooted in evolutionary instincts regarding health and safety (White et al. 2016), as well as a fear of food-borne illness (Nemeroff and Rozin 2000). These deep-rooted and protective instincts are reinforced by marketers' emphasis on visually-perfect packaged foods, leading to a cycle of wasteful behavior (Block et al. 2016). Further, expiration date labeling is not typically considered an issue of sustainable consumption, but rather supply chain management, and has received less research and media attention than other sustainability-focused food production and consumption practices such as eco-labeling (e.g., Grunert, Hieke and Wills 2014; Taufique, Vocino, and Polonsky 2017). Knowing the role individual differences play in informing sustainable consumption (White et al. 2019), Essay 2 examines these differences in the context of perishable goods approaching their expiration dates. Specifically, the research finds consumers with high green consumption values are more likely to purchase perishable goods approaching their expiration date, compared to consumers with average or low green consumption values.

Given the urgency around climate change and severe consequences associated with overlooking the impacts of consumerism on the environment, understanding and integrating sustainable practices into marketing decision making is critical. By using the essays of this dissertation to examine the role of manufacturing practices regarding packaging and labeling on the attitude-to-behavior gap, I seek to advance marketing research that will help lay the path towards a more sustainable future.

CHAPTER 2

DENSITY AND DISPOSAL:

WHY CONSUMERS TRASH LOW-DENSITY RECYCLABLE PACKAGING

Introduction

A product's packaging serves not only as the face of the brand in the store but provides the important function of containing and protecting the product prior to and even during consumption, especially in the case of fast-moving consumer goods (FMCGs). Accordingly, considerable work has explored how various characteristics of product packaging influence consumer perceptions and consumption behavior: size (Granger and Billson 1972; Argo and White 2012; Coelho Do Vale, Pieters, and Zeelenberg 2008; Scott et al. 2008), shape (Folkes and Matta 2004; Raghubir and Krishna 1999; Sevilla and Kahn 2014; Yang and Raghubir 2005), color (Hagtvedt and Brasel 2017; Karnal et al. 2016; Mai, Symmank, and Seeberg-Elverfeldt 2016; Schnurr 2019; van Esch, Heller, and Northey 2019; Piqueras-Fiszman and Spence 2011), transparency (Deng and Srinivasan 2013; Ma, Zhuang, and Ma 2020; Simmonds et al. 2018), finish (i.e., matte vs. glossy; Marckhgott and Kamleitner 2019), and density (Goldstein and Herschkowitsch 2010; Piqueras-Fiszman et al. 2011; Gatti, Bordegoni and Spence 2014; Krishna and Morrin 2008; Ryu and Park 2019).

While packaging characteristics have clearly been shown to play a role in consumer purchase and consumption behavior, there is another type of behavior in which packaging characteristics may also impact consumer perceptions and actions: disposal. In this work, we demonstrate that product packaging characteristics are important beyond the contexts of

purchase and consumption and focus on the role of packaging density in driving consumer perceptions and related disposal behavior, specifically, a consumer's decision to trash or recycle product packaging.

Density refers to the mass-to-volume ratio of an object (Merriam-Webster 2023) and is salient to the issue of disposal given the proliferation of low-density materials used in recyclable packaging for fast-moving consumer goods (Matthews 2022) and the alarming contribution of FMCG packaging to overall waste generation (McKinsey & Company 2019). Further, manipulating the density of product packaging is a growing trend among manufacturers seeking to be more sustainable. This practice, referred to by industry practitioners as lightweighting, involves replacing traditional packaging material with a lighter weight alternative or cutting down the amount of packaging material used to produce a less dense and lighter weight packaging (Szaky 2017). The amount of lower-density packaging on store shelves has increased as lightweighting is touted as a high-priority and effective method for FMCG manufacturers to meet environmental goals (Resource Plastic 2020). This practice reduces both a manufacturer's costs and environmental footprint by lowering the raw material tonnage used in production and the resources, such as fuel, needed to transport finished goods (Feber et al. 2021). In fact, demand for lightweighted packaging is predicted to grow 4.6% from 2020 to 2030 (Dabo 2023). While lightweighting helps manufacturers meet their sustainability commitments, the downstream consumer implications of these changes to packaging density have not been given adequate consideration.

We propose that density plays a critical role in a consumer's disposal decision by providing cues regarding the packaging's usefulness. That is, a consumer may view low-density packaging to be less useful than high-density packaging in a consumption context ("current use,"

e.g., its ability to hold or protect interior contents); however, low-density packaging still offers additional future use to society through its ability to be recycled. We argue that even at the time of disposal, consumers think about packaging in terms of its current use rather than future use, a form of functional fixedness. As a result, consumers inaccurately evaluate low-density packaging to be less useful and thus more akin to trash, than high-density packaging. This in turn increases their likelihood to discard low-density recyclable packaging as trash, rather than recycle it appropriately.

This research extends findings on packaging attributes and their role beyond the point of purchase by illuminating the impact packaging characteristics can have on disposal behavior. Pertaining to packaging density, which has only been examined with regards to how it impacts product perceptions prior to purchase (Krishna and Morrin 2008; Piqueras-Fiszman, Harrar, Alcaide and Spence 2011; Azzi et al. 2012; Gatti, Bordegoni and Spence 2014), we demonstrate that packaging density informs one's decision to recycle or trash product packaging. We show that assessments of density inform perceptions of the packaging's usefulness, which inform a consumer's disposal decision. However, we find that consumers' usefulness perceptions are myopic in focus and can be misapplied to disposal decisions, leading consumers to improperly discard low-density recyclable materials as trash.

This research also contributes to literature on consumer sustainability by uncovering packaging density as an additional variable that underlies the intention-to-behavior gap between a consumer's beliefs about recycling and their ultimate decisions at the time of disposal. The balance of research in this area has primarily focused on elements that impact a consumer's motivation to be sustainable (see White, Habib, and Hardisty 2019 for a review), while this work adds to a nascent body of research examining how physical attributes of an item (Donnelly et al.

2023; Langley et al. 2011; Nemat et al. 2019; Shipton 2003; Wever et al. 2010) impact a consumer's decision to trash or recycle it. Specifically, we isolate the physical attribute of packaging density across multiple material types and identify it as a key input in determining perceived usefulness perceptions which dictate disposal behavior (i.e., the decision to trash vs. recycle).

In addition to contributions to literature, our work provides an important substantive contribution to sustainable practices and environmental longevity. Recycling rates have plateaued over the years while waste generation rates continue to increase year over year, with containers and packaging associated with consumer products accounting for more than 82 million tons of waste entering U.S. landfills annually (Environmental Protection Agency 2019). It is estimated that approximately 10 million metric tons of this consumer waste can be attributed to as few as 100 FMCG manufacturers (Resource Plastic 2020). While most U.S. consumers acknowledge the importance of recycling and express the desire to do so (Corona Insights 2021), and over 90% of them have access to a recycling program (Sustainable Packaging Coalition 2022), our work identifies a characteristic of product packaging that may unduly result in packaging being improperly thrown in trash bins instead of being recycled. As manufacturers dictate the characteristics of product packaging, we find they are playing an unintended role in contributing to consumers' poor recycling behaviors. This is even more concerning as material lightweighting grows as a manufacturing trend with sustainable intentions (Resource Plastic 2020), yet manufacturers may be unaware of the downstream unsustainable consequences of these packaging density changes.

Across six studies, which include observed behavior in both field and laboratory settings as well as experiments, we find that consumers are more likely to throw low-density recyclable

packaging in the trash, rather than appropriately recycle it, compared to high-density recyclable

packaging. Specifically, we demonstrate that density-driven cues influence consumer perceptions

of the packaging's usefulness, with packaging made from low-density material being viewed as

less useful and subsequently, more likely to be disposed of in the trash. However, we show that

these reduced perceptions of usefulness are inaccurately applied to disposal decisions and can be

corrected with marketing messaging that refocuses consumers to consider the future usefulness

of a product.

Conceptual Development

Packaging Density as a Diagnostic Input to Purchase and Disposal

We argue that despite the prior focus of research on consumers' motivations to recycle,

one of the most salient inputs into a disposal decision lies in the physical attributes of the item,

specifically its density. Density can be operationalized via weight or thickness, is assessed by

evaluating an object's weight relative to its overall size and is key to the perception of an

object's heaviness (Ross and Di Lollo 1968; 1970; Harshfield and DeHardt 1970). Research on

packaging density has focused on decision making at the point of purchase, with higher-density

containers known to signal quality across varied categories including wine (Goldstein and

Herschkowitsch 2010), yogurt (Piqueras-Fiszman et al. 2011), and fragranced soap (Gatti,

Bordegoni, and Spence 2014). For example, liquid body soap sampled from a heavy bottle was

perceived to be of higher quality and have a stronger scent than identical soap sampled from a

lighter bottle (Gatti, Bordegoni and Spence 2014). In a similar vein, thin, flimsy packaging has

been shown to negatively impact perceptions of product quality and lower consumer willingness

to pay (Krishna and Morrin 2008), with mineral water in a thin (vs. thick) container viewed less favorably on judgements of taste, quality, and price. Because of this link between packaging density and perceptions of quality, certain product categories have been cautioned to carefully examine packaging design changes (Spence and Wan 2015) and to adjust packaging density to an optimal ratio based on consumer preference testing for a given good or category (Ryu and Park 2019).

While packaging density plays a role in product perceptions at the point of purchase, it is unclear how salient packaging density is and thus how diagnostic it is to one's purchase decision (Lynch 2006) when other inputs such as price or brand have been shown to drive purchase decisions for FMCGs (e.g.; relatively low-priced items such as beverages, toiletries, and over-the-counter drugs) more than physical attributes (McCabe and Nowlis 2003; Abhishek, Sinha, and Vohra 2013). While informational inputs of price and brand, as well as other packaging characteristics (size, shape, color, finish), are easy to visually ascertain and likely deemed diagnostic (Lynch 2006) to determining the value and benefits of the product at the point of purchase, the density of packaging may be less salient and more difficult to assess while the packaging holds its contents (as is the case at the point of purchase), suggesting it may be less diagnostic to consumers' purchase decisions when considered with the other inputs available at the time. Indeed, industry research supporting the manufacturing strategy of lightweighting finds that reductions in packaging density for typical FMCGs are not easily distinguishable to the consumer in the retail environment (WRAP 2007), and as a result do not impact purchase behavior.

However, we argue that at the time of disposal, the decision of whether to recycle versus trash a product will depend on various characteristics of the packaging to be disposed rather than

the same inputs that drove purchase behavior. At this point, the packaging is empty and the physical characteristics of it should be more salient, leading consumers to consider them more diagnostic to their disposal decision. Supporting this notion, physical properties such as material type and size are often articulated in recycling fact sheets (i.e., "Recycling 101"; EPA 2021) and described as primary considerations for the types of packaging that can and cannot be accepted by a recycling facility or provider. In line with this, we suggest that at the time of disposal, the physical attribute of packaging density should be more salient, as it is no longer conflated with the contents of the packaging. In other words, when there is no longer water in the plastic water bottle, one can more easily evaluate the density of the bottle itself, both visually and manually. With packaging density being more salient at the time of disposal, we suggest consumers consider it more diagnostic to their disposal decision, utilizing perceptions inferred from the packaging's density to evaluate whether to recycle or trash the packaging, which we speak to next.

Density, Usefulness, and Disposal

Research specific to product packaging suggests low-density packaging is less effective and provides less protection for the product inside compared to more high-density packaging (Azzi et al. 2012; Dillon 2023). These perceptions are associated with how well the packaging serves its expected purpose or "current use" (i.e., protecting and containing a product). If consumers employ this association between usefulness and packaging density when making disposal decisions, it suggests that consumers may perceive high-density packaging to have more remaining utility or usefulness given its strength and durability compared to low-density packaging. Prior literature on waste aversion has acknowledged its role in consumer disposal due

to consumers' aversion to creating and contributing to environmental waste (Arkes 1996; Bolton and Alba 2012; Caitlin and Wang 2013; Catlin et al. 2021; Sun and Trudel 2017). Specifically, consumers seek to avoid putting items in the trash that may have potential utility (Caitlin and Wang 2013; Sun and Trudel 2017). Further, prior work on recycling behavior has shown that products deemed by consumers to be less useful are considered more like trash and therefore less likely to be recycled (Trudel and Argo 2013). Accordingly, if consumers perceive less utility and associate less usefulness for low-density packaging compared to high-density packaging, it may justify their tendency to toss low-density recyclable packaging in the trash.

While different perceptions of usefulness regarding a product's current use explain why consumers might inadvertently trash low-density recyclable packaging compared to high-density packaging, we suggest that consumers are subject to a form of functional fixedness when thinking about the usefulness of the packaging, resulting in a misguided employment of current usefulness perceptions to inform disposal decisions. Functional fixedness refers to the inability to realize something with a known and specific function may also perform other functions (Duncker 1945; Adamson 1952). Specifically, we anticipate that when consumers think about the usefulness of product packaging, as inferred by packaging density, they think about usefulness in terms of how the product functioned for them (i.e., as a bottle, a container for an item, etc.); in other words, its current use. This functional fixedness leads to a myopic view of the packaging's usefulness. However, we suggest that assessments of product packaging's current usefulness are not valid inputs for judging disposal. Instead, consumers should consider the "future use" the item has to offer in terms of what other uses it can serve in the future. From a recyclability standpoint, both low-density and high-density versions of a product (which are often made of the same or similar material) can be recycled and made into new items. In fact, low-density materials

(e.g., LDPE, newspaper, and aluminum) and high-density materials (e.g., HDPE, cardboard, and glass) in various forms can all be recycled (EPA 2022a; EPA 2022b), thus extending their usefulness in a future sense. While there is a difference in the recyclability of certain low- and high-density plastics (i.e., LDPE and HDPE; Shore 2021), for two products made of the same inert material (i.e., paper, same plastic base), this difference does not hold. Instead, perceptions of future use for a low-density and high-density version of the same packaging should be comparable. Meaning, if consumers' usefulness perceptions focused on the "future uses" of the packaging when making disposal decisions, we would expect to see no difference in the tendency to recycle low- vs. high-density recyclable packaging.

In summary, we argue that assessments of packaging density drive perceptions of usefulness, with low-density (vs. high-density) recyclable packaging viewed as less useful, causing consumers to be more likely to incorrectly dispose of these recyclables as trash. This is based on a form of functional fixedness where consumers' density-driven inferences of packaging usefulness are driven by its salient "current use" rather than its objective recyclability or "future use." While low-density (vs. high-density) packaging material may be perceived as less useful from a current use perspective, leading to a greater tendency to trash low-density recyclable packaging, the density of packaging material does not have the same negative relationship regarding its future uses via recyclability, suggesting this disparity in disposal between density types could be corrected with a refocus on future use perceptions.

Overview of Studies

We tested our proposed effect across six studies. First, we conducted a pilot study in which we compared consumer disposal behavior between high-density and low-density bottled

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water packaging. We then examined the relationship between density and disposal outcomes using both field and in-lab observations. In Study 1A, we examined the relative density of products disposed of in trash and recycling bins across a university campus community, providing additional support that packaging density influences actual disposal behavior. Next, Study 1B provides causal support for the impact of density on consumer recycling using an in-person laboratory experiment in which we assessed actual disposal behavior in a controlled environment. Study 2 establishes support for our proposed mechanism of perceived usefulness via measured mediation, while Study 3 employs a focus on future usefulness perceptions to provide process evidence via moderation. Finally, we offer prescriptive managerial advice on how to offset the detrimental effect of manufacturer lightweighting on consumer disposal decisions by employing on-package messaging that can increase consumer recycling of low-density packaging (Study 4).

