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Unpacking Sustainability: Exploring the Effects of Packaging Cues on Consumer Perceptions

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Dedicated to my beloved parents
for their unconditional love, support, and sacrifices.

Abstract

This dissertation explores packaging cues in relation to sustainable perception. It comprises of introduction, three essays and concluding remarks. The dissertation begins with an overview on sustainable consumption and the role of packaging. The first chapter systematically reviews research on consumer perception of sustainability related cues on product packaging. The second chapter validates the Italian version of the ESE-10 scale through exploratory and confirmatory factor analysis. The third chapter explores the impact of ecolabels and textual claims on perceived environmental friendliness and willingness to pay, includes two lab experiments, one behavioral study and one utilizing eye-tracking methodology. The studies focused on testing the effect of two packaging cues (ecolabel and textual claim) on willingness to pay and perceived environmental friendliness, in a 2x2 factorial design. The results reveal that perceived environmental friendliness mediates the relationship between packaging cues and consumer willingness to pay. Moreover, environmental self-efficacy moderates the mediated relationship between packaging cues and willingness to pay. Eye-tracking measures provide some insight on the process; however this aspect of the research needs to be investigated further.

Keywords: *consumer behavior, sustainability, packaging, ecolabel, eye-tracking, perceived environmental friendliness, willingness to pay.*

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Introduction

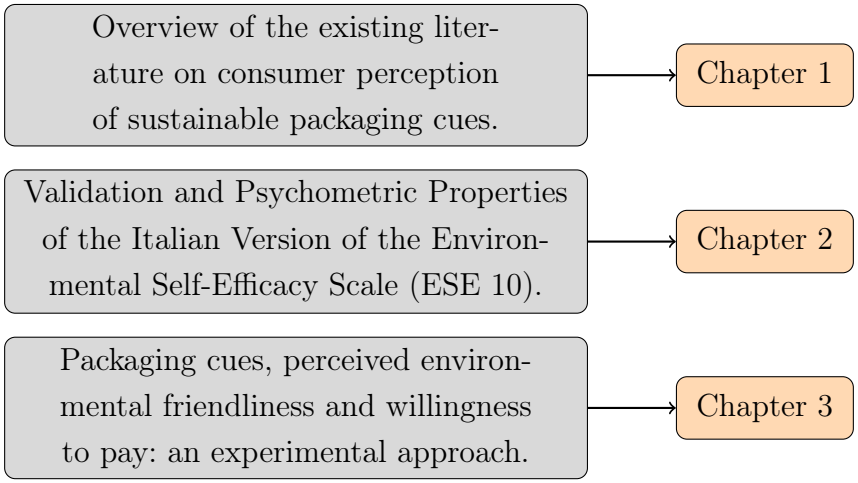
In our society mass-production has led to significant environmental challenges including, but not limited to, the acceleration of climate change, exacerbation of pollution and the extensive depletion of natural resources [Krausmann et al., 2009, Oreskes, 2018]. Given their rapid consumption and disposal cycle, fast-moving consumer goods significantly contribute to the environmental crisis [Shahmohammadi et al., 2020]. Not only are these items quickly discarded, but their purchase decisions also typically involve minimal consumer deliberation, further exacerbating their environmental impact [Muranko et al., 2021]. Packaging serves essential functions for product transportation, preservation and sale [Magnier and Schoormans, 2015, Meherishi et al., 2019] and considering that almost every product comes packaged, the production of product packaging plays a crucial role in the environmental footprint of fast moving consumer goods. Within this context communicating sustainable characteristics of FMCGs on their packaging has the potential to shift consumer choices towards more sustainable daily choices.

In this framework the essays within this dissertation tackle the following research questions:

RQ1. How do consumers perceive green packaging?

RQ2. How does the presence of ecolabels and textual claims on product packaging affect consumer perceptions and willingness to pay for a product?

In order to address these questions the dissertation is organized in three main chapters, each of which presenting a paper tackling different aspects of the problem in question. The structure of the dissertation is summarized in the diagram below:



Chapter 1:is a literature review aimed at mapping the current literature on sustainability cues on packaging and their influence on consumer perception. The articles were searched on Scoupus and resulted in a selection of n = 50 relevant articles in total, spanning from 2013 to 2023. These articles employ a plethora of methodological approaches and highlight a strong focus of literature on the food and beverage sector. Moreover, the findings underscore the impact of packaging material, ecolabel and sustainability claims in shaping consumer perception of packaging. Overall, the literature review sets a solid theoretical background for the two empirical essays presented in Chapters 2 and 3.

Chapter 2:outlines the validation of the Italian adaptation of the Environmental Self-Efficacy Scale Short (ESE-10), a measure of belief in one's ability to engage in pro-environmental behaviors. Through rigorous translation, exploratory and confirmatory factor analyses, the study affirms the scale's unidimensionality and reliability within an Italian context. The scale's internal consistency is evidenced by high Cronbach's alpha and McDonald's omega values, and its concurrent validity is established through a positive correlation with the General Self-Efficacy Scale. This validation signifies a critical step in enabling environmental psychology research across Italian-speaking populations, fostering a deeper understanding of environmental self-efficacy and promoting sustainable behaviors.

Chapter 3:investigates the influence of packaging cues on consumer perceived environmental friendliness (PEF) and willingness to pay (WTP) with two studies testing the hypothesis with a 2x2 factorial design where ecolabel and textual claim are manipulated. Study 1 one analyzes the effect of pack-

aging cues on WTP and PEF, while Study 2 uses eye-tracking to measure visual attention and its impact on PEF.This chapter hypothesizes that ecolabels and textual claims on product packaging significantly increase consumers' willingness to pay (WTP) by enhancing perceived environmental friendliness (PEF). It also posits that PEF mediates the relationship between packaging cues and WTP. Additionally, it suggests that environmental self-efficacy (ESE) moderates the relationship between packaging cues and PEF, as well as the mediation effect of PEF on WTP. The findings confirm that packaging cues positively influence consumer behavior, with eye-tracking metrics providing additional insights into the effects of visual attention on sustainability perception.

Chapter 1

Communicating Sustaiability Through Packaging Cues: A Literature Review

1.1 Introduction

This chapter aims to consolidate current knowledge on the impact of packaging cues on product packaging perception, with a particular emphasis on attributes conveying sustainability related values. In recent years several articles have focused on various facets of consumer responses to sustainable packaging [Ojha et al., 2015, Otto et al., 2021, Steenis et al., 2017, Wever and Vogtländer, 2013]. To the best of the author's knowledge, existing reviews on sustainable packaging attributes primarily address consumer perception of organic products [Schleenbecker and Hamm, 2013], packaging material of food products [Ojha et al., 2015], overall product packaging impact on sustainability and recycling [de Oliveira and de Melo, 2019, Licciardello, 2017, Otto et al., 2021] and recycling behavior [Nemat et al., 2019]. This observation highlights a gap in current literature concerning cue utilization on product packaging and, consequently, the way in which consumer perceive both the packaging and the product.

The chapter contributes to current literature on sustainable consumption by providing an overview of the present state of knowledge on sustainability-related cues on product packaging. It also proposes a classification of the relevant elements based on the available literature.

Before initiating the analysis, it is crucial to delineate the term "packaging cues." These refer to the elements and features of packaging that convey specific information to consumers, significantly influencing their perceptions and decision-making processes regarding a product. As defined by Granato et al. [2022] cues on packaging can be both implicit and explicit. On one side, implicit cues are elements like, for example, the colour green or roughness of the packaging's surface. On the other side, explicit cues include, but are not limited to, logos and explanations of the sustainable materials the pack is made of [Granato et al., 2022].
This chapter synthesizes findings from a systematic review of 50 peer-reviewed articles, all indexed in Scopus, that explore sustainability-related cues on product packaging.

1.2 Search Criteria

An online literature search was carried out in order to identify all the articles that were relevant to packaging cues and sustainability perception and preferences for products. For this goal Scopus was chosen as the database for the literature review using the following two strings of keywods:

- String1: ("packaging" AND "perception" AND ("sustainability" OR sustainable))
- String2: ("packaging" AND "cues" AND ("sustainability" OR sustainable) AND "consumers")

The initial search gave respectively 313 and 27 articles. Of these only the ones written in English and published on journals were selected, moreover the search was then limited to the following subject areas:

- Environmental Science
- Social Sciences
- Business Management and Accounting
- Economics, Econometrics and Finance
- Psychology
- Decision Sciences

The total number of articles found was 340 and, after setting up the aforementioned limitations, the final number of articles to assess was 166. To determine the relevance of each article to this review of the literature, the resulting articles were individually scanned and assessed. For this review it was necessary that the core of the article dealt with consumer perception of product packaging with a focus on specific packaging cues in relation to sustainability. Therefore, only publications that studied different cues and their effect on sustainability perception of a product and/or its packaging were considered. After the content analysis, the sample was reduced to 50 relevant articles that have been analyzed in detail with content analysis [Neuendorf and Kumar, 2015]. Therefore, for this study, the content of all 50 articles was analyzed and information regarding the objectives, methodology, stimuli used, cues implied and main findings related to consumer perceptions of the different packagings were extracted. In Figure 1.1 the selection procedure is summarized.

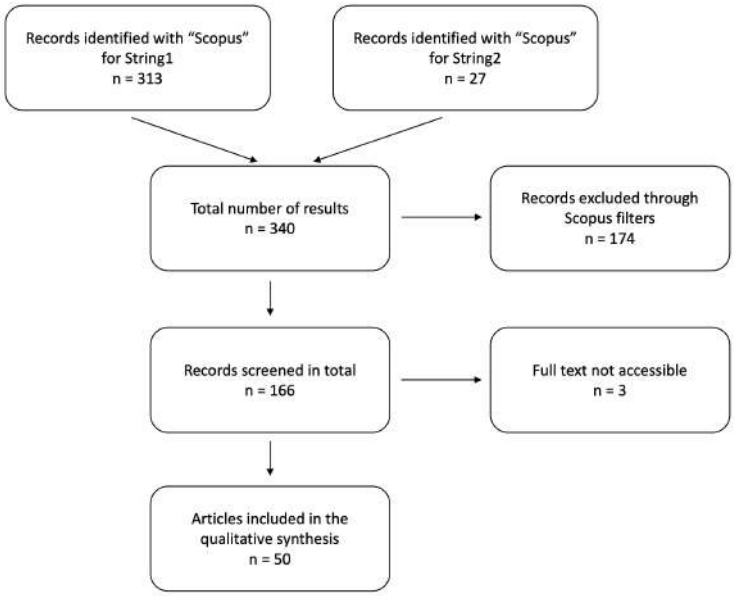


Figure 1.1: Flow Chart Of The Selection Procedure Adopted.

1.3 The Literature Review

The search included studies on packaging cues from all countries over a ten-year period, ranging from 2013 to 2023 [Ketelsen et al., 2020]. After the analysis, a

total of 50 articles, published in the last ten years (Figure 1.2) were included in the literature review. This section summarizes the methodologies implied, as well as the product categories and the cues studied.

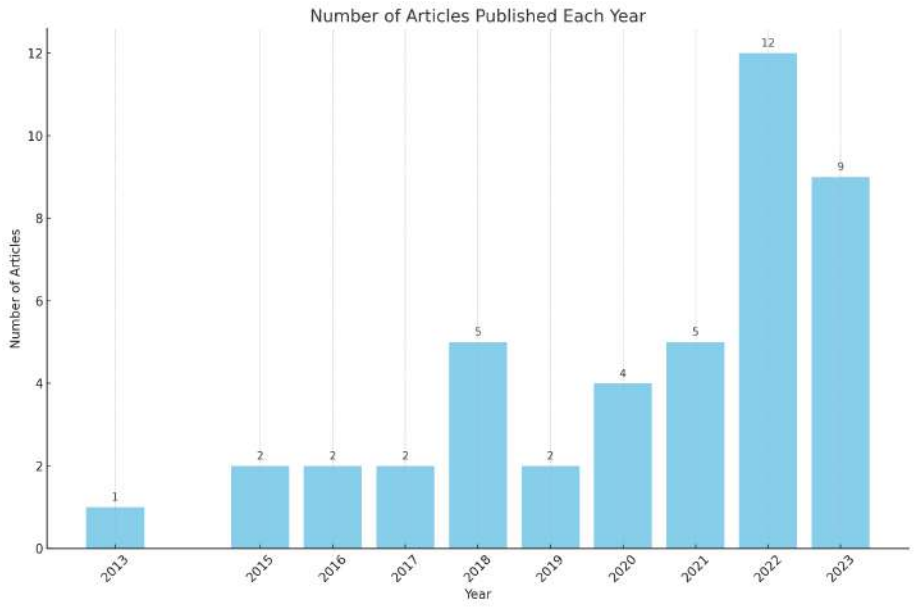


Figure 1.2: Publication Trends From 2013 to 2023.

1.3.1 Methodology

A wide range of methodological approaches emerged from the analysis of the 50 articles included in the literature review. Authors approached the issue of understanding packaging cues related to sustainability from several different angles, in particular the methodological approaches identified are: qualitative (netnography, focus groups, interviews), quantitative (surveys and experiments, both online and in the lab), literature reviews and a handful of mixed methods papers. As shown in Table 1.1 the main methodological approach was quantitative, evenly divided between surveys [1] and experiments [2], both

[1] [Borrello et al., 2019, Cavallo and Piqueras-Fiszman, 2017, Dantas et al., 2023, De Feo et al., 2022, Galati et al., 2022, Guntzburger et al., 2022, Herbes et al., 2018, Hess and Bongaerts, 2020, Lazzarini et al., 2016, Norton et al., 2022, Oliver et al., 2023, Orzan et al., 2018, Rees et al., 2019, Smith et al., 2021, Steenis et al., 2017, Walker et al., 2021, Weber Macena et al., 2021, Xu et al., 2022, Zhang et al., 2018]

[2] [Antonazzo et al., 2015, Capitello et al., 2021, Chiu et al., 2023, Galati et al., 2022, Kongsli Gjerde, 2022, Granato et al., 2022, Hallez et al., 2023, Herédia-Colaço, 2023, Jerzyk, 2016, Boz et al., 2020, Monnot et al., 2015, Simão et al., 2022, Sokolova et al., 2023, Steenis

Method	Number	% of Total
Quantitative Experiments	21	42%
Quantitative Survey	19	38%
Qualitative	5	10%
Mixed methods	3	6%
Literature review	2	4%

Table 1.1: Methodological Approaches

online and lab experiments making up 80% of the articles. The remaining 20% was split between articles utilizing qualitative [3], mixed-methods [Branca et al., 2023, Herrmann et al., 2022, Ischen et al., 2022] and literature reviews [Borgianni et al., 2022, Schleenbecker and Hamm, 2013] approaches.

1.3.2 Product Category

When taking a look at the product categories observed in recent literature (Table 1.2) the analysis reveals a significant inclination towards the study of products pertaining to the food and beverage category, in fact 70% (68% only included this category and 2% studied two categories, one of which was food and beverage) of the papers present in our dataset studied this type of product. [4]

Moreover, another significant portion of the studies, looked at the packaging attribute in isolation, meaning not liking it to a specific product category

et al., 2018, Techawachirakul et al., 2023, Vergura et al., 2020, Zeng et al., 2021]

[3] [Bauer et al., 2023, Boesen et al., 2019, Groth et al., 2023, Nguyen et al., 2020, Sekki et al., 2023]

[4] [Antonazzo et al., 2015, Bauer et al., 2023, Boesen et al., 2019, Borrello et al., 2019, Branca et al., 2023, Capitello et al., 2021, Cavallo and Piqueras-Fiszman, 2017, Cheek and Wansink, 2017, Dantas et al., 2023, De Feo et al., 2022, Donato et al., 2021, Galati et al., 2022, Kongsli Gjerde, 2022, Granato et al., 2022, Groth et al., 2023, Hallez et al., 2023, Herrmann et al., 2022, Ischen et al., 2022, Lamberz et al., 2020, Lazzarini et al., 2016, Monnot et al., 2015, Nguyen et al., 2020, Norton et al., 2022, Oliver et al., 2023, Rees et al., 2019, Simão et al., 2022, Smith et al., 2021, Sokolova et al., 2023, Steenis et al., 2017, Stremmel et al., 2022, Techawachirakul et al., 2023, Vergura et al., 2020, Xu et al., 2022, Zhang et al., 2018, Zeng et al., 2021]

but to product packaging in general [5]. Furthermore, the "other" category, comprised of 5 studies, includes one study on paint [Hess and Bongaerts, 2020], one on laundry detergent [Chiu et al., 2023], one on cleaning products [Simão et al., 2022] and two on shower gel [Herédia-Colaço, 2023, Steenis et al., 2018]. Only one article [Simão et al., 2022] included two product categories, namely food and cleaning products. Highlighting a lack of representation for categories other than fast moving consumer goods, which could, possibly, undergo different processes with regards to sustainability perception of packaging, and consequently, of the product itself.

Product Type	Number	% of Total
Food and Beverage	34	68%
Attribute only	11	22%
Other	4	8%
Two categories	1	2%

Table 1.2: Product Categories Studied

1.3.3 Packaging Cues Studied

The 50 papers study a variety of packaging cues, as shown in 1.3 six main categories of packaging cues have been studied in the current literature, with a prevalence of material [6], labels [7] and claims [8]. The remaining cues identified

[5] [Borgianni et al., 2022, Boz et al., 2020, Guntzburger et al., 2022, Herbes et al., 2018, Jerzyk, 2016, McLeod et al., 2022, Orzan et al., 2018, Sekki et al., 2023, Schleenbecker and Hamm, 2013, Walker et al., 2021, Weber Macena et al., 2021]

[6] [Boesen et al., 2019, Cheek and Wansink, 2017, Chiu et al., 2023, Dantas et al., 2023, De Feo et al., 2022, Donato et al., 2021, Galati et al., 2022, Granato et al., 2022, Groth et al., 2023, Herbes et al., 2018, Herrmann et al., 2022, Hess and Bongaerts, 2020, Ischen et al., 2022, Monnot et al., 2015, Nguyen et al., 2020, Norton et al., 2022, Oliver et al., 2023, Orzan et al., 2018, Sokolova et al., 2023, Steenis et al., 2018, Vergura et al., 2020, Walker et al., 2021, Weber Macena et al., 2021]

[7] [Antonazzo et al., 2015, Borrello et al., 2019, Cavallo and Piqueras-Fiszman, 2017, Chiu et al., 2023, Granato et al., 2022, Guntzburger et al., 2022, Hess and Bongaerts, 2020, Ischen et al., 2022, Lazzarini et al., 2016, McLeod et al., 2022, Norton et al., 2022, Rees et al., 2019, Schleenbecker and Hamm, 2013, Smith et al., 2021, Stremmel et al., 2022, Techawachirakul et al., 2023, Xu et al., 2022, Zhang et al., 2018]

[8] [Boz et al., 2020, Granato et al., 2022, Hallez et al., 2023, Herédia-Colaço, 2023, Jerzyk, 2016, Lamberz et al., 2020, Simão et al., 2022, Zeng et al., 2021]

were color [9], design [10] and origin [11]. Moreover, 16 out of the 50 papers, so 32% involved two or more packaging cues in their studies.

Cues Studied	Number	% of Total
Material	23	35.38%
Ecolabel	18	27.69%
Claim	9	13.85%
Overall design	6	9.23%
Color	4	6.15%
Origin	3	4.62%
No cue	2	3.08%

Table 1.3: Number of Studies by Cue Category

The percentage reported in Table 1.3 are to be considered individually over the total of 50 articles because 30% of the papers considered more than one cue category in their analyses.

1.4 Overall Results

In the following section the main results of the content analysis will be discussed. Ten different categories emerged from the literature review and have been summarized below in Table 1.4.

[9] [Bauer et al., 2023,Kongsli Gjerde, 2022,Jerzyk, 2016,Nguyen et al., 2020,Steenis et al., 2017,Steenis et al., 2018]

[10] [Cavallo and Piqueras-Fiszman, 2017, Granato et al., 2022, Hallez et al., 2023, Sekki et al., 2023]

[11] [Cavallo and Piqueras-Fiszman, 2017,Lazzarini et al., 2016,Smith et al., 2021]

Category	Summary
Perception vs Impact	Highlighting discrepancies between consumer perceptions of sustainability and the actual environmental impact.
Sustainability Perceptions	Studies focus on packaging materials and eco-labels influencing consumer perceptions of product sustainability.
Packaging Design Impact	Research explores the role of design elements in influencing consumption habits and purchase intentions.
Brand Perception	Investigations into how brand familiarity affects the reception of sustainability cues by consumers.
Attitudes towards Plastic	Documenting consumer attitudes towards plastic packaging and openness to sustainable alternatives.
Cue Interactions	Research on how the interaction between various sustainability cues influences consumer perceptions and behaviors.
Neuromarketing Insights	Emerging methodologies providing new insights into consumer engagement with packaging.
Material	Sustainable materials boost products' eco-friendliness perception and sway consumer choices towards greener options.
Eco-label	Eco-labels signal a product's green attributes, directly influencing consumer decisions toward sustainable purchases.
Claim	Sustainability claims on packaging positively shape eco-friendly perceptions and encourage greener purchasing behaviors.

Table 1.4: Summary of Result Categories from the Literature Review

1.4.1 A Gap Between Perceptions and Actual Environmental Impact

A notable discrepancy between consumer perceptions of sustainability and the actual environmental impact of packaging materials was identified [De Feo et al., 2022]. The study, revealed a misalignment between consumer beliefs—rating glass as the most sustainable option—and life cycle assessments showing glass to have a higher environmental footprint compared to plastics or aluminum.

1.4.2 Sustainability Perceptions and Consumer Behavior

The majority of the studies emphasize the crucial role packaging plays in shaping consumers' perceptions of product sustainability. Materials such as biodegradable plastics and the presence of eco-labels significantly enhance the perceived environmental friendliness of products [Ischen et al., 2022,Techawachirakul et al., 2023] Notably, consumer responses vary depending on the type of product, with a particular sensitivity towards food and beverage items due to

direct consumption implications [Galati et al., 2022, Smith et al., 2021].

1.4.3 Impact of Packaging Design on Consumption Patterns

Several studies explored how specific design elements, including packaging material, labels, and claims, influence consumer behavior, from purchase intentions to actual consumption habits. For instance, eco-design packaging was shown to reduce food waste by enhancing product conservation through visual cues like resealability [Zeng et al., 2021]. Conversely, the study by Donato et al. [2021] found that sustainable packaging leads to higher perceived food satiation due to the higher perceived food quality of sustainably labelled foods. This interaction effect however is only found for healthy foods, thus suggesting a complex interaction between packaging design and food type.

