Layers of green: Communicating sustainability of packaged food products

Milica Mlađenović

Propositions

1. Selective disclosure of sustainability improvements enhances consumer engagement with products incorporating multiple sustainability aspects (this thesis).
2. Striving for credible sustainability communications is Sisyphean work (this thesis).
3. Students benefit more from empathetic than intelligent teachers.
4. Learning to say “no” is essential for achieving success in academia.
5. Traditional academic metrics discourage intellectual risk-taking.
6. Sustainability is an illusion.
7. Life success hinges on strategically dropping tasks over juggling them all.
8. The rise of political correctness undermines the depth and honesty of social interactions.

Propositions belonging to the thesis, entitled

Layers of green: Communicating sustainability of packaged food products

Milica Mladenovic
Wageningen, 14 March 2025

Layers of green:

Communicating sustainability of packaged food products

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Thesis

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To my mom

Whose sacrifice built my opportunity

Whose perseverance dared me to try

And whose hard work continues to be my inspiration


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Chapter 1

General introduction

1. Background

Environmental sustainability is significantly challenged by humans. The rapid rise in population and industrialization has driven an increased demand for production of goods, which in turn exacerbates the issue of resource scarcity (Thatcher & Yeow, 2016). As industries expand and consumer demands continue to grow, the production and consumption trends are also increasing their environmental impact, coming at a direct expense of deforestation, land and water pollution, and loss of biodiversity (Edmonds-Camara et al., 2023).

Food, the most frequently purchased and consumed subcategory of fast-moving consumer goods (Bocken et al., 2022), presents a particularly challenging environmental case. Foods' large quantities of production, low prices and high turnover rates together contribute to its overall disposability (Lacy et al., 2020). The environmental burden of food production contributes to 26% of global emissions, uses 50% of world's habitable land and 70% of global freshwaters (Ritchie et al., 2022). Of those resources, most are consumed in the actual production of food (86%), followed by transport (6%), packaging (5%), and retail (3%) of food (Richie et al., 2022). The finite nature of natural resources underscores the need to adopt more sustainable production and consumption practices to reduce the current human footprint and ensure long-term resource availability.

While more sustainable production and consumption practices globally can only be achieved through plenitude of actions involving many stakeholders, the role of consumer behavior within this network can be far-reaching. In the context of food and sustainability, consumers can significantly contribute by prioritizing sustainable over conventional food products in their consumption. Although production, transport, packaging, and retail shape food's environmental burden, consumer influence is largely limited to the latter two. The most impactful actions consumers can therefore take are choosing food products with lower production impacts and selecting items with more sustainable packaging than the currently dominating material – plastic (Geijer, 2019). Considering that the bulk of the environmental burden stems from the actual production of food, it is evident that choosing products with lower production impacts should remain a central focus. Yet, packaging – despite representing a smaller share of the food system's resource use – also warrants attention. Packaging is one area where consumers have direct influence, and addressing it is vital for fostering a more sustainable food system. Unlike the

often-distant effects of food production, packaging quickly becomes waste that consumers must manage, frequently contributing to pollution. Plastic, as the dominant packaging material, is particularly problematic due to its permanent, non-degradable nature, making it an important target for reducing environmental harm.

To encourage consumers to prioritize more sustainably produced and packaged food, it is essential to understand the stages they go through before recognizing sustainability a relevant factor in their choices (Batra & Keller, 2016). Achieving this involves a strong emphasis on communication strategies for sustainable products, as consumers cannot directly evaluate sustainability and must rely on provided information to do so (Grunert et al., 2014). Since many sustainability improvements in packaged food are novel for consumers (Ruf et al., 2022), it is key to focus on increasing consumer understanding of these improvements, building trust in their credibility, and enhancing the perceived value of sustainable products over conventional alternatives (Batra & Keller, 2016). While these outcomes represent different stages in the consumer decision journey, they collectively highlight the need for communication strategies that can be considered effective if consumer actions reflect understanding, trust, and perceived value.

As the market shifts towards a growing share of sustainable food (*Sustainable Food Monitor,* 2022), it is likely that more packaged foods will incorporate multiple distinct sustainability aspects at once. For example, organic mushrooms in compostable plastic packaging can be seen as a dual sustainability effort because they incorporate two distinct sustainability improvements: one to the product and one to the packaging. This raises the question of how to communicate multiple sustainability aspects in packaged food products, given the significance of individuals' consumption patterns in fostering more sustainable production and consumption practices (e.g., Giacalone & Jaeger, 2023). Subsequently, it is important to investigate how consumers process and integrate sustainability information using different informational elements (i.e., cues) into their judgments. Existing theoretical perspectives fall short in providing a unified answer regarding how consumers integrate such multi-dimensional information. This thesis, therefore, centres its investigations around packaging and product sustainability. Perhaps unconventionally, it places particular focus on packaging sustainability, motivated by the novelty recent improvements to plastic packaging carry for consumers. Recognizing that consumer responses result from a holistic process, product sustainability is examined as a

boundary condition in these investigations. The thesis specifically addresses the following broad research question:

How do different sustainability aspects combine with each other in impacting consumer information processing and responses to sustainably packaged foods?

1.1. Communicating sustainability of packaged food products through cues

Practically speaking, multiple sustainability aspects will likely be communicated to consumers making use of several informational elements (i.e., cues) simultaneously. Consumers gather most information about the sustainability of packaged foods directly at the point of purchase, forming perceptions and expectations based on the available cues (Steenis et al., 2017). Cues can impact sustainability perceptions explicitly and implicitly. Explicit cues are designed to be consciously processed by consumers (Karjalainen, 2007). These cues, such as claims or certifications presented via logos, can directly convey specific information about both packaging and product sustainability and are actively evaluated by consumers (van Ooijen et al., 2017). They contain information that consumers judge in terms of merit, intentionally incorporating them into consequent sustainability perceptions (Underwood, 2003). In contrast, implicit cues operate on a subconscious level, shaping consumer responses without their conscious awareness (Karjalainen, 2007). These cues tap into consumers' associations and feelings, subtly influencing their perceptions and decisions (Underwood, 2003). One notable example in the field of sustainability communications relates to executional greenwashing, in which nature imagery is used to trigger the association of being in nature, further nudging consumers into believing that the product displaying nature imagery is more sustainable (e.g., Parguel et al., 2015). Even more implicitly, consumers can use uncommunicated product inferences to base their responses from. For example, when sustainability is signaled on food products that are perceived as natural (e.g., minimally processed), consumers evaluate other sustainability information more favorably (Mladenovic et al., 2024). Hence, while explicit cues serve as clear, deliberate signals, implicit cues work in the background, subtly guiding consumer sustainability perceptions (van Ooijen et al., 2017).

1.2. Consumer sense making of sustainability cues: Conflicting theoretical perspectives

Theoretically speaking, explicit and implicit sustainability cues should impact consumers' perceptions in a holistic manner. This means that consumers use all relevant cues together to construct an overall perception of sustainability (Magnier et al., 2016). However, understanding how consumers integrate cues emphasizing different sustainability aspects such as product and packaging, using both explicit and implicit cues in doing so, is challenging considering the conflicting theoretical perspectives.

Theories like the Elaboration Likelihood Model (ELM) suggest that sustainability cues impact consumer perceptions in an additive manner, where each cue independently strengthens the overall persuasive effect. According to the ELM, consumer responses are influenced by either the central or peripheral information processing systems (Petty & Cacioppo, 1986). The central route involves careful consideration and cognitive resources to evaluate the quality of the presented arguments, while the peripheral route relies on quick, intuitive responses based on cursory inspections and heuristics (Wagner & Petty, 2022). Importantly, the ELM proposes that presenting more cues is beneficial because it increases the likelihood that consumers will be persuaded by the sustainability message. In case of peripheral information processing, more cues can help consumers identify and categorize the product as sustainable by relying on heuristics. Alternatively, in the case of systematic information processing, more cues would provide additional arguments that consumers could engage with and critically assess. Thus, the ELM posits that cues contribute separately to overall responses rather than interacting with each other.

These separate, additive effects have indeed been noted in the existing literature. For instance, Ischen et al., (2022) found that consumers perceived milk packaging as more sustainable when its packaging material resembled paper rather than plastic and when a product eco-label was present. Similarly, Chen, (2023) demonstrated that packaging design and supply chain logos independently enhanced sustainability evaluations of cookie packaging. Specifically, packaging using a structural differentiation strategy (instead of imitation of the conventional alternatives) and featuring logos indicating a short (versus long) supply chain was perceived as more sustainable. These studies indicate that increasing the number of cues enhances consumer evaluations of sustainability, supporting the notion that "more is merrier" when communicating sustainability.

Contrastingly, Kahneman and Knetsch (1992) theorize about an alternative valuation pattern known as the Embedding Effect. The Embedding Effect suggests that consumers tend to evaluate sustainability at an overall level, rather than as a sum of individual benefits as proposed by ELM (Irwin & Spira, 1997). When consumers are presented with a product that incorporates multiple sustainability aspects, they do not assess each feature individually. Instead, they form an impression based on the collective presence of these aspects. Consequently, the Embedding Effect suggests that adding more sustainability aspects to a product does not proportionally increase its evaluation (Magnier et al., 2016). Even if independent sustainability aspects are initially valued by consumers on a conceptual level, their combined presence in the packaged product does not proportionally enhance the overall perceived value. This evaluation pattern indicates that consumers are insensitive to the scope of communicated sustainability efforts, focusing merely on their presence (Kahneman & Knetsch, 1992). It also suggests that consumers may view the additional aspects as redundant or less impactful when presented together, which diminishes their effect on the overall evaluations.

Embedding Effect rationale, too, finds support in the context of sustainability communications. For example, adding fair-trade labels to food products that already showcased an organic product label left consumer willingness to pay unaffected (Tebbe & von Blanckenburg, 2018). Earlier qualitative research supports a similar idea whereby consumers indicated that they did not prefer products integrating several sustainability cues at once, despite reporting interest in sustainability labels on a general level (Sirieix et al., 2013). Beyond food sustainability communications, Kahneman and Knetsch (1992) demonstrated that respondents' willingness to pay did not significantly increase with the number of bird species a protection plan aimed to preserve. Furthermore, the Embedding Effect was seen in work by Jongmans and colleagues (2014), who showed that consumers are more willing to buy desks that are advertised to incorporate fewer (versus more) sustainability aspects. Together, these findings indicate that in some instances, "less is more" in communicating sustainability.

1.3. Consumer sense making of sustainability cues: The challenge

Creating effective sustainability communications for packaged foods that highlight multiple sustainability aspects simultaneously is challenging due to lack of clear, theoretically sound principles guiding such approaches. On one hand, communicating the

full extent of sustainability improvements can be informative but risks causing information overload and consumer fatigue (Marzi, 2022). This can overwhelm consumers, diminishing their ability to process the information effectively (Peng et al., 2021), consequently reducing the intended persuasive and informative impact of the overall sustainability message. Moreover, comprehensive sustainability communications risk being perceived as exaggerated, especially in a market where widespread greenwashing has eroded consumer trust and credibility of such messages (Acuti et al., 2022; Z. Yang et al., 2020). This furthermore raises questions about the compatibility between “more is merrier” communication strategies and sustainable packaged food, given the inherent perception of such communications as untrustworthy and deceptive (Steenis et al., 2022).

On the other hand, less exhaustive sustainability communications risk going unnoticed by consumers. Such messages may fail to capture attention or convey the full extent of the implemented sustainability efforts, reducing the likelihood that consumers will appreciate and choose products based on their enhanced sustainability features. This can result in missed opportunities for consumers to recognize and derive value from the communicated sustainability improvements. Moreover, less exhaustive communications can fail to inform consumers about specific properties and intended usage of the presented sustainability aspects, potentially leading to unsustainable outcomes. For example, communications for compostable plastic packaging must clearly inform consumers about the intended disposal with organic waste, regardless of which other sustainability aspect they are co-presented with.

The challenge of creating effective sustainability communication strategies is compounded by consumers' tendency to minimize cognitive effort in decision-making while striving to maximize benefits from the offered products (Fishburn, 1968; Wagner & Petty, 2022). In the realm of sustainability communications, this presents a balancing act. From one perspective, communications must effectively convey the richness of sustainability improvements. From the other, they must achieve this without imposing undue cognitive burden on consumers (Holbrook, 1999). This juxtaposition becomes apparent when considering that to effectively communicate the depth of sustainability improvements, information that engages consumers and utilizes cognitive resources is often necessary. Thus, sustainability communication faces the dual challenge of informing consumers comprehensively while imposing minimal cognitive burden in doing so.

It currently remains unclear where the tipping point lies between providing comprehensive sustainability information and presenting fewer details. Specifically, it is worthwhile investigating when the extent of sustainability information transitions from being an appreciated effort to becoming a burden for consumers. An important question then arises concerning whether "objective" sustainability of packaged food products should be fully communicated to consumers, or whether a more strategic selection of sustainability aspects is required. This thesis therefore aims to better understand the optimal level of sustainability information for packaged food products integrating multiple sustainability aspects. It considers how these aspects are communicated and acknowledges that different stages of the consumer journey may have varied implications for how consumers will integrate multiple sustainability aspects into an overall response (Batra & Keller, 2016). Additionally, it pays special attention to the conflicting perspectives between the ELM and the Embedding Effect, seeking to contribute with knowledge on what factors and how may moderate the "more is merrier" versus "less is more" debate.

1.4. Research context: the interplay between packaging and product sustainability

This thesis investigates the outlined challenge by applying it in the context of recent technological innovations in the sustainable plastic packaging domain. It focuses on a particular type of plastic packaging, developed through YPACK – a project funded by the European Union's Horizon 2020 grant. This grant funded a 3-year long consortium, bringing together technologists, engineers, policy consultants, and consumer behavior experts from nine European countries to collaborate on advancing sustainable packaging solutions. The interdisciplinary nature of YPACK project therefore provided a rich foundation for exploring how consumers respond to these innovations.

YPACK's technological innovations enhance sustainability of plastic packaging across three key stages: pre-consumption, consumption, and post-consumption. Each phase addresses specific environmental challenges, providing a comprehensive approach to reducing the overall impact of plastic packaging throughout its lifecycle. In the pre-consumption stage, it does so using renewable sources like almond shells or sugarcane for material production. This approach considerably reduces energy expenditure associated with conventional plastic production using fossil fuel (Othman et al., 2023; Qian et al., 2021). During the consumption stage, it does so by incorporating active technology and

modified atmosphere solutions to extend the shelf life of packaged food. This approach decreases the environmental impact associated with spoilage (Westlake et al., 2023). In the post-consumption stage, it does so by making the material compostable. This approach addresses the issue of limited circularity in conventional plastic, as compostable plastic packaging degrades quickly in the environment, reducing both resource and energy costs compared to conventional plastic waste management (Mostafa et al., 2018; Thrän et al., 2024).

While these technological advancements maintain the beneficial properties of conventional plastic, such as flexibility and lightweight, each distinct improvement additionally improves the overall sustainability of the packaging. This case illustrates how combining multiple innovations can significantly enhance the material's objective sustainability. However, it also prompts the question: do consumers fully appreciate these increased sustainability efforts when communicated, or do such complex solutions fail to resonate with them in proportion to their actual benefits? As similar sustainability improvements continue to enter the market, often co-occurring in the same product design, it becomes relevant to determine which aspects should be highlighted and to what extent, to inform and convey credibility and value to consumers. To assess this, we base our research investigations on the above-described plastic packaging improvements.

Notably, consumer responses to sustainable packaging are linked to sustainability of the product, as consumers tend to evaluate the sustainability of packaged products holistically. When assessing the environmental impact of a packaged product, consumers do not compartmentalize the packaging from the product itself; instead, they form an overall perception based on the combined sustainability aspects (Magnier et al., 2016). This interconnected evaluation means that even if packaging demonstrates significant sustainability improvements, these efforts may not fully resonate with consumers unless the product's sustainability is also aligned (Steenis et al., 2023). Therefore, any communication strategy promoting sustainable packaging should not disregard the role of product sustainability in this context. Consequently, this thesis takes product sustainability as a boundary condition in assessing how consumers integrate different aspects of sustainable packaging into overall responses.

1.5. Thesis aims

This thesis adopts a chronological lens from the perspective of the consumer decision journey, examining how communication strategies that highlight multiple sustainability aspects simultaneously influence consumer responses. With three empirical chapters, three distinct communication goals are addressed: informing consumers about packaging sustainability aspects (Chapter 2), conveying the credibility of packaging sustainability initiatives to consumers (Chapter 3), and increasing the value consumers derive from sustainably packaged food products as a whole (Chapter 4). A visual overview of the thesis is presented in Figure 1.

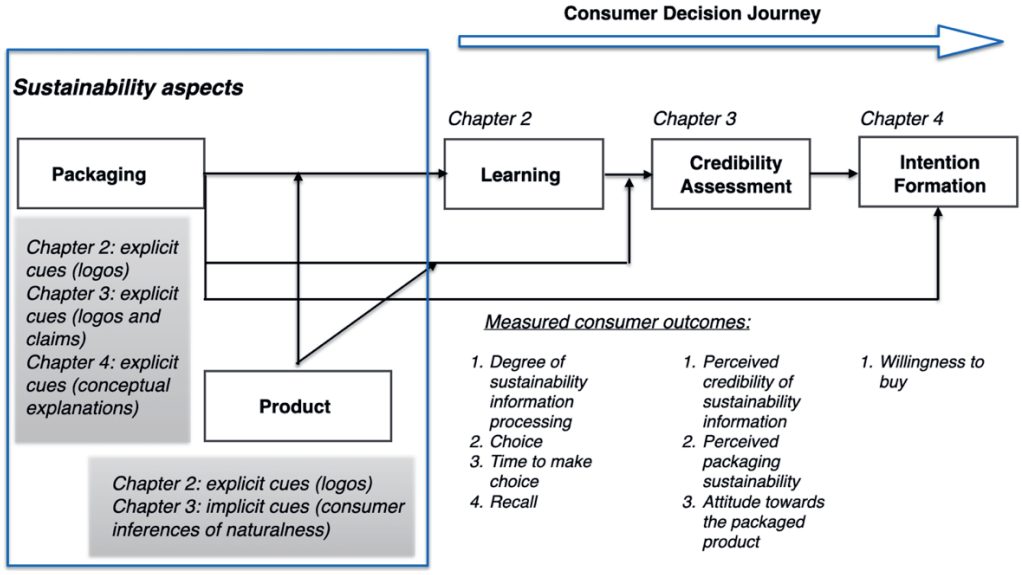

Figure 1. Thesis overview.

Chapter 2 therefore investigates how consumers **learn** about packaging innovations, examining the impact of explicitly communicating packaging and product sustainability simultaneously. Using two eye-tracking experiments, it assesses the extent to which consumers process packaging sustainability information and how this influences their choices. The chapter further explores ways to enhance consumer processing of sustainability information in general. Specifically, it tests whether a mismatch between packaging and product sustainability levels – incongruent messaging – can effectively

increase the degree of sustainability information processing and lead to more intentional and informed choices of highly sustainable packaged food products in subsequent tasks.

In two experiments, Chapter 3 explores consumer information processing strategies for assessing **credibility** of information presented through different explicit cues signaling packaging sustainability. The first experiment investigates how varying levels of credibility in explicit cues – such as claims that appeal to central information processing and logos that target peripheral processing – interact with each other. Specifically, it examines credibility of sustainability information as a mechanism in explaining how consumers evaluate packaging sustainability, suggesting that the quality of cues is more important than their quantity in shaping sustainability perceptions. The second experiment examines the role of implicit product cues in these credibility evaluations. It investigates whether sustainability information is processed more thoroughly when presented on products perceived as less natural, considering that a mismatch between packaging and product sustainability cues (i.e., incongruency) might lead to more careful considerations by the consumers. Additionally, this experiment examines how the available sustainability cues influence consumer attitudes about packaged food products.

Chapter 4 is a large-scale survey project involving seven European countries. By the means of conjoint analysis, Chapter 4 considers how and to what extent increasing the number of cues related to different sustainability aspects within a packaging design contributes to consumers' purchasing **intention** of sustainably packaged food products. Using a model-based segmentation approach, it recognizes and identifies distinct consumer mindsets with similar patterns of preferences for the outlined sustainability aspects. Consequently, it profiles the emerged consumer mindsets in terms of individual differences.

Finally, Chapter 5 discusses practical and theoretical implications of the presented empirical work.


2

Chapter 2

Expect the unexpected: Using incongruent sustainability messaging to promote more informed choices of sustainably packaged foods

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Abstract

Promoting sustainable consumer behavior requires amplifying the use of sustainable packaging alternatives. Yet, consumers often overlook these improvements, prioritizing product sustainability over packaging. Study 1 uses eye-tracking to explore how different sustainability messaging strategies influence consumer attention to packaging sustainability, when both packaging and product sustainability are presented simultaneously. It reveals that consumers focus most on highly sustainable packaging when paired with low product sustainability. Thus, incongruent messaging can draw attention to overlooked aspects. Despite this increased attention, consumers still favor congruently sustainable products in their choice. Building on these findings, Study 2 explores whether incongruent sustainability information can be used to more broadly to prompt deeper processing of sustainability information and influence the decision-making process. The results show that incongruent messaging does indeed lead to deeper information processing and delays decision-making, highlighting its ability to disrupt habitual behaviors and foster more informed consumer choices. Together, these studies underscore the strategic potential of incongruent sustainability messaging to enhance consumer engagement with sustainability in retail scenarios.

Keywords: sustainable, packaging, labelling, food, congruency, eye-tracking

1. Introduction

Amplifying the use of sustainable food packaging is an integral part of promoting more sustainable consumer behavior (*United Nations, 2022*). Within this domain, solutions that move away from the dependence on single-use plastic are particularly welcome. While plastics are valued for their durability, versatility, and affordability (Robertson, 2016), concerns arise due to their short life cycle, challenges in recycling, and environmental pollution (Beaumont et al., 2019). Consequently, there is a growing demand for more sustainable packaging alternatives. In response to this need, bio-based and biodegradable plastics emerged as innovations that preserve the beneficial properties of conventional plastic, but significantly improve the material's environmental impact (*KIDV, 2020*).

Even though sustainable alternatives for plastic packaging are becoming more prevalent in the food market, consumers often remain unaware of their sustainability improvements. One of the reasons for this is because packaging sustainability information is co-presented alongside other relevant information for consumers, especially information about the product (Steenis et al., 2022). Within the realm of sustainability, this means that product and packaging sustainability information are increasingly co-presented with each other, thereby competing for consumer attention. In such cases, consumers tend to prioritize the aspect that is of more personal relevance to them – the product – creating an environment in which packaging sustainability – a peripheral aspect – can be overlooked or undervalued (Magnier et al., 2016). At the same time, the environmental benefit of sustainable packaging alternatives in today's markets depends on whether consumers understand and find value in them (Menon & Soman, 2002), emphasizing the importance of creating communication strategies that encourage consumers to attend and thoughtfully process sustainability information about packaging as well.

Focusing on sustainable packaging innovations, our paper addresses two key limitations in peripheral attribute communications. In Study 1, we investigate how the presence of a central sustainability aspect, such as sustainability of the food product itself, influences consumer attention and choice of options communicating high packaging sustainability. In Study 2, we investigate the depth of processing that follows when attention is captured by sustainability messaging. We emphasize that effective sustainability communication involves more than just capturing attention – it requires that this attention leads to thoughtful and deliberate information processing. We hypothesize that using

incongruent sustainability messaging – where one aspect is highly sustainable while the another is not – can serve as a strategy to promote deeper processing of sustainability information, thereby influencing the process through which consumers make choices. We aim to answer two primary research questions:

1. *How does the presence of product sustainability information moderate the effect of packaging sustainability information on consumer attention and choice?*
2. *How does co-presenting product and packaging sustainability information affect the depth of sustainability information processing and influence the choice-making process in subsequent decision-making tasks?*

By investigating these questions, this paper explores whether and how certain methods of information presentation can be used to direct consumer attention towards specific aspects marketers or policymakers might be interested in highlighting. Additionally, it examines whether certain presentation formats of sustainability information can promote deeper information processing, consequently influencing the choice-making process. Studying these effects underscores the impact of presentation strategies used in sustainability communications with the goal of fostering informed decision-making and optimizing the successes of sustainability innovations in the food sector.

2. Literature review

Sustainability improvements of packaged products, including the contribution of the product contents and its packaging, are typically communicated via on-label information (e.g., Atkinson & Rosenthal, 2014; Parguel et al., 2015; Schmuck et al., 2018), using various informational cues like logos, claims, packaging materials, and color to signal sustainability (e.g., Dangelico & Pujari, 2010; De Jong et al., 2018; Steenis et al., 2022). A useful communication theory that could explain how consumers respond to on-label information is The Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986). According to ELM, individuals engage in two routes of information processing: the central route and the peripheral route (Petty et al., 2002). In the central route, they critically evaluate and elaborate on the message content, leading to judgements based on careful consideration and scrutiny. In the peripheral route, individuals rely on heuristics and

superficial cues without deeply processing the message. The chosen route largely depends on an individual's motivation and the degree of personal relevance, whereby high motivation and personal relevance would favor central route processing and low motivation and low personal relevance would direct individuals to the peripheral route (Wagner & Petty, 2022).