Pilot Study

In this initial study, we capitalized on the packaging transition of a major beverage manufacturer to examine the role of material density on disposal behavior (trash vs. recycle) in a field experiment while holding factors such as product, brand, color, and package size (in oz) constant. In accordance with their stated sustainability goals (The Coca-Cola Company 2021), during the spring of 2022 the manufacturer was transitioning their leading bottled water brand to a lightweight bottle made of thinner plastic with a smaller plastic cap and closure. At the time of this pilot study, both the new, lightweighted low-density bottle and the legacy, high-density bottle were available for sale in the market, suggesting that neither bottle was unusual or unfamiliar to consumers. In a field experiment, we provided the two types of plastic water bottles

(low-density vs. high-density) to attendees at two campus events, conducting post-event audits of disposal bins to determine if bottle density impacted whether the bottle tended to be recycled or thrown in the trash.

Design and Procedure

We provided attendees at two campus events hosted at the business school of a large U.S. university with one of two water bottle types (low-density vs. high-density). We selected two comparable events over a two-week period to ensure an adequate sample size, with the hopes of obtaining at least 100 participants total (i.e., 50 per condition) given conversations with university event-planning staff. Both were weekday events and featured invited corporate speakers presenting to a seated audience of attendees. As people often attend university events with a friend or acquaintance, we did not randomly assign attendees their conditions upon entering the venue, as observable differences in the bottle type they received could have raised suspicion about the experiment. Instead, we randomly distributed the two different types of bottles (density: Low = 1, High = 0) across seats at the event space prior to the start of the event (see Appendix A). Bottles were randomly distributed to seats by row. In this way, participants were equally likely to sit in a seat with either type of bottle, at random, while at the same time minimizing observable differences between the bottle types by participants sitting next to each other (i.e., side by side). At the conclusion of each event, the contents from the trash and recycle bins at each location were collected. Only the focal plastic water bottles in this study were kept for analysis, the rest of the refuse (e.g., beverage containers brought by attendees and incidental waste generated by attendees) was discarded. The collected water bottles were then recorded as trashed or recycled, depending on disposal bin.

The two water bottles employed were the legacy, standard-density bottles and the new, low-density lightweighted bottles being distributed by the brand during the time frame of the events (March 2022). While this manufacturer chose to hold constant the volume, in fluid ounces (16.9 oz), of the two water bottles, they modified the packaging design, allowing for a reduction in the amount of plastic material employed, and utilized a smaller cap and closure to achieve lightweighting. These design changes resulted in a reduction in density from the legacy high-density bottle (Figure 1.1). To validate this change in density between the two bottle types, we calculated the density of each bottle using the ratio of mass (g) over volume (oz). The plastic material of the low-density bottle weighed 9 grams with a density of 0.53 g/oz, while the plastic material of the high-density bottle weighed 15 grams with a density of 0.89 g/oz, confirming the manipulation of density derived from this manufacturer's lightweighting practice.

Figure 1.1: Plastic Water Bottle Stimuli

Low-Density   **High-Density**
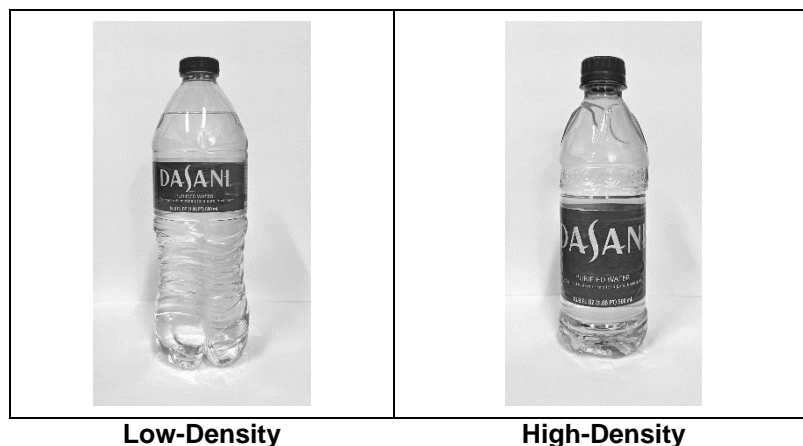
Results and Discussion

A total of 54 plastic water bottles (24 low-density and 30 high-density) were collected from the associated disposal bins following each event. The water bottles were coded for which

disposal bin they were retrieved from (1 = Recycle, 0 = Trash). A binary logistic regression revealed a significant main effect of product density on disposal type ($\chi^2 = 7.50$, $p = .011$). Specifically, while 90.00% (i.e., 27/30) of the high-density bottles were recycled, only 58.33% (i.e., 14/24) of the low-density plastic bottles were recycled. Despite the manufacturer's transition of employing almost half the amount of plastic in their lightweighted bottles compared to the legacy bottles (9 g for low-density bottles vs. 15 g for high-density bottles), consumers ended up throwing twice the amount of plastic material in the trash as a result of this change. That is, participants with the high-density bottles ended up throwing a total of 45 g of recyclable plastic in the trash (i.e., 3 bottles x 15 g each), while participants with the low-density bottles threw a total of 90 g of plastic in the trash (i.e., 10 bottles x 9 g each) that should have been recycled.

This pilot study provided preliminary support for the effect of packaging density on disposal behavior in a naturalistic environment that capitalized on a popular manufacturer's lightweighting strategy, highlighting the consequential and detrimental impact that this manufacturing strategy can have on downstream consumer disposal. Additionally, the over 40% reduction in density between the two bottle types employed reflects typical raw material reduction goals voiced by FMCG manufacturers (Resource Plastic 2020), reaffirming the external validity of our findings. While this study demonstrates the impact of density on disposal for one focal brand and product in a timely and ecologically valid field setting, there are alternative explanations pursuant to this naturalistic context that we control for in subsequent studies. Next, we widen our focus to examine the role of density on disposal by examining the relative density of product packaging that consumers naturally dispose of in recycling and trash bins.

Study 1A

In this field study, we sought to further examine the role of density on disposal by evaluating the relationship between the density of a product's packaging and its likelihood to end up in a recycling or trash bin. Accordingly, consumer disposal behavior was observed through an audit of contents from both the trash and recycle bins located within a university campus building.

Data Collection

We collected all waste disposed of in the trash and recycle bins (19 of each type, for a total of 38 audited bins) located on a single floor in the business school of a large U.S. university over a one-week period (Monday to Friday) during October 2022. The focal floor was selected based on proximity to classrooms, entrances, and vending and dining areas, and the one-week duration ensured that variability in foot traffic associated with daily class schedules, club/interest group meetings, company recruitment events, or other regularly occurring events was captured. We collected all contents from the trash and recycle bins on a daily basis but restricted the sample to consist of only beverage containers made of recyclable plastic material. We preregistered this design and inclusion criteria on OSF prior to collection:

https://osf.io/fx8tp/?view_only=c227daec13204613bd02eb4237df5d8e.

We focused on plastic beverage containers in this study for four reasons. First, recyclable plastics represent a significant contribution to waste generation that improperly ends up in landfills (EPA 2019). Second, beverages in plastic containers were widely available for sale and consumption throughout this campus setting. Third, plastic materials maintain their physical features while sitting in a disposal bin over time, ensuring that we could measure the density of

the material that was observed by consumers at the time they disposed of them. This is not true for products made from paper materials, which can be altered by other items while sitting in a disposal bin (i.e., food or liquid waste), degrading physical features including density, and inhibiting the ability to measure the original density of the material at the time it was disposed. Finally, beverage containers are less likely than other commonly disposed plastics to be contaminated by food residue or oils, which limits their ability to be recycled (Rachelson 2017) and can impact one's decision to recycle them altogether (Donnelly et al. 2023).

Variables

Each item collected was recorded by disposal type (1 = Recycle, 0 = Trash), based on the type of bin it was collected from. Each item was numbered, photographed (see Appendix A for a sample of item types collected), and catalogued with a brief description (e.g., "Starbucks green tea lemonade"). The weight of each item was collected using a digital scale with precision graduation units of 1 gram, and volume was recorded based on the manufacturer's stated liquid contents (e.g., a 20 oz serving) or serving capacity (e.g., a 20 oz plastic cup) listed on the container. Item descriptions and measurements of weight and volume were collected and verified independently by both the primary researcher and two research assistants who had no prior knowledge of the study's objectives. The independent variable of density (g/oz) was then calculated as a ratio of the item's weight (g) over volume (oz).

Covariates

We also collected information about additional physical attributes known to influence disposal for each collected item. Details regarding the appearance of each item, including the design elements of product color and transparency (Langley et al. 2011; Nemat et al. 2019),

presence of a brand label, product cleanliness (Langley et al. 2011; Donnelly et al. 2023), and whether the product was distorted (Trudel and Argo 2013) were documented.

Results and Discussion

A total of 172 recyclable plastic beverage containers met our pre-registered inclusion criteria and were included in the analysis. Each was coded based on which type of disposal bin it was collected from (1 = Recycle, 0 = Trash). A binary logistic regression revealed a significant main effect of density on disposal type ($\chi^2 = 22.11$, $p < .001$). On average, the plastic beverage containers disposed of in the trash bin (N = 67, $M_T = 0.86$, SD = 0.26) were lower in density than the plastic containers placed in the recycling bin (N = 105, $M_R = 1.37$, SD = 1.00). This effect of density on disposal outcome remained significant ($p < .001$) with the inclusion of the covariates of product transparency (1 = Yes, 0 = No), presence of color (1 = Yes, 0 = No), product cleanliness (1 = Yes, 0 = No), presence of distortion (1 = Yes, 0 = No), and presence of a brand label (1 = Yes, 0 = No). See Table 1.1 for full regression results.

This observation-based field study provides additional support for our hypothesized relationship between density and disposal and further increases the external validity of our findings. Additionally, we were also able to examine the impact of covariates known to influence a consumer's likelihood to recycle from previous research (Langley et al. 2011; Donnelly et al. 2023; Nemat et al. 2019; Trudel and Argo 2013), eliminating these factors as drivers of our effect and demonstrating the consistent, significant impact of density on a consumer's disposal decision.

Table 1.1: Effect of Packaging Density on Disposal Outcome

Effect	Estimate	SE	Wald Statistic	Exp(B)	95% CI Exp(B)		p
					LL	UL	
Model 1							
Intercept	-.970	.382	6.460				.011
Density	1.359	.366	13.782	3.982	1.899	7.977	.000
Model 2							
Intercept	-4.986	1.232	16.377				.000
Density (g/oz)	2.288	.562	16.551	9.858	3.273	29.686	.000
Transparent (1 = Y, 0 = N)	.717	.925	.601	2.049	.334	12.549	.438
Color (1 = Y, 0 = N)	.775	.398	3.802	2.171	.996	4.732	.051
Label (1 = Y, 0 = N)	1.783	.512	12.105	5.947	2.178	16.235	.000
Clean (1 = Y, 0 = N)	1.214	.441	7.561	3.365	1.417	7.993	.006
Distortion (1 = Y, 0 = N)	1.783	.743	5.757	5.949	1.386	25.531	.016

Summary Statistics by Disposal Bin *(Density g/oz)*

	Mean	SD	Median	Min	Max
Trash	.862	.261	.781	.473	1.444
Recycle	1.374	1.002	1.050	.533	7.059

Study 1B

While the Pilot Study and Study 1A provide externally valid support for our hypothesis, Study 1B employs a controlled experimental design to provide causal support for the effect of density on disposal. Additionally, this study expands upon prior studies by testing for our effect using a different yet commonly recyclable material: paper. Paper was selected as the focal material for this study both due to its high rate of use in FMCG packaging and its high rate of recycling in the U.S. (EPA 2019). Almost half of all paper and paperboard produced globally is used in packaging applications (James et al. 2002). Paper can serve as both primary packaging for items (e.g., seasoning packets, frozen confection wrappers) and secondarily in packaging as

an insert to provide product information or usage instructions. In using paper stimuli for this experiment, this study adds to the generalizability of our findings and serves as a conservative test of whether consumers are more likely to trash low-density (vs. high-density) recyclable packaging.

Design and Procedure

Two-hundred and thirty-five undergraduate students (M_{age} = 20.42 years, 58.3% female, 41.3% male, .5% preferred not to respond) from a large U.S. university participated in this study in exchange for course credit. We sought to obtain 100 participants per condition given the in-person lab-based nature of the study but retained the data of all participants who participated in the lab for the advertised sessions. Participants were randomly assigned to one of two conditions in a single-factorial between-subjects design manipulating density (low-density vs. high-density) in which they evaluated the physical properties of a piece of paper. Participants were asked to dispose of the paper upon leaving the laboratory; disposal type for each participant was recorded.

Participants entered the lab and were seated at a cubicle, which contained a computer as well as a 5.50 in X 4.25 in piece of paper (one quarter of a standard 8.5 in x 11 in piece of paper). High- and low-density paper samples were randomly distributed to each cubicle. Both types of paper were the same size, color (light gray), and lacked any design or texture. The only difference between the two was the density. The paper in the low-density condition had a density of .039 g/in², while the paper in the high-density condition had a density of .161 g/in². Based on the size of each piece of paper, the low-density papers weighed approximately 0.9 g each, while the high-density papers weighed approximately 3.8 g each.

To cover a broad range of potential uses, we employed a design that drew attention to the paper material itself rather than a specific packaging application. This also eliminated the risk that product type or personal product preferences would impact participant disposal behavior. Accordingly, participants were instructed to pick up the paper and imagine they had received a flyer made of this type of paper, thinking about how the paper feels in their hand. While the two types of paper employed in this study had objectively different levels of density, we wanted to ensure that these differences were noticeable as paper itself is thin and relatively low in density compared to other recyclable materials. Previous literature has demonstrated that products in lower-density packaging are perceived to be lower in quality (Krishna and Morrin 2008; Goldstein and Hershkowitch 2010; Gatti, Bordegoni, and Spence 2014). Accordingly, we asked participants to rate the perceived quality of the paper (1 = Very Low Quality, 7 = Very High Quality), to serve as a manipulation check ensuring that differences were noticeable between the two types of paper without priming participants to be aware of density and its potential impact on their disposal. Demographic measures of age and gender were also collected.

After completing the study, participants were instructed to "dispose of all materials" upon exiting the lab. A trash bin and recycle bin were placed outside the doors to the lab, arranged and labeled to replicate the appearance of other disposal bins throughout the university. Further, the contents of the bins were obscured with flip top lids to eliminate the influence of others' disposal actions on each participant (see Appendix A). At the conclusion of the study, the pieces of paper were collected from the trash and recycle bins and coded based on disposal type (1 = Recycle, 0 = Trash).

Results and Discussion

Six participants left the paper at their computer station while eleven participants left the lab with paper in hand; these seventeen participants were excluded from the analysis, leaving 218 observations. We confirmed that the objective difference in density between the two paper types was indeed perceptible to participants, as indicated by differences in quality perceptions of the paper. Participants provided the low-density paper (M_L = 2.50, SD = 1.32) perceived it to be lower in quality than participants who received the high-density paper (M_H = 6.10, SD = .83; $F(1, 216)$ = 508.27, $p < .001$), confirming the expected differences in quality via perceptible differences in density.

