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NATÁLIA ROHENKOHL DO CANTO

MOTIVATING CIRCULAR FOOD BEHAVIORS

Porto Alegre
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PhD dissertation presented to the Postgraduate Program in Management of the Federal University of Rio Grande do Sul as a partial requirement for obtaining the PhD title.
Supervisor: Prof. Dr. Marcia Dutra de Barcellos

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“If we could build an economy that would use
things rather than use them up,
we could build a future.”
(Ellen MacArthur)

RESUMO

O sistema alimentar precisa urgentemente se tornar mais sustentável. Uma possível solução está na transição para a economia circular no setor de alimentos, a qual precisa envolver diferentes atores. Nesta tese, focamos em comportamentos do consumidor que contribuem para a economia circular no setor de alimentos – o que chamamos de *circular food behaviors*. Embora muitas pessoas tenham uma atitude positiva em relação à sustentabilidade, algumas barreiras podem impedir os *circular food behaviors*, como a falta de motivação. A *goal-framing theory* explica que isso pode acontecer porque as pessoas muitas vezes têm vários objetivos ao mesmo tempo, e os objetivos de sustentabilidade (ou normativos) podem entrar em conflito com objetivos relacionados a recursos pessoais (objetivo de ganho) ou estado emocional (objetivo hedônico). Com base nessa teoria, esta tese aborda o seguinte problema: Como motivar os consumidores a adotarem *circular food behaviors*? Para responder a essa pergunta, nós desenvolvemos três artigos. O primeiro artigo revisa a literatura sobre *circular food behaviors*, proporcionando uma melhor compreensão do contexto de estudo. Neste artigo, também categorizamos os *circular food behaviors* em três tipos: linear, em transição e circular. Para cada tipo, identificamos o papel do consumidor, os objetivos de sustentabilidade, o engajamento do consumidor e o papel da tecnologia, oferecendo uma estrutura para entender melhor a transição para comportamentos mais sustentáveis. Em nosso conhecimento, este é o primeiro artigo a revisar e sistematizar comportamentos alimentares que contribuem para a economia circular. O segundo artigo compara a *goal-framing theory* com teorias estabelecidas, destacando as forças e fraquezas da teoria. A seguir, revisamos estudos empíricos aplicando a *goal-framing theory* para estudar comportamentos ambientais. Isso contribui para o nosso entendimento do estado-da-arte da literatura e das lacunas que precisam ser abordadas em pesquisas futuras. Por fim, propomos um modelo que representa a *goal-framing theory*, que é testado no artigo final. O terceiro artigo baseia-se nos anteriores: nele verificamos os pressupostos da *goal-framing theory* em uma intervenção que promove um *circular food behavior*. Por meio de um experimento online, testamos o efeito de valores e pistas situacionais na intenção dos consumidores comprarem alimentos com formatos anormais. Este artigo contribui com a aplicação empírica da *goal-framing theory* em nosso contexto de estudo. Os resultados suportam parcialmente nossas hipóteses relacionadas à influência dos

valores e das pistas situacionais na intenção de comprar alimentos com um formato anormal. Os resultados sugerem que os consumidores que priorizam valores altruístas e biosféricos podem se envolver mais facilmente em *circular food behaviors*, especialmente se a situação incluir mensagens de ganho ou normativas, e que pode ser mais difícil envolver consumidores que priorizam valores hedônicos. O artigo sugere implicações práticas direcionadas a diferentes grupos de consumidores, e que podem ser utilizadas pela cadeia de alimentos para vendas ou campanhas promovendo o comportamento estudado. A partir dos resultados da dissertação, sugerimos contribuições teóricas e práticas e possibilidade de estudos futuros.

Palavras-chave: Economia circular, comportamento do consumidor, *circular food behaviors*, setor de alimentos, *goal-framing theory*, motivação.

ABSTRACT

There is an urgent need to increase sustainability in the food system. A possible solution lies in the transition towards a circular food system, which needs to involve multiple stakeholders. In the present dissertation, we focus on consumer behaviors that contribute towards circular food systems — what we refer to as circular food behaviors. Although many people hold a positive attitude towards sustainability, some barriers can prevent circular food behaviors, as the lack of motivation at the time of choice. The goal-framing theory explains how this can happen because people often have multiple goals simultaneously, and behaving according to sustainability (or normative) goals may conflict with goals related to people's resources (gain goal) or emotional state (hedonic goal). Based on this theory, this dissertation addresses the following problem: How to motivate consumers to adopt circular food behaviors? To answer this question, we developed three papers. The first paper reviews the literature on circular food behaviors, providing a better understanding of the study context. It also categorizes circular food behaviors in three types as linear, transitioning, and circular. For each type, we identified consumers' role, sustainability goals, engagement, and technology, offering a framework to better understand the changes towards more sustainable behaviors. To our knowledge, this is the first paper to review and systematize food behaviors that contribute to the circular economy. The second paper compares the goal-framing theory with established theories, highlighting its strengths and weaknesses. Next, we review empirical research applying the goal-framing theory to study environmental behaviors. This contributes to understanding what has been done so far and which gaps need to be addressed by future research. Finally, we propose a model visually representing the goal-framing theory, which is tested in the final paper. The third paper builds upon the two prior papers: it tests assumptions of the goal-framing theory in an intervention promoting a circular food behavior. Through an online experiment, we test the effect of values and situational cues on consumers' intention to purchase abnormally shaped foods. This paper contributes with empirical evidence applying the goal-framing theory in the context of the study. Results partially support our hypotheses related to the influence of consumers' values and situational cues on the intention to purchase abnormally shaped foods. Results suggest that consumers who prioritize altruistic and biospheric values may more easily engage in circular food behaviors, especially if the behavior is supported by gain or normative

cues, and that it may be harder to engage consumers who prioritize hedonic values. We provide practical implications tailored to different groups of consumers, which the food chain actors can use in sales or campaigns to promote this circular food behavior. We draw general theoretical and practical contributions from the dissertation's results and indicate avenues for future research.

Keywords: Circular economy, consumer behavior, circular food behaviors, food sector, goal-framing theory, motivation.

TABLE OF CONTENTS

1 INTRODUCTION

The current food system is not fit to meet society's long-term needs (ELLEN MACARTHUR FOUNDATION, 2019). It threatens human health and environmental sustainability, with food production contributing to climate change, biodiversity loss, freshwater use, interference with the global nitrogen and phosphorus cycles, and land-system change (WILLETT et al., 2019). The system is wasteful, with around one-third of the food produced for human consumption being lost or wasted (FAO, 2013). The world population is predicted to reach 9.1 billion in 2050 (UNITED NATIONS, 2017), and food demand is expected to increase by 70% in 2050 (UNITED NATIONS, 2014). If no measures are taken, the food system's environmental impact could increase by 50% to 90% from 2010 to 2050, transgressing critical planetary boundaries (SPRINGMANN et al., 2018). Therefore, there is an urgent need to transition toward a more sustainable food system (WILLETT et al., 2019).

A possible solution lies in the transition towards a circular economy, a paradigm gaining prominence among scholars, governments, and businesses (GEISSDOERFER et al., 2017; KIRCHHERR; REIKE; HEKKERT, 2017; MERLI; PREZIOSI; ACAMPORA, 2018). It refers to

> an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers (KIRCHHERR; REIKE; HEKKERT, 2017, p. 229).

The circular economy can help achieve United Nations' (2015) Sustainable Development Goals, such as goal 12 on ensuring sustainable consumption and production patterns.

The circular economy offers a framework to enhance and optimize sustainability within food systems by reducing the amount of waste generated, reusing food, utilizing by-products and food waste, recycling nutrients, and changing diets toward more diverse and efficient food patterns (JURGILEVICH et al., 2016). The shift towards a circular food system can generate economic, health, and environmental benefits (ELLEN MACARTHUR FOUNDATION, 2019). This shift needs to involve multiple

stakeholders (WILLETT et al., 2019), with changes in production, consumption, food waste, and surplus management (JURGILEVICH et al., 2016). In the present dissertation, we focus on the consumption level.

Consumption is crucial in the transition towards sustainable food systems (ASCHEMANN-WITZEL et al., 2019; BORRELLO et al., 2017; KUOKKANEN et al., 2016). Consumers can contribute through their choices (JURGILEVICH et al., 2016; WILLETT et al., 2019), for example, by returning their food waste or packaging (BORRELLO et al., 2016, 2017), purchasing upcycled foods (BHATT et al., 2018), sharing and repurposing food (MYLAN; HOLMES; PADDOCK, 2016), and avoiding, reducing, recycling, reusing, or composting food waste (BORRELLO et al., 2016; JURGILEVICH et al., 2016) (for a review, see do Canto, Grunert, and De Barcellos (2021) on section 3.1).

Therefore, a successful transition to the circular economy involves, among other prerequisites, consumer behaviors that contribute towards circular food systems—what we refer to as circular food behaviors (DO CANTO; GRUNERT; DE BARCELLOS, 2021), which is the focus of this dissertation. Although many people hold a positive attitude towards sustainability, some barriers can prevent circular food behaviors, as the lack of motivation at the time of choice (GRUNERT, 2011).

The goal-framing theory (LINDENBERG; STEG, 2007) explains how this can happen because people often have multiple goals simultaneously (BARGH, 2006; KOPETZ et al., 2012), and behaving according to sustainability (or normative) goals may conflict with goals related to people's resources (gain goal) or emotional state (hedonic goal) (STEG et al., 2014a). Therefore, it is not enough to have a positive attitude towards the circular economy; this attitude (or motivation) needs to be active at the consumption moment (GRUNERT, 2011).

The goal-framing theory helps to understand what may be hindering and what could promote circular food behaviors. Based on the theory, this dissertation addresses the following problem: How to motivate consumers to adopt circular food behaviors? To answer this question, we developed three papers that (1) review the literature on circular food behaviors (section 3.1), (2) review empirical research using the theory and propose future research directions (section 3.2), (3) test an intervention based on the goal-framing theory to promote a circular food behavior (section 3.3).

In terms of methodological procedures, the first and second papers conduct literature reviews, and the third one an online experiment. The reviews of the literature

identify and categorize circular food behaviors (Paper 1) and how the goal-framing theory has been applied in empirical studies (Paper 2). These two reviews allowed us to identify existing gaps in the literature and propositions for future studies, which were addressed in Paper 3. The online experiment in Paper 3 addresses some propositions from the second paper in an intervention to promote a food behavior not extensively explored in the circular economy context (i.e., the consumption of abnormally shaped foods). Section 3 presents the papers in detail and how they contribute to the dissertation's goals.

This dissertation contributes to explain consumers' role in the circular economy (GHISELLINI; CIALANI; ULGIATI, 2016; KIRCHHERR; REIKE; HEKKERT, 2017; MERLI; PREZIOSI; ACAMPORA, 2018), to understand and test the goal-framing theory, and to propose interventions (STEG et al., 2014a) to motivate circular food behaviors, bringing several practical implications for the circular economy transition (MERLI; PREZIOSI; ACAMPORA, 2018). The following section presents the goals of the dissertation, followed by the three papers (section 3) and the conclusion of the dissertation (section 4).

2 GOALS

We propose the following goals to answer the main research question.

MAIN GOAL:

To investigate how to motivate circular food behaviors based on the goal-framing theory.

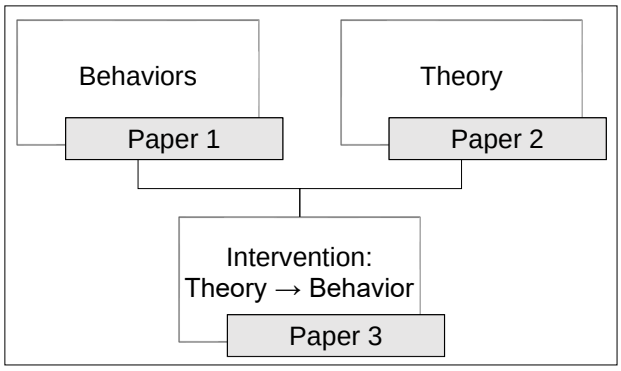
SPECIFIC GOALS:

a. To provide an overview of the literature on circular food behaviors;
b. To categorize circular food behaviors;
c. To provide an overview of empirical research applying the goal-framing theory;
d. To develop an agenda for further research that uses goal-framing theory;
e. To analyze the factors motivating a circular food behavior according to the goal-framing theory.

3 DISSERTATION STRUCTURE

We structure this dissertation into three papers, according to the key issues for encouraging pro-environmental behavior proposed by Steg and Vlek (2009). We start by identifying behaviors that could be changed (paper 1) and their determinants according to the goal-framing theory (paper 2). Then, we test an intervention to encourage a behavior and verify the effects of this intervention (paper 3). Figure 1 summarizes the main content of the papers and how they relate, and Table 1 presents an overview of the dissertation.

Figure 1 – Main content of each paper and relation between papers



Source: Prepared by the author.

The first paper investigates the context of the study, namely circular food behaviors. It consists of a semi-systematic review of the literature on circular food behaviors[1]. This paper contributes to the dissertation by identifying and categorizing circular behaviors to be targeted.

The second paper develops the theoretical basis of the dissertation. We compare the goal-framing theory to established theories and systematically review studies that apply the theory in environmental behaviors. The paper contributes to a deeper understanding of the goal-framing theory, summarizing its applications, strengths, weaknesses, and future studies opportunities.

The third paper uses the theoretical foundation from the second paper to test an intervention promoting a behavior from the first paper. In an online experiment, we test an intervention to motivate the intention to purchase abnormally shaped foods.

[1] By request of one of the board members, we clarify that we did not limit the data collected to a specific time-frame.

This paper contributes to testing theoretical assumptions and obtaining practical implications. The following sections present the three papers.

Table 1 – Overview of the dissertation.

Dissertation main goal: To investigate how to motivate circular food behaviors based on the goal-framing theory.

Dissertation specific goals	**Paper title**	**Paper's goal(s)**	**Methodological procedures**	**Contributions to the dissertation**	**Status on July 31st, 2021**
a. To provide an overview of the literature on circular food behaviors; b. To categorize circular food behaviors;	Circular Food Behaviors: A Literature Review	To provide an overview of the literature on circular food behaviors.	Semi-systematic literature review	Reviewing and summarizing the literature on the dissertations' context (circular food behaviors). Categorization of circular food behaviors in three types as linear, transitioning, and circular. For each type, we identified consumers' role, sustainability goals, engagement, and technology, offering a framework to better understand the changes towards more sustainable behaviors. Identification of behaviors to target in the 3rd paper.	Published in Sustainability
c. To provide an overview of empirical research applying the goal-framing theory; d. To develop an agenda for further research that uses goal-framing theory;	Goal-framing theory in environmental behaviors: A review and future research agenda	(1) To provide an overview of empirical research applying the goal-framing theory;; (2) To develop an agenda for further research that uses goal-framing theory;	Systematic review of the literature	Deeper understanding of the theoretical basis and its contributions to the dissertation. Identification of goal-framing theory strengths and weaknesses. Proposal of a framework. Identification of research gaps to test in the 3rd paper.	Under review at the Journal of Social Marketing
e. To analyze the factors motivating a circular food behavior according to the goal-framing theory.	The interplay between values and situations in the purchase of abnormally shaped foods	To investigate the influence of values and situational cues on consumers' intentions to purchase abnormally shaped foods and the extent to which these factors interact.	Online experiment	Testing the framework and research gaps from the second paper in an intervention promoting a behavior from the first paper; Verifying the influence of situational cues and values; Identifying incentives to promote a circular food behavior.	Working paper

Source: Prepared by the author.

3.1 PAPER 1: CIRCULAR FOOD BEHAVIORS: A LITERATURE REVIEW

Review

Circular Food Behaviors: A Literature Review

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Abstract: Consumer behavior is crucial in the transition towards circular food systems. Studies so far investigate isolated circular food behaviors, but it is still unclear how the literature comprehensively addresses these behaviors. This paper provides an overview of the literature on circular food behaviors. Following a semi-systematic literature review, we analyze 46 papers related to circular food behaviors. We summarize their main features, categorize the behaviors, and propose a future research agenda. Results show the novelty and quick popularity of the topic, a dispersion across sustainability and agri-food journals, the manuscripts' goals related to consumption, a predominance of empirical data collection in Europe, a focus on behaviors related to protein alternatives, food waste, and upcycled foods, and the importance of communication and consumers' education. We categorize and characterize three types of circular food behaviors: linear, transitioning, and circular behaviors. Circular behaviors (i) are part of a systemic circular economy view, (ii) define consumers as "doers" or "prosumers", (iii) pursue long-term sustainability goals, (iv) show a high engagement of skilled consumers, and (v) are supported by technologies. Future research should consider the social dimension of sustainability and pursue a systemic view of circular food behaviors. We suggest that a circular food-related lifestyle may incorporate the recommended directions.

Keywords: circular economy; consumer behavior; food sector; circular food behavior; semi-systematic review

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1. Introduction

The food sector impacts nature and society in several negative ways [1]. It accounts for around 30 percent of the world's total energy consumption and around 22 percent of greenhouse gas emissions [2]. Each year about 14 percent of the world's food is lost before even reaching the market, and food loss is valued at $400 billion annually [3]. The United Nations (UN) [4] calls for an urgent need to rethink food systems and combat their inefficiencies such as food loss and waste. Several of its Sustainable Development Goals [5]—such as Goal 2 on Zero Hunger, Goal 3 on Good Health and Wellbeing, and Goal 12 on Responsible Production and Consumption [6]—relate to the food sector and strongly interrelate.

A goal particularly linked to the food sector is Goal 12, which aims to ensure sustainable consumption and production patterns. Consumers have a meaningful impact on the planet by regularly purchasing products, but current and projected material consumption rates are simply not sustainable. The impact of rising consumption coupled with the middle class's projected growth in developing countries will require even more resources [6,7]. With the world's population predicted to reach 9.1 billion people in 2050 [8], the equivalent of almost three planets could be required to provide the natural resources needed to sustain current lifestyles [2]. Food demand specifically is predicted to increase by 70% by 2050 [9], which will likely also have implications in terms of food loss and waste.

Conscious, rational, and systemic management of the food supply chain can meaningfully reduce food losses [10]. Goal 12, in particular, is very consistent with the idea of

sustainable supply chain management since it is based on many practices commonly used in supply chains such as eco-design, use of recycling, stakeholder education, but also less frequently applied in projects that fit into the broadly understood idea of a closed-circuit economy [11].

A recent UN report shows that many food-related issues—such as hunger, undernutrition, family farmers, and sustainable agriculture—still fall short of the sustainability goals [12]. A possible solution may lie in the transition towards circular food systems, i.e., food systems that implement the circular economy's principles [13]. The circular economy refers to "an industrial system that is restorative or regenerative by intention and design" [14] (p. 7). This system pursues sustainable development by replacing "the 'end-of-life' concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes" [15] (p. 229).

Principato et al. [16] investigate food loss and waste valorization from a circular economy perspective in the pasta supply chain in Italy. Results show that food loss from this chain can be effectively reused for other purposes. However, the main issue remains at the consumption level—where only 25% of food wasted is reused with difficulty and ends up in landfills or, at best, being composted.

Therefore, in the transition towards sustainable food systems, consumption is crucial [17–19]. The transition towards a circular economy asks for a change in consumer behavior, increasing conscious consumption practices and green products' demand. For instance, during the COVID-19 lockdown, people who started implementing good food management practices (as shopping lists and meal planning) reduced the amount of food wasted [20] and prepared healthier food [21], showing that it is possible to transform habits and behaviors when there is control and awareness. A more substantial community involvement, public education, and proper media coverage are also critical to support circular economy initiatives [22]. Food consumption impacts human health, the environment, the economy, and society [1]. However, the literature on consumption towards circular food systems—what we refer to as *circular food behaviors*—is still scarce and fragmented.

Studies on circular behaviors (e.g., [23,24]) mostly consider products made of long-lived, durable materials that are unsuitable for the environment (like metals and most plastics), also referred to as the "technical cycle" of the circular economy [14]. The literature focuses on behaviors involving Product-Service-Systems (when consumers purchase services instead of products). Some of the most popular categories of circular behaviors in the literature involve consumer electronics and car-sharing [23]. In the circular economy, consumers use, rent, and lease these products [14,25], prefer refurbished [26] or remanufactured products [27], and repair or return them after their use [23].

Many of these studies on circular behavior fail to address the food sector [23]. Food products are mainly made of biodegradable materials that can safely return to the environment (also referred to as the "biological cycle" [14]). These products are not easily subject to "servitization" [28]: Food cannot be rented, leased, refurbished, repaired, upgraded, or reused in the same way as durable goods such as mobile phones [29] or automobiles [30]. It is necessary to understand which options of circular food behaviors exist and how the consumers perceive them. Although some studies investigate isolated circular food behaviors, it is unclear how the literature comprehensively addresses these behaviors. Therefore, this paper aims *to provide an overview of the literature on circular food behaviors*. In a semi-systematic literature review, we summarize and discuss insights from 46 articles, categorizing the circular food behaviors and proposing a future research agenda. Our findings can help researchers refine their knowledge in this field, develop new research ideas, and provide critical skills in synthesizing existing literature.

We ultimately contribute by showing from the analysis of the papers that circular food behaviors can be categorized according to three types (or levels of development) as linear, transitioning, and circular. For each type, we identified consumers' role, sustainability goals, engagement, and technology, offering a framework to better understand the changes towards more sustainable behaviors. This research represents a valuable tool, especially

considering the Sustainable Development Goal 12 (Responsible Production and Consumption), by showing a possible transition towards more circular behaviors, anchored in a broader understanding of consumers' roles and choices, and built up with the support of different stakeholders and technologies.

2. Materials and Methods

Semi-systematic reviews are useful for understanding complex areas and covering broad topics and different types of studies; they generate results as themes in literature, research agendas, and theoretical models [31]. To provide a transparent research process [31], we followed the guidelines by Tranfield et al. [32], dividing procedures into three stages: planning the review, conducting the review, and reporting and dissemination.

2.1. Stage I: Planning the Review

We planned the review according to the review protocol in Table 1. The protocol followed a flexible approach, making the research intentions explicit a priori but being open for changes through the study [32].

Table 1. Review protocol.

Step	Description
Research question	How does the literature approach circular food behaviors?
Population targeted	Papers related to circular food behaviors in marketing, management, and related areas
Search strategy	Databases: Science Direct, EBSCO Business Source, Web of Science, and Scopus Search terms [a]: 'circular,' 'food,' and 'consum *' in the title, abstract, and keywords
Inclusion criteria	Peer-reviewed journals Language: English, Portuguese, Spanish, German Areas: marketing, management, and related areas
Exclusion criteria	Repeated papers (found in more than one database) Papers failing to address at least one of the topics of interest (circular economy, consumer behavior, and food sector) Papers in unrelated areas
Data tabulation	Coding categories: title, journal, year, keywords, abstract, authors, goal, theory/approach, type of study (conceptual, empirical, review), methodological procedures, geographical scope of the analysis, sample, concept of circular economy, consumption practices/behaviors investigated, determinants of behaviors, circular products, conflicting goals/tradeoffs/barriers, main findings, practical implications, limitations, future studies
Data analysis	Descriptive analysis Content analysis
Expected results	Overview of the literature on circular food behaviors: Summary of papers Categorization of behaviors Future research agenda

[a] The asterisk (*) used in the search terms refers to a multi-character wildcard, meaning that the search engine matches any words that fit the pattern. Based on Tranfield, Denyer, and Smart [32].

2.2. Stage II: Conducting the Review

This stage aimed for a comprehensive, unbiased search, resulting in a full listing of documents for the review [32]. The selection of studies started with the search of documents in January 2021 in four databases. We defined three main strings, based on the research question and population targeted (Table 1): (1) *circular*, to account for studies in the context of the circular economy; (2) *food*, since our focus was on the food sector; and (3) *consum**, to include studies on consumer behavior. We aimed to search simultaneously in the title, abstract, and keywords. However, we had to adapt filters and criteria in each database

(see Appendix A for details) because they offered different search options. We favored peer-reviewed sources to guarantee that the papers were carefully assessed.

After the search, we refined the data (Figure 1), according to Snyder's [31] third strategy. First, we removed papers duplicated across the databases; then, two independent researchers screened the titles and abstracts of the papers and checked the inclusion and exclusion criteria. The researchers individually reviewed the papers with disagreements a second time. When no consensus was reached, the researchers discussed each paper until they decided on it. This phase resulted in 53 papers. Next, we downloaded the selected papers. Two full papers could not be found (even when we contacted their authors), so they were removed from the sample. The remaining papers were fully read and mapped according to the pre-defined categories in Table 1. In this process, we discarded five papers that failed to fulfill the inclusion and exclusion criteria, resulting in a final sample of 46 papers.

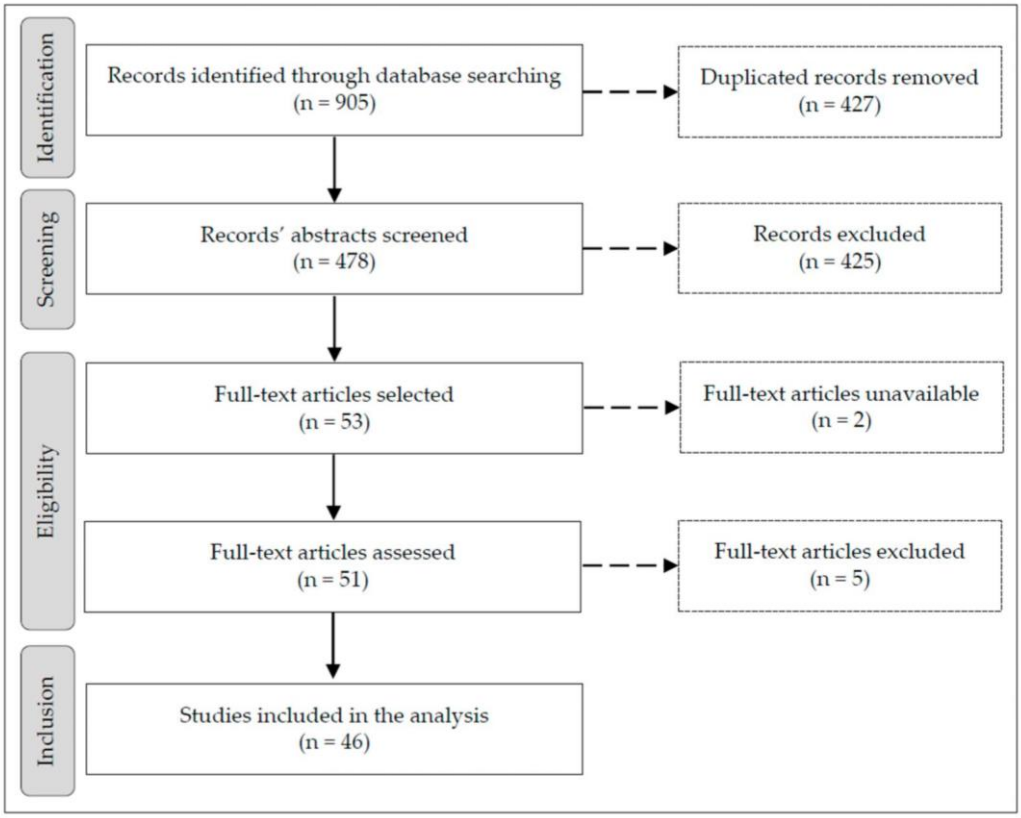

Figure 1. Methodological steps for the choice of relevant papers for the semi-systematic review. Based on PRISMA [33].

2.3. Stage III: Reporting and Dissemination of Results

This stage synthesized the selected information sources, simplifying the content [32]. We analyzed the content of the papers, starting with a descriptive analysis of the coded categories (Section 3.1). Next, we discussed findings according to a thematic analysis, which aggregated and summarized the studies. This stage focused on identifying and categorizing circular food behaviors (Section 3.2) and presenting a future research agenda (Section 3.3).