1.4.4 The Role of Familiarity and Brand Perception

A recurring theme across studies is the impact of brand familiarity on the effectiveness of sustainability cues. On this matter Herédia-Colaço et al. [2023] found that a brand's efforts towards pro-environmental communication appeals (claims) are more salient to the consumer when the appeal comes from a low-familiarity brand, this effect is stronger when consumer sustainability habits are lower. For example, when a brand communicates the adoption of sustainable packaging said claim will be more salient to consumers that have low familiarity with the brand. This underscores the role brand identity plays in sustainable packaging effectiveness.

1.4.5 Consumer Attitudes Towards Plastic and Alternatives

A significant portion of the articles reviewed focuses on consumer attitudes towards plastic packaging and their openness to alternatives. For example the mixed-methods study by Herrmann et al. [2022] finds a higher willingness to pay for sustainable packaging alternatives to plastic (paper and bioplastics). This trend is echoed by other studies [Walker et al., 2021, Weber Macena et al., 2021] documenting a strong consumer motivation to reduce their consumption

of single-use plastic as well as highlighting a willingness to pay a premium for sustainable alternatives.

1.4.6 Cue Interactions and Their Effects

The interaction between multiple sustainability cues and their collective impact on consumer perception and behavior was explored in a few studies, indicating an area ripe for further research. Granato et al. [2022] and Hallez et al. [2023] delve into how explicit and implicit cues, such as labels and packaging color, combine to influence perceptions of healthiness, sustainability, and tastiness.

1.4.7 Insights from Neuromarketing and Eye-Tracking

Emerging research methodologies like eye-tracking have provided new insights into how consumers engage with packaging [Borgianni et al., 2022]. Lamberz et al. [2020] utilized eye-tracking to demonstrate how sustainability interests affect consumer attention to packaging cues, offering a more nuanced understanding of the visual appeal of sustainable packaging.

1.4.8 Packaging Material

The choice of packaging material emerges as a dominant factor influencing consumer perceptions of sustainability (see Table 1.3. Studies consistently show that materials perceived as natural or biodegradable, such as paper or certain plastics, significantly enhance the product's perceived environmental friendliness [Groth et al., 2023,Sokolova et al., 2023,Walker et al., 2021]. The research indicates a strong consumer preference for materials that are not only sustainable but also convey a clear message of environmental responsibility [Bauer et al., 2023, Galati et al., 2022].

1.4.9 Ecolabelling

Eco-labels play a crucial role in communicating the sustainability attributes of a product to consumers [Guntzburger et al., 2022]. The presence of eco-labels on packaging effectively signals a product's environmental credentials, influencing purchase intentions towards more sustainable choices [Antonazzo et al.,

2015, McLeod et al., 2022, Stremmel et al., 2022]. This effect is particularly pronounced when eco-labels are used in conjunction with other sustainability cues, suggesting a synergistic interaction that amplifies consumer perceptions of product sustainability [Ischen et al., 2022, Smith et al., 2021]

1.4.10 Sustainability Claims

The literature highglights the influence of sustainability claims on packaging, and their role in shaping consumer perceptions and behaviors. Such claims, when clearly articulated, significantly elevate the product's perceived eco-friendliness and can drive stronger purchase intentions. However, the effectiveness of these claims often hinges on the credibility of the message and the consumer's environmental awareness. For instance, Herédia-Colaço et al. [2023] found that pro-environmental messages from less familiar brands wield more substantial influence, suggesting a nuanced interplay between brand familiarity and message efficacy. Similarly, another study [Stremmel et al., 2022] demonstrated that vegan labeling, as a form of sustainability claim, can alter product perceptions and consumption intentions, especially when it is unexpected by consumers to be dealing with a vegan product, underscoring the complexity of claim-based communication in the marketing of sustainable products.

1.5 Gaps Identification and Future Research Directions

In this section gaps in the literature will be discussed. While the current literature offers valuable insight into the role of packaging cues in communicating sustainability, it also reveals some areas in which research is currently less developed. Therefore, opening opportunities for further studies that have the potential to enhance our understanding of how sustainability related cues on product packaging influence consumers, their behaviors and their decision making processes. The gaps identified are the following: lack of diversity in product categories, lack of studies looking into the interaction of multiple cues on the same product packaging, and lastly, diversification in methodological approaches.

1.5.1 Diversification of Product Categories

The analysis presented in this chapter uncovers a notable disparity in the product categories that have been the focus of studies on packaging cues related to sustainability. As detailed in Table 1.2, a substantial 70% of the research has concentrated on products within the food and beverages sector. Hence suggesting a potential oversight of how cues are perceived by consumers across product categories. In order to enhance the applicability and dept of our understanding of this phenomenon future research should aim at including multiple product categories in future studies. Broadening the scope of research to include a greater variety of product categories would serve two purposes.
Firstly, it would allow for the generalization of the findings on sustainability related packaging cues beyond the food and beverage sector by offering insights into consumer perception across different market segments. Secondly, it would provide a more nuanced understanding of how specific product characteristics influence the effectiveness of sustainability cues in communicating the sustainable attributes of the product.
Lastly, contextual factors could also play a role in consumer perception of these cues, meaning that the ones relevant to consumers could differ for different categories. For this reason involving a broader array of product categories in future studies could uncover insights into how context-specific factors shape consumer response to packaging cues.

Moreover, contextual factors could also play a role in the consumers perception of sustainability related cues on the packaging, meaning that the cues should also hold relevance to consumers. This expanded exploration could also uncover the potential for innovative packaging solutions and sustainability communications tailored to the unique demands and characteristics of each product category.

1.5.2 Cue Interaction

A great majority of the studies included in this literature review (34%) observed only one sustainability related cue, overall it appears that studies observing the interaction between multiple packaging cues, albeit present, [Granato et al., 2022, Hallez et al., 2023, Magnier and Schoormans, 2015] are scarce. Go-

ing forward researchers should aim at investigating cues collectively, because consumers interpret packaging cues collectively, not in isolation. Moreover, understanding the relationships between different elements is crucial for uncovering how different elements combine to influence consumer perceptions of sustainable packaging.

1.5.3 Diversifying Methodological Approaches

While the studies examined utilize a plethora of methodological techniques, most use traditional consumer behavior methodologies for data collection and analysis, like surveys, online experiments, focus groups. However, these methodologies mainly allow to capture the conscious and deliberate responses of consumers to products or advertising. While these are of course appropriate and useful in uncovering the processes behind sustainability cue perception the literature review also suggests that the use of new technologies such as eye-tracking [Borgianni et al., 2022, Chiu et al., 2023] and virtual reality headsets [Branca et al., 2023] should be expanded. In particular, with regards to eye-tracking various studies have been carried out on visual attention and its role in product packaging evaluation [Clement, 2007, Clement et al., 2013, Orquin and Scholderer, 2011, Orquin et al., 2020] Moreover, although this aspect was not explicitly highlighted in the literature review the authors posit that neurophysiological data, namely EEG, fMRI, GSR, PPG and eye-tracking, commonly used in neuromarketing, could help uncover the nuanced and often subconscious elements of consumer perceptions and decision making processes [Moya et al., 2020, Spence et al., 2019, Stasi et al., 2018].

1.6 Conclusions

This chapter focused on reviewing the current literature linking sustainability cues, product packaging and consumer perception. The analysis of the article highlights the pivotal role of packaging cues in conveying sustainability of packaging to consumers and influencing their perception and decision-making processes. Through the analysis of diverse studies, both qualitative and quantitative in nature, it became evident that the use of materials, eco-labels, claims, design choices and so on substantially sway consumer perception towards eco-

friendly products. Hence demonstrating the crucial impact of packaging on consumer behavior within the context of sustainable consumption.

The main takeaways from the review bring up the importance of sustainable materials, ecolabels, and design attributes in enhancing perceived environmental friendliness of products. These elements guide the consumer towards the choice of more sustainable options, reflecting a growing demand for eco friendly products. Furthermore, sustainability claims on packaging emerge as critical in shaping consumer perceptions, effectively communicating a product's eco-friendly attributes and encouraging more responsible purchasing behaviors.

The literature also highlights some gaps in the understanding of how sustainability related packaging cues interact and the extent to which they influence consumer choice across product categories. Future research should aim to diversify product categories because while packaging for food and beverages is very frequent in consumers lives it is not possible to assume that the sustainability-related cues present on food and beverages will be perceived the same way into other product categories. Moreover, future research should delve into interaction between multiple cues and use innovative methodologies, such as eye-tracking, EEG, and virtual reality headsets, to capture the full spectrum of consumer perception of product packaging.

To conclude, this literature highlights the pivotal role of packaging cues in communicating sustainability and their direct effect on consumer behavior. It emphasizes the need for a deeper exploration of consumer behaviors in response to packaging cues, which is crucial for developing more effective marketing strategies for the promotion of sustainable consumption.

APPENDIX A - Articles Overview

This appendix presents the synthesis of the research studies included in the analysis of this literature review. It offers a breakdown of 50 articles, systematically detailing each study's authors, the title, the publication year, the journal, the methodological approaches employed, the key findings, the specific products examined, and the types of cues related to sustainability. This table serves as a cornerstone for understanding the diverse methodological perspectives and the breadth of conclusions drawn in the realm of sustainable packaging and its influence on consumer behavior. It highlights the multifaceted nature of research in this domain, ranging from the influence of visual and textual cues on consumer perceptions to the effects of packaging materials and designs on purchase intentions. The table is designed to facilitate an at-a-glance comparison and analysis of the various dimensions explored across different studies, thus providing an resource for researchers and practitioners seeking to deepen their understanding of consumer responses within the context of sustainability.

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Techawachirakul M.; Pathak A.; Motoki K.; Calvert G.A.	Negative halo effects of sustainable packaging	2023	Psychology and Marketing	Quantitative, 3 studies	Sustainable packaging in the alcoholic beverage industry, such as paper bottles, initially leads to lower consumer expectations for the product, negative perceptions can be mitigated through enforced messaging and attractive packaging, highlighting the complex impact of green packaging efforts	alcoholic beverages	eco label
Oliver M.O.; Jestratijevic I.; Uanhoro J.; Knight D.K.	Investigation of a Consumer's Purchase Intentions and Behaviors towards Environmentally Friendly Grocery Packaging	2023	Sustainability (Switzerland)	Quantitative, online survey	Subjective norms and perceived behavioral control significantly influence US consumers' intentions and actual purchasing of environmentally friendly grocery packaging	fast moving consumer goods	material
Zeng T.; Durif F.; Robinot E.	Can eco-design packaging reduce consumer food waste? an experimental study	2021	Technological Forecasting and Social Change	Quantitative, study. 2x2 factorial design online experiment	Eco-design packaging, particularly with visual improvements like resealability, significantly reduces consumer food waste by enhancing product conservation and storage guidance, more than social or commercial packaging functions, with health consciousness also playing a role.	milk (study1), cheese (study2)	seal, verbal
Bauer A.-S.; Dörnyei K.R.; Krauter V.	Consumer complaints about food packaging	2023	Frontiers in Sustainable Food Systems	Qualitative, netnography	Analyze over 250 online consumer complaints about food packaging, identifying 12 design categories causing dissatisfaction, such as misleading information on quality or quantity and excessive packaging. It suggests aligning consumer perspectives with legal requirements to improve satisfaction and ecological design.	fast moving consumer goods (15 categories)	design
Ischen C.; Meijers M.H.C.; Vandeberg L.; Smit E.G.	Seen as Green? Assessing the Salience and Greenness of Environmentally Friendly Packaging Cues	2022	Journal of Food Products Marketing	Mixed methods: self-reports and mouse tracking	Both implicit (packaging material) and explicit (eco-labeling) cues enhance the salience and perceived environmental friendliness of products, with these effects being largely independent of a consumer's personal value of green consumerism.	milk	material, ecolabel

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Herédia-Colaço V.	Pro-environmental messages have more effect when they come from less familiar brands	2023	Journal of Product and Brand Management	Quantitative, 2 online studies	Pro-environmental messages from low-familiarity brands are more effective than those from high-familiarity brands in influencing consumers, particularly among those with weaker sustainability habits. The willingness to recycle is partially driven by a sense of shared environmental responsibility.	shower gel	claim
Herrmann C.; Rhein S.; Sträter K.F.	Consumers' sustainability-related perception of and willingness-to-pay for food packaging alternatives	2022	Resources, Conservation and Recycling	Mixed meoth-ods: qualitative text analysis and discrete choice experi-ment	Consumers are willing to pay more for packag-ing perceived as sustainable (such as unpack-aged, paper, recycled plastic, bioplastic) but are unwilling to pay for options perceived as non-sustainable or when there is uncertainty about sustainability. Despite recognizing the benefits of single-use plastic, there is a general dissatisfaction among consumers with the cur-rent packaging options.	food items	material
Galati A.; Alaimo L.S.; Ciaccio T.; Vrontis D.; Fiore M.	Plastic or not plas-tic? That's the prob-lem: analysing the Ital-ian students purchas-ing behavior of min-eral water bottles made with eco-friendly pack-aging	2022	Resources, Conservation and Recycling	Quantitative, fuzzy cluster-ing	High consumer sensitivity towards paying for eco-friendly bottled water packaging among the student population of the University of Palermo, highlighting the importance of marketing and policy strategies that con-sider consumer attitudes, behaviors, and socio-economic characteristics for promoting sus-tainable consumption and firm processes within a circular economy.	water	material
Donato C.; Barone A.M.; Romani S.	The satiating power of sustainability: the ef-fect of package sustain-ability on perceived sa-tiation of healthy food	2021	British Food Journal	Quantitative, 3 studies	Sustainable packaging leads to higher per-ceived food satiation due to the associated higher perceived food quality, but this effect is significant only for healthy foods, not for unhealthy ones.	sandwich, fries, apples	material (paper plastic)

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
McLeod A.; Yang W.; Fang D.; Nayga R.M.	Aligning values to labels: A best-worst analysis of food labels	2022	Agricultural and Resource Economics Review	Best-worst scaling experiment	Consumer preferences for sustainability-related food labels shift significantly when additional information about these labels is provided, underscoring the importance of clear, strict labeling standards and education to align consumer purchases with their environmental and sustainability values.	study done on labels only	ecolabels
Groth C.; Wegmann C.; Meyerding S.G.H.	Perception of product sustainability: The case of processed tomatoes – A qualitative study in Germany	2023	Journal of Retailing and Consumer Services	Qualitative, focus group	Consumers tend to overestimate the sustainability of glass packaging and regional production, while underestimating the environmental impact of heated greenhouses and the sustainability of composite boards and plastic packaging.	processed tomatoes	material
Simão S.A.V.; Rohden S.F.; Pinto D.C.	Natural claims and sustainability: The role of perceived efficacy and sensorial expectations	2022	Sustainable Production and Consumption	Quantitative, 2 studies	Natural claims on personal care products significantly influence consumer purchase intentions, driven by the "natural-is-better" bias and associated health halos. It further uncovers that perceived efficacy, safety, sensorial expectations, and concerns about greenwashing are key factors mediating this effect, with environmental consciousness also moderating perceptions of efficacy. These insights underline the complex interplay between natural claims and consumer behavior, offering guidance for brands and policymakers to foster sustainable consumption.	food, cleaning products, fragrances	claim

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Xu H.; Xiao M.; Zeng J.; Hao H.	Green-Labelled Rice versus Conventional Rice: Perception and Emotion of Chinese Consumers Based on Review Mining	2022	Foods	Quantitative, sentiment analysis	Reveals that consumer interest in green-labelled rice has significantly increased during the COVID-19 pandemic, with a predominantly positive attitude towards it. Compared to conventional rice, green-labelled rice consumers prioritize origin, aroma, and taste, although both groups are price-sensitive. Key barriers for green-labelled rice include mistrust in the green label and packaging issues during logistics, highlighting the intention-behaviour gap in green food consumption.	rice	label
Chiu T.-P.; Yang D.J.; Ma M.-Y.	The Intertwining Effect of Visual Perception of the Reusable Packaging and Type of Logo Simplification on Consumers' Sustainable Awareness	2023	Sustainability (Switzerland)	Eye-tracking experiment	Reusable packaging significantly enhances visual attention and attraction among consumers, as demonstrated by eye tracking data showing faster attention capture by reusable packaging and monotone logos compared to traditional packaging. Survey and t-test analyses further confirm the positive impact of reusable packaging on consumer perceptions, suggesting that sustainable packaging choices can contribute to increased environmental awareness and preference in the context of the surge in online shopping due to COVID-19.	laundry detergent	logo, material (reusable)
Walker T.R.; McGuinty E.; Charlebois S.; Music J.	Single-use plastic packaging in the Canadian food industry: consumer behavior and perceptions	2021	Humanities and Social Sciences Communications	Quantitative, sruvey	A significant majority (93.7%) of Canadian consumers are motivated to reduce their consumption of single-use plastic food packaging, yet show reluctance to pay premiums for sustainable packaging alternatives. Despite environmental concerns being prioritized over food safety, there is a preference for sustainable packaging solutions over complete bans on plastic bags, indicating a gap between consumer motivation and willingness to financially support sustainable alternatives.	n/a	material (plastic)

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
De Feo G.; Ferrara C.; Minichini F.	Comparison between the perceived and actual environmental sustainability of beverage packagings in glass, plastic, and aluminium	2022	Journal of Cleaner Production	Quantitative, survey	Italian consumers perceived glass bottles as the most environmentally sustainable option, followed by aluminum cans, while plastic bottles were considered the least sustainable. However, the life cycle assessment (LCA) study found that glass packaging had the highest environmental impact, contradicting consumer perceptions.	beverages	material
Smith M.; Lal P.; Oluoch S.; Vedwan N.; Smith A.	Valuation of sustainable attributes of hard apple cider: A best-worst choice approach	2021	Journal of Cleaner Production	Quantitative, survey	Consumers highly valued attributes like 'local' and 'organic,' willing to pay premiums of \$10.05 and \$6.39, respectively. 'IPM' and 'supporting biodiversity restoration' also positively influenced perception, commanding premiums of \$5.81 and \$5.68. 'Eco-conscious packaging' and 'using renewable energy' had less utility but still prompted consumers to pay premiums. Social responsibility attributes like 'charitable donations' and 'community volunteering' were valued, with premiums of \$5.89 and \$7.49, respectively.	apple cider	label
Sokolova T.; Krishna A.; Döring T.	Paper Meets Plastic: The Perceived Environmental Friendliness of Product Packaging	2023	Journal of Consumer Research	Quantitative, 8 studies	The authors dentified a perceived environmental friendliness (PEF) bias among consumers. Specifically, consumers tended to perceive plastic packaging with additional paper as more environmentally friendly than identical plastic packaging without the paper. This bias was driven by consumers' beliefs associating paper with environmental friendliness and plastic with environmental harm, as well as by proportional reasoning. Importantly, the PEF bias influenced consumers' willingness to pay and product choice.	granola bar, chocolate bar, tomatoes, honey, chips	material (paper/plastic)

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Dantas R.; Sabir I.; Martins J.M.; Majid M.B.; Rafiq M.; Martins J.N.; Rana K.	Role of green and multisensory packaging in environmental sustainability: Evidence from FMCG sector of Pakistan	2023	Cogent Business and Management	Quantitatitve, survey	Green packaging has a significant and positive effect on environmental sustainability, while multisensory packaging has a negative impact. Consumer perception positively moderates the relationship between green packaging and ecological sustainability. However, consumer environmental knowledge did not have a mediating effect between green packaging, multisensory packaging, and ecological sustainability.	fast moving consumer goods	nan
Borgianni Y.; Maccioni L.; Dignös A.; Basso D.	A Framework to Evaluate Areas of Interest for Sustainable Products and Designs	2022	Sustainability (Switzerland)	Literature review, proposed a framework	Address the lack of generalizability in research on sustainable product design evaluation by proposing a framework of Areas of Interest. These areas, identified from past studies in ecodesign and green consumption, are not specific to particular products or sectors. The framework distinguishes between "Content," representing the quality aspect highlighted, and "Form," representing the graphical element used for communication. This framework facilitates the study of how observation of Areas of Interest influences product appreciation and value perception across various product categories, including both sustainable and commonplace products.	n/a	n/a
Granato G.; Fischer A.R.H.; van Trijp H.C.M.	A meaningful reminder on sustainability: When explicit and implicit packaging cues meet	2022	Journal of Environmental Psychology	Quantitative, 3 studies	The study explores how eco-explicit (e.g., logos, labels, statements) and implicit packaging design cues (e.g., auditory, tactile, visual elements) combine and interact to enhance sustainability salience, perception, and sustainable disposal behavior. The findings highlight conditions where the combination of explicit and implicit cues can be counterproductive, as well as situations where it positively impacts sustainability outcomes.	cookies, salad, soup	explicit cues (logos, labels, claims), implicit cues (auditory, tactile, visual elements)

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Hallez L.; Vansteenbeeck H.; Boen F.; Smits T.	Persuasive packaging? The impact of packaging color and claims on young consumers' perceptions of product healthiness, sustainability and tastiness	2023	Appetite	Quantitative, 2 studies	Both visual (colors) and textual (claims), significantly influence consumers' perceptions of product healthiness, sustainability, and tastiness. Cool packaging colors (green and blue) increase perceptions of food and drinks as healthy and sustainable. However, they also lead to lower expectations of tastiness and reduce the likelihood of product selection. On the other hand, the presence of a nutrition or ecological claim enhances perceptions of overall healthiness and sustainability without affecting taste expectations.	beverages, snacks	color, claim
Stremmel G.; Elshiewy O.; Boztug Y.; Carneiro-Otto F.	Vegan labeling for what is already vegan: Product perceptions and consumption intentions	2022	Appetite	Quantitative, experiment	Labeling randomly-vegan products influences consumer perceptions of healthiness, taste, and sustainability, particularly when consumers do not expect these products to be vegan by default. This labeling bias affects consumers' consumption intentions for unexpectedly vegan-labeled products compared to unlabeled products. Importantly, these effects are observed for both utilitarian and hedonic products. However, no significant effects of the vegan label were found for randomly-vegan products that consumers already expected to be vegan by default.	hummus, spread with herbs, jam, chocolate spread	label