In line with our previous findings, a binary logistic regression (1 = Recycle, 0 = Trash) revealed a significant effect of density (1 = Low, 0 = High) on disposal (χ^2 = 5.08, p = .024). Specifically, participants in the low-density condition (40.74%) were more likely to trash (vs. recycle) the paper than participants in the high-density condition (26.36%). As a robustness check, we considered an alternative model in which the eleven participants who left with the paper in hand may have saved it to recycle or dispose of in another sustainable manner (N = 229; 1 = Recycle or Other, 0 = Trash). We observed the same pattern of results regarding the effect of density on disposal (χ^2 = 4.74, p = .029) with participants in the low-density condition (40.00%) being more likely to throw the paper in the trash rather than recycle or employ some other form of sustainable disposal besides trash than those in the high-density condition (25.44%; See Figure 1.2).

Additionally, while we employed perceptions of quality as a manipulation check, one might also consider that the perceived quality of a material impacts a consumer's disposal decision, with individuals less likely to trash, and in turn more likely to recycle, items they view

as high in quality. However, a mediation analysis (PROCESS Model 4; Hayes 2017) employing density as an independent variable, disposal as a dependent variable, and quality as a mediator did not find quality to underlie the effect of density on disposal behavior (b = -.67; SE = .47; $CI_{95\%}$ = [-1.620, .252].

Overall, the findings of this study provide causal support for our proposed effect that consumers are more likely to trash low-density versus high-density recyclable materials using a different material type (paper) in a controlled, lab-based setting. Further, this study provides evidence that density is not just something that is objectively measured but is also perceptible by individuals. In the next two studies, we examine our proposed process underlying this effect: the perceived usefulness of the material.

Figure 1.2: Disposal Type by Density Condition
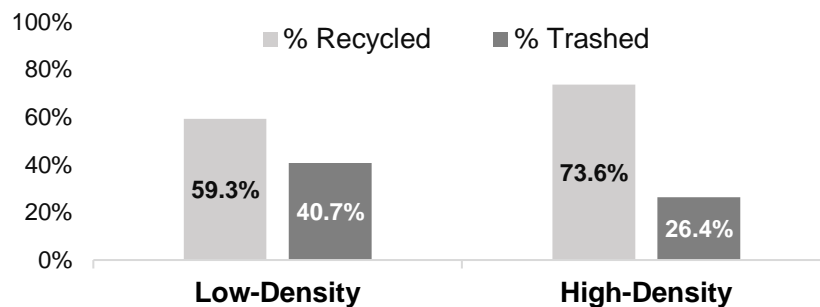
Study 2

While our work builds on findings that materials viewed as less useful are more likely to be characterized as trash and thus less likely to be recycled (Trudel and Argo 2013), it has yet to be shown that density impacts perceptions of packaging usefulness. We suggest that consumers' perceptions of packaging usefulness, as informed by the item's density, are subject to a form of functional fixedness and thus focus on the packaging's "current use," (i.e., to protect or contain

contents) rather than the other potential future uses the packaging might have which should be more relevant at the time of disposal. Accordingly, we anticipate that consumers will perceive low-density recyclable packaging to be less useful than high-density recyclable packaging, and as a result more likely to improperly dispose of it as trash. Study 2 provides support for this proposed process, demonstrating perceived usefulness as the mediation mechanism for our observed effect. Additionally, this study provides evidence of consumers' functional fixedness in that their usefulness perceptions at the time of disposal tend to focus on the packaging's current use rather than its future uses. Further, we also test for an alternative explanation that item prototypicality between different densities could be driving disposal outcomes.

Design and Procedure

Two-hundred ninety-nine U.S.-based Mturk participants via CloudResearch ($M_{age} = 41.7$, 50.2% female, 48.8% male, 1.0% preferred not to respond) participated in this study in exchange for compensation. We sought 150 participants per condition given the online nature of the subject pool. Participants were randomly assigned to one of two conditions in a single-factorial between-subjects design manipulating density (a low-density vs. high-density plastic water bottle). We preregistered the study design and measures on OSF prior to collection.

Participants were asked to imagine that while attending an event, a sponsoring group was distributing free bottles of water, one of which they took and consumed, leaving them with an empty plastic bottle. As this study was conducted online, we provided participants with product images and descriptions describing the attributes that can be adjusted to manipulate consumer perceptions of density: thickness (Krishna and Morrin 2008) and weight (Gatti, Bordegoni and Spence 2014). Specifically, in the low-density condition, the empty plastic bottle was described

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as "thin to the touch" and "quite lightweight," while in the high-density condition it was

described as "thick to the touch" and "quite heavy." The descriptions were accompanied by an

image of the type of bottle described (Figure 1.3). Extant research has shown that detailed

product descriptions can compensate for a lack of instrumental touch in an online environment

(Jha et al. 2019) and that imagining the act of touching a product can generate similar feelings

and sensations for a product as those generated when physically touching a product (Peck,

Barger, and Webb 2013). In a supplemental study, we evaluated the role of manual (i.e., touch)

vs. visual-only packaging evaluations to assess density and density-driven usefulness perceptions

on disposal and did not find a difference between evaluation types (Web Appendix C), further

validating density descriptions as sufficient manipulations. After viewing the low- or high-

density water bottles and accompanying descriptions, per assigned condition, participants were

asked to rate the perceived usefulness of the material of the bottle on a seven-point scale (1 = Not

at All Useful, 7 = Extremely Useful). This measure of usefulness was meant to be general to

avoid prompts regarding current or future use. Subsequently, we employed a free response

question as an immediate follow-up to determine how participants conceptualize the usefulness

of the bottle to assess whether participants tend to think of packaging in its functionality as a

container (current use) or in terms of its ability to serve a new or different purpose (future use).

Specifically, participants were asked to describe the characteristics of the material that

influenced their perception of its usefulness. Next, participants rated their likelihood to throw the

bottle in the garbage by indicating their level of agreement with the statement: "I am likely to

throw this bottle in the garbage," (1 = Strongly Disagree, 7 = Strongly Agree). In prior literature

(Trudel and Argo 2013), likelihood to throw in the garbage has been interpreted as an inverse of

one's likelihood to recycle. If consumers perceive low-density materials to be low in usefulness, they should subsequently be more likely to view them as trash and dispose of them accordingly.

Further, to address an alternative mechanism for our effect, we sought to evaluate the possibility that consumers may view the low-density bottles as physically dissimilar to more typical water bottles and may be more likely to characterize the bottles as trash as a result. In their work on item disposal, Trudel and Argo (2013) find that as items move "away from the prototypical standard for the category," they will be viewed as less useful and therefore are more likely to be trashed despite their inherent recyclability. Accordingly, the perceived prototypicality (i.e., how typical the item is compared to the standard for its category) of each bottle type was assessed by having participants answer, "How good an example is this of a water bottle?" (1 = Not at All, 7 = Very Good). This operationalization of prototypicality was adapted from work assessing how representative items are of a given category (Nedungadi and Hutchinson 1985), specifically the measure of how "good an example" (Rosch 1973) the item is. Lastly, demographic measures of age and gender were collected.

Figure 1.3: Plastic Water Bottle Stimuli
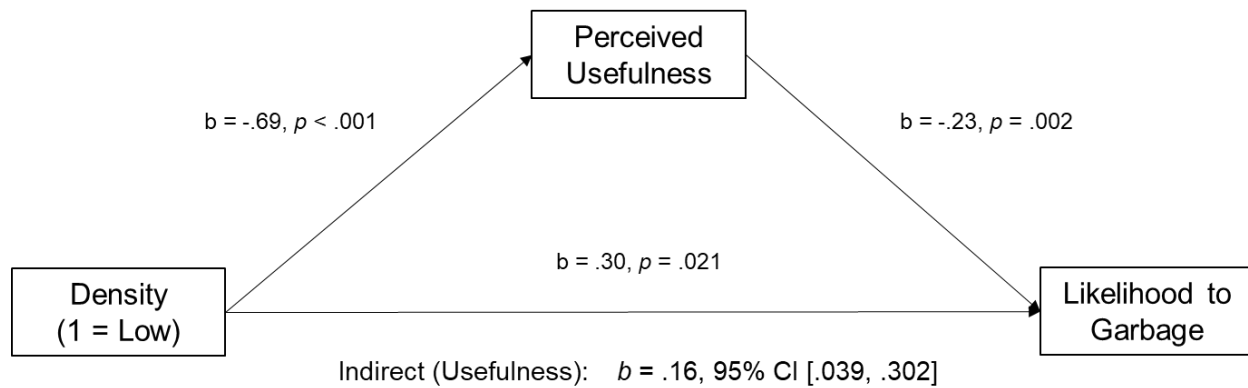

| Low-Density | High-Density |
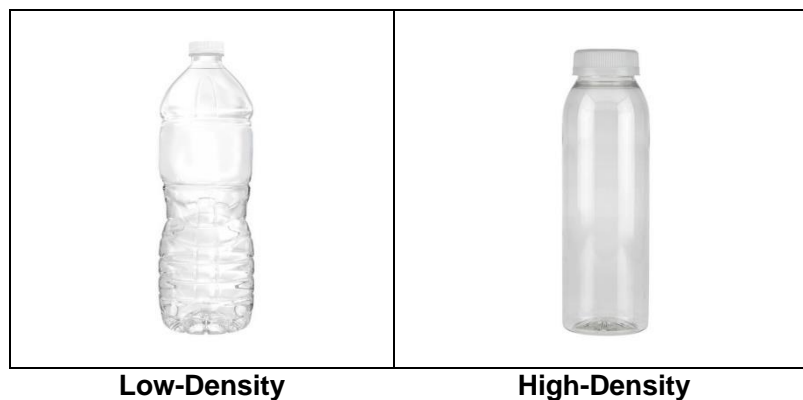
Results and Discussion

Likelihood to throw in garbage

A one-way ANOVA revealed that participants in the low-density condition (M_L = 3.95, SD = 2.62) were significantly more likely to throw the bottle in the garbage than those in the high-density condition (M_H = 3.03, SD = 1.96; $F(1, 297)$ = 14.13, $p < .001$, η^2_p = .045). Said inversely, this suggests that participants in the low-density condition would be less likely to recycle the plastic bottle than those in the high-density condition, aligning with prior results.

Perceived usefulness and mediation

A one-way ANOVA revealed significant differences in perceived usefulness of the material across the two density conditions, with the low-density plastic bottle viewed as less useful (M_L = 3.70, SD = 1.69) than the high-density plastic bottle (M_H = 5.08, SD = 1.60; $F(1, 297)$ = 52.59, $p < .001$, η^2_p = .150). A mediation analysis was conducted to test the indirect effect of perceived usefulness on the relationship between product density (1 = Low, -1 = High) and likelihood to throw in the garbage. The mediation model (Figure 1.4) was tested using PROCESS Model 4 (Hayes 2017), with product density as the independent variable, perceived usefulness as the mediator, and likelihood to throw in the garbage as the dependent variable. The analysis revealed a significant indirect effect of product density on likelihood to throw in the garbage via perceived usefulness (b = .16; SE = .07; $CI_{95\%}$ = [.039, .302]), supporting our proposed mechanism.

Figure 1.4: Mediation Model

Perceived Usefulness

b = -.69, p < .001

b = -.23, p = .002

b = .30, p = .021

Density (1 = Low)

Likelihood to Garbage

Indirect (Usefulness): *b* = .16, 95% CI [.039, .302]

Analysis of usefulness perception free responses

  To understand how consumers view packaging usefulness perceptions and whether they are subject to the functional fixedness that we theorize, we evaluated the free responses for how participants conceptualized usefulness. Responses were coded by two independent research assistants with no knowledge of the study objectives or hypotheses (IRR = 76.6%) to determine whether respondents were conceptualizing the usefulness of the plastic bottle in terms of its current use (e.g., used as a water bottle or for holding/protecting contents; "I can use as my water bottle,") or future use (e.g., used as something else besides a water bottle, repurposed, transformed, etc.; "can be melted and turned into a lot"). Responses that did not sufficiently respond to the prompt (i.e., single-word answers such as "plastic," "generic," or "good") accounted for 25.4% of responses and were excluded from further analysis. Of participants who did elaborate on what served as the basis for their perceptions of usefulness, 85.4% cited aspects related to its current use as a water bottle (e.g., "works well to hold liquids"), rather than the plastic bottle's ability to be transformed (e.g., "can be molded into an infinite number of items"). This speaks to our argument that consumers' perceptions of usefulness, when judging the usefulness of recyclable materials, are subject to a form of functional fixedness leading them to

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focus more on the packaging and its ability to serve its current use rather than the packaging material's potential future use in a different form or function.

Alternative mechanisms

Perceived prototypicality was assessed as an alternative mechanism for our effect, as previous work has shown that items less prototypical of their category are more likely to be trashed (Trudel and Argo 2013). Specifically, it is possible that less dense packaging may be perceived as less prototypical, which could explain the greater tendency to trash rather than recycle. A one-way ANOVA revealed significant differences in perceived prototypicality between the two density conditions, however it was in the opposite direction of the predicted alternative explanation. The low-density plastic bottle was viewed as a better example of a water bottle (i.e., more prototypical; M_L = 5.67, SD = 1.38) than the high-density plastic bottle (M_H = 4.82, SD = 1.53; F(1, 297) = 25.77, $p < .001$, η^2_p = .080). Further, a PROCESS Model 4 (Hayes 2017) mediation model showed the indirect effect of product density on likelihood to throw in the garbage via perceived prototypicality was not significant (b = -.07; SE = .04; $CI_{95\%}$ = [-.156, .009]), eliminating prototypicality as an alternative explanation for the effect of packaging density on consumer disposal. This finding also speaks to the proliferation of low-density packaging materials available in the marketplace, strengthening the level of impact of our findings regarding the waste generation implications of manufacturer lightweighting.

Overall, the results of this study strengthen our conceptual argument that density influences perceptions of packaging usefulness, with assessments of usefulness driving the effect of packaging density on disposal. Additionally, in line with our theorizing we find that consumers view items made from high-density materials as better able to perform their current intended function than items made from low-density materials, and that consumers' usefulness

perceptions suffer from a form of functional fixedness leading to a focus on usefulness perceptions related to the items' current rather than future use when making disposal decisions. While perceptions of prototypicality did not underlie the effects of packaging density on disposal, in a supplemental study (Appendix B), we also considered whether consumers may feel a moral obligation to recycle (Kaiser and Shimoda 1999) that could make emotions of guilt salient at the time of disposal. Specifically, failing to recycle high-density vs. low-density packaging could be associated with greater guilt, thus motivating people to be more apt to recycle high-density packaging. However, we did not find support for this alternative explanation of guilt, and further, confirmed that the effect of density on recycling holds when disposal is framed as an intention to recycle rather than an intention to trash. Next, we provide additional support for perceptions of usefulness as the process underlying the effect of density on disposal by demonstrating the ability to moderate the role of usefulness by priming consumers to evaluate packaging in the context of future (vs. current) use.