3. Findings

3.1. Summary of Papers

Year of publication. The papers were published from 2016 to 2020 (Figure 2). The number of papers increased through the years, with the great majority published in the last two years. This publication trend reflects the novelty and quick popularity of the topic.

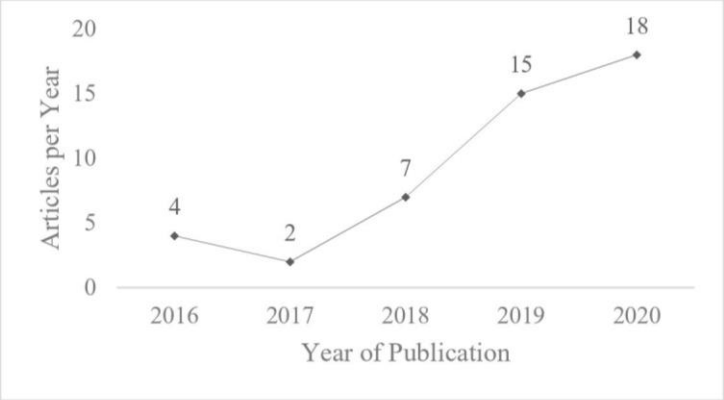

Figure 2. Circular food behaviors: article publication trends (data collected in January 2021).

Outlet. The papers were published in 29 academic journals (Table 2), demonstrating a dispersion across sources. The Journal of Cleaner Production published more papers on circular food behaviors, closely followed by Sustainability. Three other journals published more than one paper. Most journals focus on sustainability or agri-food.

Goals. The papers investigated three main types of goals: related to consumers or consumption (most frequent); unrelated to consumers, but in the circular economy context; and unrelated to consumers and circular economy, but in a related context (least frequent). Appendix B details each paper's goal.

Table 2. Journals disseminating circular food behaviors.

Source	Papers
Journal of Cleaner Production	8
Sustainability	7
Food Quality and Preference	3
Journal of Insects as Food and Feed	2
Trends in Food Science & Technology	2
Agronomy	1
AIMS Agriculture and Food	1
Bioresource Technology	1
Current Opinion in Clinical Nutrition & Metabolic Care	1
Current Opinion in Green and Sustainable Chemistry	1
Environmental Innovation and Societal Transitions	1
Frontiers in Environmental Science	1
Frontiers in Sustainable Food Systems	1
Geoforum	1
Global Change Biology	1
International Journal of Food Science and Technology	1
Journal of Business Ethics	1
Journal of Consumer Culture	1
Organic Agriculture	1
Packaging Technology and Science	1
PLoS ONE	1
Quality—Access to Success	1
Recent Patents on Food, Nutrition and Agriculture	1
Resources	1
Resources, Conservation and Recycling	1
Rural Society	1
Sociologia del Lavoro	1
Supply Chain Management: An International Journal	1
Sustainable Production and Consumption	1
Total	**46**

Research methods. Most papers (32) collected empirical data, with fewer review and conceptual papers (8 and 6 each, respectively). The majority of empirical papers adopted quantitative methodologies, with surveys and experiments as the most employed research methods (Figure 3).

Geographical scope of analysis. The papers mostly targeted European countries, with Italy and the United Kingdom as the most frequently investigated countries (Table 3). Four studies investigated two or more countries, also mainly in Europe. In fourteen studies (mostly reviews and conceptual papers), the geographical scope was not described.

Behaviors explored. The papers most frequently explored behaviors related to protein alternatives (e.g., plant-based, insects as feed), food waste, and upcycled foods. Other behaviors were related to alternative food networks, food provisioning, and packaging. Fewer papers mentioned consumers' use of wild plants in nutrition, responsibility for nutrients, reduced consumption, general dietary changes, among others. Some papers explored behaviors fitting in more than one category, but most papers investigated isolated behaviors, lacking a comprehensive perspective. Appendix B lists the behaviors each paper explores.

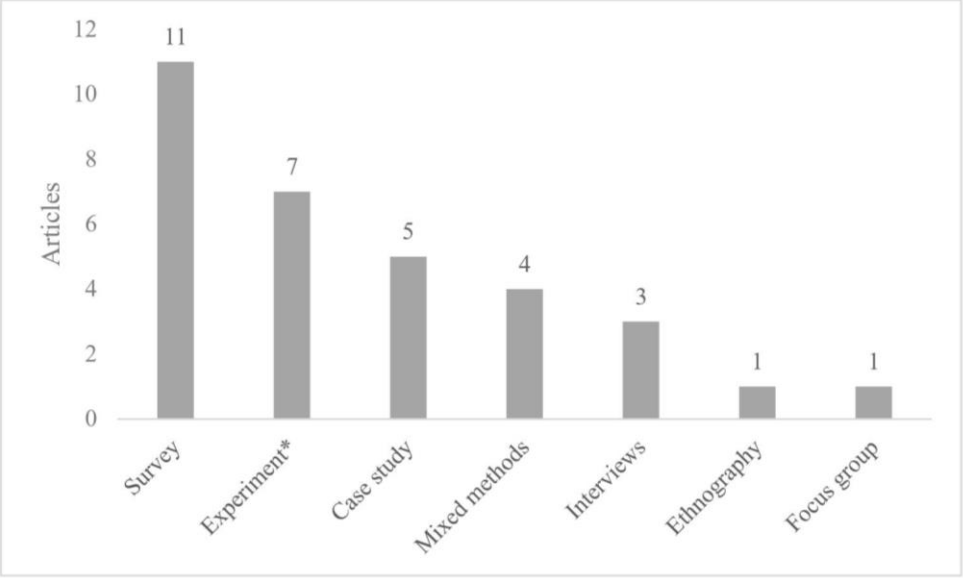

Figure 3. Research methods in the empirical papers. * Including surveys with experimental design.

Table 3. Geographical scope of analysis.

Investigated Country	Papers
Italy	6
United Kingdom	5
The Netherlands	4
Finland	3
Denmark	2
Australia	1
Belgium	1
Bulgaria	1
China	1
Hungary	1
Luxembourg	1
Norway	1
Spain	1
Multiple (two or more)	4
Total	**32**

Main results. Appendix B summarizes the results of each paper. Some studies identified how different variables influenced consumers' behaviors, highlighting the importance of education and communication. Other studies emphasized consumers' role in promoting circular food systems, relevant practices and products, main barriers, and the need for collaboration between stakeholders.

Some studies provided encouraging results. Cattaneo et al. [34] found a positive attitude towards the uses of food by-products (new food products with high added-value compounds recovered from food production). Russo et al. [35] found that British consumers are willing to participate in circular economy initiatives incorporating products from regenerated bio-waste. In Aschemann-Witzel and Peschel [36], communicating that a food ingredient was previously "waste" did not seem to influence consumers negatively. In another study, Peschel and Aschemann-Witzel [37] (p. 9) found that "upcycling in products can be popular among consumers". In Coderoni and Perito [38], 56% of respondents stated to be willing to buy waste-to-value food. In Grasso and Asioli [39] (p. 5), 85% of respondents said they "would consider buying foods with upcycled ingredients". Borrello et al. [19,28] found that many consumers would be willing to participate in innovative circular food loops. In Steenis et al. [40], packaging with a circular design was perceived as more sustainable than the one with a linear design and generated the most positive attitudes. Biological solutions were considered more sustainable than technical solutions [40]. Van Huis [41,42] stressed that insect-based foods are a sustainable protein alternative and present a high nutritional value and health benefits. In Sijtsema et al. [43], participants presented several motives or advantages for circular food behaviors, such as preventing food and plastic waste, economic advantages, a more social food production system, and positive feelings of helping others.

Studies also highlighted challenges. Sijtsema et al. [43] raised several objections and disadvantages consumers perceive in circular food behaviors, such as products' lack of functionality, lack of interest in participating in production systems, economic disadvantages, and risks. In Peschel and Aschemann-Witzel [37], consumers seemed unwilling to pay more for upcycled plant-based alternatives (unless there was transparency about the costs involved, but then the choice likelihood also decreased). Further challenges towards circular food behaviors related to consumers' education [44,45] and lack of knowledge and awareness [18,43,46]. Consumers seemed unaware of food sustainability challenges, failing to include these in their food purchase goals [47]. The lack of information—for example, on the sustainability of different packaging [48] and upcycled food ingredients [39]—showed a need to communicate better with consumers [44]. Further consumption-related barriers found were food neophobia [41,42] and food technology neophobia [17,38] (although food neophobia was not relevant in all cases, e.g., [39]); lack of acceptance of insect as a food source [42,47,49,50] and food produced with upcycled ingredients [18,39]; globalized diets leading to inattention towards diversified, local and seasonal foods [17]; the change of shopping habits [44] and dietary choices [13]; lack of convenience [1,28,44]; adaptation to new technologies [46]; perception of risk in new food technologies [34]; lack of planning in food purchases [51]; the perceived tradeoff between sustainability and taste [36]; unfamiliarity with the "circular economy" term [43]; and the negative influence of the media [44,52].

In short, the selected papers show the novelty and quick popularity of the topic, a dispersion across sustainability or agri-food journals, goals mostly related to consumption, a predominance of empirical data collection in Europe, a focus on behaviors related to protein alternatives, food waste, and upcycled foods, the importance of consumers' education and communication, and mixed results in terms of circular food behaviors.

3.2. Categorization of Circular Food Behaviors

From the analysis of the papers, we offer a framework to better understand the changes towards more sustainable behaviors (Figure 4). We categorize circular food behaviors according to three types, or levels of development: linear, transitioning, and

circular behaviors. Next, we describe the behavior types and characterize them in terms of consumers' role, sustainability goals, engagement, and technology.

	Linear behaviors	Transitioning behaviors	Circular behaviors
Definition	Follow a linear logic	Go beyond the linear logic but lack a systemic view	Integrate into a systemic view
Consumers' role	'Purchasers,' 'users,' 'wasters'	'Learners'	'Doers,' prosumers
Sustainability goals	Short-term economic goals, with secondary environmental or social benefits	Medium-term goals, involving two sustainability dimensions	Long-term economic, social, and environmental goals
Engagement	Low engagement. Consumers believe other actors are responsible for the impact of their behaviors	Medium engagement. Consumers inform about the impact of their behaviors	High engagement. Consumers are skilled and take responsibility for their behaviors
Technology	Traditional technologies. Low complexity	New technologies, connecting niches and informing consumers. Medium complexity	Support consumers' education and connection. High complexity

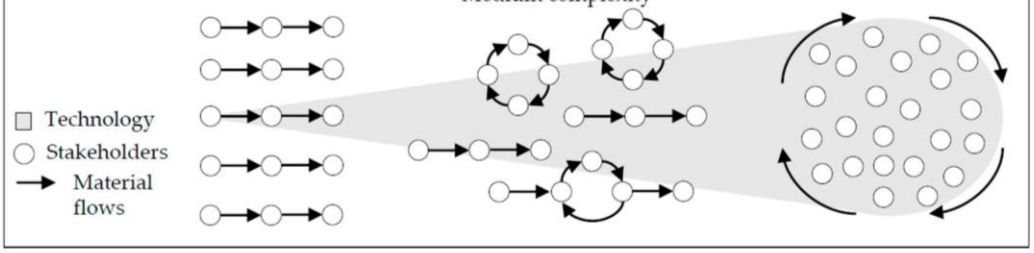

Figure 4. Transition towards circular food behaviors: three types of behaviors and their characteristics.

3.2.1. Linear, Transitioning, and Circular Behaviors

We distinguish three types of circular food behaviors: linear, transitioning, and circular behaviors. In this section, we define these behaviors and give some examples. The categorization is a general guide, and the examples are illustrative. A clear-cut categorization would require a more precise assessment, such as approaches combining life cycle assessment (LCA) and behavioral sciences [53] or social practice theory [54]. For instance, Di Sorrentino et al. [53] propose that LCA can integrate with behavioral science (BS) and help measuring behavior and assessing potential and means for changing behavior. This combination of LCA and BS is meaningful in terms of behavior-driven ecodesign since, in the environmental impact assessment of a product, behavioral aspects are crucial in the choice between different alternative products, the subsequent behavior of using the product, and—at the end of the use phase—in the decision how to dispose of the product. To assess sustainable consumer behavior, the authors review cognitive aspects underlying human decision making that can suggest concrete intervention for behavior change in the context of sustainable product design and policy interventions.

Linear behaviors follow a linear logic of taking-making-disposing materials [14] but contribute to the circular economy by having secondary environmental or social impacts. Examples are purchasing products that use resources more efficiently (e.g., through eco-efficiency) [40] and separating waste.

Transitioning behaviors go beyond the linear logic but lack a systemic view. The transition phase involves a mix of linear behaviors and new, circular behaviors that develop in niches. Examples are: purchasing innovative products, such as insect-based foods, upcycled food products [19,37], and foods with edible coatings [55]; purchasing less appreciated products, such as food with a non-standard aesthetics [46] or surplus food [56]; purchasing local and seasonal foods [57]; participating in alternative food networks, as packaging-free grocery shops, community-supported agriculture [57], short food chains [46,58], online groceries shopping [51], food box schemes [51,57], and digital platforms fighting food

waste [45]; returning food waste to be upcycled [19,59] in "food-product-as-a-service" approaches [28]; finding new strategies towards circularity, such as food sharing and repurposing [60]; and more radical practices, like dumpster diving [13,61]. The niche experiments that succeed in the transition phase become mainstream in the circular phase—not necessarily by upscaling these experiments since small cases might be multiplied in local communities [57].

In circular food systems, products follow a cyclical loop—for example, with packaging made of renewable material [51], or with consumers' food waste serving as insect feed, which later becomes feed for animals that re-enter the food consumption [19]. To this end, production cycles need to be redesigned and incorporate consumers [51]. In this way, what differentiates *circular behaviors* is that they integrate into a systemic view [51], in which broad, systemic, and economic changes are the goal. We agree with Holmes [62] and Jurgilevich [13] in that many practices to the circular economy are not novel and are already in use or recognized. To Jurgilevich et al. [13] (p. 12), the difference is that the "circular economy provides a framework in which society can create cross-sectoral policy to support varied initiatives in different 'parts of the circle' for the ultimate goal of breaking away from the linear and extractive model to a more sustainable mode of production and consumption".

Circular behaviors go beyond the individual products' choices: they are part of consumers' lifestyle [17], with consumers actively involving in initiatives that promote the circular economy. Borrello et al. [28] find that lifestyle measures (coping with risks of food provisioning, managing dependencies in food provisioning, convenience, and social pressure towards recycling) can be relevant drivers of consumers' willingness to participate in innovative circular food loops [28]. We propose that circular food behaviors imply adopting a *circular food-related lifestyle*, in which food consumption is part of systemic thinking. Consumers' choices are interconnected and consider a combination of factors, with the complete management of the food provisioning and diets primarily based on sustainable decisions.

3.2.2. Consumers' Role

The investigated papers emphasize the role of consumers in the transition towards circular food systems: "The transition to a circular economy [...] requires first and foremost a change in the situation of consumers and not just that of isolated entrepreneurs" [46] (p. 129). Consumers can support circular food systems through their choices [51] in terms of lifestyle and dietary eating patterns [17]; and by accepting novel products, such as upcycled foods [37,38] and new packaging solutions [44]. Consumers may have different roles in circular food behaviors: classic customers, prosumers with flexible commitment, and compulsory volunteers [57]. We propose that these roles differ in each type of behavior.

In *linear behaviors*, consumers are customers [57] and owners [59] of products or services. Food consumption is centralized in supermarkets [46], with a passive purchase, use, and discard of products, and a lack of awareness about the food chain [13,19]. Consumers are "considered mere intermediaries between retailers and waste collection" [59] (p. 40).

We propose that in *transitioning behaviors*, consumers become "learners": they educate, learn, inform, and develop new abilities, knowledge, and competencies [13,60] to support the transition towards circular food behaviors. Consumers' education seems essential in adopting new food technologies and has been associated with lower food technology neophobia [34]. By learning more about the circular economy and how to make it concrete, consumers also increase their involvement [43]. Consumers can learn about the "complexity of food consumption" and the "sustainability and health gains of sustainable diets" [63] (p. 16); they can start to "change their habits regarding the end-life of products" [59] (p. 43) and learn "what can be composted, replanted, or what is suitable for wildlife to eat" [60] (p. 10). They can learn how to interact with food products designed for circularity and change their perception of what "waste" is [56]. This learning can happen through formal education in schools, promotion campaigns in the media [59,64,65], educa-

tion policies promoted by governments [66], or even through companies' educational and engagement efforts [56]. It can also occur in niche experiments that educate consumers [57] and develop their skills and knowledge through the exchange between people [62].

In *circular behaviors*, consumers are "doers" of everyday activities, who incorporate food in their daily activities [60]; they become prosumers [57], which means the division between consumption and production is less clear [67]. Prosumption can imply different activities, such as volunteering to work in food initiatives and accepting the limitations of the work in the field [57].

3.2.3. Sustainability Goals

The circular economy aims to achieve sustainable development [15], i.e., a development that meets "the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs" [68] (p. 292), implying a long-term perspective. Sustainability is also commonly divided into three dimensions: economic, environmental, and social. We propose that consumers' goals in circular food behaviors vary in terms of the time-frame and sustainability dimensions targeted.

In *linear behaviors*, the main focus is on short-term economic goals, which might have secondary benefits for the environment or society. People might reduce food waste, which positively impacts the environment—but their primary motivation is economic. *Transitioning behaviors* broaden consumers' concerns [46], who then motivate by the economic and at least one more sustainability dimension (usually the environmental). They focus on medium-term goals. We propose that *circular behaviors* target broad and holistic sustainability goals—simultaneously considering long-term economic, social, and environmental aspects. So far, studies mostly neglect the social dimension, although it might enable sharing and circulating food in different ways [62]. Mylan et al. [60] (p. 11) recommend, "a move beyond the current focus on economic value and environmental costs produced by material flows, to also consider the social value generated through processes of 'consumption'". Circular food behaviors may involve social benefits such as the "provision of care, enjoyment, maintenance of traditions and connections with personal histories" [60] (p. 11) and create a community and social support [57,62]. In addition, the social aspect (such as caring for farmers' welfare) may be critical to motivate consumers to participate in circular systems [65].

3.2.4. Engagement

In the linear economy, consumers mostly act isolated; the circular economy presupposes their engagement. We propose that consumers' engagement gradually increases from linear to circular behaviors.

In *linear behaviors*, consumers have no responsibility toward products (apart from domestic recycling) [59] and believe that other actors (as companies and governments) are responsible for the environment and society [43]. Therefore, consumers adopt the options available in the market and act according to their private interests. In *transitioning behaviors*, consumers start to engage in niche experiments and develop, test, and disseminate them. This engagement may happen in a more flexible or binding way [57]. In niche experiments, consumers get informed about their behaviors' impact, develop skills relevant to circular food behaviors [60], and promote these experiments so that they can be upscaled [13]. In *circular behaviors*, consumers actively and voluntarily engage in circular practices and long-term relationships [56]. They assume responsibility for their behaviors [18,57] and for the design, use, and disposal of products [52,59] and have a set of skills that support circular food behaviors. Some niche experiments become mainstream, some remain a niche, and others disappear [13].

These different engagement levels presuppose that not only consumers get involved. Multiple stakeholders—such as industries, the government, social research, media, retailers, consumer organizations, the food and packaging design industry, and circular economy groups [13,46,47,49,51,52,57,59,69]—should focus "on the collective efforts that

are necessary to build a more resilient food system" [57] (p. 174). The behavioral changes towards circular food systems have to occur in a broad, systemic [51], economic, social [60], political [57], and cultural [1,57] level. Collaboration is the keyword, and consumers are part of it.

3.2.5. Technology

Technology may support circular food behaviors through innovation, connection, and education. As in the previous point, we propose that the support and complexity of technology increase from linear to circular behaviors.

Linear behaviors use traditional technologies, such as recycling and composting [19,35]. Innovations are incremental, e.g., based on reducing resources used in the production stage and end-of-pipe approaches. Consumers use technology to reproduce the linear logic—for example, to make online purchases and compare prices.

In *transitioning behaviors*, consumers experiment and adopt new technologies that support the circular economy. This experimentation may involve radical innovations, as insects as animal feed [19,59], refrigerators and freezers with "integrated storage solutions and tools for measuring shelf life" [51] (p. 1440) or technologies in food packaging [44], such as QR codes that interact with bins and aid consumers in the disposal process [52]. Innovations are consumer-oriented and may be developed in collaborative approaches, such as co-creation [43], co-innovation, or co-design [70].

Technologies can support in new ways old modes of provision [62] or engage consumers in innovative experiments [57]. Both in transitioning and circular behaviors, technologies connect, inform, and educate consumers and have the potential to bridge the "circularity holes" in food chains [45]. They can educate about a product's benefits, indicate how and where to dispose of products [44,52], guide consumers towards healthier and more sustainable food choices [13], and increase transparency in the food chain [63]. Digital means and online communities—such as information and communications technologies, apps, digital platforms, and social networks—disseminate established practices and simplify and amplify the connections between different actors [45].

A circular economy "takes a step beyond the pursuit of waste prevention and reduction to inspire technological, organizational, and social innovation across supply chains" [35] (p. 966). Therefore, *circular behaviors* involve changing infrastructures and technologies that support consumption [52,60]. In the circular economy, the technologies from the transitioning phase become established and widely adopted. Innovations occur at a systemic level [18], and niche experiments become mainstream.

In sum, the main takeaway of this section is that the transition to circular food systems aims to achieve *circular behaviors*, which (i) are part of a systemic circular economy view, (ii) define consumers as doers or prosumers, (iii) pursue long-term sustainability goals, (iv) show a high engagement of skilled consumers, and (v) receive the support of technologies for education and connection.

3.3. Future Research

In the promotion of circular food behaviors, engaging consumers may be one of the greatest challenges [43]. Behaviors may involve different tradeoffs, such as investing more time and effort to behave more sustainably. Future studies should investigate ways of making circular food behaviors more familiar and attractive to consumers [43]. This greater engagement can support a systemic view of circular behaviors, which mostly lacks in the current literature.

Although we present some examples of foods and behaviors that could fit each category, the literature needs an understanding and consensus on what sustainable food is [18]. Future studies should clarify differences between circular behaviors so that consumers can have confidence in what they should do. The linear, transitioning, and circular behaviors (Figure 4) could also be explored in different ways. These behaviors' characteristics (their definition, consumers' role, engagement, and technology) could be refined—for example,

by understanding users' willingness to adopt circular food-related technologies and the existing drivers and barriers [45]. Future studies could also check whether the proposed framework applies to other contexts than the food sector.

In terms of scope of analysis, future studies could collect data in other regions than Europe and compare results. Studies could also expand knowledge to product categories not yet investigated—for example, other upcycled and innovative food products [36,37,39] or bio-based products [35]. In addition, most of the selected studies investigate isolated behaviors or products. We call future studies to address multiple behaviors, aiming to achieve a systemic view of circular food behaviors. Future studies could also use real products and realistic designs (such as field experiments) to reduce hypothetical- and social desirability biases [39]. Aschemann-Witzel et al. [17] and Grasso and Asioli [39] also recommend studies to do sensory tests so that the taste is taken into account.

Many current studies investigate the consumption of recent, hypothetical, or not-yet-in-the-market innovations. Examples are waste-to-value/upcycled food products or novel ingredients in food [34,36,37,39]; a bio-fiber beer bottle [48]; a new biodegradable material based on food waste [35]; and hypothetical food waste recycling initiatives [19,28]. This shows that there is still much to understand in terms of consumers' reactions to these innovations and reinforces Kirchherr et al.'s [71] (p. 269) argument that the circular economy is a "difficult-to-implement concept"—also in terms of food consumption. Future studies should explore the feasibility of these initiatives. For example, is it technically possible to develop the innovations considered? If yes, would this be a sensible financial investment for companies? Are the other actors involved in the initiatives willing to invest the time, effort, and financial resources necessary? Does the legislation allow and support the development of these hypothetical innovations [70]? These and other factors should also be examined for each initiative before they are considered applicable (for an overview of possible challenges for the circular economy in the food sector, see [59]).

The investigated studies mostly disregard the social dimension of sustainability, a gap also found in previous reviews on the circular economy [72]. Future studies should take a better account of this dimension. Social outcomes, such as consumers' health and healthcare costs [73], could be further explored. In addition, considering that the ongoing pandemic situation has changed food consumption habits [66], studies could investigate changes in food-related lifestyle behaviors in the "post-COVID" world.

Finally, future studies should focus on behaviors with the greatest sustainability potential. The ranked lists proposed by Aiking and de Boer [1,47] (with potential improvements in the food system and current Western consumption patterns, respectively) could guide it. Although reducing consumption is considered one of the most critical strategies, few studies in our sample have investigated it. The behaviors investigated focus more on reducing food waste or the consumption of animal-based products (and substituting these with other protein alternatives [56])—but not so much on overconsumption.

4. Discussion

Previous reviews on circular economy called for more research on motivating consumers to participate in circular solutions [74], showed that consumers have been neglected in initial circular economy definitions [15], and suggested that circular food consumption was rarely investigated [23]. This trend seems to be reverting: our results show a growing number of studies in recent years on the topic, indicating that interest in circular food behaviors is increasing.

As in previous reviews on circular consumption [23] and circular economy in general [72], the Journal of Cleaner Production is the outlet publishing more papers. Sustainability is also among the most important journals. Differently from previous reviews, in our study, outlets related to agri-food have greater importance. This result reflects the focus on food-related behaviors. However, it also indicates that researchers on circular food consumption could direct their efforts not only for sustainability-related outlets but also towards niche-journals from different areas.

Despite the growth in publications, room exists for expanding the knowledge in the area. Most empirical studies reviewed collect data from Europe, with few articles exploring other regions, especially emerging economies. The same issue appears in previous reviews on consumption in the circular economy [23] and circular economy in general [72,74]. China and Asia have the largest number of articles on the circular economy in the reviews by Ghisellini et al. [74] and Merli et al. [72], respectively. However, only one study in our sample targets the country, and Camacho-Otero et al. [23] also found fewer studies on circular consumption in the region. This imbalance indicates that research on circular production is not always accompanied by research on circular consumption in the same geography.

Our main contribution is to propose and characterize three types of circular food behaviors (linear, transition, and circular). All types contribute to the transition towards the circular economy, but the third one is the "ideal" to achieve. A linear logic can gain efficiency, but it also leads to "low food prices [...], a lack of a connection between consumers and the food they eat, and a lack of appreciation of food as a vital source of life by consumers or food supply chain actors" [75] (p. 6471). Therefore, only a systemic logic, with changes in diets and purchase habits, may achieve a resilient, regenerative food system [73].

A systemic view of consumption may imply a lifestyle change; in the food sector, this means a new food-related lifestyle and responsible multi-stakeholder engagement. Recent studies have related the food-related lifestyle to edible insects [76] and food waste [77]. We suggest that future research expands this view to circular food behaviors by developing a circular food-related lifestyle concept.

In circular food-related lifestyles, consumers will avoid or reduce the consumption of foods with a negative environmental impact [78]. The behaviors mostly studied in the selected papers relate to protein substitution. This focus aligns with studies recommending reducing red meat production and consumption to diminish the environmental impacts of food systems and help the transition towards more sustainable food consumption patterns [79–81].

Our results support that sustainable behaviors may involve tradeoffs for consumers [82] Usually, acting in favor of the environment is more costly in terms of time and money [83] or considered less pleasurable or convenient [82]. For example, although consumers want to avoid food waste, this usually is not prioritized when there are tradeoffs concerning taste, convenience, or health [75]. Therefore, it is essential to find ways of helping consumers to behave more sustainably, without giving up other priorities.

