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CONSUMERS INFERENCES OF CIRCULAR ECONOMY PRODUCTS

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RESUMO

Mudanças na forma em que consumimos os recursos já fazem parte das pautas de pesquisa. Novas formas de se produzir, bem como consumir, são essenciais para um futuro sustentável. Recentemente, a economia circular tem sido pautada como uma das soluções para os problemas de produção e consumo que enfrentamos. Dentro desse modelo, há a adoção de sistemas com ciclos de produção fechados, aumentando a eficiência no uso de recursos, reduzindo o uso de matérias-primas virgens e minimizando a geração de resíduos. Esta tese foca nos princípios da economia circular dentro do consumo, relacionando a forma como os consumidores se comportam e adotam produtos oriundos da economia circular. Mais especificamente, analisamos na tese como os consumidores se comportam dentro da aceitação de produtos feitos de materiais reciclados. Pesquisas mostram uma ambiguidade na aceitação dos consumidores em relação a esses produtos, sendo um desafio para o avanço da economia circular. Sabe-se que diversos fatores podem influenciar na decisão final. No entanto, falta clareza na literatura de como podemos contribuir com esse avanço. O objetivo principal dessa tese é de retratar os diferentes fatores que afetam as inferências dos consumidores de produtos da economia circular e analisar como superar as inferências negativas que os consumidores possam ter. A pesquisa começa com uma análise aprofundada das principais motivações dos consumidores para a aceitação de produtos feitos com materiais reciclados (artigo 1). As discussões iniciais proporcionam avanço para a teoria de comportamento do consumidor e economia circular, trazendo em detalhe, os diferentes papéis e comportamentos que os consumidores podem ter para contribuir para o desenvolvimento da economia circular. Mostra-se que muitos desses comportamentos são dependentes um dos outros para a sua execução. Além disso, analisou-se as principais barreiras e oportunidades para a aceitação de produtos feitos com materiais reciclados. Dentro das barreiras identificadas, pode-se afirmar que muitas delas possuem papeis fundamentais para a não aceitação dos consumidores. Destaque-se a questão da qualidade percebida e impressões de contaminação como duas barreiras importantes a serem discutidas. Diante disso, analisou-se o papel da percepção de contaminação na aceitação desses produtos e a sua relação com a qualidade (artigo 2). O conhecimento teórico sobre contaminação e comportamento do consumidor foi detalhado, suportando os caminhos da pesquisa. Através de um estudo experimental, pode-se analisar que a percepção de contaminação desses produtos pode ser explicada por mecanismos emotivos, como

aversão (*disgust*), mas também por mecanismos cognitivos, como qualidade percebida. A tese avança na teoria de contaminação/contágio, adicionando às discussões uma variável que até então não era abordada dentro dos estudos (qualidade percebida). Com o objetivo de propor possíveis estratégias para a ampliação da aceitação de produtos feitos com materiais reciclados, analisou-se como os comportamentos dentro da economia circular interagem e se há a possibilidade de avanço entre seus efeitos (artigo 3). Mais especificamente, analisou-se como o comportamento de reciclar influencia o comportamento de compra de produtos feitos de materiais reciclados, e vice versa. Com um estudo longitudinal, realizado em dois países avançou-se na teoria de *spillover* e *goals.* Mais especificamente, forma analisados os mecanismos psicológicos subjacentes aos processos de *spillover* comportamental, especialmente aqueles relacionados aos objetivos que motivam os dois comportamentos a adotarem os comportamentos em análise. Os resultados mostram que quanto mais os consumidores reciclam, mais propensos estão a comprarem também produtos feitos com materiais reciclados, e vice-versa. Além disso, essa variação comportamental é mediada pelo fortalecimento das metas individuais de redução de resíduos. O estudo final mostra como pode-se superar as inferências negativas que os consumidores têm sobre os produtos da economia circular. Estimulando um dos comportamentos dentro da economia circular, pode-se abrir espaço para a adesão de comportamentos que contribuem para o avanço desse modelo. A partir dos resultados, sugerimos contribuições teóricas e praticas e possibilidade de estudos futuros.

Palavras-chave: Economia circular, comportamento do consumidor, produtos feitos de materiais reciclados, contaminação, *spillover*.

ABSTRACT

Changes in the way we consume resources are already part of the research agenda. New ways of producing, as well as consuming, are essential for a sustainable future. Recently, the circular economy has been presented as one of the solutions to the production and consumption problems we face. Within this model, there is the adoption of systems with closed production cycles, increasing the efficiency in the use of resources, reducing the use of virgin raw materials and minimizing the generation of waste. This dissertation focuses on the principles of the circular economy inside the phase of consumption, relating the way consumers behave and adopt products from the circular economy. More specifically, in this dissertation we analyze how consumers behave within the acceptance of products made from recycled materials. Research shows an ambiguity in consumer acceptance of these products, being a challenge to the progress of the circular economy. It is known that several factors can influence their final decision. However, the literature lacks clarity on how we can contribute to the broad acceptance. The main goal of this dissertation is to depict the different factors that affect the consumers inferences of circular economy products and to analyze how to overcome the negative inferences that consumers may have. The research begins with an in-depth analysis of consumers' main motivations for accepting products made from recycled materials (Paper 1). The initial discussions provide advancement to the theory of consumer behavior inside the circular economy, bringing in detail the different roles and behaviors that consumers can have to contribute to the advancement of the circular economy. It is shown that many of these behaviors are dependent on each other for their execution. In addition, the main barriers and opportunities to the acceptance of products made with recycled materials were analyzed. Within the barriers identified, it can be said that many of them have fundamental roles in the consumers' rejection. Concerns with the quality of the product and contamination impressions stand out as two important barriers to be discussed. In view of this, the role of contamination in the acceptance of these products and its relationship with quality was analyzed (Paper 2). Theoretical contributions about contamination and consumer behavior were detailed, supporting the research paths. Through an experimental study, it was analyzed that the perception of contamination can be explained by emotional mechanisms, such as disgust, but also by cognitive mechanisms, such as perceived quality. The dissertation advances in the theory of contamination/contagion, adding to the discussions a variable that until then was not

addressed in the studies (perceived quality). With the goal of proposing possible strategies to increase the acceptance of products made with recycled materials, we analyzed how behaviors within the circular economy interact and whether there is a possibility of progress between their effects (Paper 3). More specifically, we analyzed how the behavior of recycling influences the behavior of buying products made from recycled materials, and vice versa. A longitudinal study carried out in two countries advanced the theory of spillover and goals. More specifically, the psychological mechanisms underlying the behavioral spillover processes were analyzed, especially those related to the goals that motivate the two behaviors to adopt the behaviors under analysis. Results showed that the more consumers recycle, the more likely they are to also buy products made from recycled materials, and vice versa. Furthermore, this behavioral variation is mediated by the strengthening of individual waste reduction goals. The final study shows how to overcome the negative inferences that consumers may have about circular economy products. By stimulating one of the behaviors within the circular economy, space can be opened for the adoption of behaviors that contribute to the progress of the circular economy. From the results, it is suggested theoretical and practical contributions and the possibility of future studies.

Summary

Chapter 1

Introduction

Debates on the importance of sustainability have gained increasing attention in the last decade. Human beings have dominated earth's continental and oceanic ecosystems (Braje & Erlandson, 2013), resulting the achievement of some planetary boundaries of safe operating space for humanity development (Rockström et al., 2009). In the least years, we have seen changes in production and consumption in order to mitigate the impacts of human operation (Hoekstra & Wiedmann, 2014). A concern around the consumption phase led researches to pay special attention to this topic (Biggs et al., 2015; Prothero et al., 2011; White et al., 2019). Consumption patterns have been accused for several environmental impacts (Stern, 2000). Moreover, it has been noted the importance of changing behaviors in order to achieve environmental goals (Vallance et al., 2011).

With this scenario, new forms of consumption emerged, such as access-based consumption (Bardhi & Eckhardt, 2012), collaborative consumption (Scaraboto, 2015) and sharing (Belk, 2009), amongst others, showing an emergent concern with sustainable consumption options. Companies are also pressured to change their marketing practices toward sustainable initiatives (Kotler, 2011; White et al., 2019) and to offer more sustainable options (Kiron et al., 2012). Companies are incorporating new practices and methods into their production, such as organic production, local production and reused materials, just to mention some (Du et al., 2010; Tischner & Charter, 2017).

Companies are adopting new models of production (Kotler et al., 2019) and an emerging solution that is receiving special attention due to its impacts on sustainable development is the circular economy (Geissdoerfer et al., 2017). Within this model, there is the adoption of systems with cycles of closed production, increasing efficiency in the use of resources, reducing the use of virgin materials, and minimizing waste generation (Ghisellini et al., 2016; Sauvé et al., 2016). Circular economy is systemic by its nature, operating at different levels (Kirchherr et al., 2017), being considered a key tool for sustainable development and sustainability (Sauvé et al., 2016). According to the authors, sustainable development is a goal of society defined at the macro level, while circular economy is defined mainly at the micro level, through production and consumption models.

Defining circular economy

We based our study on the definition of Kirchherr et al. (2017, pp. 224–225) to explain what is a circular economic system:

> circular economy describes 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.

The concept of circular economy brings the idea of cyclical closed-loop systems (Murray et al., 2017). This refers to the utilization of recovered materials from the same production chain (Singh & Ordoñez, 2016). Within closed resource loop systems, recycling plays an important role to the circularity of resources (Bocken et al., 2016). Stahel (1982) uses the idea of four loops to circularity, which are: reuse, repair, reconditioning, and recycling. And all of these loops integrate a circular economic system.

There is a wide range of options for circular economy, some of them are related to the participation of consumers, such as returning packages (Borrello et al., 2017), access-based consumption (Bardhi & Eckhardt, 2012; Catulli et al., 2013), reducing food waste and redistributing unwanted food (Mylan et al., 2016), just to mention some. Circular economy is also applied to products, such as upcycled food (Bhatt et al., 2018), remanufactured products (Abbey, Meloy, Blackburn, et al., 2015; Baxter et al., 2017; Camacho-Otero et al., 2018; Sun et al., 2018), products with recycled packages (Geueke et al., 2018; Marsh & Bugusu, 2007), amongst others. All of these solutions are aligned through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling (Geissdoerfer et al., 2017). Summing up, restorative systems include a shift in the use of products, where the "end-of-life" concept does not exist, materials in production are reused, and the waste is eliminated through the superior design of materials, products and systems (MacArthur, 2013).

This dissertation focuses on the micro level, integrated by products and consumer (Kirchherr et al., 2017). Specifically, we analyze the acceptance of products from the circular economy. About circular economy products, Selvefors et al. (2019) describe four strategies and design opportunities: design for extended use (to increase products' utility); design for pre and post use (to handling a product prior to and after use); design for exchange (to exchange the products with others agents); and design for multiple use-

cycles (to put the product back to new product cycles). The focus of this dissertation is on the last case, design for multiple use-cycles, where products and materials are used more than once to the creation of a different or similar product. Moreover, den Hollander et al. (2017) classify design strategies into three main options: design for long use (with physically durability), design for extended use (for maintenance), and design for recovery (for recontextualizing, repairing, refurbishing and remanufacturing). We focus on the definitions of design for recovery, where recontextualizing, repairing, refurbishing, and remanufacturing solutions are applied in products of the circular economy (see Table 1 for a detailed explanation).

Table 1 - Design approaches for recovery and their definitions.

Design approaches for recovery	Definition
Recontextualizing	Recontextualizing is a term for use of an obsolete product, or its constituent components, without any remedial action, in a different context than it was originally designed for.
Repairing	Repairing is the correction of specific faults in an obsolete product, bringing the product back to working condition, whereby any warranty on the repaired product generally is less than those of newly manufactured equivalents and may not cover the whole product, but only the component that has been replaced.
Refurbishing (or reconditioning)	Refurbishing is the process of returning an obsolete product to a satisfactory working and/or cosmetic condition, that may be inferior to the original specification, by repairing, replacing or refinishing all major components that are markedly damaged, have failed, or that are on the point of failure, even where the customer has not reported or noticed faults in those components.
Remanufacturing	Remanufacturing is a term for a series of industrial processes in a factory environment, whereby an original equipment manufacturer disassembles obsolete products into components, to a level as far down as needed to bring as many of those components as considered eligible after testing back to at least original performance specifications and recombines those components (generally originating from different used products) with as few as possible new parts, to manufacture new products of a similar type and specification, that result in a new product with a warranty that is identical to that of an equivalent product manufactured out of all new parts.

Source: Based on den Hollander et al. (2017)

Consumers and the circular economy

There is a research call on consumers' acceptance of products from the circular economy (Farooque et al., 2019; Mugge et al., 2017). While the phenomenon of sustainable consumption has been noted in the literature (Prothero et al., 2011; Spaargaren, 2003; Stern, 2000; Vermeir & Verbeke, 2006), we lack an understanding of how consumers will behave in circular economic system. It is unclear how consumers react in a system that is restorative or regenerative by intention and design (MacArthur,

2013). It is known that consumers must have different ways of thinking to participate in a circular economy system (Borrello et al., 2016). However, there are few researches on consumer behavior and circular economy solutions (Farooque et al., 2019; Ghisellini et al., 2016; Kirchherr et al., 2017; Merli et al., 2018).

Studies show that consumers' initial response of these products are mostly positive (Gaur et al., 2015; Harms & Linton, 2016; Hazen et al., 2017; Holmström & Böhlin, 2017b; Jiménez-Parra et al., 2014; Matsumoto et al., 2018; Sun et al., 2018; van Weelden et al., 2016). However, a major concern is that recent research showed that the adoption of circular economy solutions has failed in consumers' acceptance (Abbey, Meloy, Guide Jr., et al., 2015; Bardhi & Eckhardt, 2012; Baxter et al., 2017; Camacho-Otero et al., 2018; Catulli et al., 2013; Chamberlin & Boks, 2018; Farooque et al., 2019; Holmström & Böhlin, 2017a; Mugge et al., 2017; Rozin et al., 2015; Sun et al., 2018; van Weelden et al., 2016), showing that these initiatives are not always accepted by the consumer.

With this background, the literature shows that consumers have different reactions to products from the circular economy. We know that environmentally friendly attributes may induce consumers to make trade-offs with other important attributes (Herédia-Colaço & Coelho do Vale, 2018; Prothero et al., 2011), affecting intentions to purchase the products (Auger et al., 2008). Ethical attributes can be defined as attributes aimed to reflect social and environmental issues (Luchs et al., 2010). We say that circular economy products can be associated with ethical attributes, internalizing environmental impacts of resource extraction and waste generation (Sauvé et al., 2016). However, it is important to analyze how the particularities of these products affect consumers preferences. By the definition of circular economy, it is important to analyze how consumers respond to the particularities of this system. **With this background, the aim of this dissertation was to depict the different factors that affect consumers inferences of circular economy products and to analyze how to overcome the negative inferences that consumers may have.**

To that end, three studies aimed to contribute to the knowledge of consumer behavior and circular economy. Figure 1 shows the structure of this dissertation and how the theory evolves throughout the papers and their specific goals.