2.1. Attention and packaging sustainability information

Introducing sustainable packaging alternatives to the market, like most innovations, requires that consumers understand and derive value from these improvements. Therefore, it is important to design communication strategies that effectively engage and inform the consumers. This task can be particularly challenging in contexts that favor quick decisions and minimal interaction – such as food shopping (Maheswaran & Chaiken, 1991). Moreover, another considerable barrier in informing consumers of packaging innovations is the fact that they view packaging as a peripheral aspect in decision-making (Steenis et al., 2018). Put differently, information related to the packaging is less personally relevant for consumer judgements than is the information about the product, as the packaging is not actually consumed/ingested. This limited personal relevance likely further diminishes the attention consumers allocate to information about the packaging itself, consequently limiting the potential that on-label communication strategies have for informing the consumers about packaging sustainability improvements.

Promoting more thoughtful, systematic decision making would be particularly beneficial in the case of packaging innovations that require consumers' active understanding – that is, not just perceiving the communicated sustainability aspects as an added benefit to the offering but grasping their specific purpose and recognizing their role in ensuring the intended benefits are realized. One potential strategy to achieve this goal involves strategic presentation of front-of-package label messages to increase consumer attention towards sustainability information about the packaging itself.

When sustainability information about the packaging and the product is co-presented on the label, it can either send a congruent (i.e., both the packaging and the product are highly (un)sustainable) or incongruent (i.e., one of them is, but not the other) message to the consumers. According to ELM, it can be expected that congruent messages about the sustainability level of packaging and product will ease information processing by creating conceptual fluency, leading consumers to largely rely on the peripheral processing

route. This is because conceptual fluency creates familiarity for consumers, which is on its own enough for information to be deemed as sufficiently informative for judgement making, without the additional and time-consuming systematic processing (Jiang et al., 2023). When congruent sustainability information is presented, it can therefore be expected that processing of the actual *packaging* information would be minimized for two reasons. First, because congruency in general prompts consumers to process information automatically, relying on existing mental concepts and without challenging its status quo through elaboration (Granato et al., 2022; Petty & Cacioppo, 1986) and secondly, because the information about the packaging will be overshadowed by the fact that it is conceptually fluent with sustainability information of the more personally relevant aspect – the product (Magnier et al., 2016).

On the other hand, information incongruency creates cognitive dissonance in consumers, prompting them to resolve conflicting information through heightened elaboration of the available (sustainability) information (Diemand-Yauman et al., 2011). This cognitive capacity is inherently linked to central information processing (Wagner & Petty, 2022), and the empirical evidence associated with it is well-documented. For example, when presented with arguments that are inconsistent with their attitudes, individuals spend more time assessing them and recall them better than when they are presented with attitude-consisted arguments (Briñol et al., 2011). Similar effects were noted in online and magazine advertising; brand advertisements in magazines that represented the brand's image in an incongruent manner were remembered better (Dahlen & Caldwell-Harris, 2013), and websites with a background color that is incongruent with the website's message attracted more attention, as evident from visitor's ability to better recall the content of the presented message in the incongruent (versus congruent) condition (Moore et al., 2006). Hence, humans have a natural inclination to pay more attention to information that contradicts their expectations. This helps them resolve the internal conflict caused by information incongruency, restoring the positive psychological state humans gravitate towards (Mandler, 1982). Therefore, it can be expected that incongruent sustainability information in which the packaging is presented as sustainable, but the product is not will result in increased attention towards packaging information. Consequently, we hypothesize that:

H1: Consumers will allocate more attention to highly sustainable packaging information in the presence of incongruent (vs. congruent) packaging-product sustainability messaging.

2.2. Choice and packaging sustainability information

While it is reasonable to expect that information about highly sustainable packaging will attract most attention when presented alongside information of a low sustainability product, we do not anticipate that incongruent sustainability messaging will result in the highest probability of choice. Encountering congruent information is typically viewed favorably by consumers, as it aligns with their expectations, fostering a positive psychological state (Mandler, 1982). Consumers tend to attribute these positive psychological states to the stimuli they are processing at that moment, subsequently leading to positive evaluations thereof (Reber et al., 2004). Indeed, positive attitudes towards branded products are observed when influencers whose social media presence fits with the product they endorse advertise them (Kim et al., 2021). Similarly, research has shown that visual congruency between packaging shape and label enhances consumer trust in the advertised products (Pleyers, 2021). Beyond that, consumers are expected to gravitate towards choosing options that display congruent sustainability messaging due to highest personal benefits they carry, including moral satisfaction from acting sustainably and the perception that sustainable products are healthier to consume (Irwin & Spira, 1997; Noguerol et al., 2021). Aligning with this notion, we hypothesize that:

H2: Consumers will choose options displaying highly sustainable packaging more frequently in the presence of congruent (vs. incongruent) packaging-product sustainability messaging.

3. Methods

3.1. Participants and study design

One hundred and twenty-two Dutch students (M_{age} = 23.18, SD = 3.23, 66.39% female) were recruited to participate in a study examining consumer snack choices. The focus on snacks was chosen due to the high prevalence of snack consumption among young

adults (ages 18-35), making them an appropriate population of interest (Esteky, 2021). They all reported having normal to corrected-to-normal vision and were not colorblind. The study consisted of an eye tracking and a questionnaire part. The eye tracking part entailed a 2 (packaging sustainability: high versus low) x 2 (product sustainability: high versus low) within-subject design. The sample size was sufficient to detect any significant effects, as the G*Power analysis suggested that minimally 56 participants would be needed to detect a conservative, small effect size (ANOVA: repeated measures, within factors will be estimated; 1-β = .80, α = .05, Effect size f = .10 and four groups). The study took on average 15 minutes to complete and received the ethical approval from Wageningen University & Research.

3.2. Apparatus and stimuli

The study was carried out in a university research lab, using Tobii Pro Spectrum eye tracker with 600Hz sampling speed. Tobii Pro Lab software was used for calibration and validation, as well as to present the stimuli and process and store the data on. Room lighting and position from the eye tracker were consistent for all participants (approximately 65cm). All eye-tracking recordings were of good quality, recording more than 70% of consumers' gaze. The stimuli were presented on a stationary 23.8-inch screen with a 1920 x 1080-pixel resolution.

To select the stimuli for the main study, a pretest involving 27 Dutch consumers was conducted. Snacks were selected as a product category given that most snacks are sold packaged (Statista, 2024). Consumers rated 30 packaged products (6 for each of the 5 snacks categories: hummus, nuts, smoothies, vegetable chips and granola) based on perceived packaging attractiveness and expected taste. Afterwards, when faced with all four options presented together in each of the category assortments, consumers were asked whether any of the options within each product category stood out positively concerning taste expectations and willingness to purchase. Stimuli images, taken from the American market, were sourced to be as comparable as possible in terms of packaging shape, size, color, and brand familiarity. On-package claims were removed, and the stimuli were uniformed to emphasize the same flavor (e.g., apple cinnamon granola bars). After analyzing the results using ANOVAs, four stimuli per category were chosen for the main study, based on similar evaluations in terms of perceived packaging attractiveness and taste, as well as the frequency of positive responses when presented in an assortment.

In the main study, the four selected stimuli were presented in assortments. Granola was used as a warm-up trial that was discarded from the analyses and the remaining four snack trials were presented in a randomized order (see Figure 1). To avoid biasing consumer attention, options within the assortments were placed in an equal distance to the center of the screen. Aside from randomizing the order of snack presentation, two additional between-subject randomizations were carried out to assure that the placement of packaging sustainability information and the images used as stimuli did not bias consumer attention. As a result, half of the consumers saw packaging information placed on the left side of the product and half of the consumers saw it placed on the right side. Secondly, the presentation of the images presenting the actual snacks were rotated clockwise. Manipulations of sustainability information were achieved by creating a logo using a signaling schema to inform the consumers that "A" ratings in green color were high in sustainability and "E" ratings in red color were low in sustainability. A title above the logo was used to inform the consumers about the distinction between the logo related to the packaging and product sustainability. Logo design and opacity for both the product and the packaging were the same.

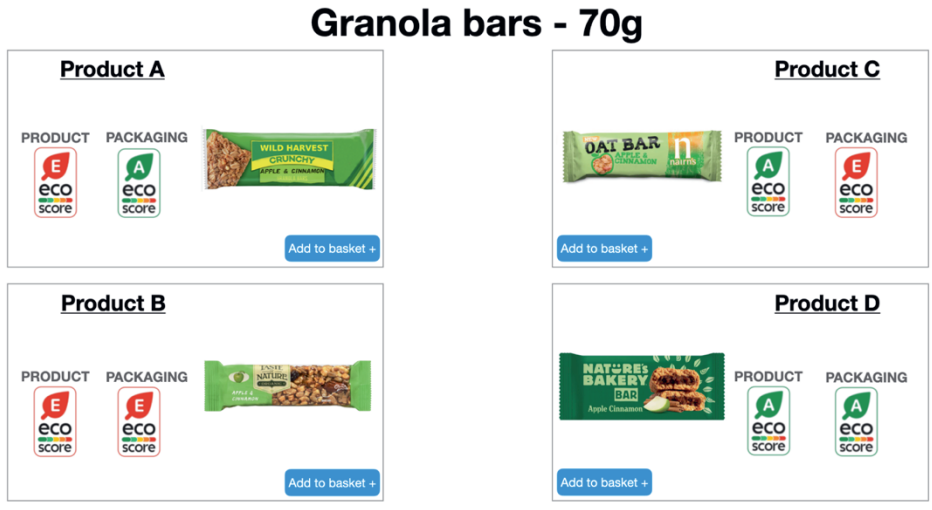

Figure 1. Sample of Study 1 stimuli.

3.3. Procedure and measures

After signing the consent form, participants were told that the purpose of the research was to assess snack choices. The eye-tracking part started with consumers completing a 9-point calibration and validation task. Afterwards, they were instructed to choose one product they would be most likely to purchase in each of the five snack assortments (one warm-up – granola – and four test trials). Each assortment contained four product alternatives with varying presentations of sustainability information in accordance with our study design. Consumers marked their product choice by clicking "add to basket" button. Trials therefore lasted for as long as consumers took to make the choice. Between trials, a fixation cross was presented for 500ms in the center of the screen. After seeing all product assortments, consumers completed a short questionnaire where their demographics (gender, age, and education) were measured. Upon finishing, they were given more context about the purpose of the study.

3.4. Data analysis

Attention measures. To analyze our data, we specified three Areas of Interest (AOIs) per snack option – one covering the whole stimuli image, one covering packaging sustainability score and one product sustainability score (see example of relevant AOIs in Figure 3). For each snack option, AOIs were the same in size, position relative to the product image, and distance from each other. Subsequently, two relevant eye tracking measures were extracted per AOI, total fixation duration (the total amount of time spent fixating on an AOI) and visit count (number of times the consumer visited an AOI).

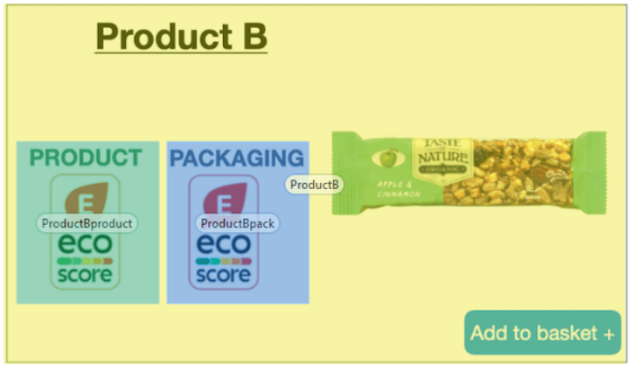

Figure 2. An example of Study 1 AOI specifications.

To answer how much attention consumers allocated to sustainability packaging information (i.e., H1), we transformed the variable total fixation duration into a proportion reflecting the time consumers spent attending to sustainability information of the packaging relative to all available information about the snack at stake. This was done by dividing total fixation duration on the packaging AOI with total fixation duration of the whole stimuli AOI. Variable visit count was used as is. Thereafter, we specified two mixed-effects models, each with one eye-tracking measure as an outcome variable, and sustainable packaging information and product information as the two dichotomous fixed effects. To account for repeated measures and individual response tendencies between consumers, consumer ID was specified as a random effect.

To gain insights about consumer choices (i.e., H2), a multinomial logistic regression was used in which the unordered categorical variable with products "A", "B", "C" or "D" as possible choice options was the outcome variable. The two dichotomous predictors were the same as in the ANOVA models, that is, sustainable packaging information and product information. All statistical analyses were performed in R programming language (*R Core Team, 2020)* and the hypotheses were preregistered (https://aspredicted.org/e6xa2.pdf).

4. Results

To ensure that study stimuli did not inadvertently influence consumers' attention, we checked whether snack type (hummus, nuts, smoothies and vegetable chips) and sustainability information placement (i.e., whether packaging information was presented to the left or right of the stimuli image) influenced the two relevant eye-tracking measures. The results showed that snack type had a marginally significant effect on the visit count ($F(3, 1872) = 2.61$, $p = .052$) and a significant effect on the proportion of fixation duration spent on the packaging AOI ($F(3, 1872) = 2.71$, $p = .044$). The placement of packaging information did not significantly influence visit count ($p = .075$) or fixation proportion ($p = .063$). Considering these results, snack type was included as a control variable in H1 analysis testing.

The model examining whether consumers visited packaging information more frequently in the presence of incongruent versus congruent sustainability messaging

revealed no significant main effects for packaging (p = .878) or product (p = .431) information. However, a significant interaction effect between these predictors was observed (b = -0.35, SE = 0.09, t(1877.48) = -3.73, p = .001). Post-hoc analyses of this interaction identified three significant pairwise comparisons, none of which supported the proposed incongruency hypothesis. The visit count to high packaging sustainability information was similar regardless of whether the sustainability information was presented incongruently or congruently. The model explained approximately 16.8% of the total variance in the outcome visit count.

The model investigating proportion of fixation duration on the packaging AOI revealed significant main effects of both packaging (b = .014 SE = 0.006, t(1869) = 2.26, p = .024) and the product (b = .028, SE = .006, t(1869) = 4.25, $p <$ .001). Interestingly, the main effects indicated that consumers spent proportionally more time fixating on both packaging and product information communicating low (versus high) sustainability. More notably, the interaction term was also significant (b = -.039, SE = .009, t(1869) = -4.23, $p <$ .001). Post-hoc tests supported the incongruency hypothesis, indicating that consumers spent proportionally the most time fixating on high packaging information when it was presented alongside low product sustainability (see Figure 3), partially supporting H1. The model explained approximately 15.7% of variance in the outcome fixation proportion.[1]

[1] Comparisons of AIC and BIC values between models including and excluding consumer ID as a random factor indicated better model fit with the inclusion of variable ID and better overall suitability of mixed-effects models for analyses. Moreover, the variance associated with the random effect was considerable across models, indicating that consumers exhibited baseline differences in the amount of attention they allocated to sustainability information in general.

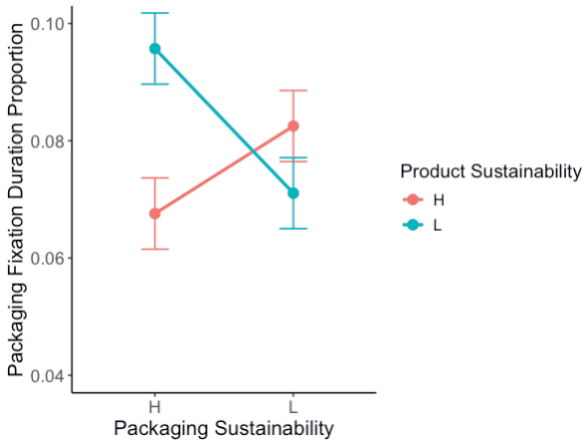

Figure 3. Proportion of fixation duration spent on packaging information per experimental condition.

The model results used to examine how packaging and product sustainability impacted consumer choice (H2) are presented in Table 1. The parameter estimates support our predictions; both packaging and product sustainability independently predicted the likelihood of consumer choice. Consumers chose options communicated as high in both packaging and product sustainability most frequently (54.16%), followed by options low in packaging but high in product sustainability (22.33%) and options high in packaging but low in product sustainability (16.60%). The least chosen options were those communicated as low in both packaging and product sustainability (7.79%).

Table 1. Multinomial logistic regression estimates of consumer choice.

Coefficients	Estimates	Std. error	z-values	p-values	OR
Packaging sustainability	.87	.21	4.16	<.001	2.38
Product sustainability	1.22	.20	6.10	<.001	3.40
Packaging x product sustainability	.52	.25	2.08	=.037	1.69
Log likelihood	-947.99				

5. Study 1 Discussion

This study examined how various formats of presenting sustainability information influence consumer attention to packaging sustainability during a choice task, particularly when about both packaging and product sustainability information are presented together. As expected, highly sustainable packaging received the most attention when paired with low product sustainability information, creating an incongruent scenario [2]. Furthermore, the results indicate a distinction between attention allocation and consumer choice. While product sustainability information moderated the amount of attention consumers allocated to packaging sustainability information, this effect was not observed in consumer choices. Consumers selected options that communicated high sustainability for both packaging and product (i.e., congruent sustainability messaging) most frequently, suggesting a positive, additive effect of the two types of sustainability information.

Study 1 findings underscore two key insights. First, the increased attention to highly sustainable packaging in the context of incongruent messaging suggests that consumers engage in more deliberate and analytical processing of peripheral sustainability information when it is presented in a surprising, incongruent manner. Second, although options featuring both highly sustainable packaging and product information did not capture the most attention, they were chosen most frequently. These findings raise important research questions about the broader potential of incongruent messaging. Specifically, they motivate further investigation into whether incongruent messaging can be

[2] Technological constraints prevented us from examining how the order of stimulus presentation influenced consumer attention. However, the effect remained robust, persisting across five consecutive trials, even as the repeated presentation of identical sustainability information likely reduced its impact over time.

strategically used to encourage consumers to choose truly sustainable options, that score highly on both product and packaging sustainability. Additionally, they prompt consideration of whether the process, if not the outcome, of consumer choices differs depending on the depth of elaboration consumers engage in. Understanding how consumer makes these choices is important, particularly for innovations that depend on proper consumer action to realize their full environmental potential. For example, compostable plastic packaging must be disposed of with organic waste, despite its resemblance to conventional plastic. This highlights the need to ensure that consumers deliberate sufficiently during purchasing decisions to enable them to follow through with appropriate post-purchase actions.

6. STUDY 2

Study 2 explores whether incongruent sustainability messaging prompts consumers to process subsequent sustainability information in more depth. Additionally, it examines whether the depth of information processing influences the process through which consumers arrive at their choices (see the conceptual model in Figure 4).

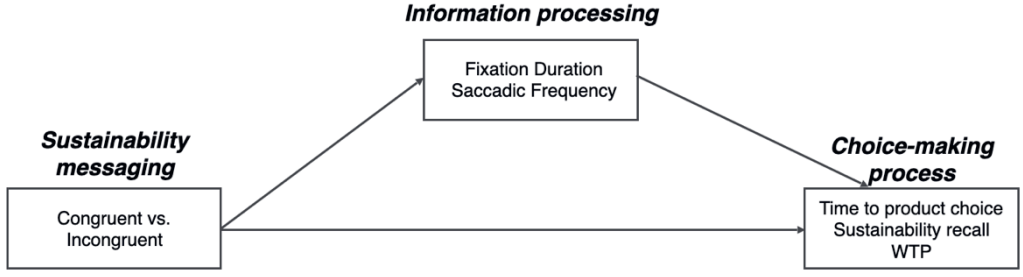

Figure 4. Study 2 conceptual model.

6.1. Incongruent sustainability information and systematic processing

We put forth the idea that incongruent sustainability messaging serves not only as an "attention grabber" but also as a disruptor of automatic shopping routines (Granato, 2022). Incongruent information, by its nature of being harder to process, prompts individuals to exert more effort into understanding it (Alter et al., 2007). This contradicts

the quick and heuristic nature of the peripheral information processing consumers usually resort to when shopping for low involvement products (Atkinson & Rosenthal, 2014). Consequently, incongruent sustainability information may serve as a cue for consumers to engage in deeper processing of sustainability information, thereby switching from peripheral to central information processing. In this mode, consumers engage more deeply with sustainability information, carefully weighing the alternatives, and make decisions that are stable and consistent over time (Briñol et al., 2011). This perspective is consistent with prior studies indicating that creating incongruency using difficult-to-read fonts led to improved comprehension of educational materials. Specifically, students engaged in deeper information processing to decipher the meaning of the message (Diemand-Yauman et al., 2011). By the same mechanism, in marketing, consumers preferred offers displayed on products whose labels induced cognitive incongruency through the use of multiple fonts (Motyka et al., 2016). While these findings focused on incongruency induced by aesthetic elements, we hypothesize that the observed increases in deliberation would also occur stimulated by conceptual incongruency. Specifically, we expect that when initially confronted with options portraying incongruent (versus congruent) sustainability information, consumers will engage in deeper processing of sustainability information of both the packaging and the product in the subsequent assortments. We hypothesize:

H3: Within assortments, sustainability information will be processed in more depth after initially seeing an option displaying incongruent (vs. congruent) packaging-product sustainability messaging.

6.2. Incongruent sustainability information and the choice-making process

We argue that while the final outcome of consumer choices may not necessarily change, the decision-making process will be influenced by incongruent sustainability messaging, as it prompts more deliberate information processing. This reasoning follows from the idea that judgments formed through central information processing involve deeper cognitive engagement, which is characterized by more thorough evaluation of alternatives and factors (Briñol et al., 2011). Consequently, the expectation is that decisions derived from this process tend to be more informed and intentional in their nature.

We expect that improved informedness will manifest itself with longer decision-making time and improved recall of the communicated sustainability information. Here, extended decision times reflect not just hesitation caused by surprise, but a deliberate consideration of all presented information, as opposed to reflexive reliance on simple heuristics. Improved recall, meanwhile, is a known outcome of central information processing, where deeper cognitive engagement enhances memory retention, allowing consumers to remember sustainability information beyond the initial choice (Motyka et al., 2016).

Moreover, when consumers invest cognitive effort in evaluating sustainability information through central (rather than peripheral) processing, they tend to value their decision more highly and trust its long-term benefits (Petty et al., 2002). In this way, incongruent sustainability messaging not only fosters deeper engagement and more deliberate information processing but also enhances consumer confidence in their choice – leading them to assign greater value to the product, even if the choice itself remains unchanged. As a result, we expect that consumers will be more intentional about their purchases, manifesting this through a higher willingness to pay (WTP) for the selected packaged product. Formally, we hypothesize:

H4a: Consumers will a) take longer to make a choice, b) have a greater recall of the communicated sustainability aspects and c) have a higher willingness to pay (WTP) for the chosen product after initially seeing an option incongruent (vs. congruent) packaging-product sustainability messaging.

H4b: The depth of information processing will mediate the relationship between sustainability messaging and 1) time to make a choice, 2) sustainability aspect recall and 3) WTP for the chosen product.

7. Study 2 Methods

7.1. Participants and study design

Eighty-nine Dutch students (M_{age} = 23.29, *SD* = 3.61, 60.67% female) participated for a monetary compensation. Like Study 1, Study 2 consisted of an eye tracking and

questionnaire part. The eye tracking part entailed a two condition between-subject (sustainability messaging: incongruent versus congruent) design. Based on the G*Power analysis, a minimal sample size of 86 consumers was needed to detect a medium effect size (ANOVA: Repeated measures, between subjects; 1-β = .80, α = .05, Effect size f = .25, two groups, 3 measurement repetitions). The study took approximately 10 minutes to complete and has, too, received the ethical approval from Wageningen University & Research.

7.2. Procedure and measures

After signing the consent form, consumers were randomly allocated to a condition and were informed that they would be seeing several snack assortments in which their task was to select their preferred snack to purchase from each assortment. Prior to that, participants were shown explanations of sustainability ratings they would be seeing in the assortments, presented in an incongruent or congruent way (more details in Stimuli section). Participants were informed that the explanations were intended to help them understand the specific sustainability aspects used to calculate the sustainability scores for each snack. Following, three different assortments containing 4 packaged snacks each were presented. The snacks varied in the presentation of sustainability information in the same way they did in Study 1. To complete the eye-tracking part of the study, consumers indicated their three choices by clicking “add to basket” button. In the questionnaire part of the study, participants were asked to indicate their willingness to pay for each of the alternatives in the previously presented assortments using a slider scale that was approximated based on the current cost range of the snack in question. Demographic (gender, age, and education) measures were recorded using the same measures as Study 1. At the very end of the experiment, consumers’ recall of the sustainability aspects presented at the beginning of the experiment was measured. Using an open-ended box, consumers were asked to list as many sustainability aspects as they remembered. Considering that 8 distinct sustainability aspects were presented (four for the packaging and four for the product, see Appendix A), the answers were consequently coded on a scale ranging from 0-8. For each correctly remembered sustainability aspect, the researchers increased the recall score by one.