We also concur with the importance of educating consumers on a more practical level. People may lack the skills or knowledge to perform more sustainable behaviors in a way that just being aware of an environmental issue may not necessarily translate into behavioral changes [83]. For example, consumers present a lack of knowledge about environmentally friendly packaging, and the characteristics that make a packaging be considered "sustainable" can differ across cultures [84]. The awareness of consumers in various European countries about meat production's environmental impact is also surprisingly low [80]. Finding out the appropriate educational tools for different contexts is essential in the promotion of circular food behaviors.

5. Conclusions

The circular economy is a framework that can help to integrate sustainability in food systems [13,63]. Promoting circularity in food systems is more relevant than ever, considering that the ongoing pandemics "has highlighted the importance of sustainable food management by revealing the food system as a pivotal aspect of the sustainable supply chain" [66] (p. 9). In this sense, the literature lacked an integration of what has been studied so far in terms of circular food behaviors. This paper contributes to that by providing an overview of the literature on circular food behaviors. It summarizes the insights of 46 studies, categorizes the circular food behaviors, and proposes an agenda for

future studies. This overview of current studies helps to understand the state-of-the-art of research and direct future efforts towards unexplored areas.

Although circular economy literature clearly emphasizes systems thinking, we see a predominance of incremental changes at consumers' and users' level. It is hard to change the existing paradigm, as some structures are highly rooted [18]. We propose that the path towards circular food behaviors could start with small changes within the current practices that support this evolution (*linear behaviors*), going through slightly more transformative practices (*transitioning behaviors*) until reaching circular practices (*circular behaviors*). We propose that, by understanding different behaviors that can be encouraged, it could be easier to transition towards circular food systems. The expectation of rapidly moving from linear directly to circular behaviors is probably exaggerated and unrealistic, but a smooth transition may have better chances of being welcomed and long-lasting.

We acknowledge that this paper is limited by a small sample of papers and illustrative examples of behaviors fitting in each category, without an empirical analysis that identifies which practices are the most sustainable. However, to the best of our knowledge, this is the first review addressing circular food behaviors and provides a set of future research possibilities. Future reviews could develop the theme further, for example, by applying meta-analytical designs that provide statistical analysis of the outcomes of studies.

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Appendix A

Table A1. Data collection in the databases.

	EBSCO Business Source	Web of Science	Science Direct	Scopus
Initial search [a]	• Strings: circular AND food AND consum * • Field searched: Abstract • Results' limits: Full Text, Scholarly (Peer Reviewed) Journal	• Strings: circular AND food AND consum * • Fields searched: Topic (Title, Abstract, Author Keywords and KeyWords Plus [b])	• Strings: circular AND food AND (consumer OR consumption OR consume [c]) • Fields searched: Title, abstract or author-specified keywords	• Strings: circular AND food AND consum * • Fields searched: Article title, Abstract, Keywords
Partial result	378 papers	420 papers	184 papers	487 papers
Inclusion criteria	• Language: English (n = 376)	• Research Areas: Agriculture (42), Behavioral Sciences (1), Business Economics (16), Communication (1), Cultural Studies (1), Development Studies (2), Education Educational Research (3), Environmental Sciences Ecology (147), Food Science Technology (67), International Relations (1), Operations Research Management Science (3), Psychology (1), Public Administration (3), Science Technology Other Topics (113), Social Sciences Other Topics (1), Sociology (2), Urban Studies (4) • Document types: Article (186), Editorial Material (5), Early Access (3), Review (29)	Article type: Discussion (2), Research articles (124), Review articles (37), Short communications (5)	• Source type: Journal (432) • Language: English (472), Spanish (3), German (1), Portuguese (1) • Subject areas: Agricultural and Biological Sciences (167), Arts and Humanities (5), Business, Management and Accounting (63), Decision Sciences (5), Earth and Planetary Sciences (11), Economics, Econometrics and Finance (19), Environmental Science (176), Multidisciplinary (11), Neuroscience (5), Psychology (2), Social Sciences (52) • Document type: Article (283), Review (41), Note (3), Editorial (1), Short Survey (1)

Table A1. *Cont.*

	EBSCO Business Source	Web of Science	Science Direct	Scopus
Exclusion criteria	• Language: Lithuanian (1) and Turkish (1) • Exact duplicates (180)	• Research areas: Allergy (1), Anthropology (1), Asian Studies (1), Biochemistry Molecular Biology (11), Biodiversity Conservation (2), Biophysics (2), Biotechnology Applied Microbiology (11), Cell Biology (1), Chemistry (39), Computer Science (3), Construction Building Technology (1), Electrochemistry (1), Endocrinology Metabolism (2), Energy Fuels (25), Engineering (87), Entomology (4), Evolutionary Biology (2), Fisheries (14), Forestry (1), Gastroenterology Hepatology (2), General Internal Medicine (1), Genetics Heredity (3), Geography (2), Geology (2), Government Law (2), Health Care Sciences Services (3), Immunology (2), Infectious Diseases (1), Instruments Instrumentation (1), Life Sciences Biomedicine Other Topics (1), Literature (1), Marine Freshwater Biology (15), Materials Science (5), Mechanics (1), Metallurgy Metallurgical Engineering (1), Microbiology (7), Nutrition Dietetics (20), Oceanography (2), Parasitology (1), Pharmacology Pharmacy (3), Physics (4), Physiology (2), Plant Sciences (10), Polymer Science (1), Psychiatry (1), Public Environmental Occupational Health (10), Remote Sensing (1), Robotics (1), Sport Sciences (1), Thermodynamics (2), Toxicology (2), Tropical Medicine (1), Veterinary Sciences (8), Virology (1), Water Resources (2), Zoology (2) • Document types: Proceedings Paper (20)	Article type: Book chapters (10), Conference abstracts (4), Encyclopedia (1), Other (1)	• Source type: Conference Proceeding (22), Book (22), Book Series (11), Trade Journal (2) • Language: Chinese (6), French (3), Russian (1) • Subject areas: Biochemistry, Genetics and Molecular Biology (69), Chemical Engineering (44), Chemistry (41), Computer Science (5), Energy (88), Engineering (92), Health Professions (3), Immunology and Microbiology (26), Materials Science (14), Mathematics (8), Medicine (44), Nursing (24), Pharmacology, Toxicology and Pharmaceutics (14), Physics and Astronomy (5), Veterinary (9) • Document type: Conference Paper (2)
Sample collected	**188 papers**	**220 papers**	**168 papers**	**329 papers**

[a] The asterisk (*) used in the search terms refers to a multi-character wildcard, meaning that the search engine matches any words that fit the pattern. [b] KeyWords Plus are index terms automatically generated from the titles of cited articles [85]. [c] Science Direct did not support wildcard characters at the time of the search.

Appendix B

Table A2. Goals, primary behaviors explored and main results of the selected papers.

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Aiking and de Boer [1]	To sketch why a transition from diets based primarily on animal proteins towards diets based primarily on plant proteins products is urgent for both food security and sustainability.	Adopting a diet based primarily on plant proteins products	A dietary transition from primarily animal towards plant protein products is required. New dietary guidelines are taking sustainability into account, and the contours of a diet transition are slowly emerging.
Aiking and de Boer [47]	To outline the role and potential contribution of insects towards food security and sustainability from a multidisciplinary perspective.	Accepting edible insects	In light of the circular economy, insects are useful for food, feed, and other purposes. Health may be key to entice consumers to progress towards a diet transition. An integrated, multidisciplinary approach, including all stakeholders, remains a prerequisite.
Aschemann-Witzel and Peschel [36]	To explore how Danish consumers of cocoa drinks react to the use of potato and grass protein in a mock-up plant-based cocoa drink in terms of attitude towards the product and expected quality.	Attitude and expected quality towards a plant-based cocoa drink	Results show a main effect of gender and brand and an interaction of ingredients with both brand and communication, respectively. For both grass and potato proteins, the unknown brand is relatively preferred and better liked by males. Communication improves attitude towards potato drink. Brand- and product design-related differences play a role in determining attitude to products with such new ingredients.
Aschemann-Witzel et al. [17]	To outline how sensory consumer science can contribute to the further sustainable development of food production and consumption.	Changing food choices and diets, accepting new food and food-related behaviors	Six transformations to which sensory consumer science can contribute: (1) promotion of a dietary shift towards more sustainable foods and diets, (2) increase of food diversity, (3) food waste reduction, (4) enhancement of the circularity of the food system, (5) heightening and prioritizing food-related well-being, and (6) coping with the effects of climate change.
Bocken et al. [56]	To explore business innovation for sufficiency as a means to encourage sustainable consumption.	Slow consumption; moderate consumption; sustainable consumption.	Creation of a conceptual framework, including a range of sufficiency strategies for food. Although sufficiency implies consumption moderation, it is suggested that when a company substitutes the consumption of a less sustainable option, growth could be desirable.
Boesen et al. [48]	To investigate how consumers living in Denmark perceive the environmental sustainability of liquid food packaging and how much they know about eco-labels; to compare the perceived environmental sustainability with LCA.	Perception of the environmental sustainability of food packaging; knowledge about eco-labels	There is a gap between Danish consumers' perception of the environmental sustainability of packaging and LCA results. Consumers have limited knowledge of sustainability-related eco-labels.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Borrello et al. [59]	To illustrate an alternative to the traditional supply chain of bread based on the principles of a circular economy; to highlight the major barriers to achieving a smooth transition into a bio-based economy in the agri-food sector.	Returning bread leftovers and used packaging to retailers; household recycling/reuse of materials	Presentation of a framework for the bread chain with two technologies (insects as feed and degradable packaging); Seven macro-categories that summarize the main challenges which actual implementation of the model would face: regulatory limitations; reverse cycle logistics management; geographic dispersion of enterprises; system boundaries and leakages of matter; acceptance among consumers; technology development and diffusion; uncertainty of investments and incentives.
Borrello et al. [19]	To assess consumers' willingness to participate in strategies to reduce food waste inspired by the circular economy.	Returning food waste, purchasing circular food products	Portrait of the potential participation of consumers to closed loops inspired by the principles of the circular economy. The willingness to participate did not depend significantly on the level of innovativeness of the technology.
Borrello et al. [28]	To analyze consumers' willingness to participate in an innovative food provisioning mechanism with retailers.	Willingness to participate in an innovative food provisioning mechanism with retailers	The expected participant is an individual already engaged in tasks to cope with risk in food provisioning and having already developed a long-lasting relation with a retailer. The study reveals the opposite effect of concerns about tasks related to take-back system, such as food waste handling, and social desirability of recycling.
Cattaneo et al. [34]	To investigate how food technology neophobia level, socio-economic variables, and information affect consumers' attitude towards uses of food by-products in relation to positive effects on the environment and consumers' health.	Attitude towards uses of food by-products	Education and food technology neophobia and information can be critical in facilitating the adoption of new food technologies. Positive attitudes towards food by-products were found, even in people with a greater food neophobia and lower education level.
Christis et al. [86]	To measure to which extent circular economy strategies in Brussels Capital Region can enable climate change mitigation and understand their effect on the material footprint.	Consumption adapted to needs, improved diets, no excessive consumption	With circular economy-strategies on consumption or production of food, mobility, and housing, Brussels could mitigate 25% of its carbon footprint and 26% of its material footprint, 18% of its carbon footprint and 26% of its material footprint, and 7% of its carbon footprint and 10% of its material footprint, respectively.
Ciulli et al. [45]	To investigate the 'circularity broker', uniting network research and circular supply chain research.	Food waste recovery	The paper uncovers how platform organizations foster the recovery of waste by bridging circularity holes. It identifies and explicates six brokerage roles (connecting, informing, protecting, mobilizing, integrating, and measuring), and discusses them in relation to extant literature, highlighting novelties compared to earlier studies.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Clark et al. [44]	To understand the views of stakeholders from the UK food packaging supply chain towards a move to the circular economy.	Perception of food packaging, changing shopping habits, reducing food and packaging waste	Possible solutions towards the circular economy have different benefits and limitations. Transformative technologies could enable these solutions; in selecting the best solution for packaging, a decision-maker must consider supply chain constraints and consumers' behaviors.
Clark et al. [52]	To understand how packaging development stakeholders can apply consumer behavior research methods within the packaging development process to aid the UK's food-to-go supply chain in the transition to a circular economy.	Consumer engagement in the food-to-go packaging development process; disposal of food-to-go packaging	Although all stakeholders identified strengths in incorporating behavior studies into the supply chain packaging development process, providing essential knowledge feedback loops, barriers to their application include the cost and time to implement, plus the existing inconsistent UK waste infrastructure.
Coderoni and Perito [38]	To evaluate factors that favor consumer engagement in the circular economy by purchasing waste-to-value (WTV) food.	Purchasing waste-to-value food	Food neophobia and food technology neophobia negatively influenced the probability of positive purchase intentions. Consumers who give importance to reading food labels and think that food could have environmental or health benefits are more likely to be willing to buy WTV food.
de Boer et al. [87]	To explore the relative importance of 'Reward' and 'Reflection' in food orientations.	Consuming meat versus plant-based food	Giving relatively low importance to both Reward and Reflection ('routine taste') is not favorable for healthier and more sustainable diets; giving importance to Reward but not Reflection ('hedonic taste') is not better; giving relatively high importance to both Reward and Reflection ('reflective taste') can be a favorable, complementary combination.
Farooque et al. [64]	To identify and systematically analyze the causal-effect relationships among barriers to circular food supply chains in China.	End-of-life management of leftovers; of unwanted, expired, or wasted food; and of packaging materials	Two key cause-barriers to circular food supply chains in China are weak environmental regulations and enforcement and lack of market preference/pressure. Lack of collaboration/support from supply chain actors is the most prominent barrier.
Fogarassy et al. [88]	To explore the circular characteristics of consumers' attitude towards food purchasing in Hungary.	Consumers' attitude towards food purchasing	Highly educated young people, who are conscious consumers and live on good incomes, may be the target group for circular innovation.
Grasso and Asioli [39]	To understand the most preferred attribute composition for upcycled foods using the attributes price, type of flour, protein content and Carbon Trust label.	Consumers' preferences for novel food products made with upcycled ingredients	Consumers preferred biscuits made with wheat flour and tended to reject biscuits made with upcycled sunflower flour. Three consumers' groups were identified: (1) price sensitive consumers with the strongest preferences for low price biscuits, (2) traditionalist consumers and strongest rejection for upcycled sunflower-flour, (3) environmentalist consumers with the strongest preference for biscuits with the Carbon Trust label. Most consumers had not heard of upcycled ingredients before, but they would consider buying foods with upcycled ingredients.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Hebrok and Heidenstrøm [51]	To identify decisive moments and contexts within everyday practices where food waste could be prevented.	Food waste-related practices (acquiring, storing, assessing, valuing, and eating)	Five practices emerged as significant to food waste generation: acquiring, storing, assessing, valuing, and eating. Discussion of the role of the material structures within these practices and the possible interventions.
Holmes [62]	To explore how alternative modes of provisioning employ ordinary practices of sharing and circularity.	Participating in an alternative food provisioning group	Studying materiality is one way to illuminate new and emerging spaces of provisioning; this material focus illustrates how provisioning practices are not new but organized in original and novel ways; the materials of provisioning can be both beneficial and troublesome to provisioning organizations' practices of circulating and sharing and the extent to which they tackle social and sustainable issues.
Jurgilevich et al. [13]	To shed light on the concept of circular economy in the context of a circular food system.	Avoiding food waste and surplus, reusing food, utilizing by-products and food waste, changing the diet, political activity	Challenges and potential solutions. Circular economy as a framework to create policies supporting sustainable initiatives in different 'parts of the circle.'
Kiss et al. [58]	To cast light on the short supply chains' role in circular economy and sustainability.	Consuming in short food supply chains	Short supply chains connect to circularity and sustainability through environmental issues, health, food quality, consumers' behavior, producer-consumer relationships, and the local economy. These factors cannot be generalized across all short chains. Their circular economic and sustainability features depend on their location, type, and individual attitudes of the involved consumers and producers.
Kuokkanen et al. [18]	To understand what hampers the transition to a circular nutrient economy in Finland from the stakeholders' perspective.	Consuming food produced with recycled nutrients; taking responsibility for nutrients	The policy-governance interface lacks directionality and coordination; the enterprise-market interface creates inadequate demand articulation. The resilience of deep-rooted structures is critical.
Lakemond et al. [49]	Does not apply (editorial)	Consuming edible insect	The circular economy is a perfect vehicle to plug in edible insects, but their embedding in the whole process should be further worked out.
Lehtokunnas et al. [61]	To examine the everyday practices of food waste reduction in households as ethical work.	Household food waste practices	Results suggest that in order to understand the circular economy as a moral economy, it is crucial to note the moral complexity of everyday life that results from partly contradictory ethical sensitivities and practices.
Mak et al. [89]	To elucidate how circular bioeconomy can be achieved through sustainable food waste management, review the existing food waste management literature, and suggest research directions and limitations.	Food waste-related behavior	Future developments on food waste management are expected to explore the multi-functionality of products, boundary and allocation in a circular system, and the tradeoff between food waste and resources.
McCarthy et al. [65]	To assess consumers' willingness to buy food derived from underutilized biomass.	Willingness-to-buy value-added foods	Half of the sample was willing to buy value-added food. Helping Australian farmers was the top-ranking factor driving demand. Awareness of the food waste problem distinguished consumers willing to buy value-added food.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Mylan et al. [60]	To illustrate an alternative account of 'consumption' through the application of a 'sociotechnical' perspective to understanding what shapes patterns of resource use in everyday life.	Domestic food provision practices	A suggestion of conceptualizing consumers as 'doers' of everyday activities, instead of 'users' of products or services; and of taking account of the social value of consumption in the principle of eco-effectiveness.
Núñez-Cacho et al. [90]	To analyze what consumer's characteristics influence a sustainable purchase decision.	Sustainable purchase decision	Consumers' purchase decision on the food industry is conditioned by factors such as age, sustainable behavior, knowledge of the circular economy and the perception of usefulness of plastic.
Pashova et al. [55]	To examine consumer attitudes towards the use of edible coatings in various sectors of the food industry.	Purchasing products with edible coatings	Most consumers are not familiar with edible coatings, so they would not consume foods with them. There is a need to raise consumer awareness of the benefits of edible coatings.
Pereira et al. [46]	To estimate the environmental benefits of milk sold through vending machines compared to milk sold in supermarkets, and to assess it from a socio-economic point of view.	Purchasing from a milk short supply chain based on vending machines	A short supply chain can bring environmental and socio-economic benefits, but the entrepreneurship may not suffice—the transformation towards a circular food system requires political and societal commitment.
Peschel andAschemann-Witzel [37]	To investigate different degrees of transparency in communicating sustainable production practices, especially upcycling, on consumers' perceived benefit (preference) as well as companies' potential cost and benefits (sales volume and prices charged).	The likelihood of choosing plant- based foods with upcycled ingredients	A higher degree of transparency in communicating sustainability efforts increases product choice only to a minor degree or even affects it negatively. Fair price perception increases for upcycled alternatives, but only when cost transparency, a specific type of transparency, is disclosed. This leads to a tradeoff consisting of selling either more of the product but for lower price, or less product but at a higher value, that is, more for less or less for more.
Principato et al. [16]	To quantify the main food loss and waste and their causes along the food supply chain of the pasta production; to understand if this food loss and waste could be reused according to the circular economy approach.	Reusing and minimizing food loss and waste (FLW)	The pasta supply chain is a good example of a circular economy as little is lost. Food losses in the field are minimal, while the straw obtained during the harvest is typically used as animal feed and litter. The losses in the grinding of the wheat and pasta production amounted to approximately 2%. Most FLW occurs during the cultivation and consumption.
Reckinger [57]	To analyze four case studies of the circular and collaborative economy-type fruit and vegetable production as well as unpackaged and/or socially responsible food retail.	Participating in alternative food networks (AFNs)	AFNs carve out a protected space for themselves on a small scale, allowing them to experiment and develop know-how, building networks to ground their knowledge claims onto agricultural practices and community backing. They hope to set a precedent for informed policy-making. AFNs need prosumers to make their knowledge claim strong and legitimate.
Rumpold and Langen [50]	To give an overview on potential strategies for the promotion of edible insects as food; to portray challenges regarding consumer acceptance of edible insects in an organic-based bioeconomy; to highlight the role of the consumer for the success of an organic-based bioeconomy.	Consumer acceptance of edible insects	Trust, willingness to eat, and overcoming disgust and neophobic reactions are central aspects to attain consumer acceptance of edible insects. Other key factors seem to be taste and other sensory aspects.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Russo et al. [35]	To understand consumers' intentions to purchase, pay for, and switch to products made from regenerated bio-waste.	Intention to purchase, pay for, and switch to products made from regenerated bio-waste	Findings reveal no effects for product involvement and gender on the dependent variables, but for green self-identity, attitude towards bio-based products, age and past purchase experience of eco-friendly products.
Saviolidis et al. [63]	To explore and analyze stakeholders' proposed solutions for creating sustainable agri-food systems.	Sustainable food consumption behavior	Most of the identified solutions were located in the strategic tools category, reflecting shared recognition of the need to integrate food policy to achieve long-term goals. Emerging solutions—those which were most commonly identified among the different national contexts—were used to derive empirically-grounded and more universally applicable recommendations for the advancement of sustainable food consumption policies.
Sijtsema et al. [43]	To find the starting points for consumer involvement in activities that promote a circular economy.	Perception of circular economy and of food-related practice cases of a circular nature.	Most consumers did not have a clear understanding of the term 'circular economy'; Perceptions, attitudes, motives and barriers in terms of advantages and disadvantages varied and were related to (1) the functionalities of the products, (2) the production system, (3) economic aspects and (4) emotions such as concern about risks. The authors identified four key messages: targeting with regard to behaviors, attitudes and product functionalities; aligning with emotions; linking to practical cases; and applying multidimensional circular economy-related behavior in everyday life and involving consumers in its innovation.
Sijtsema et al. [70]	To introduce circular food design model and present some applications.	Participation in circular food design	The added value of circular food design model is; first, the model stimulates a citizen participation approach in a creative way; second, the model supports communication and collaboration among all involved disciplines. The newly developed circular food design model visualizes an iterative approach meant to be a flexible and creative tool to structure the new food development in the different phases to support value creation in the food system in order to support its transition.
Steenis et al. [40]	To assess to what extent (combinations of) sustainable design strategies affect consumers' purchase intentions.	Consuming packaging redesigned following circular economy strategies	Consumers respond favorably to more sustainable packaging redesigns, particularly biological circular improvements and less so to linear ones. Such effects are mainly driven by higher perceived sustainability, associated with greater perceived naturalness and moral satisfaction. The combinations of sustainable design strategies in packaging design follow the principle of diminishing returns.
van Huis [41]	To elucidate the effect of insects as feed and food on nutrition and health of humans and animals.	Consumption of insects as food	The academic interest in insects as food and feed is growing exponentially. In addition to their high nutritional values, there are also health benefits, such as prebiotic effects of insect products, and antioxidant properties. The main strategies related to consumer issues are disguising the insects in familiar products and making them tasty.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
van Huis [42]	[To clarify] prospects of insects as food and feed.	Consumption of insects as food	People in western countries are not used to eating insects, and therefore, strategies to 'convince' consumers of their hygienic safety, environmental sustainability, and tastiness are necessary. The insect sector is maturing fast, but still faces many challenges, which can only be met when all stakeholders cooperate closely.
van Zanten et al. [69]	To assess the potential contribution of livestock—fed with low-opportunity cost feedstuff—to the food supply, while reducing arable land use.	Consuming livestock raised under the circular economy concept	Livestock—by recycling biomass unsuited for direct human consumption back into the food system—can potentially play a key role in feeding the future population.
Vilariño et al. [91]	To review global food loss and waste (FLW) and the related environmental, social, and economic impacts.	In-home practices to reduce food loss and waste	The literature lacks information and evaluation of the socio-economic impact of measures and policies to reduce FLW. Lack of reliable and consistent data and inconsistences in definitions and measurement frameworks of FLW need to be addressed.
Zarbà et al. [92]	To evaluate potential changes in habitual and occasional consumers in the use of wild plants in human nutrition.	Using wild plants in human nutrition	Wild leafy 'vegetables' are included among new food lifestyles and are valued mainly due to health, popular tradition, and sustainability aspects.

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3.2 PAPER 2: GOAL-FRAMING THEORY IN ENVIRONMENTAL BEHAVIORS: A REVIEW AND FUTURE RESEARCH AGENDA

This paper is under review at the Journal of Social Marketing. The authors are Natália Rohenkohl do Canto, Marcia Dutra de Barcellos, and Klaus G Grunert. Next, we present the most recent version of the paper.

Abstract

Purpose: Preserving the environment is fundamental to the planet's long-term sustainability, but people often lack the motivation to adopt pro-environmental behaviors. According to goal-framing theory, pro-environmental behaviors might stem from conflicting goals. Considering the stream of studies that has been published recently applying the goal-framing theory, now is a good time to review their findings and derive implications for future efforts to explain pro-environmental behaviors. Therefore, the current study aims to provide an overview of empirical research applying the goal-framing theory and to develop an agenda for further research that uses the theory.

Design/methodology/approach: We systematically review 25 empirical research studies that adopt the goal-framing theory.

Findings: Most studies rely on survey data, focus on Europe, and gather self-reported behaviors or hypothetical responses. Furthermore, many studies of goal frames neglect key situational factors. Thus, the directions for further research outlined herein emphasize the need for more experimental studies of real behaviors, with consideration of situational factors, using methods that can explicate unconscious processes too. Overall, goal-framing theory provides a promising approach for analyzing pro-environmental behaviors, in that it explicitly deals with goal conflicts, takes situational factors into account, and encompasses conscious and unconscious processes.

Originality: As the first systematic review of empirical applications of goal-framing theory, this study provides refinement and validation. By also offering propositions and a research agenda, we hope to inspire researchers to address remaining gaps and refine the theory even further.

Keywords: goal-framing theory, pro-environmental behavior, motivation, systematic literature review, theory-based review.

1. Introduction

Human behaviors have environmental impacts, whether because they alter the materials available, emit greenhouse gasses, reduce biodiversity, or produce non-biodegradable waste. If people modify their actions to minimize these negative impacts on the environment, or even exert positive impacts, they engage in *pro-environmental behaviors* (STEG; VLEK, 2009). Despite the critical need to preserve the environment to ensure the planet's long-term sustainability though, people appear to lack motivation

to adopt these pro-environmental behaviors, often due to their short-term, personal disadvantages, such as less pleasure or fun, higher costs, or more demands on time (LINDENBERG; STEG, 2007).

To explain why people might engage in pro-environmental behaviors, or not, goal-framing theory (LINDENBERG; STEG, 2007) predicts that people have multiple goals (KOPETZ et al., 2012); for example, the goal of preserving the environment may conflict with the goal of maintaining private resources or enjoying immediate pleasure (STEG et al., 2014a). All three types of goals (normative, gain, and hedonic) are latent drivers of most types of behavior, through their interaction, such that different goals may dominate any particular situation. This relatively new theory has not yet been applied widely, though possibilities for empirical applications have been growing in recent years (see Lindenberg and Steg (2007, 2013) and Steg and Vlek (2009)). Considering the centrality of multiple goals and goal conflicts for determining pro-environmental behaviors, a theory pertaining expressly to goal conflicts should be relevant, and accordingly, in this paper, we start by analyzing the potential contributions of goal-framing theory for explaining pro-environmental behaviors, relative to those offered by more well-established theoretical approaches that also have been used to explain such behaviors. Our main goal is twofold. First, we review existing empirical research that uses goal-framing theory; considering the stream of studies that has been published recently, now is a good time to review their findings and derive implications for future efforts to explain pro-environmental behaviors. Second, by integrating the results of our theoretical analysis and literature review, we develop an agenda for further research that uses goal-framing theory. As the first systematic review of empirical applications of goal-framing theory, this study provides refinement and validation (STEG et al., 2014a). By also offering propositions and a research agenda, we hope to inspire researchers to address remaining gaps and refine the theory even further.