Figure 1 – Dissertation structure.
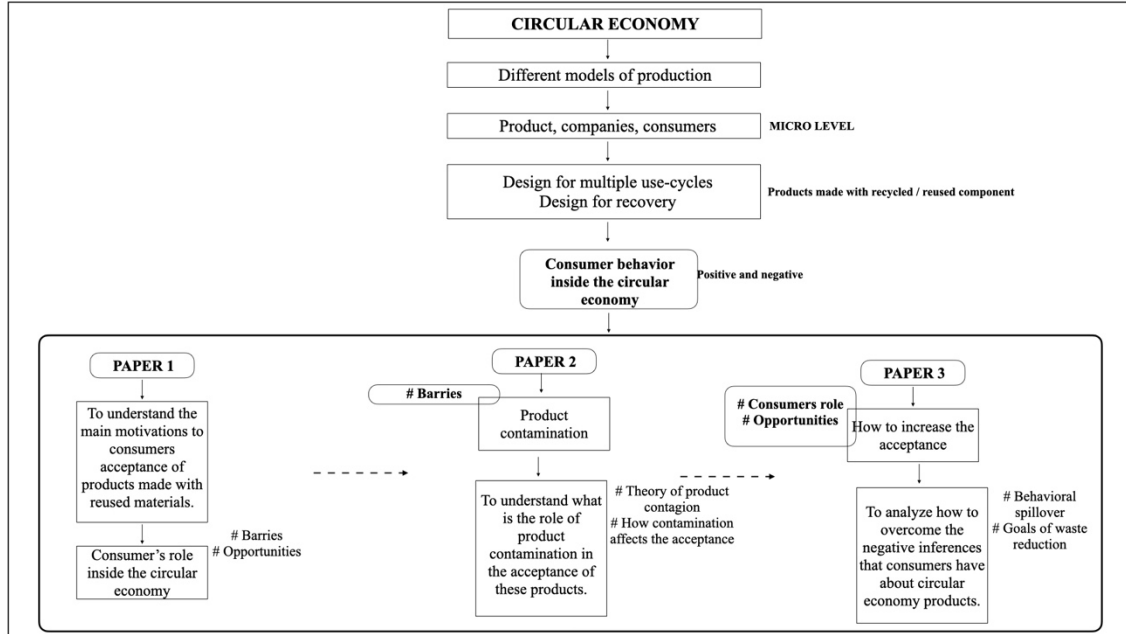
Overview of research papers - aims, scope and research questions

This PhD dissertation comprises three research papers: a literature review and two empirical studies. These papers contribute to a deeper understanding of the acceptance of circular economy products by the end consumer. We explored the underlying mechanisms of positive and negative associations with products from the circular economy. More specifically, in the first study, we tried to understand how consumers form inferences of products from the circular economy and the factors that lead consumers to have negative associations of products (Stangherlin & Thøgersen, 2020) (Paper 1). With this background, we explored the nature of one of the negative associations that consumers can have toward these products (Paper 2). Finally, we explored how behaviors inside the circular economy correlate to each other and, therefore, help individuals to accept circular products (Paper 3). In the end, we proposed different alternatives that could minimize the negative inferences of circular economy products and how to intensify their acceptance.

Paper 1: Consumption and Materialism: From Acquisitive to Responsible Materialism

This first study aimed to answer the following research question: *What are consumers' main motivations to the acceptance of products made with reused materials?* This research explored consumer responses to the use of recycled, recovered, or used

materials, where products are made of recycled content from post-consumer products and post-consumer waste. The main goal was to gain insight into what the use of reused materials in the product means to consumer's motivation to buy it, identifying the most important barriers and opportunities regarding the acceptance of products with reused materials. We also discussed mechanisms that explain the ambiguity of positive and negative associations of products made with recycled and reused components. In the end, we reviewed the evidence and presented the main barriers and opportunities for consumer's acceptance of circular economy products.

This study brings several contributions to the circular economy. It can be considered a first movement towards the building of a consumer theory inside the circular economy. With a systematic understanding of consumers' role inside the circular economy (Maitre-Ekern & Dalhammar, 2019), we systematically showed how consumers can engage in different behaviors to facilitate the transition towards a circular economy model. Moreover, it is extremely important to the progress of the circular economy to understand how these behaviors are connected: performing one of them is dependent of the performance of a second behavior. This means that the achievement of one behavior, such as buying products made with reused materials, can be dependent, in some level, to a second behavior, such as sending products to recycling facilities. Findings can help in the design of interventions to increase the adoption of circular economic models.

We also identified the most important barriers and opportunities regarding the acceptance of products with reused materials. We explained in detail which barriers and opportunities can affect the acceptance of these products. Results can help policy makers and product designers in overcoming the negative inferences that consumers may have and, therefore, help the engagement in circular models. We conclude that a single action will not be effective. It is necessary to develop a combination of strategies, using different levels of behaviors and roles, to increase the acceptance of circular economy products. Moreover, results show that some consumers already accept and value circular economy products and we can increase the adoption of these attitudes to other segments. It is possible to increase consumers' perceived value of circular economy products by securing and certifying high quality combined with transparency, well-crafted information and education interventions.

- Status of the study: published as a book chapter in the Handbook of Waste, Resources and the Circular Economy.

Paper 2: Consumer reaction to products with reused materials: examining different routes of contamination

The second research paper aimed to answer the following research questions: *What is the role of product contamination in the acceptance of circular economy products?* Our first study gave us the opportunity to understand several barriers to the acceptance of products made with reused materials (Stangherlin & Thøgersen, 2020). There is a strong evidence suggesting that consumers reject these products due to contamination concerns (Abbey, Meloy, Guide Jr., et al., 2015; Meng & Leary, 2021) and risks of product contamination (Magnier et al., 2019). In our second study, we analyzed in depth the effect of contamination on consumers responses to products made with reused materials (a key barrier). Based on previous studies, it is possible to say the contamination can affect the acceptance of products with reused materials (Meng & Leary, 2021). In this study, we tried to understand how contamination operates in the case of products with reused materials.

The theory of product contagion shows that feelings of contamination lead consumers to decrease their evaluations of the products (Morales & Fitzsimons, 2007), especially when they know that they were previously touched by another person (Argo et al., 2006). This means that the contact of a different person (such as the previous owner) can affect evaluations of the entire object (Kapitan & Bhargave, 2013), especially if this object/product has close physical contact with the body (Morales & Fitzsimons, 2007). In this way, the acceptance of products made with reused materials can be influenced by how close the product is to the user's body.

Feelings of disgust is considered an outcome of perceived contamination (Rozin & Fallon, 1987), being considered an emotive reaction. In this paper, we explored if disgust is one of the mechanisms that could explain the impact of contamination in these products. However, we also explored different mechanisms that could affect consumers acceptance of these products. One of the most important concerns that consumers express regarding products with reused components is quality concerns (Abbey, Meloy, Guide Jr., et al., 2015; Wang & Hazen, 2016). Hence, we also explore if perceived quality is one of the underling mechanisms of the effect of contamination on product acceptance.

We used an experimental study to explore our research question. We recruited 346 respondents from Prolific Academic to participate in a one-way between-subjects experimental design with degrees of physical contact (high vs low) as the experimental

factor. Each condition had two different products, presented as a between-subjects factor. With an experimental study, we explored how contamination influences product acceptance by two different routes of reaction: a cognitive route (perceived quality), and an emotive route (disgust). Results showed that the effect of contamination on product acceptance is mediated by these two routes of reaction. When analyzing a boundary condition of contamination (differences in products with high (vs. low) degree of physical contact), results showed that consumers perceive products with high degree of physical contact as more contaminated than products with low degree of physical contact. Results indicated that the influence of perceived contamination on the acceptance of products made with reused materials is mediated by feelings of disgust and perceived quality. However, contrary to what is widely explored in the literature (Baxter et al., 2017; Meng & Leary, 2021; Rozin & Nemeroff, 1990), the effect of contamination on the acceptance of the products is mainly explained by perceived quality and not by feelings of disgust. This is an interesting finding and deserves attention. The literature of contamination usually explores disgust as the explaining mechanism of the effect of contamination (Argo et al., 2006; Morales & Fitzsimons, 2007). Results showed that it is important to study contamination effects in different contexts, such as inside the circular economy, to add new perspectives to the theory.

- Status of the study: This paper is finished. The paper was presented at EMAC Regional Conference 2020 (September 2020) and at EnANPAD 2020. We are improving this paper to be published in a journal.

Paper 3: Behavioral spillover in the circular economy: The importance of consumer goals

The third paper aimed to address the following research questions: *How to overcome the negative inferences that consumers have about circular economy products? How behaviors inside the circular economy interact and what it represents in the acceptance of products made with reused materials?* With this paper, we tried to create a positive environment for consumers to accept products made with reused materials. In the first study, we analyzed the different behaviors that consumers can have inside the circular economy (Stangherlin & Thøgersen, 2020). The third paper focuses on two of

these behaviors: recycling and purchasing circular products. Consumers make essential decisions in this connection, such as whether to purchase new, used or remanufactured products, when, where and how to dispose (rest) products after use, and whether and how they will adopt new ways of consuming (Hazen et al., 2017). To make the economy truly circular, consumers need to buy used products or products with recycled materials (i.e., circular products). Some consumers resist to circular products, assuming lower quality, while others value them for being environmentally friendly.

In this study, we tested the hypotheses that (a) the more consumers recycle, the more inclined they are to also buy circular products, and vice versa, and (b) that this behavioral spillover is mediated through strengthening the goal of waste reduction. These hypotheses were tested in a cross-lagged panel regression model by means of a two-waves online panel survey. To check the cross-national validity of results, the survey was carried out in both Copenhagen and Lisbon (N's ≈ 500 in Wave 1 in each city). In both cities, we found a significant and positive cross-lagged effect from recycling to buying circular products, and in Lisbon also the other way round. Most of the cross-lagged effects are mediated through the importance of and progress towards the goal of waste reduction. The study implies that communication to engage consumers in the circular economy should emphasize the link between recycling and circular buying behavior and especially the superordinate waste and conservation goals that they both contribute to. Moreover, this study has important contributions in methodological terms. Collecting data in two different waves brought robust and original results to the study.

- Status of the study: This paper is under review at Journal of Environmental Psychology – impact factor 5.192 (A2).

Table 1 presents an overview of the dissertation.

Table 1 – Summary of the studies.

Main goal: To depict the different factors that affect consumers inferences of circular economy products and to analyze how to overcome the negative inferences that consumers may have.						
Paper	**Specific goals**	**Paper title**	**Paper's goal(s)**	**Methodological procedures**	**Contributions to the dissertation**	**Status of the paper**
Paper 1	a) To understand the main motivations to consumers acceptance of products made with reused materials.	Consumption and Materialism: From Acquisitive to Responsible Materialism	a) To understand the main motivations to consumers acceptance of products made with reused materials. b) To analyze the main barriers and opportunities to the acceptance of these products.	Literature review	The description of consumers role inside the circular economy. The analysis of the main barriers to the acceptance of products made with reused materials. The analysis of the main opportunities to the acceptance of products made with reused materials.	Published in the Handbook of Waste, Resources and the Circular Economy.
Paper 2	a) To analyze how to overcome the negative inferences that consumers have about circular economy products. b) To understand what is the role of product contamination in the acceptance of these products.	Consumer reaction to products with reused materials: examining different routes of contamination	a) To understand how contamination operates in the case of products with reused materials b) To examine how perceived contamination influences the acceptance of products made with reused materials with feelings of disgust and perceived quality as mediators	One experimental study	We found differences in the acceptance of products with low and high physical contact. Differences in the perceived contamination was found in products with high and low degree of physical contact. Both quality and disgust mediate the influence of perceived contamination on purchase intentions and product evaluations.	Working paper presented at EMAC Regional Conference 2020 (September 2020) and at EnANPAD 2020. Will be submitted to a high impact journal.
Paper 3	a) To understand how behaviors inside the circular	Behavioral spillover in the circular economy: The importance of	a) To understand if the more consumers recycle, the more inclined	Longitudinal study with two waves of data collection (Surveys)	There is a significant and positive cross-lagged effect from recycling to buying	Under review at Journal of Environmental Psychology

| | economy interact

b) To analyze if this interaction influences the acceptance of products made with reused materials | consumer goals | they are to also buy circular products, and vice versa

b) To analyze if this behavioral spillover is mediated through strengthening the goal of waste reduction | | circular products. These effects are mediated through the importance of and progress towards the goal of waste reduction. | |

Source: Elaborated by the authors.

In the following chapters, we present the three studies that compose the body of dissertation,

Chapter 2

Consumption and Materialism: From Acquisitive to Responsible Materialism

1. Introduction

Our current model of consumption and production is unsustainable (Steffen et al., 2015; Thøgersen, 2014b). Humans now dominate the earth's continental and oceanic ecosystems (Braje & Erlandson, 2013) to an extent that has led to the crossing of some planetary boundaries of safe operating space and the rapid approaching of others (Rockström et al., 2009). Changes in production and consumption in order to mitigate negative impacts on the planet have begun, but are progressing much too slowly (Hoekstra & Wiedmann, 2014; IPCC, 2018). Suggestions for more sustainable forms of consumption often takes it point of departure in a critique of current, "acquisitive" materialism, with material possessions being a central aspect of consumers' lives and source of satisfaction or dissatisfaction (Belk, 1985). Suggested alternatives include access-based consumption (Bardhi & Eckhardt, 2012), collaborative consumption (Scaraboto, 2015), sharing (Belk, 2009), and sufficiency (Gorge et al., 2015). Companies are also under increasing pressure to make their production more sustainable and to offer more sustainable options to their customers (Kiron et al., 2012; Kotler, 2011).

An important part of the problem is the current linear model of consumption and production, which is built on a "take, make, and dispose" view (Ghisellini et al., 2016), resulting in waste and over-consumption of resources (Biggs et al., 2015; Prothero et al., 2011; Thøgersen, 2014a; White et al., 2019). Hence, a change to a circular economy is urgently needed (Geissdoerfer et al., 2017; MacArthur, 2013). A circular economy is an economic model based on cycles of closed production, increased efficiency in the use of resources, reduced use of virgin materials, and minimizing waste generation (Ghisellini et al., 2016; Sauvé et al., 2016). The circular economy concept integrates the idea of cyclical closed-loop systems (Kirchherr et al., 2017; Murray et al., 2017) and the use of recovered materials and recycled products (Singh & Ordoñez, 2016). Within a closed loop resource system, recycling is important to secure the circular flow of resources (Bocken et al., 2016). Stahel (1982) suggested four loops of circularity: reuse, repair, reconditioning, and recycling. All of these loops are integrated in a circular economic

system. Company strategies to achieve a circular economy include remanufactured products (Abbey, Meloy, Guide Jr., et al., 2015; Baxter et al., 2017; Camacho-Otero et al., 2018; Sun et al., 2018), access-based consumption (Bardhi & Eckhardt, 2012; Catulli et al., 2013), refurbished products (Holmström & Böhlin, 2017b; Mugge et al., 2017; van Weelden et al., 2016), use of recycled components (Rozin et al., 2015), amongst others. A successful circular economy strategy requires the involvement of a range of stakeholders, including suppliers, producers and consumers (Jabbour et al., 2019).

Radical changes in consumers behavior are needed for the transition to a circular economy (Jurgilevich et al., 2016; Merli et al., 2018; Mont & Heiskanen, 2015; Singh & Ordoñez, 2016). By definition, a circular economy means reusing, repairing, reconditioning and recycling products (Bocken et al., 2016; Stahel, 1982). Consumers make essential decisions in this connection, such as whether to purchase new, used or remanufactured products, when, where and how to dispose (rest) products after use, and whether and how they will adopt new ways of consuming (Hazen et al., 2017). Hence, for a circular economy to work, consumers are required to change their perceptions of possession, ownership and product newness and to make substantial changes in everyday routines, engaging more in behaviors, such as repairing, returning and recycling products (Camacho-Otero et al., 2018). Therefore, it is important to study the role and requirements of consumer behavior in the circular economy transition (Farooque et al., 2019; Ghisellini et al., 2016; Kirchherr et al., 2017; Merli et al., 2018; Mugge et al., 2017).

Among other things, a circular economy requires a change from the "acquisitive" materialism we know, with its focus on the acquisition of material goods as a means to achieve distinction and status (Kasser et al., 2004), to a new materialism (Scott et al., 2014) that we could call "responsible materialism," built on the insights of circular economy thinking and focusing on the responsible use of limited material and other resources. Materialism as a consumer value (Richins & Dawson, 1992), is conceptually close to self-enhancement in Schwartz's value system (Schwartz, 2007) and negatively related to pro-environmental attitudes and behavior (Hurst et al., 2013). In contrast, pro-environmental attitudes and behavior, including valuing products for environmentally friendly attributes, are related to self-transcendence values in Schwartz's value system (de Groot & Steg, 2009; Thøgersen & Ölander, 2002). Hence, motivations to acquire, possess and collect (Belk, 1982) may change by the inclusion of reused materials. The usual conceptions of possessions and ownership are also challenged by circular economy

principles (Singh & Ordoñez, 2016). Hence, the transition to a circular economy requires a radical change from an "acquisitive" to a responsible materialism.