Study 3

In the prior study we found that consumers are more likely to trash low-density recyclable packaging because consumers view low-density packaging as less useful than high-density packaging with these usefulness perceptions being based on the packaging's current use. However, in the context of disposal, we argue consumers should instead focus on the material's future usefulness to society via its ability to be recycled. We believe that if consumers instead evaluate packaging usefulness in the context of future use via the packaging's ability to be recycled, the difference in disposal between high-density and low-density packaging would be attenuated. In this study, we primed participants to think of packaging usefulness in the context

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of future use by highlighting the ability of packaging to be recycled into new goods, an

operationalization based on findings regarding recycling intentions and transformation salience

(Winterich et al. 2019).

Design and Procedure

Eight-hundred U.S.-based Mturk participants via CloudResearch (M_{age} = 41.2, 50.8%

female, 48.4% male, .8% preferred not to respond) completed this study in exchange for

compensation. We sought to obtain 200 participants per condition to ensure sufficient statistical

power to achieve our proposed interaction. Participants were randomly assigned to one of four

conditions in a 2 (density: low vs. high) X 2 (usefulness: current vs. future) between-subjects

design.

To manipulate packaging density, we employed the same scenario and low- and high-

density water bottle stimuli images and descriptions as in Study 2. In the current use condition,

no additional information beyond the consumption scenario was provided, as Study 2 confirmed

our theorizing that consumers are prone to functional fixedness regarding their conceptualization

of packaging usefulness within a current use context. In the future use condition, participants

were presented with a short message about the future use of recycled water bottles: "PET, the

type of plastic used in water bottles, is recycled into plastic fiber. This fiber is then sold to

manufacturers to be made into goods such as jackets and carpets." In their examination of

transformation salience as a motivator of recycling behavior, Winterich and colleagues (2019)

acknowledge that "consumers do not typically consider how recyclables are transformed into

new products with future use and have difficulty understanding the impact of their recycling."

This specific manipulation, drawn from language describing the journey of a recycled plastic

bottle (American Chemistry Council 2017), highlights the repurposing capabilities of recycled plastic, increasing the perceived future use of the product by showcasing what new useful things it can be made into, that should hold for all PET plastic products, regardless of density.

All participants answered the same measure on intention to trash the item as Study 2 by indicating their level of agreement with the statement: "I am likely to throw this bottle in the garbage" (1 = Strongly Disagree, 7 = Strongly Agree). Participants completed an attention check by indicating whether the plastic bottle in their assigned scenario was described as either "thin to the touch and quite light" or "thick to the touch and quite heavy," before completing demographic measures of age and gender.

Results and Discussion

A 2 x 2 between-subjects ANOVA revealed a main effect of density on likelihood to throw the bottle in the trash (M_L = 3.90, SD = 2.15, M_H = 3.04, SD = 1.92; $F(1, 796)$ = 36.88, $p <$ .001, η^2_p = .044), with participants more likely to throw the low-density bottle in the garbage as opposed to the high-density bottle. There was also a main effect of the future usefulness manipulation on likelihood to throw in the trash (M_C = 3.83, SD = 2.17, M_F = 3.10, SD = 1.92; $F(1, 796)$ = 27.06, $p <$ .001, η^2_p = .033), with the future usefulness manipulation successfully decreasing likelihood of throwing the plastic bottle in the trash. Most importantly, there was a significant interaction between product density and the future usefulness manipulation ($F(1, 796)$ = 4.89, p = .027, η^2_p = .006). Replicating prior studies, among participants in the current usefulness condition, those in the low-density condition (M_{LC} = 4.42, SD = 2.19) were much more likely to throw the bottle in the trash than those in the high-density condition (M_{HC} = 3.25, SD = 1.98; ($F(1, 796)$ = 34.57, $p <$ .001, η^2_p = .042). While this difference in likelihood to throw

in the trash still persisted with the employment of the future usefulness manipulation, it was diminished in magnitude (M_{LF} = 3.37, SD = 1.98 vs. M_{HF} = 2.83, SD = 1.83; (F(1, 796 = 7.40, p = .007, η^2_p = .009; Figure 1.5). This is because the future usefulness manipulation reduced participants' likelihood to throw the low-density bottle in the trash compared to the current usefulness condition (M_{LC} = 4.42, SD = 2.19 vs. M_{LF} = 3.37, SD = 1.98; F(1, 796) = 27.34, p < .001, η^2_p = .033). And further, this future usefulness manipulation reduced the likelihood to throw the low-density bottle in the trash to a level in line with that of the high-density bottle in the current usefulness condition (M_{LF} = 3.37, SD = 1.98 vs. M_{HC} = 3.25, SD = 1.98; post-hoc LSD p = .539). Lastly, while the future usefulness manipulation was applicable to all plastic materials, it also resulted in a significant reduction in likelihood to throw the high-density bottle in the trash (M_{HC} = 3.25, SD = 1.98 vs. M_{HF} = 2.83, SD = 1.83; F(1, 796) = 4.50, p = .034, η^2_p = .006). However, this reduction in likelihood to trash was smaller for the high-density bottle than the low-density bottle, suggesting that the future usefulness manipulation had a larger impact in prompting consumers to consider future usefulness for the low-density packaging. These results also hold when excluding the 24 participants who failed the attention check.

Overall, this study provides additional support for usefulness perceptions as our process mechanism, as we show that highlighting the future usefulness of packaging via its ability to be recycled can curtail the detrimental misinterpretations of usefulness that consumers have for low-density recyclable packaging. Next, we provide actionable implications for managers by showing how marketing messages can be employed on low-density packaging to reduce the detrimental effects of lightweighting on consumer disposal behavior.

Figure 1.5: Interaction of Packaging Density and Future Use Manipulation
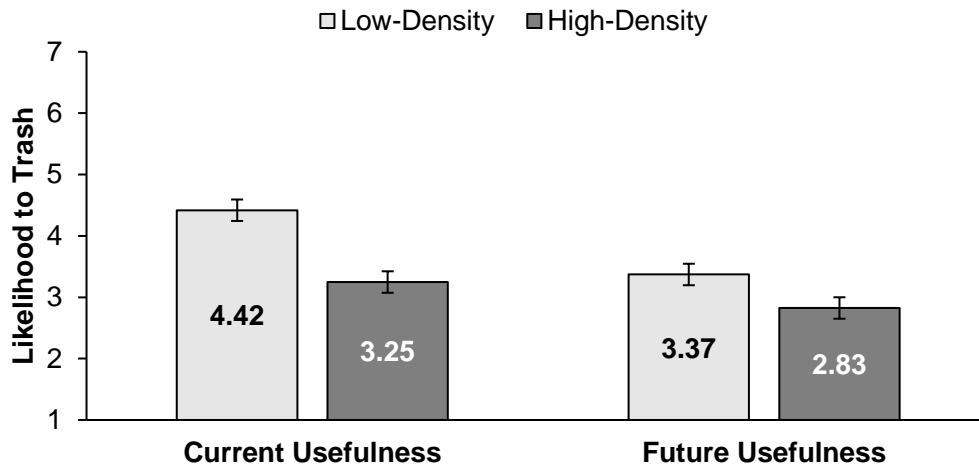
Study 4

Results of the previous studies have shown that consumers are more likely to improperly

trash packaging made from low-density recyclable material compared to similar packaging made

from high-density recyclable material, with the density of the packaging providing cues

regarding its usefulness. Equally important to understanding why this behavior occurs is

identifying ways for managers and policy makers to address it. FMCG manufacturers are already

using on-package messages to promote their sustainability achievements, such as "100%

Recycled Bottle," and state that this kind of messaging resonates with consumers (The Coca-

Cola Company 2022). We believe that instead of using on-package messaging to communicate

sustainability goals that have already been met, this valuable real estate could be used to nudge

consumer disposal behavior toward recycling, combatting detrimental perceptions prompted by

lightweighted packaging's lower density. In Study 4, we position the benefits of packaging

lightweighting in the context of recycling to draw attention to the packaging's future (vs. current)

usefulness. We believe that by highlighting the ability for low-density materials to be easily reprocessed via on-package messaging we can counteract the main effect of density on disposal.

Design and Procedure

Six-hundred and eight U.S.-based Mturk participants via CloudResearch ($M_{age} = 39.91$, 53.0% female, 46.2% male, .9% preferred not to respond) completed in this study in exchange for compensation. In line with Study 3, we sought to obtain 200 participants per condition. Participants were randomly assigned to one of three conditions in a single-factorial between-subjects design manipulating density and the perception of low-density usefulness for a plastic water bottle: low-density vs. high-density vs. low-density with usefulness prime.

Participants in the low-density and high-density conditions read the same scenario of being left with an empty plastic water bottle as Studies 2 and 3, with the low-density bottle described as "thin to the touch" and "quite lightweight," the high-density bottle described as "thick to the touch" and "quite heavy," and the descriptions accompanied by an image of the type of bottle described. However, those in the low-density with usefulness prime condition first read a paragraph framed as an excerpt from a recent news article at the start of the study. The paragraph described a new way to break down PET, the type of plastic material commonly used in water and soda bottles, using a naturally occurring enzyme, with the amount of enzyme required based on the weight of the plastic material to be decomposed. After reading the paragraph, participants in the low-density with usefulness prime condition were presented with the same empty plastic bottle scenario, along with the same bottle description as the low-density condition. Additionally, in comparison to the low-density condition, the bottle pictured in the low-density with usefulness prime condition also included a call-out text box representing on-packaging messaging that read, "This thin bottle design uses fewer resources to be broken down

when reprocessed into new items." To make the call-out box feel more authentic to a real-world marketing environment, a fictional bottled water brand name was employed across all three stimuli images (Figure 1.6).

Figure 1.6: Plastic Water Bottle Stimuli

High-Density   **Low-Density**   **Low-Density Usefulness**
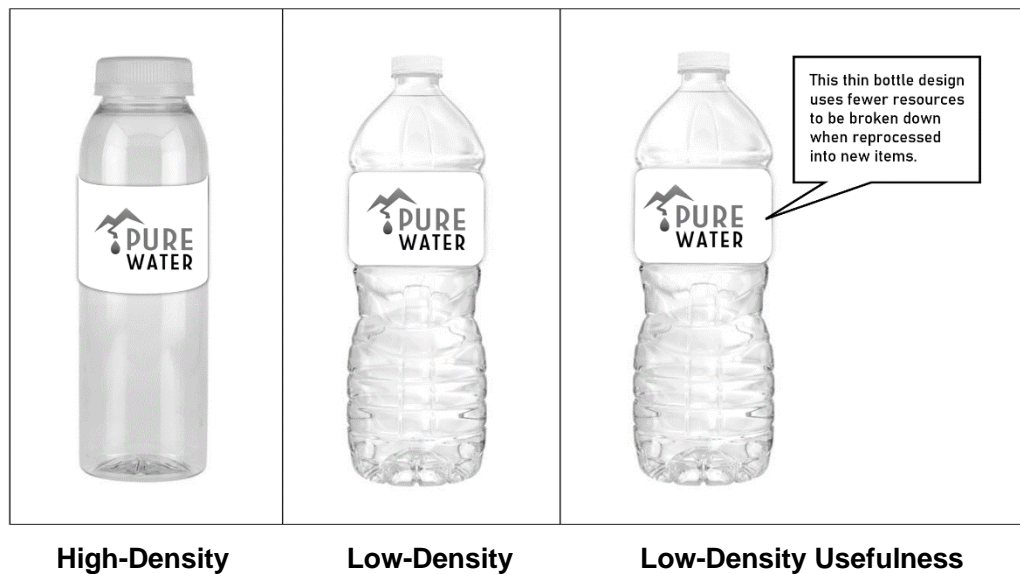
We employed two manipulation checks. First, to assess that people perceived a difference in the density of the two types of bottles, we employed the same manipulation check as Study 1B regarding density-driven quality perceptions, with participants rating the quality of the bottle on a 7-point scale (1 = Extremely Poor, 7 = Extremely Good). This check was used to validate that the same differences in density could be observed through both in-person (manual) and online (visual-only) assessments. Additionally, to evaluate the effectiveness of our low-density with usefulness manipulation, perceived usefulness of the bottle was assessed by indicating level of agreement with the statement: "This bottle is useful," (1 = Strongly Disagree, 7 = Strongly Agree). Participants were then asked to rate their likelihood to trash the bottle using the same item as Studies 2 and 3. An attention check asking participants to describe the plastic bottle in

their assigned scenario as either "thin to the touch and quite light" or "thick to the touch and quite heavy" was included as well as demographics of age and gender.

Results and Discussion

Manipulation checks

Indicating a successful manipulation, a one-way ANOVA revealed significant differences in perceptions of usefulness across the three conditions ($F(2, 599) = 18.40$, $p < .001$, $\eta^2_p = .058$). The bottle in the low-density condition ($M_L = 4.97$, $SD = 1.60$) was seen as significantly less useful than both the high-density plastic bottle ($M_H = 5.57$, $SD = 1.21$, $p < .001$) and the bottle in the low-density with usefulness prime condition ($M_{LFU} = 5.73$, $SD = 1.15$, $p < .001$). LSD post-hoc analysis revealed no significant difference in perceived usefulness of the bottle between the high-density condition and the low-density with usefulness prime condition ($p = .209$), demonstrating our manipulation's ability to improve perceptions of material usefulness.

Additionally, a one-way ANOVA revealed significant differences in perceptions of quality across the three conditions ($F(2, 600) = 86.65$, $p < .001$, $\eta^2_p = .224$), with the high-density plastic water bottle ($M_H = 5.50$, $SD = 1.19$) rated as significantly higher in quality than both low-density bottles ($M_L = 3.85$, $SD = 1.21$, $p < .001$ and $M_{LFU} = 4.45$, $SD = 1.43$, $p < .001$). Further, the bottle in the low-density with usefulness prime condition was viewed as significantly higher in quality than the bottle in the low-density condition ($p < .001$), suggesting that this manipulation of usefulness may even be capable of improving purchase-relevant density-driven perceptions of quality for low-density products.

Disposal

Most importantly, a one-way ANOVA revealed significant differences in disposal across the three conditions (F(2, 599) = 11.23, $p < .001$, $\eta^2_p = .036$), with the bottle in the low-density condition (M_L = 4.08, SD = 2.24) being significantly more likely to be disposed of in the trash than the bottles in the high-density (M_H = 3.26, SD = 1.97, $p < .001$) and low-density with usefulness prime (M_{LFU} = 3.21, SD = 1.97, $p < .001$) conditions. In line with perceptions of usefulness, LSD post-hoc analysis revealed no significant difference in disposal between the bottles in the high-density condition and the low-density with usefulness prime condition ($p =$ .807). These results also hold when excluding the 23 participants who failed the attention check. The ability for this manipulation to decrease the likelihood to trash low-density recyclable packaging to be equal to that of high-density recyclable packaging offers promising evidence for managers and policy makers that density-driven disposal outcomes for lightweighted packaging can be successfully reformed through marketing messaging tactics.