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Guntzburger Y.; Peignier I.; de Marcellis-Warin N.	The consumers' (mis)perceptions of ecolabels' regulatory schemes for food products: insights from Canada	2022	British Food Journal	Quantitative, survey	The research aimed to delve into how consumers interpret these labels, particularly looking at their understanding of the regulatory mechanisms that ensure the products meet certain standards. The findings suggest that while ecolabels are intended to guide consumers towards more sustainable consumption choices, there's a significant need for enhanced communication strategies to better convey the regulatory frameworks and certifications behind these labels, thereby potentially influencing consumer trust and purchasing behavior.	n/a	ecolabel
Weber M.; Carvalho R.; Cruz-Lopes L.P.; Guiné R.P.F.	Plastic food packaging: Perceptions and attitudes of portuguese consumers about environmental impact and recycling	2021	Sustainability (Switzerland)	Quantitative, survey	Significant portion of participants recognize the negative environmental impact of plastic packaging. Specifically, 39% of respondents sometimes refrain from purchasing plastic, while 30% actively seek alternatives. Additionally, 81% support reducing the use of plastic utensils and bags. The majority of participants demonstrate good knowledge of recycling practices and express strong support for the use of recycled materials, with 87% practicing waste separation for recycling purposes.	n/a	material
Norton V.; Waters C.; Oloyede O.O.; Lignou S.	Exploring Consumers' Understanding and Perception of Sustainable Food Packaging in the UK	2022	Foods	Quantitative, survey	Labelling on packaging successfully influences consumer behavior, encouraging more sustainable choices. Key sustainable packaging attributes identified by consumers include biodegradability, disposal methods, renewable sources, recyclability, minimal packaging, and product quality. Overall, consumers express confusion about recycling and a lack of knowledge about sustainable materials.	food items	label, material

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Cavallo C.; Piqueras-Fiszman B.	Visual elements of packaging shaping healthiness evaluations of consumers: The case of olive oil	2017	Journal of Sensory Studies	Quantitative, survey	Visual elements of Extra-Virgin Olive Oil packaging influence consumers' perception of the product's healthiness. Elements such as organic production logos, country of origin (COO), and cold processing enhance healthiness perception, while sensory quality claims related to pungent properties lower it. The color of the bottle is interpreted differently by Dutch and Italian consumers, with dark bottles preferred in Italy and transparent bottles in The Netherlands.	oil	color, ecolabel, country of origin
Borrello M.; Annunziata A.; Vecchio R.	Sustainability of palm oil: Drivers of consumers' preferences	2019	Sustainability (Switzerland)	Quantitative, survey	Consumers generally prefer palm oil-free products, perceiving them as healthier or more eco-friendly. Respondents are influenced by available information on these foods, which guides their choices for palm oil-free options perceived as cleaner. However, findings also underscore a low level of information about palm oil, indicating a need for public information and communication campaigns to address misconceptions.	oil	label
Zhang B.; Fu Z.; Huang J.; Wang J.; Xu S.; Zhang L.	Consumers' perceptions, purchase intention, and willingness to pay a premium price for safe vegetables: A case study of Beijing, China	2018	Journal of Cleaner Production	Quantitative, survey	Consumers perceive food safety, strict production and processing, and a healthy environment as the top three advantages of safe vegetables. A large majority of consumers are familiar with organic and green vegetables, and many identify safe vegetables through certification labels on packaging. Additionally, a significant portion of consumers express willingness to buy safe vegetables and pay a premium price for them.	vegetables	label

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Nguyen A.T.; Parker L.; Brennan L.; Lockrey S.	A consumer definition of eco-friendly packaging	2020	Journal of Cleaner Production	Qualitative, focus group	Three main dimensions of consumer perceptions regarding eco-friendly packaging in Vietnamese packaged food products: packaging materials, manufacturing technology, and market appeal. Consumers exhibit diverse views, prioritizing factors like biodegradability, recyclability, attractive design, and competitive pricing. Although knowledge of manufacturing technologies is limited, consumers express a preference for an eco-friendly manufacturing process.	food	design, material
Steenis N.D.; van Herpen E.; van der Lans I.A.; Ligthart T.N.; van Trijp H.C.M.	Consumer response to packaging design: The role of packaging materials and graphics in sustainability perceptions and product evaluations	2018	Journal of Cleaner Production	Quantitative, survey	Packaging sustainability is a highly salient association for consumers but only moderately influences their attitudes. Despite this, consumers rely on inaccurate lay beliefs to judge packaging sustainability, leading to potentially ineffective environmental decisions. Changes in packaging materials can affect perceptions of sustainability as well as other product attributes like taste and quality. Graphical packaging cues also strongly influence consumers' sustainability assessments, regardless of their actual environmental impact.	soup	material, graphics (visual elements)

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Cheek A. K.; Wansink B.	Making It Part of the Package: Edible Packaging Is More Acceptable to Young Consumers When It Is Integrated With Food	2017	Journal of Food Products Marketing	Quantitative, experiment	Participants who received information about edible packaging and tasted it separately rated the product lower on taste, healthiness, and intention to purchase compared to other treatment groups. This suggests that framing a product as having environmental benefits due to its edible packaging can lead to negative judgments. The study also indicates that consumers' perceptions of edible packaging may depend on how well the packaging material is integrated with the principal food product, with highly separated products facing greater barriers to adoption.	frozen yogurt	material (edible)
Jerzyk E.	Design and Communication of Ecological Content on Sustainable Packaging in Young Consumers' Opinions	2016	Journal of Food Products Marketing	Quantitative, experiment	Sustainable packaging is not a significant factor in consumers' product purchasing decisions, Key information consumers seek includes recycling capabilities, efficient use of materials, and consumer health and safety. Interest in recycling stems from heightened awareness of packaging waste and associated costs.	n/a	design, claim
Boz Z.; Korhonen V.; Sand C.K.	Consumer considerations for the implementation of sustainable packaging: A review	2020	Sustainability (Switzerland)	Quantitaive, survey	study found that while sustainable packaging has limited influence on purchasing decisions, consumers value trust and confidence in packaging messaging. Key information sought includes recycling capabilities, efficient material use, and assurances of consumer health and safety. Consumers prioritize messages aligning with environmental consciousness and emphasize consumer welfare. Credibility is crucial, and consumers are unwilling to compromise on quality for sustainability.	n/a	claim

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Hess M.; Bongaerts J.C.	Differences in perception of the environmental and health impacts of decorative paints among average consumers	2020	Sustainability (Switzerland)	Quantitative, survey	The survey indicated differences in perceptions between genders and parental status on the importance of ecolabels and Material Safety Data Sheets for decorative paints, and the preference for using solvent-free paints.	paint	ecolabel, material
Monnot E.; Parguel B.; Reniou F.	Consumer responses to elimination of overpackaging on private label products	2015	International Journal of Retail and Distribution Management	Quantitative, experiment	Eliminating overpackaging affects the image of mimic private labels negatively, particularly in perceived quality and convenience, and this influences purchase intentions.	yogurt	material (overpackaging), private label
Antonazzo A.P.; Fiore M.; La Sala P.; Contò F.	Assessing perceptions of wine tourists on organic wine	2015	Economia Agro-Alimentare	Quantitative, choice experiment	Organic certification labels significantly influence consumer choice, favoring wines with attributes like Protected Designation of Origin and region of origin.	wine	ecolabel
Schleenbecker R.; Hamm U.	Consumers' perception of organic product characteristics. A review	2013	Appetite	Literature review	Reveals limited knowledge and action towards environmentally friendly packaging among South African consumers, suggesting a need for improved awareness and promotion.	n/a	organic label
Lamberz J.; Litfin T.; Teckert Ö.; Meeh-Bunse G.	Is there a Link between Sustainability, Perception and Buying Decision at the Point of Sale?	2020	Business Systems Research	Eye-tracking experiment	Consumers interested in sustainability demonstrate a higher willingness to pay for products with sustainable packaging, as evidenced by longer attention spans to specific packaging and display elements during a real shopping experience.	juice packaging	claim
Orzan G.; Cruceru A.F.; Balaceanu C.T.; Chivu R.-G.	Consumers' behavior concerning sustainable packaging: An exploratory study on Romanian consumers	2018	Sustainability (Switzerland)	Quantitative, survey	onsumers prioritize environmental protection in their packaging choices, showing a preference for paper, glass, and cardboard, but face barriers such as price and a lack of information which impede the adoption of green packaging solutions.	n/a	material

Authors	Title	Year	Journal	Methods	Findings	Product	Cue
Herbes C.; Beuthner C.; Ramme I.	Consumer attitudes towards biobased packaging – A cross-cultural comparative study	2018	Journal of Cleaner Production	Quantitative, survey	Consumers mainly focus on packaging attributes related to its end-of-life, such as recyclability, reusability, and biodegradability, with notable differences in perception between Germany, France, and the U.S., indicating cultural variances in environmental priorities.	n/a	env impact, material, overpackaging
Boesen S.; Bey N.; Niero M.	Environmental sustainability of liquid food packaging: Is there a gap between Danish consumers' perception and learnings from life cycle assessment?	2019	Journal of Cleaner Production	Qualitative, interviews	significant gap between Danish consumers' perceptions of environmentally sustainable packaging, which is mainly based on material type and disposability, and the more comprehensive environmental impacts identified through LCA studies, suggesting a need for enhanced consumer education on sustainable packaging.	beer, soft drinks	material
Lazzarini G.A.; Zimmermann J.; Visschers V.H.M.; Siegrist M.	Does environmental friendliness equal healthiness? Swiss consumers' perception of protein products	2016	Appetite	Quantitative, sorting	Findings indicate a strong correlation between the perceived environmental friendliness and healthiness of food products, with consumers basing their evaluations on factors such as product category, organic labeling, and product provenance, pointing towards a synergy between environmental and health motivations in food choices.	protein products	ecolabel, provenience
Steenis N.D.; van der Lans I.A.; van Herpen E.; van Trijp H.C.M.	Effects of sustainable design strategies on consumer preferences for redesigned packaging	2018	Journal of Cleaner Production	Quantitative, 2 studies	The study reveals a consumer preference for packaging designed according to circular strategies (like biodegradability) over linear strategies (such as lightweighting), and suggests that combining multiple sustainable design strategies does not significantly increase consumer purchase intentions, highlighting a nuanced consumer response to sustainability claims.	mock pack, shower gel	design

Chapter 2

Validation and Psychometric Properties of the Italian Version of the Environmental Self Efficacy Scale Short (ESE 10)

The Environmental Self-Efficacy Scale (ESE), conceived in 2019 by Moeller and Stahlmann [Moeller and Stahlmann, 2019], represents an essential tool for gauging individual beliefs in their capability to undertake actions beneficial to the environment. This concept of environmental self-efficacy is critical, especially in the face of escalating environmental crises that demand collective action. It embodies the conviction that one can meaningfully contribute to environmental conservation and sustainability, a belief that is pivotal for fostering proactive environmental behaviors.

The development of the ESE scale, and specifically its abbreviated form, the ESE-10, marks a significant advancement in environmental psychology. It provides researchers and practitioners with a succinct, yet effective, instrument for measuring an individual's perceived efficacy in environmental engagement. The brevity of the ESE-10 enhances its practicality and accessibility, making it an invaluable asset for large-scale surveys and studies aimed at understanding and enhancing pro-environmental behaviors.

The need for such measures extends beyond mere academic interest, addressing a critical gap in the global endeavor to promote sustainable living practices. As environmental challenges become increasingly borderless, the

ability to assess and compare environmental self-efficacy across cultures becomes indispensable. This necessitates the translation and validation of reliable instruments like the ESE-10 into various languages, thereby enabling cross-cultural research and facilitating a more unified global response to environmental issues.

This chapter endeavors to validate the Italian translation of the ESE-10, seeking to fill a notable void in the tools available for measuring environmental self-efficacy among Italian-speaking populations. This work is not just a contribution to the methodological arsenal available to researchers in environmental psychology; it is also a step towards understanding the universal and culture-specific aspects of environmental self-efficacy. By exploring how environmental attitudes and behaviors manifest across different cultural contexts, this research aims to uncover deeper insights into the global psyche regarding environmental conservation and action.

The validation of the Italian ESE-10 scale is poised to offer significant contributions to the field. It will facilitate the engagement of Italian-speaking populations in environmental behavior research, enabling investigations into the effectiveness of interventions aimed at enhancing environmental self-efficacy and, ultimately, promoting more sustainable behaviors. Furthermore, this research will contribute to the broader discourse on the role of individual beliefs and attitudes in the collective effort to address environmental challenges, highlighting the importance of psychological factors in the global environmental movement.

2.1 Materials and Methods

2.1.1 Participants and Procedure

For the validation of the Italian version of the Environmental Self-Efficacy Scale short (ESE-10) a total of 549 Italian participants were recruited through convenience sampling, the data was collected through an online survey using Google Forms and data collection took place between 19/12/2022 and 06/02/2023. All answers were mandatory, consequently there are no instances of missing data in the dataset. The data cleaning process, after which 140 participants were excluded from the analyses, consisted of checking and removing uniform,

sequential and alternating patterns leaving a total sample of 409 participants included in the analyses.

Participants' ages ranged from 18 to 75 years old [mean 31,48, SD: 13,52]. The majority of the sample was made up of female participants [80.2%], while men accounted for 16,87% of the sample and the last 2.93% preferred not to specify their gender. All participants were of legal age and were asked to provide their informed consent prior to starting the survey.

In the conducted survey, respondents first filled out the Italian version of the ESE-10 scale, followed by the Italian GSE-short scale, and finally answered a set of demographic questions. The characteristics of the sample have been summarized in Table 2.1.

Characteristic	**Category**	**Percentage (%)**
Gender	Female	80
	Male	17
	Rather not say	3
Age	<35 years	73
	36-50 years	11.5
	>50 years	15.4
Occupation	Student	38
	Employee	25
	Freelance	11
	Other	26
Education Level	Highschool or lower	47
	University Degree	44
	Post Graduate	9
Place of Residence	North	62
	South	26
	Islands	5
	Center	4
	Abroad	3
Marital Status	Unmarried	65
	Married	23
	Cohabitant	9
	Divorced/Widower	3

Table 2.1: Characteristics of Participants

2.1.2 Instruments

The Evironmental Self-Efficacy Scale short (ESE-10 hereforth) was proposed by Moeller and Stahlmann [2019] and is an instrument designed to measure an individual's confidence in their capacity to perform pro-environmental actions. The scale was developed in relation to individual character strengths and aimed at highlighting environmental self-efficacy as a novel and self standing construct different from the already existing measures for self-efficacy. Considering that character strengths are assumed to contribute to an individual's well-being and also communal thriving, which includes environmental behaviors. Therefore, starting from this concept Moeller and Stahlmann demonstrate that five othter-focused character strengths (kindness, humility, prudence, fairness and forgiveness) are uniuely related to environmental self-efficacy and not to generalized-self-efficacy [Gifford, 2011, Moeller and Stahlmann, 2019, Norgaard, 2009].
The ESE scale comprises ten items representing dimension, namely environmental self-efficacy, using an 11-point Likert scale that ranges from from 0 (cannot do at all) to 10 (highly certain can do).

The General Self Efficacy Scale short (GSE-short) was introduced by Romppel et al. [2013] in order to provide a shorter form of the original GSE scale proposed by Schwarzer and Jerusalem in 1995. The GSE scale evaluates an individual confidence in their own ability to handle new or challenging circumstances and to overcome any related obstacles or difficulties. Each statement has to be evaluated based on four response options ranging from "1 = not at all true" to "4 = exactly true"; higher scores represent a greater sense of general self-efficacy of the individual [Schwarzer and Jerusalem, 1995,Romppel et al., 2013]. This instrument has been used in order to confirm the concurrent validity of ESE with GSE, as suggested by Moeller and Stahlmann [2019]. The scale has already been validated in the Italian language [Sibilia et al., 1995].

2.1.3 Translation

The ESE-10 Items [Moeller and Stahlmann, 2019] underwent a process of *back-translation* [Brislin, 1970, Klotz et al., 2023] from English into Italian and was

performed by two independent translators as recommended in the literature [Klotz et al., 2023, Spector 2013]. Back-translation was chosen as the preferred methodology for this scale because of its relevance with regards to cross-cultural scale validation [Klotz et al., 2023] in the social sciences. Firstly, the first translator translated the scale into Italian, followed by a second translator who translated this Italian version back in to English. Then the two English versions of the scale were compared by the author and another expert in the field to ensure that the translated items retained the conceptual meanings of the original version. Discrepancies between the original and back-translated version were discussed leading to the finalization of the Italian version of the ESE-10 [Klotz et al., 2023]. This rigorous process aimed to achieve semantic, idiomatic, experiential, and conceptual equivalence between the English and Italian versions of the ESE-10 scale.

The original version of the scale and the translated version can be found, respectively, in Table 2.2 and Table 2.3

Table 2.2: ESE original Version

No.	I can...
1	help mitigate environmental problems in my community, if they arise
2	find several ways to be part of the solution when I am introduced to an environmental problem
3	reduce the environmental problems that the next generation will need to face in the future
4	have a significant positive impact on the environment
5	reduce the negative impact I have on the planet
6	support environmental policy through political activism
7	do my part in solving the world's environmental problems
8	be environmentally friendly even when the people with whom I have close relationships are not
9	set an example of environmentally friendly behavior, for others to follow
10	continue to take steps towards solving large environmental problems, even when others are overwhelmed by the scale of these problems

Table 2.3: ESE Italian Version

No.	Posso...
1	aiutare a mitigare i problemi ambientali nella mia comunità, qualora comparissero
2	trovare diverse modalità per rendermi parte della soluzione quando mi viene posto un problema legato all'ambiente
3	ridurre i problemi ecologici che la prossima generazione dovrà affrontare nel futuro
4	avere un impatto positivo significativo sull'ambiente
5	ridurre l'impatto negativo che ho sul pianeta
6	sostenere politiche ambientali attraverso l'attivismo politico
7	fare la mia parte nella risoluzione dei problemi ambientali del mondo
8	essere rispettosa/o nei confronti dell'ambiente anche quando le persone a me vicine non lo sono
9	rappresentare un esempio di comportamento ecologico che gli altri possono seguire
10	fare continui passi avanti verso la risoluzione dei grandi problemi ambientali, anche quando gli altri si sentono sopraffatti dalla loro portata

2.2 Exploratory Factor Analysis

The exploratory factor analysis (EFA) was carried out using packages *factoextra* [Kassambara and Mundt, 2020], *psych* [William Revelle, 2023], *lavaan* [Rosseel, 2012] using Rstudio version 2022.02.3+492. In line with best practices for scale validation and to ensure the robustness of the findings, the sample was divided in a 40/60 ratio for exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), respectively. This approach facilitates the independent identification of the factor structure and, consequently, the confirmation of the identified structure's validity [Henson and Roberts, 2006,Costello and Osborne, 2019].

The preliminary tests employed suggested the dataset suitability for factor analysis. In particular Bartlett's Test of Sphericity reported a Chi-square Value of 1619.538 and $p < 0.001$ indicating that the correlations between variables

are different from zero. KMO Measure of 0.9206573 suggests that the data is well suited for factor analysis. Moreover, the scree plot parallel analysis (Figure 2.1) suggests number of factors = 1 and number of components = 1, aligning with the findings reported in the original ESE scale paper [Moeller and Stahlmann, 2019]. A split index of 0.6 was applied in order to divide the dataset between exploratory and confirmatory factor analysis (respectively EFA and CFA). The total sample used in EFA was 40% of the dataset meaning that the analyses were performed on a sample of 164 subjects in total. The Maximum Likelihood (ML) method was chosen for factor extraction due to its robustness and efficiency in handling complex models and its suitability for hypothesis testing concerning the factor structure. This method is particularly effective in estimating parameters that result in the best fit of the model to the observed data, making it ideal for the exploratory phase of scale validation. The factor loadings for the ten scale items (ESE1-ESE10), reported in 2.4, range from 0.712 to 0.957, exceeding the commonly accepted threshold of 0.7, indicating a strong correlation of each item with the single underlying factor therefore reflecting the robust factorial structure of the translated scale. Moreover, 78% of the variance is accounted for by the ML1 structure.

	ML1
ESE1	0.827
ESE2	0.881
ESE3	0.943
ESE4	0.957
ESE5	0.920
ESE6	0.712
ESE7	0.878
ESE8	0.857
ESE9	0.878
ESE10	0.910

	ML1
SS loadings	7.724
Proportion Var	0.772

Table 2.4: Loadings

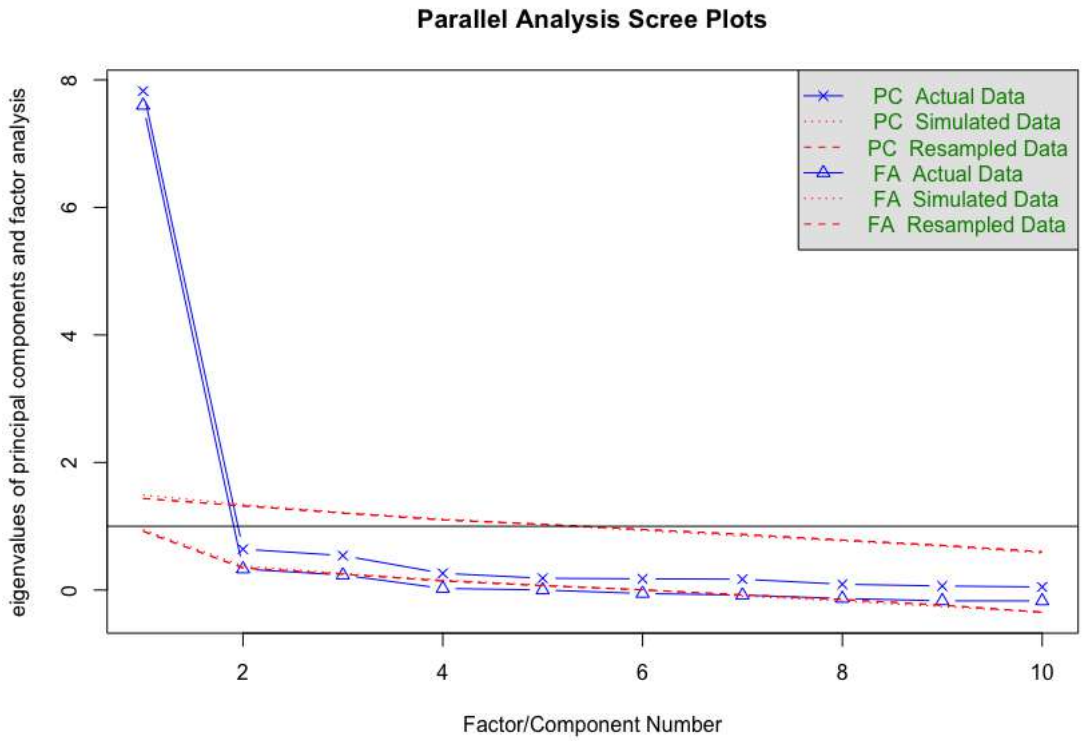


Figure 2.1: Scree Plot

In summary, the results derived from the EFA provide robust support for the reliability and unidimensionality of the Italian version of the ESE-10 scale, laying a firm groundwork for its use in scholarly investigations. This segment of the investigation sets the stage for the following phase, the Confirmatory Factor Analysis (CFA), which is expected to enhance the scale's construct validity further.