7.3. Stimuli

In the incongruent condition, consumers were presented with conflicting sustainability messages: a logo communicated high sustainability for the packaging (score “A”), while a

separate logo indicated low sustainability (score “E”) for the product. In contrast, the congruent condition presented a consistent message, where both the packaging and product were communicated as highly sustainable (score “A”). In both cases, four sustainability aspects about the packaging and four sustainability aspects about the product contents were outlined as those assessed in deriving an “A” or “E” sustainability rating (see Appendix A). Thereafter, product assortments were identical to Study 1, thus containing logos, but not the explanations of the sustainability ratings.

7.4. Data analysis

Attention measures. To test the depth of information processing, visual attention was used as a proxy (Banovic et al., 2014). Both the still time spent processing information (i.e., fixations) and the frequency of rapid eye movements (i.e., saccades) indicating increased interest in understanding the visual environment (Orquin & Mueller Loose, 2013) were used. Fixations are commonly used as indicators of consumer attention and information processing, whereby longer fixation duration would indicate deeper information processing (Orquin & Mueller Loose, 2013). Fixation durations were therefore obtained for the one AOI that was specified. It covered both the sustainability logo of the packaging and the product at the same time (see Appendix B). Saccadic frequencies, on the other hand, are less frequently used, despite their ability to reflect a consumer's interest in exploring and understanding the visual environment through browsing behavior (Martinovici et al., 2023). Thus, the more saccades consumers, the more interested they are in processing the presented information. For our study, saccadic frequency was obtained per product assortment.

To analyze H3, two linear mixed-effect models with the same predictors were specified: the type of sustainability messaging (incongruent versus congruent) and order of snack presentation as the fixed effects, and to account for individual variability in consumers’ attention and the repeated measurements, consumer ID number as a random effect. In the first mixed model, total fixation duration was the outcome, while saccadic frequency was the outcome in the second mixed model.

To analyze the process through which consumers arrive at their choices (i.e., H4a and H4b), several mediation analysis pathways were specified, following the suggestions of Baron and Kenny (1986). Specifically, the direct effect of sustainability messaging (incongruent versus congruent) was specified for each of the three outcome variables

related to the nature of consumer choice (time to choice, recall and WTP) separately. The first part of the indirect effects in the mediation model involved sustainability messaging as the predictor and total fixation duration as the outcome variables. Finally, the second part of the indirect effects in the mediation model involved the eye tracking measures as the predictor variables and the three variables reflecting the process of consumer choice (time to choice, recall and WTP) as the outcome variables, each of which will be assessed separately. The analyses of the choice process were further complemented with the examination of the actual consumer choice, using the same model specification as in Study 1. The predictions were preregistered, https://aspredicted.org/ws5ss.pdf[3]

8. Study 2 Results

Our results indicate H3 was partially supported. Namely, consumers browsed product assortments significantly more in the incongruent condition, as evidenced from higher saccade frequency (b = 11.27, SE = 4.78, $t(87)$ = 2.36, p = .021). Furthermore, the order of snack presentation was significant and negative, indicating that consumers browsed less the more product assortments they saw (b = -19.53, SE = 1.60, $t(177)$ = -12.23, p < .001). The model explained approximately 58.6% of variance in the outcome saccade frequency. Fixation duration on sustainability information, however, was not statistically significant different between the incongruent and congruent condition (b = .544, SE = 3.46, $t(87)$ = 1.58, p = .118), albeit mean trend differences indicated that consumers fixated on sustainability information approximately 540 ms more per assortment in the incongruent than congruent condition, as per our hypothesis. Like in the case of the saccades, the order of presentation was a significant predictor, suggesting that the more snack assortments consumers saw, the less they fixated on sustainability information (b = -1.61, SE = .12, t (177) = -12.94, p < .001). The model explained approximately 56.1% of variance in the outcome fixation duration. [4]

When considering the process of consumer choices, among the outcomes time to choice, recall and WTP, the manipulation only produced significant differences between the

[3] Preregistered analyses, but not predictions, slightly differed from originally pre-registered.
[4] Goodness of model fit indices – AIC and BIC values – indicated better fit for models that included (versus omitted) consumer ID number as a random effect, justifying mixed effects' use for analyses. As expected, variance associated with the random effect in both models suggested that the average amount of visual attention consumers allocated to stimuli significantly differed between consumers in the sample.

conditions in the case of time to choice. As hypothesized, consumers took longer time to choose their preferred snack within assortments after being exposed to the incongruent versus the congruent condition (b = 3.29, SE = 1.47, t (87) = 2.23, p =.028). In this model, too, order was a significant negative predictor (b = -5.47, SE = .488, t (177) = -11.21, p <.001), indicating a previously observed pattern: consumers took less time to choose their preferred snack within product assortments the more assortments they saw. The model explained approximately 55.7% of variance in the outcome time to choose. No significant differences were noted between the conditions in terms of WTP (b = .01, SE = .05, t (264) = .12, p =.904) and aspect recall (t(85.47) = .16, p = .874). Thus, hypothesis H4a was partially supported. Hypothesis H4b was not supported. Fixation duration of sustainability information did not mediate the relationship between the manipulation and variables a) aspect recall, b) WTP and c) time to choice, considering that the manipulation did not produce significant differences in consumers' total fixation duration – a necessary condition to proceed with mediation analysis testing (Baron & Kenny, 1987).

The findings related to the actual consumer choices were consistent with Study 1. Specifically, consumers were significantly more likely to choose snacks whose packaging (b = 2.05, SE = 0.42, z = 4.92, p <. 001) and product (b = 1.88, SE = 0.42, z = 4.48, p <. 001) sustainability was high. Indeed, consumers chose products high in packaging and product sustainability most often (65.92%), followed by products high in packaging and low in product sustainability (17.23%) and those low in packaging but high in product sustainability (14.98%). The least chosen snacks were those that were low in both packaging and product sustainability (2.62%).

Table 2. Means and standard deviations per condition.

Condition	Fixation Duration *M (SD)*	Saccade Frequency *M (SD)*	Time *M (SD)*	Willingness to pay *M (SD)*	Recall *M (SD)*
Congruent	2.94 (2.19)	51.25 (30.85)	16.8 (9.76)	2.21 (.34)	1.56 (1.40)
Incongruent	3.48 (2.74)	62.51 (34.09)	20.35 (10.30)	2.21 (.37)	1.48 (1.36)

9. Study 2 Discussion

Study 1 revealed that while consumers appreciate sustainability of both the packaging and the product in their choice, they allocate more attention to the packaging information when sustainability cues are presented incongruently (i.e., when only packaging is sustainable). Given this increased attention to packaging in the incongruent context, Study 2 aimed to investigate whether incongruent sustainability messaging offers additional benefits. Specifically, Study 2 examined whether incongruently sustainability messaging can prompt deeper processing of sustainability information in general. Furthermore, it assessed whether this shift in processing – driven by the need for more deliberation – alters the way consumers arrive at their choices, even if the outcome (choice itself) remains unchanged. The main goal of Study 2 was to investigate whether the process with which consumers arrive at their choices becomes more informed and intentional in its nature.

Our findings indicate that exposing consumers to incongruent, as opposed to congruent sustainability information does indeed lead to more thorough sustainability information processing. Consumers displayed quicker eye movements during subsequent choice tasks after being exposed to incongruent information, suggesting a heightened motivation to explore and evaluate the available options within the assortment that followed (Kaspar & König, 2011). Furthermore, despite a non-significant finding, consumers spent approximately 540 ms more fixating on sustainability information per assortment in the incongruent condition. This is arguably a meaningful between-condition difference considering the study context. Within the assortments, consumers encountered logos that were easy to process, with their meanings explained prior to viewing the actual product options. More notably, eye-tracking research suggests that consumers can extract information efficiently, in as little as 50 ms (Rayner, 1998), suggesting that a 540ms difference between the conditions likely gave consumers in the incongruent condition a more informed overview of the sustainability information. That said, it should be acknowledged that the considerable mean differences likely did not emerge as statistically significant due to large standard deviations of the measure. This variability can likely be attributed to the diversity of the sample, where individual differences among consumers led

to varying processing strategies. For instance, consumers with differing levels of interest in sustainability may have spent more or less time engaging with the logos. Similarly, it is also plausible that variations in expertise could have played a role, with more knowledgeable consumers requiring less time to compare and evaluate sustainability labels and vice versa.

Furthermore, our results consistently show that as consumers familiarize themselves with the assortment layout, they tend to browse less through snack assortments and fixate less on sustainability information. These effects developed linearly for both measures, whereby decreases in information processing were proportional as the trials progressed. This likely indicates the presence of learning effects (Fudenberg & Levine, 2022). Such learning effects suggest that, as consumers become more accustomed to a particular environment or presentation format, they rely on heuristics or shortcuts to make quicker decisions, reducing the need for extended information processing. This finding is interesting as it suggests that repeated exposure to sustainability messaging needs to be varied or refreshed to prevent disengagement.

Study 2 results additionally show that while incongruent sustainability information influenced the process of consumer choices, it did not change the outcome. Like Study 1, consumers' final choices still reflected an appreciation for both sustainability of the packaging and the product. This was expected, as fundamental preferences are unlikely to shift solely due to message presentation. However, the decision-making process itself was affected, with incongruent sustainability messaging delaying consumer's final choice. This suggests that incongruent messaging prompts consumers to spend more time inspecting the available information before committing to a product, potentially encouraging more informed decision-making. This finding presents an interesting addition to the tools facilitating consumer routine disruption in efforts of stimulating for sustainable consumer behaviors (Granato, 2022). Nevertheless, our results show no evidence that the additional time spent when making the final choice improved information retention. Consumers' ability to recall the sustainability aspects that were presented to them to explain how the options' sustainability was evaluated was similar between the two conditions and interestingly low. This finding corroborates various speculations that consumers seem to be generally uninformed of sustainability improvements to their products, despite valuing them as a part of a product offering (e.g., Ketelsen et al., 2020; Otto et al., 2021). Finally, the nature of consumers' choices did not become more intentional, as indicated by similar

willingness to pay (WTP) between the conditions. This suggests that while incongruent messaging can alter the process of decision-making by delaying it, it does not necessarily enhance the depth of consumer commitment to sustainability, as reflected in their WTP.

10. General discussion

Overall, these studies' findings outline the potential of using incongruent sustainability messaging in promoting at least two important outcomes related to sustainable consumer behavior. Within assortments, incongruent information can draw more consumer attention onto sustainability innovations related to peripheral aspects of packaged products, such is the packaging. Outside assortments, incongruent information can encourage more thoughtful consideration of sustainability in subsequently presented packaged products. This effect is evident both from increased browsing behavior within the assortments that follow and from more in-depth processing of the available sustainability information. Additionally, this research underscores and thereafter examines the importance of studying the nature, not just the outcome of consumer choices, in efforts of understanding the degree of informedness and intentionality of consumer choices. These results show that although consumers convincingly favor snacks that highlight high sustainability of both the product and the packaging in their choice, the level of informedness in doing so is higher if incongruent sustainability information was used to prompt elaboration.

10.1. Theoretical implications

Building on the recent research studying the role of aspect centrality in sustainable communications (Steenis et al., 2022), this research provides evidence that the centrality of product-level sustainability information can diminish consumer attention to peripheral aspects such as packaging sustainability. This suggests that when consumers are presented with sustainability information about the product itself, they may cognitively prioritize central information, thereby allocating less attention to related, but less central, aspects such as the sustainability of the packaging. This finding contributes to the understanding of consumer attention allocation in multi-aspect decision-making contexts, highlighting the need to consider the hierarchical processing of sustainability information.

Responding Eklund and Helmefalk's (2022) call to further explore the potential of (in)congruency in advertising, our research identifies unique positive spill-over effects

stemming from incongruent sustainability information within this domain. Namely, exposure to conflicting or unexpected sustainability cues in one task can lead to more deliberate and reflective consumer decision-making in subsequent tasks. Thus, when consumers encounter sustainability information that challenges their expectations, it prompts them to engage in more thoughtful processing of similar information in later decisions, as evidenced by prolonged consideration times and delayed product choices. This supports the notion that cognitive dissonance or surprise arising from incongruent information can enhance consumer engagement with sustainability issues (Festinger, 1957; Levy et al., 2018; Yoon, 2013), potentially leading to more informed and sustainable choices over time.

Finally, this research highlights the importance of examining not only consumer choice as *the* outcome but also the decision-making processes, such as the time taken to make a decision. The observed delay in decision-making following incongruent sustainability information suggests a reallocation of cognitive resources, where consumers engage more deeply with choice-making tasks in retail scenarios after encountering conflicting information. Therefore, decision latency may serve as an important marker of cognitive engagement and should not be overlooked. Theoretically, this implies that examining the process of decision-making – especially when faced with complex or contradictory information – can reveal important dynamics about how consumers prioritize and integrate sustainability information. Moreover, this approach suggests that decision delays might offer opportunities for enhancing consumer education by maximizing on the additional cognitive resources engaged during these moments.

10.2. Practical implications

Study 1 shows that when multiple sustainability aspects are highlighted simultaneously, consumer attention tends to gravitate towards the most central aspect, often neglecting less central ones, like the packaging. This has important implications for communicating sustainability innovations that require consumer action to achieve their full environmental potential. For instance, compostable plastic packaging, which needs to be discarded with organic waste, is frequently mistaken for conventional plastic, leading to contamination of recycling streams (Yaradoddi et al., 2022). To address this, it is essential to emphasize such innovations as the primary sustainability improvement in sustainability communications, avoiding diverting attention to other sustainability aspects. Marketeers

should therefore consider this targeted approach to increase the likelihood that consumers will notice and comprehend important peripheral (sustainability) aspects, consequently maximizing their intended environmental benefits.

Our findings also show that incongruent sustainability information increases the depth of information processing and delays consumer decision-making, making it an effective tool in disrupting consumer routines. Incongruent sustainability messaging could therefore be used to prompt consumers to consider more sustainable options, by placing incongruent messages in highly visible areas or near products that consumers typically buy without much thought. Furthermore, incongruent sustainability messaging could be used to inform consumers more effectively about sustainability aspects. Since this type of messaging encourages consumers to think more deeply, it can be particularly useful for products with complex or less intuitive sustainability benefits, such as innovative packaging or sustainable production methods. However, considering that consumer recall of sustainability aspects was low across the sample and not significantly different between the two conditions, presenting incongruent sustainability information will likely be more effective in combination with other strategies that promote consumer learning. Presenting information that at the same time triggers consumer curiosity due to its content, not just its way of presentation, could be one viable option. Some concrete examples can include explaining sustainability improvements using new logos (see Kraus & Gierl, 2017), gamified information presentation (Müller-Stewens et al., 2017) or through trivia questions (see Daume & Hüttl-Maack, 2020; Marvin & Shohamy, 2016).

10.3. Study limitations and future directions

The first limitation of our studies is that the respondents may have already processed sustainability information in greater depth by default, which likely influenced our findings. This limitation consists of two components. First, conducting the studies in a lab setting, while providing controlled conditions, reduces ecological validity (Holleman et al., 2020). In this environment, consumers may have inspected the presented information more carefully than they would in a typical supermarket, possibly influenced by the researcher's proximity. Second, our sample consisted of students from a university with a strong emphasis on sustainability in its curriculum. This likely resulted in higher interest and engagement with sustainability among respondents, potentially skewing their attention towards sustainability information in food shopping. In both cases, the baseline level of

sustainability information processing may have been higher than average, either due to the controlled lab environment or the characteristics of the sample. We anticipate that such circumstances reduced the impact of incongruent messaging in encouraging more deliberated choices, therefore discounting the observed effects. Future research should investigate these dynamics by using a less sustainability-oriented sample and conducting studies in more natural settings. For example, research conducted in supermarkets with "regular shoppers", utilizing portable eye-tracking devices and minimizing researcher visibility could better simulate typical shopping behavior.

Our studies also used simplified versions of product stimuli, thereby excluding important aspects like taste, convenience, or price – known to significantly influence consumer choice (Drewnowski & Monsivais, 2020). While this simplification was intentional for the purpose of initial investigations, future research should incorporate a broader range of product aspects to provide more comprehensive insights. By examining how consumers allocate attention and process sustainability information alongside other relevant aspects, future studies can offer results that are more generalizable to real-world shopping contexts.

Considering that our research focused on the depth of information processing within assortments, future studies could further refine our findings by distinguishing between the frequency of within-snack saccades and between-snack saccades. Insights from within-snack saccade frequencies could be used to shed light on the degree of consumer integration attention, while insights from between-snack saccade frequencies could be used to inform about the extent of comparative attention consumers engage in (Martinovici et al., 2023). This approach would offer a more nuanced understanding of why consumers shift their gaze rapidly.

11. Conclusions

This research advances our understanding of consumer engagement with sustainability information by demonstrating the nuanced effects of incongruent sustainability messaging on attention allocation, decision-making processes, and consumer choice. Across two studies, we found that incongruent sustainability information not only captures more consumer attention towards peripheral aspects, such as packaging, but also encourages more informed decision-making, evidenced by increased information

processing depth and delayed choices. As such, this research suggests that incongruent sustainability messaging can serve as a strategic tool for disrupting habitual consumer behaviors and fostering greater consumer engagement with sustainability. By encouraging consumers to allocate more cognitive resources to processing sustainability information, such messaging has the potential to enhance informed and intentional consumer choices, thereby maximizing the impact of sustainability innovations.

Appendix A. Incongruent sustainability messaging manipulation (Study 2).

This packaging scored **positively** in terms of the following sustainability aspects:

- Renewability
- Recyclability
- Low-impact material use
- Life cycle assessment

This product scored **negatively** in terms of the following sustainability aspects:

- Fair trade
- Social responsibility
- Resource efficiency
- Local production

Appendix B. An example of Study 2 AOI specifications.


3

Chapter 3

(Un)believably green: The role of information credibility in green food product communications

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Abstract

This research explored how variations in green information influence consumer responses to green food packaging. Study 1 (N = 355) addressed how consumers evaluate packaging sustainability given the interplay between source cues, claim cues and the order of cue presentation. Study 2 (N = 546) additionally investigated the role of product cues (namely, naturalness) in sustainability evaluations of green packaging. Both studies examined perceived credibility of green information as the underlining mechanism explaining packaging cues' effects on perceived sustainability. Overall, consumers valued green communication using credible cues on packaged foods but they also: 1) appreciated higher cue quantity, 2) did not penalize communications using low credibility cues, and 3) evaluated green packaging information swayed by product cues.

Keywords: green communication, packaging, source cues, claim specificity, marketing

1. Introduction

Consumers prefer and are more willing to purchase sustainable products than conventional alternatives (Bianchi et al., 2022; He & Lai, 2014). To capitalize on consumers' interest in sustainability, companies communicate products' green attributes on packaging labels, through combinations of packaging cues (Seo & Scammon, 2017). This information forms consumers' expectations (Steenis et al., 2022) and purchase intentions about the product (Orth & Malkewitz, 2008; Steenis et al., 2017). However, communicating green attributes is challenging, as more than 50% of consumers do not believe the green information companies communicate on their products (Euroconsumers, 2021). Such considerable degree of consumer distrust increases the importance of investigating how consumers decode the interplay between green packaging cues into sustainability evaluations.

Sustainability is a credence attribute whose accurateness or sincereness consumers cannot directly verify (Grunert et al., 2014). An important component of credence-based information is its perceived credibility, because people use credibility evaluations as a strategy to help them decide how relevant the presented information is (Wathen & Burkell, 2002). When direct verification is not an option, credibility becomes crucial for consumer decision-making (Eisend, 2002). This places credibility – a perception of expertise and trustworthiness of information or its source (Eisend, 2002; Metzger, 2007) – central to packaging cues' ability to influence sustainability perceptions.

This research builds a conceptual framework to assess how consumers integrate green packaging information into perceptions. Study 1 explores how sustainability evaluations are formed given the interplay between green source cues (i.e., the type of entity certifying the packaging's sustainability) and claim cues (i.e., informational text on sustainability). We argue that consumers reach sustainability evaluations in a sequential information search process whereby perceived credibility of the first processed cue determines the added weight subsequent green cues will have for evaluations. Therefore, perceived credibility of green information – especially that of the first processed cue – governs the outcome of the interplay between green source and claim cues on sustainability evaluations. Study 2 investigates how consumers' perceptions of products' naturalness (i.e., its perceived closeness to nature) influence packaging sustainability evaluations, as well as consumers' attitudes about the packaged product. Here, we propose that consumers' evaluations of

green packaging information are inherently linked to product cues, as packaged products are evaluated holistically.

Our research's theoretical contribution stems from examining how consumers integrate pieces of information that appeal to different information processing routes into judgements, providing insights into how they prioritize and understand green information. Moreover, we assess the boundary effects of these cue interactions in efforts of grasping which circumstances and what formats of green information are most likely to be successful. We also put forth perceived credibility as one potential mechanism that could explain why certain green packaging cues lead to more positive product evaluations. Practically, our research helps marketers gauge the relative impact of green cues on evaluations, crucial for preventing consumer overload and unfavorable responses when sharing environmentally friendly information across multiple channels (Marzi, 2022). Additionally, it offers guidelines relevant for the design of more persuasive and credible sustainability communication in the food industry, which could have a direct contribution to more sustainable consumer choices and behaviors.

2. Theoretical Background

In the domain of persuasive communication and decision-making, the Elaboration Likelihood Model (ELM) serves as one of the fundamental frameworks for elucidating the processes governing judgment and persuasion. The ELM delineates two distinct routes to persuasion: the central route, characterized by deliberate analysis of message content, and the peripheral route, influenced by superficial cues (Petty & Cacioppo, 1986). Along the central route, individuals engage in thoughtful evaluation of arguments, forming judgments grounded in content merits (Petty & Wegener, 1999). Conversely, the peripheral route relies on heuristics and mental shortcuts, where factors like the source of the message play a significant role (Briñol et al., 2011).

Source and claim cues communicate information to consumers via different processing routes (Underwood & Klein, 2002). Source cues require little cognitive resources and are fast to process (Chaiken & Ledgerwood, 2012), impacting consumer perceptions through established heuristics (Luna et al., 2003). Claim cues are primarily processed through the central route, requiring consumers' involvement and dedication of cognitive resources to reach an evaluation (Fogg & Tseng, 1999).

Both source and claim cues can improve consumers' evaluations of the product and the brand (e.g., Brach et al., 2018; Olsen et al., 2014). Source cues were found to boost evaluations of products' eco image, brand attitudes and intention to buy (e.g., Atkinson & Rosenthal, 2014; Liu et al., 2017). These links were established using various sources to communicate green improvements related to energy saving (e.g., EU Energy Rating Label), deforestation (e.g., FSC logo) and, most often, food (e.g., EU organic logo and German Bio-Siegel logo) (Darnall et al., 2018.; Janssen & Hamm, 2012). Similarly, condensed textual information consumers receive via packaging claims can also lead to positive responses (Osburg et al., 2016; Rettie & Brewer, 2000). Indeed, consumers prefer and are more willing to buy products with than without green claims (Atkinson & Rosenthal, 2014; Kao & Du, 2020).

Consumers value sustainability improvements more when companies improve credibility of the green information the products communicate (Atkinson & Rosenthal, 2014). For instance, governments or third-party certified source cues are perceived as more credible than corporation issued source cues (Darnall et al., 2018; Moussa & Touzani, 2008). Consumers generally consider governments and third party sources more trustable because such certifications testify that the product met certain criteria that were consequently objectively evaluated by an independent entity (Darnall et al., 2018; Finch et al., 2015). Furthermore, consumers believe that independent entities have no ulterior motives to make a profit out of selling products with such certifications (Busch & Jörgens, 2005). Subsequently, consumers prefer products incorporating certified source cues over those incorporating corporation certified source cues (e.g., Atkinson & Rosenthal, 2014; Brach et al., 2018; Ketelsen et al., 2020).

Considering credibility of textual cues, the specificity of green claims is an important factor. Consumers prefer claim objectivity and good argumentation quality and strength (Alniacik & Yilmaz, 2012) because they provide concrete reasons to believe the communicated improvements. Presenting highly specific, as opposed to vague and unspecific green claims not only increases credibility of the claim but leads to higher willingness to buy and more positive attitudes towards these companies (Ganz & Grimes, 2018; Jäger & Weber, 2020).

Taken together, it is known that both green source and claim cues independently improve consumers' responses, especially when perceived as credible. Yet, these insights were largely drawn from isolated research contexts, studying the effect of each cue

independently and often in reference to products without green information altogether (e.g., Busch & Jörgens, 2005; Ganz & Grimes, 2018). Therefore, the understanding of the cue interplay remains limited.