Figure 1.7: Impact of Marketing Messaging Tactics
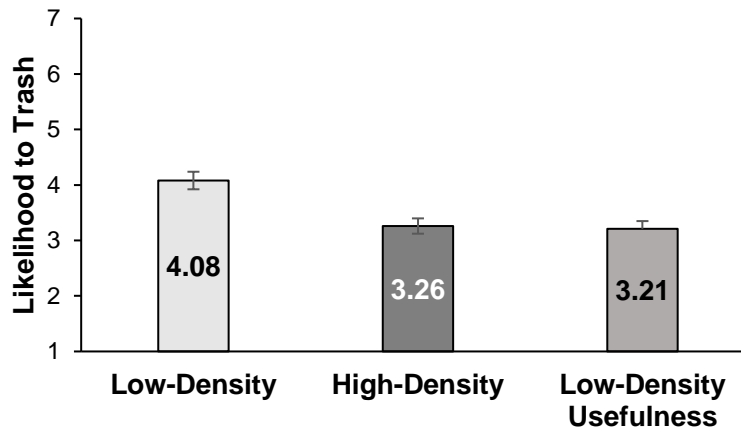
General Discussion

This research demonstrates that physical attributes of packaging play a role beyond the point of purchase and consumption; they impact disposal. Specifically, the density of product

packaging influences a consumer's decision to trash or recycle it. Across six studies employing

experiments and real behavior in field and lab settings, we find that consumers are more likely to

discard low-density recyclable packaging as trash compared to high-density recyclable

packaging. Specifically, we find that density influences consumers' perceptions of the

packaging's usefulness, with low-density packaging viewed as less useful than high-density

packaging, leading to an increased likelihood this packaging will be disposed of as trash despite

its inherent recyclability. Due to a form of functional fixedness, we find that consumers'

assessments of usefulness are based on perceptions about the packaging's current use, rather than

future use, despite future use considerations being more relevant to the context of disposal.

Importantly, the results of our studies bring light to the unintended negative consequence of

manufacturer packaging lightweighting and suggest that manufacturers should more carefully

balance their sustainability production processes with end-user implications.

Theoretical Contributions

This research makes a number of contributions. First, our research extends findings on

how packaging attributes serve as diagnostic inputs to consumer decision making. While extant

research on assessments of packaging density focus on consumer evaluations during a purchase

decision (e.g., Krishna and Morrin 2008; Piqueras-Fiszman, Harrar, Alcaide and Spence 2011;

Azzi et al. 2012; Gatti, Bordegoni and Spence 2014), we argue the same type of product attribute

information is applied to the novel context of disposal. When consumers evaluate the properties

of a material for disposal cues, its physical qualities become increasingly salient (McCabe and

Nowlis 2003; Peck and Childers 2003). Accordingly, we argue that elements of an item's density

(i.e., its thickness and weight) serve as key diagnostic inputs when deciding whether to trash or

recycle product packaging at the time of disposal, making the case that packaging characteristics impact consumer behavior beyond the point of purchase and consumption. As a result, we suggest that managers should not only evaluate how the density of product packaging impacts manufacturing processes, costs, and consumer evaluations, but also what role it plays in consumer post-consumption decision-making.

Second, despite the increased focus on recycling behavior in consumer research, little attention has been given to the physical attributes of an item that influence consumer disposal decisions. The balance of research in this area has primarily focused on the consumer's motivation or personal sense of environmental stewardship (see White, Habib, and Hardisty 2019 for a review), including how personal consumer characteristics such as political affiliation (Kidwell, Farmer, and Hardesty 2013), identity (Trudel, Argo, and Meng 2016), and gender (Brough et al. 2016) impact the adoption of sustainable disposal behaviors. Looking beyond individual characteristics that influence the adoption of greener habits, marketing researchers have examined how to most effectively persuade consumers to consider the impacts of their disposal choices through messaging, from providing information on post-use transformation (Winterich, Nenkov, and Gonzales 2019) to pairing loss- and gain-framed messages with marketing appeals to manipulate one's mindset (White, MacDonnell, and Dahl 2011) to receptacle labeling (Catlin et al. 2021). Our work extends a nascent but growing exploration of how specific physical attributes of an item, such as size and form (Trudel and Argo 2013), degree of dirtiness (Donnelly et al. 2023), and anthropomorphic characteristics (Wu, Malter, and Johar 2023) impact a consumer's decision to trash or recycle it. In doing so, our work makes a case for viewing consumer recycling not just as a decision of motivation and desire, but one of

recycling feasibility and disposal appropriateness that even environmentally conscious consumers can be impacted by.

Managerial Contributions

The findings of this research have implications for both marketing managers and public policy practitioners by examining sustainable packaging design and implementation from the perspective of the end-consumer. As governments and regulatory bodies push lightweighting as a promising tactic (European Commission 2014), packaging design researchers are increasingly examining end-of-life considerations for FMCGs (Khan and Tandon 2018), but consumer attitudes toward environmentally-focused packaging innovations have been identified as a potential blind spot (Boz, Korhonen and Sand 2020). Our findings demonstrate the impact that packaging attributes have not only on purchase and consumption behaviors, but also on disposal behaviors, and suggest that manufacturers should be more cognizant of the downstream effects that packaging changes can have on consumer behaviors post-acquisition. More specifically, we identify an unintended negative consequence associated with the increasingly prevalent manufacturing practice of material lightweighting (Lifshitz 2014; Szaky 2017). The need to balance multiple aspects of sustainable production and consumption has been identified as a key challenge for manufacturers (Mattia, Di Leo and Pratesi 2021; Feber et al. 2021), but more in terms of performance tradeoffs, and not in the context of downstream consumer disposal outcomes. This work highlights the implications of lightweighting from the consumer's perspective and demonstrates how this sustainability strategy can prove to be counterproductive if not addressed.

As an attempt to understand at what point packaging density can lead to improper disposal of recyclable packaging, we calculated the minimum packaging density (0.714 g/oz) at which there is an equal likelihood of the packaging being trashed or recycled from the data collected during our field experiment (Study 1A). Meaning, packaging density values beneath this inflection point would result in an exponential increase in the likelihood that the piece of packaging in question would be incorrectly disposed of in the trash. While this rough calculation is specific to the collection of materials in our study and those available for sale in the campus community where it was conducted, this kind of analysis could be performed by manufacturers to be specific to their packaging materials, types, and usage occasions to identify the threshold at which sustainability gains are eroded by consumer disposal behavior.

Additionally, we also provide guidance to manufacturers by illuminating how messaging strategies can be employed to help counteract the negative effect of packaging density reductions so that lightweighting strategies can be employed while also encouraging appropriate disposal outcomes by end consumers. This successful moderation of our effect shows the potential for consumer education efforts to combat consistently low recycling rates (EPA 2019) through targeted communication campaigns and on-package messaging.

CHAPTER 3

ROLE OF GREEN CONSUMPTION VALUES ON

PURCHASE INTENT FOR EXPIRING GOODS

Roughly one-third of all food waste in the U.S. can be attributed to the retail sector (USDA 2023). While this volume of waste is unsustainable in terms of its environmental and humanitarian impact, it also poses a significant business challenge for grocers, restaurants, and manufacturers. Retailers must discard approximately 43 billion pounds, or $161 billion worth, of food annually, costing the sector $18.2 billion every year (ReFED 2016). These are costs not just of lost revenue, but also costs incurred during the acquisition, transportation, and storing of perishable goods that ultimately go unsold, increasing operating costs by as much as 6 percent (McKinsey 2022). On a per store basis, it is estimated that the average grocery store in the U.S. must discard $2,300 worth of food daily, totaling an annual loss per store of $900,000 directly attributable to unpurchased perishable goods (Gunders 2012). As perishable goods account for half of total grocery revenue (Hansen, Misra, and Sanders 2024), the economic reality of this issue is causing retailers to reexamine their supply chain and marketing activities, including labeling and pricing practices (Ludmir 2023). It has also inspired the launch of tech start-ups such as Too Good To Go (Tamayo 2024) and Wasteless (World Economic Forum 2021), which leverage dynamic pricing technology to address at-risk restaurant and grocery surplus.

In developing nations, most food waste occurs due to a lack of infrastructure for safely processing, storing, and distributing agricultural goods (FAO 2015), but in industrialized nations, consumer behavior accounts for up to 40% of food supply loss (Buzby et al. 2014). One facet of

consumer behavior driving retail food waste is an aversion to goods approaching their expiration date (Block et al. 2016). Impending expiration dates have been shown to significantly reduce purchase intent across multiple retail contexts, with extant research identifying issues such as perceived risk (Tsiros and Heilman 2005), reduced perceptions of brand quality (Theotokis, Pramatari, and Tsiros 2012), and confusion regarding how to interpret date labels (Neff et al. 2019) as inhibitors of consumption. While 72% of consumers report increased awareness of their own food waste and want to change their behavior, only 39% say retailer labels with "consume by" or "best before" dates are helpful in improving their behaviors (Capgemini 2022). In fact, 57% of consumers in the same study say they are disappointed that the business community is not doing more to address food waste.

How can retailers address this unsustainable issue while recognizing the reality of consumers' aversion to expiring goods? And are some consumers more willing than others to purchase these at-risk goods? This research aims to answer those questions by examining how individual green consumption values impact a consumer's decision to purchase a perishable good approaching its expiration date. Specifically, we demonstrate that green consumption values (GCV), defined as "the tendency to express the value of environmental protection through one's purchases and consumption behaviors" (Haws, Winterich, and Naylor 2013), can predict the likelihood a consumer will purchase a perishable good approaching its expiration date.

We argue that differences in shopping behavior across consumer groups, and how those shopping habits impact food waste, warrant further exploration, as individual differences have been consistently shown to influence sustainable consumption (White et al. 2019). Personal characteristics such as political affiliation (Kidwell, Farmer, and Hardesty 2013), level of education (Semenza et al. 2008), and identity (Trudel, Argo, and Meng 2016), as well as traits

such as gender (Luchs and Mooradian 2012; Brough et al. 2016), mindfulness (Sheth, Sethia, and Srinivas 2011), and extraversion (Fraj and Martinez 2006), have all been shown to impact level of environmental concern and attitudes toward sustainability efforts. This variability in values and attitudes has been shown to predict behaviors including participation in curbside recycling programs (Guagnano, Stern, and Dietz 1995), willingness to pay more in taxes to cover sustainability initiatives (Guagnano, Dietz, and Stern 1994), and willingness to pay a premium for sustainably sourced foods (Wiidegren 1998). We suggest that in addition to making financial sacrifices to benefit the environment, individuals with high green consumption values are also more willing to sacrifice the quality of their consumption experiences, even in cases where resources of time or money are not constrained. For example, sustainability appeals have encouraged dorm residents to take shorter showers (Parker et al. 2018), without the conservation incentive of a reduced water bill, and are effective in encouraging eco-minded car owners to opt into public transportation for the environmental benefit (Soto, Cantillo, and Arellana 2021). We argue that to consume foods seen as potentially less fresh or suboptimal in taste, rather than having those items go to waste, represents a similar sacrifice in consumption quality. Although perceived sacrifice has been established as a barrier to sustainable behavior (Cleveland et al., 2012; Tseng 2016; Luchs and Kumar 2017), we argue that in this consumption scenario, sacrifice serves as the mediation mechanism when purchases are framed as choices between optimal freshness and food waste.

This work makes contributions to both sustainability literature and managerial practices. While much research has been conducted to understand food waste that takes place post-purchase at the household level (for a review, see Porpino 2016), our work focuses on food waste that occurs when safe, unspoiled perishable items go unpurchased from retailers, failing to ever

reach the hands of the consumer. Reducing food waste by purchasing perishable goods as they approach their expiration date is a critical consumption goal highlighted in the U.N.'s 2030 Agenda for Sustainable Development (United Nations 2015), but it has received considerably less research attention than other sustainability-focused food production and consumption practices. A 2022 retailing survey found that four in five consumers consider environmentally-focused attributes when selecting products (Haller, Wallace, Cheung, and Gupta 2022), but expiration date is not typically categorized as a sustainability-focused food labeling practice. Instead, labels regarding freshness and perishability are seen by consumers as warnings of safety, even if the items are still perfectly fit for consumption (Ankiel and Samotyja 2020). Accordingly, this research is distinct from research on the effectiveness of eco-labeling (e.g., Grunert, Hieke and Wills 2014; Taufique, Vocino, and Polonsky 2017), purchase intention for products marketed as environmentally-friendly (e.g., Vermeir and Verbeke 2006; Gershoff and Frels 2015; Hsu, Chang and Yansritakul 2017; Tan, Ooi and Goh 2017), or the growing consumer preference for products with sustainable sourcing and production claims such as "organic" (Carlson et al. 2023), "fair trade," (Hainmueller, Hiscox, Sequeira 2015), and "non-GMO" (Adalja et al. 2023). Rather than examine sustainable messaging techniques, we aim to identify the mechanism that drives consumers with high green consumption values to make sustainable purchase decisions. Said differently, rather than evaluating purchase intent for goods based on how they market themselves as sustainable, we evaluate purchase intent for broad categories of perishable goods that may otherwise become unsustainable pre-acquisition waste by failing to reach the hands of the consumer. When these goods go unsold, they are often disposed of rather than donated or sold at a discount, as perceived risks associated with expiration date labeling prevents the donation of surplus food to organizations such as food banks (Feeding America 2023).

As reported concerns over climate change are reaching all-time highs (Leiserowitz, Maibach, Roser-Renouf and Smith 2021), the impact of individual environmental attitudes on purchase behavior is of heightened importance to both researchers and managers. This work answers the call to better understand the sustainability-focused consumer in a number of ways. In examining the role of green consumption values on purchase intent for expiring goods.

Conceptual Development

Psychological Drivers of Food Waste

Calls to reduce consumer food waste, defined by the United Nations as "food appropriate for human consumption being discarded or left to spoil at the consumer level – regardless of the cause" (Committee on World Food Security 2014), are pressing and distinct from efforts to improve agricultural and production practices that generate waste before food reaches retail shelves. Research on the consumer behavior-based drivers of food waste in industrialized nations such as the U.S. has skyrocketed in the last 20 years (Principato 2021), driven in part by the increasing levels of food waste identified by the United Nations (Food and Agricultural Organization of the United Nations [FAO] 2013; Porpino 2016). The balance of this research focuses on food waste that takes place at the household level, after food is purchased from a retailer or brought home from a restaurant, identifying waste drivers ranging from difficult-to-empty food packaging (Williams et al. 2012), excess serving sizes on large dinnerware (Wansink and van Ittersum 2013), and over-preparation of food (Silvennoinen et al. 2014). Factors related to lifestyle and knowledge also contribute to food waste at the consumer level. Consumption habits that emphasize convenience (Parizeau, Massow, and Martin 2015), anxiety around food-

borne illnesses (Neff, Spiker, and Truant 2015), lack of knowledge around how to properly handle food (Porpino et al. 2015), household composition (Tucker and Farrelly 2016), and even political ideology (Mas, Haws and Goldsmith 2022) can serve as determinants of how much food is discarded by individuals. Additionally, confusion around expiration dates has been identified as a key driver of food waste at the household level (Abeliotis, Lasaridi, and Chroni 2014), although the sense of psychological ownership around perishable items brought into the home can sometimes offset contamination concerns (Sen and Block 2009).

Rather than examining factors inside the home, this research focuses instead on the underlying psychological processes that prevent consumers from buying perishable goods from a retailer, with those goods then contributing to food waste by going unsold. Block et al. (2016) mapped consumer motivations that contribute to food waste along a consumption path from purchase to disposal they identified as the "squander sequence." In the retail environment, described as the pre-consumer acquisition stage, avoidance of misshapen, blemished, or otherwise unattractive items (Gunders 2012) or of items in damaged packaging (White et al. 2016), can be seen as an evolutionary response to protect oneself from illness or contamination. Although for processed foods, aesthetic imperfections can increase preference by signaling human involvement in the production process, the effect of imperfections remains negative for unprocessed foods such as produce (Suher, Szocs, and van Ittersum 2021).