2.3 Confirmatory Factor Analysis

Building upon the exploratory factor analysis, a confirmatory factor analysis was conducted to validate the unidimensional structure of the Italian ESE-10 scale. Utilizing 60% of the original sample (n=245) this analysis aims to confirm the hypothesis that the ten items of the ESE-10 scale are indicative of a single underlying construct of environmental self-efficacy.

The CFA was executed using Rstudio version 2022.02.3+492, applying a Maximum Likelihood estimation method to assess the data's fit to the proposed

factor structure. Key fit indices, including the Chi-square/df ratio, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA), were selected to evaluate model fit. This approach enables a rigorous validation process, ensuring the scale's applicability in measuring the targeted psychological construct of environmental self efficacy.

As shown in the model specification below, during the process of validating the Italian version of the ESE-10 scale, item ESE9 was excluded post-translation as its inclusion consistently led to a poor model fit. Due to the iterative nature of confirmatory factor analysis (CFA), the model fit assessment becomes a critical factor. This decisions was empirically driven given that the goodness of fit indices (CFI, TLI, RMSEA and SRMR) did not meet the acceptable thresholds when item ESE9 was included in the model. The removed item, ESE09, concerned being an example to follow for others with regards to sustainable behaviors, two other items revolved around similar concepts, in particular items ESE08 and ESE10 focusing on being environmentally friendly regardless of the attitues of the people around oneself and continue working towards the resuluting of environmental problems even when others are overwhelmed by the magnitude of these issues. It seems that these three items, in the italian context represent very similar contexts and therefore explaining the poor performance of item ESE09, in fact items ESE08 and ESE10 allowed for the scale consistency to be maintained since the removed item's content was adequately covered by the remaining items, ensuring the construct's integrity was not compromised.

From a theoretical standpoint, the translation and adaptation process must consider semantic equivalence. If an item's translation fails to capture the original construct or overlaps significantly with other items, as was the case with item ESE9, its removal may be justified. This ensures that the scale measures the intended construct without redundancy, which is paramount in maintaining the scale's conceptual clarity and applicability within the new cultural context.

Therefore, the removal of item ESE9 is justified on both statistical and theoretical grounds. Statistically, the improved model fit post-removal confirms that the item was not contributing unique and meaningful variance to the construct

measurement. Theoretically, the construct of Environmental Self-Efficacy remains intact, as the essential qualities measured by the removed item are still captured within the scale. The pragmatic approach to scale adaptation ensures the ESE-10 scale's utility and relevance in Italian-speaking contexts, aligned with rigorous psychometric standards.

The model was therefore specified as follows:

$$\begin{aligned} \text{ESE} = \text{ESE1} + \text{ESE2} + \text{ESE3} + \text{ESE4} + \text{ESE5} + \text{ESE6} + \text{ESE7} + \text{ESE8} + \text{ESE10} \\ \text{ESE1} \sim \text{ESE2} \\ \text{ESE8} \sim \text{ESE10} \end{aligned}$$

The results highlight a good model fit. All the indices reported are scaled, which are deemed more appropriate when dealing with smaller samples like in this case. The model fit is assessed by the following indices:
Comparative Fit Index (CFI) = 0.996
Tucker-Lewis Index (TLI) = 0.995
Root Mean Square Error of Approximation (RMSEA) = 0.046
Standardized Root Mean Square Residual (SRMR) = 0.021.
In tables 2.5 and 2.6 the estimates for latent variables and covariance estimates were reported.

	Estimate	Std.Err	z-value	P($>\|z\|$)
ESE =∼				
ESE1	1.000			
ESE2	1.007	0.033	30.563	0.000
ESE3	1.039	0.034	30.939	0.000
ESE4	1.086	0.035	30.887	0.000
ESE5	1.072	0.036	29.709	0.000
ESE6	0.767	0.059	12.986	0.000
ESE7	0.980	0.038	25.978	0.000
ESE8	0.949	0.044	21.431	0.000
ESE10	0.953	0.044	21.584	0.000

Table 2.5: CFA Estimates for Latent Variable ESE

In conclusion the CFA further substantiated the unidimensional structure of the Italian ESE-9 scale (Table 2.7), with all fit indices indicating a good

	Estimate	Std.Err	z-value	P(> |z|)
.ESE1				
.ESE2	0.089	0.025	3.554	0.000
.ESE8				
.ESE10	0.114	0.036	3.214	0.001

Table 2.6: Covariance Estimates

model fit. These results highlight the scale's reliability and construct validity this supporting its effectiveness in assessing environmental-self-efficacy among Italian-speaking populations. The alignment of these findings with those of the original ESE-10 scale validation reinforces the scale's consistnecy across cultural contexts.

No.	**Posso...**
1	aiutare a mitigare i problemi ambientali nella mia comunità, qualora comparissero
2	trovare diverse modalità per rendermi parte della soluzione quando mi viene posto un problema legato all'ambiente
3	ridurre i problemi ecologici che la prossima generazione dovrà affrontare nel futuro
4	avere un impatto positivo significativo sull'ambiente
5	ridurre l'impatto negativo che ho sul pianeta
6	sostenere politiche ambientali attraverso l'attivismo politico
7	fare la mia parte nella risoluzione dei problemi ambientali del mondo
8	essere rispettosa/o nei confronti dell'ambiente anche quando le persone a me vicine non lo sono
9	rappresentare un esempio di comportamento ecologico che gli altri possono seguire *[EXCLUDED]*
10	fare continui passi avanti verso la risoluzione dei grandi problemi ambientali, anche quando gli altri si sentono sopraffatti dalla loro portata

Table 2.7: ESE-9 Final Italian Version

2.4 Internal Consistency

To asses the scale's internal consistency both Cronbach's alpha [Cronbach, 1951, Taber, 2018] and McDonald's omega [McDonald, 2013] have been estimated as shown in Table 2.8 and both indicate excellent internal consistency of the Italian ESE-9 scale.

Estimate	McDonald's ω	Cronbach's α
Point estimate	0.971	0.970
95% CI lower bound	0.967	0.966
95% CI upper bound	0.976	0.975

Table 2.8: Internal Consistency

Infact, the confidence intervals as well as point estimates indicate a high degree of precision in the estimates. Lastly, both measures yield similar results therefore adding robustness to the conclusion of high internal consistency of the scale.

2.5 Concurrent Validity

The validation of the Italian version of the ESE-10 scale also included an examination of concurrent validity, as evidenced by the correlations between the Italian ESE-9 and the Italian General Self-Efficacy Scale (GSE). Both Pearson and Spearman correlations revealed significant positive relationships, with Pearson's $r = 0.322$ and Spearman's $\rho = 0.302$, both at $p < .001$ as reported in Table 2.9. These findings indicate a weak [Schober et al., 2018] but positive association between environmental self-efficacy and general self-efficacy in the Italian context, aligning with Moeller and Stahlmann's original validation, which posited the ESE scale as a reliable measure of one's confidence in engaging in pro-environmental behaviors. The significant correlations support the construct validity of the Italian ESE-9 scale, suggesting that individuals with higher general self-efficacy also perceive themselves as capable of contributing to environmental solutions, a premise supported in broader self-efficacy literature.

				Pearson		Spearman	
			n	r	p	rho	p
ESE	-	GSE	409	0.322	$< .001$	0.302	$< .001$

Table 2.9: Correlation Table

2.6 Discussion

This study represents a significant contribution to the field of environmental psychology by introducing the Italian version of the Environmental Self-Efficacy Scale Short (ESE-10). The findings from the exploratory factor analysis (EFA) was pivotal in confirming the unidimensional structure of the scale, aligning with Moeller and Stahlmann's [2019] orginal validation in English. The subsequent confirmatory factor analysis (CFA) further validated the scale unidimensionality, demonstrating a good model fit and reinforcing the scale's robustness within the Italian context.
The final scale comprised of 9 items in total. Item ESE9 [1] was removed due to its poor performance, which may have been related to cross-cultural differences due to different environmental engagement [Milfont, 2012] as well as semantic similarity of the item to items ESE8 [2] and ESE10 [3] suggesting that the nuances given by ESE9, in the Italian context, are included by ESE8 and ESE10. Moreover, strong factor loadings across all items and the high internal consistency (Cronbach's α and McDonald's ω exceeding 0.97) underscore the reliability and validity of the Italian ESE-9 in measuring environmental self-efficacy.

The translation and back-translation process ensured semantic equivalence, maintaining the scale's integrity across cultural contexts. The small, but significant, positive correlation between the ESE-9 and the General Self-Efficacy Scale (GSE-short), already validated in Italian by, further supports the concurrent validity of the ESE-10. This correlation suggests that individuals who

[1] *I can set an example of environmentally friendly behavior, for others to follow*

[2] *I can be environmentally friendly even when the people with whom I have close relationships are not*

[3] *I can continue to take steps towards solving large environmental problems, even when others are overwhelmed by the scale of these problems*

perceive themselves as capable of engaging in pro-environmental behaviors also tend to have a higher general sense of self-efficacy.

2.7 Conclusions

The validation of the Italian version of the ESE-10 scale fills an important gap by providing a reliable and valid tool for assessing environmental self-efficacy in Italian-speaking populations. Its strong psychometric properties, including high internal consistency and confirmed unidimensional structure, make it an excellent instrument for research in environmental psychology, education, and behavior change interventions.

The study's findings have several implications:

- They enable cross-cultural studies on environmental self-efficacy, facilitating comparisons between Italian-speaking populations and those studied with the original ESE-10 scale.
- The scale can support interventions aimed at enhancing environmental self-efficacy among Italian speakers, contributing to more effective environmental education and behavior change programs.
- Future research could explore the scale's predictive validity concerning pro-environmental behaviors and its applicability in diverse Italian-speaking contexts.

Limitations of this study include the use of convenience sampling and the potential impact of self-selection bias, which may limit the generalizability of the findings. Moreover, a increased sample could improve the concurrent validity, which as of the current results, shows a positive but weak correlation. Lastly, while the concurrent validity was assessed using the GSE scale [Romppel et al., 2013, Sibilia et al., 1995], like in the original paper [Moeller and Stahlmann, 2019], it could also have been tested with a measure not anchored to the construct of self-efficacy (for example a more general measure of attitude towards sustainability-related issues) in order to better highlight the differences between the two constructs. Future research should aim to validate the scale with a more balanced and diverse sample in terms of gender, age,

and place of residence, while also exploring its longitudinal reliability. This approach will enhance the generalizability of the findings and provide insights into the scale's performance over time.

In summary, the Italian ESE-9 emerges as a valuable tool for advancing research and practice in environmental psychology within Italian-speaking communities, supporting global efforts to foster sustainable behaviors.

APPENDIX A - GSE Scale

Table 2.10 reports the short version of the general self-efficacy scale [Romppel et al., 2013].

	Respond by indicating how true you think the following statements are.
1	If someone opposes me, I can find the means and ways to get what I want.
2	It is easy for me to stick to my aims and accomplish my goals.
3	I am confident that I could deal efficiently with unexpected events.
4	Thanks to my resourcefulness, I know how to handle unforeseen situations.
5	I can remain calm when facing difficulties because I can rely on my coping abilities.
6	No matter what comes my way, I'm usually able to handle it.

1 = Not at all true 2 = Barely true 3 = Moderately true 4 = Exactly true

Table 2.10: General Self-Efficacy Scale (short)

In 2.11 the Italian adaptation of the general self-efficacy scale [Sibilia et al., 1995] has been reported.

	Risponda indicando quanto pensa siano vere le seguenti affermazioni.
1	Se qualcuno mi contrasta, posso trovare il modo o il sistema di ottenere ciò che voglio.
2	Per me è facile attenermi alle mie intenzioni e raggiungere i miei obiettivi.
3	Ho fiducia di poter affrontare efficacemente eventi inattesi.
4	Grazie alle mie risorse, so come gestire situazioni impreviste.
5	Rimango calmo nell'affrontare le difficoltà perché posso confidare nelle mie capacità di fronteggiarle.
6	Non importa quello che mi può capitare, di solito sono in grado di gestirlo.

1 = Per nulla vero 2 = Poco vero 3 = Abbastanza vero 4 = Totalmente vero

Table 2.11: Self-efficacy Generalizzata (short)

APPENDIX B - The Survey

After giving their informed consent each participant filled out the questionnaire. First of all they were asked to complete the ESE-10 Italian version. Secondly, they were asked to complete the GSE short scale Italian version. Lastly, participants were asked to fill out the demographics section displayed in Table 2.12. The demographic questions were, in order, gender, age, maridal status, education, profession, living situation and place of residence. The platform used for the data collection was Google Forms.

Domanda	**Risposta**
Genere	M F Altro
Età	_ _ _ _ _ _ _ _
Stato civile	Celibe/Nubile Coniugato/a Separato/Divorziato Vedovo/a Convivente
Qual è il suo titolo di studio?	Licenza elementare Licenza media Titolo di istruzione secondaria superiore Diploma di laurea Titolo post laurea
Qual è la sua professione?	Imprenditore Libero professionista Studente Impiegato Operaio Apprendista Disoccupato Pensionato Altro
Con chi vive?	Genitori/famiglia di origine Compagno/coniuge Compagno/coniuge e figli Figli Da solo Con coinquilini Altro
Provenienza:	Nord Centro Sud Isole Estero

Table 2.12: Demographics

Chapter 3

Packaging Cues and Perceived Environmental Friendliness on Willingness to Pay: Evidence From Behavioral and Eye-Tracking Studies.

3.1 Introduction

This chapter explores the effect packaging cues (ecolabel and claim) on perceived environmental friendliness and willingness to pay for products. In their daily life, consumers encounter an overwhelming number of cues [Berger and Fitzsimons, 2008], therefore, when deciding on what to buy they depend on different product features and cues to judge the quality of the items [Jover et al., 2004, Lee and Lou, 1995, Steenkamp, 1990, Bruwer et al., 2017]. Cue utilization theory suggests that products have a set of signals that consumers use as indirect measures of the product's quality (Richardson et al., 1994). Therefore, this chapter investigates how specific packaging signals, such as ecolabels and textual claims, influence consumers' perceptions of environmental friendliness and their willingness to pay (WTP) for products. The chapter also examines the nuances of these signals through the lens of eye-tracking data, offering a detailed account of the visual attention processes that underpin consumer evaluations of ecolabeled and sustainability-claimed packaging.

In this context, ecolabels serve as pivotal indicators of environmental performance, the understanding of what ecolabels are and what they represent is therefore crucial for this study. The Environmental Protection Agency of the United States defines Ecolabes as:"[...]marks used on product packaging that can help consumers and institutions to quickly identify the products that meet specific environmental performance criteria and are deemed "environmentally preferable". Ecolabels can be owned or managed by government agencies, nonprofit environmental advocacy organizations, or private sector entities." They can focus either on a single attribute of the product's lifecycle or an environmental issue. [Environmental Protection Agency, 2024]. Several companies are now using ecolabels across many categories in order to signal their products sustainability to both consumers and stakeholders [Iraldo et al., 2020], in Figure 3.1 some examples of ecolabelled products are shown.

Figure 3.1: Examples of Ecolabelled Products

Consequently the practice of ecolabelling sustainable products has been getting more attention in literature across different product areas [Abdu and Mutuku, 2021, Yokessa et al., 2019]. Literature also highlights the role of ecolabels as a tool for aiding consumers in assessing product properties like food safety, organic nature of the product, environmental friendliness and so on [Abdu and Mutuku, 2021]. Moreover, literature highlights the positive relationship between ecolabel presence and willingness to pay, meaning that when an ecolabel is present consumers' willingness to pay for the product is higher [Abdu and Mutuku, 2021, Bastounis et al., 2021].
Furthermore, recent studies emphasize the significant influence of sustainability-

related claims on product packaging and their ability to shape consumer perceptions of the product and their behavior in response [Herbes et al., 2018, Stremmel et al., 2022]. Therefore, addressing the effect of claims on perceived environmental friendliess of a product is of interest in this study. Figure 3.2 represents some examples of sustainability-related claims on packaging.

Figure 3.2: Examples of Product Packaging with Sustainability Claim

This chapter argues, and shows empirically, that consumers tend to perceive a product as more sustainable when an ecolabel or sustainability-related claim is present on its packaging therefore affecting the willingness to pay for the product. Moreover, it is argued that environmental self-efficacy, as a measure of each individuals' efforts towards more environmentally friendly behaviors moderates the relationship between packaging cue, perceived environmental friendliness and willingness to pay. Therefore, we propose that consumers will perceive the product option without any sustainability-related cues as less sustainable than the ones with ecolabels/claims. The proposed conceptual framework is depicted in Figure 3.3 below.

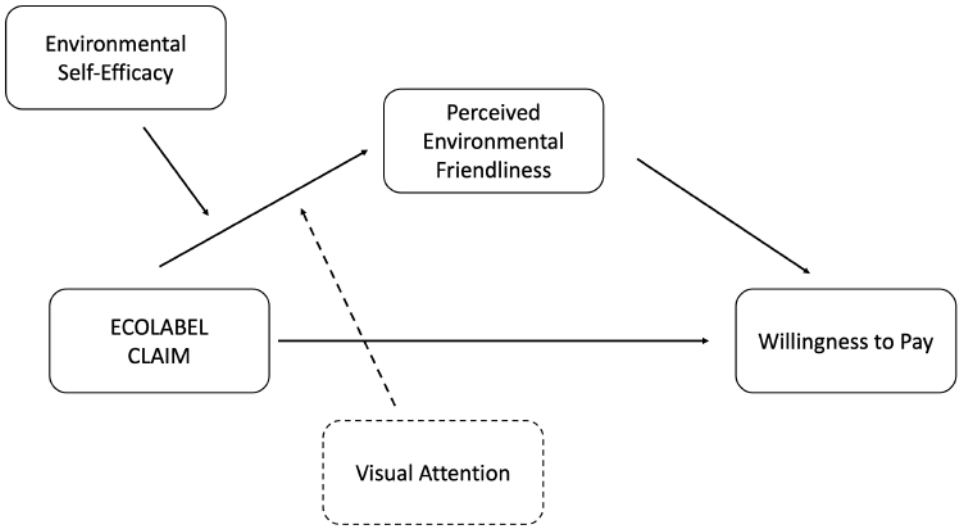


Figure 3.3: Conceptual Framework

In approaching the study of product packaging cues eye-tracking methodology can allow researchers to gain valuable insights on the processes underlying consumer choice and perception of products and brands [Martinovici et al., 2023]. When faced with a product evaluation task consumers explore the product packaging by moving their eyes across their various attributes, these eye movements represent covert unobservable attention processes during the task performed [Glaholt and Reingold, 2011, Hutton, 2008, Martinovici et al., 2023]. Eye movements are divided in two main categories, fixations and saccades. While fixating the eye remains relatively still focusing on a specific point on the stimulus, in fact, during a fixation information regarding the stimulus is being acquired. Typically fixations last between 200 and 400 milliseconds. On the other side, during saccades information is not processed, because due to the rapidity of the movement vision is suppressed, these eye-movements last between 20 and 50 milliseconds and allow to redirect one's gaze onto other aspects of the stimulus [Hutton, 2008].

This research contributes to packaging literature in marketing by focusing specifically on packaging cues in relation to sustainability perception. Several studies demonstrate how different elements of packaging such as color [Mai et al., 2016, Xu et al., 2022], size [Argo and White, 2012, Chandon and Ordabayeva, 2009, Shirai, 2020], material [Donato et al., 2021, Sokolova et al.,

2023] and labelling [Dubois et al., 2021,Smith et al., 2021] affect consumption and purchase decisions. This research adds to the above stream of literature by showing how packaging cues, specifically ecolabels and claims, affect the product evaluation and shape willingness to pay of consumers for the product shown.
Two studies have been carried out in order to assess the issue in question. Study 1 is a behavioral lab experiment in which the effect of the selected packaging cues on willingness to pay is assessed, both directly and indirectly through perceived environmental friendliness and, at a second stage, environmental self-efficacy. On the other side Study 2 aims at assessing the role of visual attention on the perceived environmental friendliness of packaging.
Therefore, In the upcoming sections, focus on empirically testing this theorizing through two different experiments and conclude with a discussion on the theoretical and practical implications of these findings.

3.2 Measures

In order to assess the variables of interest and evaluate the outcomes effectively, the following measures were meticulously selected and implemented throughout the course of the study.
Each product will be evaluated by the participants with two distinct measures: the **PEF** scale, representing **Perceived Environmental Friendliness** of the packaging [Sokolova et al., 2023] and the **willingness to pay (WTP)** for the specific product. These two measures serve to answer our main research question: "Does the presence of an ecolabel and/or claim on product packaging affect the perceived environmental friendliness of the product? and will this increased perception of ecofriendliness affect consumer willingness to pay for the product?"
Moreover, consumers will also be assesed with regards to their attiture towards sustainable living, in particular using the **Environmental Self-Efficacy Scale-Short (ESE 10)** [Moeller and Stahlmann, 2019] a tool developed to measure an individuals' capability to undertake actions beneficial to the environments and catered more towards understanding a consumers' values independently of the stimulus presented.

Lastly, three eye-trackign metrics, representing different realms of visual attention will be employed:

- **Time to First Visit on eco and claim (TTFV):** This metric reflects the amount of time it took for the participant to fix their gaze on the AOI therefore representing visual saliency.
- **Total Number of Visits on eco and claim (TNOV):** Shows the average number of visits to the eco and claim AOIs. A relatively low standard deviation implies a similar visiting pattern among participants. Revisit metrics give useful insight into the visual attention patterns of the consumer.
- **Duration of First Visit on eco and claim (DOFV):** Represents the time spent during the first visit to the eco and claim AOIs therefore representing engagmenet and also complexity.