We organize the remainder of this article into four sections. We start by discussing goal-framing theory and how it relates to other, existing approaches to the analysis of pro-environmental behaviors. After we present the methodology and results of the literature review, we propose directions for further research. Finally, we conclude with a discussion of some limitations and implications.

2. Goal-Framing Theory

To assess the potential contribution of goal-framing theory for explaining pro-environmental behaviors, we both introduce the theory and compare it with some well-established prior theories, to highlight its strengths and weaknesses.

2.1 Overview

Goal-framing theory (LINDENBERG; STEG, 2007) attempts to explain what motivates people to behave in a certain way (STEG; LINDENBERG; KEIZER, 2016), with the basic premise that most behaviors are influenced by multiple goals (KOPETZ et al., 2012). Goals thus influence behavior but also frame and direct people's attention, the routes they use to access information, their evaluations of a situation, and which alternatives they consider (LINDENBERG; STEG, 2007). The resulting processes may be deliberate or unconscious (KRUGLANSKI et al., 2002; STEG et al., 2014a). Furthermore, goal-framing theory distinguishes three overarching goals: hedonic goals to feel better right now, gain goals to maintain and improve available resources, and normative goals to do the right or appropriate thing. In any situation, one of them is the focal goal, or goal frame. It influences, more than the other goals, how the person thinks, responds to information, considers alternatives, and acts. The other goals, in the background, may increase the strength of the focal goal if they are compatible or mitigate that strength if they are in conflict with the focal goal (LINDENBERG; STEG, 2007).

Two main factors influence the strength of goals: values and situational cues. Values refer to stable concepts or beliefs people have about what they want to achieve; they are ordered by relative importance and guide how people select or evaluate behaviors and events (SCHWARTZ; BILSKY, 1987). When they make individual choices, people usually prefer the alternatives that are consistent with their most important values (VERPLANKEN; HOLLAND, 2002); values even determine which goals people find most important (STEG; LINDENBERG; KEIZER, 2016). Because they influence the accessibility and salience of goals, they help determine the likelihood that a particular goal will be(come) salient in a particular situation (STEG et al., 2014a; STEG; LINDENBERG; KEIZER, 2016). Table 1 contains a summary of the three goals and their supporting values.

Table 1 – Three overarching goals

	Hedonic Goal	Gain Goal	Normative Goal
Definition	To feel better right now	To maintain and improve resources	To do the appropriate and right thing
Sensitive to	What increases and decreases pleasure and affects mood, energy level, social atmosphere	What improves or guards resources; incentives	What a person thinks he or she ought to do (according to self and others and people's behavior)
Time horizon	Short	Medium or long	Long
Examples of sub-goals	Avoiding effort, negative thoughts, negative events, and uncertainty. Seeking pleasure, improvement in self-esteem, and excitement	Saving money, increasing income, dealing with threats to financial security	Behaving the right way, contributing to a clean environment, showing exemplary behavior
A priori strength	Strongest a priori. Needs the least external support	Needs support of institutions (e.g., religion, secure property rights)	Most dependent on external support (e.g., institutions, morality)
Strengthening values	Hedonic	Egoistic	Altruistic and biospheric

Source: Based on Lindenberg and Steg (2007), Steg and Vlek (2009), and Steg, Lindenberg and Keizer (2016).

But people sometimes behave inconsistently with their important values (VERPLANKEN; HOLLAND, 2002), due to situational cues, or elements in the environment that affect how people perceive their options or intensify the importance of alternative values. Some examples of situational cues include other people's support or violation of norms; perceived behavior-related efforts, costs, or discomfort; a perceived need to balance different goals; and symbols that work to prime particular goals, such as tasty chocolates as hedonic symbols, signs of money as gain symbols, or organic labels as normative symbols (STEG et al., 2014a; STEG; LINDENBERG; KEIZER, 2016). When situational cues strengthen a goal, they may inhibit other concerns people have and redirect their final behavior (STEG et al., 2014a). As this situational influence implies, goals are dynamic and depend on the circumstances of the situation, which may result in unstable preferences and choices (KOPETZ et al., 2012).

Lindenberg and Steg (2007) explicitly propose goal-framing theory as a good way to study environmental behaviors; in a subsequent article, these authors offer a relevant hypothetical example:

> Imagine that you do your grocery shopping…. At the vegetable section, you have the choice between organic tomatoes and non-organic greenhouse tomatoes…. People with a strong hedonic goal may particularly consider the tastiness or the shape and look of the tomatoes. A strong gain goal will make

> people … likely to opt for the cheapest tomatoes … [and] people with a strong normative goal will probably opt for the organic tomatoes because they particularly consider the environmental impact of the tomatoes (STEG; LINDENBERG; KEIZER, 2016, p. 181–182).

Goal-framing theory thus predicts that people face a trade-off between doing the right thing (normative goal), saving resources (gain goal), and feeling good (hedonic goal) (LINDENBERG; STEG, 2007). The chances of choosing the organic tomatoes increase if the consumer strongly endorses altruistic or biospheric values, such that they judge phenomena on the basis of their costs or benefits to ecosystems or the biosphere (STERN; DIETZ, 1994), but they decrease if people strongly endorse hedonic or egoistic values. Situational cues like an organic claim or other people's choices of organic alternatives also might support the normative goal, just like a salient price tag can support a gain goal or a product's appearance might support the hedonic goal. Even if people believe buying organic tomatoes is the right thing to do, they may perceive the cost as too high or not like the tomatoes' appearance and therefore still opt for another product.

2.2 Goal-framing versus established theories

The basic question of how people make choices when they confront alternative options is addressed by many other theories as well. To evaluate the potential contribution of goal-framing theory to explaining pro-environmental behaviors, we compare it with three general theoretical approaches, often used to analyze behavioral change: social cognitive theories, operant conditioning theories, and dual-processing theories. All of these approaches are well-established in prior literature and suitable for investigating environmental behaviors at the individual level. Accordingly, we select a typical theory within each approach and illustrate its application to the tomato example from the previous section. For our comparisons, we address four reputed strengths and one weakness of goal-framing theory (see Table 2), related to whether the theories account for (1) individual differences, (2) histories of similar behaviors by decision makers, (3) the effect of situational cues, (4) interactions among goals, and (5) deliberate and conscious but also unconscious decision-making processes.

Table 2 – Comparison of goal-framing theory with established consumer behavior theories

	Individual Differences	**History of Behavior**	**Context**	**Division Between Goals**	**Unconscious vs. Conscious Processes**
Goal-Framing Theory	Values	Not explicitly considered	Situational cues influence goal salience	Gain, normative and hedonic goals	Behaviors can be based on both processes
Theory of Planned Behavior	Considered in all constructs	Not explicitly considered	Indirectly considered by being reflected in beliefs	Not explicitly considered	Behaviors as a function of conscious cognitive processes
Behavioral Perspective Model	Derived from learning history of the behavior	Considers learning history of the behavior	Differences between settings	Not explicitly considered	No distinction
Elaboration Likelihood Model	Not explicitly considered	Not explicitly considered	Attention to messages differs depending on situational context	Not explicitly considered	Among the first theories to consider two processes

Source: Prepared by the authors.

2.2.1 Social cognitive theories: Theory of planned behavior

Social cognitive theories propose that social factors influence behavior through cognitive appraisals (PLOTNIKOFF et al., 2013). Social cognitive theory (BANDURA, 2001) and the theory of planned behavior (AJZEN, 1991) are well-known representatives of this category. We consider the latter, noting its frequent application in studies of green purchasing behavior (JOSHI; RAHMAN, 2015). According to the theory of planned behavior (AJZEN, 1991), the choice of organic tomatoes would depend on whether consumers intend to make such a purchase and perceive it as something that is possible to do (i.e., within their perceived behavioral control). Their intention depends on their attitudes toward buying organic tomatoes, perceived pressures from relevant groups (subjective norms), and their perceptions of behavioral control, such that they think they can buy organic tomatoes if they want to do so. Attitude, subjective norms, and perceived behavioral control in turn are determined by behavioral, normative, and control beliefs that inform the decision maker's cognitive structure.

Both the theory of planned behavior and goal-framing theory focus on individual differences and exclude habitual or routine behaviors (JOSHI; RAHMAN, 2015;

THØGERSEN, 2014) or past behaviors (PORTO; OLIVEIRA-CASTRO, 2013). The theory of planned behavior considers the context indirectly, in terms of how it might be reflected in a person's individual beliefs (STEG; VLEK, 2009), but it does not account for how contextual factors influence people's beliefs or intentions (LINDENBERG, 2000). Goals constitute part of the theory of planned behavior only indirectly, through evaluations of beliefs, without any explicit consideration of specific goals, their conflicts, or their interaction. Finally, the theory of planned behavior only deals with conscious processes.

2.2.2 Operant conditioning theories: Behavioral perspective model

According to operant conditioning theories, behaviors depend on people's past behaviors and their consequences (FOXALL, 1992; SKINNER, 1963). We will use the Behavioral Perspective Model (FOXALL, 1992) as an example; it was developed explicitly to analyze consumer behavior (FOXALL, 1993, 2009). In this model, two factors would determine the purchase of organic tomatoes: the behavior setting, which refers to elements present in the purchase context that facilitate or inhibit the behavior (e.g., how freely consumers can choose among different types of tomatoes, organic and non-organic), and the consumer's learning history, defined as the accumulated consequences of past behaviors that prime either an approach or avoidance response in future behaviors (e.g., if purchasing organic tomatoes felt rewarding in the past, people are more likely to repeat the purchase).

The behavioral perspective model considers consumers' learning history, which is not part of goal-framing theory, and also addresses individual differences. As a non-cognitive approach to the analysis of human behavior though, the model does not distinguish different goals and their relationships, nor does it differentiate conscious versus unconscious processes.

2.2.3 Dual-processing theories: Elaboration likelihood model

Dual-processing theories distinguish two types or systems of mental processes: System 1 contains fast, automatic, unconscious processes, and system 2 features slow, deliberative, conscious processes (EVANS, 2008). The heuristic-systematic model (CHEN; CHAIKEN, 1999) and elaboration likelihood model (PETTY; CACIOPPO, 1986) are well-known dual-processing models, used widely to analyze consumer behavior. We focus on the latter and note that, according to the elaboration

likelihood model (PETTY; CACIOPPO, 1986), consumers purchasing organic tomatoes could use either of the two different routes to process information and develop their attitudes. Highly motivated consumers prefer the *central route*. They process information deeply and carefully and react best to messages with strong arguments. In turn, their longer-lasting attitude changes predict behaviors. Less motivated consumers instead use a *peripheral route* to evaluate the implementation of the messages, rather than the arguments. The result is a temporary attitude change that is less predictive of behavior. That is, if consumers use a central route, arguments about the advantages of organic production should have most effect, but if they adopt a peripheral processing route, arguments presented in an appealing way would be most effective. Central processes mostly involve conscious reasoning, whereas peripheral processing can be semi- or even unconscious.

The elaboration likelihood model relies strongly on the distinction between conscious and unconscious processes and the influence of situational factors, both of which are also central to goal-framing theory. Motivation is key to the elaboration likelihood model, but in contrast with goal-framing theory, it distinguishes only between strong and weak motivation, not different types of motives or goals. Neither theory considers a previous history of similar behaviors. The summary of these comparisons in Table 2 in turn provides the basis for discussing the strengths and weaknesses of goal-framing theory next.

2.3 Goal-framing theory's strengths and weaknesses

The comparison identifies two major strengths and one weakness of goal-framing theory. First, it explicitly distinguishes different types of goals and their interactions, whereas previous behavioral models rarely integrate multiple goals into a single framework (BARBOPOULOS; JOHANSSON, 2017). By doing so, goal-framing theory supports a better understanding of the interplay across different motivations, their combined effects (REZVANI; JANSSON; BENGTSSON, 2018), and the trade-offs consumers face, which is particularly critical for understanding pro-environmental behaviors. Second, in analyzing how situational factors determine the relative importance of goals in any particular situation, goal-framing theory can explain contextual variability in goals, another aspect often overlooked in consumer behavior models (BARBOPOULOS; JOHANSSON, 2017). Third, its main weakness is that the

goal-framing theory fails to consider past and habitual behavior, as some other theories do.

In outlining how this theory has been used in empirical research, we reflect on the preceding theoretical assessment. In turn, we can develop some proposals for continued developments and applications.

3. Systematic Literature Review

3.1 Methodology

To perform a systematic review of empirical research conducted to date using goal-framing theory, we chose a theory-based review, among the various types of systematic reviews available (see (Palmatier, Houston, and Hulland (2018)), because our review prioritizes empirical research that uses one specific theory. Theory-based reviews are designed to "review, synthesize, and extend a body of literature that uses the same underlying theory" (PALMATIER; HOUSTON; HULLAND, 2018, p. 3). We adopted the procedure suggested by Tranfield, Denyer, and Smart (2003) (see Table 3 for the review protocol).

In December 2019, we searched for the term "goal-framing theory" in the Business Source Complete, ScienceDirect, and Web of Science databases, using the broadest field categories available in each database. This search resulted in 141 papers, which decreased to 127 simply by removing conference proceedings (Table 4).

Next, we removed 30 duplicate papers. We screened and assessed the eligibility of the 97 remaining papers, according to four inclusion criteria. First, we wanted to review empirical applications of the theory, so the papers had to report an empirical study; we removed reviews, theoretical discussions, and scale development papers. Second, we required the papers to invoke goal-framing theory explicitly as their theoretical base. Third, the studies should investigate environmental behaviors, which is both the focus of our paper and the foundational impetus for Lindenberg and Steg (2007) to conceptualize goal-framing theory. Thus, for example, we excluded papers on bullying behavior, financial behavior, inequality preferences, moral behavior, and corruption. Fourth, we required the papers to be indexed in one of the main social science databases (SSCI, SCOPUS, ABS), which only removed 1 paper. Through this procedure, we obtained a sample of 25 papers (Figure 1), which we coded according

to their publication year, journal, objective, methodology, and constructs investigated (Table 3).

Table 3 – Review protocol

Step	Description
Research questions	(1) What has been empirically investigated using goal-framing theory in the context of pro-environmental behaviors? (2) When and where has the research been published? (3) Which research methods were used? (4) Where did the research take place? (5) What were the major results with regard to the theory?
Population targeted	Empirical studies that explicitly invoke goal-framing theory to investigate environmental behaviors
Search strategy	Search in three databases: Science Direct, EBSCO Business Source, and Web of Science Search term: Goal-Framing Theory Field search: broadest field available in each database Time-frame: no limit
Inclusion criteria	Empirical papers Goal-framing theory used Investigation of pro-environmental behaviors
Exclusion criteria	Duplicate papers Not meeting at least one inclusion criteria Conference proceedings Not indexed in SSCI, SCOPUS or ABS
Data tabulation	Coding of papers according to the following categories: - General features: year, journal, objective - Methodological procedures: data collection, dependent variable/behavior investigated, independent/moderator/mediator variables, control variables, country investigated - Constructs investigated: individual differences, situational cues, goals, unconscious and conscious processes, temporal dimension
Data analysis	Content analysis of the categories
Targeted results	Overview of current studies Future research agenda

Source: Prepared by the authors based on Tranfield, Denyer, and Smart (2003).

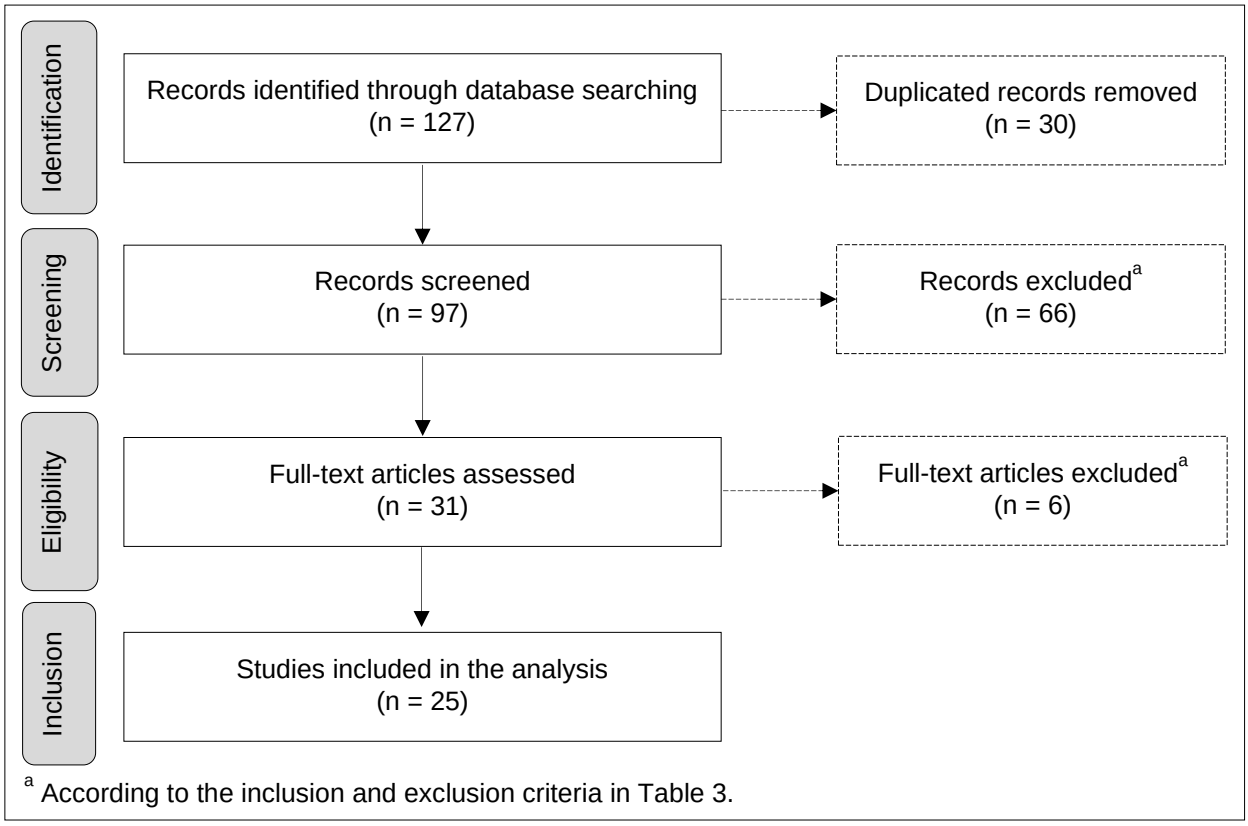
Table 4 – Papers identified in the database search

Source	EBSCO Business Source	Web of Science	Science Direct
Search term	Goal-framing theory	Goal-framing theory	Goal-framing theory
Field searched	Field search without restriction	Topic (title, abstract, author keywords, and KeyWords Plus[a])	Full document (excluding references)
Partial result	26 papers	46 papers	69 papers
Exclusion criteria	Conference proceedings	Conference proceedings	Conference proceedings
Records identified	23 papers	39 papers	65 papers

Source: Prepared by the authors

[a] KeyWords Plus are index terms automatically generated from the titles of cited articles (WEB OF SCIENCE, 2019).

Figure 1 – Selection process



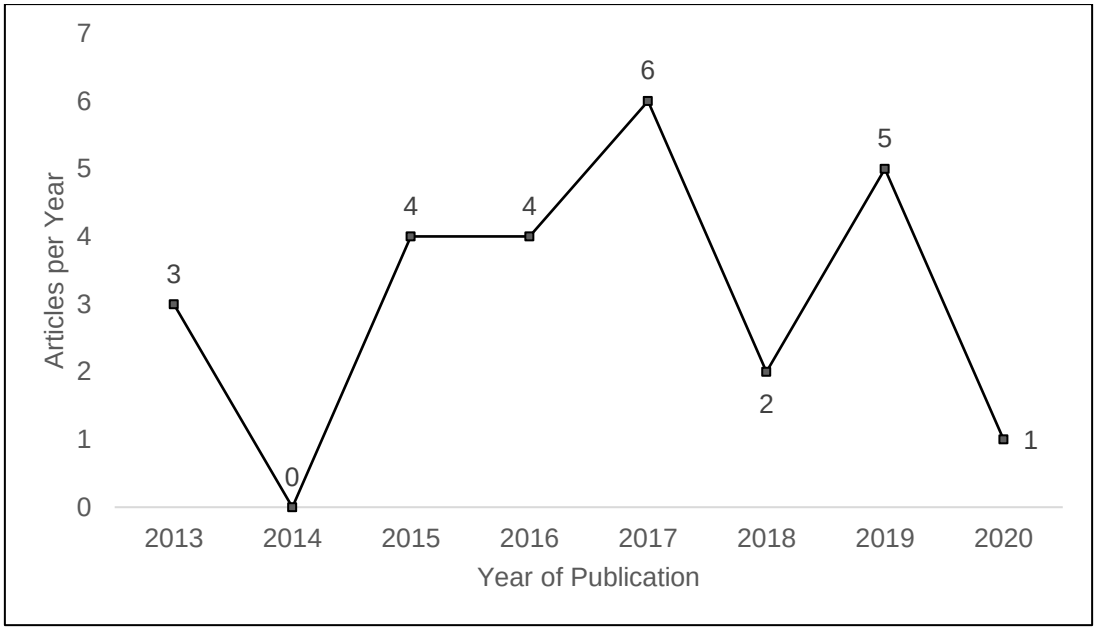
Source: Prepared by the authors based on PRISMA (2020).

3.2 Findings

3.2.1. Year of publication. The publication year varies between 2013 and 2020 (Figure 2), with peaks in 2017 and 2019. As noted, goal-framing theory is relatively new and has become more popular recently. Although Lindenberg and Steg first presented it in 2007, the first article in our sample was published in 2013, so it took several years for empirical studies to emerge.

3.2.2. Outlet. The papers were published in 18 different academic journals (Table 5), and only 5 journals published more than one paper. Journals focusing on sustainability are the primary outlets. Other journals highlight specific topic areas (e.g., energy, transportation) or else broader domains (e.g., management, psychology). This distribution indicates that goal-framing theory is multidisciplinary in nature, so journals with different foci publish studies that apply it.

Figure 2 – Publications using goal-framing theory over time



Source: Prepared by the authors.
Note.: Data collected in December 2019.

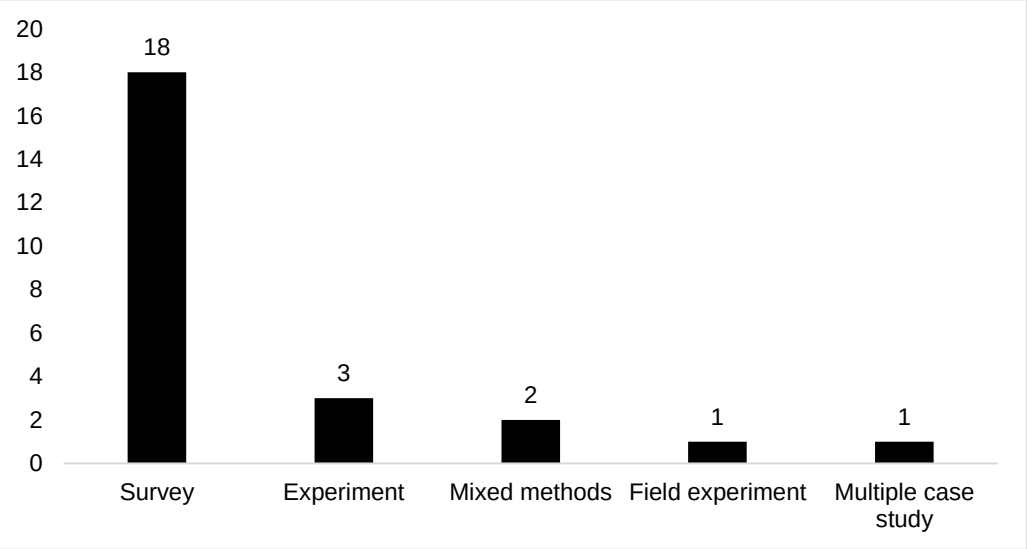
Table 5 – Journals that published papers using goal-framing theory

Journal	#	Articles
Energy Procedia	3	Bariss et al. (2015), Timma et al. (2015), Timma et al. (2016)
Journal of Cleaner Production	3	Liobikienė and Juknys (2016), Liobikienė, Grincevičienė, and Bernatonienė (2017), Liobikienė et al. (2020)
Ecological Economics	2	Handgraaf, Van Lidth de Jeude, and Appelt (2013), Gkargkavouzi, Halkos, and Matsiori (2019a)
Resources, Conservation and Recycling	2	Wallin et al. (2013), Geng et al. (2017)
Transportation Research Part A: Policy and Practice	2	Geng, Long, and Chen (2016), Dastjerdi et al. (2019)
Energy Policy	1	Brandsma and Blasch (2019)
Energy Research & Social Science	1	Gölz and Hahnel (2016)
Frontiers in Psychology	1	Bergquist, Nilsson, and Hansla (2017)
Indoor and Built Environment	1	Gerhardsson, Laike, and Johansson (2019)
International Journal of Hospitality Management	1	Miao and Wei (2013)
International Journal of Sustainability in Higher Education	1	Chakraborty, Singh, and Roy (2017)
Journal of Artificial Societies and Social Simulation	1	Gotts and Polhill (2017)
Journal of Environmental Psychology	1	Steinhorst, Klöckner, and Matthies (2015)
Management Research Review	1	Arroyo and Carrete (2019)
Psychology & Marketing	1	Onel and Mukherjee (2017)
Renewable & Sustainable Energy Reviews	1	Dóci and Vasileiadou (2015)
Sustainability	1	Uehara and Ynacay-Nye (2018)
Sustainable Development	1	Tang, Chen, and Yuan (2019)
Total	**25**	

Source: Prepared by the authors.

3.2.3. Research methods. Surveys are the most used research methods, followed by experiments, mixed-method studies, and a multiple case study (Figure 3). Therefore, many of the results are based on correlational data.

Figure 3 - Research methods



Source: Prepared by the author.

Studies mostly measure self-reported behavior and intentions, which might be subject to social desirability biases (ARROYO; CARRETE, 2019; GENG; LONG; CHEN, 2016). Research into motivations for past behavior (e.g., Dóci and Vasileiadou (2015), Wallin et al. (2013)) also might suffer a recall bias. Only two studies measured actual behavior, and one simply checked if people accessed an energy feedback system, not their actual energy consumption (GÖLZ; HAHNEL, 2016). In most cases, the studies rely on goals to explain environmental behaviors and include socio-demographics as control variables; they generally do not account for other constructs raised by the theory, such as situational cues.

3.2.4. Location of studies. The studies were carried out in 15 countries, mostly in Europe, followed by Asia and North America. The most frequent target countries were China, Germany, Latvia, Lithuania, the United States, and the Netherlands. Three studies (DÓCI; VASILEIADOU, 2015; GÖLZ; HAHNEL, 2016; LIOBIKIENĖ; GRINCEVIČIENĖ; BERNATONIENĖ, 2017) investigated more than one country.

3.2.5. Results in relation to theory. These studies confirm that the three goal frames are distinct; their importance is situationally dependent (DASTJERDI et al., 2019); they influence pro-environmental behaviors (ARROYO; CARRETE, 2019; CHAKRABORTY; SINGH; ROY, 2017; ONEL; MUKHERJEE, 2017); and they can classify individual consumers according to different profiles (GENG et al., 2017; GÖLZ; HAHNEL, 2016). In particular, the evidence in these studies implies that strengthening the normative goal can promote pro-environmental (CHAKRABORTY; SINGH; ROY, 2017; STEINHORST; KLÖCKNER; MATTHIES, 2015; TANG; CHEN; YUAN, 2019) and long-term oriented behaviors (HANDGRAAF; VAN LIDTH DE JEUDE; APPELT, 2013) behaviors. A gain goal is associated with generating status (CHAKRABORTY; SINGH; ROY, 2017; LIOBIKIENĖ et al., 2020) and exerts more influence in situations marked by unfavorable cost-benefit trade-offs (WALLIN et al., 2013), which then may hinder pro-environmental behaviors (STEINHORST; KLÖCKNER; MATTHIES, 2015; TANG; CHEN; YUAN, 2019). The hedonic goal was associated with pro-environmental behaviors that increase pleasure and happiness (TANG; CHEN; YUAN, 2019), but it may prevent effortful and uncomfortable behaviors (CHAKRABORTY; SINGH; ROY, 2017).