Notable exceptions studying cue interplay include the work of Atkinson and Rosenthal (2014), who examined the influence of label specificity and source cues on overall consumer evaluations of packaged products. Here, consumers generally placed more trust and held more favorable attitudes towards products that provided specific on-label information and originated from certified sources. Similarly, Ischen et al. (2022) investigated the combined effects of sustainable packaging materials and logos, again finding that each cue independently improved sustainability evaluations. Lastly, Spack and colleagues (2012) studied how argument strength and imagery influence perceptions of product greenness and purchase intent, observing similar effects as Ischen et al., (2022). Spack and collagues (2012) furthermore speculated that the two cues might additively affect perceived attitudes towards the product. However, none of the studies noted significant effects resulting from cue interplay, nor inspected which underlining mechanisms could explain the observed effects. Other related studies add complexity to the topic, generating mixed results and deepening the cue interplay ambiguity. Seo and Scammon (2017) observed that beverages in green bottles, displaying a green claim, were perceived as environmentally superior compared to drinks in differently colored bottles featuring the same claim. Conversely, Granato and colleagues (2022) discovered that green colored packaging, combined with a green claim, had adverse effects on consumer evaluations of pre-packaged salads. These studies, too, did not explore the potential underlining mechanisms influencing consumer evaluations.

2.1. The effect of the source and claim cue interplay on credibility

Existing theories that could help explain the source-claim cue interplay focus on how the number of cues affects consumer responses. The Elaboration Likelihood Model (Petty & Cacioppo, 1986) and The Information Theory (Shannon, 1948) suggest that using several green cues provides more information, making the message of sustainability more salient. Previously mentioned findings of Seo and Scammon (2017) support this, reasoning that green color (as opposed to red or yellow) enhances the meaning of the sustainability message. The implication here is that sustainability information is best processed when there is conceptual fluency between message content and the symbolic meaning of the

color. Thus, both cues communicate sustainability in an additive, “more is merrier” fashion.

The Embedding Effect (Kahneman & Knetsch, 1992) reasons in the “less is more” direction. It suggests that consumers are prone to value each two or more green cues less saliently when presented together than separately. It further assumes that one green cue already activates moral satisfaction – which is believed to be the reason why consumers appreciate sustainable products. Adding subsequent cues results in several cues sharing the same degree of moral satisfaction that one cue previously activated on its own (Irwin & Spira, 1997; Kahneman & Knetsch, 1992). Therefore, combining several green cues may backfire on sustainability evaluations. Per this reasoning, Granato and colleagues (2022) found adverse effects on sustainability evaluations when cues were combined. The authors theorized that the counterproductive effect stems from green overload, as the abundance of information resulted in consumers questioning the products’ real environmental benefit.

We propose that sustainability evaluations depend on perceived credibility of green information rather than the mere number of presented cues. When cues compete for consumers’ attention, we argue that perceived credibility of the first processed cue determines whether sustainability will be communicated in a “more is merrier” or “less is more” fashion. This makes perceptions of the first processed cue crucial. Indeed, consumers tend to simplify their judgement making by selectively using the first piece of processed information to build expectations (Sanbonmatsu et al., 1998). This strategy evolved due to time restrictions, abundance of choice, and information overload that consumers face in every-day consumption contexts (Mick et al., 2004). These considerations highlight the weight of the initially processed information, which acts as an “anchor” for consumers’ judgement making and therefore introduces order of information processing as a relevant factor.

Our "quality over quantity" argument aligns with the idea that the initial cue has an anchoring effect on the cue interplay outcome. When initial information appears highly credible, consumers usually do not search for additional information to corroborate their perceptions (Tucker et al., 2012). Conversely, consumers typically seek more information when unsure about the credibility of the initial information (Sinaceur, 2010). Following this rationale, if the initially processed information is deemed insufficient, consumers are likely to seek out more cues. We therefore anticipate that "more is merrier" when the first

processed cue is perceived as lacking credibility, and "less is more" when the first processed cue is perceived as sufficiently credible.

The “quality over quantity” argument also considers varied judgement strengths stemming from processing differences between the two ELM routes. Specifically, deliberate allocation of attention and thorough cognitive engagement with information should form more robust and enduring attitudes – inherent to central information processing (Petty & Wegener, 1999). Extensive elaboration of information also enhances individuals' confidence in the conclusions they draw from said information (Briñol et al., 2011). Therefore, it can be deduced that cues designed to engage central (i.e., claim cues) rather than peripheral (i.e., source cues) information processing routes generally convey green information with heightened credibility to consumers. Furthermore, it becomes reasonable to anticipate that if this greater credibility is attributed to the initially processed cue, consumers’ subsequent need for additional information search will also be reduced.

In summary, our reasoning is built on three core assumptions. Specifically: sustainability evaluations involve a sequential information search process. The credibility of the first processed cue is pivotal in influencing subsequent evaluations. And finally, centrally (versus peripherally) processed cues generally carry more influence in consumer evaluations due to differences in nature of their information processing and need for additional information after. Altogether, we hypothesize that:

H1: Source cues will lead to more information search than claim cues.

H2: For both cue types, less credible cues (i.e., corporation certified source cues and low specificity claims) will lead to more information search than more credible cues (i.e., government certified source cues and high specificity claims).

H3: Perceived credibility of green information will mediate the relationship between (a) source and (b) claim cues and perceived sustainability of the packaging, more credible cues leading to higher perceptions of sustainability.

If consumers judge the first processed cue as sufficiently credible, then this cue likely determines the overall perceived credibility of green information in the presence of

two (or more) cues too. We expect that adding a high credibility second cue will constitute a considerable benefit in terms of improved credibility evaluations of green information if the first cue is low in credibility. If the second cue is low in credibility, however, its expected role will not be in improving credibility evaluations of green information. Instead, the low credibility of the second cue will do harm by decreasing the credibility of green information, but only if the first cue is also low in credibility. Namely:

H4a: If the first processed cue is low (versus high) in credibility, adding a high credibility second cue will result in a larger increase in credibility of green information.
H4b: If the first processed cue is low (versus high) in credibility, adding a low credibility second cue will result in a larger decrease in credibility of green information.

3. Study 1 Methods

3.1. Participants and design

For a small compensation, responses of 362 British consumers were collected online using Prolific – a crowdsourcing platform. Per our pre-registration (see https://aspredicted.org/3MK_VKR), consumers whose response time was 3 standard deviations away from the average were removed from the sample. The final sample consisted of 355 consumers (M_{age} = 36.85, SD = 13.8; 49.58% female, 66.76% holding a bachelor's degree). The study involved a 2 (source cue: government versus corporation certified) x 2 (claim cue: high versus low specificity) x 2 (order of cue presentation: source cue versus claim cue first) between-subject design. Study conditions did not significantly differ in consumers' age ($F(7, 347) = .95$, $p = .47$), gender ($X^2(14, N = 355) = 13.20$, $p = .51$) or education ($X^2(21, N = 355) = 30.06$, $p = .09$). The study received the Ethical approval from the university the research was carried out in.

3.2. Stimuli

The manipulated stimuli were the source and specificity of claim cues (see Figure 1), both of which were separately piloted before (N = 78 and N = 60, respectively). Source cues were manipulated with a logo that was either third-party government agency or

corporation issued. Like Atkinson and Rosenthal (2014), the source cue design was kept constant, while the source itself varied. Government certified source was The European Environment Agency, and corporation certified source was Aldi. Claims were manipulated to be high or low in specificity. High claim specificity provided concrete information about the packaging improvements to sustainability (i.e., "Biobased packaging made entirely from renewable plant-based fibres"). Low specificity claims built on the same context the high specificity claims did but provided no details how packaging sustainability was achieved (i.e., "Green packaging made entirely from sustainable materials").

Figure 1. Study 1 stimuli.

3.3. Procedure and measures

After agreeing to participate, consumers received a definition of packaged foods' environmental sustainability to ensure that evaluations of green information aligned with this specific sustainability aspect. They were then randomly assigned to a condition and asked to imagine shopping for mushrooms at a local supermarket. To avoid negative consumer reactions towards products whose packaging is perceived as excessive (Hoppe & Kleinen-von Königslöw, 2023), mushrooms were chosen as stimuli. They fit both relevant criteria: being predominantly packaged in plastic trays in British supermarkets and being fresh and minimally processed. Depending on cue order presentation, consumers saw either a source or claim cue on packaging design. They then evaluated how credible they found the presented green information, measured with one item: "How credible do you think the information about sustainability of these packaged mushrooms is?", on a 7-point scale ranging from 1 (not at all credible) to 7 (very credible). Following, consumers rated packaging sustainability with one item: "How sustainable is this mushroom packaging to

you?", on a 7-point scale ranging from 1 (not at all sustainable) to 7 (very sustainable; Granato et al., 2022). Consumers furthermore evaluated the need for additional information in terms of information adequateness with one item adapted from Menon and Soman (2002): "How adequate is this information to make an accurate sustainability evaluation?", on a 7-point scale ranging from 1 (not at all adequate) to 7 (very adequate). Afterwards, a second cue was added in addition to the initially presented cue (i.e., a source cue or a claim cue, depending on whichever the consumers did not yet see). Consumers then re-evaluated perceived credibility and sustainability. The study concluded with two manipulation checks adapted from Atkinson and Rosenthal (2014) and questions about age, gender, and education. The strength of the source manipulation was measured by asking "Which entity issued the logo you just saw?" on a scale including government and corporation/company as possible answers. The claim manipulation's strength was measured by asking "How detailed was the information in the claim you just saw?" on a 7-point scale, ranging from 1 (not at all detailed) to 7 (very detailed).

3.4. Data analysis

Hypotheses 1 and 2 were tested with t-tests. In H1, the need for additional information after source cues versus claim cues presentation was compared. In H2, two t-tests were used. The first compared the difference in need for additional information between government and corporation certified source cues. The second compared the difference in need for additional information between high and low claim specificity cues. The mediating effect of perceived credibility of green information on the effect of packaging cues on perceived sustainability (i.e., hypotheses H3a and H3b) was tested with a structural equation model (SEM) (Rosseel, 2012). Direct, indirect, and total effects were specified at the same time. Final evaluations of perceived credibility and sustainability were specified as the model's mediator and the dependent variable. Independent variables were source cues and claim cues. Bootstrapping procedures provided confidence intervals.

To answer H4a and H4b, we specified the interaction between source cues, claim cues, and the order of cue presentation as the predictor in an ANOVA model. The dependent variable was the difference between the final and initial credibility evaluation. Because of the selectivity of H4a and H4b predictions, there was no dependence on the overall significance of the three-way interaction. Instead, we focused on the specific post-hoc

pairwise comparisons. Data were analyzed using R programming language (*R Core Team, 2020*).

4. Study 1 Results

4.1. Manipulation checks

Manipulations were successful: most consumers were able to identify the issuer of the source cue correctly ($X^2(1, N = 355) = 116.89$, $p < .001$) and claim cues were perceived as more detailed in the high ($M = 4.38$, $SD = 1.38$) than in the low ($M = 4.08$, $SD = 1.47$, $t(351.44) = 1.96$, $p = .05$) specificity condition.

4.2. The effect of cues on additional information search

H1 was supported. Irrespective of both cues' content, presenting source cues led to significantly higher need for additional information search than presenting claim cues did ($\Delta M = .56$, $t(353) = 3.15$, $p = .002$).

H2 stated that low credibility cues would lead to more need for additional information than high credibility cues. Indeed, corporation certified source cues and low claim specificity cues led to more need for additional information than government certified source cues ($\Delta M = .62$, $t(175.94) = 2.53$, $p = .01$) and high claim specificity cues ($\Delta M = .64$, $t(173.38) = 2.62$, $p = .01$). Thus, the need for additional information was significantly lower when high credibility cues were used to communicate green information, supporting H2.

4.3. The mediating role of green information's credibility in sustainability perceptions

Regarding H3a and H3b, both source and claim cues significantly contributed to packaging sustainability evaluations, albeit in different ways. The total effect of source cues on perceived sustainability was significant ($\beta = .29$, $p = .04$, 95% CI [.08, .51]), in the expected direction of high credibility source cues increasing sustainability evaluations more than low credibility source cues. This effect was entirely carried out through perceived credibility of green information ($\beta = .37$, $p = .007$, 95% CI [.01, .58]), as the direct effect of source cues on perceived sustainability was not significant ($p = .97$). This full mediation therefore supported H3a. The total effect of claim cues on perceived

sustainability was also significant (β = .54, $p < .001$, 95% CI [.26, .83]), high credibility claims increasing sustainability evaluations more than low credibility claims. This effect was carried out through both significant direct (β = .28, $p = .003$, 95% CI [.10, .47]) and indirect effects (β = .26, $p = .02$, 95% CI [.05, .48]). Thus, claim cues influenced perceived sustainability, the effect being partially mediated through perceived credibility of green information and supporting H3b.

4.4. The effect of cue interplay on credibility

H4a stated that if the first cue was low (versus high) in credibility, adding a high credibility second cue would result in a larger increase in perceived credibility of green information. Despite the three-way interaction between source cues, claim cues and the order of cue presentation being overall insignificant ($F(1, 347) = 5.44$, $p = .09$), post-hoc tests were carried out to inspect the specific pair-wise comparisons of interest. Of two, one comparison was significant (Figure 2, panel b). Partially supporting H4a, we found that if the first cue was low (versus high) in credibility, adding a high credibility source cue increased credibility evaluations significantly more ($\Delta M = .65$, $p = .02$, 95% CI [.09, 1.21]). This effect was not observed when the second cue was a high credibility claim.

H4b stated that if the first cue was low (versus high) in credibility, adding a low credibility green cue would result in a larger decrease in perceived credibility of green information. Neither of two pairwise comparisons were significant. Notably, however, mean increases in perceived credibility were found with the addition of the low credibility cue. This indicates that less was *never* more, as consumers did not penalize the addition of low credibility cues with lower evaluations of credibility under no circumstances.

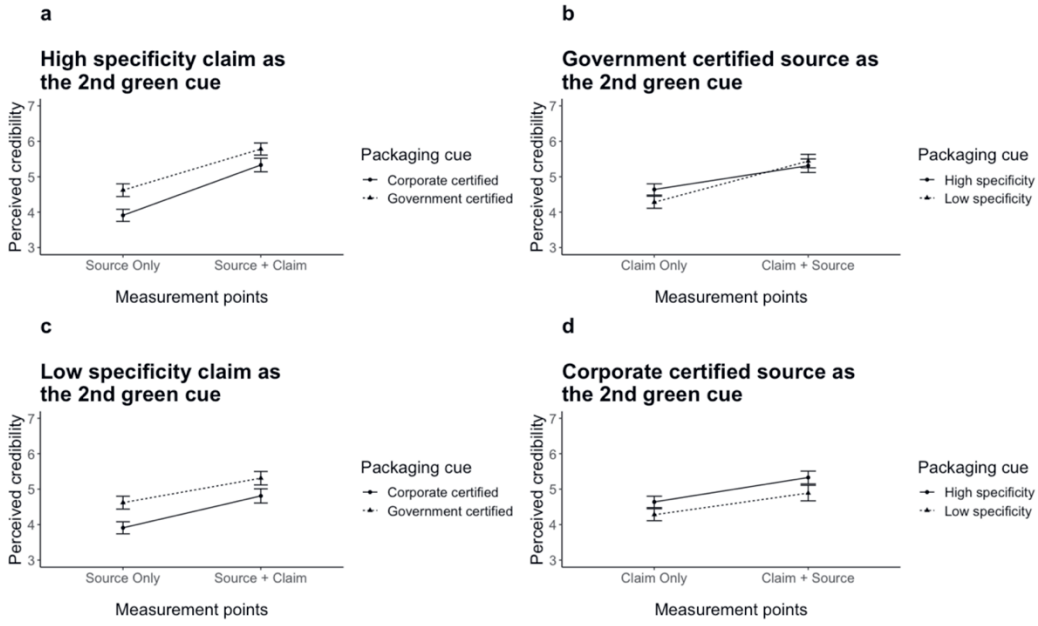

Figure 2. The effect of adding a second cue on perceived credibility of green information. *Note*. Panels a and b summarize H4a. Panels c and d summarize H4b.

5. Study 1 Discussion

Study 1 supported our reasoning that packaging sustainability evaluations are reached in a sequential information seeking process. Extending on Ischen et al. (2022) findings, we identified perceived credibility as an important mechanism explaining packaging cues' ability to influence perceptions of sustainability. This was especially true in the case of source cues, whose entire effect on perceived sustainability was gained through perceived credibility of green information. Overall, increasing the number of cues always improved sustainability evaluations, but the extent of the benefit of the second cue depended on perceived credibility of the first – in line with the "quality over quantity" reasoning.

While this study clarifies how consumers evaluate packaging sustainability given the available green information, it does not consider the role of the product in this process. Product cues (such as product (un)naturalness) are likely important in this context because

packaging is a collateral of product purchases and consumers typically evaluate packaged food products holistically (Magnier et al., 2016). Indeed, green packaging information depends on product-related inferences. In Steenis et. al.'s (2022) study, consumers perceived advertisements as more deceptive when sustainable packaging did not contain a sustainable product. Addressing this consideration might explain why consumers never penalized green information with lower evaluations of credibility. Specifically, it is possible that consumers processed green information's content more peripherally because inferred product cues (the content were mushrooms) were congruent with the notion of sustainability green packaging information was communicating.

6. Study 2

With Study 2, we tested the role of product cues (namely, product naturalness) in relation to packaging cues' effect on green information's credibility. Furthermore, to comprehensively evaluate the central concept in our studies, perceived credibility was measured using a different, previously evaluated credibility scale. We also extended the conceptual model to consider how credibility of green information and packaging sustainability influence consumers' overall attitudes – a proxy for consumer behaviors – about packaged products (Figure 3 shows the full model).

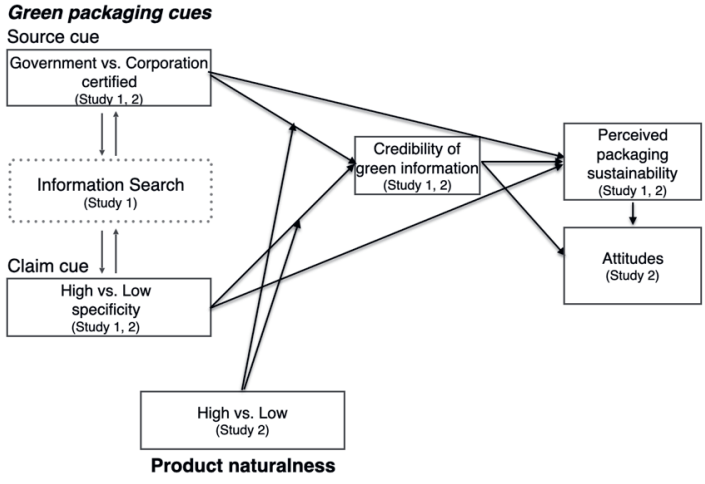

Figure 3. Full conceptual model.

6.1. The role of product naturalness

Consumers navigate their evaluations guided by mental schemas activated by available information. These mental schemas are cognitive structures that allow individuals to organize existing knowledge and interpret new information by comparing it with what they already understand (Fiske & Taylor, 1991). Mental schemas related to both product and packaging are interconnected and sometimes share overlaps due to content similarities (e.g., emphasizing sustainability benefits) or their typical coactivation. Reinforced by green information on the packaging, consumers might turn to additional contextual cues for validation or contradiction. Most often, these cues originate from closely linked conceptual entities, like the product itself (Steenis et al., 2022).

The (in)congruency between product and packaging cues, driven by these mental schemas, plays a role in influencing how consumers process green information. According to the ELM, cue congruency creates conceptual fluency (Hur et al., 2020), nudging consumers to process information peripherally, by relying on their habits and entering automatic states (Petty & Cacioppo, 1986). This may reduce their inclination to challenge the information's status quo (Granato et al., 2022), potentially also hindering the detection of credibility nuances in the presentation of green information. Conversely, cue incongruency prompts deeper thinking (central processing; Briñol et al., 2011). This natural human tendency is driven by the motivation to make sense of conflicting information, even if it requires more cognitive effort (Petty & Cacioppo, 1986). For example, individuals invest more time in assessing and better remember arguments contradicting their attitudes (Briñol et al., 2011). Therefore, empirical evidence supports the idea of more thoughtful consideration in the presence of information discrepancies. If these principles apply to information on packaged products, cue incongruence should stimulate consumers to scrutinize green information more closely, hence enhancing the detection of credibility nuances.

The association closest to the concept of sustainability is likely that of nature and nature experiences (Tobler et al., 2011). Consequently, products perceived as highly natural, like fresh food items (e.g., mushrooms in Study 1), innately align product and packaging cues. This cue congruency should thus promote peripheral processing of green information. Conversely, for less natural products (e.g., heavily processed items),

incongruencies between product and packaging cues might steer consumers towards central processing of green information. We explore this, hypothesizing that:

H5: The effect of the second cue on credibility evaluations of green information (i.e., H4a & H4b) is stronger when the product is low (versus high) in naturalness.

6.2. Consumers' attitudes about green packaged products

Sustainability drives positive consumer attitudes about food products. For example, consumers are more positive about organic over non-organic vegetables or local over internationally grown fruit (e.g., McCarthy, 2015; Meyerding et al., 2019). Admittedly, sustainability aspects of the actual product are more central to consumers' decision making (Skard et al., 2021), and thus contribute more meaningfully to consumers' attitudes about packaged products. However, we propose that positive attitudes about packaged products can also stem from moral satisfaction of exercising sustainability (Kahneman and Knetsch, 1992) peripherally, via packaging for instance. Communicating these sustainable aspects using credible information can further add to positive attitudes, as consumers can more easily be persuaded of the importance of the message when it is credible (Zhang et al., 2016). Hence, credible information likely increases consumers' appreciation of the packaged product beyond influencing the perception of sustainability. Considering these arguments, we hypothesize that:

H6: Higher perceived credibility of green information and perceived sustainability of the packaging will lead to more positive attitudes about the packaged product.

7. Study 2 Methods and Results

Identical to Study 1, 563 consumers were recruited via Prolific, 17 of which were excluded[5], resulting in 546 consumers (M_{age} = 39.54, SD = 14.13; 50.73% female, 43.40% holding a bachelor's degree). Additional to experimental conditions from Study 1, product

[5] The same exclusion criteria from Study 1 were used.

naturalness (high versus low) was added as a between-subjects factor. To operationalize product naturalness, two products were selected: fresh mushrooms for the high naturalness condition, and pink-frosted, pre-made cookies for the low naturalness condition (see Figure 4). Source and claim cue manipulations were kept identical to those in Study 1. Alike Study 1, Study 2 conditions did not significantly differ from each other in consumers' age ($F(7, 538) = 1.49$, $p = .17$), gender ($X^2(14, N = 546) = 7.71$, $p = .90$) or education ($X^2(21, N = 546) = 15.30$, $p = .81$).

Figure 4. Study 2 stimuli showing the low naturalness product.

After seeing the one cue design, consumers rated perceived credibility using a 3-item, semantic differential scale. Accurateness, authenticity, and believability of the presented green information was evaluated on a 7-point scale ($\alpha = .93$; Ganz & Grimes, 2018; Tucker et al., 2012). Then, perceived sustainability of the packaging was assessed using the same item as in Study 1. After adding the second cue, consumers revaluated perceived credibility, sustainability, and rated their overall attitudes about the packaged product. Using Chang, and colleagues' (2011) scale, consumers rated how bad/good, unfavorable/favorable, and negative/positive their overall attitudes about the packaged product were on a 7-point bipolar scale ($\alpha = .97$). Purchasing frequency and product liking were included as covariates. The study concluded with manipulation check questions and demographic measures. Additional to Study 1 manipulation checks, another about perceived naturalness was added. Specifically, consumers evaluated how close the packaged product was to nature experiences (e.g., "This packaged product makes me feel

close to nature"). Three items were evaluated on a 7-point Likert scale (α = .94; Hartmann & Apaolaza-Ibáñez, 2012).

7.1. Data analysis

The moderation effect of product naturalness was tested by including it as a two-level moderator in the H4a and b analysis, contingent on a successful manipulation check. Relevant pairwise comparisons were then compared between the high and low product naturalness samples. In H6, perceived credibility and perceived sustainability were the predictors in a regression model in which the outcome were consumers' attitudes about the packaged product. To assure that consumers' attitudes were not influenced by their general liking or frequency of purchase of the products used as stimuli, these variables were added as covariates to the model.

7.2. Manipulation checks

Manipulation checks were successful. Most consumers correctly indicated who the issuer of the source cue was ($X^2(1, N = 546) = 221.06$, $p < .001$) and perceived high specificity claims as more detailed ($M = 4.55$, $SD = 1.38$) than low specificity claims ($M = 4.12$, $SD = 1.59$, $t(536.98) = 3.40$, $p < .001$). Consumers also reported higher nature experience evaluating mushrooms ($M = 10.37$, $SD = 4.70$) than cookies ($M = 9.47$, $SD = 4.91$, $t(536.98) = 2.21$, $p = .03$). For simplification purposes, mushrooms will be referred to as the 'high naturalness' product and cookies as the 'low naturalness' product throughout the rest of the paper.