3.3 Hypotheses

Given the framework presented, the chapter puts forward the following hypotheses:

- **Hypothesis 1 (Hp1)**: The presence of an eco-label on product packaging will significantly increase the WTP of consumers for the product.
- **Hypothesis 2 (Hp2)**: The presence of a sustainability claim on product packaging will significantly increase consumers' WTP for the product.
- **Hypothesis 3 (Hp3)**: There will be an interaction effect between eco-label and sustainability claim presence on consumers' WTP, indicating a higher willingness to pay when these two are combined rather than when each attribute is presented alone.
- **Hypothesis 4 (Hp4)**: Perceived Environmental Friendliness (PEF) will mediate the relationship between the independent variables (eco-label and sustainability claim) and the dependent variable (WTP).

- **Hypothesis 5 (Hp5)**: Environmental Self-Efficacy (ESE) will moderate the mediation effect of PEF on the relationship between the independent variables (ecolabel and claim) and WTP, the dependent variable.
- **Hypothesis 6 (Hp6)**: Ecolabel and Claim saliency, represented by the time to first visit (TTFV) eye-tracking metric, significantly and positively affects PEF.
- **Hypothesis 7 (Hp7)**: Ecolabel and Claim revisits, represented by Total Number of Visits (TNOV) eye-tracking metric, significantly and positively affect PEF.
- **Hypothesis 8 (Hp8)**: Focus on Ecolabel and Claim, represented by the Duration of First Visit on the AOI (DOFV), significantly and positiely affects PEF.

3.4 Studies Overview

Two studies have been carried out in order to test the framework proposed. Study 1 investigates the effect of ecolabels and claim on WTP, the mediating role of PEF and the moderating role of ESE. Study 2 explores the role of visual attention in the processes observed in the first study. Both study1 and study2 received the approval of the Ethics Committee of Erasmus University Rotterdam [1],[2].

Four mock product packagings (see Figure 3.4, pertaining to different categories, were selected as stimuli for the studies. In particular two products for the food and beverages category and two for the personal care category.

[1]Application reference for Study1 ETH2324-0177
[2]Application reference for Study2 ETH2324-0318

Figure 3.4: Product Categories

The ecolabels used are the EU Organic Products Ecolabel, for the chocolate and chips mock packagings, the EU Ecolabel for the shampoo mock pagaging and the Forest Stewarship Council (FSC) Ecolabel for the toilet paper mock packaging (Table 3.5. All three labels are indexed on Ecolabel Index [EcoLabel Index, 2023].

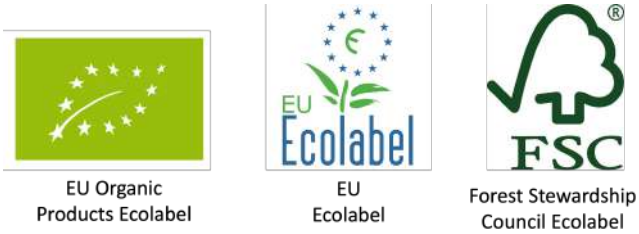


Figure 3.5: Ecolabels Used

The textual claims manipulated are the following:

- "It's Raw and Organic" on the chocolate bar mock packaging
- "Organic" on the chips bag mock packaging
- "100% Organic" on the shampoo bottle mock packaging
- "Eco-friendly" on the toilet paper mock packaging

For each one of the stimuli four experimental conditions were created, representative of the 2x2 factorial design of the experiments. Figure 3.6 shows all four conditions for the chocolate stimulus from left to right the conditions are: control, ecolabel, claim and ecoclaim (see APPENDIX A for all the conditions presented).

Figure 3.6: Conditions for Chocolate Mock Packaging

3.5 Study 1

Study 1 was carried out at Erasmus Behavioral Lab of Erasmus University, Rotterdam and each participant gave their informed consent prior to starting the experiment. It is a between subject design, each participant saw one of four conditions per each stimulus, the choice of condition was randomly attributed to each participant through Qualtrics. Each participant evaluated four different product packagings. For each mock packaging viewed participants were firstly asked to state how much they were willing to pay for the item on a scale from 0 to 4 euro and, secondly to evaluate the packaging based on the 4 item PEF scale proposed by Sokolova et al [2023]. A total of of 405 participants, ages ranging between 18 and 25 years old (mean = 19.15, SD=0.95, M = 51,11%) were included in the analysis after the data cleaning processes. Figure 3.7 reports the study structure. Lastly, the concluding section of the study comprised the ESE scale [Moeller and Stahlmann, 2019] and demographic questions, namely age and gender.

Figure 3.7: Study 1 Flow

3.5.1 Data Cleaning Process

Before addressing the hypotheses of the study, it is imperative to assess the integrity of the dataset upon which our findings are predicated. The dataset was subjected to a rigorous cleaning process aimed at ensuring the accuracy, consistency and validity of subsequent analyses. This was accomplished by identifying and removing statistical outliers – data points that deviate markedly from the overall pattern of responses.

An outlier detection method based on z-scores, a measure of how far a data point is from the mean in terms of standard deviations, was employed. By examining the absolute differences between the z-scores of willingness to pay (WTP), perceived environmental friendliness (PEF), and environmental self-efficacy (ESE), we were able to flag inconsistencies across these critical measures. Data points that exhibited a significant discrepancy, as determined by a carefully chosen threshold, were deemed outliers. This threshold was set to capture only the most divergent cases, thus refining the dataset without compromising the breadth of consumer insights.

The removal of these outliers is a fundamental step enabling a more accurate interpretation of trends and relationships. Such precision is crucial when evaluating the nuanced impacts of ecolabels and sustainability claims on consumption patterns. By purging the data of these anomalies, we ensure that the analysis reflects genuine consumer responses, thereby solidifying the foundation for the evidence-based conclusions drawn in the subsequent sections of this paper.

3.5.2 Descriptive Statistics

The preliminary data analysis, as illustrated by the violin plots, represented in Figure 3.8, and corroborated by the statistical metrics, summarized in Table 3.1, reveals discernible patterns in the willingness to pay (WTP) and perceived environmental friendliness (PEF) across different informational conditions [3].

[3]The analyses were carried out with the aggregated product and divided by condition.

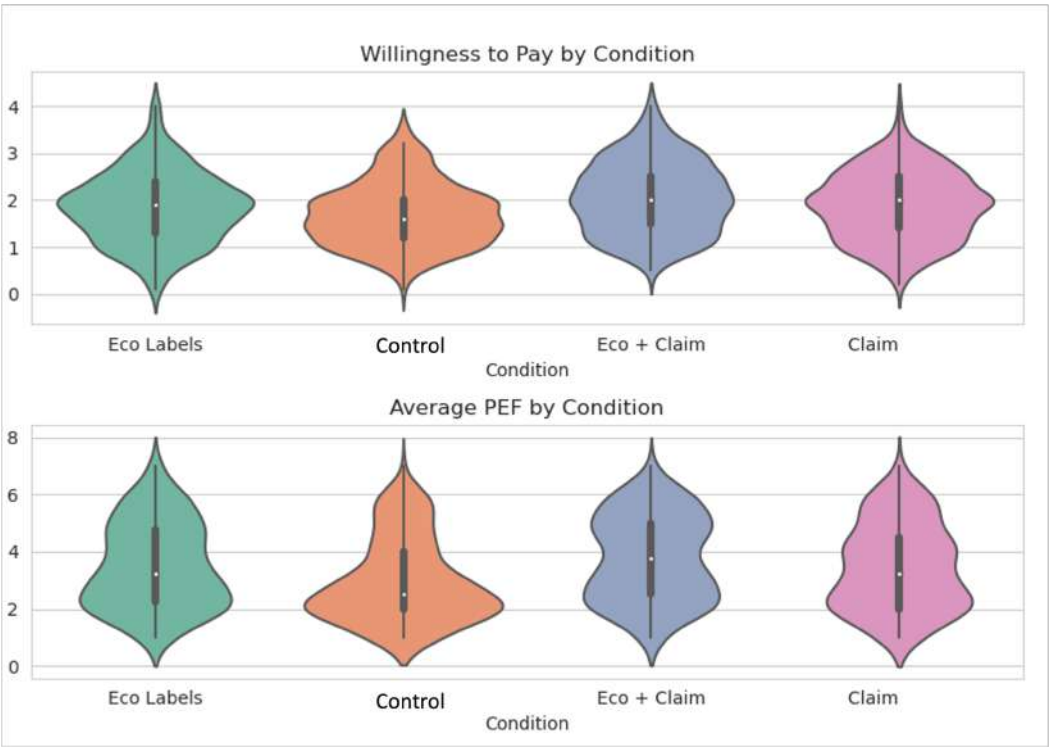


Figure 3.8

With regards to PEF the data suggests that consumers' perceptions of a product's environmental impact are susceptible to the presence of sustainability cues. The violin plots demonstrate a distinct bulge towards the lower end of the PEF scale for the eco-labeled products, which is substantiated by the ecolabels condition's mean PEF of 3.50 (std = 1.51). The ecolabel condition, contrasted with the control condition, which has a mean PEF of 2.97 (std = 1.45), illustrates that ecolabels may lead consumers to perceive products as more environmentally friendly. The broadening of the violin plot in the combined condition (eco + claim) with a mean PEF of 3.76 (std = 1.50) further suggests that integrating ecolabels with textual claims possibly amplifies this perception of sustainability.

Synthesizing these findings, it is evident from both the violin plots and the descriptive statistics that ecolabels and claims shape perceive environmental friendliness of the product packaging.

Moreover, the correlational patterns represented by the scatter plots in Figure 3.9 between WTP, PEF and ESE provide relevant insights regarding how PEF and ESE relate to WTP for sustainable product. The scatter plots present

Condition	WTP				Average_PEF			
	mean	std	min	max	mean	std	min	max
con	1.71	0.67	0.1	3.5	2.97	1.45	1.0	7.0
eco	1.85	0.75	0.1	4.0	3.50	1.51	1.0	7.0
cl	1.89	0.72	0.2	4.0	3.46	1.51	1.0	7.0
ecocl	2.07	0.76	0.5	4.0	3.76	1.50	1.0	7.0

Table 3.1: Summary of Conditions

a visual interpretation of the relationship between Average Perceived Environmental Friendliness (PEF) and WTP, as well as between Average Environmental Self-Efficacy (ESE) and WTP. The first plot shows a positive correlation between PEF and WTP, suggesting that as participants perceive products as more environmentally friendly, their willingness to financially support such products increases. This relationship is depicted by a moderate upward trend, with a scatter of data points that suggests variability among individual participant responses. The spread of points indicates that while there is a general trend, individual differences in perception can lead to a range of WTP, reflecting the multi-faceted nature of consumer decision-making.

In the second plot, which examines the relationship between ESE and WTP, a similar positive correlation was observed. This implies that participants who have higher confidence in their ability to make environmentally friendly decisions are more likely to pay a premium for sustainable products. The trend line ascends more steeply compared to the PEF-WTP relationship, possibly indicating a stronger link between self-efficacy and economic behavior. This could be interpreted to mean that when consumers feel empowered and capable of discerning environmentally friendly products, their conviction is reflected in a greater willingness to invest in these products.

The third plot explores the relationship between PEF and ESE, revealing an intriguing positive correlation. When participants show a higher environmental self-efficacy their perceptions of a product's environmental friendliness increase. This suggests a reciprocal relationship where perceiving a product as environmentally friendly not only influences purchasing decisions but also reinforces the consumer's belief in their capacity to make such decisions. The

density of data points clustered around the middle range of PEF scores with corresponding moderate ESE scores indicates a central tendency where most participants align.

These correlations underscore a vital aspect of consumer behavior in the realm of sustainable consumption: the psychological constructs of perceived environmental friendliness and environmental self-efficacy are not only interlinked but also serve as significant predictors of economic action.

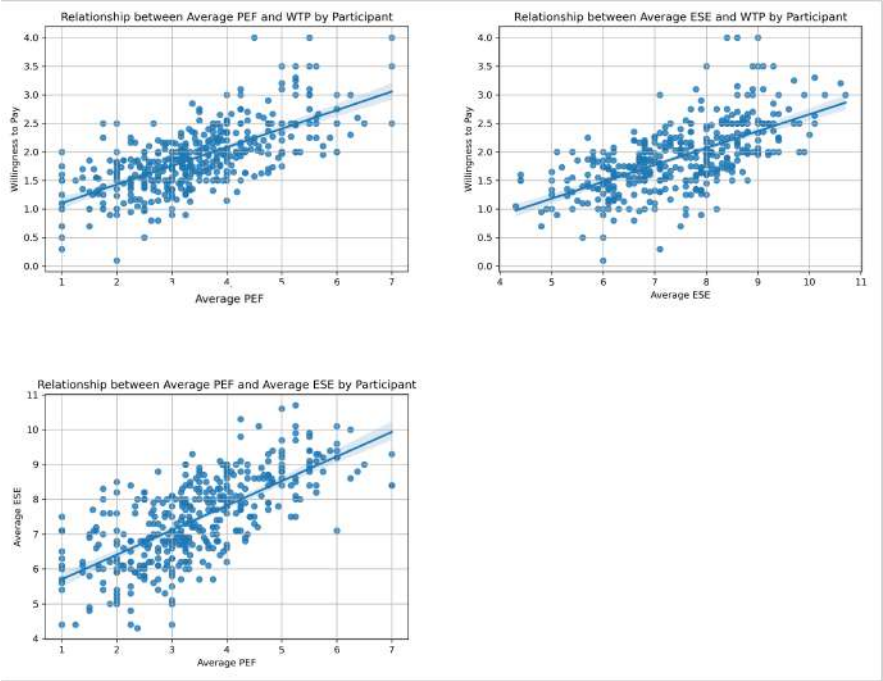


Figure 3.9: Scatter Plots

3.5.3 Analytical Procedures

Main Effect - Hp1 and Hp2

In order to asses the effect of ecolabel and textual claim on product packaging on WTP for the product a robust ANOVA was performed for Hp1 (ecolabel) and Hp2 (textual claim) respectively. The choice of robust ANOVA, using the t1way function from the WRS2 package [Mair and Wilcox, 2020] in R (version 4.1.2), was driven by its proven effectiveness with the unique challenges of behavioral data. It stands out because it can deal with data that's not normally distributed and has varying variances, common issues in consumer response data. The method's focus on trimming ensures the reliability of our findings.

Trimming, a key feature of the t1way analysis, involves the systematic exclusion of a specified percentage (in this case, 3%) of the data from both tails of the distribution. This procedure is instrumental in diminishing the influence of extreme values, thereby aligning the analysis more closely with the central tendencies of the dataset. By attenuating these extremes, trimming enhances the representativeness of the dataset, ensuring that the statistical conclusions drawn are reflective of the broader consumer population.
For Hypotheses 1 and 2, the dataset underwent an encoding process to distinguish between the conditions of interest: products with eco-labels ('eco_yes') versus without ('eco_no') for Hp1, and products with sustainability claims ('cl_yes') versus without ('cl_no') for Hp2. This encoding facilitated a direct comparison of WTP across these distinct conditons where different packaging cues come into play, allowing us to isolate and evaluate their individual impacts on consumer valuation.
The utilization of robust ANOVA, underscored by the trimming process, addressed potential issues of non-normality head-on, ensuring that our analysis remained resilient against the skewness and kurtosis characteristic of consumer data. This methodological rigor not only fortified our analysis against statistical anomalies but also underscored the nuanced interplay between ecolabels, sustainability claims, and consumer WTP.

Interaction Effect - Hp3

Building on the detailed discussion of the methodologies employed to test Hypotheses 1 and 2, the our analytical approach was extended to explore Hypothesis 3 (Hp3), which posits an interaction effect between ecolabel and textual claim on consumer willingness to pay (WTP). This hypothesis introduces a more complex relationship, suggesting that the combined presence of ecolabels and sustainability claims may have a synergistic effect on enhancing consumer WTP beyond the impact of each attribute in isolation.
To test this hypothesis, a robust two-way ANOVA analysis was adopted, facilitated by the t2way function within the WRS2 package [Mair and Wilcox, 2020]. This method was chosen to accommodate the multifaceted nature of Hp3, allowing us to assess not only the individual effects of eco-labels (eco) and sustainability claims (cl) but also their interaction effect on WTP. The

dataset was meticulously prepared, converting the 'Condition' variable into two binary factors — eco and cl — representing the presence (1) or absence (0) of eco-labels and sustainability claims, respectively. This transformation enabled a nuanced exploration of the hypothesized interaction within a multivariate analytical framework.

The transition to a robust two-way ANOVA was a natural progression from the one-way analyses used for Hp1 and Hp2, reflecting the increasing complexity of the relationships under investigation. The robustness of the t2way function is particularly crucial in this context, as it ensures that the analysis remains valid even in the face of non-normality and outliers, common challenges in consumer behavior data. By extending the robust analytical approach to a two-way design, we were able to explore the interaction between eco-labels and sustainability claims, providing a comprehensive understanding of how these factors jointly influence consumer WTP.

Mediation Model - Hp4

To elucidate the methodology applied for testing Hypothesis 4 (Hp4), which posits that Perceived Environmental Friendliness (PEF) mediates the relationship between ecolabels/textual claims and consumers' willingness to pay (WTP), the author transitioned to a structural equation modeling (SEM) approach in Python, version 3.11.5. This shift enabled a more nuanced analysis of the mediating effects, leveraging the statistical power and flexibility of SEM to explore complex causal relationships within our data.

The analysis began with pre-processing the dataset to operationalize the key variables: eco-label presence (eco), textual claim presence (claim), WTP, and PEF. Both eco and claim variables were encoded as binary indicators, reflecting their presence or absence, while WTP and PEF were normalized to ensure comparability and to mitigate scale effects.

The SEM model was specified to investigate both the direct paths from ecolabels and claims to WTP, and the indirect paths through PEF, thereby testing the mediation hypothesis. The model included paths from eco and claim to PEF, reflecting the hypothesized influence of these independent variables on the mediator, and subsequently from PEF to WTP, capturing the mediated effect on the dependent variable.

Utilizing Python's SEM libraries, the model wad fitted to thr data, extracting estimates for the direct and indirect effects. The analysis of indirect effects was particularly crucial, as it provided empirical evidence for the mediation hypothesis. We applied the Sobel test [Abu-Bader and Jones, 2021] to assess the significance of these indirect paths, calculating z-values and p-values to determine the statistical significance of the mediation effects of PEF between ecolabel/textual claim and WTP.

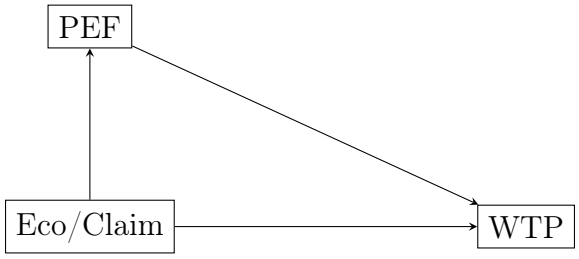


Figure 3.10: Path diagram for mediation model including direct and indirect effects with confidence intervals.

Moderated Mediation Model Hp5

Building directly upon the insights derived from Hypothesis 4 (Hp4), which established the mediating role of Perceived Environmental Friendliness (PEF) in the relationship between ecolabel/claim and consumers' willingness to pay (WTP), the research progresses to explore an additional layer of consumer perception of packaging in Hypothesis 5 (Hp5). A further analysis was conducted to explore the nuanced role of ESE as a moderator of the mediation path through PEF. This analysis represents a logical extension from the initial investigation. Building upon this foundation, the moderated mediation model assesses how the indirect effects of packaging cue type on WTP through PEF are contingent upon varying levels of ESE, thereby offering deeper insights into the interplay between these constructs.

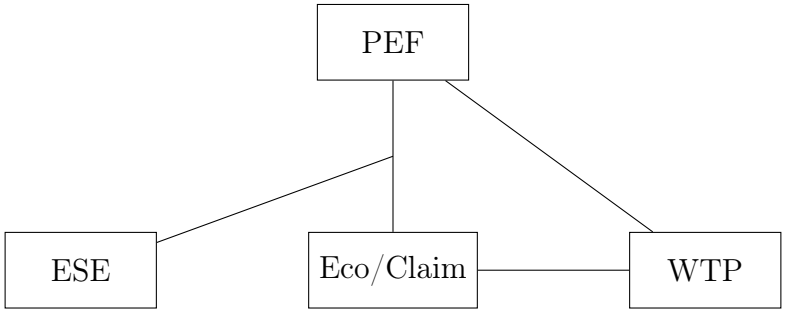


Figure 3.11: Path diagram for mediation model including direct and indirect effects with confidence intervals.

3.5.4 Results

Main Effect - Hp1 and Hp2

As illustrated in Table 3.2, a one-way trimmed means robust ANOVA (t1way) was conducted to assess the impact of eco-label presence ('eco_yes') versus absence ('eco_no') on consumers' willingness to pay (WTP) for products. This analysis highlighted a statistically significant difference in WTP between the two groups, with an F-statistic of $F(1, 912.9) = 12.1982$ and a p-value less than .001, indicating the substantial influence of ecolabels on consumer valuation. Notably, the presence of ecolabels accounted for 17% of the variance in WTP, as denoted by an explanatory measure of effect size of 0.17. The robustness of this effect is further confirmed by a 95% bootstrap confidence interval ranging from 0.08 to 0.25, ensuring a reliable estimate of the eco-label impact.

Statistic	**Value**
Test Statistic (F)	12.1982
Degrees of Freedom 1	1
Degrees of Freedom 2	912.9
P-value	5e-04
Explanatory Measure of Effect Size	0.17
Bootstrap CI	[0.08; 0.25]

Table 3.2: Results of the One-way ANOVA - Hp2 Ecolabel

The analysis proceeded to explore the effect of sustainability claims on WTP, as delineated in Hypothesis 2 (Hp2). The objective was to verify whether textual

claims' presence on product packaging ('cl_yes') as opposed to their absence ('cl_no') wield a comparable influence on consumer purchasing decisions. Referencing Table 3.2, a one-way trimmed means analysis (t1way) was conducted, revealing a notable difference in WTP between products endorsed with sustainability claims and those without. The statistical outcome, F(1, 909.58) = 19.4957 with a p-value strikingly less than .001, underscores the potency of sustainability claims in elevating consumer WTP.