This chapter focuses on consumer reactions to a restorative system, where there is no "end-of-life" of material products, where waste is eliminated through superior design of materials, products and systems (Bovea et al., 2018) and where production materials are reused (MacArthur, 2013). For the end consumer, the circular economy implies more recycling (Hamzaoui-Essoussi & Linton, 2014), more remanufactured products (Abbey, Meloy, Guide Jr., et al., 2015; Hazen et al., 2017), extension of product life (Selvefors et al., 2019), and perhaps also new and extended ways of sharing (Belk, 2009). Selvefors et al. (2019) discuss four design strategies for the circular economy: (1) design for extended use (to increase products' utility), (2) design for pre- and post-use (to handling a product prior to and after use), (3) design for exchange (to exchange the products with others agents), and (4) design for multiple use-cycles (to put the product back to new product cycles).

In this chapter, we will especially focus on challenges related to multiple use-cycles, where waste products and rest materials are reused for the creation of different products. Hence, we discuss consumer responses to the use of recycled, recovered, or used materials, where products are remanufactured or made of recycled content from post-consumer products and post-consumer waste. The main goal is insight into what the use of reused materials in the product means to consumer motivation to buy it, identifying the most important barriers and opportunities regarding the acceptance of products with reused materials. We also discuss mechanisms that explain the ambiguity of positive and negative associations of products made with recycled and reused components. Finally, we discuss a few cases where recycled products have been successful.

2. The role of consumers in the circular economy

To be part of the circular economy, consumers can change behavior in different ways, such as: use products for longer time, repair products that are broken, use products that have outlived their original purpose for other purposes, and recycle the products. These behavior changes challenge the "acquisitive" materialistic mind-set (Richins & Dawson, 1992) and studying them can provide valuable insights for the design of interventions to promote and facilitate a circular economy (Singh & Ordoñez, 2016). Several consumer practices of relevance for the transition to a circular economy have been studied by past research, as illustrated in Table 2. In Table 2, the studied practices

are organized in stages of the consumption cycle: acquisition, use, maintenance and post-use.

As reflected in these practices, consumers have different roles in the circular economy: as purchaser, maintainer, repairer, seller, sharer and collaborator, engaging with waste sorting and re-use (Maitre-Ekern & Dalhammar, 2019), see Figure 2. Each of these roles implies different activities, which can be overlapping, for example, when a "repairer" buys spare parts or tools. Also, a "purchaser" may acquire access to products in different ways than buying, for example, renting, leasing or sharing.

For companies to be able to produce products made with recycled components, consumers need to return end-of-use products for reuse, refurbishing or recycling (Ylä-Mella et al., 2015). Hence, companies, governments and/or NGOs need to provide opportunities for consumers to return their used products. However, perhaps even more important for the evolution of a circular economy is consumer acceptance of products with reused materials. Therefore, we focus mostly on the consumer as purchaser in this chapter. Consumer acceptance requires that consumers perceive products made with recycled components favorably. Products with reused materials are not evaluated as new products (Mobley et al., 1995) and consumers often hold negative beliefs about the quality of used products (Matsumoto et al., 2018). However, not all individuals have equally negative, or only negative beliefs about circular products.

Table 2 – Examples of researched consumers practices in the circular economy

Stage	Practices
Acquisition	Reduce overall consumption levels (Tunn et al., 2019)
	Participate in access-based consumption (Bardhi & Eckhardt, 2012; Catulli et al., 2013) and product service systems (Camacho-Otero et al., 2018)
	Participate in sharing economy and collaborative consumption solutions (Camacho-Otero et al., 2018)
	Buy circular products (Borrello et al., 2017), such as: upcycled food (Bhatt et al., 2018); refurbished smartphones (Mugge et al., 2017; van Weelden et al., 2016); remanufactured products (Camacho-Otero et al., 2018; Hazen et al., 2017; Singhal et al., 2019; Wang & Hazen, 2016; Wang et al., 2013); products made of recycled plastic (Magnier et al., 2019)
	Buy products with recycled packaging (Geueke et al., 2018)
Use	Reducing food waste (Borrello et al., 2017; Jurgilevich et al., 2016; Mylan et al., 2016)
	Deal with unwanted food (Mylan et al., 2016)
	Using and reusing leftovers (Mylan et al., 2016)
	Reusing products and use for different purposes (Camacho-Otero et al., 2018)
	Use the product for a longer time (Bovea et al., 2018; Tunn et al., 2019)
	Reuse packages (Marsh & Bugusu, 2007)
Maintenance	Repairing products (Bovea et al., 2018; Camacho-Otero et al., 2018; Gwozdz et al., 2017; McCollough, 2009)
Post-use	Returning packages (Borrello et al., 2017; Marsh & Bugusu, 2007)
	Returning goods to recycle (Camacho-Otero et al., 2018)
	Source-separating household waste (Camacho-Otero et al., 2018; Maitre-Ekern & Dalhammar, 2019)

Camacho-Otero et al. (2018) reviewed a large number of studies on factors influencing consumer acceptance of circular products. They found that acceptance is reduced by beliefs about lower quality and risk of contamination, among other things, personal characteristics that are negatively related to acceptance include materialism, status concern and lack of knowledge and understanding. The most important factors increasing acceptance are perceived environmental benefits and lower prices (Hazen et al., 2017).

Overall, research suggests an ambiguity in consumers' acceptance of products with reused materials. Several studies report positive attitudes and intentions to buy these products (Holmström & Böhlin, 2017b; van Weelden et al., 2016), which increase with environmental knowledge (Sun et al., 2018), pro-environmental attitudes (Harms & Linton, 2016), environmental consciousness (Gaur et al., 2015), and price consciousness (Matsumoto et al., 2018). However, other studies report negative consumer responses due

to the belief that products made with recycled components are inferior. Research has identified concern about product performance (Abbey, Meloy, Guide Jr., et al., 2015; Camacho-Otero et al., 2018; Holmström & Böhlin, 2017b; Mugge et al., 2017), contagion concerns (Bardhi & Eckhardt, 2012; Baxter et al., 2017; Catulli et al., 2013; Rozin et al., 2015) and disgust reducing the acceptance of products made with reused materials (Abbey, Meloy, Guide Jr., et al., 2015; Bardhi & Eckhardt, 2012; Camacho-Otero et al., 2018; Rozin et al., 2015).

Figure 2 – The role of consumers in the circular economy
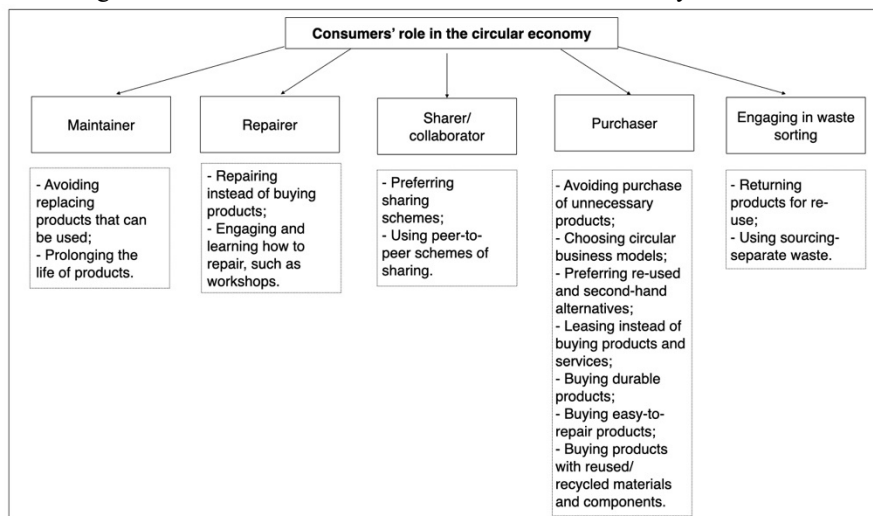
Note: Based on Maitre-Ekern and Dalhammar (2019).

In the next section, we discuss the most important positive and negative consumer associations to products made with reused materials identified by extant research and their implications for consumer motivation to buy these products.

3. Consumer acceptance of circular products: barriers and opportunities

3.1 Barriers

Various factors influence the acceptance of reused or remanufactured products and products made with recycled materials or components. Most studies find that consumers evaluate these products less favorably than a "new" version of the same product (Abbey, Meloy, Guide Jr., et al., 2015). Moreover, when comparing remanufactured products with products that have different environmental advantages, such as an energy-efficient product, consumers generally prefer the latter (Khor & Hazen, 2017). Consumers generally perceive a higher perceived risk and lower benefits/value of

remanufactured products (Matsumoto et al., 2018; Mugge et al., 2017; van Weelden et al., 2016; Wang & Hazen, 2016) and products with recycled components (Sun et al., 2018). These negative inferences lead to lower willingness to pay for products that are made with used materials (Guide & Li, 2010; Harms & Linton, 2016). Hence, consumers often perceive a trade-off between the possible environmental benefits of products with reused components and other quality attributes.

The most important reservation consumers express regarding remanufactured products is lower quality (Abbey, Meloy, Guide Jr., et al., 2015; Achabou & Dekhili, 2013; Gan & Chen, 2019; Kuah & Wang, 2019; Vafadarnikjoo et al., 2018; Wang & Hazen, 2016). Abbey et al. (2017) found that the lower perceived quality is due to a higher perceived probability of functionality and cosmetic defects, which translates into a higher perceived risk (Magnier et al., 2019; van Weelden et al., 2016). The perceived risks include performance, financial, time, obsolescence, physical, social and resource risks, with performance risks (Holmström & Böhlin, 2017b; Matsumoto et al., 2018; Mugge et al., 2017) and financial risks (Holmström & Böhlin, 2017b; Wang & Hazen, 2016) having the biggest negative effects on consumers' motivations to buy products with recycled components.

Performance risks are associated with functionality expectations (Magnier et al., 2019). They represent consumers' doubts about the performance quality of remanufactured products (Wang & Hazen, 2016) and other product containing recycled/reused materials (Sun et al., 2018). Consumers may fear that these products will break down quicker due to the fact that they or materials in them already had a previous use (van Weelden et al., 2016). Therefore, perceived performance risks are linked to lower perceived product quality. However, lower performance risk are generally perceived for refurbished products than for secondhand products (van Weelden et al., 2016).

Product quality and functionality are often difficult to assess before purchasing and using the product (van Weelden et al., 2016). It appears that uncertainty about the use history of a reused or refurbished product can strengthen the fear of functional failure (Ovchinnikov, 2011; van Weelden et al., 2016). The increased uncertainty has a negative impact on consumers' quality perceptions and willingness to pay for products with reused components (Hazen et al., 2012). In addition, consumers sometimes fear that remanufactured products and products containing reused components can quickly become technically obsolete (van Weelden et al., 2016).

Research suggests that consumer motivation to buy a remanufactured product is higher if the product has a superior brand image (Achabou & Dekhili, 2013; Gaur et al., 2015; Guide & Li, 2010; Vafadarnikjoo et al., 2018). In general, consumers express more confidence in refurbished products offered by a well-known company (van Weelden et al., 2016). However, in some studies found no relationship between brand image and consumers' perceptions of these products (Abbey, Meloy, Guide Jr., et al., 2015).

A reduced price is a common strategy to compensate for consumers' negative beliefs regarding remanufactured products. However, the results of discounts for remanufactured products are equivocal. Some scholars found that a lower price is an important reason to buy these products (Guide & Li, 2010; van Weelden et al., 2016; Wang & Hazen, 2016). However, a discount can also amplify negative associations to the product (Abbey, Meloy, Guide Jr., et al., 2015), leading to lower quality perceptions and increased perceived risks (Ovchinnikov, 2011; van Weelden et al., 2016). Therefore, it is important to carefully consider the right price strategy for these products.

Widely different willingness to pay for circular products has been found in different product categories. For example, Hamzaoui-Essoussi and Linton (2014) found a higher willingness to pay for recycled paper than for branded new paper. However, a lower willingness to pay was found for other products, including food products produced using recycled irrigation water (Savchenko et al., 2018) and remanufactured cameras (Michaud & Llerena, 2011). Hence, it appears that reused or recycled content is more acceptable in some product categories than in others (Hamzaoui-Essoussi & Linton, 2014; Magnier et al., 2019). For example, consumers seem to have lower quality perceptions and purchase intentions for textile products with reused or recycled content than for durables and fast-moving consumer goods (Magnier et al., 2019). Magnier et al. (2019) found differences between running shoes, sweaters, dishwashing soap and hand cream. They also found that consumers respond less favorably to packaging made of recycled ocean plastic when the product it is used for is absorbed through the skin, such as creams. Hence, it appears that consumers are less willing to accept such a product when they perceive it as unsafe.

A key consumer reservation with products made of recycled ocean plastic is risk of contamination (Magnier et al., 2019). Similarly, Abbey, Meloy, Guide Jr., et al. (2015) found that consumers describe remanufactured products with words such as used, old, broken, dirty. Hence, it seems that remanufactured products and products made with recycled materials are sometimes perceived as dirty and disgusting, mainly because they

were previously used by a different person (Abbey, Meloy, Guide Jr., et al., 2015). This is at least partly due to consumer uncertainty and confusion (Abbey, Meloy, Guide Jr., et al., 2015; Holmström & Böhlin, 2017b; Ovchinnikov, 2011). Hence, consumers' lack of knowledge and misunderstanding of what refurbishment and recycling entails is an important barrier to the acceptance of these products (van Weelden et al., 2016).

When the product or parts of it were used before, it may lack the thrill of newness and also desirable innovative features (van Weelden et al., 2016), which are additional barriers to the adoption of these products (Mugge et al., 2017). Singh and Ordoñez (2016) explain consumers' rejection of circular products with reference to psychological essentialism. Recycled items lack authenticity (Singh & Giacosa, 2019), which reduces their uniqueness and the perceived value of the product.

Another barrier is lack of availability. Because consumers are not willing to make an extra effort to find a store with products made with recycled materials they are less likely to buy these products (Tunn et al., 2019; van Weelden et al., 2016).

3.2 Opportunities

Some research found positive consumer responses to products with reused materials (Holmström & Böhlin, 2017b; Magnier et al., 2019). For example, Mobley et al. (1995) found that consumers rated recycled paper products more favorably than products made of virgin fibers. Also, Sun et al. (2018) found a positive attitude, intention to purchase and self-reported purchase of products with recycled content. Some consumer segments are more willing than others to accept products with reused materials (Mugge et al., 2017). The former perceive lower risk and trust these products' quality and performance more (van Weelden et al., 2016). They are also characterized by higher environmental consciousness (Gaur et al., 2015) and expertise, and demographically by higher age, education and income (Magnier et al., 2019). Hence, it seems that products with reused materials represent a market opportunity for companies targeting consumers with these characteristics (Mobley et al., 1995).

Knowledge and information are essential to consumer acceptance of circular products (Mugge et al., 2017; Vafadarnikjoo et al., 2018) and consumer quality perceptions can be improved by educational means (Abbey, Meloy, Guide Jr., et al., 2015). The better consumers understand these products, the lower risk they perceive (Wang et al., 2013). An important impediment is that consumers often cannot assess quality of the product before using it (Michaud & Llerena, 2011; Wang & Hazen, 2016).

However, when they can experience the product before buying it, even in a retail store, this has a positive impact on quality perceptions (van Weelden et al., 2016). In addition, social norms, including how the country values recycled and remanufactured products, affect consumer acceptance (Gaur et al., 2015). Consumers' evaluation of these products is also influenced by their beliefs about important others' perceptions (van Weelden et al., 2016). In this way, well-crafted communication is needed to increase attention to and positive perceptions of product with reused materials as well as their perceived social acceptance.