7.3. Moderating effects of product naturalness

Although the obtained patterns of results differed between high and low product naturalness subsamples, we found no support for the H5 moderation effect. In the high product naturalness (i.e., mushroom) subsample, Study 1 results were replicated. Namely, adding a high credibility source cue contributed significantly more to evaluations of green information's credibility when paired with a low versus a high credibility claim ($\Delta M = 1.78$, $p = .02$, 95% CI [.23, 3.32]), green lines in Figure 5b). The same comparison was insignificant in the low product naturalness (i.e., cookie) subsample. Furthermore, another significant difference between the low and high product naturalness subsample was found. In low product naturalness subsample, adding a low credibility source cue increased

evaluations significantly more when paired with a low versus a high specificity claim (ΔM = 1.08, p = .03, 95% CI [.09, 2.07], red lines in Figure 5d). The remaining results were alike between high and low product naturalness subsample, although perceived credibility was generally less positively evaluated in the low versus product naturalness subsample and when claims were the first presented cue (see Figure 5). This trend was evident regardless of cue content. Notably, similar results were obtained when product naturalness (i.e., manipulation check question) was the specified moderator using a median-split approach (Iacobucci et al., 2015).

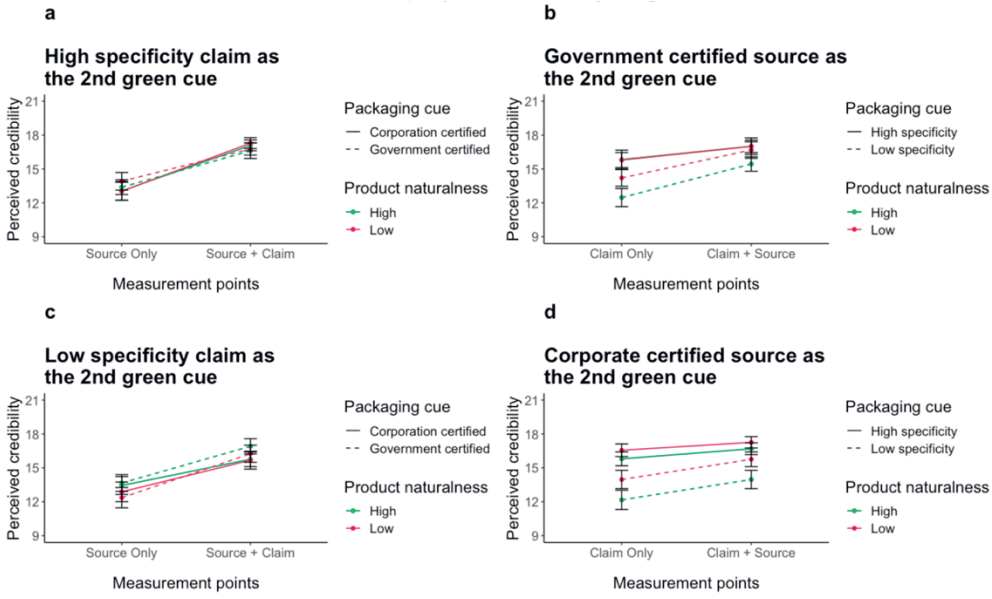

Figure 5. The moderating role of product naturalness in the effect of second cue addition on green information's perceived credibility.

7.4. Consumers' attitudes about green packaged products

Supporting H6, consumers' attitudes about packaged products were significantly and positively influenced by both perceived credibility (β = .32, t = 6.67, p < .001) and sustainability (β = 1.36, t = 10.45, p < .001), explaining a considerable portion of the variance (R^2 = .57, F(4, 541)= 184.1, p < .001).

8. Study 2 Discussion

Study 2 replicated Study 1 findings showing support for the "quality over quantity" argument in the high naturalness subsample. Notably, this reasoning only held when the first piece of processed information was claims. We attribute this finding to differences in informational utility between source and claim cues. While high specificity claims were as effective on their own in communicating credibility and sustainability as they were in combination with source cues, government certified source cues were not. This is because source cues generally provide more ambiguous information than claims (Sundar & Kellaris, 2017), likely carrying less informational utility for consumers. Source cues are therefore more dependent on other green information, even if consumers consider them credible, as evident from our results.

Contrary to our expectations, consumers processed information more peripherally on less natural products. This unexpected finding might have occurred because product naturalness increased the salience of sustainability in consumers' minds, making them deliberately focus on the content of green information. Consequently, consumers were better able to detect nuances in green communication. This finding may explain why Spack and colleagues (2012) found that weak and strong arguments comparably influenced consumer purchasing intentions – because the product used as stimuli (i.e., detergent) is not typically regarded as natural. Hence, the product the green arguments were presented on did not facilitate more deliberate information processing.

Consumers were also generally more positive about green information when presented on more natural products. Earlier work demonstrated that consumers infer less ad deceptiveness and consequently evaluate products more favorably when packaging sustainability improvements are communicated on products whose sustainability ratings are high (Steenis et al., 2022). Whereas this research used explicit ratings to signal products' sustainability, we show that consumers make similar inferences themselves: evaluating the same packaging information more positively when they perceive the accompanying product as more natural.

Finally, high perceived credibility and sustainability of the packaging improved attitudes about the packaged product. Hence, credible green communication appears beneficial for the overall image of the products beyond the established route via perceived sustainability (e.g., Steenis et al., 2022).

9. General Discussion

The rising demand for sustainable consumption highlights the importance of better understanding how consumers use green information to assess product sustainability. This research extends beyond the well-established knowledge that independently used credible cues improve consumer evaluations of packaged products (e.g., Darnall et al., 2018; Jäger & Weber, 2020) to delve into the intricacies of cue interplay. We found that cues appealing to different information processing routes interact in a complementary fashion, supporting the theoretical considerations of ELM (Petty & Cacioppo, 1986). However, the degree of benefit from co-presenting the cues largely depends on perceived credibility of the first processed cue, in line with the "quality over quantity" argument. Within this process, consumers assign more relative weight to centrally processed (i.e., claim) cues than peripherally processed (i.e., source) cues. Indeed, claims contributed more to consumer evaluations, both when independently and co-presented. Nevertheless, involving more rather than fewer cues improved consumer evaluations, irrespective of their credibility. Hence, while consumers generally express lower evaluations of a company's credibility in response to being explicitly informed that the claims they saw were fabricated (Keilmann & Koch, 2023), in practical scenarios, they seem to be less adept at distinguishing and penalizing communication efforts that are inherently less credible. Finally, the influence of packaging cues should not be considered in isolation, as consumers tend to make judgments influenced by both aspects, even when product cues are not explicitly emphasized. Therefore, beyond the format of green packaging information, the means on which this information is delivered is also relevant.

9.1. Theoretical implications

Our research adds to the literature on how green on-package communication affects consumer evaluations (e.g., Schmuck et al., 2018; Steenis et al., 2017). We found perceived credibility of green information to be an important mechanism explaining how green packaging cues exert an effect on consequent judgments about packaged products. We shed additional light on the nature of the cue interaction, whereby a notable caveat lays in the confirmed "quality over quantity" argument. Specifically, the added weight of the second piece of green information depends on the first processed green cue. Hence, introducing additional green cues to an initially highly credible piece of green information minimally improves overall perceived credibility and sustainability evaluations. The need for

additional information search potentially explains these findings, as consumers feel less inclined to search, and by proxy process, additional green information when the first cue is perceived as sufficiently credible. Nevertheless, the quantity of cues also matters as consumers' overall evaluations are more positive when more, rather than less cues are presented.

This study also extends the current knowledge on how product inferences influence evaluations of green packaging information (e.g., Anghelcev et al., 2020; Magnier et al., 2016; Van Doorn & Verhoef, 2011). We demonstrate that green packaging information is evaluated more positively and processed more centrally when presented on products that are perceived as natural. Therefore, we deduce that the relatedness between mental schemas of product naturalness and packaging sustainability (Tobler et al., 2011) inadvertently reinforces positive responses towards green packaging information in a manner that is independent of the information's content. Furthermore, co-activating the naturalness concept with that of sustainability might work as a reminder for consumers to *carefully* inspect green information. This suggests that product naturalness also seems to motivate consumers to process green information more centrally.

9.2. Practical implications

Our research shows that strategic presentation of green communication can counter low credibility information. Specifically, co-presenting green cues enhances sustainability evaluations, mostly if these cues themselves lack credibility. Consequently, companies employing vague or misleading green information may not face substantial negative consequences, as they do not significantly lower consumer evaluations. This provides a strategic advantage for companies seeking to bolster their sustainability image. Additionally, consumers tend to process green information less critically when it is presented on products perceived as having lower naturalness, offering companies another opportunity to mask deficiencies in their green communication efforts. These findings suggest that in markets where less credible green communication strategies are prevalent and consumer perception is the primary driver, genuinely transparent and credible green communication strategies will likely not enjoy a competitive "sustainability" advantage. They also underscore the importance of regulatory measures by governments and policymakers to safeguard consumers against potential misinformation.

There are also implications for green marketeers wishing to increase consumer value of green communications. Claim, rather than source cues, have a stronger influence on credibility, sustainability, and attitude evaluations. Marketeers should therefore capitalize on claims' positive impact by using them to communicate sustainability in a specific and honest manner. However, claims are more cognitively demanding to process and as such, consumers often overlook them (Fogg & Tseng Hsiang, 1999). Marketeers should assure claim visibility to increase the chances of claims being processed first. This can be achieved by using larger fonts or placing the claims centrally on the label, for example. Especially in assortments, marketers should consider the product they display green information on, as it is better received on items perceived as natural. Therefore, natural, or minimally processed foods will likely be more suitable to present green information on.

9.3. Study limitations and future directions

Our research has limitations, as both studies were conducted online. Real-world consumer responses may differ, especially if packaged products were to be presented in assortments whereby consumers could directly compare various formats of green information.

Because of the significance of perceived credibility in consumer sustainability evaluations, future research could explore how different packaging cues, such as typography, imagery, and materials, influence credibility assessments. Their presence (or absence) might work as a positive (or negative) a credibility reinforcer. Furthermore, to best gauge the impact of sustainable labelling on consumer choices, future studies should consider moving beyond using consumer attitudes as a proxy for consumer behaviors. Finally, exploring how consumer traits, such as environmental consciousness, impact green packaging information processing is relevant, as environmentally conscious consumers might scrutinize green packaging information more than others (Ahmed et al., 2021).

10. Conclusions

Communicating product greenness is challenging, considering that most consumers are interested in green products, but somewhat skeptical of the benefits claimed via the labeling. We explored consumers' reactions to green source and claim cue interplay, simultaneously assessing the role of cue order, and product naturalness. Our results suggest

that even though cues interact in a complementary manner, the added weight of the second added cue is contingent on the first processed cue's perceived credibility. Moreover, green information is more positively and more centrally evaluated on products perceived as more natural. Taken together, consumers valued green communication using credible cues on packaged foods but they also: 1) appreciated higher cue quantity, 2) did not penalize communications using low credibility cues, and 3) evaluated green packaging information swayed by product cues.


4

Chapter 4

Is more merrier? Consumers' inferred value of sustainable aspects for plastic food packaging

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Abstract

Research on consumer responses to sustainable food packaging often only compares materials or evaluates one sustainable aspect within a material category at a time. However, sustainability improvements are proliferating and can-co-appear in the packaging design. This study builds upon existing research by identifying and describing the heterogeneity of consumer responses when three sustainable aspects (combinations) of plastic are simultaneously assessed. Bio-based, active technology, and compostable aspects were considered because they improve sustainability at different stages of packaged foods' lifecycle. Using conjoint analysis, model guided segmentation and profiling, we found that consumers' preferences for sustainable aspects vary, and that considering this heterogeneity matters to best understand consumer responses. Differences between the five identified consumer mindsets suggest that ecologically conscious consumers were more likely to prefer sustainable over conventional options and vice versa. These findings underscore the importance of taking consumer diversity into account when introducing sustainable packaging innovations to the market.

Keywords: sustainable, packaging, food, plastic, consumer responses

1. Introduction

Plastic packaging plays an essential role in the current food market. Plastic is durable, versatile, and light. Moreover, it is cheaper, easier, and less polluting to transport than aluminum or glass packaging (Robertson, 2013). The environmental gain of food waste reductions thanks to plastic packaging often exceeds the environmental loss of adding it (Zero Waste Scotland, 2019). Consumers, too, appreciate plastic for its storage convenience and fit with on-the-go lifestyles (Andrady & Neal, 2009). However, the concerns associated with heavy plastic use are growingly dominating the discourse about plastic. Plastics' negative environmental impact is measured in quantities of material's disposal (approximately 300 million tons per year; *United Nations, 2022*), the prevalence in the nature, the amount of fossil fuel needed for production, and the complexity of recycling (Beaumont et al., 2019).

Plastic's negative environmental impact can be decreased by adapting the material's properties. Technological innovation can be used to improve plastic's sustainability at each stage of a packaging's lifecycle, namely, in pre-consumption, during consumption, and post-consumption (*KIDV, 2020*). In the pre-consumption stage, bio-based materials like food by-products can be used to alter plastic's composition (van den Oever et al., 2017). Such plastic types use renewable resources and require less energy for production *(Holland Bioplastics, 2020*). In the consumption stage, sustainability contributions can come from incorporating active technology that extends the product's consumption window (Peelman et al., 2013). Contrary to passive technology which only limits the contact between substances from the environment and the product, active technology has antimicrobial and antioxidant components that eliminate the germs causing food spoilage (Wyrwa & Barska, 2017). Incorporating active technology, hence, entails less food waste. In the post-consumption stage, sustainability contributions come from plastic packaging being compostable, and therefore allowing a circular waste disposal strategy. These plastics decompose in a composting site or at home in a short time, without releasing dangerous substances (e.g. Mostafa et al., 2018; Sintim et al., 2018).

While these packaging aspects may not be groundbreaking from a manufacturing standpoint, their novelty remains distinct in the eyes of consumers due to their limited prevalence in the market (Ruf et al., 2022). This holds particularly true for packaging alternatives that integrate multiple aspects within a single design. Consequently, little is

known about how these three aspects, and their combinations, contribute to consumers' valuation of food products in sustainable plastic packaging. The existing literature has focused on a single aspect at the time: either on the use of bio-based materials, active technology, or compostable plastic packaging. Such a reductionist approach can be problematic as it overlooks the potentially non-additional effects and aspect interdependencies across the life cycle of packaged food products, which are relevant for external validity of the research findings. Hence, an integrative insight considering relevant aspects is needed. To fill this knowledge gap, the present study addressed the following research question:

How, to what extent, and why do combinations of sustainable aspects of plastic resonate differently to (different groups of) consumers in terms of willingness to buy a packaged food product?

This study contributes to the existing literature in three ways. First, it moves beyond focusing on a single sustainable aspect of plastic to recognize and include interactions between sustainable aspects at different stages of the packaging lifecycle. Second, it compares the "one-size-fits-all" approach to appreciating sustainable aspects of plastic with the one in which the heterogeneity across subpopulations of consumers is identified and quantified. And third, it adds to the conceptual understanding of subpopulation differences by linking the identified heterogeneity to differences in desired product related characteristics and individual consumer characteristics.

2. Literature review

Most research on consumer responses to sustainable packaging focused on between-material comparisons. For instance, consumers consider aluminum cans, paper and glass more sustainable than plastic and consequently report preferring products packaged in these materials over products in plastic packaging (e.g. Lindh et al., 2016; Otto et al., 2021; Steenis et al., 2017). Research investigating consumer responses to sustainable aspects within one material category, like plastic, is scarcer and almost entirely focused on assessing a single aspect at a time. The following section synthesizes the literature on

consumer responses to bio-based, active technology, and compostable aspects of plastic packaging.

2.1. Consumer responses to each sustainable aspect

Consumers have mixed feelings about bio-based plastic. Generally, they have limited knowledge and understanding of how bio-based origin improves plastic's sustainability (Carus et al., 2019). However, consumers with environmental knowledge, an interest in sustainability, or a belief that bio-based plastic contributes to closed-loop waste management tend to exhibit favorable attitudes towards it (Delioglamnis et al., 2018; Gaffey et al., 2021; Gill et al., 2020). Negative attitudes, on the other hand, come from consumers' ambivalence and skepticism about bio-based plastic's real environmental benefits (Herbes et al., 2018; Mehta et al., 2021; Sabini et al., 2020), as well as doubt about companies' motives and the degree of material's actual environmental friendliness (Meeusen et al., 2015; Sijtsema et al., 2016). Consumers may also exhibit hesitation towards products in bio-based packaging when they harbor concerns about packaging quality, anticipate higher costs, or when their purchasing and waste disposal habits are incongruent with sustainability (Confente et al., 2020; Ruf et al., 2022; Weinrich & Herbes, 2023). The described findings therefore suggest that the appreciation of bio-based plastic is amplified among consumers with general interest in helping the environment and, vice versa, reduced among consumers who associate liabilities with it. Direct comparisons between bio-based and conventional plastic products paint a more coherent story, revealing that most consumers – regardless of their initially mixed attitudes – have higher purchase intentions for bio-based products, especially when they are fully, rather than partially bio-based (De Marchi et al., 2020; Reinders et al., 2017; Taufik et al., 2019). Furthermore, Delioglamnis et al. (2018) reported that around 41% of European consumers are willing to pay a slight price premium for bio-based products with similar functionality and properties to conventional plastic.

Active, nanotechnology and modified-atmosphere packaging are all similar innovations intended to prolong food's shelf-life in reference to conventionally used, passive technology (Young et al., 2020). Although research on this issue is scarce, some works like the one by Brennan and colleagues (2021) show that such sustainable aspects typically do not influence consumers' satisfaction, as consumers are largely unfamiliar or unaware of them (Loučanová et al., 2019; Young et al., 2020). When specifically

introduced to the concept, positive consumer attitudes stem from acknowledging that increasing sustainability in this way enables more functionality and flexibility to consume food products (Gupta et al., 2015; Pennanen et al., 2015) and can act as an investment in healthier products with higher quality (Wyrwa & Barska, 2017; Young et al., 2020). Others, however, express negative attitudes due to low knowledge about this type of innovation (Siddiqui et al., 2022). Consumers also associate high perceived liabilities with technologies that deal with, or are in close contact with food (Li et al., 2020). Specifically, consumers worry about the impact of technology on health (Pennanen et al., 2015), are concerned about contamination of the food packaged inside (Qian et al., 2021), dislike adding unnatural components to food (López-Vázquez et al., 2012; Sodano et al., 2016), and generally perceive lack of need for such innovations (Aday & Yener, 2015; O' Callaghan & Kerry, 2016a). Moreover, as highlighted by Huang and colleagues (2021), a significant portion of consumer reluctance toward active technology stems from their limited exposure to it. Regardless of these liabilities, consumers' willingness to buy products incorporating this sustainable aspect appears to be either unaffected (Henchion et al., 2019; Zhou & Hu, 2018) or higher (Gupta et al., 2015; Pennanen et al., 2015; Wilson et al., 2018) than for packaging incorporating passive barriers.

Consumer responses to compostable and biodegradable plastics are diverse. On one hand, consumers positively view compostable plastic because they perceive it as enhancing plastic's eco-friendliness (Arboretti Giancristofaro & Bordignon, 2016; Boesen et al., 2019; Herbes et al., 2018). Furthermore, consumers regard compostability as an additional advantage for packaged food products and view it as a significant solution for mitigating pollution caused by conventional plastics (*Ipsos, 2019*; Magnier & Schoormans, 2015). Compostability can also influence product-specific evaluations, as products in compostable packaging were perceived as healthier than those in conventional plastic (Koenig-Lewis et al., 2022). However, consumer reluctance toward compostable plastic is also evident. Confusion about its properties (Otto et al., 2021a) and its limited availability (Molina-Besch & Keszleri, 2023) contribute to this hesitancy. Finally, negative attitudes arise when consumers lack familiarity with the material's properties or have limited understanding of its environmental contribution (Dilkes-Hoffman et al., 2019; Orset et al., 2017). Some consumers favor recyclable materials over compostable ones, perceiving them as more resource-saving (Allison et al., 2021). This suggests that the array of sustainable options for packaged products could be another barrier to consumer interest in compostable

plastic. Nevertheless, direct comparisons between compostable and conventional plastic packaging show that consumers have a higher purchase intent and are more willing to pay a premium for compostable options (De Marchi et al., 2020; Walker et al., 2021). This trend is particularly prominent among environmentally conscious consumers actively striving for sustainable lifestyles (Moshood et al., 2022).

2.2. Consumer responses to multiple sustainable aspects

The three described aspects are clearly not mutually exclusive and can co-appear in sustainable plastic packaging. However, consumers do not always judge sustainable aspects following the "the more the merrier" assumption (Magnier et al., 2016). In several studies, Irwin and Spira (1997) showed that consumers' willingness to pay was lower for car options that included four versus two sustainable aspects. Consumers also expressed higher willingness to pay for food products with fewer sustainable labels (Tebbe & von Blanckenburg, 2018) and desks that were advertised with fewer sustainability features (Jongmans et al., 2014). What makes these findings remarkable is that lower willingness to pay for products incorporating more (versus fewer) sustainable aspects persisted even when each individual aspect in a particular combination was independently highly valued by the consumer (e.g., Irwin & Spira, 1997; Tebbe & von Blanckenburg, 2018). Such evaluation patterns were termed the "embedding effect" by Kahneman and Knetsch, (1992). The phenomenon happens when consumers deem two or more sustainable aspects as lower in value when presented together than separately (Irwin & Spira, 1997).

The embedding effect occurs when consumers assume correlations between different aspects of the product or the service they are evaluating (Irwin & Spira, 1997). For example, Boesen and colleagues (2019) asked consumers to rate sustainability of different sustainable packaging options. The results showed that consumers inferred that bio-based packaging is by default compostable and therefore valued sustainability of these two aspects as complementary, rather than additive. These findings may imply that the increase from one to two sustainable aspects of plastic packaging will not proportionally increase consumers' willingness to buy (WB). Consequently, packaging types that are objectively more sustainable might not be feasible in markets that are solely driven by consumer demand. The present study is the first to examine whether more, versus less, sustainable aspects result in proportionally higher WB in the context sustainable plastic packaging.

2.3. Understanding consumer responses

The existing literature explored how consumer responses to each sustainable aspect differ due to various individual product related characteristics and consumer characteristics. Most often, consumers with higher sustainability knowledge also valued sustainable aspects more (e.g., Herbes et al., 2018; Kainz, 2016; Koutsimanis et al., 2012) and vice versa (Allison et al., 2021). Hence, a positive relationship between consumer knowledge and appreciation of sustainable packaging aspects can be expected. Positive consumer attitudes towards sustainable aspects can also be expected from consumers whose general attitudes towards the environment are positive (e.g., high waste reduction involvement, see Altintzoglou et al., 2021) and those who associate benefits with sustainable aspects (for a systematic review, see Young et al., 2020). In contrast, certain characteristics of the products, as well as individual consumer characteristics can deter consumers from accepting sustainable plastic aspects, thereby contributing to negative attitudes towards alike sustainable innovations. Concretely, consumers who associate liabilities with sustainable aspects of plastic packaging are more likely to report dislike of it. Limited convenience in terms of lack of physical opportunity to purchase and correctly dispose sustainable plastic (Allison et al., 2021), reduced naturalness and healthiness (e.g., O' Callaghan & Kerry, 2016b), as well as higher price (Pennanen et al., 2015) are some of the notable liabilities consumers previously expressed about sustainable aspects in question. The present study builds on these constructs to understand why and to which extent differences in preferred product related characteristics as well as consumers' individual characteristics can explain the value consumers associate with the three sustainable aspects (combinations) of plastic.

3. Materials and Methods

3.1. Study Design

The study collected data in 2020, funded by the EU Horizon 2020 Grant (H2020-SFS-2017-1). The broad focus of the project was understanding European consumers in the context of food sustainability. Using three waves of separate surveys, consumers' attitudes, and intentions towards sustainability in general (wave 1 and 2), as well as towards sustainable plastic packaging for food (wave 3) were measured. To procedurally control for the potential of common method bias, the waves of data collection were separated by a

couple of weeks (Podsakoff et al., 2003). To answer the part of our research question regarding how and to what extent do different combinations of sustainable aspects of plastic resonate differently to (different groups of) consumers in terms of willingness to buy, a task in wave 3 of data collection was introduced. The task involved asking the consumers to imagine they were buying a fresh food product packaged in plastic ("Imagine that you are in the supermarket going to buy a fresh food product"). Although the product category itself was not specified, it had to be fresh food (i.e., not dry) to ensure all three sustainable aspects could be similarly relevant for consumers. Next, respondents were shown, in random order, eight packaging options, composed by a combination of (un)sustainable aspects (see section 3.2 for the details). For each packaging option they were asked how willing they would be to buy it. To address the part of the research question regarding why combinations of sustainable aspects for plastic resonate differently to consumers, consumer answers from wave 1 and 2 of data collection were used. Here, consumers answered questions about their own individual characteristics and desired product related characteristics. The study was approved by the university's Social Sciences Ethics Committee.