Statistic	**Value**
Test statistic (F)	19.4957
Degrees of freedom 1	1
Degrees of freedom 2	909.58
p-value	1e-05
Explanatory measure of effect size	0.2
Bootstrap CI	[0.11; 0.29]

Table 3.3: Results of the One-way ANOVA - Hp2 Claim

The analysis attributed a 20% variance in WTP to the presence of sustainability claims, evidenced by an explanatory measure of effect size of 0.20. This effect's reliability is further affirmed through a 95% bootstrap confidence interval, extending from 0.11 to 0.29. Such findings not only reinforce the critical role of textual claim in shaping consumer behavior but also complement the insights garnered from the investigation into eco-labels.

These test serves as a foundational analysis, distinguishing packages with sustainability cues[4] from the control group[5] devoid of such cues. The significant findings from these two robust ANOVAs underscore the effectiveness of ecolabels and texual claims in enhancing consumer willingness to pay, hence suppporting Hp1 and Hp2.

Interaction Effect - Hp3

In order to test Hp3 the analysis proceeded to explore the interaction effect between ecolabel and textual claim presence on the product pack on consumers'

[4]Ecolabel condition, Claim condition and EcoClaim condition3.6
[5]Control condotion 3.6

willingness to pay (WTP). A robust two-way ANOVA was performed to examine the effect. The analysis revealed significant main effects for textual claim, F(1, 1013) = 16.8388, p = 0.001, and for ecolabel, F(1, 1013) = 10.0024, p = 0.002. However, the interaction between claims and eco-labels was not significant, F(1, 1013) = 0.1088, p = 0.742.

These findings confirm what was found in the previus tests (Hp1 and Hp2), so that while both ecolabels and texual claims independently influence consumers' willingness to pay a premium for products. However, their combined presence does not result in a statistically significant increase in WTP beyond the impact observed from each attribute alone.

Mediation Model - Hp4

The Structural Equation Modeling (SEM), carried out with Python (version 3.11.5), library semopy [Igolkina and Meshcheryakov, 2020] analysis supports the hypothesis that PEF mediates the effect between packaging cue and WTP. Direct paths from eco-label presence (*eco*) and sustainability claim presence (*claim*) to Perceived Environmental Friendliness (PEF) were significant, with estimates for *eco* of 0.274696, $p < .00001$, and for *claim* of 0.244701, $p < .0001$, respectively. These results indicate that both ecolabels and textual claims positively influence consumers' perceptions of environmental friendliness. However, the direct effects of *eco* and *claim* on Willingness to Pay (WTP) were nuanced. The path from *claim* to WTP was significant, $B = 0.138754$, $p = .008$, while the path from *eco* to WTP was not, $B = 0.069879$, $p = .184$, suggesting a larger influence of claims on WTP compared to ecolabels.

Further analysis of indirect effects through Sobel testing [Me, 1982, Abu-Bader and Jones, 2021] reinforced the significance of these mediated (indirect) effects. Specifically, the indirect effect of *eco* on WTP through PEF was significant, $B = 0.148387$, $p < .00002$, and for *claim*, $B = 0.132184$, $p < .0001$. The bootstrapping procedure provided additional validation, yielding 95% confidence intervals for the indirect effect of 'claim' ($[0.066, 0.195]$) and 'eco' ($[0.088, 0.221]$), both excluding zero, which affirms the statistical significance and robustness of these mediation effects.

The model's fit indices summarized in Table 3.4 further corroborated its adequacy, with a chi-square value ($\chi^2 = 1.791955e^{-04}$, $p = .9999994$), Compara-

tive Fit Index ($CFI = 1.007$), Goodness-of-Fit Index ($GFI = .9999996$), and Root Mean Square Error of Approximation ($RMSEA = 0.000$) indicating an excellent fit. These metrics underscore the effectiveness of the model in capturing the complex relationships between eco-labels, sustainability claims, PEF, and WTP.

Path	Est.	Est. Std.	Std. Err.	z-val.	p-val.	CI Lwr.	CI Upr.
PEF ~ eco	0.275	0.137	0.062	4.448	9e-06	0.154	0.396
PEF ~ claim	0.245	0.122	0.062	3.964	7.4e-05	0.124	0.366
WTP ~ eco	0.070	0.035	0.053	1.328	0.184	-0.033	0.173
WTP ~ claim	0.139	0.069	0.052	2.644	0.008	0.036	0.242
Indirect Effect (claim)	0.132	0.066	0.034	2.21	9.97e-05	0.066	0.195
Indirect effect (eco)	0.148	0.074	0.034	4.34	1.39e-05	0.088	0.221

Table 3.4: SEM Mediation Analysis Results with Direct and Indirect Effects

Moderated Mediation Model - Hp5

The Structural Equation Modeling (SEM) analysis conducted to assess Hypothesis 5 (Hp5) revealed significant insights into the moderating role of Environmental Self-Efficacy (ESE) on the relationship between the ecolabel and textual claim packaging cue and consumers' Willingness to Pay (WTP). The model accounted for direct effects, mediation through Perceived Environmental Friendliness (PEF), and moderation effects via ESE, with variables centered around their means to facilitate interpretation and reduce multicollinearity.
Significant direct effects were observed from eco-friendly packaging ($b_1 = 0.24$, $SE = 0.057$, $p < .001$, 95% CI [0.128, 0.352]) and claim-based packaging ($b_2 = 0.215$, $SE = 0.057$, $p < .001$, 95% CI [0.103, 0.327]) on PEF. Additionally, ESE was found to significantly moderate the relationship between both packaging attributes and PEF, with eco-friendly packaging ($a_3 = 0.325$, $SE = 0.047$, $p < .001$, 95% CI [0.233, 0.417]) and claim-based packaging ($a_4 = 0.248$, $SE = 0.049$, $p < .001$, 95% CI [0.151, 0.344]) interactions with ESE showing substantial effects.
The impact of these packaging attributes on WTP also presented noteworthy findings. It should be noted that eco-friendly packaging alone had a marginal direct effect on WTP ($b_1 = 0.071$, $SE = 0.052$, $p = .171$, 95% CI [−0.031, 0.172]).

A slopes analysis was performed to show how Environmental Self-Efficacy (ESE) changes the effect of packaging attributes on Willingness to Pay (WTP) through PEF. By examining the relationship at different levels of ESE, specifically, one standard deviation above and below its mean. The computational methodology employed to deduce the moderated mediation model is based upon the two functions defined in the Python code. The function labelled `calculate_indirect_effect` computes the basic indirect effect of the packaging types on WTP through PEF, devoid of the moderation by ESE. In contrast, the function named `conditional_indirect_effect` refines this computation by incorporating the moderating influence of ESE, adjusting the initial path from the packaging type to PEF (a_{path}) by the interaction term ($mod\_path \times mod\_value$), and subsequently multiplying by the effect of PEF on WTP (b_{path}).
The coefficients derived from the SEM analysis:
$a1_{eco}$, $a2_{claim}$, $a3_{eco\_ESE}$, $a4_{claim\_ESE}$, and b_{PEF}
represent the respective influences of ecolabel (eco) and textual claim (claim) packaging cue on PEF, the moderation of these effects by ESE, and the influence of PEF on WTP. These coefficients served as the parameters for the calculation functions.
The moderated mediation plot depicted in Figure 3.12 illustrates the role of Environmental Self-Efficacy (ESE) on the conditional indirect effects of packaging type on Willingness to Pay (WTP). The x-axis of the plot represents standardized levels of ESE, ranging from -1 to +1 standard deviation from the mean. The y-axis quantifies the conditional indirect effects on WTP for eco-friendly (ECO) and claim-based (CLAIM) packaging types at corresponding levels of ESE.

- At the mean ESE level, the indirect effect for ECO packaging was estimated at 0.1155, whereas for CLAIM packaging it was 0.1036.
- An increase in ESE by one standard deviation resulted in higher indirect effects, with ECO packaging reaching 0.2720 and CLAIM packaging reaching 0.2229.
- Conversely, a decrease in ESE by one standard deviation led to lower indirect effects of -0.0411 for ECO packaging and -0.0157 for CLAIM

packaging.

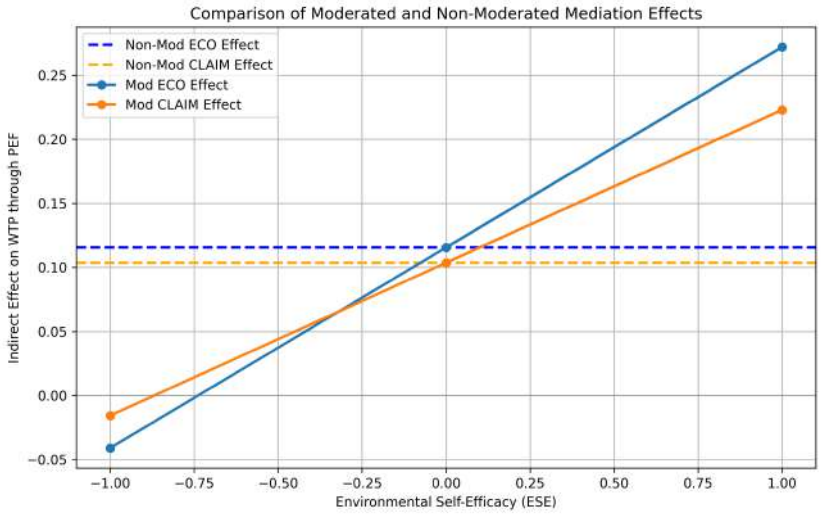


Figure 3.12: Slopes analysis for moderated mediation, depicting the conditional indirect effects on WTP for ECO and CLAIM packaging at various levels of Environmental Self-Efficacy (ESE). The dashed lines represent the absence of the mediator. The analysis delineates a pronounced increase in the indirect effects as ESE escalates, with both ECO and CLAIM packaging demonstrating steep slopes.

The plot summarizes these values, highlighting the influence of ESE on the indirect effects of ecolabel and textual claim across the ESE spectrum. The noticeable upward trend for both types of packaging underscores the significant moderating effect of ESE, with the steepness of the slopes indicating the considerable impact of environmental self-efficacy on the mediation process.

The graphical representation andociated computational analysis corroborate the hypothesis that ESE substantially moderates the indirect effects of packaging cues on WTP through PEF.
Lastly, the model fit statistics for Hp5 are reported in Table 3.5

Path	Estimate	Est. Std	Std. Err	z-value	p-value	CI Lower	CI Upper
PEF ∼ eco	0.240	0.120	0.057	4.185	2.85×10^{-5}	0.128	0.352
PEF ∼ claim	0.215	0.108	0.057	3.757	1.72×10^{-4}	0.103	0.327
PEF ∼ eco_ESE	0.325	0.241	0.047	6.918	4.57×10^{-12}	0.233	0.417
PEF ∼ claim_ESE	0.248	0.175	0.049	5.025	5.03×10^{-7}	0.151	0.344
WTP ∼ eco	0.071	0.035	0.052	1.368	0.171	−0.031	0.172
WTP ∼ claim	0.142	0.071	0.052	2.740	6.15×10^{-3}	0.040	0.243
WTP ∼ PEF	0.481	0.481	0.028	17.111	0.000	0.426	0.537

Table 3.5: Summary Statistics Hp5 and Hp6

3.6 Study 2

Study 2 aimed at incorporating eye-tracking data into the initial study design, the experiment was carried out at the eye-tracking lab of the Erasmus Behavioral Lab complex. It is a within subject 2x2 factorial design. The experiment was set up on Tobii Pro Lab software, version 1.217[6], and Tobii Pro fusion (250 Hz). Participants saw the stimuli on a 24 inch screen with 1920×1080 resolution and the eye-tracker calibration was performed for each participants on five points. A total of 88 participants, aged between 18 and 27 (mean=1.54, SD: 1.74, M = 49)%) were included in the analyses after the data cleaning process. Each participant evaluated all four conditions for each product category, totalling 16 packaging evaluations. The order of stimulus presentation was fully randomized across conditions and product categories within Tobii Pro Lab. For each mock packaging viewed participants were firstly asked to state how much they were willing to pay for the item on a scale from 0 to 4 euro (0 to 6 for shampoo) and, secondly to evaluate the packaging based on the 4 item PEF scale [Sokolova et al., 2023]. Figure 3.13 represent the presentation structure for one stimulus, this same structure was repeated 16 times, for each product category and condition. Moreover, at the end of the experiment participants were asked to full out the ESE-10 scale [Moeller and Stahlmann, 2019] and give their demographic information (age and gender). Lastly, each participant gave their informed consent prior to starting the experiment.

[6]Tobil AB (2823). Tobii Pro Lab (Version 1.217) (Computer software]. Danderyd, Sweden: Tobil AB.

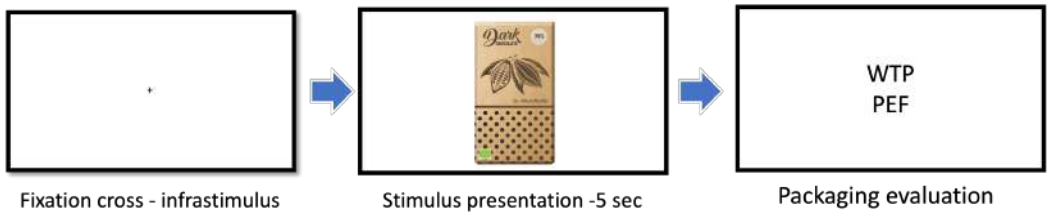


Figure 3.13: Stimulus Presentation Flow for Study 2

3.6.1 Data Preprocessing Methodology

The data for this study was preprocessed through a methodical approach utilizing Python scripts, with the assistance of data manipulation libraries (Pandas [McKinney et al., 2010]) and NumPy [Harris et al., 2020], to address the challenge of integrating disparate datasets. The eye-tracking metrics, collected via tobii pro lab, generated timestamps and tracking metrics, which were stored in a TSV (Tab Separated Values) format for subsequent processing. Concurrently, Qualtrics surveys yielded participant responses WTP, PEF, ESE and demographics, encompassed in CSV (Comma Separated Values) files. These files contained additional metadata, including timestamps that were crucial for cross-referencing.

To reconcile the lack of common identifiers across systems, a Python script was developed to examine and correlate entries based on the timestamp data. A 15-minute matching window was established, enabling the association of questionnaire responses with the relevant eye-tracking data points. This matching was predicated on the assumption that participants would complete the WTP and PEF questionnaires within this time frame post the eye-tracking session. Moreover, a naming standardization subroutine was introduced within the script to unify the nomenclature for products and manipulations. This was imperative to ensure that data merged from various sources remained consistent and identifiable throughout the analysis. Calibration files were also scrutinized; entries with suboptimal calibration quality were excluded from the dataset to maintain the integrity of the eye-tracking metrics.

The preprocessing phase culminated in the assembly of a master dataset, wherein each participant's data was fused into a single record. This included calibrated eye-tracking metrics, WTP values, PEF scores, ESE-10 and demo-

graphics, all synchronized on a temporal axis. The final dataset, thus prepared, presented a comprehensive foundation for conducting nuanced analyses that could reliably inform the interrelations between visual engagement, perceived value, and psychological entitlement in consumer behavior.

3.6.2 Analytical Approach

Eye Tracking Metrics

Table 3.6: Summary of Visit Metrics

Statistic	Time to First Visit		Number of Visits		Duration of First Visit	
	Eco	**Claim**	**Eco**	**Claim**	**Eco**	**Claim**
Count	687	647	709	711	687	647
Mean	1271.59	933.05	1.82	2.13	648.41	438.39
Std Dev	891.94	876.86	0.89	1.23	571.29	399.02
Min	187	0	0	0	9	13
25%	654.5	375	1	1	250	167
50%	950	595	2	2	450	325
75%	1558	1190	2	3	850	567
Max	5563	4989	6	6	4560	3108

Table 3.7: Summary of eye tracking metrics used in the study

The eye-tracking metrics used in the analyses to assess the role of visual attention on sustainability perception of packaging are, as mentioned in section two, the following:

- **Time to First Visit on eco and claim (TTFV):**
- **Total Number of Visits on eco and claim (TNOV):**
- **Duration of First Visit on eco and claim (DOFV):**

A visit includes both saccades and fixations occurred within one visit to the AOIs.

Hypotheses Confirmation

To confirm the influence of packaging cues on consumer WTP and PEF, we employed t-tests comparing each metric across different conditions against a control group devoid of ecological hints. This approach aimed to validate our pre-tested hypothesis that sustainability related packaging cues, ecolabel and textual claim, and their combination (ecoclaim), positively affect WTP and PEF.

Regression Analysis - Hp6, Hp7 and Hp8

Building upon the findings, from Study1, highlighting that sustainability related packaging cues significantly and positively influence WTP and PEF the aim of this section is to explore the contribution of eye-tracking metrics to these relationships.
Utilizing linear regression analysis, the aim is to quantify the direct impact of these visual attention metrics, namely TTFV, TNOV and DOFV, on PEF. Linear regression allows us to model the relationship between our dependent variable (PEF) and the three independent variables (eye-tracking metrics), thereby enabling the identification of specific visual behaviors that are most predictive of consumer perceptions towards environmental claims. This targeted analysis not only seeks to isolate the effects of each metric but also to understand how consumers' visual engagement with packaging cues translates into their valuation of product packaging.

3.6.3 Results

Hypotheses Confirmation - t-tests

The t-test results, as summarized in Table 3.8, underscore significant distinctions between the control and experimental conditions across both WTP and PEF metrics. Notably, all conditions ("eco", "cl", and "ecocl") demonstrated statistically significant differences from the control, suggesting that packaging cues influence consumer sustainabile perception of packaging.
The analyses revealed significant differences in both willingness to pay (WTP) and average PEF across conditions. Specifically, the eco, cl, and ecocl conditions each demonstrated statistically significant differences from the control

condition for WTP and PEF, with p-values ranging from less than .00001 to .00002. These findings provide robust evidence supporting the hypothesis that ecological labels significantly influence consumer behavior and perceptions.
A detailed analysis of WTP metrics indicated a notable ascending trend. Starting from the control condition, which had a mean WTP of 2.02 (SD = .99), there was a progression through the eco condition (M = 2.34, SD = 1.05) and the cl condition (M = 2.10, SD = .95), culminating in the ecocl condition with the highest mean WTP of 2.40 (SD = 1.06). This trend underscores the positive impact of ecological packaging cues on consumers' willingness to pay.
Similarly, the analysis of PEF metrics highlighted a significant increase from the control condition (M = 2.02, SD = .99) to the ecocl condition, which exhibited the most substantial rise in PEF to a mean of 4.50 (SD = 1.56). Such increases in PEF were observed across all experimental conditions, illustrating the effect of ecological labels in enhancing psychological entitlement feelings.
Notably, the ecocl condition showed the most pronounced impact on both WTP and PEF. This finding aligns with the initial hypothesis, suggesting that a larger effect arises from combining the two packaging cues.

Condition	**Metric**	**T Statistic**	***p***	**Summary Statistics**
Control Group				M: 2.02, SD: 0.99
Condition Group				
eco	WTP	4.28	$< .001$	M: 2.34, SD: 1.05
cl	WTP	3.31	$< .001$	M: 2.10, SD: 0.95
ecocl	WTP	5.89	$< .001$	M: 2.40, SD: 1.06
eco	PEF	11.48	$< .001$	M: 4.25, SD: 1.59
cl	PEF	6.22	$< .001$	M: 3.25, SD: 1.61
ecocl	PEF	15.11	$< .001$	M: 4.50, SD: 1.56

Table 3.8: Summary of t-test Results

Regression Analysis - Hp6, Hp7 and Hp8

The regression analysis of eye-tracking metrics in relation to PEF towards eco-friendly products revealed nuanced insights summarized in Table 3.9. Specifically, the findings indicated statistically significant positive relationships for

both *Duration of First Visit_ eco* ($\beta = 0.093$, $p = .009$, $R^2 = .009$, 95% CI [0.023, 0.163]) suggesting that longer engagement times with eco-friendly labels positively associate with an increase in PEF. Additionally, *Time to First Visit_ claim* ($\beta = 0.144$, $p < .001$, $R^2 = .021$, 95% CI [0.069, 0.219]) was found to significantly predict PEF. These results highlight the importance of saliency, for claim, and engagement, for eco.

Conversely, metrics such as *Duration of First Visit_ claim*, and *Number of Visits_ eco*did not exhibit statistically significant effects, suggesting that other factors beyond the duration or frequency of visits to eco-friendly or claim labels may play a pivotal role in influencing PEF. Notably, *Number of Visits_ claim* ($\beta = -0.089$, $p = .016$, $R^2 = .008$, 95% CI [-0.161, -0.017]) demonstrated a negative association with PEF, hinting at a potential diminishing return on PEF with increased exposure to textual claims.

The modest R-squared values for models with significant predictors underscore the partial role of eye-tracking metrics in explaining variance in PEF. This complexity highlights that consumer perceptions towards eco-friendly products are likely influenced by a multitude of factors beyond visual attention alone. The inclusion of confidence intervals provides a more comprehensive understanding of the precision of our estimates, underscoring the variability inherent in consumer behavior research.

Metric	Estimate	p-value	R^2	Adjusted R^2	F-statistic	Lower CI	Upper CI	DF
Duration of first Visit_eco	0.093	.009	.010	.008	6.87	0.023	0.163	685
Duration of first Visit_claim	0.047	.220	.002	.001	1.51	-0.028	0.123	645
Time to first Visit_eco	-0.030	.397	.001	-.0004	0.72	-0.100	0.040	685
Time to first Visit_claim	0.144	$< .001$	.021	.020	14.08	0.069	0.219	645
Number of Visits_eco	0.014	.695	.0002	-.0012	0.15	-0.055	0.083	707
Number of Visits_claim	-0.089	.016	.008	.007	5.88	-0.161	-0.017	709

Table 3.9: Regression Analysis of Eye-Tracking Metrics on PEF

Hp6: For Ecolabel (eco): The p-value for TTFV is .397, which is above the typical alpha level of .05, indicating that the time to first visit on the ecolabel AOI does not significantly affect PEF. For Claim (claim): The p-value for TTFV is .001, which is below the .05 threshold, indicating that the time to first visit the claim does significantly and positively affect PEF.