Most relevant to this research is literature examining the role of expiration dates on consumer purchase behavior. Unfortunately, because date-labelling practices, with the exception of infant formula, are unregulated in the United States, these dates are placed by the manufacturers to indicate peak freshness and are not to be interpreted as measures of safety (USDA 2024). Meaning interpretation of date labels and phrases such as "sell by," "use by," or

"freeze by," which for the purposes of this research we will refer to collectively as expiration dates, are left to individual consumers. As a result, many consumers are confused by expiration date labels (Neff et al. 2019) and in some cases do not pay attention to them at all (Hansen, Misra, and Sanders 2024). Consumers are more likely to pay attention to expiration dates if they are not able to assess other sensory freshness cues such as taste and smell (Hall-Phillips and Shah 2017). Tsiros and Heilman (2005), looking at perishable goods across meat, dairy and produce categories, found consumers were less likely to purchase perishable items as their expiration date approached, perceiving these products as higher risk. Although discounts are a proven method of increasing purchase intent, Theotokis, Pramatari, and Tsiros (2012) found that expiration date-based pricing had a negative effect on consumer perceptions of brand quality and garnered distrust toward the discounted brand. Attitudes around expiration dates can vary significantly between consumers, with individual differences such as culture (Harcar and Karakaya 2005) and age and gender (Secondi 2019) known to play a role in how much weight expiration dates are given at the point of purchase. In this research, we make the case that an additional personal attribute worth investigating in this context is an individual's green consumption values, which we argue impact the weight consumers give to expiration dates at the point of purchase relative to their motivation to shop sustainably.

Green Consumption Values and Sacrifice

Sacrifice involves giving up something that is valued for the sake of something else deemed more important (Oxford 2024). Sacrifice within a consumption context has long been conceptualized to include both monetary and non-monetary costs, including time spent searching for and obtaining products, physical and mental effort exerted in making a purchasing decision,

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and the opportunity cost of satisfaction had said time and effort been spent differently (Zeithaml 1988). Consumers' willingness to sacrifice plays a significant role in shaping their behaviors in the context of ethical and environmentally-friendly consumption. White, Habib, and Hardesty (2019) argue that because sustainable consumption is often viewed as requiring some kind of individual sacrifice such as time, money, or quality (Luchs and Kumar 2017), for the benefit of an external social or environmental recipient (Campbell and Winterich 2018), traditional views of self-serving consumer behavior will not hold. Sustainable consumption practices often ask individuals to weigh vaguely defined consequences of climate change against more immediate and personal interests (Amel et al. 2017; Spence, Poortinga, and Pidgeon 2012). Sacrifice can also be associated with forgoing a purchase altogether for the sake of a cause deemed more worthy than personal value capture, such as in the case of boycotting (Hutter and Hoffmann 2013). This self-other trade off implies that consumers with high green consumption values are more likely to deprioritize product attributes that are beneficial to the self and instead prioritize product attributes that benefit the environment. In this research, we argue that this sustainably-minded trade off takes the form of deprioritizing consumption quality and prioritizing saving an item from otherwise going to waste, and as a result increases purchase intent for a perishable good approaching its expiration date.

H1: Consumers with high (low) green consumption values will be more (less) likely to purchase perishable goods approaching their expiration date.

A purchase decision in which a consumer knowingly sacrifices quality for the benefit of an abstract cause, such as the consumption scenario we examine in this research, functions

contradictory to evolutionary psychology and basic self-interest. One way this contradiction inherent to sustainable consumption has been addressed in marketing research is through social status signaling. Because sacrifice is seen as a costly act, it can serve as a signal of abundance and status. As such, reputation signaling has been identified as an important motivator to induce prosocial sacrifice (e.g., Griskevicius, Tybur, Van den Bergh 2010; Green and Peloza 2014; Johnson and Park 2021). Although extant literature on sacrifice associated with prosocial behavior primarily focuses on donations of time and money (e.g., Wiener 1993; Johnson 2019; Dunn, White and Dahl 2020; Jami, Kouchaki and Gino 2021), in this work we focus on sacrifices of consumption quality, such as choosing to consume a good past its point of peak freshness. Because this form of sacrifice is often invisible to others (Garcia-Rada, Kim, and Liu 2024), status or reputation signaling no longer serves as a relevant motivator. Rather than engaging in this form of sustainability-minded sacrifice to send external-facing signals of reputation or status, we argue consumers with high green consumption values engage in this type of sacrifice because it helps to meet an identity-congruent goal of benefiting the environment (Dominick and Cole 2020).

H2: This increased likelihood to purchase goods approaching their expiration date is driven by the increased likelihood of individuals with high GCV to sacrifice consumption quality to achieve the identity-congruent goal of reducing food waste.

In summary, we predict that individuals with high (vs. low) green consumption values are more likely to purchase perishable goods approaching their expiration date. Because consumers with high GCV are more likely to view environmental issues such as food waste as more

important than their own consumption quality, they are more likely to engage in this type of sacrifice. Said differently, they will view the global benefits associated with reducing food waste as more important than the individual benefits associated with purchasing and consuming food at its peak freshness. Additionally, by engaging in this form of consumption sacrifice, a behavior that is congruent with their identity as individuals take actions to protect the environment, these consumers feel a sense of pride from purchasing foods approaching expiration. The findings detailed in this research offer preliminary evidence in support of these proposed differences in consumer behavior and outline next steps to better examine the proposed processes. By better understanding the psychological processes at play in the mind of sustainable consumers, we hope to identify marketing mechanisms that can encourage all consumers to make purchases in a manner that reduces food waste, regardless of their individual green consumption values.

Overview of Studies

Across three studies, we find that consumers with high green consumption values are more likely to purchase perishable goods approaching their expiration date, compared to consumers with average or low green consumption values. Specifically, we demonstrate that individual consumers with high green consumption values are more likely to prioritize their ability to reduce food waste over the increased consumption quality associated with consuming a good at peak freshness.

Study 1A

In our first test of main effect in a controlled environment, we examine our proposed main effect of consumers' green consumption values (GCV) on their likelihood to purchase a perishable good approaching its expiration date using a scenario-based manipulation. In alignment with our hypothesis 1, we expect consumers with high self-reported measures of GCV to be more likely to purchase the expiring good than consumers with low self-reported measures of GCV.

Method

Four-hundred and ninety-nine undergraduate students (M_{age} = 20.33 years, 60.5% female, 37.9% male, 1.6% preferred not to respond) from a large U.S. university participated in this study in exchange for course credit. Participants were asked to imagine that while picking up lunch from a supermarket, they see multiple packaged turkey sandwiches that are going to expire the next day. An example image of a turkey sandwich with visible on-package description of its contents was provided. After reading the scenario, participants were asked to indicate their likelihood to purchase the sandwich ("How likely are you to purchase this sandwich?") on a seven-point scale (1 = "Not Very Likely," 7 = "Very Likely"). A measure of liking ("In general, how much do you like turkey sandwiches?" 1 = "Not at All," 7 = "Very Much") was included to be evaluated as a potential covariate that influenced purchase intent. To determine their individual green consumption values, participants were then asked to indicate their agreement (1 = "Strongly Disagree," 7 = "Strongly Agree") with the six statements that comprise the GREEN scale (Haws, Winterich and Naylor 2014), with the order of the statements randomized. Demographics measures of age and gender were also collected.

Results and Discussion

Purchase Intent. Indicated agreement with the six statements that comprise the GREEN scale (Haws, Winterich and Naylor 2014) were averaged to create a single measure of individual green consumption value (GCV) ($\alpha = .92$). We regressed purchase intent for the sandwich approaching its expiration date on participant GCV ($M_{GCV} = 4.15$, $SD = 1.19$) and found a positive and significant effect ($B = .219$, $p < .001$). As hypothesized, consumers with higher GCV were more likely to purchase the sandwich than participants with lower GCV. The pattern of results held when including how much the participants liked turkey sandwiches as a covariate. We then created three groups based on +1/-1 standard deviation around the mean GCV to evaluate differences in purchase intent across consumers with high (1.00), average (0.00), and low (-1.00) GCV. Individuals with high GCV ($M_{HGCV} = 3.94$, $SD = 2.12$) were significantly more likely to purchase the sandwich compared to both those with low GCV ($M_{LGCV} = 2.78$, $SD = 1.70$, $p < .001$) and those with average GCV ($M_{AGCV} = 3.21$, $SD = 1.76$, $p = .002$). There was a marginal difference in purchase intent between the low and average GCV groups ($p = .060$).

Discussion. Study 1A provides further support for our hypothesis that environmentally-friendly consumption intentions, as measured here using the Haws, Winterich and Naylor (2014) GREEN scale, have a positive and significant effect on purchase intent for expiring goods. As predicted, when examined as discreet groups, consumers with high GCV were more likely to purchase the sandwich than both consumers with average- and low-levels of GCV. However, we acknowledge that measures of purchase intent have limitations in predicting actual consumer behavior. To address this concern, we follow up with a study design leveraging a binary choice DV to evaluate our main effect.

Study 1B

We follow up our first test of main effect by examining the impact of consumers' green consumption values (GCV) on their likelihood to purchase a perishable good approaching its expiration date using a choice study design. In keeping with our previous results in support of hypothesis 1, we expect consumers with high self-reported measures of GCV to be more likely to choose the good with the nearer-term expiration date than consumers with low self-reported measures of GCV.

Method

Four-hundred and forty-six undergraduate students (M_{age} = 20.31 years, 60.4% female, 39.1% male, 0.4% preferred not to respond) from a large U.S. university participated in this study in exchange for course credit. Participants were asked to imagine that while picking up lunch from an on-campus cafe, they see two packaged turkey sandwiches for sale, leveraging the same example image and on-package description as in study 1A. Participants were told that the two sandwiches look the same, but one is labeled "best by" today and the other as "best by" tomorrow. Participants were then asked to select which of the two sandwiches they would purchase. To determine their individual green consumption values, participants were then asked to indicate their agreement (1 = "Strongly Disagree," 7 = "Strongly Agree") with the six statements that comprise the GREEN scale (Haws, Winterich and Naylor 2014), with the order of the statements randomized. A measure of liking ("In general, how much do you like turkey sandwiches?" 1 = "Not at All," 7 = "Very Much") was included to be evaluated as a potential covariate that influenced purchase intent. Demographics measures of age and gender were also collected.

Results and Discussion

Sandwich Choice. Indicated agreement with the six statements that comprise the GREEN scale (Haws, Winterich and Naylor 2014) were averaged to create a single measure of individual green consumption value (GCV) (α = .92). A binary logistic regression (1 = Best by today, 0 = Best by tomorrow) revealed a positive and significant main effect of individual GCV on sandwich choice (B = .386, p = .005), with high GCV participants more likely to purchase the sandwich labeled best by today than participants with lower GCV. The pattern of results held when including how much the participants liked turkey sandwiches as a covariate.

Discussion. Study 1B provides further support for our hypothesis that environmentally-friendly consumption intentions, measured using the Haws, Winterich and Naylor (2014) GREEN scale, have a positive and significant effect on a consumer's likelihood to purchase a good with an impending expiration date. Although we argue a consumer's personal sense of environmental stewardship is the primary driver of our effect, we acknowledge there are multiple additional factors and individual differences that may influence purchase intent in our proposed scenario. We address this concern in study 2, in which we evaluate alternative individual differences on purchase intent for an expiring good and test the role and relative strength of these factors in the presence of a price discount.

Study 2

Although studies 1A and 1B offer promising preliminary evidence of our main effect, we know from extant research that many individual differences could influence purchase intent in our proposed scenario. In this study we evaluate the impact of individual GCV on purchase

intent for a good approaching its expiration date relative to other individual differences that are

known to influence purchase intent for expiring goods, including frugality (Lastovicka et al.

1999), food waste aversion (Raghunathan and Chandrasekaran 2020), and political ideology

(Lisjak and Ordabayeva 2023). We also evaluate the strength of these individual differences

relative to the presence of a price discount given mixed results in marketing and supply chain

research on the effects of dynamic, expiration-based pricing on purchase intent for perishable

goods. Dynamic or expiration date-based pricing increasingly discounts a perishable item as it

approaches its "sell by" or expiration date, rendering the items with the shortest remaining shelf

life as the most discounted in the retail set. Although discounts are a proven method of increasing

purchase intent, Theotokis, Pramatari, and Tsiros (2012) found that expiration date-based pricing

had a negative effect on consumer perceptions of brand quality and garnered distrust toward the

discounted brand. However, an analysis of sales data from a grocery chain that employed such

dynamic pricing in their bread category showed a reduction in retail food waste of 21% (Sanders

2020). These conflicting findings suggest further investigation into expiration-based discounting

and messaging around expiration dates is needed to inform recommendations for retailers and

manufacturers.

Method

Three-hundred and ninety-nine online panel participants (M_{age} = 42.15 years, 46.1%

female, 53.1% male, 0.8% preferred not to respond) completed this study in exchange for

compensation. Participants were randomly assigned to one of two conditions in a single-factorial

between subjects design (discount present vs. discount absent). Participants were asked to

imagine that while shopping in the dairy aisle of the grocery store, they saw multiple containers

of yogurt on the shelf. In the discount absent condition, participants were told "There are multiple containers of yogurt on the shelf that you notice because their expiration date is in two days," accompanied by an image of a fictional brand of yogurt marked with an expiration date two days after the day the study was conducted. In the discount present condition, participants were told "There are multiple containers of yogurt on the shelf marked on sale because their expiration date is in two days," accompanied by an image of a fictional brand of yogurt marked with a tag indicating a price drop and the same expiration date two days after the day the study was conducted. After reading the scenario, participants were asked to indicate their likelihood to purchase the yogurt ("How likely are you to purchase this yogurt?") on a seven-point scale (1 = "Not Very Likely," 7 = "Very Likely"). Next, participants completed questions intended to identify four categories of individual difference that could impact their purchase intent: political affiliation, green consumption values, frugality, and food waste aversion.

Green Consumption Values. To determine their individual green consumption values, participants were asked to indicate their agreement (1 = "Strongly Disagree," 7 = "Strongly Agree") with the six statements that comprise the GREEN scale (Haws, Winterich and Naylor 2014), with the order of the statements randomized ($\alpha = .95$).

Political Ideology. We measured political ideology using a single measure by asking participants to answer, "How would you describe your political affiliation?" on a seven-point scale (1 = "Extremely Liberal," 7 = "Extremely Conservative").

Frugality. To obtain a measure of individual frugality, participants were asked to indicate their agreement (1 = "Strongly Disagree," 7 = "Strongly Agree") with the eight statements that comprise the frugality scale developed by Lastovicka et al. (1999) (e.g., "I discipline myself to

get the most from my money," "Making better use of my resources makes me feel good,"), with the order of the statements randomized ($\alpha = .90$).

Food Waste Aversion. Finally, to account of the role of general aversion to food waste, participants were asked to indicate their agreement (1 = "Strongly Disagree," 7 = "Strongly Agree") with the six statements that comprise the food waste aversion scale developed by Raghunathan and Chandrasekaran (2020) (e.g., "Growing up, I was taught not to waste food by my parents," "I always eat whatever is put on my plate,") with the order of the statements randomized ($\alpha = .79$). Demographics measures of age and gender were also collected.