Research suggests that both generic and product-related information is needed (van Weelden et al., 2016). Generic information concerns the process of production and the benefits associated with circular production. Product-related information, on the other hand, should aim to reduce perceived risks and promote the product. For example for a refurbished smartphone, this information might include details on the battery life, guaranteed software updates and upgraded performance scores (Mugge et al., 2017). Moreover, it is important to include clear and precise information about the state of the product (such as age, possible damages, battery condition, and results of performance tests) and often also its history (such as how the product was used, the reasons for discarding it, and use of protective tools) (van Weelden et al., 2016). Sometimes it is possible to offer features that are better than in a new product, such as better batteries, which can increase the attractiveness of a refurbished product (van Weelden et al., 2016). Obviously, such benefits should always be communicated at the point of purchase.

Consumers are more willing to accept circular products when doubts and knowledge deficits are reduced (van Weelden et al., 2016). Research find that consumer acceptance of circular products increases with their knowledge (Matsumoto et al., 2018) and experience with the products (Guide & Li, 2010; Hamzaoui-Essoussi & Linton, 2014). Communication should be designed to inform consumers in a balanced way about possible risks and imperfections (van Weelden et al., 2016). Balanced information has been found to increase consumers' willingness to pay, for example, for food products produced with recycled water (Savchenko et al., 2018). Information about the nature of the production process is important to avoid or reduce exaggerated risk perceptions (Abbey et al., 2017). Also, making the past history of the product transparent appears to increase the acceptance of products with reused components (Kamleitner et al., 2019). Winterich et al. (2019) found the positive side-effect of making consumers think about the transformation of recyclables into new products that it also makes them recycle more.

Together with interventions to increase knowledge about a circular product (cost, quality, and greenness), it is useful to implement risk-mitigating strategies (Wang & Hazen, 2016), such as quality assurance and warranties (Magnier et al., 2019; Michaud & Llerena, 2011; Ovchinnikov, 2011; Vafadarnikjoo et al., 2018), quality labels (van Weelden et al., 2016) and performance classification systems (Mugge et al., 2017). Consumer acceptance of circular products can be improved by means of quality certification (Abbey et al., 2017) and a warrant (van Weelden et al., 2016). Consumer in general evaluate remanufactured products more favorably when they are remanufactured by the original manufacturer or its authorized factories than by a third party (Subramanian & Subramanyam, 2012). In contrast, information about the history of the product is more effective at reducing uncertainty about the products when it comes from independent third-parties (Ovchinnikov, 2011), including third-party eco-labels (Harms & Linton, 2016). The same is true for a system providing verification of the product quality (Ylä-Mella et al., 2015).

Consumers' intention to buy a refurbished product is positively related to perceived environmental benefits (Kuah & Wang, 2019; Mugge et al., 2017). However, environmental benefits are usually not the most important determinant of consumer choices (Gan & Chen, 2019; Holmström & Böhlin, 2017b; van Weelden et al., 2016), among other things because consumers often lack necessary knowledge to judge which product is more environmentally friendly (Khor & Hazen, 2017). For this and other reasons, consumers do not necessarily view remanufactured products as more environmentally friendly (Abbey, Meloy, Guide Jr., et al., 2015). Still, new buyers express that the environmental benefits are an important motivation to choose these products (van Weelden et al., 2016). Hence, it is important to clearly communicate the environmental benefits associated with these products.

Magnier et al. (2019) found that recognizability increases the willingness to pay for products made from recycled ocean plastic. This suggests that consumers acceptance of circular products can be increased by making recycled components clearly visible (cf. Griskevicius et al., 2010). As a caveat, Achabou and Dekhili (2013) found that consumers responded positively to recycled packages of luxury products, but not to recycled materials in the product itself, such as luxury shirts. Recycled packaging generally benefits from low perceived risks in terms of quality, functionality and contamination, which increases consumer acceptance (Magnier et al., 2019).

4. Some practical cases

Companies increasingly reuse materials for their products. For example, Nike collect waste products to use in new products (https://purpose.nike.com/reuse-a-shoe), such as recycled PET for lace tips and recycled factory waste rubber outsole (Mestre & Cooper, 2017), something which they highlight in market communication (https://purpose.nike.com/vapormax-random and https://purpose.nike.com/flyleather-earth-day-pack). In a similar way, Patagonia and The North Face sell outdoor products that are "made from other clothes" (https://wornwear.patagonia.com and https://www.thenorthfacerenewed.com) and Elvis & Kresse sells luxury bags with reclaimed materials (https://www.elvisandkresse.com). One of Fairphone's key selling propositions is that their mobile phones are produced with recycled components (https://shop.fairphone.com) and the fabric in the new edition of Renault's popular electric car, ZOE, introduced in 2019, is made from 100% recycled materials (https://group.renault.com/en/news-on-air/news/new-zoe-recycled-fabrics-nothing-is-lost/). These are just some of the many examples of companies that reuse materials in their products and use this fact actively in their marketing while trying to overcome consumers' quality concerns and perceived risks. All of these companies explicitly communicate that their product contains reused or recycled materials leading to reduce waste and other environmental benefits. Hence, they all seem to agree that a well-crafted communication strategy is a key to consumer acceptance, even valuing, products with reused materials. Supporting this, Kamleitner et al. (2019) find that a communication strategy making the past "identity" of an upcycled product salient (e.g., a backpack made from an airbag) can spur the demand for an upcycled product by allowing the buyer to feel special.

It is obviously also important to engage consumers in returning the end-of-use products for reuse, reprocessing or recycling (Kamleitner et al., 2019; Ylä-Mella et al., 2015). The companies mentioned above and many others have programs to collect consumers' post-use products, as part of an integrated strategy to increase production with reused materials. Winterich et al. (2019) showed that information about the transformation of materials into final products can motivate consumers to participate in recycling programs. In sum, well-crafted communication is needed to both increase the acceptance of products with reused materials and motivate consumers to participate in recycling programs.

5. Conclusion

Driven by mounting waste problems and even more by dwindling virgin resources, a transition from a linear to a circular economy is emerging, including the increasing use of reused or recycled materials in the productions of new products. This chapter has reviewed research on factors that influence consumer acceptance of circular products. It appears that products with reused materials are sometimes viewed favorably by consumers, but they are more often perceived negatively. Hence, it is important to develop effective strategies to promote and facilitate the broad acceptance of circular products. The research reviewed in this chapter suggests that a combination of means is needed for this purpose.

A transition to a circular economy requires several changes by consumers, including engaging in different models of ownership, changing their perception of product newness, and reducing their obsession with possessions and ownership (Scott et al., 2014). Current "acquisitive" materialism should be replaced by a new responsible materialism, built on an understanding of circular economy principles, respect for material resources and environmental values. There is a movement in the direction of a higher acceptance of products with reused parts (Mugge et al., 2017), especially among people with higher environmental consciousness (Gaur et al., 2015) and expertise (Magnier et al., 2019). Social norms aligned with the importance of valuing reused materials also seem to be emerging (Gaur et al., 2015; Griskevicius et al., 2010; van Weelden et al., 2016). However, it is difficult to change materialistic consumers' view of ownership and possessions (Scott et al., 2014). Hence, it is also important that the perceived quality of the products improve, the perceived risks are reduced through improved production processes and, when needed, assurances and warranties. In addition, well-crafted communication is needed to inform and educate consumers about the products, the production processes and sometimes the past history of reused materials, to reduce consumer uncertainty and misperceptions.

Governments play an important role for increasing consumer acceptance of these products as well, for example, by means of ecolabels certifying and communicating products' environmental impact from a life-cycle perspective (Darnall et al., 2018). Third-party ecolabels are effective means to inform consumers about products' environmental characteristics and help them make better choices (Thøgersen, 2002). They can also be instrumental in educating consumers about their choice options and providing assurance of product quality.

Several factors need to be considered to craft an effective communication strategy for products with reused materials (Kamleitner et al., 2019). The environmental benefits are important for consumers' choice of products with reused materials. However, only stressing the environmental benefits may backfire, since they are rarely the main reason why consumers buy a product (Abbey, Meloy, Guide Jr., et al., 2015; van Weelden et al., 2016). Especially, it is essential to deal effectively with consumer concerns about performance and financial risks. The reuse of components and materials can become a competitive advantage for companies who know how to position their products and have a good understanding of their target customers.

At a more basic level, the transition to a circular economy with effective reusing materials for new products in a never-ending cycle, requires that we challenge the current "acquisitive" materialism with its obsession with possessions and ownership. Instead, we need a new, responsible materialism, built on an understanding and appreciation of circular economy principles and intelligent and respectful use of limited resources. Responsible companies and public policy need to work together to accomplish this value change. Alone, consumers cannot build a sustainable future, but this goal can also not be achieved without their contribution in many different roles. Equally indispensable are companies and private and public institutions organizing and regulating circular economic systems and motivating and facilitating the participation of all stakeholders in the transition to a circular economy.

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Chapter 3

Consumer reaction to products with reused materials: examining different routes of contamination

1. Introduction

Companies are incorporating new practices and methods into their production, such as organic production, local production, reused materials, just to mention some. The "throwaway society" (Cooper, 2005) led researches to pay special attention to the consumption phase (Biggs et al., 2015; Prothero et al., 2011; White et al., 2019). We throw away a lot of things that ends up polluting the environment. However, now it is actually possible to transform some of this material, previously thought of as waste, as components in the production of new products.

Companies are incorporating into their products reused materials in order to reduce the levels of waste and to have different solutions in the management of resources. For example, Nike uses recycled PET for lace tips and recycled factory waste rubber outsole for some of its products (Mestre & Cooper, 2017). Similarly, different companies are including post-consumer-recycled materials into their products. However, despite the progress toward these solutions, consumer acceptance of these products has not been totally explored. Past research has identified that the incorporation of reused materials in the products leads to positive reactions. Kamleitner et al. (2019) found that making the past identity of an upcycled product salient (e.g., a backpack made from an airbag) can spur the demand for an upcycled product by allowing the buyer to feel special. Therefore, making the past history of the product transparent appears to increase the acceptance of products with reused components (Kamleitner et al., 2019).

On the other hand, there is an indication that consumers do not always respond positively to products made with reused materials. For example, consumers reject these products due to contamination concerns. Abbey, Meloy, Guide Jr., et al. (2015) found that consumers describe products with reused components with words such as used, old, broken, dirty. Similarly, consumers perceive risk of contamination in products made of recycled ocean plastic (Magnier et al., 2019), such as products with recycled plastic bottles (Meng & Leary, 2021). The literature also shows that products made with recycled

materials can be perceived as dirty and disgusting, mainly because some of their parts were previously used by a different person (Abbey, Meloy, Guide & Atalay, 2015). Based on these studies, we can say that contamination affects the acceptance of products with reused materials. However, this effect deserves more investigation.

In this study, we aim to understand how contamination operates in the case of products with reused materials. The literature shows that feelings of contamination lead consumers to decrease their evaluations of the products (Morales & Fitzsimons, 2007), especially when they know that they were previously touched by another person (Argo et al., 2006). This means that the contact of a different person (such as the previous owner) can affect evaluations of the entire object (Kapitan & Bhargave, 2013). Contamination has been explored in different domains and was proved to impact different behaviors, such as product evaluations (Argo et al., 2008; Morales & Fitzsimons, 2007), responses to production locations (Fuchs et al., 2015; Newman & Dhar, 2014), acceptance of second-hand markets (Ackerman & Hu, 2017; Kapitan & Bhargave, 2013), products with recycled plastic (Meng & Leary, 2021), influence of attractive others (Argo et al., 2008), influence of product designers (Stavrova et al., 2016), celebrity possessions (Newman et al., 2011), and transference of abilities (Kramer & Block, 2014). In different areas, contamination concerns impact individuals' behaviors, both in positive and negative ways.

Therefore, it is important to understand how contamination operates in the case of products with reused materials. Drawing from dual-process theories (for a review see Samson & Voyer, 2012), this paper examines how perceived contamination influences the acceptance of products made with reused materials with feelings of disgust and perceived quality as mediators. Although contamination and product contamination have been a focal point of marketing and consumer research (Argo et al., 2006; Morales & Fitzsimons, 2007), little research has focused on utilizing perceived quality and disgust as a means of generating consumers reactions to the products. Contamination is largely associated with disgust feelings in the literature (Argo et al., 2006; Meng & Leary, 2021; Morales & Fitzsimons, 2007). However, we also focus our study on a different dimension: perceived quality.

Consumer processing can be formed through both central and peripheral routes. The elaboration likelihood model (Petty & Cacioppo, 1986) and the systematic-heuristic processing model (Eagly & Chaiken, 1993) support both routes in consumer processing. "Peripheral" routes are associated with fast, easily processed cues, such as attractiveness.

"Central" routes consist of consumers' effort to the arguments, the elaboration of these arguments, and to generally respond based on their judgment, which usually involves quality. Studies have proven both central paths via judgments of quality and peripheral paths (Petty & Cacioppo, 1986). To date, however, there is limited (if any) research that applies a dual-process perspective to products made with reused materials and the analysis of perceived quality and disgust together. The effect of contamination on the acceptance of products made with reused materials may not influence all consumers in the same manner. Extending dual-process theories to quality and disgust would suggest that these products may be processed differently by individuals, depending on whether processing follows a more central route (quality) or a more peripheral route (disgust).

Past research on consumers' acceptance of products with reused materials shows that there is an important concern about product quality and performance (Abbey, Meloy, Guide Jr., et al., 2015; Wang & Hazen, 2016). Product quality is formed by evaluative processes (Golder et al., 2012). So, it is likely to be driven by cognitive reactions. We also know that consumers have emotive reactions to products made with reused components, such as disgust (Abbey, Meloy, Guide Jr., et al., 2015; Meng & Leary, 2021). The premise of this paper is that perceived contamination will be explained by two different routes of reactions. The first route, called "cognitive route", is explained by perceived quality. The second route, called "emotional route", is driven by feelings of disgust. Previous studies have covered these two reactions separately, but have failed to produce a comprehensive understanding. We, therefore, try to offer a more holistic approach by combining both routes of reaction. An important assumption in this paper is that the acceptance of products made with reused materials can be understood from both a cognitive and an emotional perspective, forming the basis for the acceptance of these products.

2. Contamination

By knowing that a product was previously touched or owned by another person, individuals can have different evaluations to the product. This fact is embedded in the psychological law of contagion. The law of contagion states that when two objects come into contact, their proprieties can be transferred to each other (Nemeroff & Rozin, 1994). When a source, that can be a person or an object, comes into contact with a recipient (person/object), the source can influence the recipient through touch (Rozin & Nemeroff,

1990). When touch occurs, some proprieties of the source can be transferred to the recipient by a contagious mechanism of transference of essence (Nemeroff & Rozin, 1994). Hence, contamination is strongly related to the law of contagion (Argo et al., 2006). Baxter et al. (2016) define contamination "as the process through which the quality, meaning, or value of an object change due to interaction with someone or something" (p. 1219).

One of the proprieties of the law of contagion is that the transference of essence is assimilated as unseen contagious entity (Rozin et al., 1986). This mean that this is a process where you don't see the transference of the proprieties, but once in contact objects or people can affect each other, passing some or all of their properties to each other. Also, it is possible that the transference of proprieties remains even after the contact no longer exists. This fact is represented by one of the premises of the law that says "once in contact, always in contact" (Rozin et al., 1986). If the source is perceived as contaminated, individuals believe that the recipient will receive the same properties of contamination (Nemeroff & Rozin, 1994). For example, individuals would not drink a glass of juice that was mixed with a used fly swatter, even when it was carefully washed (Rozin & Fallon, 1987) or would not drink a juice touched by a sterilized cockroach (Rozin et al., 1986). Even when there is no real chances of contamination (Morales & Fitzsimons, 2007; Nemeroff & Rozin, 1994) and when actions to "purify" the object are used, such as washing or sterilization, individuals still believe in the contagious proprieties of the product and tend to reject them (Angyal, 1941; Kim & Kim, 2011).