Some studies also offer insights into how situational factors (e.g., interventions, incentives, environments, settings, rewards, feedback) influence environmental behaviors. Miao and Wei (2013) show that goals and environmental behaviors differ in household versus hotel settings. According to Arroyo and Carrete (2019), situational triggers can determine intentions to buy a photovoltaic system, by directing attention toward different goals. Furthermore, Gkargkavouzi, Halkos, and Matsiori (2019a) assert that situational barriers mediate the impact of environmental knowledge and motivation on intentions to engage in pro-environmental behaviors. These results support the theoretical prediction that goals are situationally dependent (DASTJERDI et al., 2019).

In summary, goal-framing theory has been applied to predict pro-environmental behaviors, by studies mainly published in sustainability outlets. Most of the research data come from Europe, with surveys as the preferred collection procedure, targeting hypothetical or self-reported behaviors. These studies focus on the three goal frames and usually do not account for other background factors.

4. Directions for research

We present several recommendations and propositions for research, classified as theory, contexts, and methodology.

4.1 Theory development

We organize this section according to the main constructs in goal-framing theory.

4.1.1. Goal frames. The distinction of three types of goals and the notion that one of them dominates in each choice situation is central to goal-framing theory. Yet the definitions of the three goals remain unclear, and many studies do not investigate all three types of goals. The definitional concerns in turn make it difficult to classify concrete goals into the three categories. For example, eating healthy food has been classified as a normative goal (LINDENBERG; PAPIES, 2019) and increasing status as a gain goal (LINDENBERG; STEG, 2007). But Liobikienė, Grincevičienė, and Bernatonienė (2017) categorize status as a hedonic goal, and Miao and Wei (2013) identify health as a gain goal. Other authors report their struggles with classifying the goals: Dóci and Vasileiadou (2015) assert that it is challenging to classify motives into just one goal frame, and Gölz and Hahnel (2016) argue that saving energy could be both a normative and a gain goal. This difficulty may reflect a weakness of goal-framing theory when applied to any particular concrete case, because concrete goals governing behavior may fit with or link to more than one goal frame. Continued research might clarify how concrete goals can be classified into the three broad categories, while also determining and establishing if and how any particular concrete goal might fit more than one goal frame. Formally, we propose:

Proposition 1. A concrete goal can fit into more than one goal frame.

Most studies focus on a focal goal or goal frame, paying less attention to background goals, despite their influence on behavior (GENG; LONG; CHEN, 2016). The goal frame and background goals even might have conflicting implications for behavior, such that background goals arguably may weaken the relationship between the goal frame and the target behavior. Few studies (e.g., Gkargkavouzi, Halkos, and Matsiori (2019a), Gölz and Hahnel (2016), and Geng et al. (2017)) have investigated

goal conflict, and those mainly are based on retrospective reports. Additional studies should experimentally manipulate the conflict level between the goal frame and the background goals to determine how the level of goal conflict affects this link (BERGQUIST; NILSSON; HANSLA, 2017; GENG et al., 2017). We propose

Proposition 2. The degree of conflict between a goal frame and background goals has a negative effect on the likelihood that people behave according to the goal frame.

Goal conflict can moderate the relationship between the goal frame and the targeted behavior; so might other factors. Other moderators suggested in prior applications of goal-framing theory include lifestyle and perceived risk (TANG; CHEN; YUAN, 2019).

Proposition 3. Lifestyle and perceived risk moderate the relationship between the goal frame and the behavior corresponding to the goal frame.

4.1.2. Values and goals. Steg, Lindenberg, and Keizer (2016) propose that hedonic values strengthen hedonic goals, egoistic values strengthen gain goals, and biospheric and altruistic values strengthen normative goals. However, studies rarely measure values. If they do, many of them fail to include all values or consider other values, not mentioned by the theory. Only one study investigates all four values. Thus, we need more research into how values affect the enduring salience of the three types of goals. Such research should draw on existing studies of human values to establish how the three types of goals relate to previously introduced typologies of human values (e.g., Bouman, Steg, and Kiers (2018), Schwartz (1992)). We posit:

Proposition 4. The relative importance of consumers' hedonic, egoistic, biospheric, and altruistic values have effects on goal framing.

4.1.3. Temporal dimension. Some studies investigate past and habitual behaviors, though such a feature is not a construct introduced by goal-framing theory. Dastjerdi et al. (2019) identify a negative association between normative goals and habitual daily car and transit use; Wallin et al. (2013) find that homeowners who have

changed their on-site sewage systems in the past are less ready to change it again. Further studies might address whether past and habitual behaviors influence goal framing or the link of the goal frame with behaviors (STEG; VLEK, 2009). We propose:

Proposition 5. Consumers' past and habitual behaviors affect the goal frame and the way the goal frame links to behavior.

4.1.4. Unconscious processes. A key strength and distinction of goal-framing theory compared with, especially, socio-cognitive approaches is its ability to deal with unconscious processes, though most studies ignore this factor and rely on verbal measures for their data collection. A few experimental studies include stimuli that work as (unconscious) primers for goal activation (ARROYO; CARRETE, 2019; BERGQUIST; NILSSON; HANSLA, 2017; BRANDSMA; BLASCH, 2019; HANDGRAAF; VAN LIDTH DE JEUDE; APPELT, 2013; STEINHORST; KLÖCKNER; MATTHIES, 2015). Continued studies should put more emphasis on unconscious processes governing the activation of goals and how those goals affect behavior.

Proposition 6. Goal activation and the way goals affect behavior are influenced by unconscious processes.

4.1.5. Relations among constructs. Researchers should clarify the relationships among the theoretical constructs, especially values and situational cues (GENG; LONG; CHEN, 2016; LIOBIKIENĖ et al., 2020). Existing studies offer contradictory results: Sometimes values (BRANDSMA; BLASCH, 2019), but sometimes the context (MIAO; WEI, 2013), might have more importance for promoting behaviors. It is necessary to understand the conditions in which values or situational cues might be more important. Continued studies could clarify how values and situational cues relate, how they differently affect behaviors, and how much they can conflict and still promote consistent behavior.

4.2 Contexts

We need replications (ARROYO; CARRETE, 2019) and cross-cultural studies (DASTJERDI et al., 2019; LIOBIKIENĖ et al., 2020; TANG; CHEN; YUAN, 2019) in different regions and with more representative samples. Significant scope for research

on goal-framing theory remains in Africa, South America, and Australia. Data from these regions may offer new findings, especially considering that the theory explicitly accounts for contextual influences.

Studies in which the results do not accord with the theory also suggest a potential association between the type of environmental behavior and goal frames. Liobikienė and Juknys (2016) uncover an unexpected, positive correlation between the purchase of green products and values related to gain and hedonic goals; Brandsma and Blasch (2019), studying energy conservation, fail to confirm a positive effect of environmental feedback on altruistic people, who instead appear most strongly motivated by monetary gains. These results may be explained by the difficulties people have associating energy conservation with the welfare of others (altruistic values) (STEG et al., 2014b, p. 166). Lindenberg and Steg (2007) also assert that goals other than normative goals influence environmental behaviors. We propose:

Proposition 7. Different types of pro-environmental behaviors are associated with different goals; a normative goal frame is not always most effective for promoting pro-environmental behaviors.

Instead, perhaps a normative goal frame is most effective only if the target behavior fails to make people feel better at the moment or improve their resources, such as recycling or bringing reusable bags. Other pro-environmental behaviors might improve or maintain personal resources, such as purchases of green products or energy conservation, in which case they might be motivated primarily by a gain goal frame. Finally, there are pro-environmental behaviors that immediately improve people's enjoyment, including car use and environmental tourism, so they may be motivated by a hedonic goal frame.

Studies thus should test goal-framing theory according to different pro-environmental behaviors (LIOBIKIENĖ et al., 2020), which might be high or low cost, more or less effortful (GKARGKAVOUZI; HALKOS; MATSIORI, 2019a), and habitual or sporadic, and they also could pertain to low- and high-involvement products, durable or soft goods, or luxury or necessity products (LIOBIKIENĖ; GRINCEVIČIENĖ; BERNATONIENĖ, 2017). Such studies thus could identify domains in which, say, the hedonic goal is particularly relevant (LINDENBERG; STEG, 2007; STEG; VLEK,

2009), such as cars and, potentially, hotels that might guide environmental behaviors (MIAO; WEI, 2013).

4.3 Methodology

The studies we reviewed adopt different measures to assess the constructs of goal-framing theory, which limits the comparability of the results. We need “instruments to measure active goal frames” (BÖSEHANS; WALKER, 2020, p. 24), which also might reveal how different goal frames become activated and deactivated (WALLIN et al., 2013) and assess which situational cues affect goal frames (BERGQUIST; NILSSON; HANSLA, 2017). Some recently developed scales aim to measure subgoals contained within the three overarching goals Barbopoulos and Johansson (2017) and assessments of the motivational aspects of the theory (GKARGKAVOUZI; HALKOS; MATSIORI, 2019b). Continued efforts could test and refine these scales, develop and validate appropriate methodologies, and standardize the measures and procedures.

Longitudinal studies also could monitor goal frames, situational cues, and behaviors over time to learn whether interventions have been successful (STEG; VLEK, 2009). Such longitudinal evidence could shed light on the interplay of goals over time (DÓCI; VASILEIADOU, 2015; GÖLZ; HAHNEL, 2016), the long-term effect of interventions that pursue different goals (BRANDSMA; BLASCH, 2019; HANDGRAAF; VAN LIDTH DE JEUDE; APPELT, 2013), and differences between intentions and post-adoption behaviors (DASTJERDI et al., 2019). Because many studies use intentions and self-reported behaviors as the dependent variables, actual behaviors may differ. Thus, research should investigate actual behaviors (UEHARA; YNACAY-NYE, 2018), using experimental designs and field studies (BRANDSMA; BLASCH, 2019). The replication and cross-validation of goal-framing theory with multiple research designs would increase the internal and external validity of prior findings (HANDGRAAF; VAN LIDTH DE JEUDE; APPELT, 2013; STEG et al., 2014a).

4.4 Graphical representation

For continued applications of goal-framing theory, a graphical representation would be helpful, to summarize its main constructs and their relationships. Such a representation also can pinpoint which parts of the theory each empirical study aims to address. We propose one version in Figure 4, in which pro-environmental behaviors are explained by the goals that govern behavior. These goals can be categorized as

hedonic, gain, and normative, and one category serves as the focal goal, while the others function as background goals. Which goals are focal and which move to the background depends on individual values and situational cues. With regard to individual values, we adopt Bouman, Steg, and Kiers's (2018) distinction of egoistic, hedonic, altruistic, and biospheric values; for situational cues, we classify them according to the type of goal they activate.

5. Discussion, Conclusion, and Limitations

Our aim was to provide an overview of empirical research applying the goal-framing theory and to develop an agenda for further research that uses the theory. We do that by reviewing empirical studies that have applied it. The theory has been around for a little more than 20 years; considering the topicality and importance of understanding pro-environmental behaviors, we believe it is timely to assess the potential of this particular theory. To our knowledge, this study is the first systematic review of applications of goal-framing theory.

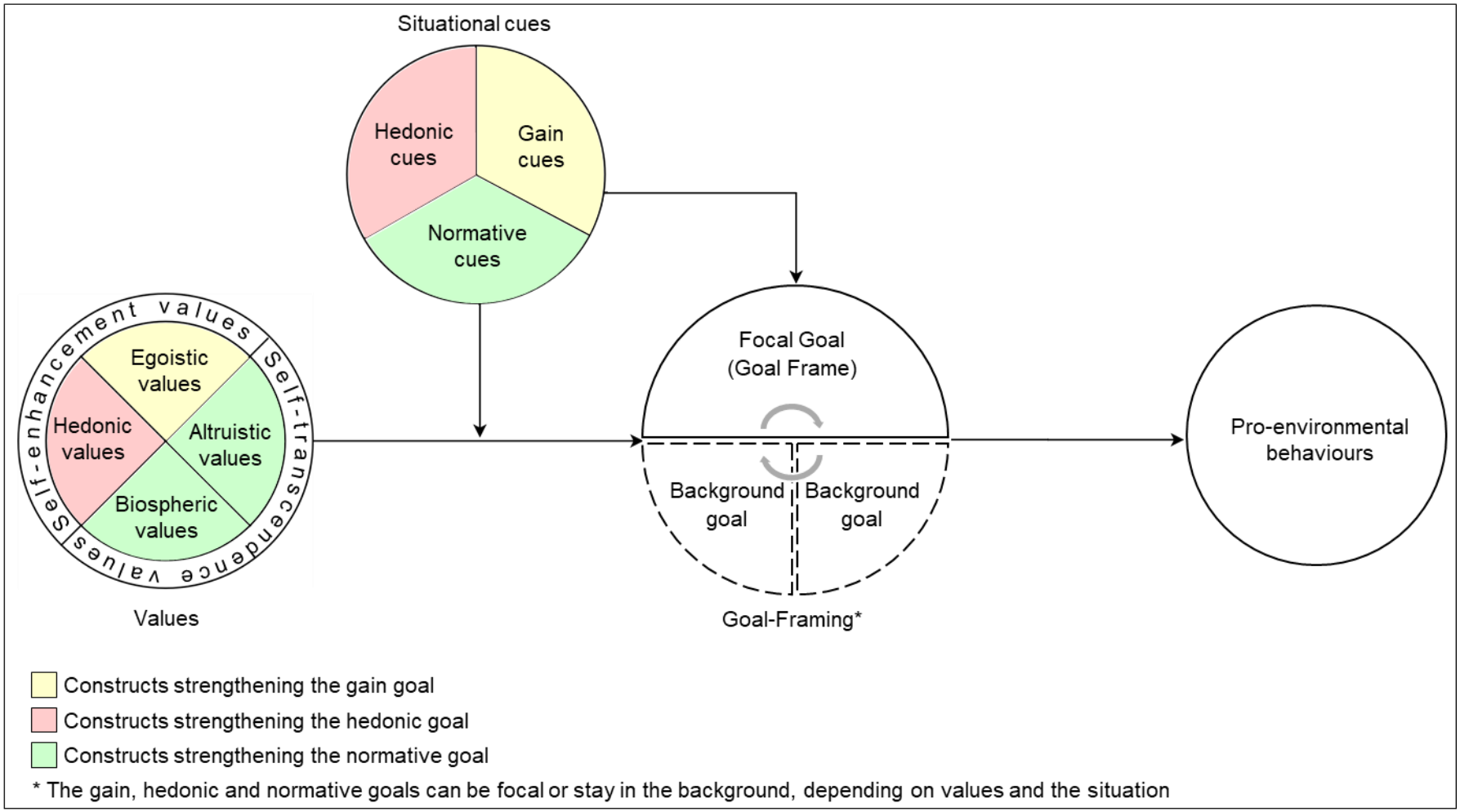
We conclude that the theory has considerable potential for explaining pro-environmental behaviors, because of its focus on goal conflicts and the situational dependence of goals that determine behavior. Yet empirical research using the theory also needs to advance to exploit this potential and apply the theory usefully to the explanation of pro-environmental behaviors, as well as provide a basis for promoting such behaviors. We offer multiple recommendations for research directions, while also emphasizing the need for more experimental research and field studies and a stronger focus on the relative role of values and situational cues in explaining the emergence of goal frames.

A main limitation of this paper is the relatively small number of studies on which we base our systematic review, though reviews based on similarly small samples of papers are not uncommon (e.g., Hassan, Shiu, and Parry (2016)). Yet we assert that now is the right time to establish the current state of the theory and its applications, to ensure its full potential is realized in the future, and to offer a clear explanation and means to promote pro-environmental behaviors.

References

The references of this paper are presented together with the references of the dissertation.

Figure 4 – Graphical presentation of goal-framing theory



Source: Prepared by the authors.

3.3 PAPER 3: THE INTERPLAY BETWEEN VALUES AND SITUATIONS IN THE PURCHASE OF ABNORMALLY SHAPED FOODS

This paper is a working paper, which we plan to submit to a conference or journal after defending the dissertation and considering the commentaries of the board members. The authors are Natália Rohenkohl do Canto, Marcia Dutra de Barcellos, Mariana Mizutani Ribeiro, Natascha Loebnitz, and Klaus G Grunert. Next, we present the most recent version.

Abstract: One way of reducing food loss and waste is by promoting the consumption of abnormally shaped foods. Based on the goal-framing theory, we conduct an online experiment investigating how consumers' values and situational cues influence the intentions to purchase abnormally shaped foods and the extent to which these factors interact. The study followed a 4 (claim factor$_{Between_Factor}$: no claim, taste claim, waste claim, price claim) x 2 (food item$_{Within_Factor}$: apple, carrot) x 3 (values$_{Between_Factor}$: normative, hedonic, egoistic) within-between subjects' design. Results suggest that consumers who strongly support hedonic values have a lower purchase intention. The ones strongly supporting altruistic and biospheric values have a higher purchase intention, especially if followed by discount or food waste claims. Consumers are less likely to purchase abnormally shaped foods when they lack a claim. The discount message was associated with the highest purchase intention, the food waste message was the second-best, and the taste claim was not associated with the purchase intention. The findings allow deriving managerial recommendations to promote abnormally shaped foods to different consumer groups.

Keywords: Goal-framing theory; abnormally shaped foods; food waste; values; situational cues; suboptimal food; consumer behavior; motivation.

1. Introduction

Around one-third of the food produced for human consumption is lost or wasted (FAO, 2013). This represents a waste of the natural resources used in food production (GÖBEL et al., 2015) and farmers' investments (LIPINSKI et al., 2013). Food loss and waste cause negative economic, environmental, health-related, and social impacts and is an issue that needs to be addressed to achieve a more sustainable food system (ASCHEMANN-WITZEL et al., 2015; BORRELLO et al., 2016; GÖBEL et al., 2015) and a circular economy (DO CANTO; GRUNERT; DE BARCELLOS, 2021). This is why Sustainable Development Goal 12.3 commits to halve food waste at the retail and

consumer levels by 2030 and to reduce food loss across supply chains (UNITED NATIONS, 2015).

One of the barriers to prevent food waste is the strict cosmetic standards of fresh produce imposed on farmers (PORTER et al., 2018; REFED, 2016). Foods that fail to fulfill these standards may be left in the field, discarded before reaching retailers, used to create processed foods with a lower value added, or donated to the emergency food system (ROE; QI; BENDER, 2020). Therefore, one way of reducing food loss and waste is through the promotion of cosmetically-imperfect food. Specifically, we focus on abnormally shaped foods (LOEBNITZ; SCHUITEMA; GRUNERT, 2015) – i.e., edible foods with a shape that deviates from what is regarded as optimal or perceived as 'normal' (ASCHEMANN-WITZEL et al., 2015; DE HOOGE et al., 2017).

Abnormally shaped foods may be discarded before reaching retailers because of the perception that consumers prefer to purchase foods that fulfill specific aesthetic standards (ASCHEMANN-WITZEL et al., 2015; LOEBNITZ; SCHUITEMA; GRUNERT, 2015). Indeed, studies show that consumers expect aesthetically unattractive foods to be less tasty (MOOKERJEE; CORNIL; HOEGG, 2021), that deviations in foods' shapes can negatively influence purchase intentions (HELMERT et al., 2017; LOEBNITZ; SCHUITEMA; GRUNERT, 2015), and that deformed foods are rated with low overall quality (ASCHEMANN-WITZEL; GIMÉNEZ; ARES, 2018). On the other hand, moderate deviations in foods shapes may not influence consumers' purchase intentions (LOEBNITZ; SCHUITEMA; GRUNERT, 2015), some consumers seem willing to purchase food items with a shape deviation (ASCHEMANN-WITZEL; GIMÉNEZ; ARES, 2018; DE HOOGE et al., 2017), and unattractive foods are judged as healthy and natural (MOOKERJEE; CORNIL; HOEGG, 2021). Besides, certain messages next to the products may improve the chance of consumers choosing abnormally shaped foods (HELMERT et al., 2017; MOOKERJEE; CORNIL; HOEGG, 2021). These results suggest that retailers could market abnormally shaped foods – if they know which strategy works best.

Therefore, it is essential to find out the best ways of promoting abnormally shaped foods. Retailers may need to adopt marketing communications appropriate to consumers with different motivations to reduce food waste (ASCHEMANN-WITZEL et al., 2015). This can be done, for example, by testing the effect of different messages on different groups (ASCHEMANN-WITZEL; GIMÉNEZ; ARES, 2018). To that end, a

theory combining situational and individual factors – such as the goal-framing theory – can provide insights on how to market abnormally shaped foods.

Many goals can influence people's motivation to reduce food waste, such as saving money or preserving the environment (ASCHEMANN-WITZEL et al., 2015). Based on the goal-framing theory (LINDENBERG; STEG, 2007), we propose that the purchase of abnormally shaped foods involves a trade-off between the normative goal of reducing food waste versus the hedonic goal of selecting the best-looking food. We expect that the gain goal of saving resources also influences consumers' intentions in relation to the price of abnormally shaped foods.

According to the theory, in a specific situation, one of three overarching goals (hedonic, gain, or normative) most strongly frames consumers' motivation to purchase abnormally shaped foods – this is the focal goal, or goal frame, of the situation (LINDENBERG; STEG, 2007). Two main factors are expected to determine the goal frame: consumers' values and the situational cues in the context (STEG et al., 2014a). Values reflect which goals, in general, people find most important to their life, and they are relatively stable across situations (VERPLANKEN; HOLLAND, 2002). Situational cues refer to elements of a situation that influence people's choices, resulting in unstable preferences (STEG et al., 2014a). However, few empirical studies applying the goal-framing theory have investigated the interplay between individual and situational factors (THØGERSEN; ALFINITO, 2020; DO CANTO; GRUNERT; DE BARCELLOS, under review).

This study investigates the influence of values and situational cues on consumers' intentions to purchase abnormally shaped foods and the extent to which these factors interact. Through an online experiment with consumers in the United States, we investigate whether consumers' purchase intentions depend on (a) the priority of their values, and (b) the situational cues they see (i.e., claims related to the hedonic, gain, or normative goal).

Results contribute to identifying the best conditions to reduce food waste through a higher purchase intention of abnormally shaped foods. Based on the results, we propose interventions to make it easier for consumers to behave more sustainably without giving up other priorities (DO CANTO; GRUNERT; DE BARCELLOS, 2021). Our findings can help increase consumers' motivation to combat food waste by purchasing abnormally shaped foods (ASCHEMANN-WITZEL et al., 2015). Theoretically, we contribute with the empirical test of the goal-framing theory.

2. The goal-framing theory

The goal-framing theory (LINDENBERG; STEG, 2007) tries to explain what motivates people to behave in a certain way (STEG; LINDENBERG; KEIZER, 2016), based on the idea that multiple goals[2] often influence a person's behavior (BARGH, 2006; KOPETZ et al., 2012). According to the theory, "goals govern or 'frame' what people attend to, what knowledge and attitudes become cognitively most accessible, how people evaluate various aspects of the situation, and what alternatives are being considered" (LINDENBERG; STEG, 2007, p. 119).

Lindenberg and Steg (2007) distinguish three overarching goals[3] that affect how people process information and act upon it: the *hedonic goal* of feeling better at the moment, the *gain goal* of maintaining and improving one's resources, and the *normative goal* of doing the appropriate and right thing. One of these goals is active or the "focal goal" in a situation and has a stronger influence on a person's thoughts, sensibility to information, consideration of alternatives, and actions. This is not necessarily a conscious and intentional process (KRUGLANSKI et al., 2002; STEG et al., 2014a).

Steg, Lindenberg, and Keizer (2016, p. 181–182) illustrate how these three goals influence people's food choices:

> Imagine that you do your grocery shopping…. At the vegetable section, you have the choice between organic tomatoes and non-organic greenhouse tomatoes.… People with a strong hedonic goal may particularly consider the tastiness or the shape and look of the tomatoes. A strong gain goal will make people … likely to opt for the cheapest tomatoes … [and] people with a strong normative goal will probably opt for the organic tomatoes because they particularly consider the environmental impact of the tomatoes.

In pro-environmental behaviors, consumers may perceive a trade-off between sustainability (normative goal) at the expense of hedonic and gain goals (STEG et al., 2014a; THØGERSEN, 2014; VAN TRIJP, 2014). These behaviors may be less profitable, less pleasurable, more time-consuming, or more effortful than environmentally harmful actions (STEG et al., 2014a; THØGERSEN, 2014). For example, although consumers want to avoid food waste, they may perceive trade-offs concerning taste, convenience, or health (ASCHEMANN-WITZEL et al., 2015; ASCHEMANN-WITZEL; GIMÉNEZ; ARES, 2018).

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[2] Goals are defined as "mental representations of desired future states" (LINDENBERG, 2012, p. 121).
[3] Overarching goals are "abstract goals that, when activated, guide large sets of subgoals, and affect many different cognitive processes" (LINDENBERG, 2012, p. 121).

Consumers may consider that abnormally shaped foods have a lower value and are not worth the money or time necessary (ASCHEMANN-WITZEL; GIMÉNEZ; ARES, 2018). We propose that abnormally shaped foods face a trade-off between the normative goal of reducing food waste versus the hedonic goal of selecting the most good-looking food. We use the goal-framing theory to explain consumers' intentions to purchase abnormally shaped foods and make these foods more attractive and easier to consume.

The goal-framing theory proposes that the strength and salience of goals depend on a person's value priorities and the situational cues in the context (STEG et al., 2014a). Considering that consumer preference for abnormally shaped foods may depend on situational and personal factors (DE HOOGE et al., 2017), these elements of the theory can help propose interventions that increase the purchase of abnormally shaped foods. In the following sections, we review how values and situational cues can influence this behavior and present our hypotheses.

2.1 Values

Values refer to stable concepts or beliefs people have about what they want to achieve; they are ordered by relative importance and guide how people select or evaluate behaviors and events (SCHWARTZ; BILSKY, 1987). Values influence the chronic accessibility and salience of goals, determining the likelihood that a particular goal will become focal (STEG et al., 2014a). They influence people's preferences and choices by influencing how people perceive behaviors and how attractive attributes are for them (STEG et al., 2014a; VERPLANKEN; HOLLAND, 2002). Although people endorse all values to some extent (STEG et al., 2014a), individuals are likely to prioritize values differently. Thus, people tend to favor considerations and actions according to their most important values (STEG et al., 2014a).

Four values are important for environmental behaviors: *hedonic values*, which reflect a concern with improving one's feelings and reducing effort; *egoistic values*, which reflect a concern with safeguarding or increasing one's resources; *altruistic values*, which reflect a concern with other human beings, and *biospheric values*, which reflect a concern with nature and the environment (STEG et al., 2014b, 2014a). Hedonic and egoistic values are self-enhancement values, reflecting a concern with individual interests. Altruistic and biospheric values are self-transcendence values and reflect a concern with collective interests (STEG et al., 2014a, 2014b). According to

the goal-framing theory, hedonic values strengthen the hedonic goal; egoistic values the gain goal; altruistic and biospheric values the normative goal (STEG; LINDENBERG; KEIZER, 2016).