3.2. Stimuli

Sustainable packaging aspects. Three sustainable packaging aspects were manipulated across two levels, aligned with distinct stages of the packaging lifecycle targeted for sustainability enhancement. Specifically, the manipulated packaging aspects corresponded to the:

1. Pre-consumption stage: through it being bio-based or non-bio-based,
2. Consumption stage: through inclusion of active or passive technology, and
3. Post-consumption stage: through it being compostable or non-compostable.

By incorporating or omitting these three aspects, we designed a trade-off scenario to evaluate consumers' preferences for distinct combinations of sustainable features. This was achieved using a systematic within-subjects experimental design known as conjoint analysis. The aspects were combined in a 2^3 full factorial design. Figure 1 shows the eight packaging combinations which were presented to consumers as descriptions. A short explanation of each packaging aspect was also provided (Appendix A contains the exact information consumers received).

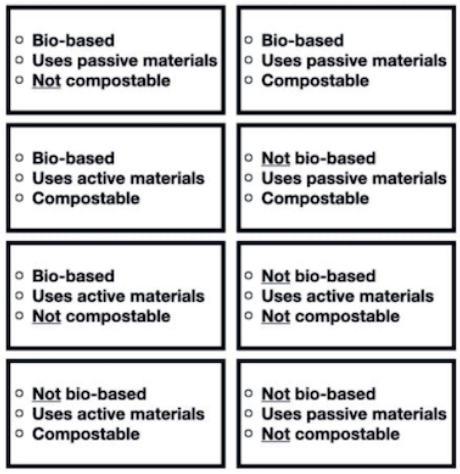

Figure 1. The eight evaluated packaging options.

3.3. Participants

Quota samples of consumers from Denmark, France, Hungary, The Netherlands, Portugal, Spain, and Turkey were obtained in three data collection waves via a recruitment agency[6]. The countries were selected to gain diverse consumer perspectives from a wide geographical and socio-cultural spread across Europe. Each country's sample was intended to match its current socio-demographic makeup, provided that there were enough participants to fulfil the eligibility criteria, which was to shop for food at least once a week. Fifty-two consumers (across all countries) showed no variance in their evaluations of the packaging combinations and were thus excluded, leading to the final sample of 1341 consumers. The overall and per country sociodemographic distribution of these consumers is presented in Table 1. The Turkish sample is underrepresented due to difficulties reaching these consumers online in the second and third wave of data collection.

[6] In wave 1, 7044 consumer responses were collected (DR = 1000, FR = 1002, HU =1002, NL = 1001, PT = 1009, ES = 1016, TK = 1014). In wave 2, a subsample of the consumers was invited to participate until the established quotas were reached, resulting in the overall consumer sample of 3267 (DR = 500, FR = 502, HU = 500, NL = 500, PT = 504, ES = 501, TK = 257). In wave 3, the quotas were further reduced to 200 participants per country. Since the evaluation of packaging solutions was included in wave 3, only a subsample of consumers who fully completed all three survey parts in due time were considered for the analysis in the study. The final sample composition is described in Table 1.

	Overall *N*=1341	DR *N*=195	FR *N*=195	HU *N*=208	NL *N*=205	PT *N*=209	ES *N*=216	*TR* *N*=100
Gender (χ^2 = 9.94, *df* = 6, *p* = .127)								
Female	42.4%	44.9%	38.9%	45.7%	45.4%	47.4%	40.7%	33%
Male	57.6%	55.1%	61.1%	54.3%	54.6%	52.6%	59.3%	67%
Age (*F* (1, 1339) = 18.46, p < .001)								
	47.9 (16.1)	48.5 (16.9)	50.8 (15.8)	46.1 (15.9)	52.3 (18.1)	47.5 (15.1)	46.7 (14.2)	38.4 (11.6)
Education (χ^2 = 268.4, *df* = 12, *p* < .001)								
Low	7.9%	12.3%	12%	2%	20.1%	2.4%	1.4%	2%
Medium	43.3%	39.5%	51.9%	63.9%	32.6%	40.2%	15.7%	77%
High	48.8%	48.2%	36.1%	34.1%	46.3%	57.4%	82.9%	21%
Income (χ^2 = 421.41, *df* = 18, *p* < .001)								
Low	32.3%	60.5%	53.8%	12%	23.4%	38.8%	9.7%	28%
Medium	37.7%	20.1%	35.1%	9%	46.4%	30.1%	63.4%	35%
High	18.7%	4.6%	1.4%	52.4%	14.1%	16.3%	15.3%	33%
Unknown	11.3%	12.8%	9.7%	6.7%	16.1%	14.8%	11.6%	4%

Table 1. Consumer demographics for each country.

Note. Country abbreviations in order presented in table: Denmark (DR), France (FR), Hungary (HU), The Netherlands (NL), Portugal (PT), Spain (ES) and Turkey (TR).

3.4. Measures

3.4.1. Product related characteristics.

Willingness to buy (WB). Consumers rated the statement "I would like to buy this product" for each packaging combination on a 7-point Likert scale, resulting in eight ratings per consumer.

Perceived Liabilities. Consumers rated perceived liabilities of food products in sustainable plastic packaging in terms of safety, price, and convenience, and relative to conventional plastic packaging. The included liabilities were based on considerations of a consumer panel from the earlier stages of the project. Seven statements (e.g., "A fresh food product packed in plastic material which is bio-based, compostable, and employs antimicrobial and antioxidant component (i.e., active technology) would be less safe to eat than food packaged in conventional plastic packaging") were measured on a 7-point Likert scale, $\alpha = .78$.

Perceived Benefits. Consumers compared the benefits of food in sustainable versus conventional plastic packaging with 12 items measuring attributes like freshness and environmental friendliness (e.g., "A fresh food product packed in plastic material which is bio-based, compostable, and employs antimicrobial and antioxidant component (i.e., active technology) would be fresh for longer than food packaged in conventional plastic packaging") on a 7-point Likert scale, $\alpha = .80$. Like the case of perceived liabilities, perceived benefits were derived from a consumer panel in earlier stages of the project.

Availability. Consumers indicated how readily available food packaged in plastic that was bio-based, using active technology, and compostable was to them. Three statements (e. g. "How easily do you believe you could acquire foods packaged in this kind of material?") were measured on a 7-point scale ranging from "Not at all easy" (1) to "Very easy" (7) (Vermeir and Verbeke, 2006). The reliability of this scale was high, $\alpha = .87$.

3.4.2. Individual consumer characteristics

Demographic variables. Consumers' gender, age, nationality, education, and income were recorded. Except for age, measured on interval scale, the measures were

categorical in nature. Income was categorized according to each country's average Gross Domestic Product.

Food choice motives. To assess important food choice motives, a 13-item version of the food choice questionnaire (Steptoe et al., 1995) was adopted. Initial constructs were identified through Exploratory Factor Analysis (EFA) using suitable data (KMO = .90, Bartlett's test of sphericity: $\chi 2 = 6020.89$, $df = 78$, $p < .001$). Three constructs emerged: naturalness, convenience and appeal, and practicality (see Appendix D for rotated EFA results). A Confirmatory Factor Analysis (CFA) supported the proposed measurement model, with Comparative Fit Index = .91 and Tucker-Lewis Index = .89. The Root Mean Square Error of Approximation (RMSEA) was .07 (90% CI: .07-.08) and therefore acceptable. The three constructs showed inter-correlations, resulting in factor loadings beyond -1, 1 range. Specifically, for naturalness, factor loadings ranged from 1.00 to 1.16; convenience and appeal from .95 to 1.1; and practicality from .79 to 1.15. Subsequently, items like "To me it is important that the food I buy is as natural as possible" were used to measure naturalness (5 items, $\alpha = .83$). Convenience and appeal were measured with five items, e.g., "To me it is important that the food I buy is convenient to prepare" ($\alpha = .75$). Practicality was measured with three items, e.g.: "To me it is important that the food can be stored for a long time at home" and was slightly lower in reliability ($\alpha = .58$). All items were measured on a 7-point scale ranging from "Not at all important" (1) to "Extremely important" (7).

Waste reduction involvement was measured by tapping into the behavioral frequency of consumers' resource saving purchases, reduction of food spoilage and waste handling efforts using Roberts (1996) scale. Items like "Whenever I can, I use a compost at home or in some way compost some of my household trash") were measured on a 6-point scale ranging from "Never" (1) to "Always" (6), $\alpha = .79$.

Responsibility for the environmental decline. Consumers rated statements about whether they believed food individual and societal-level consumption practices contributed to the global environmental decline. The measure distinguished between individual consumer responsibility (e.g., "An individual person can make a difference in the sustainability of our food consumption by carefully selecting the food products.") and societal responsibility (e.g., "The government is responsible for the impact of our food

consumption on the environment."), using 1 and 2 items respectively and measured on a 7-point Likert scale.

Subjective knowledge of waste disposal practices. Consumers' endorsement of three statements related to subjective knowledge of recycling and selecting more ecological product-packaging (e.g., "I know how to select packages that reduce the amount of waste ending up in landfills") was measured on a 7-point Likert scale (α = .81). The items were adapted from Ellen (1994).

3.5. Data analysis

To answer how and to what extent combinations of sustainable plastic aspects resonated differently to consumers in terms of WB a packaged food product, two approaches were utilized. Specifically, the "one-size-fits-all" approach was compared with the one in which consumers' appreciation of sustainable plastic is identified and quantified across different subpopulations of consumers based on the sustainable aspect (combination) in question. The "one-size-fits-all" approach was assessed with an aggregate regression model for the entire consumer sample. Both approaches entailed creating consumer mindsets that were based solely based on variations in the constellation of the objective design aspects of the packaging. Therefore, willingness to buy was defined as a dependent variable, and the three sustainable aspects of plastic and combinations thereof were specified as model predictors.

The second approach investigated whether distinct consumer mindsets would emerge in response to different sustainable aspect (combinations) using latent class finite mixture models (Mclachlan et al., 2019). Here, the same regression model as the one in the aggregate model was specified. The utility of each aspect and its combinations, as well as consequent group membership were estimated in one step, using an R-based package Flexmix (Green et al., 2001; Leisch, 2004). To maximize model accuracy, 1200 iterations were used. The AIC, BIC and ICL fit criteria for cluster solutions were used as an indication of how many consumer mindsets best represented the heterogeneity in the data. Individuals were then assigned to the mindset for which they had the highest posterior probability. In other words, consumers were grouped based on their similarity in beta weights associated with each sustainable aspect (combination) of plastic packaging. Both models were fit according to the equation:

$$WB = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_1 X_2 + \beta_5 X_1 X_3 + \beta_6 X_2 X_3 + \beta_7 X_1 X_2 X_3$$

Prior to answering why combinations of sustainable plastic aspects reasoned differently with consumers, data had to be pre-processed. Composite scores were created for the scales whose structure was determined by the existing literature or considerations that arose from the consumer panels. In the case of food motives scales, constructs were first inspected using Exploratory Factor Analysis (EFA), and the proposed measurement model was consequently evaluated using Confirmatory Factor Analysis (CFA). Furthermore, single factor test indicated there was no Common Method Bias in the data. [7] Product related characteristics and consumer characteristics that were measured on continuous scales were then mean-centered per consumer to account for individual response tendencies (Grunert, 2019) and to allow between variable comparisons. Consequently, analysis of variance (ANOVA) was used to interpret the variations between the emerged consumer mindsets, all of the continuous variables used being normally distributed (see Appendix C). If the criterion of homogenous variance was met, differences between consumer mindsets were explored with ANOVA and Tukey post-hoc tests. Otherwise, Kruskal Wallis and Wilcoxon pairwise tests with false discovery rate p correction for post-hoc analyses were used.

4. Results

4.1. Consumers' overall appreciation of sustainable aspects

Table 2 summarizes the results of the aggregate model (first column), as well as model solutions for each identified consumer mindset. On the aggregate level, including either bio-based or compostable aspects increased consumers' WB, as evident from higher coefficients representing the inferred value associated with them. Insignificant interaction terms, except for the small negative coefficient associated with the interaction between bio-

[7] To examine whether Common Method Bias was present in the data, Harman's (1967) single factor test was used. Accordingly, all variables used to measure product and consumer related characteristics were restricted to a one-factor solution and interpreted using Principal Component Analysis (PCA), followed by Confirmatory Factor Analysis (CFA). According to the PCA, the one-factor solution accounted for only 16 % of the variance. The same model, when assessed using CFA, indicated unacceptable model fit (Comparative Fit Index = .33 and Tucker-Lewis Index = .30. The Root Mean Square Error of Approximation (RMSEA) was .10 (90% CI: .09-.10). Together, these results suggest Common Method Bias was not a problem in the data.

based and active technology aspect, suggested that the combinations of sustainable aspects did not significantly increase WB. The “one-size-fits-all” solution therefore indicated that consumers derived moderate value from sustainable than conventional aspects, and only when sustainability improvements are bio-based or compostable.

Table 2. Per mindset aspect coefficients for standardized willingness to buy (WB).

Packaging attribute	**Aggregate Model**	Mindset 1 "Active-tech rejectors"	Mindset 2 "Indifferent"	Mindset 3 "Bio-compost favoring"	Mindset 4 "Bio-based favoring"	Mindset 5 "Compost favoring"
	n=1341	*n*=210	*n*=515	*n*=136	*n*=251	*n*=229
	100%	15.7%	38.4%	10.2%	18.7%	17.01%
Intercept	**-.65*** **	-.19***	-.30***	-1.43***	-.97***	-1.08***
Bio-based	**.66*** **	.64***	.29***	1.74 ***	1.01***	.56***
Active Technology	**.02**	-1.12***	.37***	.04	.11	.12
Compostable	**.65*** **	.64***	.17**	1.62***	.60***	1.36***
Bio-based x Active Tech	**-.11***	.35**	-.49***	-.01	.11	.07
Bio-based x Compostable	**.06**	.06	.01	-.92***	.54***	.17
Active Tech x Compostable	**-.05**	.34*	-.22*	-.05	-.21	.18
Bio-based x Active Tech x Compostable	**.04**	-.58**	.50***	-.08	.03	-.38***
Adjusted R^2	**25%**	55.6%	3.7%	86.3%	73%	71.9%

Note. Sustainable aspect coefficients and significance levels for each consumer mindset. Intercepts represent mean WB per mindset when all predictors are set to 0, i.e., in the absence of bio-based, active technology and compostable aspects. *$p < .05$, ** $p < .01$, *** $p < .001$.

4.2. Identifying heterogeneity in consumers' appreciation of sustainable aspects

Identifying and quantifying heterogeneity of consumer responses significantly increased the goodness of model fit compared to the aggregate model, as seen from AIC, BIC and ICL values. The same was evident from adjusted R^2 values, whereby the aggregate model explained significantly less variance in consumers' WB than the segmented solution. Heterogeneity of consumer responses was best represented with five distinct consumer mindsets (see Table 2). The first mindset (15.7% of all consumers) was most notable for being strongly opposed to active technology as the only sustainability improvement to the packaging. We named this mindset "Active-tech rejectors". The most frequent mindset (38.4%) consisted of consumers who expressed mild appreciation for each sustainable aspect. However, the explained variance within this mindset showed that consumer responses did not meaningfully fluctuate with the sustainable aspects in the study design. Thus, this mindset was characterized as "Indifferent" consumers. Mindset 3 (10.2%) was termed "Bio-compost favoring" due to similar importance consumers assigned to packaging sustainability at the pre- and post-consumption stage. The same logic was applied in the naming of Mindset 4 (18.7%) as "Bio-based favoring", and Mindset 5 (17.01%) as "Compost favoring", for the highest relative importance given to the biobased and composting aspects.

Most consumers showed appreciation for sustainable aspects of plastic in the pre- and post-consumption stage. The degree of importance of the bio-based aspect was heterogeneous across consumer mindsets, ranging from small to considerable increases in WB. Similar small to considerable increases in WB were noted when the sustainable improvement stemmed from the compostable aspect. The least heterogeneity in consumers' WB was observed when the sustainability of the packaging was facilitated through active technology. Aside from the first consumer mindset, whose WB decreased for packaging options incorporating active (vs. passive) technology, consumers in the remaining mindsets agreed with each other: active packaging technology was unimportant for their WB.

Combining more sustainable aspects in one packaging design impacted consumers' WB, albeit not in the magnitude that would support the "the more the merrier" hypothesis. The interactions across consumer mindsets showed that aspect combinations were less important for consumers' WB than one salient aspect alone. In fact, for one consumer mindset, the combination of the bio-based and compostable aspect resulted in

lower WB than for conventional plastic, even though each aspect independently had a positive effect on WB. For other mindsets, combinations of bio-based and compostable aspects were valued less in terms of WB than they were independently. The remaining interactions offer less relevant insight for "the more the merrier" hypothesis, as they include active technology. Because the presence of active technology on its own influenced WB negatively or insignificantly, we could not fully deduce if interactions involving this aspect suggest that consumers did not value active technology in any packaging combination altogether, or because more was simply *not* merrier.

4.3. Understanding consumer response heterogeneity

To understand the nature of consumer heterogeneity deeper, the resulting mindsets were first characterized and explored in terms of demographic characteristics. Demographic differences were modest: small effect sizes for nationality ($\chi^2(23, N = 1341) = 76.24$, $p < .001$, $\varphi = .12$) and education level ($\chi^2(12, N = 1341) = 48.29$, $p < .001$, $\varphi = .11$), and insignificant effects for gender, age, and income level. Overall, demographic variables did not meaningfully explain differences between consumer mindsets.

Consumer mindsets could, however, be characterized in terms of desired product characteristics and individual consumer characteristics (see Table 3). Consumers who expressed considerably more value for bio-based and (or) compostable aspects than for conventional plastic (i.e., Mindset 3, 4 and 5) recognized more benefits and less liabilities associated with sustainable plastic packaging in general. Vice versa, consumers who were active-technology averse or indifferent towards sustainable aspects of plastic (i.e., Mindset 1 and 2) perceived the opposite: less benefits and more liabilities associated with sustainable plastic. Individual characteristics of consumers were in line with this division. Higher scores for subjective knowledge, waste reduction involvement, value of naturalness in food products and acceptance of individual responsibility for the environmental decline were noted among consumers who expressed higher value for sustainable aspects of plastic than the conventional packaging. The highest scores were observed in the "Bio-compost favoring" mindset, while similar, but weaker trends were observed in "Bio-based favoring" and "Compost favoring" mindsets. The remaining two mindsets scored below sample average on these constructs. All measured individual characteristics were at their lowest in the "Indifferent" mindset, which was most populated and consisted of consumers without a clear value for any sustainable aspect (combination) in question. Lastly, and in contrast to

previous findings in the literature, other measured product, and individual consumer characteristics (i.e., food choice motives relating to practicality and convenience, appeal of the packaging, social responsibility for the environmental decline, and availability of sustainable plastic packaging) did not significantly differ between consumer mindsets.

Table 3. Product-related and individual consumer characteristics that presented significant between mindset differences.

	Mindset 1 "Active-tech rejectors" *n*=210 15.7%	Mindset 2 "Indifferent" *n*=515 38.4%	Mindset 3 "Bio-compost favoring" *n*=136 10.2%	Mindset 4 "Bio-based favoring" *n*=251 18.7%	Mindset 5 "Compost favoring" *n*=229 17.01%	*F* (4, 1336)	*η2*
Perceived Liabilities	.14a***, b***	.21c***, d***, e***	-.38a***, c***	-.24b***, d***	-.12e***	17.03	.05
Perceived Benefits	-.08a*, c**	-.18b***, d***, e**	.22a*, b***	.23c**, d***	.10e**	10.56	.03
Subjective Knowledge	.08	-.17a*, b*	.12a*	.12b*	.10	3.93	.01
						χ^2 (4)	*η2*
Waste Reduction Involvement	.03a*, b*	-.22a*, c***, d***, e***	.25b*, c***	.16d***	.13e***	40.01	.03
Naturalness	.001	-.18a**, b***, c*	.20a**	.18b***	.07c*	26.62	.02
Individual Responsibility	-.001a*	-.12a*, b*, c**	.17b*	.13c**	.04	19.36	.01

Note. Coefficients with the same letters within rows (between columns) indicate significant differences between consumer mindsets. *$p < .05$, ** $p < .01$, *** $p < .001$.

5. General Discussion

Our findings demonstrate that consumers hold a moderate level of appreciation for bio-based and compostable aspects, while active technology and combinations of aspects did not surpass the perceived value of conventional plastic options (equivalent to the option with the absence of these aspects). These results not only corroborate the generally positive consumer attitudes observed in previous studies (Ruf et al., 2022; Otto et al., 2021; Young et al., 2020), but additionally, they underscore the importance of considering the diversity of sustainable aspects, as multiple sustainable aspects are increasingly likely to coexist in packaging designs. We also showcased that a more comprehensive understanding of consumers' valuation of sustainable plastic aspects can be achieved by accounting for the heterogeneity of their responses. By identifying five distinct consumer mindsets within our sample, each exhibiting differing levels of appreciation and aversion towards the three aspects and/or their combinations, we emphasize the significance of tailoring communication strategies to specific target audiences. This highlights that the communication of sustainable aspects is not only about what is communicated but also about who it is communicated to (Kreuter & Wray, 2003). Subsequent sections delve into the nuanced examination of consumers' responses to each individual aspect and combination.

Irrespective of the consumer mindset they aligned with, our findings highlight a considerable likelihood that bio-based plastic holds greater value than conventional, non-bio-based alternatives for most consumers in the market. This observation is in line with previous research suggesting that consumers show strong purchase intentions and occasional willingness to pay premiums for bio-based products (Delioglamnis et al., 2018; De Marchi et al., 2020; Reinders et al., 2017). Notably, the extent to which consumers attributed value to the bio-based aspect varied among individuals and was most pronounced within the “Bio-compost favoring” and “Bio-based favoring” mindsets. Simultaneously, these mindsets were characterized by the strongest tendency to engage with sustainable practices in daily life, as evident from their above-average consumer related characteristics. This includes their active participation in waste reduction initiatives and heightened subjective understanding of sustainability. Therefore, bio-based plastic packaging likely carries a particularly strong appeal for sustainability-oriented consumers.

Consumers lacked appreciation for active technology as a packaging aspect worth higher willingness to buy (WB) beyond what is seen with conventional, passive technology. In fact, active technology in plastic packaging reduced WB for some, indicating that a segment of consumers in the market might resist solutions that technologically extend food's shelf life. Consumers were similarly reserved in prior studies when evaluating packaging options incorporating nanotechnology (Gupta et al., 2015; Sodano et al., 2016) or smart technology (O'Callaghan & Kerry, 2016). These reservations were linked to perceived compromises in food quality and safety (Pennanen et al., 2015), as well as the overall perceived lack of reliability and performance of such technologies (Gupta et al., 2015). Moreover, active technology held little relevance for consumers in packaging designs integrating other sustainable aspects, possibly because the mere presence of active technology lacked salience in general. However, an exception was identified within the "Active-tech rejectors" mindset, where aversion towards active technology transformed into appreciation when combined with either a bio-based or compostable aspect. This intriguing shift implies that the "the more the merrier" concept only yields a positive effect on consumers' WB when one of the two sustainable aspects independently reduces WB. Bio-based and compostable aspects might have been effective in this regard because they embody more natural solutions that could decrease consumers' hesitation toward the "artificial" active technology (Henchion et al., 2019). Considering these insights, it is advisable for managers and policymakers not to anticipate that active technology will serve as a distinct driver of consumer preference for sustainable plastic packaging. Hence, advertising campaigns should be cautiously designed, avoiding the expectation that active technology alone will significantly boost WB.

Compostable plastic, on the contrary, holds the potential to increase consumers' WB of sustainably packaged food products. Each observed consumer mindset demonstrated a greater appreciation towards compostable rather than non-compostable plastic packaging, aligning with previous research (e.g., Allison et al., 2021; De Marchi et al., 2020; Orset et al., 2017). The extent to which consumers valued compostable plastic varied across mindsets, mirroring the pattern observed for bio-based plastic evaluations. The highest valuation was found among consumers strongly favoring compostable plastic ("Compost favoring" mindset) and those equally valuing bio-based and compostable plastic ("Bio-compost favoring" mindset). Analyzing individual characteristics of these consumers revealed that those predominantly oriented towards compostable plastic were showing

moderate engagement with sustainability in their daily lives. For example, their subjective knowledge of sustainability and involvement in waste reduction activities were notably lower compared to the consumers in the "Bio-compost favoring" mindset. This suggests that the exclusive focus on compostable plastic might stem from consumers who appreciate sustainability advancements in the food market but are less proactive about engaging with sustainable practices themselves.