Contagious beliefs apply for objects and possessions, but also applies for individuals (Nemeroff & Rozin, 1994), named as conceptual contaminants (Kapitan & Bhargave, 2013) or interpersonal-moral contagion process (Huang, Ackerman, & Newman, 2017). They represent social-related cues that increase contagion perceptions (Morales et al., 2018). For example, consumers avoid contact with objects that were in touch with a disliked person (Nemeroff & Rozin, 1994; Rozin et al., 1986) or have better evaluations of products that were in contact with a "positive person", such as a close friend (Nemeroff & Rozin, 1994).

The theory evolved and the contact between the source and the recipient is no longer a necessary condition for contamination to occur (Morales et al., 2018). Actually, nonphysical contagion has important effects in different contexts (Huang, Ackerman, & Newman, 2017). For example, for intention-based contagion, there is no physical contact between the source and the recipient, but moral characteristics can be transferred between

the source and the recipient (Stavrova et al., 2016). Similarly, consumers have high purchase intentions for products owned by a well rated celebrity, even when the product was never touched by this person (Newman et al., 2011).

Recently, the theory has been used in the consumer behavior literature. Argo et al. (2006) expanded this theory to the "theory of consumer contamination" to explain why consumers reject products in the purchasing environment when they know that they were previously touched by a different person. This theory is the application of the law of contagion in a consumer context and tries to explain how contamination beliefs affect evaluations and acceptance of products.

We use this theory to support our study. The literature shows that contamination concerns can be a barrier to the acceptance of products made with reused components (Abbey, Meloy, Blackburn, et al., 2015; Magnier et al., 2019; Meng & Leary, 2021) and explore how contamination interacts in this context.

In the following section, we first discuss how perceived contamination occurs in the case of second-hand markets. The literature of second-hands products has important insights into how contamination affects the acceptance of the products and try to extend it to the reused materials concept. Products with reused materials have their components not only touched, but also used by a different person. Based on this idea, products can be negatively affected by the inclusion of reused components. By knowing that a product has its parts made with reused components, which means that some parts were touched by a different person, we investigate how contamination affects the evaluation of the entire product.

2.1 Contamination in second-hand markets

Past research shows that second-hand products have positive evaluations (Holmström & Böhlin, 2017a; van Weelden et al., 2016), such as perceived uniqueness (Park & Lin, 2018). Also, consumers perceive second-hand products as vintage products, achieving their goals of individuality (Park & Lin, 2018). For contamination effects, it is possible to observe a positive contamination in second-hand markets. For example, when a pair of sunglasses was used by a celebrity with positive evaluations, his/her essences can be transferred to the object and the product is evaluated positively (Newman et al., 2011).

However, contamination can also be considered a barrier in second-hand markets. O'Reilly et al. (1984) found that consumers have low intentions to purchase used products, such as clothes, mainly due to contamination concerns. Ackerman and Hu (2017) found that consumers have negative reactions to used pants. The authors claim that this effect occurs because consumers know that another person had contact with the product and they perceive it as contaminated. Similarly, Clube and Tennant (2020) found that garment rental is affected by contamination concerns. Huang, Ackerman and Sedlovskaya (2017) tested different reused products, such as a microwave, an office chair, a sweater, and a DVD player, and found that infectious disease cues negatively impact evaluations of second-hand products.

In the context of second-hand markets, consumers explicitly know that the product was owned and had contact with a different person, where the "usage history" (Huang, Ackerman, & Sedlovskaya, 2017) makes contamination a more direct process. However, recent literature shows that this can also occurs for products made with reused materials (Abbey, Meloy, Guide Jr., et al., 2015; Magnier et al., 2019; Meng & Leary, 2021), where some of the components of the product are made from used products. In this case, parts discarded from another product (usually wasted products) are reintroduced in the production system to be part of a new product. Therefore, we extend past research in second-hand products and try to explain why products with reused materials can have low acceptance (Mugge et al., 2017; van Weelden et al., 2016; Wang & Hazen, 2016), by exploring contamination effects.

2.2 Contamination in products made with reused materials

There is an ambiguity in consumers' acceptance of products with reused materials. Some studies found positive consumer attitudes and intentions to buy (Holmström & Böhlin, 2017a; van Weelden et al., 2016), while others found that consumers are reluctant to accept these products (Abbey, Meloy, Guide Jr., et al., 2015; Camacho-Otero et al., 2018; Holmström & Böhlin, 2017a; Mugge et al., 2017).

Consumers have different reactions to different categories of products made with reused components (Hamzaoui-Essoussi & Linton, 2014; Magnier et al., 2019). For example, Hamzaoui-Essoussi and Linton (2014) found a higher willingness to pay for recycled paper than for branded new paper. However, a low willingness to pay was found for other products, such as remanufactured cameras (Michaud & Llerena, 2011). Also,

consumers seem to have lower quality perceptions and purchase intentions for textile products with reused or recycled content than for durables and fast-moving consumer goods (Magnier et al., 2019). Magnier et al. (2019) found differences between running shoes, sweaters, dishwashing soap and hand cream. Recycled packaging generally benefits from low perceived risks in terms of quality, functionality and contamination, which increases consumer acceptance (Magnier et al., 2019). Achabou and Dekhili (2013) found that consumers respond positively to recycled packages of luxury products, but respond negatively to recycled materials in the product itself, such as luxury shirts. However, consumers respond less favorably to packaging made of recycled ocean plastic when the product is absorbed by the skin, such as creams (Magnier et al., 2019).

A key consumer reservation with products made of recycled ocean plastic is risk of contamination (Magnier et al., 2019). Consumers' lack of knowledge and misunderstanding of what refurbishment and recycling entails is an important barrier to the acceptance of these products (van Weelden et al., 2016). Abbey, Meloy, Guide Jr., et al. (2015) found that consumers have negative perceptions, such as disgust, to different products, such as technology products, household products, and personal care products. Meng and Leary (2021) studied T-shirts and carrying bags made of 100% recycled plastic bottles and found that consumers perceive these products as contaminated.

Hence, we depart from previous studies that found that products with reused materials are affected by contamination concerns and we explore different factors that can explain why contamination is an issue in the acceptance of these products. In the following section, we discuss a boundary condition to this effect: the degree of physical contact of the product.

2.3 Contamination and different degrees of physical contact

In the case of second-hand markets, products close to the body generate higher negative perceptions than products distant from the body (Ackerman & Hu, 2017). Rejection is greater when the product has a high proximity to the body, such as clothes (Roux & Korchia, 2006). Hence, how close the product is to the body affects product responses (O'Reilly et al., 1984). Recent research found a similar effect for products made with reused materials (Abbey, Meloy, Blackburn, et al., 2015). Mobley et al. (1995) found that consumers are more sensitive to the quality of the product when, to use the product, it is necessary to bring it in close contact with the body. In the case of packaging made

with reused materials, contamination is also greater for products that are absorbed by the skin, such as hand creams (Magnier et al., 2019). Abbey, Meloy, Blackburn, et al. (2015) analysed different levels of products, such as products that are "around the consumer", products that are "on the consumer", and products that are "in the consumer" and found that contamination effects are greater for products that have higher contact to the user (products "in the consumer").

This effect is common in studies about contamination. Morales and Fitzsimons (2007) showed that contagion effects are greater for products that have close physical contact with the body. Therefore, the acceptance of products with reused materials can be influenced by how close the product is to the user's body. This fact is similar to studies of "intimate corporeal proximity" (Roux & Korchia, 2006) or physical closeness and distance (Williams & Bargh, 2008). Whereas spatial distance can affect judgement and decision making (Williams & Bargh, 2008), consumers use spatial closeness and distance to make evaluations about products. Bodur et al. (2014) analysed differences in products that require a higher degree of physical contact compared to those that require a lower degree of physical contact (or no physical contact) and found differences in responses to these products.

For the purpose of this study, we assume that products with reused materials that are near the body, that is, products with high a degree of physical contact during consumption, will have different evaluations compared to products with a low degree of physical contact. We predict that product evaluations and purchase intentions will be lower to products high degree of physical contact compared to products with low degree of physical contact. Our prediction is based on the discussion above: as the product becomes close to the body, it is necessary more corporal contact and perceived contamination will be greater. We predict that:

Hypothesis 1: Consumer intentions to purchase and product evaluations will be lower when a product made with reused materials has a high degree of physical contact during consumption compared to those that have a low degree of physical contact.

Hypothesis 2: Products made with reused materials that have a high degree of physical contact during consumption will be perceived to be more contaminated compared to those that have a low degree of physical contact.

Using dual-process theories to analyze consumers acceptance of products made with reused materials suggest two basic routes of how consumers form their evaluations to the products: a central route via quality inferences and a peripheral route via judgements of disgust. Figure 3 gives an overview of the relationships discussed in the following sections.

Figure 3 – Conceptual model.
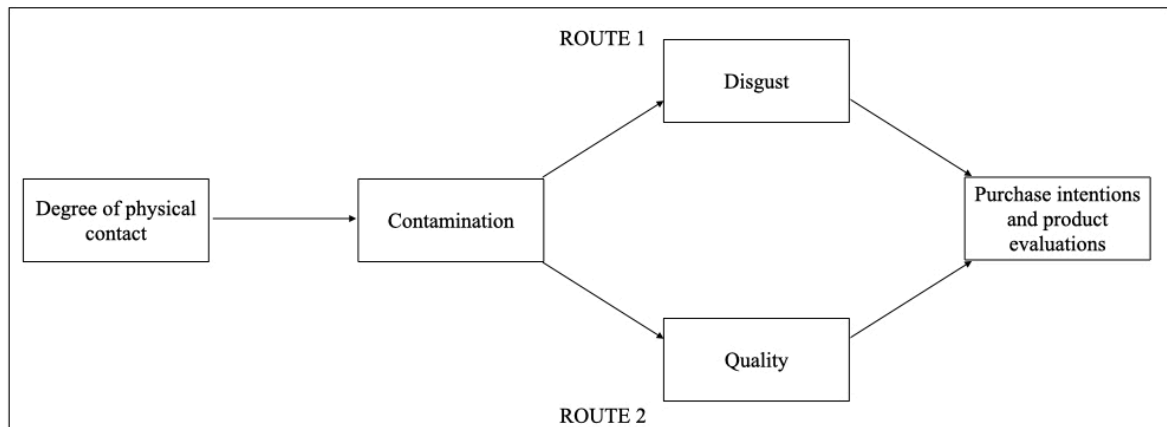
3. Feelings of disgust

The emotion of disgust has been largely explored in studies about contamination. Feelings of disgust is considered an outcome of perceived contamination (Rozin & Fallon, 1987). Disgust can be activated by both physical and non-physical contaminated sources (Kapitan & Bhargave, 2013) and is described as a basic emotion associated with avoidance systems (Rozin et al., 1986). In the retail context, different cues can elicit disgust (Castro et al., 2013). For example, products touched by others can result in feelings of disgust (Argo et al., 2006). Also, products considered disgusting impact evaluations of other products once they are in contact (Morales & Fitzsimons, 2007). Even packaged products are assumed to be contaminated when disgusting sources are in contact with them (Castro et al., 2013; Morales & Fitzsimons, 2007).

Recent research showed that products made with recycled plastic bottles are perceived as contaminated and, therefore, disgusting (Meng & Leary, 2021). Ackerman and Hu (2017) found that consumers perceive second-hand products as more disgusting, even when they are presented with positive certification (such as a certification that shows that the product was cleaned and is "just like new"). Different cues can make contamination salient (Castro et al., 2013) and the emotion of disgust can be one of the

explanations to this effect. Taking the case of products made with reused materials, we assume that perceiving the product as contaminated can be explained by the emotion of disgust. We expected that as the product is perceived as contaminated, consumers will experience the emotion of disgust. The emotion of disgust will impact product evaluations and low purchase intentions. Hence, given the interactive nature between disgust and contamination, we propose that:

Hypothesis 3: Disgust mediates the influence of perceived contamination on purchase intentions and product evaluations.

4. Perceived quality

One of the most important concern that consumers express regarding products with reused components is low quality (Abbey, Meloy, Guide Jr., et al., 2015; Wang & Hazen, 2016). Quality is a combination of attributes associated with the performance of the product, its functionality and reliability (Golder et al., 2012). In the case of products made with reused materials, Abbey et al. (2017) found that perceived low quality is due to a perceived probability of functionality and cosmetic defects, which translates into high perceived risk (Magnier et al., 2019; van Weelden et al., 2016). Perceived risks include performance, financial, time, obsolescence, physical, social and resource risks.

Mitra and Golder (2006) define perceived quality as "the overall subjective judgment of quality relative to the expectation of quality". Once consumers perceive the products as contaminated, quality perceptions can be affected (Clube & Tennant, 2020). Camacho-Otero et al. (2018) found that acceptance of products made with reused materials is reduced by beliefs about low quality and risk of contamination.

In different domains, contamination and quality perceptions interact. In the case of positive contamination, Bodur et al. (2014) found that the transference of quality is greater for products close to the body, mainly due to a contagion effect. Morales and Fitzsimons (2007) found that contagion effects reduced evaluations of the quality of the product, affecting willingness to try and quality expectations. Mugge et al. (2018) found evidence for a different type of contagion, called digital contagion, representing residues in the performance of the product (e.g. software) due to prior use.

Hence, in this study we explore perceived quality as one of the underling mechanisms of the effect of contamination on product acceptance. In this case,

contamination concerns will lead to lower quality perceptions, which in turn will influence product evaluations and purchase intentions. As it is difficult for consumers to judge the quality performance of these products, consumers may use different cues to judge product quality, such as perceived contamination. As contamination can be defined as "as the process through which the quality, meaning, or value of an object change due to interaction with someone or something" (Baxter et al., 2016, p. 1219), we assume:

Hypothesis 4: Perceived quality of the product made with reused materials mediates the influence of perceived contamination on purchase intentions and product evaluations.

5. Methods

In this study, we propose that consumers will have lower evaluations of products that have a high degree of physical contact than products that have a low degree of physical contact (H1 and H2). Also, we explore two different routes of the effect of product contamination on product evaluations: one leading to an emotional reaction, such as disgust (H3), and the other a cognitive reaction, such as perceived quality (H4).

5.1 Pre-test with products

A pre-test with 27 participants tested the degree of physical contact of 11 different products (e.g. "Imagine you are using this product, how close do you think it is from you?", 1 = Very far from me, 7 = Very close of me; "What is the level of contact that you have with the product while using it?", 1 = No contact with my body, 7 = Too much contact with my body). Items to measure degrees of physical (Bodur et al., 2014; Fajardo & Townsend, 2016; Latané et al., 1995) and product categories included in the pre-test (Magnier et al., 2019; Mugge et al., 2017; van Weelden et al., 2016) were based on earlier research.

We used three different categories (electronics, household appliances, apparel) to evaluate the level of physical contact of 11 different products. We selected four different products to our study (two products in the high degree of physical contact group and two products in the low degree of physical contact group). Based on the questions to evaluate the degree of physical contact of the products, low mean values indicate that the products have low degree of physical contact, whereas high mean values indicate products with

high degree of physical contact. T-tests with paired samples inside each product category showed a significant difference in the scores between the earphone (M = 5.89, SD = 1.47) and the printer (M = 2.30, SD = 1.41), t(26) = -11.120, p = .000 (electronics), and between the electric toothbrush (M = 5.06, SD = 2.06) and the vacuum cleaner (M = 3.02, SD = 1.65), t(26) = -5.375, p = .000 (household appliance). In this way, the earphone and the electric toothbrush are used to represent products with high degree of physical contact and the printer and the vacuum cleaner are used to represent products with low degree of physical contact.