Hp7: For Ecolabel (eco): The p-value is .695, suggesting that the total number

of visits to the ecolabel does not significantly affect PEF. For Claim (claim): The p-value is .016, which is below the .05 cutoff, indicating that the total number of visits to the claim does significantly and positively affect PEF.
Hp8: For Ecolabel (eco): The p-value is .009, indicating a significant effect. Thus, the duration of the first visit to the ecolabel does significantly and positively affect PEF. For Claim (claim): The p-value is .220, which does not indicate a significant effect at the .05 level. This suggests that the duration of the first visit to the claim does not significantly affect PEF.

To conclude, in the regression analysis of eye-tracking metrics on Perceived Environmental Friendliness (PEF), the presented hypotheses received varied support from the data. Hypothesis 6 (Hp6), which posited that the saliency of ecolabels and claims would positively affect PEF, was partially supported; significant effects were found for claims as indicated by a p-value of .001, but not for ecolabels, where the p-value was .397. Hypothesis 7 (Hp7) proposed that revisits to ecolabels and claims would positively affect PEF; this was supported for claims ($p = .016$) but not for ecolabels ($p = .695$), suggesting revisits to claims are important in affecting PEF. Conversely, Hypothesis 8 (Hp8) received support only for the ecolabel ($p = .009$), with the duration of the first visit significantly affecting PEF, while the claim did not have a significant effect ($p = .220$). The low R^2 values across the metrics indicate that while some of the hypothesized relationships are present, they account for a small proportion of the variance in PEF.

Lastly, it should be noted that at this stage of the research project no statistically significant results were found beyond the regression model implemented, meaning that no significant effect have been found for the metrics in relation to WTP yet and the SEM models could not be replicated at this stage.

3.7 Conclusions

This chapter has provided a comprehensive empirical analysis of how ecolabels and sustainability claims on product packaging affect consumers' perceived environmental friendliness (PEF) and willingness to pay (WTP) as well as the moderating role of environmental self efficacy (ESE) and the role of visual attention on product PEF. The evidence from two studies suggests that both

ecolabels and claims individually enhance WTP, confirming Hypotheses 1 and 2. However, contrary to Hypothesis 3, no synergistic effect was observed when these cues were combined. The SEM analysis further substantiated the mediation role of PEF in the relationship between packaging cues and WTP, as outlined in Hypothesis 4, as well as the moderating role of ESE in the aforementioned mediated relationship. Further more, the employment of eye-tracking data enriched the findings, offering granular insights into the role of visual attention in processing packaging cues, with mixed support for Hypotheses 6 to 8. In Table 3.10 the results have been summarized.

Hypothesis	**Verified**
Hypothesis 1: The presence of an eco-label on product packaging will significantly increase consumers' WTP for the product.	Yes (Eco-label)
Hypothesis 2: The presence of a sustainability claim on product packaging will significantly increase consumers' WTP for the product.	Yes (Sustainability Claim)
Hypothesis 3: There will be an interaction effect between eco-label and sustainability claim presence on consumers' WTP, indicating a higher willingness to pay when these two are combined rather than when each attribute is presented alone.	No (Interaction not significant)
Hypothesis 4: Perceived Environmental Friendliness (PEF) will mediate the relationship between the independent variables (eco-label and sustainability claim) and the dependent variable (WTP).	Yes (Eco-label and Sustainability Claim)
Hypothesis 5: Environmental Self-Efficacy (ESE) will moderate the mediation effect of PEF on the relationship between the independent variables (eco-label and claim) and WTP, the dependent variable.	Yes (Eco-label and Sustainability Claim)
Hypothesis 6: Ecolabel and Claim saliency, represented by the time to first visit (TTFV) eye-tracking metric, significantly and positively affects PEF.	Partially (Claim Only)
Hypothesis 7: Ecolabel and Claim revisits, represented by Total Number of Visits (TNOV) eye-tracking metric, significantly and positively affect PEF.	Partially (Claim Only)
Hypothesis 8: Focus on Ecolabel and Claim, represented by the Duration of First Visit on the AOI (DOFV), significantly and positively affects PEF.	Partially (Ecolabel Only)

Table 3.10: Summary of the Results

Contributions

This research makes significant contributions to the field of consumer behavior and marketing, particularly in the context of cue utilization theory and eye-tracking methodology. It underscores the importance of ecolabels and sustainability claims in shaping consumer perceptions and willingness to pay, aligning with cue utilization theory which posits that consumers use various cues as surrogate indicators in their evaluation product [Berger and Fitzsimons, 2008, Jerzyk, 2016, Steenkamp, 1990]. The integration of eye-tracking metrics into this research framework provides a novel methodological contribution, offering a nuanced understanding of the visual processing that underpins the evaluation of eco-communication on packaging. This approach not only advances our comprehension of how visual attention to packaging cues influences consumer behavior but also enriches eye-tracking theory by demonstrating its applicability in investigating the impact of environmental sustainability cues on consumer decision-making processes.

Furthermore, the findings of this study have significant practical implications for marketers. They suggest that transparent and prominent ecolabeling can be a powerful tool to influence consumer behavior towards more sustainable consumption patterns. By leveraging insights from both cue utilization theory and eye-tracking methodology, marketers can design packaging that effectively communicates environmental benefits, thereby enhancing consumer engagement and willingness to pay for sustainable products. This research thus bridges theoretical concepts with practical marketing strategies, highlighting the critical role of visual cues in promoting sustainable consumption.

Limitations

Despite the robust findings, this research is not without its limitations. One key limitation lies in the use of mock packagings, which, while necessary to avoid issues with product and brand familiarity, may not fully capture the complexity of real-world consumer choices. The design choice to use mock packaging was driven by a desire to eliminate biases associated with pre-existing brand perceptions, ensuring that the study's focus remained squarely on the impact of ecolabels and sustainability claims. Additionally, the participant pool was relatively homogeneous primarily consisting of younger individuals, due to the fact

that participants were all students at Rotterdam Erasmus University, which might not reflect broader consumer demographics. The controlled lab setting also limits the generalizability of the results to real-life shopping environments, where numerous external factors can influence decision-making. Moreover, in Study 1 the data shows that consumers always perceive the product with an environmentally related packaging cue as more sustainable independently of the cue itself, therefore explaining why no interaction effect was found. Lastly, in Study 2 the within subject design could also have had an impact on the results obtained meaning that, for example, the consumer focus could have been shifted away from the manipulated cues and towards other elements, like the price of the product.

Future Research

Future research could address these limitations by considering a more diverse sample and extending the study to in-store settings to test the ecological validity of the findings. Additionally, investigating the long-term impact of ecolabels and claims on consumer behavior could provide insights into their effectiveness in fostering sustainable consumer habits over time. Moreover, researchers should consider running the eye-tracking experiment again in order to first, confirm the findings provided by this chapter and, second, broaden the understanding on the relationship between visual attention and packaging cues. Another aspect that could be address by researchers in the future could be to observe a three way interaction between ecolabel, textual claim and packaging material, which is, according to the literature review in chapter 1, one of the main drivers of sustainability in relation to packaging. Lastly, future research could also look into the implementation of electroencephalography (EEG) in the study in order to asses neurological responses to the stimuli, in particular the WPI index developed by Ramsøy and colleagues could be of particular use for this study [Ramsøy et al., 2018].

APPENDIX A - Stimuli

Figure 3.14: Conditions - Chocolate Bar

Figure 3.15: Conditions - Chips

Figure 3.16: Conditions - Shampoo Bottle

Figure 3.17: Conditions - Toilet Paper

APPENDIX B - Packaging Evaluation Qualtrics

In this study we are interested in how much people are willing to pay for products.
Take a look at the chocolate bar presented below in all its elements.

How much would you be willing to pay for this product?

0 4

€

Now look at the product packaging again and answer how much you agree with the statements below.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This packaging is friendly to the environment.	○	○	○	○	○	○	○
The manufacturing and disposal of this packaging causes less harm to the environment.	○	○	○	○	○	○	○
This packaging is relatively more eco-friendly than other packaging.	○	○	○	○	○	○	○
This packaging deserves to be labeled "environmentally friendly."	○	○	○	○	○	○	○

Figure 3.18: Packaging evaluation questions

APPENDIX C - End of study Qualtrics

Please rate how certain you are that you can do each of the following environmental actions on a regular basis. Remember, these are not asking what you have done or are sure to do in the future, they are asking what you can do.

	Cannot do at all 0	1	2	3	4	Moderately can do 5	6	7	8	9	Highly certain can do 10
I can help mitigate enviromental problems in my community, if they arise	○	○	○	○	○	○	○	○	○	○	○
I can find several ways to be part of the solution when I am introduced to an environmental problem	○	○	○	○	○	○	○	○	○	○	○
I can reduce the environmental problems that the next generation will need to face in the future	○	○	○	○	○	○	○	○	○	○	○
I can have a significant positive impact on the environment	○	○	○	○	○	○	○	○	○	○	○
I can reduce the negative impact I have on the planet	○	○	○	○	○	○	○	○	○	○	○
I can support environmental policy through political activism	○	○	○	○	○	○	○	○	○	○	○
I can do my part in solving the world's environmental problems	○	○	○	○	○	○	○	○	○	○	○
I can be environmentally friendly even when the people with whom I have close relationships are not	○	○	○	○	○	○	○	○	○	○	○
I can set an example of environmentally friendly behavior, for others to follow	○	○	○	○	○	○	○	○	○	○	○
I can continue to take steps towards solving large environmental problems, even when others are overwhelmed by the scale of these problems	○	○	○	○	○	○	○	○	○	○	○

How do you identify?

- ○ Male
- ○ Female
- ○ Prefer not to say

Please enter your age (numbers only)

Figure 3.19: End of Study Questions With ESE and Demographics

APPENDIX D - Areas of interest

Figure 3.20: AOIs per ondition for chocolate packaging

Figure 3.21: AOIs per condition for chips packaging

Figure 3.22: AOIs per condition for shampoo packaging

Figure 3.23: AOIs per condition for toilet paper packaging

APPENDIX E - Eye Tracker calibration

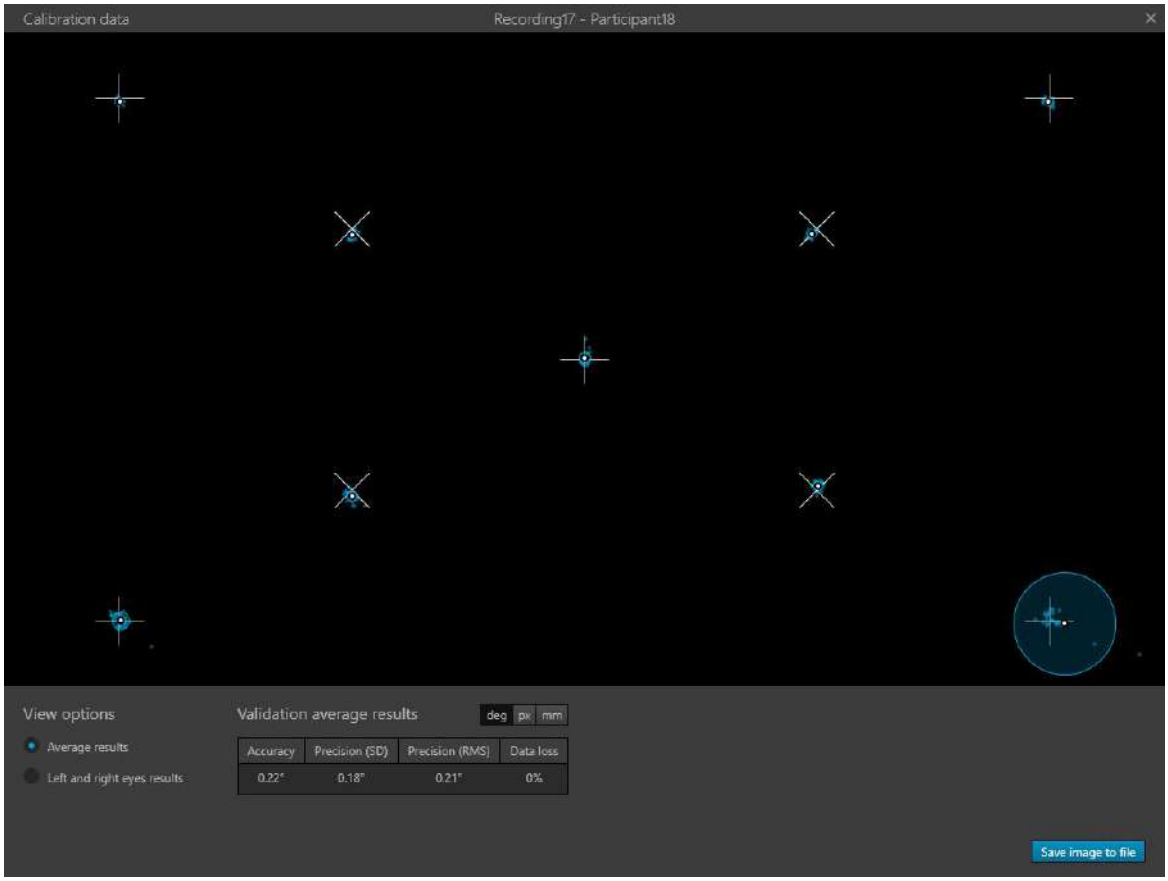


Figure 3.24: Tobii Pro Lab Calibration Screen

Source: how-to-calibrate-and-validate-in-tobii-pro-lab[7]

[7]https://connect.tobii.com/s/article/how-to-calibrate-and-validate-in-tobii-pro-lab?

APPENDIX F - Alternative Model Proposal

Given the limited explanatory power of individual eye-tracking metrics on PEF, the author was motivated to explore another analytical approach. By employing a weighted sum method to aggregate the effects of the three metrics, the aim was to capture the collective influence of visual attention on consumer valuation of packaging cues. This technique, facilitated by a random search algorithm to identify the optimal combination of metric weights, represents a significant leap forward in the attempt to decode the complexities of consumer gaze behavior on packaging.

To investigate the aggregate impact of eye-tracking metrics on PEF, the following analytical approach was adopted. Utilizing the linear regression model, specified as:

$$\text{model} = \text{lm}(\text{Average\_PEF} \sim \text{Comprehensive\_Score}, \text{data} = df),$$

enabled a direct comparison of individual and aggregated metrics' influence on PEF. This analytical consistency extended to the standardization of variables, ensuring that each metric was treated with the same statistical considerations as when analyzed independently. The comprehensive score was calculated through a weighted sum method, incorporating the set of predefined eye-tracking metrics 3.6.2. The formula for this weighted sum, given the metrics, is articulated as:

$$\begin{aligned}\text{Comprehensive\_Score} = {} & w_1 \cdot \text{Total\_duration\_of\_Visit} + w_2 \cdot \text{Duration\_of\_first\_Visit} \\ & + w_3 \cdot \text{Average\_duration\_of\_Visit} + w_4 \cdot \text{Time\_to\_first\_Visit} + w_5 \cdot \text{Number\_of\_Visits}^{s}\end{aligned} \tag{3.1}$$

where w_i represents the weight assigned to the i^{th} metric, optimized through a random search algorithm to best predict PEF. By standardizing the variables in the same manner as they were when modeled individually and adopting the same linear regression model, reliability and comparability of our findings was ensured. This methodological rigor guaranteed that the analysis of the composite influence of eye-tracking metrics was directly comparable to the analysis of individual metrics, both conducted within the same standardized dataset.

The regression analysis conducted to assess the relationship between the comprehensive score—derived from a weighted sum of eye-tracking metrics (Duration of First Visit, Time to First Visit, and Number of Visits)—and Perceived Environmental Friendliness towards eco-friendly products yielded statistically significant results. Specifically, the comprehensive score was found to have a positive effect on PEF ($B = 0.345$, $SE = 0.025$, $t(1418) = 13.82$, $p < .001$), indicating that increased visual engagement across these metrics is associated with stronger entitlement feelings toward eco-friendly products. The model explained a noteworthy proportion of variance in PEF, with an R^2 of 0.1187 and an adjusted R^2 of 0.1181, suggesting that the comprehensive score significantly contributes to our understanding of consumer behavior in the context of eco-friendly products. The confidence interval for the comprehensive score's effect ranged from 0.296 to 0.393, further substantiating the robustness of this relationship.

The coefficients derived from the random search, representing the weight of each metric in the comprehensive score, were as follows: Duration of First Visit (0.0260), Time to First Visit (0.3604), and Number of Visits (0.1514). These values highlight the relative importance of Time to First Visit in influencing PEF, suggesting that the duration and promptness of consumer engagement with eco-friendly product labels are particularly pivotal.

Notably, this method of aggregating eye-tracking metrics into a comprehensive score significantly outperformed all single metrics analyzed individually, as detailed in Table 3.9.

These findings underscore the value of integrating multiple eye-tracking metrics to elucidate the complex dynamics of consumer engagement with eco-friendly cues on product packaging, offering empirical support for the utility of the weighted sum approach in consumer behavior research within the environmental sustainability domain.

Conclusions

This dissertation has explored the mutifaceted role in packaging in conveying sustainability information and the related beahvioral responses by consumers. The journey begins with a comprehensive literature review in **Chapter 1**, where an analysis of peer-reviewed articles spanning a decade provides a deep dive into how sustainability cues on packaging shape consumer perceptions and behaviors. This chapter reveals that consumers are increasingly aware of the environmental impact of their purchases, with sustainability cues such as material, ecolabels, and claims playing a significant role in guiding their choices. It discusses the importance of packaging design and brand perception in fostering trust and loyalty among consumers, while also highlighting a critical gap between consumer perceptions of packaging sustainability and its actual environmental impact. This gap underscores the need for clearer communication and education to bridge consumer understanding and actual sustainable practices.

In **Chapter 2**, the dissertation shifts focus to the psychometric validation of the Italian version of the Environmental Self-Efficacy Scale Short (ESE-10), a tool crucial for measuring individuals' belief in their capacity to perform environmentally friendly actions. The successful adaptation and validation of this scale in the Italian context not only enriches environmental psychology research but also offers new avenues to understand the psychological underpinnings of sustainable behaviors. The chapter confirms the scale's reliability and its potential to unlock insights into how self-efficacy influences environmental actions among Italian-speaking populations.

Chapter 3 presents an empirical investigation into how specific packaging cues influence consumer perceptions of environmental friendliness and their willingness to pay for sustainable products. Through a sophisticated experi-

mental design integrating behavioral analysis and eye-tracking technology, the study uncovers that ecolabels and sustainability claims significantly enhance consumers' willingness to pay by elevating their perceptions of environmental friendliness. Furthermore, it introduces the mediating role of these perceptions in the relationship between packaging cues and willingness to pay, alongside the moderating effect of environmental self-efficacy. This suggests that individuals with a higher sense of environmental responsibility are more attuned to sustainability cues on packaging.

The cumulative insights from these chapters provide a nuanced understanding of the dynamics at play in the interaction between packaging cues and consumer perceptions of sustainability. They highlight the critical role of clear and credible sustainability information on packaging in navigating consumer choices towards more sustainable options. The dissertation concludes with a call for further research to expand the scope of product categories examined, explore the interplay between various packaging cues, and employ innovative methodologies to deepen our understanding of consumer behaviors related to sustainable packaging. This body of work significantly contributes to the fields of marketing, environmental psychology, and sustainability studies, offering valuable perspectives for developing effective strategies to promote sustainable consumption.

Bibliography

[Abdu and Mutuku, 2021] Abdu, N. and Mutuku, J. (2021). Willingness to pay for socially responsible products: A meta- analysis of coffee ecolabelling. *Heliyon*, 7(6).

[Abu-Bader and Jones, 2021] Abu-Bader, S. and Jones, T. V. (2021). Statistical mediation analysis using the sobel test and hayes spss process macro. *International Journal of Quantitative and Qualitative Research Methods*.

[Antonazzo et al., 2015] Antonazzo, A. P., Fiore, M., La Sala, P., and Contò, F. (2015). Assessing perceptions of wine tourists on organic wine. *Economia Agro-Alimentare*, pages 57–76.

[Argo and White, 2012] Argo, J. J. and White, K. (2012). When do consumers eat more? the role of appearance self-esteem and food packaging cues. *Journal of Marketing*, 76(2):67–80.

[Bastounis et al., 2021] Bastounis, A., Buckell, J., Hartmann-Boyce, J., Cook, B., King, S., Potter, C., Bianchi, F., Rayner, M., and Jebb, S. A. (2021). The impact of environmental sustainability labels on willingness-to-pay for foods: A systematic review and meta-analysis of discrete choice experiments. *Nutrients*, 13(8):2677.

[Bauer et al., 2023] Bauer, A.-S., Dörnyei, K. R., and Krauter, V. (2023). Consumer complaints about food packaging.

[Berger and Fitzsimons, 2008] Berger, J. and Fitzsimons, G. (2008). Dogs on the street, pumas on your feet: How cues in the environment influence product evaluation and choice. *Journal of marketing research*, 45(1):1–14.

[Boesen et al., 2019] Boesen, S., Bey, N., and Niero, M. (2019). Environmental sustainability of liquid food packaging: is there a gap between danish consumers' perception and learnings from life cycle assessment? *Journal of Cleaner Production*, 210:1193–1206.

[Borgianni et al., 2022] Borgianni, Y., Maccioni, L., Dignös, A., and Basso, D. (2022). A framework to evaluate areas of interest for sustainable products and designs. *Sustainability*, 14(13):7931.

[Borrello et al., 2019] Borrello, M., Annunziata, A., and Vecchio, R. (2019). Sustainability of palm oil: Drivers of consumers' preferences. *Sustainability*, 11(18):4818.

[Boz et al., 2020] Boz, Z., Korhonen, V., and Koelsch Sand, C. (2020). Consumer considerations for the implementation of sustainable packaging: A review. *Sustainability*, 12(6):2192.

[Branca et al., 2023] Branca, G., Resciniti, R., and Loureiro, S. M. C. (2023). Virtual is so real! consumers' evaluation of product packaging in virtual reality. *Psychology & Marketing*, 40(3):596–609.

[Brislin, 1970] Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of cross-cultural psychology*, 1(3):185–216.

[Bruwer et al., 2017] Bruwer, J., Chrysochou, P., and Lesschaeve, I. (2017). Consumer involvement and knowledge influence on wine choice cue utilisation. *British Food Journal*, 119(4):830–844.