Across all five mindsets, consumers consistently assigned no higher value to packaging combinations featuring two aspects together compared to those incorporating a single aspect. This observation held true even when these combinations included aspects that were individually highly valued by consumers, such as the packaging incorporating both bio-based and compostable elements. Similarly, the inclusion of all three sustainable aspects had minimal impact on consumers' willingness to buy (WB) in comparison to fully conventional plastic design. This phenomenon aligns with the embedding effect (Kahneman & Knetsch, 1992), suggesting that the combined sustainable aspects hold less value for consumers than their individual counterparts (Popkowski Leszczyc et al., 2008). Contrary to the "the more the merrier" hypothesis, these findings therefore provide empirical evidence that this approach does not hold in the context of sustainable plastic packaging. Regardless of consumers' desired product and individual characteristics, packaging highlighting a single aspect proved more attractive than packaging combining multiple aspects, at least when explicitly communicated. Thus, our results caution against the assumption that emphasizing numerous sustainable aspects on a label would serve as a competitive advantage over conventional plastic packaging. Instead, consumers appear to be guided by the "less is more" principle when evaluating sustainable plastic packaging.

Finally, our findings support prior research by establishing that environmental concern, beliefs, and past behaviors can indeed have a spillover effect on other sustainable contexts (e.g., Truelove et al., 2014) – including the appreciation of sustainable aspects within plastic packaging for food. We noted a relationship between the strength of these attitudes and behaviors and consumers' varying valuation of aspects. Specifically, heightened engagement in waste reduction activities was aligned with a stronger appreciation for aspects that supported the notion of circular economy, whereas limited familiarity with sustainability translated to a diminished regard for sustainable aspects as a whole. Interestingly, demographic variables could minimally explain differences in consumers'

appreciation of these sustainable aspects, implying that the consumer mindsets were independent of factors such as age, gender, education, nationality, or income.

5.1. Study limitation and avenues for future research

Our study was limited to packaging evaluations of vignettes explaining main features of each aspect to ensure consumers responded to the aspects themselves. While this may be a good start in assessing initial consumer responses, real consumer decision-making takes part in far more dynamic environments. Future research should explore the idea of using actual packaged food products as stimulus material and introducing other relevant decision-making aspects like price, logos or verbal claims (Jerzyk, 2016; Magnier et al., 2016; Rokka & Uusitalo, 2008). Furthermore, assessing consumer behaviors in real environments of interest like supermarkets could help understand the degree of intention-behavior gap in this domain of research. Finally, our research took the initial step of describing the emerged consumer groups using variables that were identified as relevant from previous research studying sustainable innovations. Future research efforts could benefit from a more systematic approach of organizing these variables, using the (Hofstede (2006) cultural dimensions paradigm, for example.

6. Conclusions

In conclusion, our study underscores the importance of recognizing the diversity of consumer preferences, encouraging targeted communication strategies, and cautioning against assuming that emphasizing multiple sustainable aspects will necessarily enhance consumer preference. More concretely, consumers demonstrate an affinity for either sustainability in the pre- or post-consumption stages of packaged products' life cycle. At present, it seems plausible to consider communication strategies that focus on either of the aspects, rather than attempting to address both simultaneously. At the same time, consumers are not enthusiastic about sustainability innovations during the actual consumption phase. Therefore, educating consumers about the environmental promise of sustainable improvements during the consumption phase could potentially unlock the true potential of such solutions over the long term. These findings have practical implications for packaging designers, marketers, and policymakers seeking to effectively convey the

value of sustainable plastic packaging in a way that resonates with consumers and aligns with their preferences.

Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, [M.M.], upon reasonable request.

Appendix A

Packaging Attribute Descriptions

Bio-based: A ‘bio-based’ material or product is (partly) derived from renewable material, e.g., from food industry by-products, and not from fossil resources as crude oil.

Compostable: This means, that the material can decompose in a relatively short time (usually in about 12 weeks) in a composting site. During the process, the material does not release dangerous substances or changes the quality of the produced compost.

Technology to preserve the food for longer: Passive barriers and active materials are incorporated as part of the packaging material to increase the shelf life of a food product.

- Passive barrier layers in the packaging material prevent substances as oxygen from the environment to enter the pack and keep the product from spoiling fast.
- Active materials prevent oxidation of the food (antioxidative properties) and/or kill germs which cause foods to ‘go off’ (antimicrobial properties).

Appendix B

Scale Measurement				
Construct	Response scale	Item(s)	α	Scale/Item origin
Perceived Liabilities	7-point (Completely (dis)agree)	When comparing foods in plastic material which is bio-based, compostable, and employs antimicrobial and antioxidant components with foods packaged in conventional plastic, please indicate to what extent do you agree with the following statements. A fresh food product packaged in [sustainable plastic description] … 1. … would be more dangerous for my health… 2. … would be less unnatural. (R) 3. … would not be more harmful to people who eat it. (R) 4. … would be less safe to eat. 5. … would harm the environment more by introducing toxic products to the soil. 6. … would have a higher bacterial risk. 7. … would have too much technology in it.	.75	Self-constructed, derived from a consumer panel *ICC=.296*

Perceived Benefits	7-point (Completely (dis)agree)	When comparing foods in plastic material which is bio-based, compostable, and employs antimicrobial and antioxidant components with foods packaged in conventional plastic, please indicate to what extent do you agree with the following statements. A fresh food product packaged in [sustainable plastic description]… 1. …would be kept fresh for longer. 2. … would be a fresher product. 3. … would be easier to dispose of. 4. … would be more convenient/easier to transport and store at home. 5. … would be more nutritious. 6. … would have a more altered taste. (R) 7. … would be more delicious. 8. … would be less affordable. (R) 9. … would be more environmentally friendly. 10. … would not help more to reduce wasting of valuable resources. (R) 11. … would help more to reduce the amount of plastic waste. 12. … would help more to reduce the amount of food wasted.	.80	Self-constructed, derived from a consumer panel *ICC=.451*

Availability	7-point scale (Not at all to extremely easy)	How easily do you believe… 1. … you could acquire foods packaged in this kind of material? 2. … you could find foods packaged in this kind of material in your neighborhood? 3. … foods packaged in this kind of material are available to you?	.87	Adapted from Vermeir & Verbeke (2006 & 2008) *ICC=.694*
Naturalness	7-point (Not at to extremely important)	To me it is important the food I buy … 1. … keeps me healthy. 2. … is packaged in an environmentally friendly way. 3. … gives little waste. 4. … is as natural as possible. 5. … has undergone minimal processing.	.83	Adapted from Steptoe et al. (1995) *ICC =.494*
Convenience & Appeal	7-point (Not at to extremely important)	To me it is important the food I buy … 1. … is convenient to prepare. 2. … is convenient to store. 3 … looks nice. 4. … is what I normally eat. 5. … is well-known.	.75	Adapted from Steptoe et al. (1995) *ICC= .381*
Practicality	7-point (Not at to extremely important)	To me it is important the food I buy … 1. … can be stored long at home. 2. … is tasty. 3. … is not expensive.	.58	Adapted from Steptoe et al. (1995) *ICC = .316*

Waste Reduction Involvement	6-point (Never-Always)	Whenever I can, I… 1. Sort trash at home. 2. Use a compost at home or in some way compost some of my household trash. 3. Use a recycling center or in some way recycle some of my household trash. 4. Try to buy products that can be recycled. 5. Make a conscious effort to limit my use of products that are made of / use scarce resources. 6. Buy toilet paper made from recycled paper. 7. Buy products made from renewable resources. 8. Make an effort to store my foods in a way that they are not spoiling quickly. 9. Inform myself about the optimal storage of my food so they keep fresh as long as possible.	.79	Adapted from Thøgersen & Ölander (2002), Roberts (1996) *ICC =.289*
Individual responsibility	7-point (Completely (dis)agree)	To what extent do you agree with the following statement? 1. An individual person can make a difference in the sustainability of our food consumption by carefully selecting the food products.		Self-constructed

Social responsibility	7-point (Completely (dis)agree)	To what extent do you agree with the following statements? 1. The government is responsible for the impact of our food consumption on the environment. 2. Food companies are responsible for the impact of our food consumption on the environment.	.62	Self-constructed *ICC = .452*
Subjective sustainability knowledge	7-point (Completely (dis)agree)	To what extent do you agree with the following statements? 1. I know more about recycling than the average person. 2. I know how to select products that reduce the amount of waste ending up in landfills. 3. I know how to select packages that reduce the amount of waste ending up in landfills.	.81	Adapted from Ellen (1994) *ICC=.581*

Appendix C

Variable	Mean	*SD*	Skewness	Kurtosis
Perceived Liabilities	25.90	5.55	.20	.96
Perceived Benefits	56.64	9.03	-.15	.73
Availability	12.17	4.05	-.19	-.30
Naturalness	28.42	4.47	-.62	.23
Convenience & Appeal	26.13	4.34	-.27	.27
Practicality	16.92	2.55	-.39	-.16
Waste reduction involvement	37.22	7.22	-.5	.15
Individual responsibility	5.49	1.34	-.99	.99
Social responsibility	10.58	2.29	-.57	.47
Subjective knowledge of waste disposal practices	14.38	3.5	-.46	.12

Appendix D

Food choice motives

Exploratory Factor Analysis results

Item	Factor			Construct
	1	2	3	
…is as natural as possible.	.83			Naturalness
…has undergone minimal processing.	.75			
…is packaged in an environmentally friendly way.	.73			
…keeps me healthy.	.72			
…gives little waste.	.61			
…is well-known.		.81		Convenience & Appeal
…looks nice.		.65		
…is convenient to store.		.58		
…is convenient to prepare.		.56		
…is what I normally eat.		.52		
…is not expensive.			.79	Practicality
…is tasty.			.56	
…can be stored long at home.			.54	

Note. Extraction method: maximum likelihood; Rotation method; varimax. Loadings below .40 are not reported.
Each question was prompted with "To me it is important the food I buy…".


5

Chapter 5

General Discussion

The market has recently experienced a significant influx of packaged foods marketed as sustainable (Sustainable Food Monitor, 2022). However, sustainability remains a complex concept for consumers, largely because it offers no immediate or tangible benefits (Grunert, 2014). As a result, companies often struggle deciding which specific sustainability aspects to emphasize in their communication strategies and how, particularly in cases when products incorporate multiple sustainability aspects simultaneously. This challenge raises the core research question of this thesis:

How do different sustainability aspects combine with each other in impacting consumer information processing and responses to sustainably packaged foods?

To address this question, this thesis adopts the framework of the consumer decision journey, analyzing how consumers interact with sustainability communications at different stages within the journey (Batra & Keller, 2016). Each chapter explores the research question from a unique perspective, focusing on different outcomes relevant for decision-making: learning (Chapter 2), credibility diagnostics (Chapter 3), and intention formation (Chapter 4). The following paragraphs summarize the main findings from each chapter.

6.1. Summary of the main findings

6.1.1. Learning

Chapter 2 primarily examined how explicit communication of both product and packaging sustainability (i.e., front-of-the package cues) affects consumer learning. The results show that product sustainability information often dominates consumer attention, overshadowing packaging sustainability information. The findings, therefore highlight the importance of aspect centrality – where information related to the core function of the packaged product (e.g., the product itself) tends to capture more consumer attention than

peripheral aspects (e.g., the packaging). Consequently, when sustainability is highlighted for central aspects, peripheral sustainability elements may go unnoticed by the consumers, building on previous research within this domain (Gershoff & Frels, 2015; Steenis et al., 2022). Interestingly, although consumers may not actively learn about both packaging and product sustainability when presented together, they still prefer products that incorporate both sustainability aspects. Hence, while learning may be limited, consumers exhibit a clear preference for the presence of sustainability in both central and peripheral aspects during choice-making.

Chapter 2 also reveals that incongruent sustainability messaging – where one aspect is communicated as highly sustainable, and the other is not – can lead to deeper deliberation of sustainability information in subsequent tasks, therefore facilitating consumer learning. Specifically, the incongruence prompts more thorough information processing and delays decision-making. However, despite deeper information processing, consumers' recall of the sustainability information remains low. This suggests that while incongruence can trigger more thoughtful decisions like previous research suggests (e.g., Eklund & Helmefalk, 2022; Germelmann et al., 2020), its overall impact could be improved by incorporating additional strategies aimed at enhancing interest in the content of the presented sustainability information itself.

6.1.2. Credibility Diagnostics

Chapter 3 explored how information credibility influences consumer perceptions of packaging sustainability, focusing on both explicit packaging information (i.e., front-of-package cues) and implicit product information (i.e., inferences consumers made based on the product the information was presented on). The findings highlight the importance of perceived credibility in shaping consumers' evaluations of packaging sustainability. The observed effect unfolded interestingly. When sustainability information was presented clearly and transparently, consumer evaluations of packaging sustainability were the strongest, with additional cues offering little added value. This suggests that highly credible, singular cues are sufficient to maximize consumer perceptions of sustainability. However, when sustainability information lacked concrete detail or transparency, additional cues meaningfully improved consumer evaluations of packaging sustainability. This finding illustrates that there are circumstances in which the abundance of cues can strengthen consumer associations with sustainability, even when those cues are less substantiated.

Consequently, our research finds no evidence that consumers are becoming increasingly skeptical of sustainability communications, like previous research suggests (Farooq & Wicaksono, 2021; Lins et al., 2024).

Moreover, we found that credibility and sustainability evaluations are shaped by implicit product cues, particularly consumers' inferences about product naturalness. Packaging sustainability information is perceived as more credible and packaging as more sustainable when aligned with consumers' broader perceptions of product naturalness. This suggests that sustainability communications do not exist in isolation; rather, they are contextually anchored within consumers' holistic product perceptions (Magnier et al., 2016; Steenis et al., 2022). The expectation is therefore that sustainability information resonates better with consumers when there is congruency between products' inherent aspects and the explicitly communicated (packaging) sustainability information.

6.1.3. Intention Formation

Chapter 4 examined how are consumers' purchase intentions for packaged foods influenced by the increasing number of sustainability improvements to the packaging. The focus was on the explicit communication of biobased, active-technology, and biodegradable aspects of the packaging, and in reference to conventional, fossil fuel-based packaging alternatives. This research furthermore intended to identify and describe consumer heterogeneity in preferences for different combinations of sustainability aspects.

The findings show that purchase intentions for sustainably packaged foods are stronger than for conventional alternatives. Moreover, considerable consumer heterogeneity is found in terms of preferences for specific sustainability aspect combinations, with individual characteristics shaping the value consumers assign to these aspects. Two key themes are identified in this heterogeneity. First, despite differences in preferences, consumers consistently base their intentions on the most salient sustainability aspect. Focusing on one prominent aspect likely demonstrates another strategy consumers use to simplify decision-making, in efforts of reducing cognitive load caused by information complexity (e.g., Evans et al., 2010; Vyvey et al., 2018; Wang et al., 2014). Therefore, while consumer preferences do differ, they follow a structured pattern in doing so. Second, consumers who expressed a stronger (weaker) intention to purchase sustainably packaged foods also report greater (lower) interest and knowledge of sustainability in their daily lives. Thus, sustainable packaging improvements are best received among consumers when

they align with their personal sustainability engagement – a finding consistent with other related research (Aschemann-Witzel et al., 2022; Ruf et al., 2022; Weinrich & Herbes, 2023).

6.2. Theoretical Implications

6.2.1. Contributions towards “more is merrier” vs. “less is more” debate

This thesis aimed to assess how consumers process and respond to sustainability information highlighting multiple sustainability aspects in packaged foods. The aim entailed studying a theoretically polarizing question, specifically: should these strategies follow a “more is merrier” approach, highlighting all incorporated sustainability aspects, or a “less is more” approach, selectively focusing on key aspects? The relevant theoretical frameworks within this domain are the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986) and the Embedding Effect (Kahneman & Knetsch, 1992). Both theories acknowledge the quantity of the highlighted aspects as the main determinant of a given communication’s effectiveness. Nevertheless, they diverge in implications. The ELM suggests that increasing the number of highlighted sustainability aspects strengthens the message’s overall persuasiveness, as each additional argument provides an *incremental* increase in the merit of the message. These suggestions therefore adhere to the “more is merrier” communication approach, where packaged foods opting to highlight the full extent of sustainability efforts would be perceived most favorably by the consumers, assuming all other factors remain constant. In contrast, the Embedding Effect argues that consumers may process multiple sustainability aspects as a singular "sustainable" message, disregarding the value of individual contributions. For example, instead of considering the details of biobased, active-technology, and biodegradable aspects individually, consumers may opt for products that seem broadly sustainable, bypassing the need to analyze specific contributions. This leads to a "less is more" argument, where emphasizing multiple aspects at once would dilute the persuasive power of each aspect.

Addressing this theoretical conflict requires moving beyond the traditional binary comparisons that dominate existing research – comparing sustainable products with conventional, non-sustainable alternatives (e.g., Bianchi et al., 2022; Khachatryan et al., 2021). This thesis therefore contributes to the literature by examining consumer responses to different "layers" of green, by varying sustainability levels of both the packaging and the

product within an offering. The findings bridge the divide between the "more is merrier" and "less is more" approaches by emphasizing that consumers do not rigidly adhere to either approach when processing information. Instead, more attention should be paid to the characteristics of the communicated information. In the following paragraphs, I discuss centrality, credibility and salience as three moderators this research identified to be of theoretical significance for the outlined question.

Chapter 2 demonstrates that when sustainability information for both the packaging and the product is communicated together, consumer attention gravitates toward the more **central** aspect, overshadowing sustainability improvements in the peripheral aspects. However, when it comes to influencing consumer choice, the presence of both central and peripheral sustainability aspects is preferred. This dynamic implies that a "less is more" approach may be more suitable for highlighting peripheral aspects, as reducing the quantity of information allows these aspects to be more easily recognized by the consumers. Conversely, when influencing consumer choice, the findings support a "more is merrier" strategy, where both central and peripheral sustainability aspects individually contribute to the consumer's decision-making. Here, presenting a more comprehensive set of sustainability aspects strengthens the packaged food's appeal by offering a holistic narrative of sustainability. Hence, consumer information processing of sustainability information depends not just on the number of the communicated aspects but on whether these aspects are central or peripheral to the packaged food's core value. This insight helps reconcile the conflicting "less is more" and "more is merrier" approaches by emphasizing that the choice depends on the communication's primary objective – whether to enhance attention and learning or influence choice – supporting Batra and Kelly's (2016) reasoning.

Merely highlighting the presence of sustainability aspects in products can offer an advantage over conventional alternatives in the eyes of consumers (e.g., Bianchi et al., 2022). However, in contexts where the competing products are similarly marketed as sustainable, the **quality** of sustainability information becomes increasingly important. Chapter 3 findings demonstrate that **credibility** of information plays an important role in determining consumer responses in these cases. We show that communication strategies rooted in the "less is more" approach are effective provided that the presented sustainability information is perceived as credible, showcasing clear and transparent information. At the same time, sustainability information lacking concrete detail or transparency can still lead to positive consumer response by rooting its communication in the "more is merrier"

approach. In these cases, the abundance of cues can strengthen consumer associations with sustainability even if those cues are less substantiated. These findings therefore introduce information **credibility** as the second moderating factor in the "more is merrier" vs. "less is more" debate. While a "less is more" approach is effective when the information is highly credible, a "more is merrier" strategy can still drive consumer responses in cases where credibility is lacking. This new perspective broadens the theoretical understanding of how consumer process sustainability information from a focus on the quantity of information to include its quality as well.

Finally, Chapter 4 findings suggest that consumer intentions are primarily influenced by the **salience** of individual sustainability aspects, rather than the total number of the presented aspects. This supports the "less is more" approach, suggesting that concentrating on a single, highly salient sustainability aspect can be more effective in driving consumer intentions, particularly in contexts where cognitive overload is a concern. The chapter therefore challenges the assumption that offering multi-faceted sustainability information will necessarily lead to more favorable consumer evaluations (Wagner & Petty, 2022). Instead, our research shows that communicating too many sustainability aspects runs the risk of overwhelming consumers, diminishing their ability to process and engage with the message (Marzi, 2022). This supports the idea that simplifying communication, by highlighting just one key aspect in this case, can lead to stronger consumer engagement and more desired behavioral outcomes. Moreover, it provides a theoretical rationale for the selective, minimalistic presentation of sustainability efforts (Ton et al., 2024).

Together, these findings reveal that the effectiveness of sustainability communications considerably depends on the properties, not sheer quantity, of information. They suggest that "more can be merrier" and "less can be more" depending on characteristics of sustainability information. This insight highlights that established frameworks, the Elaboration Likelihood Model (ELM) and the Embedding Effect, are incomplete without considering these factors, underscoring the need for adaptable and context-sensitive interpretation of the outlined theories.

6.2.2. Contributions to consumer sense making of sustainability cues

This thesis not only explores the "more is merrier" vs. "less is more" debate but also enhances our understanding of how consumers interpret different types of cues in sustainability communications. Across chapters, we examine various cue combinations:

explicit packaging and product cues (Chapter 2), explicit packaging and implicit product cues (Chapter 3), and multiple explicit cues highlighting different sustainability aspects of packaging (Chapter 4).

When explicit sustainability cues are presented simultaneously, consumer responses are primarily shaped by cues that are more central to the offering, effectively overshadowing less central ones. These findings reflect the role of objective relevance in shaping of consumer responses to sustainability communications. This prioritization occurs regardless of factors like the amount of information or visual appeal. Hence, consumers likely engage in cognitive filtering, selectively processing information and focusing on the aspects that offer more personal benefit (Pasquale et al., 2024), subsequently building on the previous research highlighting the importance of personal relevance in marketing communications (Geng et al., 2021; Zhu & Chang, 2016).

When explicit packaging cues are presented on products conveying varying implicit meanings, consumer responses to explicit information are shaped by the subconscious associations they have with other parts of the packaged food product. Implicit cues, such as perceived naturalness, serve as a cognitive frame that guides consumers' interpretation of explicit sustainability claims (Houdek, 2016; Walsh, 1995). This supports a schema-congruence model, suggesting that explicit messages are more persuasive when aligned with implicit cues that resonate with consumer expectations (Hur et al., 2020; Lee & Cho, 2022; Yoon et al., 2023).

Our investigation into how consumers process multiple explicit cues related to the same sustainability component (i.e., the packaging) reveals that consumers often fixate on one particularly salient aspect. Salience in this regard does not refer to the objective relevance of the cue – such as how much personal benefit consumers might derive from it – but rather how prominently it stands out to them, shaped by personal values, experiences, or interests. This highlights a distinct form of overshadowing, where consumer responses are driven by the subjective importance they assign to a given cue. By focusing on the most salient aspect, consumers simplify decision-making, avoiding the cognitive effort of integrating all cues into a holistic evaluation (Kahneman, 2003; L. Yang et al., 2015). This selective processing, while helping consumers manage complex information, underscores the risk of overwhelming them when presenting multi-dimensional sustainability communications (Florack et al., 2020; Hu & Krishen, 2019).

6.3. Practical Implications

The findings of this thesis are relevant for marketers and policymakers aiming to promote sustainable consumption. While incorporating multiple sustainability improvements enhances the packaged product's overall environmental contribution, we demonstrate that the communication of these improvements requires careful consideration. Communicating several sustainability aspects simultaneously can dilute consumer attention, leading to the oversight of key details – especially when these improvements pertain to less central aspects of the product (Chapter 2). Furthermore, our research shows that consumers often do not perceive added value in products featuring multiple sustainability aspects simultaneously (Chapter 4). Although many companies tend to favor extensive communications of their sustainability efforts (Bocken et al., 2016; Steenis et al., 2017), we show that this approach may not always be cost-effective or strategic. Instead, focusing on a single, salient sustainability aspect can be more effective in ensuring that consumers fully understand and appreciate the product's sustainability. This approach aligns with the concept of "green blushing", where companies purposely under-communicate the extent of their sustainability achievements, recognizing that consumers may not perceive the full significance of these efforts when they are presented all at once (Falchi et al., 2022).

Moreover, this research contributes insights relevant for strategizing the presentation of sustainability information (Allen, 2016; Genç, 2017). Given that consumers make purchases of food products and fast-moving consumer goods in general often without paying much attention, it is crucial to maximize the cognitive resources they are willing to allocate to sustainability. Our findings identify three ways in which this can be achieved. First, information should be conveyed in a credible and straightforward manner, prioritizing fewer but more informative cues over numerous, less impactful ones (Chapter 3). Second, context plays a significant role. Consumers interpret packaging-related information differently based on their perceptions of the product's naturalness, pointing to the need for careful consideration of which products should be used to convey sustainability information on (Chapter 3). Finally, when multiple sustainability aspects are presented simultaneously, those more relevant to the packaged product’s core offering tend to overshadow others, diminishing processing of less relevant information (Chapter 2). Thus, increasing the “richness” of sustainability information should be approached with caution.

In contexts requiring deeper consumer engagement – such as the introduction of a novel sustainability aspect – both marketers and policymakers may want to prioritize strategies that enhance consumer information processing. In those cases, presenting sustainability information in an incongruent manner can be effective. Incongruence generates surprise for consumers (Derbaix & Vanhamme, 2003; Schumacher et al., 2024), encouraging more thorough consideration of the information and postponing decision-making, ultimately leading to more informed choices (Chapter 2). Leveraging incongruency can disrupt routine decision-making, therefore serving as a tool for increasing consumer engagement with sustainability innovations (Eklund & Helmefalk, 2022; Granato, 2023).