5.2 Participants and design

Participants were 346 (M_{age} = 36.4 years, SD = 11.96; 56.6% females) workers recruited from Prolific Academic to participate in an experimental study. Study 1 consists of a one-way between-subjects experimental design with degrees of physical contact (high vs low) as the experimental factor. Each condition had two different products, presented as a between-subjects factor. Participants were assigned to one of the four experimental groups ($N_{earphone}$ = 76, 25%; $N_{toothbrush}$ = 73, 24%; $N_{printer}$ = 79, 26%; N_{vacuum} = 76, 25%). Prior to the analysis, we removed participants who failed one or more attention checks (N = 42). Data cleaning resulted in the retention of 304 participants for subsequent analysis.

5.3 Procedures

After consenting, participants read that they would be asked to give their opinion on a specific product. Participants were exposed to one of the four products, presented with three descriptions containing characteristics of the products. One of them represented a message about the material used in the product: "some of its parts are made with materials from recycled products that other people have discarded". All messages were the same between products (see Appendix A for a description of the scenarios).

After manipulation, participants completed a set of dependent measures: purchase intentions (three items e.g. "I would buy this product", 1 = "strongly disagree", and 7 = "strongly agree" α = .927) and overall impressions of the product (five seven-point scales, "1 = bad, 7 = good"; "1 = not appealing, 7 = appealing" α = .962) (Argo et al., 2006). Next, participants were asked to indicate perceived contamination (three items e.g. "I believe this product made is very unsanitary"; "I believe this product is contaminated", 1

= "strongly disagree", and 7 = "strongly agree"; α = .912) (Ackerman & Hu, 2017; Argo et al., 2006; Magnier et al., 2019), and perceived quality of the product ("durability"; "materials"; "overall quality", 1 = "very low", and 7 = "very high"; α = .936) (Newman & Dhar, 2014). To measure disgust, participants had to indicate how the product made them feel using a battery of negative affect terms. Within these items, two of them were used to measure disgust, averaged to create a disgust index: "disgusted"; and "unclean" (1 = "Not at all", and 7 = "Extremely"; α = .854) (Argo et al., 2006; Morales & Fitzsimons, 2007). Finally, we measured demographic questions and an attention check for the product material.

5.4 Results

Pre-analysis: Study 1 consisted of a one-way between-subjects experimental design with degrees of physical contact (high vs low) as the experimental factor. Each factor had two different products, presented as a between-subjects factor. Before main analyzes, we compared purchase intentions and product evaluations (dependent variables) inside each condition (high and low degree of physical contact). We compared these variables between the earphone and the electric toothbrush and between the vacuum cleaner and the printer. With that, we compared dependent variables inside each category of high and low degree of physical contact. The comparison between mean values for products in each category yielded a nonsignificant effect between conditions (purchase intentions: high degree of physical contact, $M_{ear} = 4.68$, $M_{toot} = 4.91$, p = .355; low degree of physical contact, $M_{print} = 4.15$, $M_{vacuu} = 4.36$, p =.395 / product evaluations: high degree of physical contact, $M_{ear} = 5.40$, $M_{toot} = 5.23$, p = .421; low degree of physical contact, $M_{print} = 4.95$, $M_{vacuu} = 4.93$, p = .959). For the hypothesis test, we therefore collapsed the data across each condition.

Also, due to the fact that the variables contamination and disgust were non-normally distributed, we transformed these variables in order to have a normal distribution. As the variables were right skewed, we recoded the items of the variables in the following categories: 1 = 0, 2 and 3 = 1 and 4 to 7 = 2. Then, as suggested by Tabachnick et al. (2007) we used the square root of these variables in the process of transforming non normal data to create the final index for contamination and disgust.

Main effects: In the first hypothesis, we predicted that purchase intentions and product evaluations would decrease as the product had high degree of physical contact during consumption. The analysis of variance (ANOVA) using degree of physical contact as the independent variable and purchase intentions as the dependent variable produced a significant main effect ($F_{(1,302)} = 9.54$, $p < 0.01$). However, results go into the opposite direction from what was predicted in the hypothesis. Participants had higher intentions to purchase products with high degree of physical contact ($M_{high} = 4.80$, $SD = 1.54$) than products with low degree of physical contact ($M_{low} = 4.26$, $SD = 1.51$). The same occurs for product evaluations ($F_{(1,302)} = 5.50$, $p < 0.01$ / $M_{high} = 5.32$, $SD = 1.27$; $M_{low} = 4.94$, $SD = 1.49$). Thus, hypothesis 1 is rejected.

An ANOVA was used to analyze main effects of perceived contamination (hypothesis 2). We tested whether products with high degree of physical contact were perceived as more contaminated. Results showed a significant main effect ($F_{(1,302)} = 5.40$, $p < 0.01$). Participants considered the product with high degree of physical contact as more contaminated ($M_{high} = 1.82$, $SD = 1.20$) than products with low degree of physical contact ($M_{low} = 1.48$, $SD = .84$). In this way, hypothesis 2 is accepted.

Mediation analysis: We predicted that that disgust (Hypothesis 3) and quality (Hypothesis 4) mediate the influence of perceived contamination on purchase intentions and product evaluations. To test the mediating role of quality and disgust, we conducted a mediation analysis with the two mediators (Hayes PROCESS Model 4).

First, we used purchase intentions as the dependent variable. We found a significant indirect effect for purchase intentions through perceived quality and disgust ($b_{indirect} = -.66$, 95% confidence interval [CI] = [-1.01, -.324]). However, the effect is significant only through perceived quality ($b_{indirect} = -.46$, 95% confidence interval [CI] = [-.67, -.29]), and not through disgust ($b_{indirect} = -.21$, 95% confidence interval [CI] = [-.51, .08]), once the null of zero falls inside of the 95% confidence interval (see Figure 4).

Figure 4 – Mediation analysis with purchase intentions as dependent variable.
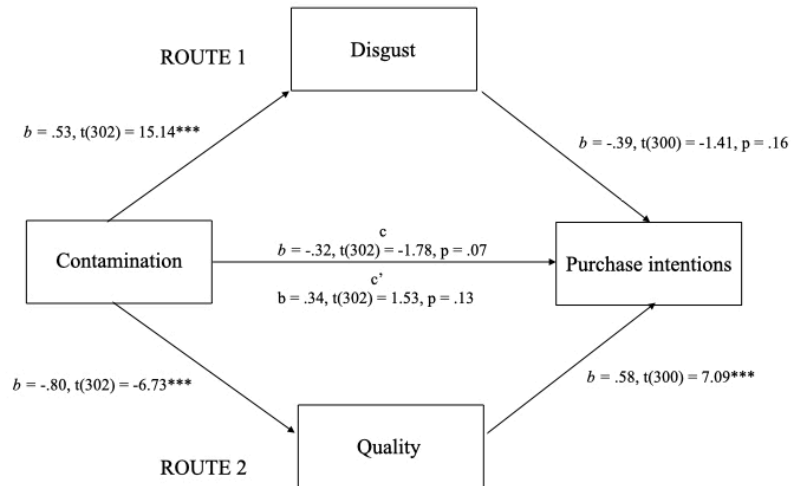
When product evaluations are the depended variable, we found a significant indirect effect through perceived quality and disgust ($b_{indirect}$ = -.80, 95% confidence interval [CI] = [-1.15, -.465]). In this case, both perceived quality ($b_{indirect}$ = -.52, 95% confidence interval [CI] = [-.73, -.33]) and disgust ($b_{indirect}$ = -.28, 95% confidence interval [CI] = [-.58, -.02]) contribute to the model. However, perceived quality is the mediator responsible to the variance in the data (see Figure 5).

Figure 5 – Mediation analysis with product evaluation as dependent variable.
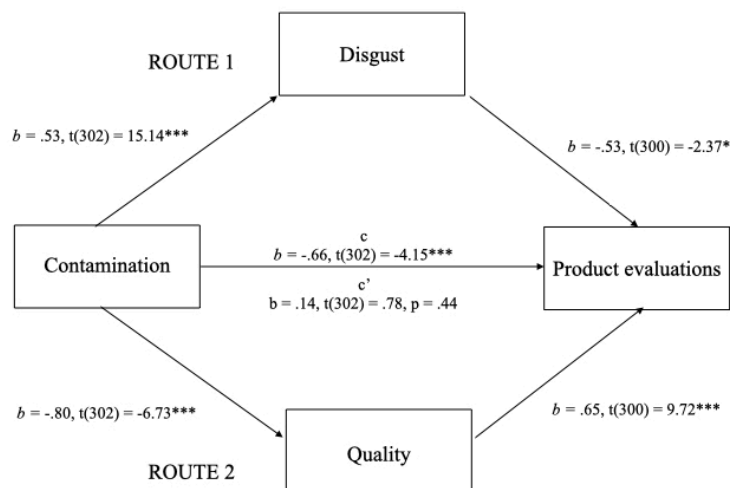
6. Discussion

Contrary to our hypothesis, participants had greater purchase intentions and product evaluations for products with high degree of physical contact than for products with low degree of physical contact. A possible explanation to this result is the products used the study. There is a chance that the two products with high degree of physical contact are more desirable than the other products. At the same time that it is important to study contamination effects across different product categories to gain better knowledge of the issue (Argo et al., 2006), it is possible that evaluations of products with reused materials are be product dependent (Magnier et al., 2019). Hence, future studies would benefit by balancing the chosen products in terms of general desirability. Moreover, consumers are affected by the amount of reused materials included in the product (Hunka et al., 2020). It is also possible that the results were affected by the fact that we did not explicitly inform the amount of reused materials that were part of the product.

When analyzing the effect of contamination, our results are aligned with previous studies that showed that products with high degree of physical contact are perceived as more contaminated than products with low degree of physical contact (Argo et al., 2006; Morales & Fitzsimons, 2007). We also proposed that contamination would lead to two different routes of reaction, one considered more cognitive, with quality perceptions, and the other more emotive, with disgust feelings. Results show that both quality and disgust mediate the influence of perceived contamination on purchase intentions and product evaluations. However, results are mainly explained by perceived quality. This is an interesting finding since the literature on contamination usually explores emotional reactions, such as disgust (Argo et al., 2006; Morales & Fitzsimons, 2007), and tend to overlook the role of perceived quality. In the end, our results confirm that perceived contamination can be activated by the two systems of reasoning: one more cognitive and one more emotive (Petty & Cacioppo, 1986).

The established effects are important for several reasons. Our findings suggest that contamination has the ability to influence purchase intentions and product evaluations via consumer judgments of quality and disgust. Especially, the finding that the influence of contamination on purchase intentions and product evaluations is mediated in part through quality judgments and in part through disgust adds a new perspective to the research, which has largely focused on consumer emotional feelings of

disgust (Morales & Fitzsimons, 2007). Although extant research has identified the effect of disgust on the acceptance of products with reused materials (Meng & Leary, 2021) and has established links to the importance of product quality (Magnier et al., 2019), we offer a new and integrative explanation for consumer response to products with reused materials that draws from dual-process theories (Petty & Cacioppo, 1986). Our research presents initial evidence for the general existence of both routes: a central or cognitive route via perceived quality and a peripheral or affective route via disgust.

Although a specific route may be more or less prominent depending on the product category selected, we can say that we used similar categories and all of them have more utilitarian attributes than hedonic ones. In order to allow us to test for the general existence of both routes, we believe that it's important to consider hedonic products in future studies.

7. Conclusion

As a solution to the growing environmental problems, companies are incorporating reused materials in their products aiming to reduce waste levels. Past research shows that products with reused materials have low acceptance and a reason to this is due to contamination concerns. In this study, we examined how contamination operates in the case of products with reused materials. Whereas contamination effects increase by their salience and intimacy contact, we started our analysis by showing that contamination is grater for products with high degree of physical contact. Consumers believe that contact results in the transference of properties from one product to another, even when there isn't the real contact. Therefore, it is questionable how marketers should communicate about products that have reused materials. A central premise of the current research is that consumers form product evaluations based on a combination of these factors (contamination, quality, disgust).

Our study shows two possible phycological mechanisms to explain product contamination. We show that both quality and disgust affect perceived contamination. This adds a new discussion to product contamination: not only emotional factors interact with contamination, but also cognitive ones. By knowing when or why some products are perceived as contaminated has important practical implications. The negatives outcomes of contamination represent important barriers to the diffusion of products perceived as

contaminated. Also, marketers should create measures to minimize the impact of these factors when selling products made with reused components.

7.1 Main limitations and future studies

Several limitations could have influenced our results. First, the choice of products may have affected results. As past research shows, responses to products with reused materials can be product depended (Magnier et al., 2019). There is a chance that the two products with high degree of physical contact may simply have been much more desirable than the two other products. Hence, future studies would benefit by balancing the chosen products in terms of general desirability. Moreover, it is a much smaller financial investment to buy either a toothbrush or a set of earphones, than the other two products. It is also probable that purchase frequency is also higher for the selected products in the high degree of contact condition than for products in the low degree of contact. Purchase intentions may be influenced by these factors. For future studies, we recommend to choose pairs of products that are more comparable, such as: earphones and speaker, underwear and overcoat, or cutlery and plates. Also, it is suggested to use only one product and to manipulate different degrees of physical contact.

It is also important to note that the selected products have more utilitarian attributes than hedonic attributes, and this may have influenced our results. Hedonic consumption is associated with consumption of affective, sensory, fantasy and emotional experiences with a product (Hirschman & Holbrook, 1982; Strahilevitz & Myers, 1998; Voss et al., 2003). Whereas utilitarian consumption is motivated to fulfil basic needs, being associated with the functionality or efficiency of the product (Dhar & Wertenbroch, 2000; Okada, 2005; Strahilevitz & Myers, 1998; Voss et al., 2003). Feelings evoked by deciding between hedonic or utilitarian items are not the same (Chitturi et al., 2008; Strahilevitz & Myers, 1998). For utilitarian products, we usually don't have an emotional reaction to these products and this can explain why disgust did not had an effect on the model for purchase intentions. In this way, future studies could analyze different types of products.

Chapter 4

Behavioral spillover in the circular economy: The importance of consumer goals

1. Introduction

Global boundaries of safe operating space are being crossed by human action in the earth's continental and oceanic ecosystems (Braje & Erlandson, 2013; Rockström et al., 2009). The discussion about the necessity of changes in our current model of production and consumption is not new (Steffen et al., 2015) and there are many critiques of our current linear model of "take, make, and dispose" (Ghisellini et al., 2016). Among other perils, this linear model leads to over-consumption of resources and a huge amount of waste (Biggs et al., 2015; Prothero et al., 2011; Thøgersen, 2014a; White et al., 2019). Hence, there are many calls to change our way of producing and consuming to a circular economic model and to the responsible use of limited material and other resources (Geissdoerfer et al., 2017; MacArthur, 2013).

The transition to a circular economy implies the elimination of an "end-of-life" of material products (Bovea et al., 2018). The circular economy is an economic model based on cycles of closed loops of production, increased efficiency in the use of resources, reduced use of virgin materials, reuse of materials in production and minimized waste generation (Ghisellini et al., 2016; Sauvé et al., 2016). The concept integrates the idea of cyclical closed-loop systems (Kirchherr et al., 2017; Murray et al., 2017) with loops such as reuse, repair, reconditioning, and recycling (Stahel, 1982). The use of recovered materials and recycled products is essential in this model (Singh & Ordoñez, 2016). Stangherlin and Thøgersen (2021) suggest that, in order to facilitate the transiton to a circular economy, it is necessary to challenge the current acquisition, possession and collection model and its "acquisitive materialism" (Belk, 1982) and to move to a "responsible materialism," where materials are valued and reusing them is facilitated in the production-consumption system.