Results and Discussion

Purchase Intent. We regressed purchase intent for the yogurt approaching its expiration date on participant GCV ($M_{GCV} = 4.69$, $SD = 1.46$) and found a positive and significant effect ($B = .223$, $p = .002$), in support of our hypothesized main effect (Model 1). We then evaluated the strength of this effect against the three other predictors known to influence purchase intent for expiring goods as well as the presence of a discount (Model 2). Even with the inclusion of frugality ($M_F = 5.97$, $SD = .85$), waste aversion ($M_{WA} = 5.21$, $SD = 1.11$), political affiliation ($M_P = 3.61$, $SD = 1.83$), and presence of a price discount (1 = Yes, 0 = No), the effect of individual GCV on purchase intent remained significant ($B = .205$, $p = .009$). Further, the effect size of GCV is larger in magnitude than the other predictors measured, indicating its relative strength in predicting this type of purchasing decision. The full results are listed in Table 2.1.

Table 2.1: Effect of Individual GCV on Purchase Intent

Effect	Estimate	SE	β	95% CI Exp(B)		p
				LL	UL	
Model 1						
Intercept	2.261	.351				<.001
GCV	.223	.071	.154	.082	.363	.002
Model 2						
Intercept	.137	.790		-1.416	1.689	.863
GCV	.205	.078	.142	.051	.359	.009
Frugality	-.107	.143	-.043	-.388	.174	.455
Waste Aversion	.186	.110	.097	-.030	.402	.091
Political Affiliation	.118	.058	.103	.005	.232	.041
Discount (1 = Y, 0 = N)	.967	.205	.229	.564	1.369	<.001

Discussion. The results of this study further helped us to evaluate the influence of individual green consumption values on purchase intent for an expiring good, testing them against other individual traits known to influence sustainable consumption while also evaluating the strength of those differences against the presence of a price discount. In doing so, we were able to demonstrate the relative strength of GCV as a predictor of purchasing behavior in our proposed scenario. Although political affiliation also had a significant impact on purchase intent, its effect was smaller than that of green consumption values, and not surprising given extant research on the role of political views on green consumption (Kidwell, Farmer, and Hardesty 2013). This study also extended the generalizability of our main effect by demonstrating its strength leveraging a scenario of purchasing a dairy product (versus a prepared entrée). Next, we test our hypothesis that the relationship between green consumption values and purchase intent is mediated by a willingness to sacrifice consumption quality.

Food waste is not just an environmental or humanitarian issue, but a business issue as well. The consequences of food waste including greenhouse gas emissions (EPA 2020) and food insecurity (Coleman-Jensen et al. 2020) are so great that the United Nations' 2030 Agenda for Sustainable Development calls for a 50% reduction in food waste at retail and consumer levels by 2030 as one of the 17 Sustainable Development Goals (SDGs). This research seeks to advance a better understanding of the psychological processes at play in the mind of eco-minded consumers when they shop for perishable goods, and how they weigh the expiration dates of those goods against their interest in reducing food waste. Specifically, we find that that individuals with high (vs. low) green consumption values are more likely to purchase perishable goods approaching their expiration date. This is because consumers with high green consumption values also show a higher likelihood to prioritize environmental causes over their own consumption quality, which in this purchasing scenario translates into a sacrifice of taste or freshness. Said differently, consumers with high green consumption values view the environmental benefits associated with preventing food waste as more important than the potentially higher consumption quality they would experience by purchasing and consuming food at its peak freshness.

Theoretical Contributions

This works adds to the growing body of sustainable consumption literature seeking to identify the underlying psychological processes that motivate consumers to make environmentally friendly purchase decisions, even when those decisions contradict the

consumers self-interest (e.g. Grewal et al. 2019; Stuppy, Mead, and Van Osselaer 2020; Lisjak and Ordabayeva 2023). Our aim is that by identifying these underlying mechanisms, we can develop strategies to encourage all consumers to make purchases in a manner that reduces food waste, regardless of their individual green consumption values, as some previously studied, and well-intentioned, food waste mitigation strategies run the risk of generating counterproductive outcomes. Specifically, outright environmentally-focused appeals have the potential to backfire when consumers believe the environmental benefits of consumption come at the expense of product quality or taste (Newman, Gorlin, and Dhar 2014). In product categories where efficacy or strength are valued, promoting items as environmentally-friendly has been shown to reduce product preference, even with consumers who voice concern around sustainability (Luchs et al. 2010). Highlighting perishable items as rescue-based foods can trigger an association with waste, reducing demand for these safe to consume items (de Visser-Amundson, Peloza, and Kleijnen 2021).

Managerial Contributions

The impact of individual environmental attitudes on purchase behavior is of increased focus for marketers, as reported concerns over climate change are reaching all-time highs (Leiserowitz, Maibach, Roser-Renouf and Smith 2021), and increasing numbers of consumers indicating a willingness to change their habits accordingly (Nielsen 2019). It is an unfortunate irony that in a country generating such large volumes of food waste, roughly 10% of households in the U.S. face periods of food-insecurity (Coleman-Jensen et al. 2019). If just 30% of annual U.S. food waste was properly recovered, it would be enough to feed an estimated 50 million citizens (ReFED 2016). Unfortunately, confusion and perceived risks associated with expiration

date labeling sometimes prevents the donation of surplus food to organizations, such as food

banks, designed to help those facing food insecurity (Feeding America 2023). The successful

moderation of our effect shows the promising potential for marketing efforts to offset the effect

of expiration dates on purchase intent, reducing pre-acquisition food waste as a result. By

implementing effective food waste reduction strategies, retailers have the potential to improve

operational efficiencies, increase profitability, and also help address food insecurity in their

communities.

CHAPTER 4

CONCLUSION

Informed by experience in consumer packaged goods manufacturing, personal interest in sustainability, and academic training, I sought to offer a unique perspective from which to examine barriers to sustainable consumption that are directly within the realm of control of manufacturers and retailers. This unique perspective and combination of my experience, interests, and expertise was able to contribute to and shape this work in a way that creates a whole that is greater than the sum of its parts.

From my time working in industry, I understand that managers are making decisions under constraints of time and money; they do not always have the luxury of stepping back and deeply investigating an issue from the point of view of the consumer. They are also balancing the sometimes-competing objectives of maintaining positive perceptions of brand quality against manufacturing practices that are intended to minimize the environmental impact of the firm. The time, training, and resources to more carefully look into the consumer-facing impacts of managerial decisions was a luxury I was afforded in the pursuit of my doctorate. In the two essays comprising this dissertation, I attempt to do exactly that, examining packaging and labeling decisions and their impacts on consumer behavior against the backdrop of the pressing issue of sustainability. The research in this dissertation aims to bridge the gap between theory and practice, offering practical suggestions and relevant insights for managers seeking to encourage sustainable consumer behavior through their actions. This closing chapter aims to summarize the key findings from each essay, their contributions to the body of marketing research on sustainability and offer suggested avenues for future work in this space.

The first essay explored the role of density on a consumer's decision to trash or recycle product packaging. Across two field studies and four laboratory experiments, we found consumers are more likely to trash recyclable packaging that is manufactured to be low in density compared to similar packaging that is higher in density. This occurs because the density of packaging serves as a cue regarding its usefulness, with low-density recyclable packaging viewed as less useful, and thus more likely to be improperly disposed of as trash. While density-driven perceptions of usefulness are relevant for evaluating packaging in a consumption context ("current use," e.g., its ability to hold or protect interior contents), we found the same perceptions are inaccurately applied when evaluating packaging for disposal, a time when its "future use" or ability to be recycled into a new item, which is more comparable between the two density types, should be considered. Despite the increased focus on recycling in consumer research, little attention has been given to the physical product attributes that inform disposal decisions. The balance of research in this area has primarily focused on how the consumer's motivation or personal sense of environmental stewardship impacts the adoption of sustainable disposal behaviors (see White et al. 2019 for a review). Our work extends literature exploring the role of physical attributes on recycling decisions (e.g., product size and form, Trudel and Argo 2013), showing that regardless of shape or material, the density of the product impacts perceptions of product usefulness which can drive recycling. In doing so, our work helps to make a case for recycling not just as a decision of motivation and desire, but one of recycling appropriateness, even for environmentally conscious consumers. This work suggests that manufacturer lightweighting, a popular sustainability initiative that reduces the amount of raw material used in packaging often leading to reduced density, has counterproductive effects on consumer disposal that need to be addressed.

The focus on density in Essay 1 was driven by attention to the rising manufacturing trend of material lightweighting (Resource Plastic 2020), but given the nature of sorting waste, we believe different physical attributes, such as packaging texture or format, which may be impacted by sustainable manufacturing advances such as through the use of compostable or plant-based materials, or through the employment of reusable packaging, could impact disposal. Additionally, while we find the density of a package impacts consumers' recycling behavior, packaging has various different physical attributes (Klatzky, Lederman, and Matula 1991; Lederman and Klatzky 1987) that might also play a role in its likelihood to be recycled. Future research should consider other packaging attributes like color, shape, texture, or sheen and their potential impact on consumer disposal decisions. Understanding the downstream consumer implications of any sustainability-focused managerial practice is critical to ensure that these well-intended manufacturing decisions are also benefiting the environment in practice. We hope our work furthers future exploration of the physical attributes that impact consumer disposal behavior, as these are aspects for which managers have control and can utilize to make a concerted effort in positive contributions to societal sustainability.

The second essay examines how differences between individuals regarding their environmentally-friendly consumption behaviors impacts their likelihood to purchase a perishable good as it approaches its expiration date. Pre-acquisition food waste, when perishable products go unsold by retailers and must be discarded, accounts for roughly one-third of all food waste in the United States each year (USDA 2023). On average, a U.S. grocery store discards $2,300 worth of perishables daily, totaling an annual loss of $900,000 per store (Gunders 2012). In developing nations, the generation of food waste can be attributed to inadequate infrastructure for processing, storing, and distributing agricultural goods (FAO 2015). But in industrialized

nations, a significant percentage of food waste generation can be influenced by marketing efforts, as individual consumer behavior accounts for up to 40% of food waste (Buzby et al. 2014). Consumers often avoid goods nearing expiration dates due to perceived risks (Tsiros and Heilman 2005), reduced perceptions of brand quality (Theotokis, Pramatari, and Tsiros 2012), and confusion over the meanings of expiration date labels (Neff et al. 2019). This research aimed to understand how green consumption values (GCV), as defined by Haws, Winterich, and Naylor (2013), can predict the likelihood of buying such goods most vulnerable to becoming waste. Across three studies, we found that consumers with high green consumption values are more likely to purchase perishable goods approaching their expiration date, compared to consumers with average or low green consumption values.

Essay 2 contributes to sustainability literature and managerial practices by focusing on food waste from perishable items that have gone unpurchased. Reducing food waste by purchasing near-expiration goods aligns with the U.N.'s 2030 Agenda for Sustainable Development but has received less attention than other sustainability practices. We hypothesize this increased likelihood to purchase goods approaching their expiration date is mediated by an increased willingness to sacrifice the quality of the consumption experience such as taste or satisfaction, to be evaluated by future research that manipulates individual GCV. By offsetting the well-established negative effect of impending expiration dates on purchase intent by inducing a mindset associated with sustainable consumption, this research offers a promising stream of future research for retailers and manufacturers looking to combat pre-acquisition food waste.

By highlighting the critical role of managerial decisions in shaping consumer behavior, this research underscores the potential for businesses to be powerful change agents in society's ongoing pursuit of sustainability. However, the scope of this research was limited to factors such

as packaging and labeling that are specific to fast-moving consumer goods, which are only one aspect of sustainable consumption that warrants further investigation. Looking at waste generation rates related to other consumer products, the United Nations estimates that consumers are generating up to 50 tons of electronic waste every year, with these rates expected to double by the year 2050 (United Nations Environment Program [UNEP] 2021). Additionally, the Ellen MacArthur Foundation has estimated that the fashion industry produces up to 92 million tons of waste worldwide each year, with little effort to reclaim materials throughout the manufacturing process (Ellen MacArthur Foundation 2017). As sustainability is increasingly prioritized in business school curriculum (Marquis 2024), it is my hope this area of research will receive additional attention and scholarship.

By examining the interplay between consumer behavior and manufacturing practices, I seek to advance marketing research that helps lay the path towards a more sustainable future. The findings outlined in this dissertation are useful to marketers, policymakers, and organizations seeking to promote sustainable consumption behavior among consumers. It is my hope that these insights will inspire further research and innovation in the field, driving a collective effort towards a more sustainable future.

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APPENDIX A

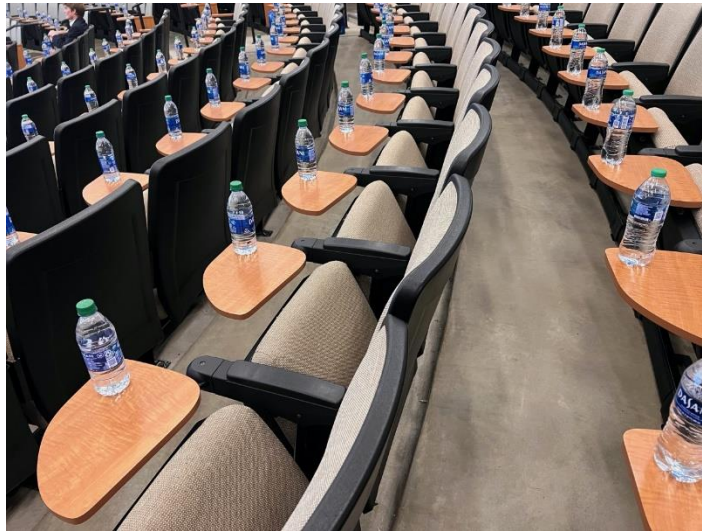Figure A1: Distribution of Water Bottles at Speaker Event (Pilot Study)

Figure A2: Representative Sample of Items Collected (Field Study)
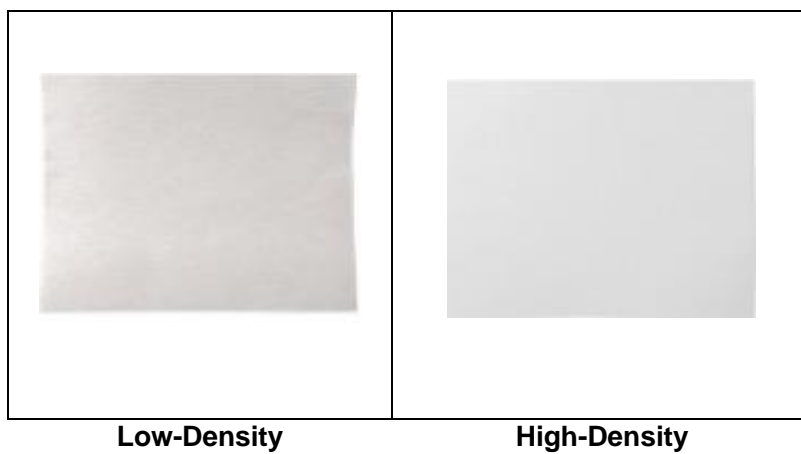
Figure A3: Paper Flyer Stimuli (Study 1B)

Low-Density   **High-Density**

Figure A3: Disposal Bins Outside Behavioral Lab (Study 1B)

APPENDIX B

Supplemental Study 1: Manual vs. Visual Assessments

While detailed product descriptions can compensate for a lack of instrumental touch in an online

environment (Jha et al. 2019) and imagining the act of touching a product can generate similar

feelings and sensations for a product as those generated when physically touching a product

(Peck at al. 2013), we tested for the possibility that consumers' perceptions of the product might

differ between whether participants physically feel the product or not, which could impact their

disposal behavior. Accordingly, we conducted a study in which participants indicated their

perceptions of low-density and high-density product packaging in which they assessed the

product manually (by picking it up) or visually (by simply looking at the product).