Some studies have investigated the influence of values on food consumption. Steg et al. (2014b) demonstrate that consumers tend to have value-congruent preferences and consider aspects of choices aligned to their values. In Study 3, participants indicated the likelihood of visiting a restaurant. The more respondents endorsed hedonic values, the more information on tasty food influenced their decisions; the more they endorsed altruistic values, the more they considered the working conditions of the restaurant's employees and the restaurant's environmental impact (STEG et al., 2014b).

De Hooge et al. (2017) investigated the influence of egoistic, altruistic, and biospheric values in the consumption of suboptimal foods at home and the supermarket. In general, value orientations did not influence the choices of suboptimal food products. However, consumers in the supermarket condition "were more likely to choose suboptimal products when […] they had a lower egoistic value orientation" (DE HOOGE et al., 2017, p. 86).

In another context, Schuitema and De Groot (2015) investigated the influence of biospheric and egoistic values on the intentions to purchase green products. When biospheric values were strong, green product attributes were more influential on consumers' purchasing intentions; and when biospheric values were weak, egoistic product attributes were more influential. This suggests that values (especially biospheric) strengthen or weaken the influence of product attributes on purchase intentions.

Therefore, studies show different results in terms of how values affect environmental behaviors. In studies applying the goal-framing theory in environmental behaviors (see do Canto, Grunert, De Barcellos (under review) for a review), most studies fail to investigate values or do not consider the four values in the theory. Our study contributes to the validation of the goal-framing theory by investigating the influence of the four values.

Based on the goal-framing theory (STEG et al., 2014b; STEG; LINDENBERG; KEIZER, 2016), we propose that three values (altruistic, biospheric, and hedonic) influence consumers' intention to purchase abnormally shaped foods. Consumers who prioritize biospheric and/or altruistic values tend to have the normative goal as focal –

what probably makes them motivated to reduce food waste. Therefore, we expect them to have a greater intention to purchase abnormally shaped foods. Consumers who prioritize hedonic values focus on behaviors that improve their feelings, paying attention to the appearance and the taste of the food. For these consumers, purchasing an abnormally shaped food goes against their naturally salient hedonic goal. Consumers who prioritize gain values will focus on improving personal resources, such as money. These consumers will likely base their intention on the food's price, in which case an abnormal appearance may not necessarily influence their intention. Formally:

H1a: The more a consumer supports biospheric and/or altruistic values, the higher intention to purchase abnormally shaped foods.
H1b: The more a consumer supports hedonic values, the lower intention to purchase abnormally shaped foods.

Despite the influence of values, people occasionally behave inconsistently with their strongly endorsed values (VERPLANKEN; HOLLAND, 2002). This may occur because of situational cues (STEG; LINDENBERG; KEIZER, 2016), which we address in the next section.

2.2 Situational Cues

Situational cues refer to elements in the environment that influence the relative strength of the goals (LINDENBERG, 2012). They can activate different cognitive structures (PAPIES, 2016a), inhibit concerns people usually have (STEG et al., 2014a), and activate less strongly endorsed values (VERPLANKEN; HOLLAND, 2002). The cues in a situation can prime a goal (THØGERSEN; ALFINITO, 2020) or increase (or decrease) the relative importance of a goal (LINDENBERG; PAPIES, 2019; STEG; LINDENBERG; KEIZER, 2016).

Environments usually have more cues supporting gain and hedonic goals and weakening the normative goal (LINDENBERG, 2012). The food domain is particularly challenging because it tends to be full of hedonic cues (for example, cues promoting indulgence) at the cost of long-term goals (such as health or sustainability) (PAPIES, 2016a). When buying food, the situation may have some chronic cues, such as the price (gain cue), taste and appearance (hedonic cues), and what others do (normative cue) (THØGERSEN; ALFINITO, 2020). Food shape abnormality, in particular, is a cue

intrinsic to the product (LOEBNITZ; SCHUITEMA; GRUNERT, 2015), which seems to give consumers' the perception of lower quality (HELMERT et al., 2017). To make people purchase foods with an abnormal appearance, it may be necessary to undo the negative effect of existing cues and shift the salience towards people's longer-term interests (LINDENBERG; PAPIES, 2019). Studies have tested different cues to promote abnormally shaped foods.

Mookerjee, Cornil, and Hoegg (2021) used an "ugly" label that corrected consumers' negative taste expectations in aesthetically unattractive foods and increased the likelihood of choosing these foods. The "ugly" label was most effective when associated with another cue, a moderate discount. This strategy reduced the negative influence of the appearance (hedonic cue) and made the gain goal support the consumption of ugly foods. Helmert et al. (2017) tested the influence of gain and hedonic cues on the choice of suboptimal foods, with the gain cue having the best impact on the purchase decision. Aschemann-Witzel, Giménez, and Ares (2018) tested the effect of strengthening normative and gain cues in the choice of abnormally shaped foods. They found that a food waste message significantly increased the choice likelihood of suboptimal products, compared to a price message highlighting the economic savings.

These studies show that cues associated with the three overarching goals can influence consumers' choice of abnormally shaped foods. While previous studies investigate two types of cues, our study tests three cues: hedonic, gain, and normative. Therefore, our second hypothesis proposes that cues in the environment increase consumers' intentions to purchase abnormally shaped foods. Formally:

> *H2: Situational cues in the behavioral context affect the intention to purchase abnormally shaped foods.*

Lindenberg and Steg (2007) propose two main strategies to encourage pro-environmental behaviors: making gain and hedonic goals more compatible with normative goals and strengthening the normative goal (LINDENBERG; STEG, 2007; STEG et al., 2014a; STEG; LINDENBERG; KEIZER, 2016). According to these strategies, we expect three cues to increase the intention to purchase abnormally shaped foods: (1) cues that reduce the negative influence of the hedonic cue; (2) cues

that make the gain goal support the normative goal; (3) cues that strengthen the normative goal. We refine our second hypothesis according to these three cues.

First, in terms of the hedonic goal, a study by de Hooge et al. (2017) found that northern-European consumers expected a bent cucumber to have a good taste, but not the same taste as the not abnormally shaped cucumber. Another study found that US consumers judged abnormally shaped foods as less tasty than non-abnormally shaped ones (MOOKERJEE; CORNIL; HOEGG, 2021). Based on these results, we assume that the abnormal shape is an intrinsic hedonic cue that impacts taste expectation.

Mookerjee, Cornil, and Hoegg (2021) corrected the negative taste expectation by adding an "ugly" label to the abnormal foods. Their study suggests that any label pointing out that the abnormality is in the foods' aesthetic could have a similar effect as a message[4] explaining that the visual differences do not pertain to healthiness or tastiness differences. Based on these findings, we expect that a hedonic cue stating that the food is tasty can increase consumers' purchase intentions. Formally:

H2a: A hedonic cue (e.g., a taste claim) increases the intention to purchase abnormally shaped foods.

Second, in terms of the gain goal, price strategies can help balance consumers' price-quality expectations and their goal of reducing food waste (ASCHEMANN-WITZEL et al., 2015). Studies show that offering a price discount on abnormally shaped foods can increase consumers' choice likelihood (HELMERT et al., 2017; MOOKERJEE; CORNIL; HOEGG, 2021) and willingness to purchase these foods (DE HOOGE et al., 2017). Therefore, we expect a gain cue – for example, a price discount claim – to increase the intention to purchase abnormally shaped foods. Formally:

H2b: A gain cue (e.g., a discount claim) increases the intention to purchase abnormally shaped foods.

[4] The exact message presented was: "Please be aware that although the two types of cucumbers that you will see look different, these differences in visual appearance do not pertain to any differences other than visual: for instance, they have similar gustatory or nutritive qualities." (MOOKERJEE; CORNIL; HOEGG, 2021, p. 70).

Third, a normative cue is expected to increase the chances that people act upon biospheric values (STEG et al., 2014a) and can be used to both promote abnormally shaped products and educate consumers about food waste. Results from previous studies applying the goal-framing theory support that interventions strengthening the normative goal can promote pro-environmental (CHAKRABORTY; SINGH; ROY, 2017; STEINHORST; KLÖCKNER; MATTHIES, 2015; TANG; CHEN; YUAN, 2019) and long-term oriented behaviors (BERGQUIST; NILSSON; EJELÖV, 2019; HANDGRAAF; VAN LIDTH DE JEUDE; APPELT, 2013), and may spill over to subsequent pro-environmental actions (BERGQUIST; NILSSON; EJELÖV, 2019).

In Aschemann-Witzel, Giménez, and Ares (2018), when a food waste message was present, the likelihood of choosing an abnormally shaped food tended to be greater, and all of the products' quality dimensions were perceived as higher. In Thøgersen and Alfinito (2020), when a normative goal (vs. a hedonic or gain goal) was primed, participants were more likely to choose organic tomatoes and less focused on the appearance of the tomatoes. These results suggest that "the priming of a normative goal reduces consumer requests for a perfect product appearance" (THØGERSEN; ALFINITO, 2020, p. 10). Therefore, we expect a normative cue – i.e., a claim stating that the abnormally shaped food reduces food waste – to strengthen the normative goal and increases consumers' purchase intention. Formally:

H2c: A normative cue (e.g., a food waste claim) increases the intention to purchase abnormally shaped foods.

In summary, we verify the effect of reducing the negative hedonic expectations versus strengthening the normative or the gain goal (LINDENBERG; PAPIES, 2019).

2.3 The interplay between values and situational cues

Values and situational factors should be considered simultaneously to understand and predict pro-environmental actions (STEG; LINDENBERG; KEIZER, 2016). However, most studies applying the goal-framing theory do not consider both factors (DO CANTO; GRUNERT; DE BARCELLOS, under review). Therefore, it is still necessary to better understand the relationship between values and situational cues (GENG; LONG; CHEN, 2016; LIOBIKIENĖ et al., 2020; STEG et al., 2014a) and how they affect behaviors when they conflict (DO CANTO; GRUNERT; DE BARCELLOS,

under review). Previous studies can give some ideas on the interplay between these factors. Based on studies that we review next, we expect that situational cues will only affect or have a stronger effect on people who prioritize values aligned to these cues.

In Verplanken and Holland (2002), the priming of environmental values resulted in value-congruent behavior (i.e., environmentally-friendly choices) only for individuals to whom environmental values were a central aspect of their selves. Similarly, in Loebnitz and Aschemann-Witzel (2016), priming environmental values increased organic product expectations only for participants with strong environmental values. For participants with weak environmental values, the direction of the effect was the opposite – i.e., they seemed to have less health and quality expectations when their environmental values were primed.

Loebnitz, Loose, and Grunert (2015) found a different result: The priming of environmental values enhanced the importance of environmental aspects (i.e., an environmentally-friendly production) only for participants with a low environmental value centrality. For participants with a high environmental value centrality, the priming did not significantly alter the importance of an environmentally friendly production.

Papies (2016b) show in a meta-analysis that priming effects seem to be stronger and more persistent over time if individuals strongly value the primed concepts. In another article, Papies (2016a) proposes that goal priming (such as cue interventions) should target individuals who value the primed goals. The author proposes that “only when a person values a concept that is activated by a prime […] will this lead to the motivational benefits that support goal pursuit” (PAPIES, 2016a, p. 416).

Therefore, besides the individual influence of values and situational cues, we also expect an interaction between them. Our final hypothesis states that if situational cues align with consumers’ prioritized values, the intention to purchase abnormally shaped foods increases; if situational cues conflict with consumers’ prioritized values, we expect the opposite effect, reducing the purchase intention. Formally:

> *H3. Values and situational cues interact to influence consumers’ purchase intentions, meaning that consumers’ purchase intentions increase (decrease) when cues and values match (differ).*

According to the goal-framing theory (STEG et al., 2014a; STEG; LINDENBERG; KEIZER, 2016), hedonic, gain, and normative cues more strongly

influence consumers that prioritize hedonic, gain, and altruistic/normative values, respectively. For example, suppose that a person who prioritizes biospheric and normative values sees a normative cue, such as a food waste claim. In that case, it should increase the intention to purchase abnormally shaped foods.

However, sometimes consumers see cues that are not aligned with their prioritized values. This may happen when individuals who prioritize biospheric and altruistic values see hedonic and gain cues; or when individuals that prioritize gain and hedonic values see normative cues. We expect two possible outcomes in this case.

First, the cue may be so strong that it temporarily overrules the influence of values on the goals (LINDENBERG; PAPIES, 2019). Consequently, the consumer will act based on the goal supported by the cue, creating an inconsistency between the consumer's values and the behavior (STEG; LINDENBERG; KEIZER, 2016; VERPLANKEN; HOLLAND, 2002). For example, suppose a consumer who strongly endorses hedonic values sees a food waste claim. In that case, the normative goal may become focal, and the consumer will be motivated to buy an abnormally shaped food – despite its unattractive appearance.

Second, the cue effect may backfire (BOLDERDIJK et al., 2013), highlighting that the behavior contradicts the consumer's prioritized values. Consequently, this may either not influence or reduce the intention to perform the behavior, as reviewed earlier in this section. Papies (2016a) suggests that priming a goal that the individual does not value will fail to motivate the individual to pursue that goal. Van der Laan et al. (2016) suggest that increased attention towards a food only increases the likelihood of choosing it if the food is already liked; if the food is initially not liked, it becomes less likely to be chosen.

We contend that a similar effect might occur in the interaction between cues and values. Suppose a person highly endorses gain and hedonic values. In that case, showing a normative cue may highlight facts not valued by the person and not affect or even inhibit the intention to purchase it. In the example of a consumer who strongly endorses hedonic values and sees a food waste claim, this claim may be a reminder that the consumer is not concerned about collective interests. As a result, the hedonic goal may become even more salient and reduce the intention to purchase an abnormally shaped food.

We tentatively refine our final hypothesis according to the second possibility:

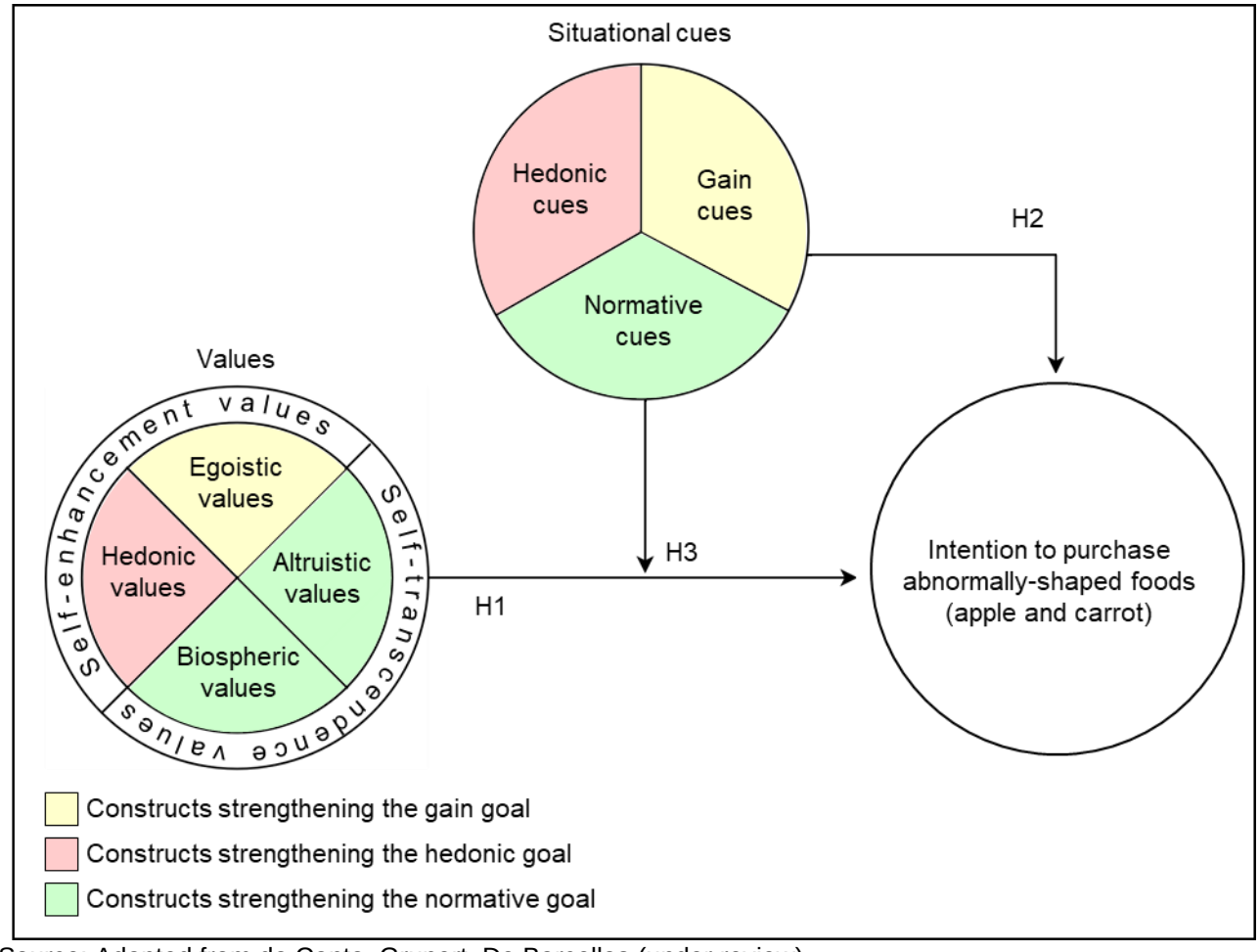
H3a. The hedonic cue has a higher (lower) influence on the purchase intention when consumers strongly support hedonic (biospheric and/or altruistic) values.

H3b. The gain cue has a higher (lower) influence on the purchase intention when consumers strongly support gain (biospheric and/or altruistic) values.

H3c. The normative cue has a higher (lower) influence on the purchase intention when consumers strongly support biospheric and/or altruistic (hedonic and/or gain) values.

Figure 1 summarizes the main hypotheses of the study.

Figure 1 – Visual representation of the hypotheses



Source: Adapted from do Canto, Grunert, De Barcellos (under review).

3. Methodological Procedures

3.1 Population and Participants

Our experiment targeted the population living in the United States for two reasons. First, around 10.1 million tons of cosmetically imperfect food remain unharvested at farms per year in the United States (REFED, 2016). Therefore, increasing consumers' willingness to buy abnormally shaped foods could help to reduce food loss in the country. The second reason is that, at the time of data collection, the United States was one of the most advanced countries in terms of vaccination against COVID-19. Therefore, we considered that respondents from the United States would be less influenced by the pandemics in comparison to respondents from other countries.

Participants (n = 600) were members of Netquest[5] permanent panel who reside in the United States. The sample (Table 1) was drawn to represent the United States in terms of gender, age (18 years old or more), and region. Participants received an invitation to partake in a 10-minute survey and received earnings according to Netquest's incentive point system. The survey took, on average, 7 minutes to complete. We excluded incomplete responses.

3.2 Experimental Design and Stimuli

The study followed a 4 (claim factor$_{Between_Factor}$: no claim, taste claim, waste claim, price claim) x 2 (food item$_{Within_Factor}$: apple, carrot) x 3 (values$_{Between_Factor}$: normative, hedonic, egoistic) within-between subjects' design. The food item factor is a within-factor, intending to generalize our findings across two food items and avoid product-specific effects (COOREMANS; GEUENS, 2019). Hence, we planned to aggregate our results. Therefore, we expected to end up with a 4 x 3 between-subjects design, leaving 12 conditions. However, as we found significant differences between the results of the two food items, we present them separately (section 4).

We selected pictures of two food items from Loebnitz, Schuitema, and Grunert (2015) according to two criteria: abnormality level (extremely abnormal) and frequency of consumption in the United States (PBH FOUNDATION, 2020). A commercial photographer designed the images, aiming for similarities in size and pixels, minimizing

[5] Netquest is a market research company certified under the ISO Standard 26362:2009.

any extraneous variance in the results. The images provide real examples of naturally occurring abnormalities in food products.

Table 1 – Sample description.

	n	%
Sex		
Female	250	58.3
Male	350	41.7
Age		
18-24	29	4.8
25-34	108	18.0
35-44	109	18.2
45-54	115	19.2
55-64	107	17.8
65+	132	22.0
Region of residence in the United States		
South	213	35.5
West	118	19.7
Midwest	146	24.3
North East	123	20.5
Education		
Completed some high school or less	17	2.8
High school graduate	139	23.2
Completed some college / Technical school / Associates Degree	230	38.3
College degree	120	20.0
Completed some postgraduate	24	4.0
Masters or professional degree	60	10.0
Doctorate, law, or professional degree	10	1.7
Monthly household income		
Less than $800	43	7.2
$800 - $1,249	35	5.8
$1,250 - $2,099	73	12.2
$2,100 - $2,999	63	10.5
$3,000 - $4,199	60	10.0
$4,200 - $5,499	92	15.3
$5,500 - $6,699	59	9.8
$6,700 - $8,299	48	8.0
$8,300 - $10,399	39	6.5
$10,400 - $12,499	17	2.8
$12,500 - $14,999	10	1.7
$15,000 - $17,499	6	1.0
$17,500 - $19,999	10	1.7
$20,000 or over	7	1.2
I prefer not to answer	38	6.3

Note. n = 600
Source: Prepared by the authors

The claim conditions represent cues related to the three goals in the goal-framing theory. We based these claims on the illustration of Steg, Lindenberg, and Keizer (2016), which links the gain goal to low prices, the hedonic goal to the tastiness, and the normative goal to environmental aspects. Therefore, as a gain cue, we used a price claim stating that the product is 25% cheaper. We defined this discount level based on previous studies (DE HOOGE et al., 2017; MOOKERJEE; CORNIL;

HOEGG, 2021). As a hedonic cue, we used a taste claim stating that the product is delicious. As a normative cue, we used a food waste claim stating that the product reduces food waste (Table 2). Thus, all participants saw the two food items in one of the four claim conditions. Each between-subjects factor (claim condition) was designed to be randomly assigned and equally present among participants. The project was approved by the Institutional Review Board at Aarhus University, approval number 2021-47.

Table 2 – Stimuli in the claim conditions.

Condition (between-subjects factor)	**Apple**	**Carrot**
No claim (control condition)		
Taste claim “I am delicious!” (hedonic cue)		
Food waste claim “I reduce food waste!” (normative cue)		
Price claim “I am 25% cheaper!” (gain cue)		

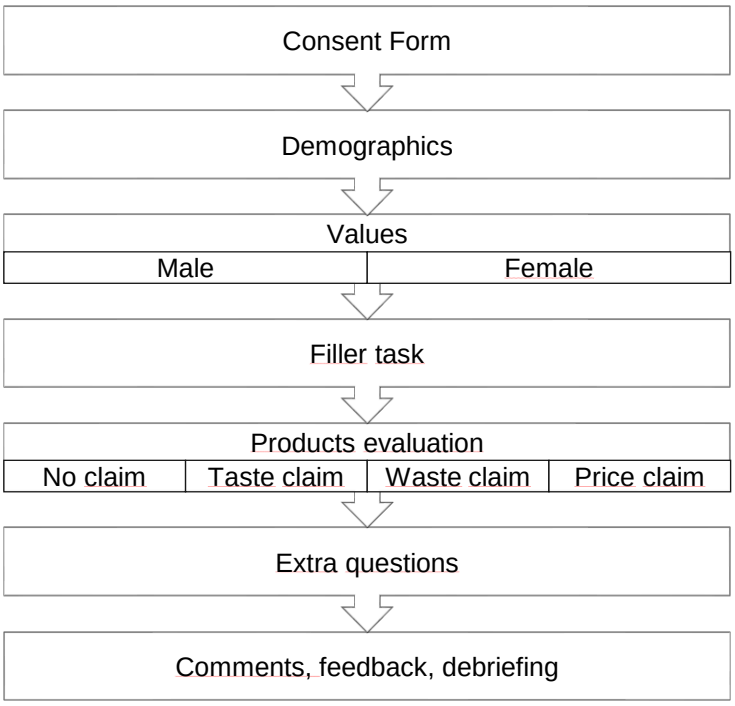
Source: Prepared by the authors.

3.3 Procedure

Figure 2 summarizes the data collection procedure. To avoid demand effects, participants were instructed that they would answer different questions about

consumers' characteristics and food preferences. After consenting to participate in the study, participants informed their sex, year of birth, and region. Respondents younger than 18 years old and who did not live in the United States were screened out in this stage. Next, each participant filled a values scale tailored to their sex (see section 3.4 for details). Then, they complete a filler task[6] based on Thøgersen and Alfinito (2020), which we added to avoid that the values scale would influence the products' evaluation.

Figure 2 – Survey design



Source: Prepared by the authors.

Afterward, based on the illustration of the theory by Steg, Lindenberg, and Keizer (2016), participants were instructed to "Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below". They saw two abnormally shaped food items (LOEBNITZ; SCHUITEMA; GRUNERT, 2015), one product at a time, together with the claim they were randomly assigned to (Table 2). After seeing each product, they indicated their purchase intention.

Participants also answered extra questions related to the claim condition, perception of abnormality of the food products, frequency of purchase of apples and carrots, and a food waste awareness scale. These questions were not used in the

[6] We only used the filler questions "Hobbies" from Thøgersen and Alfinito (2020) (see their Appendix 1, Table A), and none of the other questions (i.e., priming scales and other questions were not used in our questionnaire).

analysis, so we do not provide further details on them. Finally, participants were thanked for their participation, had the opportunity of writing a comment, and were debriefed. We also obtained information on participants' income and education level from the sample provider.

The study was designed in Qualtrics, and the Appendix shows the data collection instrument. Whenever possible, we randomized the order of questions (for example, when presenting the food items) or the statements within a question (for example, the values scale).

3.4 Measures

Values. We used the Environmental-SVS scale (BOUMAN; STEG; KIERS, 2018), which measures the four values proposed by the goal-framing theory (gain, hedonic, normative, and altruistic). Participants are instructed to compare themselves to other people, selecting how much they think the person is like them on a 7-point scale, from 1 (not like me at all) to 7 (very much like me). The people's descriptions match the participant's sex. For example, male participants saw descriptions with "him," as "It is important to him to protect the environment," while female participants saw descriptions with "her," as "It is important to her to have fun." The Appendix displays the scale.

Purchase Intentions. For every image presented, respondents expressed their purchase intentions on a 7-point scale, from 1 (very unlikely) to 7 (very likely) (LOEBNITZ; SCHUITEMA; GRUNERT, 2015).

4. Results

4.1 Values' Factor analysis

We conducted a confirmatory factor analysis to assess whether the items that theoretically fit with each value (altruistic, biospheric, egoistic, and hedonic) really relate to each other and relate more weakly to the others (BOUMAN; STEG; KIERS, 2018). Following Schwartz's scoring and analysis instructions for factor analysis (SCHWARTZ, 2016), we used the items' raw scores. The four initial factors explain 70.81% of the variance. All items but one grouped and correlated according to the

theorized value structure (Table 3). Item Ego5, “It is important to [him/her] to work hard and be ambitious,” loaded and correlated more strongly in the factor with altruistic values. Therefore, we removed this item and did a new factor analysis.

Table 3 – Correlation of the items of the values’ scale with the factors obtained by using all items.