In the end, to advance a circular economy model, it is required that people change their behavior over the long-term and across several behaviors (for a review, see Stangherlin & Thøgersen, 2021). Hence, there is a growing interest in how people's

behavior can be changed, especially to avoid conflicting strategies (Frederiks et al., 2016). For circular economy strategies to be successful, it is necessary that consumers also value or at least accept the "circular" solutions offered by companies. Hence, research on consumers' attitudes towards and acceptance of products with reused materials is emerging (Abbey et al., 2017; Abbey, Meloy, Guide Jr., et al., 2015; Gaur et al., 2015; Hazen et al., 2017; Subramanian & Subramanyam, 2012; Wang et al., 2013).

By definition, a circular economy means reusing, repairing, reconditioning, and recycling products (Bocken et al., 2016; Stahel, 1982). For the end consumer, the circular economy requires that they engage in repairing, returning, and recycling products (Camacho-Otero et al., 2018; Hamzaoui-Essoussi & Linton, 2014). In addition, consumers' decisions about whether to purchase new, used or remanufactured products, and whether and how they will adopt new ways of consuming are essential (Hazen et al., 2017). Since both recycling and the buying of products with reused materials are necessary for the circular economy, it seems likely that they are connected in the minds of consumers. Hence, the first question this article aims to answer is whether the recycling and buying of used products or products with recycled materials are indeed connected in the minds of consumers and more specifically whether the nature of this connection is a positive relationship between being engaged in recycling and accepting circular products.

Given that both recycling and buying products with reused materials are necessary for a circular economy to work, it is possible that the acceptance of products with reused materials is viewed as a natural continuation of recycling. If that is the case, it seems likely that people who recycle become more inclined to buy products with reused materials, that is, a positive "spillover" from recycling behavior to buying circular products (Lanzini & Thøgersen, 2014; Thøgersen, 1999). However, it is also possible that individuals who recycle feel that they have a "moral license" to *not* buy products with reused materials (Gneezy et al., 2012; Mazar & Zhong, 2010), or that when they recycle they have already done their bit for the circular economy (Thøgersen, 1999). Hence, there is a need for research investigating whether positive or negative spillover effects dominate the relationship between recycling behavior and the acceptance of products with reused materials.

Especially regarding unsustainable consumer behavior, research emphasizes the importance of changing behaviors repeatedly over a long period of time and across behavioral domains (Steinhorst & Matthies, 2016; Thøgersen & Ölander, 2003). For example, in our case, even if a person recycles everything at home, this may not

compensate for extreme buying behavior. Thus, it is important that interventions aimed at changing behavior in the long-term and across different behaviors consider not only the specifically targeted behavior, but also possible effects that the change in the targeted behavior may have on related behaviors.

The sometimes inconsistent and contradictory findings in studies of behavioral spillover in the environmental domain highlight the need for a deeper understanding of why positive and negative spillover effects occur and what conditions increase or decrease their likelihood (Truelove et al., 2014). Here, we employ a goal-theoretical perspective to explain positive spillover between two different behaviors that are essential for the circular economy: recycling and buying "circular" products, that is, products that are used or refurbished or contain reused or recycled components or materials. Hence, the present article's main contribution to circular economy research is an integrated understanding of these two essential behaviors, which have until now mostly been treated in isolation, both in research and practice. Specifically, we investigate the relationship between being engaged in recycling and buying circular products. Thereby, we extend the current understanding of, especially, consumers' acceptance or rejection of circular products and how and why this is related to recycling behavior. At the theoretical level, we examine psychological mechanisms underlying behavioral spillover processes, especially those related to the goals motivating the two behaviors. This study extends extant research on behavioral spillover in the environmental domain by documenting the importance of the consumer's goals and goal activation for behavioral spillover, specifically between two behaviors that are essential for the transformation to a circular economy. We hypothesize that positive spillover between the two behaviors is more likely to occur when one behavior a) makes a superordinate goal motivating both behaviors more salient, and/or b) strengthens the actor's perceived efficacy with regard to reaching an important, superordinate goal. In the end, we provide input for a strategy for how positive spillover effects can be promoted.

2. Recycling behavior and buying circular products: congruency between goals

There are different ways to stimulate consumers' engagement in the circular economy (Borrello et al., 2017; Tunn et al., 2019) and research suggests that the most effective solutions differ between sectors (Maitre-Ekern & Dalhammar, 2019; Muranko

et al., 2018). For example, with regard to computers and other IT products, manufactures can encourage consumers to buy refurbished products (Muranko et al., 2018). In the food sector, companies have especially focused on facilitating consumers' returning of their packaging for recirculation (Borrello et al., 2016). Others have suggested that circular behaviors in this sector go beyond individual product choices and imply adopting systemic, circular food-related lifestyles consisting of interconnected choices and a combination of factors to support sustainable decisions (do Canto et al., 2021).

Reflecting this diversity, Stangherlin and Thøgersen (2021) described different practices that consumers can adopt in the transition to the circular economy, each with a different focus. All of them should contribute to creating cycles of closed loops in production, distribution and use, aiming to increase efficiency in the use of resources, reduced use of virgin materials, and minimizing waste generation (Ghisellini et al., 2016; Sauvé et al., 2016). A key goal of circular economy thinking is to eliminate waste through superior design of materials, products and systems (Bovea et al., 2018). Further, practices inside the circular economy include resource management that can be linked to the best practices of the waste hierarchy framework (Figure 6) (European Union, 2008).

Figure 6 – The European waste hierarchy.
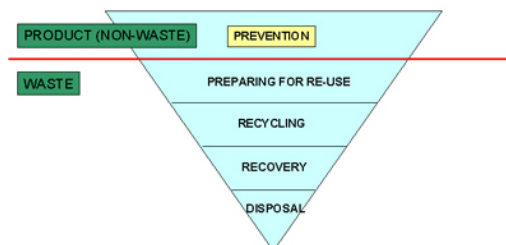
The waste hierarchy reflects strategies for sustainable resource management (Cole et al., 2019). Aligned with them, any action that consumers can take in the circular economy transition impacts at least one of the categories of the waste hierarchy. For each category, consumers can have different roles and can engage in different behaviors to help the transition to the circular economy, as suggested by Stangherlin and Thøgersen (2021) (see Table 3). It seems likely that behaviors belonging to each role are in general perceived to be more similar than behaviors belonging to different roles (cf. Thøgersen, 2004). For example, in the role of user consumers are likely to have practices (like maintenance, repair) that they consider more similar than each of them compared to post-use and/or acquisition practices.

Table 3 - The waste hierarchy and consumer roles in the circular economy.

Waste hierarchy categories	Consumer roles	Behaviors
Prevention	Acquisition	Reduce overall consumption levels
		Participate in access-based consumption
		Participate in sharing economy and collaborative consumption solutions
		Buy circular products
		Buy products with recycled packaging
	Maintenance	Repairing products
	Use	Reducing food waste
		Use the product for a longer time
Re-use	Use	Reusing products and use for different purposes
		Reuse packages
Recycling	Post-use	Returning packages
		Returning goods to reuse by others
		Returning goods to recycle
Recovery	Post-use	Returning rest products that cannot be recycled for waste collection
Disposal	Post-use	Returning rest products that cannot be recycled for waste collection

Source: Stangherlin and Thøgersen (2021)

Observe that reusing materials in products is associated with two different phases in the waste hierarchy. On the one hand, consumers have to accept products made with reused materials (prevention – acquisition). On the other hand, it is also important that consumers return goods and packages for reuse or recycling (recycling – post use) (Table 3). Hence, it is important that these activities are both promoted and facilitated in the consumption phase. Strategies to promote and facilitate recycling behavior are well known in the literature (Thøgersen, 1994). However, there is still insufficient knowledge on how to promote and facilitate the acceptance of circular products, that is, reused, refurbished or made with recycled materials (Abbey, Meloy, Blackburn, et al., 2015; Meng & Leary, 2021).

In this paper, we investigate if recycling makes a person more likely to also buy circular products, and perhaps vice versa, sometimes referred to as positive behavioral spillover (Maki et al., 2019; Thøgersen & Crompton, 2009). Specifically, we investigate whether positive and/or negative spillover exist and which direction dominates between recycling behavior and the acceptance of circular products. To illustrate the idea that the acceptance of circular products can be viewed as a "continuation" of recycling behavior, Figure 7 shows parts of material flows and the roles of consumers in this connection. The figure shows the duality between material flow, waste circularity and the integration of the waste hierarchy and consumers roles, where consumers are part of a system and can adopt specific behaviors that help the "circulation" in a circular economy. According to

research on behavioral spillover in the environmental field, pro-environmental behaviors can "spill over" to others sharing the same higher-order goal (Maki et al., 2019; Thøgersen & Crompton, 2009), and this is where we focus our study.

Figure 7 – The acceptance of products with reused materials as a "continuation" of recycling behavior.
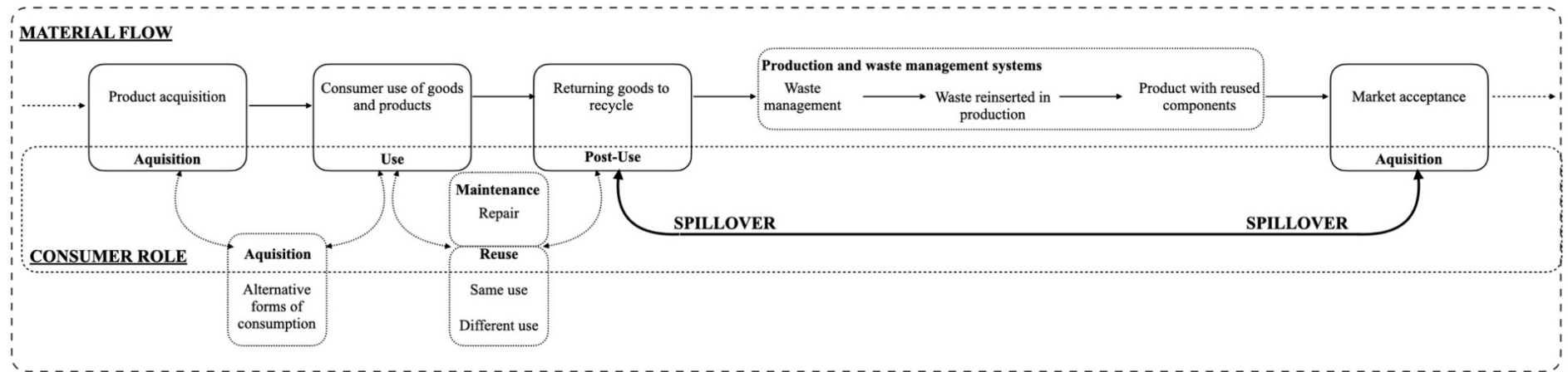
Source: elaborated by the authors.

3. Behavioral spillover effects and goal structures

A number of different theories suggest the occurrence of either positive or negative spillover between different pro-environmental behaviors (Truelove et al., 2014). Behavioral spillover occurs when performing a behavior increases or decreases the motivation to adopt a second behavior (Thøgersen & Crompton, 2009). Here, we primarily draw on predictions from goal theory to explain behavioral spillover (Lanzini & Thøgersen, 2014; Thøgersen & Noblet, 2012). Both recycling and buying circular products are instrumental for achieving a goal of waste reduction and therefore our basic assumption is that they are also both at least partly motivated by this superordinate goal. Theoretically, the performance of a behavior could both increase and decrease the likelihood of performing another behavior sharing the same higher-order goal. The former would be a case of positive and the latter of negative behavioral spillover (Truelove et al., 2014). Behavioral spillover effects can occur over time, across socio-spatial contexts, and/or across different behaviors (Nilsson et al., 2017). Most spillover research has found positive effects, where one behavior increases the occurrence of another behavior (Maki et al., 2019), but sometimes negative spillover has been found, reducing the total environmental benefits (Sorrell et al., 2020). Hence, it is important to consider when and why positive or negative spillover effects are likely to occur (Truelove et al., 2014).

Research on "psychological licensing" suggests that a "good deed" can grant a person some slack concerning future behavior (Miller & Effron, 2010). For example, individuals may feel that when they recycle they have a "moral license" to not buy products with reused materials (Mazar & Zhong, 2010), or feel that they have already done their bit with regard to this issue (Thøgersen, 1999). For example, (Nayum & Thøgersen, 2022) found that some Norwegian buyers of an electric car felt that this compensates for other negative environmental impacts, reducing their pro-environmental behavior in other fields.

A different mechanism was suggested by Fishbach and Dhar (2005), namely that perceived progress regarding the attainment of a goal tends to reduce further effort towards that goal whereas actions expressing goal commitment tend to reinforce the strength of a goal and increase further efforts towards the same goal. This implies that the likelihood of negative *versus* positive spillover depends on whether the actor frame the behavior in terms of the attainment of a specific goal or in terms of commitment to a

superordinate goal (Fishbach et al., 2006). Especially, if people perceive the first behavior as a successful achievement towards reaching a goal, that could reduce the likelihood of performing other behaviors towards that goal, that is, lead to negative spillover (Fishbach et al., 2006). Weber (1997) coined this phenomenon "single-action bias". However, when the actor perceives a behavior as an expression of commitment to a goal, this is likely to increase other behaviors towards the same goal, which are then perceived as complementary (Fishbach et al., 2006), which is an example of positive behavioral spillover. Research also finds that just priming a superordinate goal increases the likelihood of positive spillover between behaviors that are instrumental in achieving this goal (Fishbach et al., 2006). Similarly, Thøgersen and Crompton (2009) argue that positive spillover is likely between behaviors that consumers perceive as complementary and negative spillover between behaviors perceived as substitutes.

In our case, this implies that when individuals are focused on a superordinate goal, such as waste reduction or environmental protection, which several behaviors are instrumental for, they are likely to view these behaviors as complimentary and positive spillover between them is therefore likely. But if they are focused on their successful goal achievement, that may reduce further effort towards the same goal. However, whereas the former proposal seems to be uncontroversial, that is not the case with the latter. Others have argued and found empirical support for a different outcome of the perceived successful action towards a goal, namely that it increases goal efficacy and therefore can lead to positive spillover (Staples et al., 2020).

Recycling and buying circular products often involve private costs, they share superordinate goals, and each specific act represents only small, incremental steps towards the superordinate goals that motivate them. Therefore, most of the reviewed theorizing and research predict that positive spillover between recycling and buying circular products is most likely, and indeed likely. Goal theory proposes that individuals' many interconnected goals are mentally represented as a goal system (Kruglanski et al., 2002). Hence, goal theory and the shared goals of recycling and buying circular products suggest that many people will have a mental association between the two behaviors (Dhar & Simonson, 1999; Lanzini & Thøgersen, 2014). This inference is further supported by research finding that positive correlations between pro-environmental behaviors can be accounted for by their link to the same superordinate pro-environmental goals (Sharpe et al., 2021; Thøgersen & Ölander, 2006).

A specific behavior may be relevant for many goals and many behaviors may be relevant for the same goal. When behaviors are instrumental for the same goal, commitment to this goal should increase the likelihood of positive spillover between the behaviors (Fishbach et al., 2006). There is also evidence that similarity in terms of shared goals influences the likelihood of spillover between two behaviors (Truelove et al., 2014). Recycling and the purchase of circular products are solutions to waste problems that belong to different categories in the "waste hierarchy." Both behaviors share the goal of waste reduction, and, for the individual, the purchase of circular products supports recycling (Hamzaoui-Essoussi & Linton, 2014). Hence, spillover research and theorizing suggest positive spillover between recycling behavior and the purchase of circular products, leading to our first hypothesis:

H1a: Positive spillover occurs between recycling behavior and buying circular products.

Action for recycling, such as source separation of household waste and deposit schemes for (especially) beverage bottles, are common and established activities in many countries. Trade in used products, such as houses, cars, boats and other durable and expensive products as well as antiques, flea markets and the like, is also common and well established, but more limited. In recent years, the marketing of circular products, based on recycled materials or components is growing in many countries, extending the range and types of circular products offered for sale (Patwa et al., 2021). Since the buying circular products, especially as environmentally friendly products, is lagging behind the systematic sorting and recycling waste from households, we expect a stronger behavioral spillover from recycling to buying circular products than the other way around. Hence, we hypothesize:

H1b: The positive spillover from recycling behavior to buying circular products is stronger than the spillover from buying circular products to recycling behavior.