Finally, an important common theme of this research concerns policy makers. Namely, various findings throughout the empirical chapters corroborate previous research findings (Norton et al., 2023; van Bussel et al., 2022) in revealing that consumers are generally ill-equipped to assess and respond to sustainability efforts. In Chapter 2, we observe that the amount of information consumers retain from sustainability communications is notably low, even when they spent time processing relevant information. Thus, while consumers may engage with sustainability content, their recall of it is limited. This presents a challenge, particularly for sustainability innovations that require specific actions, such as the proper disposal of biodegradable plastic packaging with organic waste instead of plastic waste (Yaradoddi et al., 2022). Chapter 3 further demonstrates that consumers do not penalize communication strategies that present unsubstantiated sustainability information, such as vague claims or company-designed and certified logos. Instead, they often respond positively to these less credible signals. This indicates a concerning trend where consumers may appreciate sustainability messaging without critically evaluating its legitimacy. Lastly, Chapter 4 shows that consumers with limited appreciation for packaging sustainability improvements also tend to lack a broader understanding of sustainability as a concept. This suggests that without a foundational knowledge of sustainability, consumers are unlikely to value or recognize sustainable improvements in the marketplace. Together, these findings highlight two important areas of focus for policymakers. First, they point to a critical need to enhance consumer competence and knowledge of sustainability as a foundation for fostering more sustainable consumption patterns. Second, they affirm that regulation of sustainability labels is urgently needed to ensure that they provide clear, reliable, and standardized information. Just as Europe has

regulated nutrition and health labels (Storcksdieck Genannt Bonsmann et al., 2020), a similar approach should be taken in the realm of sustainability communications. Policymakers must hold marketers accountable for the accuracy and transparency of the sustainability information they present. By enforcing standards that prevent misleading claims and greenwashing, a more trustworthy marketplace can be created, where consumers confidently engage with sustainable products without confusion or deception.

6.4. Limitations and Future Research

This thesis identified centrality, credibility, and salience as moderators in the “more is merrier” vs. “less is more” debate, focusing on the characteristics of the sustainability information itself. This approach is limited to how specific aspects of the information itself influence consumer responses. Future research should explore the role of other moderators within this context, whereby situational moderators could equally shape how consumers process and respond to sustainability communications (Hofenk et al., 2019). Future investigations could therefore examine how factors such as familiarity, time pressure or cognitive load impact how much cognitive resources consumers are willing to allocate to the processing of sustainability information. These factors could tip the balance between information overload and the desire for comprehensive detail. An interesting research avenue would be to examine whether consumers respond better to detailed sustainability information for novel versus established brands or products, shedding light on whether familiarity moderates the "more is merrier" vs. "less is more" debate.

Moreover, this thesis examined how consumers process and integrate different informational elements into their responses. This approach overlooks the role of design elements in communication, which are known to significantly influence consumer perception and decision-making (Burnap et al., 2023). Future research could deepen the understanding surrounding the “more is merrier” versus “less is more” debate by considering how design elements, like imagery, layout, and packaging appearance, interact with sustainability information in shaping consumer responses. For example, studies could consider whether design elements can be used as a tool to enhance processing of sustainability information. It would also be interesting to study whether design elements can shift consumers’ focus from salient sustainability aspects to a broader appreciation of the overall sustainability.

Finally, we studied the balance between “more is merrier” and “less is more” in the context of communications informing about different aspects of sustainability in packaged foods. A key question emerging from this research is whether the specifics of sustainability as a benefit and packaged foods as a product category limit the generalizability of our findings. While future research is needed to explore this, we anticipate that the generalizability of our findings extends to other contexts where consumers rely on similar decision-making strategies. For instance, comparable dynamics might apply to communications about ethical practices in fashion, fair trade products, or other areas where moral considerations play a role. These contexts share two key factors with sustainability communications: fast, often cursory decision-making, and an emphasis on intangible benefits that offer moral satisfaction for consumers. In these cases, the balance between "more is merrier" and "less is more" may also depend on centrality, credibility and salience of the presented information. If these parallels hold, our findings could have broader relevance for other communication strategies involving moral and ethical benefits in other low involvement product categories.

6.5. Conclusions

This thesis provides insights into how consumers respond to communications highlighting multiple sustainability aspects in packaged foods. It examines when and how emphasizing all sustainability efforts (following “more is merrier” approach) versus a selective presentation (following “less is more” approach) is more effective. Contrary to theories like the Elaboration Likelihood Model and the Embedding Effect, which emphasize the amount of information, our findings show that successful communication depends on more than just the quantity of information. Specifically, it is also of importance how well the communication goal aligns with the characteristics of the presented sustainability information. Centrality, credibility, and salience emerge as the key moderators within this context. By identifying these factors, the research offers practical recommendations to enhance sustainability communication strategies.

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Summary

The food sector is increasingly embracing a trend towards sustainable packaged products, which often integrate multiple sustainability aspects simultaneously. This market evolution brings out an interesting dilemma involving sustainability communication strategies. Namely, packaged products incorporating multiple sustainability aspects face a choice between two approaches: a "more is merrier" communication approach, which emphasizes every sustainability improvement to convey its environmental commitment or a "less is more" communication approach, which selectively emphasizes some aspects, but not the others.

This practical dilemma also raises theoretical questions, given the conflicting theoretical perspectives. On the one hand, the Elaboration Likelihood Model reasons for the “more is merrier” approach, suggesting that each additional communicated aspect would provide an incremental increase in the merit of the sustainability message. On the other hand, the Embedding Effect Model aligns with the “less is more” approach, suggesting that sustainability is often evaluated on an overarching level rather than through individual components. This perspective therefore argues that increasing the number of communicated sustainability aspects does not necessarily lead to a proportional increase in the message's persuasiveness. Thus, although both theories emphasize the role of information quantity, they differ in proposed implications. In efforts of shedding additional light on this theoretical conflict, this thesis bases its investigations around addressing the following research question:

How do different sustainability aspects combine with each other in impacting consumer information processing and responses to sustainable packaged foods?

The research used the consumer decision journey framework to explore how consumers respond to sustainability communications highlighting multiple sustainability aspects at different stages of the journey. Each chapter investigated the outlined research question from a distinct angle, concentrating on different decision-making outcomes: learning (Chapter 2), credibility assessment (Chapter 3), and intention formation (Chapter 4). Thereafter, the findings identified three moderators of the “more is merrier” versus “less is more” debate, specifically: centrality, credibility and salience.

Chapter 2 illustrated that when sustainability information for both the product and the packaging is presented together, consumers tend to focus on the aspect that is more

central to the offering's core value, often overlooking peripheral improvements. This suggests that a "less is more" strategy may be more effective in highlighting peripheral aspects, as minimizing the amount of information can enhance their recognition by consumers. Thus, Chapter 2 demonstrates that consumer processing of sustainability information is influenced not only by the quantity of the communicated aspects but also by their relevance to the core value of the packaged food. However, including both central and peripheral sustainability aspects improves the likelihood of choice. These findings therefore advocate for a "more is merrier" approach when making choices, as including a wider range of sustainability aspects enriches the appeal of packaged foods by creating a cohesive sustainability narrative. Together, these findings reconcile the competing "less is more" and "more is merrier" perspectives by underscoring that the effectiveness of communication strategies depends on their primary goal – whether to boost attention and learning or to influence consumer choice.

Chapter 3 explored the influence of information credibility on consumer responses in multi-aspect sustainability communications, demonstrating that it plays an important role in shaping consumer responses. Concretely: when sustainability information is clear and credible, a "less is more" strategy is effective. In these cases, a single well-substantiated cue can effectively convey the sustainability message. However, when transparency is lacking, a "more is merrier" approach can be used to convey the message of sustainability to consumers, by using multiple cues to create associations with sustainability. These findings position information credibility as the second moderator in the "more is merrier" vs. "less is more" debate, expanding the theoretical understanding from a focus on the quantity of information to its quality as well.

Finally, Chapter 4 revealed salience of aspect as the third moderator of the "more is merrier" vs. "less is more debate". It showed that when multiple sustainability aspects are communicated to consumers, they tend to form their intentions based on the most salience aspect, not the objective sustainability of the offering. This finding aligns with the "less is more" approach, indicating that focusing on one highly salient sustainability aspect can be more effective in influencing behavior, particularly in cases where cognitive overload is a risk. Moreover, this research challenges the idea that providing multi-faceted sustainability information improves persuasiveness of the intended message. Instead, it highlights the potential downside, whereby information complexity can overwhelm consumers, consequently reducing their ability to process and engage with the message.

Collectively, the findings of this thesis suggest that the effectiveness of multi-aspect sustainability communications for packaged products depends on the properties, not sheer quantity of information. They indicate that "more can be merrier" and "less can be more," depending on the specific characteristics of the sustainability information being conveyed. Traditional models like the Elaboration Likelihood Model (ELM) and the Embedding Effect are therefore incomplete without considering the role of centrality, salience, and credibility, highlighting the need for a more adaptable and context-sensitive interpretation of these theories.

Prehrambena industrija sve više prihvata trend održivo zapakovanih proizvoda, koji često uključuju više razlicitih, ekoloških aspekata istovremeno. Ova evolucija na tržištu donosi zanimljivu dilemu u vezi sa strategijama komunikacije o održivosti. Naime, zapakovani proizvodi koji obuhvataju više ekoloških aspekata istovremeno se suočavaju sa izborom između dva pristupa: pristup "više je bolje", koji naglašava svako unapređenje u održivosti kako bi se pokazala posvećenost zaštiti životne sredine, ili redukovan, "što manje to bolje" pristup, koji selektivno naglašava određene aspekte, dok druge ne.

Ova praktična dilema takođe ističe važna teorijska pitanja, imajući u vidu dijametralno različite, a jednako verodostojne, postojeće teorijske perspektive. S jedne strane, Model Verovatnoće Elaboracije (MVE, slobodno preveden naziv orginalnog Elaboration Likelihood Model) zagovara pristup "više je bolje ", sugerišući da svaki dodatno komunicirani ekološki aspekat pruža inkrementalno povećanje vrednosti poruke o održivosti. S druge strane, Model o Integraciji Informacija (MII, slobodno preveden naziv orginalnog Embedding Effect) podržava pristup "što manje to bolje", sugerišući da se održivost često procenjuje na opštem nivou, a ne kroz pojedinačne aspekte. Ova perspektiva, dakle, tvrdi da povećanje broja komuniciranih ekoloških aspekata ne vodi nužno ka proporcionalnom povećanju uverljivosti i legitimnosti poruke o održivosti. Prema tome, iako obe teorije naglašavaju ulogu količine informacija, razlikuju se u implikacijama koje iz njih proističu. Sa ciljem da se dodatno rasvetli ovaj teorijski konflikt, ova disertacija postavlja sledeće naučno pitanje:

Kako marketinške strategije koje simultano komuniciraju nekoliko različitih ekoloških aspekata u istom zapakovanom proizvodu utiču na stavove potrošača?

Ova disertacija polazi od premise da potrošači prolaze kroz niz razlicitih faza u procesu donošenja odluka o (zapakovanom) proizvodu, a da su faze u kojima potrošači uče, ocenjuju kredibilitet prezentovanih informacija i, na posletku, formiraju svoje namere o proizvodu posebno važne u ovom kontekstu. Svako poglavlje ove disertacije istraživuje postavljeno pitanje iz različitog ugla, fokusirajući se na pomente faze u odlučivanju: učenje (drugo poglavlje), procena kredibiliteta (treće poglavlje) i formiranje namera (četvrto poglavlje). Prema tome, rezultati iz disertacije identifikuju tri moderatora debate "više je

bolje“ naspram “što manje to bolje”, a to su centralnost, kredibilitet i dopadljivost komuniciranih ekoloških aspekata.

Drugo poglavlje demonstrira da kada se informacije o održivosti proizvoda (centralnog aspekta) i pakovanja (perifernog aspekta) predstavljaju u isto vreme, potrošači se fokusiraju na aspekte koji su centralniji osnovnoj vrednosti ponude, često zanemarujući unapređenja u perifernim aspektima. Ovo sugeriše da strategija “što manje to bolje” je verovatno efikasnija strategija za naglašavanje perifernih aspekata, jer smanjenje količine informacija može poboljšati prepoznavanje informacija koje ostaju od strane potrošača. Međutim, uključivanje i centralnih i perifernih ekoloških aspekata povećava verovatnoću za izbor takvih proizvoda. Stoga, pristup “više je bolje” je efikasniji pri donošenja odluka, jer uključivanje šireg spektra ekoloških aspekata obogaćuje privlačnost zapakovanih proizvoda stvaranjem koherentng narativa o održivosti. Sve u svemu, rezultati ovog poglavlja mire suprotstavljene perspektive “što manje to bolje” i “više je bolje”, naglašavajući da efikasnost strategija komunikacije zavisi od primarnog cilja – da li je to stimulisanje pažnje i učenja o odredjenom aspektu ili uticaj na potrošački izbor.

Treće poglavlje istražuje kako kredibilitet predstavljenih informacija o održivosti zapakovanih proizvoda utiče na potrošače, pokazujući da kredibilitet igra važnu ulogu u oblikovanju odgovora potrošača. Konkretno: kada su informacije o održivosti jasne i kredibilne, strategija “što manje to bolje” je efikasna. U tim slučajevima, jedan dobro potkrepljen signal može efikasno preneti poruku o održivosti. Međutim, kada transparentnost nedostaje, pristup “više je bolje” takodje može efikasno da prenese poruku o održivosti, gde kumulativno dejstvo više signala stvara slično jaku asocijaciju o održivošću. Ovi rezultati pozicioniraju kredibilitet informacija kao drugi moderator u debati “više je bolje” naspram “što manje to bolje”, proširujući teorijsko razumevanje s fokusa na količinu informacija na njihov kvalitet.

Na kraju, četvrto poglavlje otkriva dopadljivost aspekta kao treći moderator debate “više je bolje” naspram “što manje to bolje”. Pokazuje da, kada se potrošačima komuniciraju nekoliko ekoloških aspekata istovremeno, oni formiraju svoje namere na osnovu aspekta koji im se najviše dopada, a ne objektivne održivosti celokupne ponude. Ovaj rezultat daje potporu “što manje to bolje” pristupu, ukazujući da fokus u komunikacijama na jedan, dopadljiv aspekt održivosti može biti efikasniji u uticanju namera potrošača, posebno u slučajevima kada postoji rizik od preopterećenja potrošača informacijama.

Sveukupno, rezultati ove disertacije sugerišu da efikasnost komunikacija koje naglašavaju nekoliko ekoloških aspekat odjednom zavisi od karakteristika, a ne same količine informacija. Konkretnije, “više može biti bolje” i “manje može biti više”, u zavisnosti od karakteristika informacija o održivosti koje se prenose potrošačima. Prema tome, tradicionalni modeli poput Modela Verovatnoće Elaboracije (MVE) i Modela o Integraciji Informacija (MII) su nepotpuni bez razmatranja uloge centralnosti, kredibiliteta i dopadljivosti komuniciranih aspekata, što naglašava potrebu za fleksibilnijim i osetljivijim tumačenjem ovih teorija.

De voedselindustrie omarmt steeds meer een trend naar duurzaam verpakte producten, die vaak meerdere duurzaamheidsaspecten tegelijk integreren. Deze marktontwikkeling brengt een interessant dilemma met zich mee rondom strategieën voor duurzaamheidscommunicatie. Verpakte producten met meerdere duurzaamheidsaspecten staan voor de keuze tussen twee benaderingen: een "meer is beter"-communicatiebenadering, die elke duurzaamheidsverbetering benadrukt om de milieubetrokkenheid over te brengen, of een "minder is meer"-communicatiebenadering, die selectief sommige aspecten benadrukt en andere niet.

Dit praktische dilemma roept ook theoretische vragen op, gezien de tegenstrijdige theoretische perspectieven. Enerzijds pleit het Elaboration Likelihood Model (ELM) voor de "meer is beter"-benadering, waarbij elke extra gecommuniceerde aspect een incrementele verhoging in de waarde van de duurzaamheidsboodschap biedt. Anderzijds sluit het Embedding Effect Model beter aan bij de "minder is meer"-benadering, waarbij duurzaamheid vaak op een overkoepelend niveau wordt geëvalueerd in plaats van via afzonderlijke componenten. Deze visie stelt dat het vergroten van het aantal gecommuniceerde duurzaamheidsaspecten niet noodzakelijk leidt tot een evenredige toename van de overtuigingskracht van de boodschap. Hoewel beide theorieën de rol van informatiehoeveelheid benadrukken, verschillen ze in de voorgestelde implicaties. Om extra licht te werpen op dit theoretische conflict, richt dit proefschrift zich op de volgende onderzoeksvraag:

Hoe beïnvloeden verschillende duurzaamheidsaspecten elkaar bij het beïnvloeden van consumenteninformatie en reacties op duurzaam verpakte voedingsproducten?

Het onderzoek maakt gebruik van het framework van de consumentenbeslissingsreis om te onderzoeken hoe consumenten reageren op duurzaamheidscommunicatie die meerdere duurzaamheidsaspecten benadrukt in verschillende fasen van de reis. Elk hoofdstuk onderzoekt de onderzoeksvraag vanuit een ander perspectief, met focus op verschillende besluitvormingsresultaten: leren (Hoofdstuk 2), beoordeling van geloofwaardigheid (Hoofdstuk 3) en intentievorming (Hoofdstuk 4). Vervolgens identificeerden de bevindingen drie moderators in het debat tussen "meer is beter" en "minder is meer": centraliteit, geloofwaardigheid en opvallendheid.

Hoofdstuk 2 toont aan dat wanneer duurzaamheidsinformatie voor zowel het product als de verpakking samen wordt gepresenteerd, consumenten de nadruk leggen op het aspect dat centraler staat tot de kernwaarde van het aanbod en perifere verbeteringen vaak over het hoofd zien. Dit suggereert dat een "minder is meer"-strategie effectiever kan zijn in het benadrukken van perifere aspecten, omdat het verminderen van de hoeveelheid informatie de herkenning ervan door consumenten kan verbeteren. Tegelijkertijd bleek het voor het beïnvloeden van de keuze van consumenten nuttig om zowel centrale als perifere duurzaamheidsaspecten op te nemen. Dit suggereert dat consumenten niet alleen worden beïnvloed door de hoeveelheid gecommuniceerde aspecten, maar ook door de relevantie ervan voor de kernwaarde van het verpakte product. Gezamenlijk overbruggen deze bevindingen de tegenstrijdige perspectieven ‘minder is meer’ en ‘meer is beter’ door te benadrukken dat de effectiviteit van communicatiestrategieën afhangt van hun primaire doel – het vergroten van aandacht en kennis, of het beïnvloeden van de keuze van consumenten.

Hoofdstuk 3 onderzocht de invloed van geloofwaardigheid van informatie op consumentreacties in multi-aspect duurzaamheidscommunicatie en toonde aan dat dit een belangrijke rol speelt in het vormgeven van deze reacties. Concreet: wanneer duurzaamheidsinformatie duidelijk en geloofwaardig is, is een "minder is meer"-strategie effectief. In dergelijke gevallen kan een enkele goed onderbouwde aanwijzing de duurzaamheidsboodschap effectief overbrengen. Wanneer transparantie echter ontbreekt, kan een "meer is beter"-benadering worden toegepast om de boodschap van duurzaamheid over te brengen door middel van meerdere aanwijzingen die associaties met duurzaamheid creëren. Deze bevindingen positioneren geloofwaardigheid van informatie als de tweede moderator in het debat tussen "meer is beter" en "minder is meer", en breiden het theoretische begrip uit van een focus op de hoeveelheid informatie naar de kwaliteit ervan.

Tot slot onthulde Hoofdstuk 4 dat opvallendheid van aspecten de derde moderator is in het debat tussen "meer is beter" en "minder is meer". Het toonde aan dat wanneer meerdere duurzaamheidsaspecten aan consumenten worden gecommuniceerd, zij hun intenties vaak baseren op het meest opvallende aspect, in plaats van op de objectieve duurzaamheid van het aanbod. Deze bevinding sluit aan bij de "minder is meer"-benadering, omdat het focussen op één zeer opvallend duurzaamheidsaspect effectiever kan zijn om gedrag te beïnvloeden, vooral in situaties waarin cognitieve overbelasting een risico vormt. Bovendien stelt dit onderzoek het idee ter discussie dat het aanbieden van

veelzijdige duurzaamheidsinformatie de overtuigingskracht van de boodschap verbetert. Het benadrukt daarentegen het potentiële nadeel, waarbij informatiecomplexiteit de consumenten kan overweldigen, waardoor hun vermogen om de boodschap te verwerken en erop in te gaan wordt verminderd.

Gezamenlijk suggereren de bevindingen van dit proefschrift dat de effectiviteit van multi-aspect duurzaamheidscommunicatie voor verpakte producten afhankelijk is van de eigenschappen, niet de hoeveelheid informatie. Ze tonen aan dat "meer kan beter zijn" en "minder kan meer zijn," afhankelijk van de specifieke kenmerken van de duurzaamheidsinformatie die wordt overgebracht. Traditionele modellen zoals het Elaboration Likelihood Model (ELM) en het Embedding Effect zijn daarom incompleet zonder rekening te houden met de rol van centraliteit, opvallendheid en geloofwaardigheid, wat de behoefte benadrukt aan een meer aanpasbare en contextgevoelige interpretatie van deze theorieën.

Completed Training and Supervision Plan

Milica Mladenovic
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
A1 Managing a research project			
WASS Introduction Course	WASS	2019	1
Writing research proposal	WUR, MCB	2019	6
Writing in the Sciences	EdX	2021	1.2
Paper Reviews	Science of Total Environment, Sustainable Consumption and Production and Environmental Communication	2020 - 2024	3
'(un)believably green: The role of credibility in sustainability perceptions of green packaging information'	International Food Marketing Research Symposium, San Antonio, Texas	2022	1
'(Un)believably green: The Role of information credibility in green food product communications'	15th Pangborn Sensory Science Symposium, Nantes, France	2023	1
Webinar presentations and Stakeholder meetings	Biovoices Webinar and GLOPACK, MYPACK & YPACK Webinar	2019 - 2020	2
A2 Integrating research in the corresponding discipline			
Advanced Qualitative Research Design and Data Collection Methods, GEO56806	WUR, GEO	2020	6
RMarkdown	WGS	2021	0.9
Literature club	WUR, MCB	2021 - 2023	1.2
SuRe – Sustainable and Resilient Societies	Groningen Summer School	2024	4

B) General research related competences			
B1 Placing research in a broader scientific context			
Popular Science Writing	WASS	2021	1.5
Eye tracking methods: Tobii Pro hardware and software programming	N/A	2022	4
Markets and Sustainability Symposium: Behavioral Economics and Environmental Decision-Making	Groningen University	2020	0.5
B2 Placing research in a societal context			
Effective and efficient communication in academia and beyond	WGS	2021	0.9
Consortium meetings: YPACK	European Commission	2019 - 2021	2
C) Career related competences/personal development			
C1 Employing transferable skills in different domains/careers			
Teaching and Supervising MSc and BSc students	WGS	2020	0.7
Master thesis supervision	WUR, MCB	2024	1
Course coordinator and teacher: “Qualitative and Quantitative Methods in Social Sciences”	WUR, MCB	2022 - 2023	1
Teacher: Product Properties and Consumer Wishes, Analytical Methods for Sustainable Business and Innovation, Advanced Experimental Research and Consumer Behavior	WUR	2020 - 2024	2
Total			**40.6**

*One credit according to ECTS is on average equivalent to 28 hours of study load.

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Throughout this PhD, many moments of doubt crept in. I doubted that this book would come together in a way that makes me proud of the process, the things I've learned, and what I've become during it. And yet, it is now here, and in true LinkedIn expression, I am thrilled about it. And if I dig deeper into this thrill, I realize that most of the thrill comes from the people that made these years meaningful, without whom none of this work would have been possible in the first place. Because of that, it is not the book itself that I will cherish the most, but the selfless, patient and encouraging relationships that shaped it into existence.

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About the author

Milica Mlađenović grew up on the Adriatic coast of Montenegro before pursuing two bachelor's degrees in Psychology and Business Administration at St. Francis College in New York City. She then continued her studies in the Netherlands, completing a Research Master in Behavioral Science at Radboud University. In late 2019, she began her PhD in Marketing and Consumer Behavior at Wageningen University & Research, where she now continues to work as a lecturer.

Her doctoral research was part of a large EU consortium dedicated to developing more sustainable plastic packaging for food. Within this project, she examined the effectiveness of marketing strategies that communicate multiple sustainability aspects within packaged food products, with a particular focus on the role of packaging sustainability in shaping consumer responses.

Milica currently lives in Nijmegen with her partner Henrik, their son Matija, and their dog Juna. In her future career, she hopes to contribute her knowledge and enthusisam to the topic that matters to her a lot – sustainability.

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