	Factor 1	2	3	4
Explained variance	*20.01%*	*19.97%*	*15.54%*	*15.30%*
Altruistic values				
Alt1 - It is important to [him/her] that every person has equal opportunities	.350**	**.739****	-.024	.234**
Alt2 - It is important to [him/her] to take care of those who are worse off.	.456**	**.662****	.082*	.083*
Alt3 - It is important to [him/her] that every person is treated justly.	.347**	**.725****	-.074	.280**
Alt4 - It is important to [him/her] that there is no war or conflict	.472**	**.491****	.032	.246**
Alt5 - It is important to [him/her] to be helpful to others.	.311**	**.717****	-.073	.352**
Biospheric values				
Bio1 - It is important to [him/her] to prevent environmental pollution.	**.842****	.280**	.128**	.124**
Bio2 - It is important to [him/her] to protect the environment.	**.852****	.263**	.104*	.144**
Bio3 - It is important to [him/her] to respect nature.	**.662****	.411**	-.042	.350**
Bio4 - It is important to [him/her] to be in unity with nature.	**.755****	.159**	.209**	.288**
Egoistic values				
Ego1 - It is important to [him/her] to have control over others’ actions.	.107**	-.070	**.818****	-.090*
Ego2 - It is important to [him/her] to have authority over others.	.065	-.068	**.868****	-.124**
Ego3 - It is important to [him/her] to be influential.	.131**	.237**	**.716****	.179**
Ego4 - It is important to [him/her] to have money and possessions.	.016	.084*	**.698****	.291**
Ego5 - It is important to [him/her] to work hard and be ambitious.	.009	**.681****	.324**	.170**
Hedonic values				
Hed1 - It is important to [him/her] to have fun.	.244**	.160**	.055	**.836****
Hed2 - It is important to [him/her] to enjoy the life’s pleasures.	.216**	.305**	.136**	**.755****
Hed3 - It is important to [him/her] to do things [he/she] enjoys.	.220**	.363**	.021	**.773****

Note. The highest correlation in each item is in bold.
* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).
Source: Prepared by the authors.

In the second factor analysis, the explained variance rises to 72.68%. All items correlate most strongly with the theorized values structure (Table 4). Therefore, we did not add the item Ego5 in the following analyses.

Table 4 – Correlation of the items of the values' scale with the factors obtained by using all items but Ego5.

	Factor 1	2	3	4
Explained variance	*22.54%*	*18.01%*	*16.10%*	*16.03%*
Altruistic values				
Alt1 - It is important to [him/her] that every person has equal opportunities	**.813****	.222**	.232**	.021
Alt2 - It is important to [him/her] to take care of those who are worse off.	**.739****	.344**	.082*	.122**
Alt3 - It is important to [him/her] that every person is treated justly.	**.802****	.221**	.278**	-.029
Alt4 - It is important to [him/her] that there is no war or conflict	**.615****	.345**	.224**	.074
Alt5 - It is important to [him/her] to be helpful to others.	**.727****	.240**	.367**	-.051
Biospheric values				
Bio1 - It is important to [him/her] to prevent environmental pollution.	.370**	**.811****	.117**	.126**
Bio2 - It is important to [him/her] to protect the environment.	.355**	**.825****	.137**	.101*
Bio3 - It is important to [him/her] to respect nature.	.465**	**.632****	.354**	-.042
Bio4 - It is important to [him/her] to be in unity with nature.	.203**	**.771****	.289**	.189**
Egoistic values				
Ego1 - It is important to [him/her] to have control over others' actions.	-.057	.097*	-.096*	**.827****
Ego2 - It is important to [him/her] to have authority over others.	-.095*	.083*	-.118**	**.866****
Ego3 - It is important to [him/her] to be influential.	.193**	.134**	.198**	**.718****
Ego4 - It is important to [him/her] to have money and possessions.	.077	-.003	.290**	**.710****
Hedonic values				
Hed1 - It is important to [him/her] to have fun.	.181**	.233**	**.832****	.053
Hed2 - It is important to [him/her] to enjoy the life's pleasures.	.319**	.185**	**.756****	.143**
Hed3 - It is important to [him/her] to do things [he/she] enjoys.	.375**	.186**	**.776****	.028

Note. The highest correlation in each item is in bold.
* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).
Source: Prepared by the authors.

4.2 Values' cluster analysis

To group respondents according to their values' priorities, we first calculated the centered items' scores, according to Schwartz's scoring and analysis instructions for within-person mean centering (SCHWARTZ, 2016). This adjustment corrects for individual differences in the use of the scale, retaining the relative importance of each item to each participant (SCHWARTZ, 2003).

We conducted a k-means cluster analysis with the mean-centered scores of the 16 values' scale items (all but Ego 5), resulting in three clusters (Table 5): (1) the normative cluster, with the highest centralized mean for altruistic and biospheric values, (2) the egoistic cluster, with the highest mean for the egoistic values and a relatively high mean for biospheric values, and (3) the hedonic cluster, with the highest mean for the hedonic values, and the second highest mean for altruistic values.

Table 5 – Descriptive statistics of the k-mean cluster analysis.

Cluster	n	Values[a]	Minimum	Maximum	Mean	Std. Deviation
Normative	192	Altruistic	-.58	2.29	1.0666	.48105
		Biospheric	-.69	2.25	.8994	.51618
		Egoistic	-4.50	-1.50	-2.7751	.65619
		Hedonic	-2.31	2.50	.7232	.70047
Egoistic	228	Altruistic	-1.94	2.25	.0634	.46873
		Biospheric	-2.44	2.50	.1294	.54342
		Egoistic	-1.56	3.06	-.3092	.66244
		Hedonic	-3.75	3.06	.1341	.69751
Hedonic	180	Altruistic	-1.50	2.54	.7610	.57616
		Biospheric	-2.63	1.00	-.2365	.68718
		Egoistic	-3.38	.63	-1.5240	.59054
		Hedonic	-.46	3.50	1.0788	.70108

Note. The analysis used the mean-centered scores of the items in the values' scale, apart from the item Ego5

[a] Centered values' scores, according to Schwartz's scoring and analysis instructions for within-person mean centering (SCHWARTZ, 2016). The values are the average of the items that compose each value (except for Ego5), standardized according to each participant's average of all items in the values' scale.
Source: Prepared by the authors.

To confirm that the means differ between the clusters, we calculated an analysis of variance (one-way ANOVA) (Table 6). As expected, the ANOVA indicates a significant difference between the created clusters for all tested variables.

Table 6 – One-way ANOVA testing the differences between values' centered means in the clusters

Values[a]		Sum of squares	df	Mean square	F	Sig.
Altruistic	Between groups	112.102	2	56.051	218.005	.000
	Within groups	153.494	597	.257		
	Total	265.596	599			
Biospheric	Between groups	126.732	2	63.366	186.858	.000
	Within groups	202.450	597	.339		
	Total	329.182	599			
Egoistic	Between groups	634.720	2	317.360	775.597	.000
	Within groups	244.281	597	.409		
	Total	879.002	599			
Hedonic	Between groups	93.643	2	46.821	95.682	.000
	Within groups	292.137	597	.489		
	Total	385.780	599			

[a] Centered values' scores, according to Schwartz's scoring and analysis instructions for within-person mean centering (SCHWARTZ, 2016). The values are the average of the items that compose each value (except for Ego5), standardized according to each participant's average of all items in the values' scale.

The Tukey posthoc test (Table 7) confirms that clusters' differences are significant. To all values (altruistic, biospheric, egoistic, and hedonic), the Tukey test shows a significant difference between all clusters. For the altruistic value, the cluster with the highest score was the normative cluster, followed by the hedonic and the egoistic clusters, with averages of 1.066, 0.7610, and 0.634, respectively. The

biospheric value also had a higher mean in the normative cluster (0.8994), but the order was inverted for the other clusters, with a higher mean value for the egoistic cluster than for the hedonic cluster (0.1294 and -0.2365 respectively). As for the egoistic value, the order from highest to lowest mean was: egoistic cluster, hedonic and normative cluster, with means of -0.3092, -1.5240, and -2.7751 respectively. Finally, the hedonic value had the highest average in the hedonic cluster, followed by the normative and egoistic clusters. The average values for this profile were 1.0788, 0.7232, and 0.1341.

Table 7 – Tukey's posthoc test.

Dependent variable (values[a])	(I) Cluster	(J) Cluster	Average difference (I-J)	Standard error	Sig.	95% Confidence Interval	
						Inferior limit	Superior limit
Altruistic	Normative	Egoistic	1.00322*	.04967	.000	.8865	1.1199
		Hedonic	.30556*	.05261	.000	.1820	.4292
	Egoistic	Normative	-1.00322*	.04967	.000	-1.1199	-.8865
		Hedonic	-.69766*	.05056	.000	-.8165	-.5789
	Hedonic	Normative	-.30556*	.05261	.000	-.4292	-.1820
		Egoistic	.69766*	.05056	.000	.5789	.8165
Biospheric	Normative	Egoistic	.77003*	.05704	.000	.6360	.9040
		Hedonic	1.13587*	.06042	.000	.9939	1.2778
	Egoistic	Normative	-.77003*	.05704	.000	-.9040	-.6360
		Hedonic	.36584*	.05806	.000	.2294	.5023
	Hedonic	Normative	-1.13587*	.06042	.000	-1.2778	-.9939
		Egoistic	-.36584*	.05806	.000	-.5023	-.2294
Egoistic	Normative	Egoistic	-2.46585*	.06266	.000	-2.6131	-2.3186
		Hedonic	-1.25111*	.06637	.000	-1.4070	-1.0952
	Egoistic	Normative	2.46585*	.06266	.000	2.3186	2.6131
		Hedonic	1.21475*	.06378	.000	1.0649	1.3646
	Hedonic	Normative	1.25111*	.06637	.000	1.0952	1.4070
		Egoistic	-1.21475*	.06378	.000	-1.3646	-1.0649
Hedonic	Normative	Egoistic	.58906*	.06852	.000	.4281	.7501
		Hedonic	-.35562*	.07258	.000	-.5261	-.1851
	Egoistic	Normative	-.58906*	.06852	.000	-.7501	-.4281
		Hedonic	-.94468*	.06975	.000	-1.1086	-.7808
	Hedonic	Normative	.35562*	.07258	.000	.1851	.5261
		Egoistic	.94468*	.06975	.000	.7808	1.1806

* The average difference is significant at the 0.05 level.

[a] Centered values' scores, according to Schwartz's scoring and analysis instructions for within-person mean centering (SCHWARTZ, 2016). The values are the average of the items that compose each value (except for Ego5), standardized according to each participant's average of all items in the values' scale.

4.3 Purchase intention

To evaluate the effect of the explanatory factors, we intended to use an analysis of variance (ANOVA), which requires that the dependent variables are continuous and normally distributed. In this study, the dependent variables are a scale ranging from 1 (Very unlikely) to 7 (Very likely), which has an ordinal categorical nature. To confirm the impossibility of using ANOVA, the Kolmogorov-Smirnov test was performed (Table

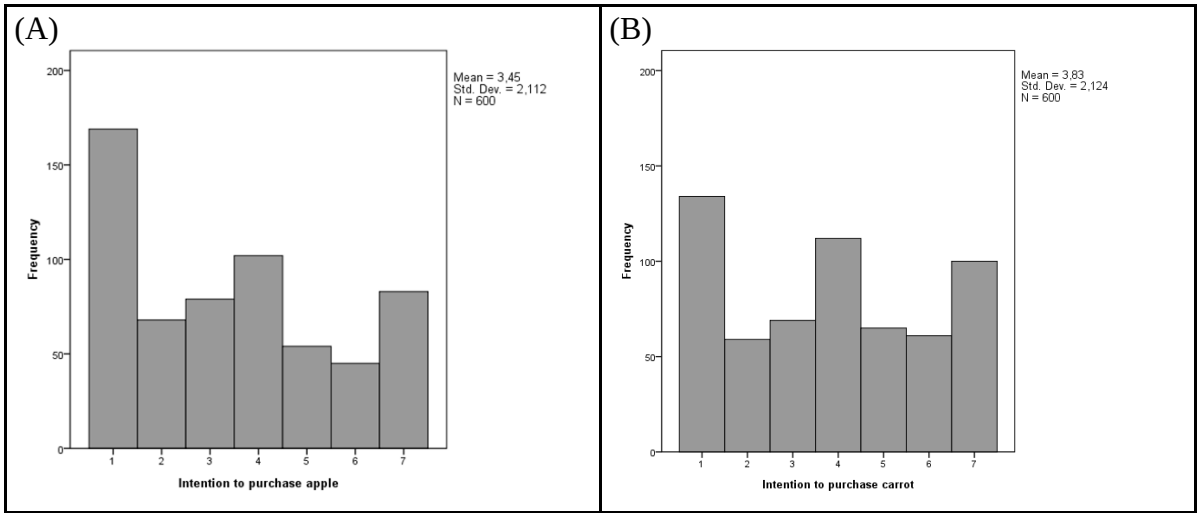
8), confirming that the response variables (intention to purchase apple and intention to purchase carrot) are not normally distributed. The null hypothesis of the test is that data are normally distributed. Thus, the test rejects the null hypothesis, indicating that the data are not normally distributed. The histograms (Figure 3) visually confirm the distribution of data.

Table 8 – Test of Normality

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Intention to purchase apple	,159	600	,000
Intention to purchase carrot	,132	600	,000

[a] Lilliefors Significance Correction

Figure 3 – Histograms of the intention to purchase apple (A) and carrot (B).



Source: Prepared by the authors.

Therefore, we treated the dependent variables “purchase intention” according to their categorical nature. To assess cause and effect hypotheses, we performed chi-square tests of independence, which indicate whether there is an association between the explanatory variable and the response variable. The adjusted residuals were used to show the nature of the dependencies found, i.e., which classes of explanatory variables are more strongly related to the purchase intention. According to Agresti (2002), the probability distribution of the adjusted residual is asymptotically normal, indicating that values above 1.96 are statistically associated with a 5% level of significance. If a higher level of significance is considered, for example, 10%, the value to be observed is 1.64.

Additionally, the strongest relationships identified by the adjusted residuals were indicated in the correspondence graph, with a significance level of 5% and 10%. The

correspondence analysis consists of a graphical representation of associations between two categorical variables and is mainly used as a descriptive tool (AGRESTI, 2002). In a correspondence analysis, the distance between objects represents the strength of the relationship between them.

The purchase intentions were categorized into 3 levels (Table 9): low (values 1 and 2), medium (values 3 to 5), and high (values 6 and 7). To analyze the interaction between values and claim condition (H3), we created a variable combining the Claim condition levels (4 levels) and Cluster (3 levels), forming a new interaction variable with 12 levels.

Table 9 – Frequencies of the categorized purchase intentions.

Purchase Intention	Apple		Carrot	
	Frequency	%	Frequency	%
Low	237	39,5	193	32,2
Medium	235	39,2	246	41,0
High	128	21,3	161	26,8
Total	**600**	**100,0**	**600**	**100,0**

Note. The level “low” corresponds to the values 1 and 2, “medium” to 3 to 5, and “high” to 6 and 7.
Source: Prepared by the authors.

The chi-square test (Table 10) indicates an association. The explanatory variable Cluster did not show a significant association with the intention to purchase the apple. The other relationships proved to be significant, indicating that the variables are related, i.e., there is an influence of one on the other.

Table 10 – Chi-square test.

Dependent Variable	Independent variable	df	Chi-Square	Sig
Purchase Intention Apple	Claim Condition	6	25,541	0,000
	Cluster	4	6,299	0,178
	Claim Condition x Cluster	22	41,571	0,007
Purchase Intention Carrot	Claim Condition	6	17,098	0,009
	Cluster	4	14,581	0,006
	Claim Condition x Cluster	22	41,982	0,006

Source: Prepared by the authors.

4.3.1 Cluster versus Purchase Intention (Carrot)

The evaluation of the explanatory variable Cluster (H1a and H1b) (which showed a significant association only with the purchase intention of the carrot in the chi-square test) showed that, with 5% significance, the purchase intention "Low" is

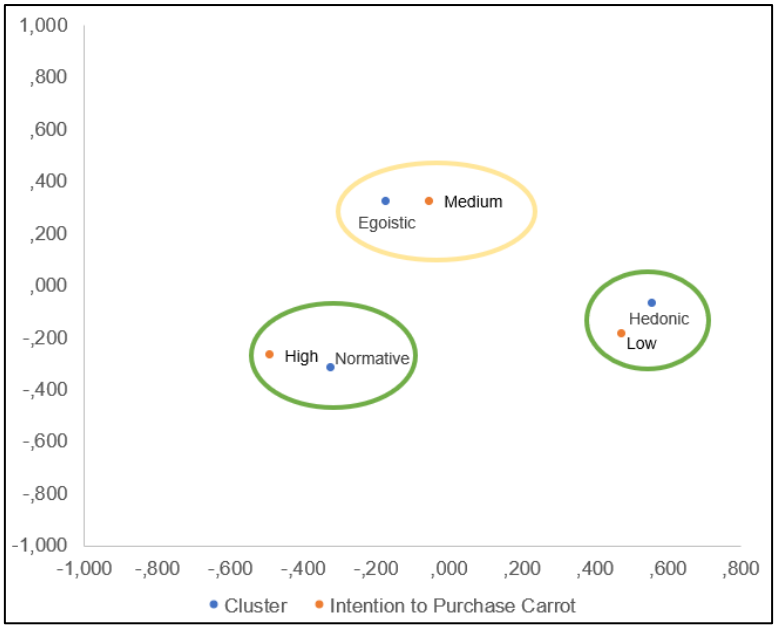
related to the cluster "Hedonic" and the “High” purchase intention is related to the “Normative” cluster. With a higher level of significance, 10%, the “Egoistic” cluster is related to the “Medium” intention of buying carrots. Table 11 and Figure 4 show the contingency table and the correspondence graph, respectively.

Table 11 – Contingency table: Clusters and the Intention to Purchase Carrot.

Cluster	**Statistics**	**Intention to Purchase Carrot**			**Total**
		Low	**Medium**	**High**	
Normative	n	56	72	64	192
	Ajusted residual	-1,08	-1,20	2,46**	
Egoistic	n	63	104	61	228
	Ajusted residual	-1,86	1,80*	-,03	
Hedonic	n	74	70	36	180
	Ajusted residual	3,07**	-,69	-2,47	
TOTAL	**n**	**193**	**246**	**161**	**600**

*p<0.1
**p<.05
Source: Prepared by the authors.

Figure 4 – Correspondence graph: Cluster and Intention to Purchase carrot



Source: Prepared by the authors.

4.3.2 Claim condition versus purchase intention

The evaluation of the explanatory variable claim condition (H2) (which showed a significant association with the intentions to purchase apple and carrot using the chi-square test) showed that, with 5% significance, the purchase intention “Low” is related

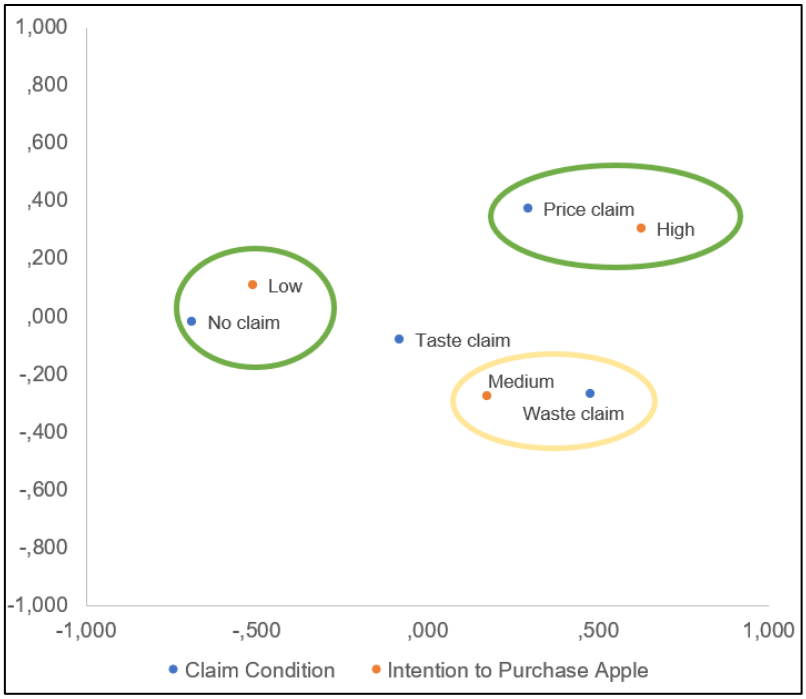
to the condition “No claim” and that the “High” purchase intention is related to the “Price claim” condition. With a lower level of significance, 10%, the “Waste Claim” condition is related to a “Medium” purchase intention for the apple and a “High” purchase intention for the carrot. Table 12 shows the contingency table and Figures 5 and 6 the correspondence graphs.

Table 12 – Contingency table: Claim Condition and the Purchase Intentions.

Claim Condition	**Statistics**	**Purchase Intention (Apple)**			**Purchase Intention (Carrot)**			**Total**
		Low	**Medium**	**High**	**Low**	**Medium**	**High**	
No claim	n	80	52	18	63	61	26	150
	Adjusted residual	4,00**	-1,30	-3,22	2,98**	-,10	-3,03	
Taste claim	n	62	60	30	51	64	37	152
	Adjusted residual	0,38	0,09	-0,56	,42	,32	-,80	
Price claim	n	52	55	41	39	60	49	148
	Adjusted residual	-1,25	-0,58	2,18**	-1,74	-,13	1,98**	
Waste claim	n	43	68	39	40	61	49	150
	Adjusted residual	-3,13	1,79*	1,61	-1,67	-,10	1,86*	
Total	**n**	**237**	**235**	**128**	**193**	**246**	**161**	**600**

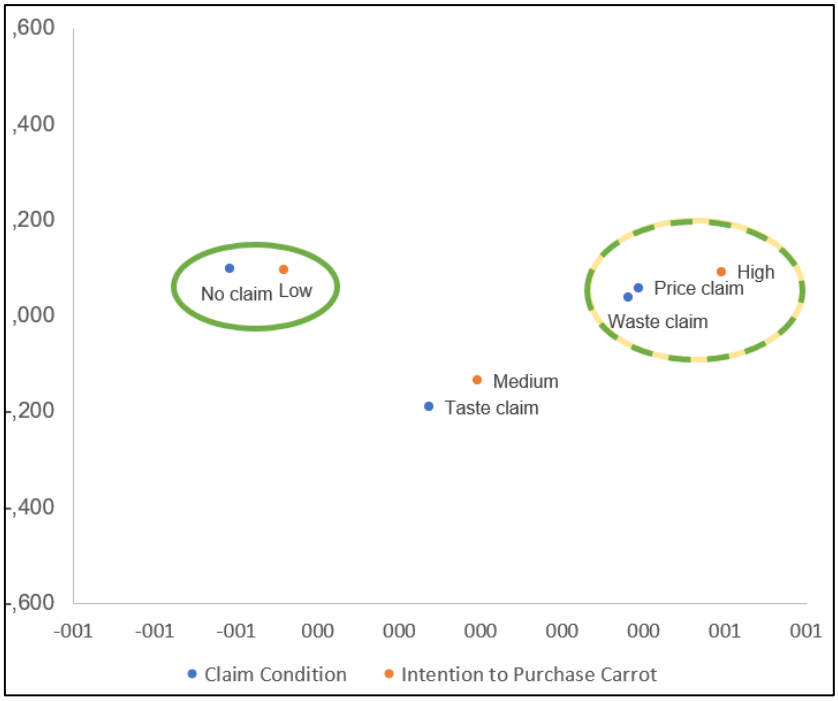
*p<0.1
**p<.05
Source: Prepared by the authors.

Figure 5 – Correspondence graph: Claim Condition and Intention to Purchase Apple



Source: Prepared by the authors.

Figure 6 – Correspondence graph: Cluster and Intention to Purchase Carrot



Source: Prepared by the authors.

4.3.3 Interaction of clusters of values and claim condition

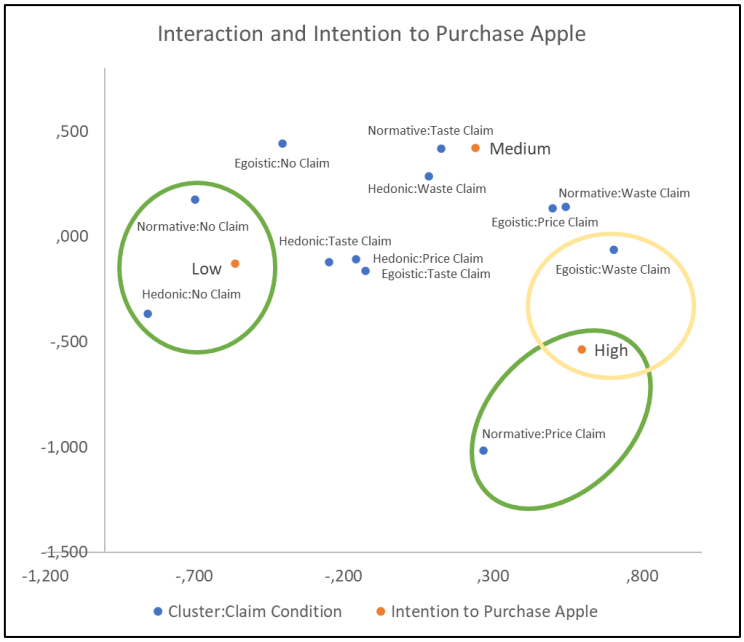
The evaluation of the interaction variable (cluster:claim condition), which showed a significant association with the purchase intentions of both apple and carrot in the chi-square test, showed that, with 5% significance, the "Low" purchase intention is related to the condition and “Hedonic:No claim” and the “High” purchase intention is related to the condition “Normative:Price claim.” “Normative:Waste Claim” has a significant relationship with the “High” intention to purchase carrot with 5% significance. Finally, “Egoistic:Waste claim” has a significant relationship with the “High” intention to purchase apple with 10% significance. Table 13 shows the contingency table and Figures 7 and 8 the correspondence graphs.

Table 13 – Contingency table: Interaction and Purchase Intentions.

Interaction		Statistics	Intention to Purchase Apple			Intention to Purchase Carrot			Total
Cluster	**Claim Condition**		**Low**	**Medium**	**High**	**Low**	**Medium**	**High**	
Normative	No Claim	n	26	17	5	16	22	10	48
		Adjusted residual	2,17**	-0,55	-1,92	0,18	0,71	-0,98	
	Taste Claim	n	19	26	10	16	25	14	55
		Adjusted residual	-0,79	1,29	-0,60	-0,51	0,70	-0,24	
	Price Claim	n	17	11	16	11	12	21	44
		Adjusted residual	-0,12	-2,00	2,53**	-1,06	-1,92	3,25**	
	Waste Claim	n	12	21	12	13	13	19	45
		Adjusted residual	-1,83	1,07	0,91	-0,49	-1,72	2,42**	
Egoistic	No Claim	n	25	23	6	22	23	9	54
		Adjusted residual	1,07	0,54	-1,92	1,41	0,25	-1,77	
	Taste Claim	n	22	18	11	17	22	12	51
		Adjusted residual	0,56	-0,59	0,04	0,19	0,32	-0,56	
	Price Claim	n	18	30	17	14	31	20	65
		Adjusted residual	-2,06	1,22	1,00	-1,94	1,16	0,76	
	Waste Claim	n	14	26	18	10	28	20	58
		Adjusted residual	-2,52	0,93	1,90*	-2,56	1,19	1,38	
Hedonic	No Claim	n	29	12	7	25	16	7	48
		Adjusted residual	3,09**	-2,10	-1,19	3,08**	-1,13	-2,00	
	Taste Claim	n	21	16	9	18	17	11	46
		Adjusted residual	0,89	-0,63	-0,30	1,05	-0,58	-0,47	
	Price Claim	n	17	14	8	14	17	8	39
		Adjusted residual	0,54	-0,43	-0,13	0,52	0,34	-0,92	
	Waste Claim	n	17	21	9	17	20	10	47
		Adjusted residual	-0,49	0,81	-0,38	0,61	0,23	-0,90	
TOTAL		**n**	**237**	**235**	**128**	**193**	**246**	**161**	**600**

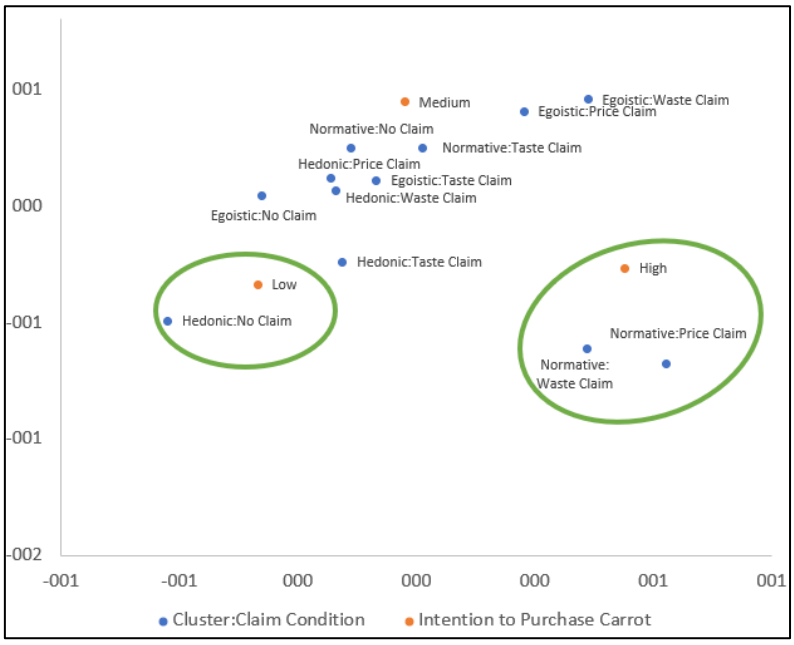
*p<0.1
**p<.05
Source: Prepared by the authors.