Design and Procedure

Three-hundred undergraduate students (M_{age} = 20.33 years, 56.7% female, 42.3% male, 1.0%

preferred not to respond) from a large U.S. university participated in this study in exchange for

course credit. We sought a total of 100 participants per condition but were limited to in-person

participants available for this session; only 300 participants electively chose to participate in this

study during the time it was offered. Participants were randomly assigned to one of four

conditions in a 2 (density: low vs. high) X 2 (assessment type: manual vs. visual) between-

subjects design in which they indicated their perceptions of a cardboard box. We preregistered

the study design and measures on OSF prior to collection:

https://osf.io/fx8tp/?view_only=c227daec13204613bd02eb4237df5d8e.

Participants entered the behavioral lab and were seated at a cubicle, which contained a computer

as well as an open 6-inch X 6-inch X 6-inch cardboard box. The cardboard boxes were

randomized by condition, with alternating high- and low-density box samples placed at each computer station. Both types of boxes were the same size, color (brown), brand (Uline), and lacked any design or texture (Figure B1). The only difference between the two types of boxes was the density. The single-wall cardboard box in the low-density condition weighed approximately 100 g and had a density of .463 g/in^3, while the double-wall cardboard box in the high-density condition weighed approximately 200 g and had a density of .926 g/in^3. Participants were asked to imagine they were sending a gift to a friend who lived far away and needed to purchase a cardboard box to use for shipping. Participants in the manual assessment condition were instructed to pick up the box and evaluate how well they believed the box would contain and protect the gift during shipping using both visual and manual cues. Alternatively, participants in the visual assessment condition were told not to touch or pick up the box and were instructed to evaluate how well they believed the box would contain and protect the gift during shipping using only visual cues. Note that instructions were focused on having participants evaluate the product based on its current use function, as Study 2 indicates a conceptualization of current use dominates consumer usefulness perceptions at the time of disposal. Additionally, no written descriptions of the boxes were provided to avoid priming participants to evaluate any specific feature or component of the boxes, such as density. Participants were then asked to rate how useful they found the material of the box on a numeric scale (1 = Not at All Useful, 7 = Extremely Useful); the same type of measure employed in Study 2. To address the possibility that participants may view the low- or high-density boxes as physically dissimilar to prototypical cardboard boxes, with atypical objects viewed as less useful (Trudel and Argo 2013), the perceived prototypicality of each cardboard box type was assessed by having participants

answer, "How good an example is this of a cardboard box?" (1 = "Not at All," 7 = "Very Good"), analogous to Study 2. Demographic measures of age and gender were also collected.

Figure B1: Cardboard Box Stimuli

Low-Density   **High-Density**
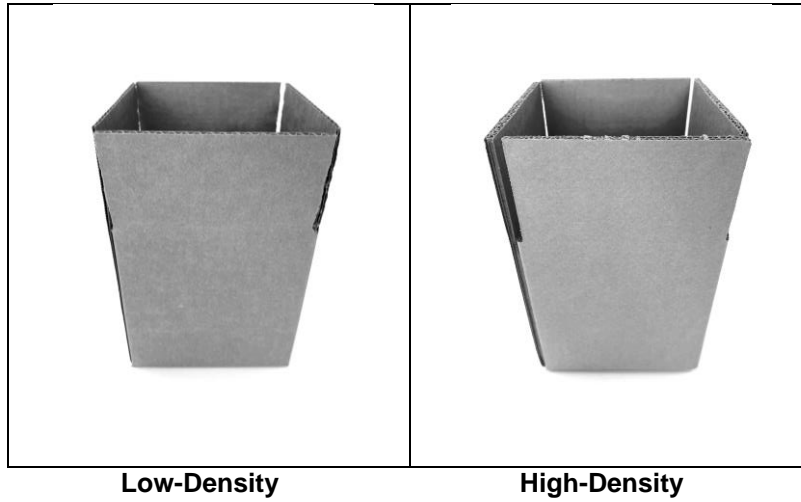
Results and Discussion

Perceived usefulness

A 2 x 2 between-subjects ANOVA revealed a main effect of density on perceived usefulness of the box (M_L = 5.42, SD = 1.02 vs. M_H = 5.72, SD = 1.24; $F(1, 296)$ = 5.13, p = .024, η^2_p = .017) with participants perceiving the low-density cardboard boxes as less useful than the high-density cardboard boxes, supporting our proposed mechanism. There was also a main effect of assessment type on perceived usefulness (M_M = 5.82, SD = 1.01 vs. M_V = 5.32, SD = 1.21; $F(1, 296)$ = 14.90, $p < .001$, η^2_p = .048) with participants who manually assessed the boxes perceiving them to be more useful than participants who only visually assessed the boxes. However, there was not a significant interaction between density and assessment type on perceived usefulness ($F(1, 296)$ = .340, p = .560, η^2_p = .001), suggesting that visual-only assessments of density are

sufficiently strong manipulations in articulating the differences between low- and high-density

packaging as manual assessments. Specifically, the difference in usefulness perceptions held

regardless of whether participants manually (M_{LM} = 5.64, SD = .79 vs. M_{HM} = 6.00, SD = 1.16;

$F(1, 296)$ = 4.031, p = .046, η^2_p = .013) or visually (M_{LV} = 5.22, SD = 1.17 vs. M_{HV} = M_{HV} =

5.43, SD = 1.25; $F(1, 296)$ = 1.420, p = .234, η^2_p = .005) assessed the boxes.

Figure B2: Interaction of Packaging Density and Evaluation Type
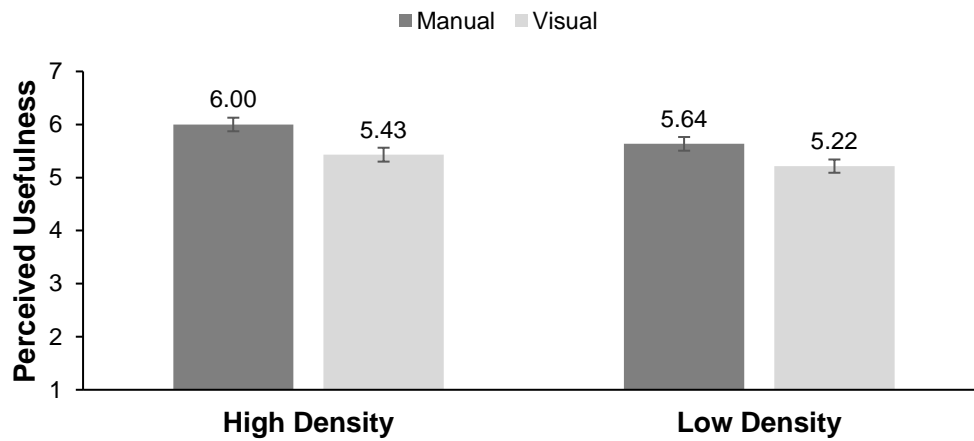
Perceived prototypicality

A 2 x 2 between-subjects ANOVA revealed no difference in perceived prototypicality of the

cardboard boxes based on density (M_L = 6.14, SD = 1.13, M_H = 6.17, SD = 1.21; $F(1, 296)$ =

.024, p = .88, η^2_p < .001). While there was a marginal main effect of assessment type on

perceived prototypicality of the cardboard box (M_M = 6.28, SD = 1.13, M_V = 6.04, SD = 1.20;

$F(1, 296)$ = 3.141, p = .08, η^2_p = .011), there was not a significant interaction between density

and assessment type on perceived prototypicality ($F(1, 296)$ = 1.725, p = .190, η^2_p = .006).

Ultimately, these findings dismiss packaging prototypicality as an alternative explanation of the

effect.

Supplemental Study 2: Exploration of Guilt Alternative Explanation

We conducted this study to evaluate the alternative explanation for our effect that product density can inform a consumer's feelings of guilt associated with disposing of the product, thereby potentially leading to a lesser likelihood to throw high-density products into the trash as more actual content would end up in the landfill. Because many consumers feel a moral obligation to recycle (Kaiser and Shimoda 1999), and guilt is a driver of sustainable behaviors (Mallett, Melchiori, and Strickroth 2013), such emotions may be present at the time of disposal. To evaluate these effects, we employed the same type of perception-based scenario as in Study 3. Additionally, we also employed a dependent variable articulated around recycling intentions to ensure the effect of product density holds when asking about intentions to trash or recycle.

Design and Procedure

Four-hundred US-based Mturk participants via CloudResearch (M_{age} = 39.61 years, 53.5% male) participated in this study in exchange for compensation. We sought to obtain 100 participants per condition. Participants were randomly assigned to one of two conditions in a single-factorial between-subjects design manipulating product density (low-density vs. high-density) for a plastic water bottle in which they indicated their likelihood to recycle the bottle and associated product perceptions.

Participants were asked to imagine that while at a tailgate before a large concert event, a sponsoring group was distributing free bottles of water, one of which they took and consumed. In the low-density condition, the empty plastic bottle was described as "thin to the touch" and "quite lightweight," while in the high-density condition it was described as "thick to the touch" and "quite heavy." The descriptions were accompanied by an image of the type of bottle

described (Figure B3). After viewing the low- or high-density water bottle, per assigned condition, participants were told that in order to enter the concert venue, they could not be holding any outside food or beverage containers and accordingly, must dispose of the water bottle. They were then informed there was a trash bin located next to the entrance to the concert, but that the only recycling bin was across the street. This element of extra effort to recycle the product (i.e., distance to the bin) was employed to dissuade simple responses given social desirability bias and was externally valid as recycling has been shown to be considered more effortful than trashing (Halvorsen 2008; McCarty and Shrum 2001; Vining and Ebreo 1990). Participants were then asked to indicate their recycling intentions using a 3-item scale following the procedure used by White et al. (2011): "How likely are you to recycle this bottle in this situation?" (1 = Highly Unlikely, 7 = Highly Likely), "How inclined are you to recycle this bottle in this situation?" (1 = Not Very Inclined, 7 = Very Inclined), and "How willing are you to recycle this bottle in this situation?" (1 = Very Unwilling, 7 = Very Willing).

Participants also indicated their perceptions of the usefulness of the bottle by noting their level of agreement with the statement: "This bottle is useful," (1 = Strongly Disagree, 7 = Strongly Agree). Level of guilt associated with not recycling the bottle was measured using the question: "How guilty would you feel not recycling this bottle in this situation?" (1 = Not at All Guilty, 7 = Very Guilty). Participants then completed an attention check asked asking them to describe the plastic bottle in their assigned scenario as either "thin to the touch and quite light" or "thick to the touch and quite heavy," analogous to prior studies. Lastly, demographic measures of age and gender were collected, along with participants' level of concern regarding climate change and the environment on a nine-point scale (1 = Not at All Concerned, 9 = Extremely Concerned), to be evaluated as a potential covariate.

Figure B3: Water Bottle Stimuli

| Low-Density | High-Density |
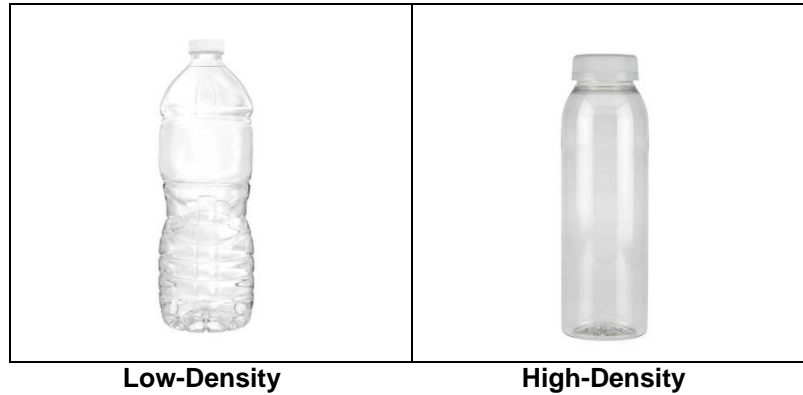
Results and Discussion

Intention to recycle

The three recycling intention measures were averaged to generate an index of recycling intentions (α = .96). A one-way ANOVA revealed the low-density plastic bottle (M_L = 4.89, SD = 2.15) was significantly less likely to be recycled than the high-density plastic bottle (M_H = 5.40, SD = 1.81; $F(1, 398)$ = 6.39, p = .012, η_p^2 = .016). This result confirmed that the effect of product density holds for recycling intentions in addition to observed recycling behavior and trashing intentions, showcasing the robustness of the effect.

Perceived usefulness

A one-way ANOVA revealed significant differences in perceived usefulness across the two density conditions, with the low-density plastic bottle viewed as less usefulness (M_L = 4.54, SD = 1.95) than the high-density plastic bottle (M_H = 5.28, SD = 1.61; $F(1, 398)$ = 17.40, p < .001, η_p^2 = .042), in line with our theorizing. A mediation analysis was conducted to test the indirect effect of perceived usefulness on the relationship between density (1 = Low, -1 = High) and recycling intentions. The mediation model (Figure B4) was tested using PROCESS Model 4 (Hayes 2017), with product density as the independent variable, perceived usefulness as the

mediator, and recycling intentions as the dependent variable. The analysis revealed a significant

indirect effect of density on recycling intentions via perceived usefulness ($b = -.17$; $SE = .05$;

$CI_{95\%} = [-.273, -.086]$), with the direct effect of density on recycling intentions no longer

significant ($b = -.08$, $p = .379$), supporting our proposed mechanism.

Figure B4: Mediation Model
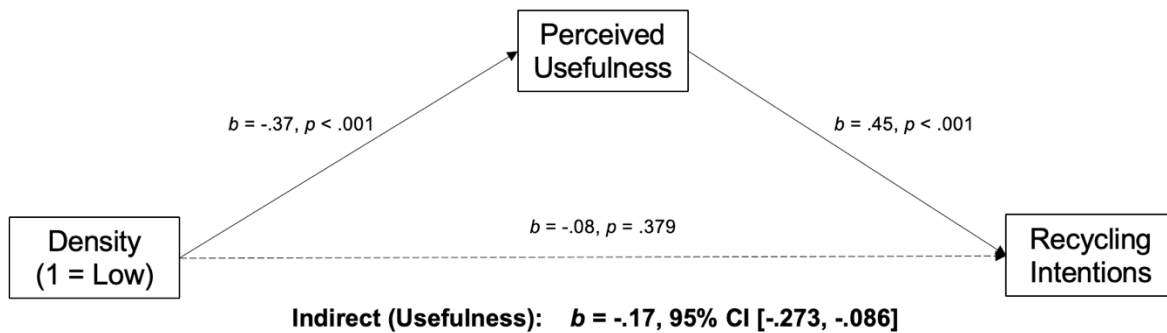
Guilt

A one-way ANOVA revealed no significant differences in feelings of guilt associated with not

recycling the bottle across the two density conditions ($M_L = 4.46$, $SD = 2.12$; $M_H = 4.74$, $SD = 2.00$; $F(1, 398) = 1.90$, $p = .169$, $\eta_p^2 = .005$), dispelling concerns of guilt as a driver of our main

effect.

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