[Capitello et al., 2021] Capitello, R., Agnoli, L., Charters, S., and Begalli, D. (2021). Labelling environmental and terroir attributes: Young italian consumers' wine preferences. *Journal of Cleaner production*, 304:126991.

[Cavallo and Piqueras-Fiszman, 2017] Cavallo, C. and Piqueras-Fiszman, B. (2017). Visual elements of packaging shaping healthiness evaluations of consumers: The case of olive oil. *Journal of sensory studies*, 32(1):e12246.

[Chandon and Ordabayeva, 2009] Chandon, P. and Ordabayeva, N. (2009). Supersize in one dimension, downsize in three dimensions: Effects of spatial

dimensionality on size perceptions and preferences. *Journal of Marketing Research*, 46(6):739–753.

[Cheek and Wansink, 2017] Cheek, A. K. and Wansink, B. (2017). Making it part of the package: Edible packaging is more acceptable to young consumers when it is integrated with food. *Journal of Food Products Marketing*, 23(6):723–732.

[Chiu et al., 2023] Chiu, T.-P., Yang, D. J., and Ma, M.-Y. (2023). The intertwining effect of visual perception of the reusable packaging and type of logo simplification on consumers' sustainable awareness. *Sustainability*, 15(17):13115.

[Clement, 2007] Clement, J. (2007). Visual influence on in-store buying decisions: an eye-track experiment on the visual influence of packaging design. *Journal of marketing management*, 23(9-10):917–928.

[Clement et al., 2013] Clement, J., Kristensen, T., and Grønhaug, K. (2013). Understanding consumers' in-store visual perception: The influence of package design features on visual attention. *Journal of Retailing and Consumer Services*, 20(2):234–239.

[Costello and Osborne, 2019] Costello, A. B. and Osborne, J. (2019). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical assessment, research, and evaluation*, 10(1):7.

[Cronbach, 1951] Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *psychometrika*, 16(3):297–334.

[Dantas et al., 2023] Dantas, R., Sabir, I., Martins, J. M., Majid, M. B., Rafiq, M., Martins, J. N., and Rana, K. (2023). Role of green and multisensory packaging in environmental sustainability: Evidence from fmcg sector of pakistan. *Cogent Business & Management*, 10(3):2285263.

[De Feo et al., 2022] De Feo, G., Ferrara, C., and Minichini, F. (2022). Comparison between the perceived and actual environmental sustainability of beverage packagings in glass, plastic, and aluminium. *Journal of Cleaner Production*, 333:130158.

[de Oliveira and de Melo, 2019] de Oliveira, A. S. B. and de Melo, N. R. (2019). Market and sustainability of food packaging: a review. *Boletim do Centro de Pesquisa de Processamento de Alimentos*, 36(1).

[Donato et al., 2021] Donato, C., Barone, A. M., and Romani, S. (2021). The satiating power of sustainability: the effect of package sustainability on perceived satiation of healthy food. *British Food Journal*, 123(13):162–177.

[Dubois et al., 2021] Dubois, P., Albuquerque, P., Allais, O., Bonnet, C., Bertail, P., Combris, P., Lahlou, S., Rigal, N., Ruffieux, B., and Chandon, P. (2021). Effects of front-of-pack labels on the nutritional quality of supermarket food purchases: evidence from a large-scale randomized controlled trial. *Journal of the Academy of Marketing Science*, 49(1):119–138.

[EcoLabel Index, 2023] EcoLabel Index (2023). Ecolabels. `https://www.ecolabelindex.com/ecolabels/`. Accessed: 2024-01-9.

[Environmental Protection Agency, 2024] Environmental Protection Agency (2024). Introduction to ecolabels and standards for greener products. `https://www.epa.gov/greenerproducts/introduction-ecolabels-and-standards-greener-products`. Accessed: 2024-01-3.

[Galati et al., 2022] Galati, A., Alaimo, L. S., Ciaccio, T., Vrontis, D., and Fiore, M. (2022). Plastic or not plastic? that's the problem: Analysing the italian students purchasing behavior of mineral water bottles made with eco-friendly packaging. *Resources, Conservation and Recycling*, 179:106060.

[Gifford, 2011] Gifford, R. (2011). The dragons of inaction: psychological barriers that limit climate change mitigation and adaptation. *American psychologist*, 66(4):290.

[Glaholt and Reingold, 2011] Glaholt, M. G. and Reingold, E. M. (2011). Eye movement monitoring as a process tracing methodology in decision making research. *Journal of Neuroscience, Psychology, and Economics*, 4(2):125.

[Granato et al., 2022] Granato, G., Fischer, A. R., and van Trijp, H. C. (2022). A meaningful reminder on sustainability: When explicit and implicit packaging cues meet. *Journal of environmental psychology*, 79:101724.

[Groth et al., 2023] Groth, C., Wegmann, C., and Meyerding, S. G. (2023). Perception of product sustainability: The case of processed tomatoes–a qualitative study in germany. *Journal of Retailing and Consumer Services*, 71:103214.

[Guntzburger et al., 2022] Guntzburger, Y., Peignier, I., and de Marcellis-Warin, N. (2022). The consumers'(mis) perceptions of ecolabels' regulatory schemes for food products: insights from canada. *British Food Journal*, 124(11):3497–3521.

[Hallez et al., 2023] Hallez, L., Vansteenbeeck, H., Boen, F., and Smits, T. (2023). Persuasive packaging? the impact of packaging color and claims on young consumers' perceptions of product healthiness, sustainability and tastiness. *Appetite*, 182:106433.

[Harris et al., 2020] Harris, C. R., Millman, K. J., Van Der Walt, S. J., Gommers, R., Virtanen, P., Cournapeau, D., Wieser, E., Taylor, J., Berg, S., Smith, N. J., et al. (2020). Array programming with numpy. *Nature*, 585(7825):357–362.

[Henson and Roberts, 2006] Henson, R. K. and Roberts, J. K. (2006). Use of exploratory factor analysis in published research: Common errors and some comment on improved practice. *Educational and Psychological measurement*, 66(3):393–416.

[Herbes et al., 2018] Herbes, C., Beuthner, C., and Ramme, I. (2018). Consumer attitudes towards biobased packaging–a cross-cultural comparative study. *Journal of cleaner production*, 194:203–218.

[Herédia-Colaço, 2023] Herédia-Colaço, V. (2023). Pro-environmental messages have more effect when they come from less familiar brands. *Journal of Product & Brand Management*, 32(3):436–453.

[Herrmann et al., 2022] Herrmann, C., Rhein, S., and Sträter, K. F. (2022). Consumers' sustainability-related perception of and willingness-to-pay for food packaging alternatives. *Resources, Conservation and Recycling*, 181:106219.

[Hess and Bongaerts, 2020] Hess, M. and Bongaerts, J. C. (2020). Differences in perception of the environmental and health impacts of decorative paints among average consumers. *Sustainability*, 12(11):4495.

[Hutton, 2008] Hutton, S. B. (2008). Cognitive control of saccadic eye movements. *Brain and cognition*, 68(3):327–340.

[Igolkina and Meshcheryakov, 2020] Igolkina, A. A. and Meshcheryakov, G. (2020). semopy: A python package for structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 27(6):952–963.

[Iraldo et al., 2020] Iraldo, F., Griesshammer, R., and Kahlenborn, W. (2020). The future of ecolabels.

[Ischen et al., 2022] Ischen, C., Meijers, M. H., Vandeberg, L., and Smit, E. G. (2022). Seen as green? assessing the salience and greenness of environmentally friendly packaging cues. *Journal of Food Products Marketing*, 28(1):31–48.

[Jerzyk, 2016] Jerzyk, E. (2016). Design and communication of ecological content on sustainable packaging in young consumers' opinions. *Journal of Food Products Marketing*, 22(6):707–716.

[Jover et al., 2004] Jover, A. J. V., Montes, F. J. L., and Fuentes, M. d. M. F. (2004). Measuring perceptions of quality in food products: the case of red wine. *Food Quality and preference*, 15(5):453–469.

[Kassambara and Mundt, 2020] Kassambara, A. and Mundt, F. (2020). factoextra: Extract and Visualize the Results of Multivariate Data Analyses — CRAN.R-project.org. `https://CRAN.R-project.org/package=factoextra`. [Accessed 17-01-2024].

[Ketelsen et al., 2020] Ketelsen, M., Janssen, M., and Hamm, U. (2020). Consumers' response to environmentally-friendly food packaging-a systematic review. *Journal of Cleaner Production*, 254:120123.

[Klotz et al., 2023] Klotz, A. C., Swider, B. W., and Kwon, S. H. (2023). Back-translation practices in organizational research: Avoiding loss in translation. *Journal of Applied Psychology*, 108(5):699.

[Kongsli Gjerde, 2022] Kongsli Gjerde, H. (2022). How graphic design can influence the perception of sustainable food packaging. In *DS 117: Proceedings of the 24th International Conference on Engineering and Product Design Education (EPDE 2022), London South Bank University in London, UK*, pages 8th–9th September 2022.

[Krausmann et al., 2009] Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K.-H., Haberl, H., and Fischer-Kowalski, M. (2009). Growth in global materials use, gdp and population during the 20th century. *Ecological economics*, 68(10):2696–2705.

[Lamberz et al., 2020] Lamberz, J., Litfin, T., Teckert, , and Meeh-Bunse, G. (2020). Is there a link between sustainability, perception and buying decision at the point of sale? *Business Systems Research: International Journal of the Society for Advancing Innovation and Research in Economy*, 11(3):1–13.

[Lazzarini et al., 2016] Lazzarini, G. A., Zimmermann, J., Visschers, V. H., and Siegrist, M. (2016). Does environmental friendliness equal healthiness? swiss consumers' perception of protein products. *Appetite*, 105:663–673.

[Lee and Lou, 1995] Lee, M. and Lou, Y.-C. (1995). Consumer reliance on intrinsic and extrinsic cues in product evaluations: A conjoint approach. *Journal of Applied Business Research*, 12(1):21.

[Licciardello, 2017] Licciardello, F. (2017). Packaging, blessing in disguise. review on its diverse contribution to food sustainability. *Trends in Food Science & Technology*, 65:32–39.

[Magnier and Schoormans, 2015] Magnier, L. and Schoormans, J. (2015). Consumer reactions to sustainable packaging: The interplay of visual appearance, verbal claim and environmental concern. *Journal of Environmental Psychology*, 44:53–62.

[Mai et al., 2016] Mai, R., Symmank, C., and Seeberg-Elverfeldt, B. (2016). Light and pale colors in food packaging: When does this package cue signal superior healthiness or inferior tastiness? *Journal of Retailing*, 92(4):426–444.

[Mair and Wilcox, 2020] Mair, P. and Wilcox, R. (2020). Robust statistical methods in r using the wrs2 package. *Behavior research methods*, 52:464–488.

[Martinovici et al., 2023] Martinovici, A., Pieters, R., and Erdem, T. (2023). Attention trajectories capture utility accumulation and predict brand choice. *Journal of Marketing Research*, 60(4):625–645.

[McDonald, 2013] McDonald, R. P. (2013). *Test theory: A unified treatment*. psychology press.

[McKinney et al., 2010] McKinney, W. et al. (2010). Data structures for statistical computing in python. In *Proceedings of the 9th Python in Science Conference*, volume 445, pages 51–56. Austin, TX.

[McLeod et al., 2022] McLeod, A., Yang, W., Fang, D., and Nayga, R. M. (2022). Aligning values to labels: A best-worst analysis of food labels. *Agricultural and Resource Economics Review*, pages 1–25.

[Me, 1982] Me, S. (1982). Asymptotic intervals for indirect effects in structural equation models. *Sociological methodology*, pages 290–312.

[Meherishi et al., 2019] Meherishi, L., Narayana, S. A., and Ranjani, K. (2019). Sustainable packaging for supply chain management in the circular economy: A review. *Journal of cleaner production*, 237:117582.

[Milfont, 2012] Milfont, T. L. (2012). Cultural differences in environmental engagement.

[Moeller and Stahlmann, 2019] Moeller, B. L. and Stahlmann, A. G. (2019). Which character strengths are focused on the well-being of others? development and initial validation of the environmental self-efficacy scale: assessing confidence in overcoming barriers to pro-environmental behavior. *Journal of Well-Being Assessment*, 3(2-3):123–135.

[Monnot et al., 2015] Monnot, E., Parguel, B., and Reniou, F. (2015). Consumer responses to elimination of overpackaging on private label products. *International Journal of Retail & Distribution Management*, 43(4/5):329–349.

[Moya et al., 2020] Moya, I., García-Madariaga, J., and Blasco, M.-F. (2020). What can neuromarketing tell us about food packaging? *Foods*, 9(12):1856.

[Muranko et al., 2021] Muranko, Ż., Tassell, C., Zeeuw van der Laan, A., and Aurisicchio, M. (2021). Characterisation and environmental value proposition of reuse models for fast-moving consumer goods: Reusable packaging and products. *Sustainability*, 13(5):2609.

[Nemat et al., 2019] Nemat, B., Razzaghi, M., Bolton, K., and Rousta, K. (2019). The role of food packaging design in consumer recycling behavior—a literature review. *Sustainability*, 11(16):4350.

[Neuendorf and Kumar, 2015] Neuendorf, K. A. and Kumar, A. (2015). Content analysis. *The international encyclopedia of political communication*, pages 1–10.

[Nguyen et al., 2020] Nguyen, A. T., Parker, L., Brennan, L., and Lockrey, S. (2020). A consumer definition of eco-friendly packaging. *Journal of Cleaner Production*, 252:119792.

[Norgaard, 2009] Norgaard, K. M. (2009). Cognitive and behavioral challenges in responding to climate change. *World Bank Policy Research Working Paper*, (4940).

[Norton et al., 2022] Norton, V., Waters, C., Oloyede, O. O., and Lignou, S. (2022). Exploring consumers' understanding and perception of sustainable food packaging in the uk. *Foods*, 11(21):3424.

[Ojha et al., 2015] Ojha, A., Sharma, A., Sihag, M., and Ojha, S. (2015). Food packaging–materials and sustainability-a review. *Agricultural Reviews*, 36(3):241–245.

[Oliver et al., 2023] Oliver, M. O., Jestratijevic, I., Uanhoro, J., and Knight, D. K. (2023). Investigation of a consumer's purchase intentions and behaviors towards environmentally friendly grocery packaging. *Sustainability*, 15(11):8789.

[Oreskes, 2018] Oreskes, N. (2018). *The scientific consensus on climate change: How do we know we're not wrong?* Springer.

[Orquin and Scholderer, 2011] Orquin, J. and Scholderer, J. (2011). Attention to health cues on product packages.

[Orquin et al., 2020] Orquin, J. L., Bagger, M. P., Lahm, E. S., Grunert, K. G., and Scholderer, J. (2020). The visual ecology of product packaging and its effects on consumer attention. *Journal of Business Research*, 111:187–195.

[Orzan et al., 2018] Orzan, G., Cruceru, A. F., Bălăceanu, C. T., and Chivu, R.-G. (2018). Consumers' behavior concerning sustainable packaging: An exploratory study on romanian consumers. *Sustainability*, 10(6):1787.

[Otto et al., 2021] Otto, S., Strenger, M., Maier-Nöth, A., and Schmid, M. (2021). Food packaging and sustainability–consumer perception vs. correlated scientific facts: A review. *Journal of Cleaner Production*, 298:126733.

[Ramsøy et al., 2018] Ramsøy, T. Z., Skov, M., Christensen, M. K., and Stahlhut, C. (2018). Frontal brain asymmetry and willingness to pay. *Frontiers in neuroscience*, 12:138.

[Rees et al., 2019] Rees, W., Tremma, O., and Manning, L. (2019). Sustainability cues on packaging: The influence of recognition on purchasing behavior. *Journal of Cleaner Production*, 235:841–853.

[Romppel et al., 2013] Romppel, M., Herrmann-Lingen, C., Wachter, R., Edelmann, F., Düngen, H.-D., Pieske, B., and Grande, G. (2013). A short form of the general self-efficacy scale (gse-6): Development, psychometric properties and validity in an intercultural non-clinical sample and a sample of patients at risk for heart failure. *GMS Psycho-Social-Medicine*, 10.

[Rosseel, 2012] Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, 48(2):1–36.

[Schleenbecker and Hamm, 2013] Schleenbecker, R. and Hamm, U. (2013). Consumers' perception of organic product characteristics. a review. *Appetite*, 71:420–429.

[Schober et al., 2018] Schober, P., Boer, C., and Schwarte, L. A. (2018). Correlation coefficients: appropriate use and interpretation. *Anesthesia & analgesia*, 126(5):1763–1768.

[Schwarzer and Jerusalem, 1995] Schwarzer, R. and Jerusalem, M. (1995). Generalized self-efficacy scale. *J. Weinman, S. Wright, & M. Johnston, Measures in health psychology: A user's portfolio. Causal and control beliefs*, 35:37.

[Sekki et al., 2023] Sekki, S., Kauppinen-Räisänen, H., Kylkilahti, E., and Autio, M. (2023). Packaging journey from retail to home: how the meaning of sustainability for colour transforms. *International Journal of Retail & Distribution Management*, 51(13):47–63.

[Shahmohammadi et al., 2020] Shahmohammadi, S., Steinmann, Z. J., Tambjerg, L., van Loon, P., King, J. H., and Huijbregts, M. A. (2020). Comparative greenhouse gas footprinting of online versus traditional shopping for fast-moving consumer goods: A stochastic approach. *Environmental science & technology*, 54(6):3499–3509.

[Shirai, 2020] Shirai, M. (2020). Understanding consumer perceptions of quality based on package size: the moderating role of the evaluation context. *International Journal of Retail & Distribution Management*, 48(7):749–762.

[Sibilia et al., 1995] Sibilia, L., Schwarzer, R., and Jerusalem, M. (1995). Italian adaptation of the general self-efficacy scale. *Resource document. Ralf Schwarzer web site. Accessed Jan*, 25:2012.

[Simão et al., 2022] Simão, S. A. V., Rohden, S. F., and Pinto, D. C. (2022). Natural claims and sustainability: The role of perceived efficacy and sensorial expectations. *Sustainable Production and Consumption*, 34:505–517.

[Smith et al., 2021] Smith, M., Lal, P., Oluoch, S., Vedwan, N., and Smith, A. (2021). Valuation of sustainable attributes of hard apple cider: A best-worst choice approach. *Journal of Cleaner Production*, 318:128478.

[Sokolova et al., 2023] Sokolova, T., Krishna, A., and Döring, T. (2023). Paper meets plastic: The perceived environmental friendliness of product packaging. *Journal of Consumer Research*, page ucad008.

[Spence et al., 2019] Spence, C., Velasco, C., and Petit, O. (2019). The consumer neuroscience of packaging. *Multisensory packaging: Designing new product experiences*, pages 319–347.

[Stasi et al., 2018] Stasi, A., Songa, G., Mauri, M., Ciceri, A., Diotallevi, F., Nardone, G., and Russo, V. (2018). Neuromarketing empirical approaches and food choice: A systematic review. *Food research international*, 108:650–664.

[Steenis et al., 2018] Steenis, N. D., van der Lans, I. A., van Herpen, E., and van Trijp, H. C. (2018). Effects of sustainable design strategies on consumer preferences for redesigned packaging. *Journal of Cleaner Production*, 205:854–865.

[Steenis et al., 2017] Steenis, N. D., Van Herpen, E., Van Der Lans, I. A., Ligthart, T. N., and Van Trijp, H. C. (2017). Consumer response to packaging design: The role of packaging materials and graphics in sustainability perceptions and product evaluations. *Journal of Cleaner Production*, 162:286–298.

[Steenkamp, 1990] Steenkamp, J.-B. E. (1990). Conceptual model of the quality perception process. *Journal of Business research*, 21(4):309–333.

[Stremmel et al., 2022] Stremmel, G., Elshiewy, O., Boztug, Y., and Carneiro-Otto, F. (2022). Vegan labeling for what is already vegan: Product perceptions and consumption intentions. *Appetite*, 175:106048.

[Taber, 2018] Taber, K. S. (2018). The use of cronbach's alpha when developing and reporting research instruments in science education. *Research in science education*, 48:1273–1296.

[Techawachirakul et al., 2023] Techawachirakul, M., Pathak, A., Motoki, K., and Calvert, G. A. (2023). Negative halo effects of sustainable packaging. *Psychology & Marketing*, 40(12):2627–2641.

[Vergura et al., 2020] Vergura, D. T., Zerbini, C., Luceri, B., and Cristini, G. (2020). Environmental sustainability and food packaging. the role of packing material in purchasing decisions. *Sinergie Italian Journal of Management*, 38(3):149–163.

[Walker et al., 2021] Walker, T. R., McGuinty, E., Charlebois, S., and Music, J. (2021). Single-use plastic packaging in the canadian food industry:

Consumer behavior and perceptions. *Humanities and Social Sciences Communications*, 8(1):1–11.

[Weber Macena et al., 2021] Weber Macena, M., Carvalho, R., Cruz-Lopes, L. P., and Guiné, R. P. (2021). Plastic food packaging: Perceptions and attitudes of portuguese consumers about environmental impact and recycling. *Sustainability*, 13(17):9953.

[Wever and Vogtländer, 2013] Wever, R. and Vogtländer, J. (2013). Eco-efficient value creation: an alternative perspective on packaging and sustainability. *Packaging Technology and Science*, 26(4):229–248.

[William Revelle, 2023] William Revelle (2023). *psych: Procedures for Psychological, Psychometric, and Personality Research*. Northwestern University, Evanston, Illinois. R package version 2.3.12.

[Xu et al., 2022] Xu, H., Xiao, M., Zeng, J., and Hao, H. (2022). Green-labelled rice versus conventional rice: Perception and emotion of chinese consumers based on review mining. *Foods*, 12(1):87.

[Yokessa et al., 2019] Yokessa, M., Marette, S., et al. (2019). A review of eco-labels and their economic impact. *International Review of Environmental and Resource Economics*, 13(1-2):119–163.

[Zeng et al., 2021] Zeng, T., Durif, F., and Robinot, E. (2021). Can eco-design packaging reduce consumer food waste? an experimental study. *Technological Forecasting and Social Change*, 162:120342.

[Zhang et al., 2018] Zhang, B., Fu, Z., Huang, J., Wang, J., Xu, S., and Zhang, L. (2018). Consumers' perceptions, purchase intention, and willingness to pay a premium price for safe vegetables: a case study of beijing, china. *Journal of cleaner production*, 197:1498–1507.

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