Figure 7 – Correspondence graph: Interaction and Intention to Purchase Apple



Source: Prepared by the authors.

Figure 8 – Correspondence graph: Cluster and Intention to Purchase Carrot



Source: Prepared by the authors.

5. Discussion

This study investigates the influence of values and situational cues on consumers' intentions to purchase abnormally shaped foods and the extent to which these factors interact. In this section, we discuss the results related to our hypotheses

(sections 5.1 to 5.3, see Table 14 for a summary), followed by managerial and theoretical implications (section 5.4) and limitations and future studies (section 5.5).

Table 14 – Summary of hypothesis testing.

Hypothesis	Description	Result
H1a	The more a consumer supports biospheric and/or altruistic values, the higher intention to purchase abnormally shaped foods.	Partially supported
H1b	The more a consumer supports hedonic values, the lower intention to purchase abnormally shaped foods.	Partially supported
H2	Situational cues in the behavioral context affect the intention to purchase abnormally shaped foods.	Supported
H2a	A hedonic cue (e.g., a taste claim) increases the intention to purchase abnormally shaped foods.	Not supported
H2b	A gain cue (e.g., a discount claim) increases the intention to purchase abnormally shaped foods.	Supported
H2c	A normative cue (e.g., a food waste claim) increases the intention to purchase abnormally shaped foods.	Partially supported
H3	Values and situational cues interact to affect consumers' purchase intention, such that cues aligned (contrary) to central values increase (decrease) consumers' purchase intentions.	Not supported
H3a	The hedonic cue has a higher (lower) influence on the purchase intention when consumers strongly support hedonic (biospheric and/or altruistic) values.	Not supported
H3b	The gain cue has a higher (lower) influence on the purchase intention when consumers strongly support gain (biospheric and/or altruistic) values.	Not supported
H3c	The normative cue has a higher (lower) influence on the purchase intention when consumers strongly support biospheric and/or altruistic (hedonic and/or gain) values.	Partially supported

Source: Prepared by the authors.

5.1 Values and Purchase Intention

We found a significant relationship between the clusters and the purchase intention of the carrot. According to our expectations, the cluster with stronger altruistic and biospheric values was associated with a higher purchase intention (H1a), and the cluster with stronger hedonic values was associated with a lower intention to purchase the carrot (H1b). This result partially supports our hypotheses H1a and H1b, since it was not replicated in the apple.

Our results differ from the study by de Hooge et al. (2017), which found that an altruistic or biospheric value orientation did not influence the choice of suboptimal foods. This difference might be because we focus on a specific food category (fruits and vegetables) and type of suboptimality (abnormal shape), while they consider the overall choice of suboptimal foods in different categories. Their study does not include hedonic values, so we contribute by showing that high support of these values is associated with a lower intention to purchase abnormally shaped foods.

Our investigation of values also tests the scale by Bouman, Steg, and Kiers (2018) in the US context, showing that most items group according to the theorized structure. The only item that failed to fit with the expected factor is the Egoistic item “It is important to [him/her] to work hard and be ambitious,” which loaded and correlated more strongly in the factor with altruistic values. We speculate this might have happened because of participants’ interpretation, as somebody can work hard with altruistic purposes – for example, to provide for the family. Future studies should verify how this item groups in other contexts and whether it is necessary to correct or remove it from the scale.

5.2 Claims and purchase intention

Results support the influence of situational cues, since consumers are less likely to purchase abnormally shaped foods when these are presented without a claim (H2). The discount message was associated with the highest purchase intention, supporting H2b. This result is similar to Helmert et al. (2017), who indicate that the abnormal appearance makes consumers expect a lower price. In Helmert et al. (2017), a price claim (vs. no claim or a taste claim) also increased the choice of visually suboptimal foods.

The food waste message was associated with a medium (apple) and high (carrot) purchase intention, partially supporting H2c. This result supports that priming a normative goal might reduce the importance of product appearance because of its link with food waste (THØGERSEN; ALFINITO, 2020).

The taste claim was not associated with the purchase intention, failing to support H2a. Previous studies have shown that abnormally shaped foods have a worse perception of taste (COOREMANS; GEUENS, 2019; MOOKERJEE; CORNIL; HOEGG, 2021) and that an “ugly” label (MOOKERJEE; CORNIL; HOEGG, 2021) or a smiling face on the food (COOREMANS; GEUENS, 2019) can increase their purchase intention through and improved perception of taste. Based on that, we expected that a direct claim stating that the food has good taste could lead to a higher purchase intention, but this was not confirmed.

5.3 Interaction between values and cues

We found three claim interactions with the normative cluster. First, we found a higher purchase intention when the normative cluster interacts with the price claim.

This may be a situation in which gain and normative goals are aligned (STEG et al., 2014a; STEG; LINDENBERG; KEIZER, 2016): for consumers who value the environment, gaining a financial incentive for reducing food waste becomes a reward for a behavior they consider important. Second, the normative cluster interacted with the waste claim, leading to a higher purchase intention of the carrot. This result partially supports H3c, which expected that a normative cue would more strongly impact consumers prioritizing altruistic and biospheric values. Third, the interaction between no claim and the normative cluster is associated with a low purchase intention. This shows that even consumers with strong altruistic and biospheric values may not want to purchase some abnormally shaped foods if the product is presented without a claim. Without a cue pointing to that, consumers may not realize that this is a pro-environmental behavior (LINDENBERG; STEG, 2007). Besides, without cues in the environment, the abnormal appearance may become even more salient and push altruistic and biospheric values to the background.

In the egoistic cluster, the only interaction is with the food waste claim, which was associated with a high purchase intention of the apple. This is an unexpected result, as consumers prioritizing egoistic values are likely to focus on their personal gains (STEG; LINDENBERG; KEIZER, 2016). A possible explanation is that this happened because, although the egoistic cluster has the highest egoistic values mean, it also has the second highest biospheric values' average (see Table 5). Therefore, the food waste claim may have brought the relatively strong biospheric values to the foreground.

The hedonic cluster only interacted with the no claim condition, leading to a lower purchase intention. This reinforces that consumers with stronger hedonic values may be more influenced by the appearance of the food, leading to a stronger rejection, especially when no communication is used to promote the food.

Therefore, apart from H3c, which was partially supported, our third hypothesis was not supported by results. Despite our expectations that the values and cues that are aligned (vs. contrary) to each other could strengthen (vs. weaken) the purchase intention, this did not happen in the study. Even for consumers with high altruistic and biospheric values, the price claim was associated with the highest purchase intention. A possible explanation may be that the behavior investigated frames a gain goal, as it is a purchase situation (THØGERSEN; ALFINITO, 2020). Future studies could verify

the interaction and effects of values and cues in pro-environmental behaviors that do not involve a financial transaction.

5.4 Managerial and theoretical implications

Interventions to promote pro-environmental behaviors may be more effective when considering both individual and situational factors (LINDENBERG; STEG, 2007). By investigating how values and cues interact, we can better understand how to communicate abnormally shaped foods to different consumer segments (ASCHEMANN-WITZEL et al., 2015). Our results suggest that the effects of claims may be limited to individuals who were already motivated to do so in the first place (PAPIES, 2016a), which may reduce the large-scale effectiveness of practical implications. Managers may more easily sell abnormally shaped foods to consumers who already care about the environment and others, especially if the foods have discounts or food waste claims.

Results also show that it may be challenging to sell abnormally shaped foods to consumers with strong hedonic values, who focus on the food's appearance and taste (STEG; LINDENBERG; KEIZER, 2016). Consumers in the hedonic group presented a lower intention to purchase the abnormally shaped foods, and none of the claims led to a high purchase intention. Alternative strategies may be more effective, such as labeling the food "ugly" (MOOKERJEE; CORNIL; HOEGG, 2021) or attributing human characteristics to the foods (COOREMANS; GEUENS, 2019). Besides, the food chain may use other strategies to sell abnormally shaped foods to the more hedonic consumers. For example, using abnormally shaped foods as ingredients to other foods does not reveal the food's appearance before being processed. This is a common strategy to use with less appreciated but edible foods, such as surplus foods or ingredients obtained during the manufacturing of other foods (BHATT et al., 2018).

Our study also finds that abnormally shaped foods without claims are associated with the lowest purchase intention, showing a need to add claims when selling these foods. Claims can focus on different aspects, such as foods being tasty or contributing to the environment; results from this study indicate price reduction claims as the best claim to increase consumers' intention to purchase abnormally shaped foods and the food waste claim as the second-best option.

A caveat to this recommendation is that a price claim may only work in the short term (BERGQUIST; NILSSON; EJELÖV, 2019) and prevent consumers from adopting

pro-environmental actions that lack a financial incentive (STEG; LINDENBERG; KEIZER, 2016). Although the effects of the normative cue are weaker, they may be longer-lasting (STEG et al., 2014a) and spillover to other pro-environmental behaviors (BERGQUIST; NILSSON; EJELÖV, 2019). Future studies could investigate the long-term effect of the different cues to learn if these interventions can be successful over time (BRANDSMA; BLASCH, 2019; HANDGRAAF; VAN LIDTH DE JEUDE; APPELT, 2013; STEG; VLEK, 2009), and how the intentions may differ from post-adoption behaviors (DASTJERDI et al., 2019).

Theoretically, this study contributes to the replication and cross-validation of the goal-framing theory (STEG et al., 2014a) by providing empirical data in the context of abnormally shaped foods using an experimental research design (BRANDSMA; BLASCH, 2019). We also contribute to understanding how individual and situational factors simultaneously influence behaviors (STEG et al., 2014a) by testing assumptions of the theory (DO CANTO; GRUNERT; DE BARCELLOS, under review). In particular, we explore the influence of the hedonic goal in a different context than car usage (LINDENBERG; STEG, 2007). The hedonic goal has been disregarded in many studies applying the goal-framing theory (DO CANTO; GRUNERT; DE BARCELLOS, under review), but hedonic aspects seem to be the biggest challenge for the promotion of abnormally shaped foods, as consumers prioritizing hedonic values showed a lower purchase intention and the taste claim did not influence the purchase intention.

5.5 Limitations and future studies

Our research was restricted to an online experiment with on-screen images, no price, and measuring consumers' self-reported purchase intentions. This is a relatively artificial and unrealistic setting, not very related to everyday life (DE HOOGE et al., 2017; WILSON; ARONSON; CARLSMITH, 2010). However, past research also uses online studies to investigate the intention to purchase suboptimal and abnormally shaped foods (DE HOOGE et al., 2017; LOEBNITZ; LOOSE; GRUNERT, 2015). This approach has the advantage of presenting a higher internal validity, since there is more control over the variables involved and reduced uncertainties regarding causality (WILSON; ARONSON; CARLSMITH, 2010). Future studies can confirm the effectiveness of the claims by investigating actual behavior in real-life purchase situations (ASCHEMANN-WITZEL; GIMÉNEZ; ARES, 2018).

Our study also only investigates two food items and one country, which compromises the generalizability to other food types and contexts. We found different results regarding the apple and the carrot, although previous studies did not report different purchase intentions across these same pictures (LOEBNITZ; GRUNERT, 2015; LOEBNITZ; SCHUITEMA; GRUNERT, 2015). These studies collected data in other contexts (Denmark and China, respectively). A study in the United States with other pictures of abnormally shaped apples and bell peppers also found a lower purchase intention for apples (COOREMANS; GEUENS, 2019), which might be influenced by the fact that apples are more often consumed uncooked, while bell peppers are more often used in cooking (DE HOOGE et al., 2017). A similar effect might have occurred in our study, as fruits are more often consumed as snacks in the United States, while vegetables are usually a part of lunch and dinner (PBH FOUNDATION, 2020).

6. Conclusion

The over-emphasis on foods' appearance contributes to loss and waste in the food chain, which can be reduced if consumers accept products with an abnormal appearance (PORTER et al., 2018). This study tests an intervention based on the goal-framing theory, showing how values and situational cues influence consumers' intention to purchase abnormally shaped foods. This means that there is not a single solution to address groups of consumers with different individual traits. The best solution may be a combination of processing solutions and actions tailored to different segments of consumers.

References

The references of this paper are presented together with the references of the dissertation.

4 CONCLUSION

This dissertation investigates how to motivate circular food behaviors based on the goal-framing theory. We have elaborated three papers to fulfill our main goal.

The first paper reviews the literature on circular food behaviors, providing a better understanding of the study context. It also categorizes circular food behaviors in three types as linear, transitioning, and circular. For each type, we identified consumers' role, sustainability goals, engagement, and technology, offering a framework to better understand the changes towards more sustainable behaviors. To our knowledge, this is the first paper to review and systematize food behaviors that contribute to the circular economy.

The second paper compares the goal-framing theory with established theories, highlighting its strengths and weaknesses. Next, we review empirical research applying the goal-framing theory to study environmental behaviors. This contributes to our understanding of what has been done so far and which gaps need to be addressed by future research based on the theory. Finally, we propose a model visually representing the goal-framing theory, which is tested in the final paper.

The third paper builds upon the two prior papers: it tests assumptions of the goal-framing theory in an intervention promoting a circular food behavior. Through an online experiment, we test the effect of values and situational cues on consumers' intention to purchase abnormally shaped foods. This paper contributes with empirical evidence applying the goal-framing theory in our context of the study. Results partially support our hypotheses related to the influence of consumers' values and situational cues on the intention to purchase abnormally shaped foods. We provide practical implications tailored to different groups of consumers, which the food chain actors can use in sales or campaigns to promote this circular food behavior.

The dissertation brings several theoretical and practical contributions and indicates avenues for future research. First, we contribute to a better understanding of consumers' role in the circular economy (GHISELLINI; CIALANI; ULGIATI, 2016; KIRCHHERR; REIKE; HEKKERT, 2017; MERLI; PREZIOSI; ACAMPORA, 2018). Current studies on the circular economy are mainly directed towards the technological innovations necessary to the circular economy transition (DE JESUS; MENDONÇA, 2018) and emphasize the role of private businesses, regulators, and policymakers in

the circular economy (GEISSDOERFER et al., 2017). However, a successful transition to the circular economy also needs to involve consumers (MERLI; PREZIOSI; ACAMPORA, 2018). Therefore, we contribute to expanding the literature on consumption towards the circular economy. Specifically, our first paper reviews how the literature has addressed this topic in the food context, and the third one proposes an intervention promoting a circular food behavior.

In a review, Camacho-Otero, Boks, and Pettersen (2018) show that studies on consumption in the circular economy have mainly applied the theory of planned behavior (AJZEN, 1991) and related theories followed by economic theories and consumer culture theories. They conclude that “less work has been done on how to trigger change both at the individual and collective levels to help the diffusion of circular solutions and the transition towards a circular economy” (CAMACHO-OTERO; BOKS; PETTERSEN, 2018, p. 18). In this way, this dissertation contributes to filling gaps related to motivational aspects through the lens of the goal-framing theory (LINDENBERG; STEG, 2007). As the lack of consumers’ interest in the circular economy is considered one of the main barriers to its implementation (KIRCHHERR et al., 2018), a theory based on motivation is ideal for promoting behavioral changes. By conducting an intervention study, we contribute to identifying how different incentives can (or not) promote consumers’ participation in the circular economy transition (BORRELLO et al., 2016).

This dissertation also contributes to the goal-framing theory validation and development, since this is a reasonably new theory, with some of the assumptions supported in one or a few studies only, with the need for additional cross-validation of findings (STEG et al., 2014a). We have used the goal-framing theory to investigate the consumption of abnormally shaped foods — a behavior that, to the best of our knowledge, has not been investigated through the lens of the theory before. By supporting some of its assumptions, we contribute to the theory validation and also to understand how, under which conditions, and which situational factors can change a situation to promote pro-environmental behaviors (STEG; LINDENBERG; KEIZER, 2016).

Results suggest that consumers who prioritize altruistic and biospheric values may more easily engage in circular food behaviors, especially if the behavior is supported by gain or normative cues. It may be harder to engage consumers who

prioritize hedonic values. However, we have only investigated one circular food behavior, so our results cannot be generalized to other behaviors.

Besides the limitations discussed in each paper, we acknowledge the final paper could have been more clearly positioned in the context of circular food behaviors. For example, we could have done the experimental study in the context of a food community, instead of a traditional supermarket. This would be more aligned with the shift towards circular food systems, since it would involve a circular food behavior in a circular business model. Therefore, future studies should address how values and cues influence other circular food behaviors found in our first paper (DO CANTO; GRUNERT; DE BARCELLOS, 2021), and seek to investigate these behaviors in the context of circular business models.

Other avenues for future research relate to the goal-framing theory. Studies can investigate how different goals interact to change behavior, test the theory's assumptions in other contexts, investigate other types of behaviors, and use other types of research designs, such as field experiments investigating real behavior.

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APPENDIX — SURVEY QUESTIONNAIRE

Start of Block: Consent Form

Consent form

1. Consumers' characteristics and food preferences

You are being invited to take part in the research study Consumers' characteristics and food preferences. We would like to ask you for your consent to participate in the study and for us to treat your data in agreement with data protection legislation. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please take the time to read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.

2. Project description and aim of the study

This project is financed by the Department of Management, Aarhus University. We recruit participants from a panel provided by Netquest. You will be asked to compare yourself to other people, answer questions about people's hobbies and work activities, and to evaluate some fruits and vegetables, so we can learn more about consumers' characteristics and food preferences. We will use the findings from the study in academic articles and presentations in aggregated and anonymized form.

3. Data controller, research group and principal investigator

Aarhus University is the data controller. Klaus G Grunert, Natália Rohenkohl do Canto, Marcia Dutra de Barcellos, and Natascha Loebnitz are responsible for the study.

Principal investigator: Klaus G Grunert, klg@mgmt.au.dk

4. Study procedure

For this study, you will take part in a quantitative study consisting of three main tasks:

(1) You will compare yourself to different people.

(2) You will answer questions about hobbies and work activities.

(3) You will evaluate fruits and vegetables.

5. Benefits and risks

There are no risks beyond those encountered in normal everyday life. Your expected earnings for participating in the study are determined by Netquest's incentive point system. The study is expected to last around 10 minutes.

6. Personal data

We do not collect any personal data.

7. Withdrawal of consent

Participation is voluntary and you may withdraw your consent at any time without stating a reason. Because the data is anonymous, the only way of withdrawing your consent is by exiting the study before completion (by closing the web browser). We will delete the incomplete responses.

By clicking the button below, I confirm to have received, read and understood the above information and that:

A. My participation is voluntary, and I may withdraw my consent and discontinue participation in the project at any time as specified in point 7. My refusal to participate will not result in any penalty.

B. By giving my consent, I do not waive any legal rights or release Aarhus University or its agents from liability for negligence.

- ○ I give my consent to treat my personal data and to participate as a subject in the study as described above. (1)
- ○ I do not give my consent, I do not wish to participate (2)

Please, confirm you are not a robot

End of Block: Consent Form

Start of Block: Sex and year of birth

What is your sex?

- ○ Male (1)
- ○ Female (2)

What is your year of birth?

_____

End of Block: Sex and year of birth

Start of Block: Values - male

Here we briefly describe different people. Please read each description and think about how much that person is or is not like you. Select the option to the right that shows how much the person described is like you.

	Not like me at all (1)	(2)	(3)	(4)	(5)	(6)	Very much like me (7)
It is important to him to prevent environmental pollution. (1)	○	○	○	○	○	○	○
It is important to him to protect the environment. (2)	○	○	○	○	○	○	○
It is important to him to respect nature. (3)	○	○	○	○	○	○	○
It is important to him to be in unity with nature. (4)	○	○	○	○	○	○	○
It is important to him that every person has equal opportunities. (5)	○	○	○	○	○	○	○
It is important to him to take care of those who are worse off. (6)	○	○	○	○	○	○	○
It is important to him that every person is treated justly. (7)	○	○	○	○	○	○	○
It is important to him that there is no war or conflict (8)	○	○	○	○	○	○	○
It is important to him to be helpful to others. (9)	○	○	○	○	○	○	○
It is important to him to have fun. (10)	○	○	○	○	○	○	○
It is important to him to enjoy the life's pleasures. (11)	○	○	○	○	○	○	○

	Not like me at all (1)	(2)	(3)	(4)	(5)	(6)	Very much like me (7)
It is important to him to do things he enjoys. (12)	○	○	○	○	○	○	○
It is important to him to have control over others' actions. (13)	○	○	○	○	○	○	○
It is important to him to have authority over others. (14)	○	○	○	○	○	○	○
It is important to him to be influential (15)	○	○	○	○	○	○	○
It is important to him to have money and possessions. (16)	○	○	○	○	○	○	○
It is important to him to work hard and be ambitious. (17)	○	○	○	○	○	○	○

End of Block: Values - male

Start of Block: Values - female

Here we briefly describe different people. Please read each description and think about how much that person is or is not like you. Select the option to the right that shows how much the person described is like you.

	Not like me at al (1)	(2)	(3)	(4)	(5)	(6)	Very much like me (7)
It is important to her to prevent environmental pollution. (1)	○	○	○	○	○	○	○
It is important to her to protect the environment. (2)	○	○	○	○	○	○	○
It is important to her to respect nature. (3)	○	○	○	○	○	○	○
It is important to her to be in unity with nature. (4)	○	○	○	○	○	○	○
It is important to her that every person has equal opportunities. (5)	○	○	○	○	○	○	○
It is important to her to take care of those who are worse off. (6)	○	○	○	○	○	○	○
It is important to her that every person is treated justly. (7)	○	○	○	○	○	○	○
It is important to her that there is no war or conflict (8)	○	○	○	○	○	○	○

	Not like me at al (1)	(2)	(3)	(4)	(5)	(6)	Very much like me (7)
It is important to her to be helpful to others. (9)	○	○	○	○	○	○	○
It is important to her to have fun. (10)	○	○	○	○	○	○	○
It is important to her to enjoy the life's pleasures. (11)	○	○	○	○	○	○	○
It is important to her to do things she enjoys. (12)	○	○	○	○	○	○	○
It is important to her to have control over others' actions. (13)	○	○	○	○	○	○	○
It is important to her to have authority over others. (14)	○	○	○	○	○	○	○
It is important to her to be influential (15)	○	○	○	○	○	○	○
It is important to her to have money and possessions. (16)	○	○	○	○	○	○	○
It is important to her to work hard and be ambitious. (17)	○	○	○	○	○	○	○

End of Block: Values - female

Start of Block: Filler questions

Now comes a series of questions about what you think most people do. Please indicate whether you believe each statement is true or false.

	True (1)	False (2)
The average person in the United States spends around 5 hr a week pursuing a “hobby” (1)	○	○
The most popular hobby in the United States for men is playing football (2)	○	○
The most popular hobby in the United States for women is scuba diving (3)	○	○
Since the 1990s, playing computer games has become the most popular hobby for men under 25 (4)	○	○
“Using social networking websites” (such as Facebook) is the fastest growing type of “hobby” in the United States (5)	○	○
20% of people in the United States say they have no hobby whatsoever (6)	○	○

On a scale from 0 to 100, where 0 is “never” and 100 is “practically every day,” how often do you take part in a hobby?

Never Always

0 10 20 30 40 50 60 70 80 90 100

()

End of Block: Filler questions

Start of Block: Product evaluation - No claim

Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below.
Please indicate your purchase intention for this food item:

- Very unlikely (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- Very likely (8)

Page Break

Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below.

Please indicate your purchase intention for this food item:

- Very unlikely (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- Very likely (7)

End of Block: Product evaluation - No claim

Start of Block: Product evaluation - Taste claim

Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below.
Please indicate your purchase intention for this food item:

- Very unlikely (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- Very likely (7)

Page Break

Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below.

Please indicate your purchase intention for this food item:

- Very unlikely (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- Very likely (7)

End of Block: Product evaluation - Taste claim

Start of Block: Product evaluation - Price claim

Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below.

Please indicate your purchase intention for this food item:

- Very unlikely (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- Very likely (7)

Page Break

Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below.

Please indicate your purchase intention for this food item:

- Very unlikely (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- Very likely (7)

End of Block: Product evaluation - Price claim

Start of Block: Product evaluation - Waste claim

Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below.

Please indicate your purchase intention for this food item:

- Very unlikely (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- Very likely (7)

Page Break

Imagine that you are doing your grocery shopping. In the fruits and vegetable section, you find the product below.

Please indicate your purchase intention for this food item:

- Very unlikely (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- Very likely (7)

End of Block: Product evaluation - Waste claim

Start of Block: Extra questions - perception of abnormality of the food products, claim condition, frequency of purchase of apples and carrots

Page Break

Please rate the foods you just saw in terms of how abnormal you think they are. You can choose any option between 1 (“very normal”) and 7 ("very abnormal”).

	Very normal (1)	(2)	(3)	(4)	(5)	(6)	Very abnormal (7)
Apple (1)	○	○	○	○	○	○	○
Carrot (2)	○	○	○	○	○	○	○

Which of the following messages appeared next to the foods you saw?

- ○ I help to reduce food waste! (1)
- ○ I am 25% cheaper! (2)
- ○ I am delicious! (3)
- ○ No message (4)

Page Break

Please indicate how often you purchase the products below:

	Never (1)	(2)	(3)	(4)	(5)	(6)	Always (7)
Apple (1)	○	○	○	○	○	○	○
Carrot (2)	○	○	○	○	○	○	○

End of Block: Extra questions - Extra questions - perception of abnormality of the food products, claim condition, frequency of purchase of apples and carrots

Start of Block: Extra questions - food waste awareness

Please indicate how much you agree with the following statements:

	Totally disagree (1)	(2)	(3)	(4)	(5)	(6)	Totally agree (7)
Food waste increases the burden on the environment (1)	○	○	○	○	○	○	○
We can avoid food waste by selling fruits and vegetables with 'abnormal' shapes (2)	○	○	○	○	○	○	○
It is a good thing that a-typical/abnormal products are not being sold in regular shops (3)	○	○	○	○	○	○	○
Most 'abnormal' fruits and vegetables are wasted (4)	○	○	○	○	○	○	○

End of Block: Extra questions - food waste awareness

Start of Block: Comments and feedback

Was everything clear and understandable in the survey? If not, please let us know what was not, or if you have any additional feedback: *(This is an optional question)*

_____

_____

_____

Thank you for your participation.

For your information, the first and third tasks (comparing yourself with another person and evaluating the foods) were related.
The second task (about hobbies and work) was a filler task, which was used to make sure your answers to the first task did not influence your answers to the third one.

If you have any further doubts or comments, please contact Klaus Grunert at klg@mgmt.au.dk

Page Break

End of Block: Comments and feedback