Knowing their likely outcomes and goal-relevance is an essential aspect of learning different environmentally-friendly behaviors (Thøgersen & Ölander, 2003). Also, research finding that the correlation between pro-environmental behaviors can be accounted for by their link to broader pro-environmental goals and values (Sharpe et al., 2021; Thøgersen & Ölander, 2006) suggests that the activation or reinforcement of pro-

environmental goals and values, triggered by the behavior that is performed first, might be a mediator of the spillover between different pro-environmental behaviors (Sharpe et al., 2021; Thøgersen, 2012). On this background, we hypothesize:

H2a: The perceived importance of waste avoidance and resource conservation goals mediates the spillover between recycling and buying circular products.

Both recycling and buying circular products are means to achieve the goal of waste reduction, that is, a joint superordinate goal (Kruglanski et al., 2002). Hence, their connection becomes apparent when focusing on waste reduction. Successfully engaging in one of these behaviors might create the perception of partial completion, which might therefore reduce the actor's motivation for further actions (Fishbach et al., 2006; Weber, 1997). Alternatively, the perceived success with the first behaviors may increase perceived efficacy with regard to the superordinate goal of waste reduction and thereby lead to positive spillover (Margetts & Kashima, 2017). As earlier mentioned, individual recycling and buying circular products behaviors represent small, incremental steps towards the superordinate pro-environmental goal of waste reduction only, which makes the latter mechanism more likely to dominate. Therefore, we hypothesize:

H2b: Perceived goal success mediates positive spillover between recycling behavior and buying circular products.

Taken together, we argue that consumers' association of recycling and buying circular products to the goal of waste reduction is the cause and mediator of positive spillover between the two behaviors.

4. Method

To investigate if doing one of the two behaviors – recycling and buying circular products – at one time point influences the likelihood of doing the other behavior at a later time, two waves of survey panel data were collected in November 2020 (T1) and March 2021 (T2) by a professional market research company, Userneeds. By using a panel study, repeating the same survey with the same representative sample from a given population, it is possible to investigate changes over time and obtain stronger evidence

regarding causality (Thøgersen & Ölander, 2003). We conducted the survey in the capitals of two countries, Denmark (Copenhagen) and Portugal (Lisbon), primarily for cross-country validation and to check for national idiosyncrasies. Practices related to waste handling, recycling and sustainability differ between these two contexts, which means that when findings are replicated across contexts, this is strong evidence that they can be generalized.

The questionnaires contained questions related to recycling and buying circular products in addition to different evaluative constructs and demographic characteristics. The questions regarding recycling, respectively buying circular products, were organized as separate blocks and the presentation order of the two blocks randomized so that half of the respondents answered the recycling questions first and the other half the buying circular products questions first. Respondents were asked to report their frequency of recycling/buying circular products before answering questions about goal importance and goal progress. Questions about demographic characteristics were placed last. In addition, the questionnaire contained a number of questions not pertinent to this study.

a. Participants

Representative samples of the adult population in terms of gender, age, income, and education were drawn from Userneeds' standing panels in both countries and interviewed, in both waves, by means of CAWI (Computer Assisted Web Interview). The sample size at T1 was N=503 in Portugal and N=513 in Denmark. At T2 N=315 were re-interviewed in Portugal and N=384 in Denmark. In the original Portuguese sample, the mean age was 42 years, 50,3% were men and 49,7% women, 42,1% were college graduates, and 32,3% lived with at least one other person. In the original Danish sample, the mean age was 53 years, 53.6% were women and 46,4% were men, 32,6% had higher education, at least 3-4 years, and 39,6% lived with at least one other person. These distributions were similar at T2 in both countries.

4.2 Measures

To measure recycling behavior, we used two items with a joint introduction: "How often did you do the following in the last month? (1 = never to 7 = every time): (a) Delivered used glass packaging and newspapers for recycling? (b) Sorted your green kitchen waste for composting?"

To measure the buying of circular products, we used four items adapted from Thøgersen and Ölander (2006): "How often did you do the following in the last **month**? (1 = never - 7 = every time): (a) Deliberately chose a product with packaging made from recycled material? (b) Checked information on recyclability on a packaging to make sure it is recycled, made with recyclable materials or recyclable?" "How often did you do the following in the last **year**? (1 = never - 6 = I practically only buy this): (a) Bought products, such as clothing, electronics or household items, made from recycled materials? (b) Bought recycled products, such as clothing, electronics or household items?"

To measure goal importance, we used three items adapted from previous studies (Cornelissen et al., 2008; Klein et al., 2013): "How important a goal for you is it to avoid waste and save resources? (1 = not at all - 7 = very important): (a) Is avoiding waste one of your goals? (b) Is saving on the planet's resources one of your goals? (c) Compared to other goals you have, how important is it for you to avoid waste and save resources? (1 = not important at all - 7 = the most important goal)." The construct had an acceptable reliability in both countries (Cronbach's alpha in Denmark/Portugal = .88/.90).

For perceived goal progress, we used four items adapted from previous studies (Cornelissen et al., 2008; Koo & Fishbach, 2014): (a) "Do you feel that what you have done for recycling has been effective in saving resources and avoiding waste? (1 = not at all - 7 = a lot). (b) Do you feel that buying products with recycled materials has been an effective way for you to save resources and avoid waste? (1 = not at all - 7 = a lot). (c) How much do you feel you have already done to avoid waste and save resources? (1 = too little - 7 = enough). (d) How much success have you had so far in avoiding waste and saving resources? (1 = too little - 7 = great success). The construct had an acceptable reliability in both countries (Cronbach's alpha in Denmark/Portugal = .79/.78).

5. Results

Direct effects are analyzed by means of multiple regression analysis with cross-lagged effects representing the spillover effects. Mediation is analyzed with Hayes' (2017) PROCESS SPSS macro Model 4.

5.1 Hierarchical regression analysis

Our first hypothesis is that positive spillover occurs between recycling behavior and buying circular products. The results of the multiple regression analyses reported in Table 4 are consistent with the expected behavioral spillover from recycling to buying circular products in both Portugal and Denmark. We find that, after controlling for the (highly significant) autoregressive effect of buying circular products on itself (betas = .48 in Portugal and .60 in Denmark, p's < .001), recycling at T1 increases buying circular products at T2 (betas = .19 in Portugal and .11 in Denmark, p's < .01). In addition, buying circular products at T1 increased recycling at T2 in Portugal, but not in Denmark (betas = .15 in Portugal, p < .001 and -.009 in Denmark, n.s.), again after controlling for the highly significant autoregressive effect of recycling on itself (betas = .53 in Portugal and .79 in Denmark, p's < .001).

Table 4 - Regressing recycling and buying circular products at T2 on the same two variables at T1, Portugal (N = 312) and Denmark (N = 384)

	Portugal						Denmark					
	Recycling T2			Buying circular T2			Recycling T2			Buying circular T2		
Independent	Beta	t	Sig.	Beta	t	Sig.	Beta	t	Sig.	Beta	t	Sig.
Recycling T1	.53	10.716	<.001	.19	4.21	<.001	.79	24.266	<.001	.11	2.663	.008
Buying circular T1	.15	3.072	.002	.48	9.88	<.001	*-.009*	*-0.262*	*.867*	.60	14.511	<.001

Not statistically significant results in italics.

Note. $R^2_{Portugal}$ = .35, $R^2_{Denmark}$ = .63 for recycling and $R^2_{Portugal}$ = .33, $R^2_{Denmark}$ = .41 for buying circular products.

The stronger autoregressive effects in the Danish than in the Portuguese context suggest that the two behaviors are more habitual and the reporting of the behaviors, and especially recycling, more experience-based in the former than in the latter context (Ouellette & Wood, 1998). If especially recycling has become strongly habituated in the Danish context, this would also explain the non-significant spillover effect of buying circular products in this case (Cornelissen et al., 2008). However, irrespective of the reason, the strong autoregressive effect left little non-random variance to explain in the case of recycling in Denmark, that is, a type of ceiling effect.

In sum, the results are consistent with H1b, that the positive spillover from recycling behavior to buying circular products is stronger than the spillover from buying circular products to recycling behavior, and partly consistent with H1a, that there is a positive spillover between recycling behavior and buying circular products.

5.2 Mediation analysis

To test if pro-environmental goal importance and/or perceived goal progress mediate the spillover between recycling and buying circular products (H2), mediation analyses were carried out with the PROCESS SPSS macro Model 4 (Hayes, 2017). As in the previous analyses, we used both recycling and buying circular products T1 as independent variables. In practice, to include both variables, we specified two different mediation models for each of the dependent variables. In one model, recycling T1 was the independent variable and buying circular T1 was included as a covariate and in the other model, the two T1 variables switched roles. The mediation analyses revealed that both goal measures function as positive mediators of the significant spillover effects between recycling and buying circular products (see Table 4 to Table 7).

5.2.1   Mediation through goal importance

In the case of Portugal, the spillover effects of recycling and buying circular on buying circular and recycling, respectively, at T2 are found to be partly mediated through how important participants perceive the goal of waste reduction is. As can be seen in Table 4, participants' recycling and buying circular at T1 significantly predict the importance of the waste reduction goal, measured at T2. They also significantly predict recycling and buying circular at T2 after controlling for goal importance. In addition, the importance of the waste reduction goal influenced both recycling and buying circular after controlling for the two behaviors at T1. The bias-corrected bootstrap confidence intervals for the unstandardized indirect spillover effects between buying circular and recycling (.070), based on 5.000 bootstrap samples, does not contain zero (.032 to .116), and neither does the bias-corrected bootstrap confidence intervals for the unstandardized indirect spillover effects between recycling and buying circular (.028; .006 to .053). Hence, goal importance partly mediates the spillover effects between the two behaviors.

Table 4 - Mediation analysis of goal importance as mediator of the effects of recycling and buying circular products T1 on the same two variables at T2, Portugal ($N = 312$)

Antecedent		Goal importance (M)				Recycling T2 (Y)				Buying circular T2 (Y)		
		Coeff.	*SE*	*p*		Coeff.	*SE*	*p*		Coeff.	*SE*	*p*
Recycling T1	*a1*	0.20	.03	<.001	*c'1*	0.14	.07	<.05	*c'1*	0.11	.04	<.001
Buying circular products T1	*a2*	0.23	.05	<.001	*c'2*	0.45	.05	<.001	*c'2*	0.46	.06	<.05
Goal importance					*b1*	0.29	.07	<.001	*b1*	0.15	.06	<.05
Constant		4.13	.17	<.001		0.13	.40	.75		0.49	.30	.10
		$R^2 = .15$				$R^2 = .38$				$R^2 = .35$		

As can be seen in Table 4, also in the case of Denmark, participants' recycling and buying circular at T1 significantly predict the importance of the goal of waste reduction, measured at T2. The autoregressive effects are also significant for both recycling and buying circular, but the spillover effects are not significant when controlling for goal importance. In addition, the importance of the waste reduction goal influenced both recycling and buying circular. The bias-corrected bootstrap confidence intervals for the unstandardized indirect spillover effects from recycling to buying circular (.058), based on 5.000 bootstrap samples, does not contain zero (.031 to .090). The unstandardized indirect effect of buying circular at time 1 on recycling at time 2 (.070) is also significant, the bias-corrected bootstrap confidence interval, based on 5.000 bootstrap samples, does not contain zero (.032 to .116). Remember that we reported in Table 3 that only the positive spillover from recycling at T1 to buying circular at T2 is significant in the Danish sample. The mediation analysis reveals that this effect is completely mediated through how important the goal of waste reduction is. In addition, a significant mediated spillover effect is found from buying circular to recycling, despite the statistical insignificance of the direct spillover effect.

Table 5 - Mediation analysis of goal importance as mediator of the effects of recycling and buying circular products T1 on the same two variables at T2, Denmark ($N = 384$)

Antecedent	Goal importance (M)				Recycling T2 (Y)				Buying circular T2 (Y)		
		Coeff.	*SE*	*p*		Coeff.	*SE*	*p*	Coeff.	*SE*	*p*
Recycling T1	*a1*	0.31	.04	<.001	*c'1*	-0.07	.05	.19	*c'1*	0.02	.04	.51
Buying circular products T1	*a2*	0.41	.05	<.001	*c'2*	0.80	.04	<.001	*c'2*	0.54	.04	<.001
Goal importance					*b1*	0.14	.05	<.01	*b1*	0.18	.04	<.001
Constant		1.94	.21	<.001		0.60	.22	<.001		0.15	.18	.43
		$R^2 = .33$				$R^2 = .64$				$R^2 = .44$		

5.2.2 Mediation through perceived goal progress

The mediation analyses also reveal that the perceived progress towards the goal of waste reduction mediates the significant spillover effects between recycling and buying circular products. In the case of Portugal, the spillover effects of recycling and buying circular at T1 on buying circular, respectively recycling, at T2 are at least partly mediated through the progress towards the goal. As can be seen in Table 6, participants' recycling and buying circular at T1 significantly predict the perceived progress towards the goal, measured at T2. In addition, perceived goal progress influences both recycling and buying circular after controlling for the two behaviors at T1. When controlling for perceived goal progress, the stabilities are highly significant, but the spillover effect from buying circular to recycling is non-significant and the one from recycling to buying circular is significantly attenuated. The bias-corrected bootstrap confidence intervals for the unstandardized indirect spillover effects from buying circular to recycling (.090), based on 5.000 bootstrap samples, does not contain zero (.047 to .142), and neither does the bias-corrected bootstrap confidence intervals for the indirect spillover effects from recycling to buying circular (.060; .034 to .091).

Table 6 - Mediation analysis of goal progress as mediator of the effects of recycling and buying circular products T1 on the same two variables at, Portugal ($N = 312$)

Antecedent		Goal progress (M)				Recycling T2 (Y)				Buying circular T2 (Y)		
		Coeff.	SE	p		Coeff.	SE	p		Coeff.	SE	p
Recycling T1	a1	0.22	.04	<.001	c'1	0.11	.07	.11	c'1	0.07	.05	.05
Buying circular products T1	a2	0.23	.05	<.001	c'2	0.43	.05	<.001	c'2	0.44	.05	<.001
Goal progress					b1	0.41	.07	<.001	b1	0.24	.05	<.001
Constant		3.44	.19	<.001		-0.07	.34	.84		0.27	.25	.29
		$R^2 = .22$				$R^2 = .42$				$R^2 = .38$		

In the case of Denmark, the results of this mediation analysis are in principle the same, except that both spillover effects are insignificant when controlling for the mediator and hence completely mediated (see Table 7). The bias-corrected bootstrap confidence intervals for the unstandardized indirect spillover effects from recycling to buying circular via perceived goal progress (.054), based on 5.000 bootstrap samples, does not contain zero (.027 to .085), and neither does the bias-corrected bootstrap confidence intervals for the unstandardized indirect spillover effects from buying circular to recycling (.057; .022 to .096). Hence, again, a significant mediated spillover effect is found from buying circular to recycling, despite the statistical insignificance of the direct spillover effect.

Table 7 - Mediation analysis of goal progress as mediator of the effects of recycling and buying circular products T1 on the same two variables at, Denmark ($N = 384$)

Antecedent		Goal progress (M)				Recycling T2 (Y)				Buying circular T2 (Y)		
		Coeff.	SE	p		Coeff.	SE	p		Coeff.	SE	p
Recycling T1	a1	0.25	.04	<.001	c'1	-0.07	.05	.17	c'1	0.03	.03	.41
Buying circular products T1	a2	0.24	.04	<.001	c'2	0.79	.04	<.001	c'2	0.57	.04	<.001
Goal progress					b1	0.23	.07	<.001	b1	0.22	.05	<.001
Constant		2.47	.18	<.001		0.31	.24	.20		-0.03	.20	.89
		$R^2 = .26$				$R^2 = .64$				$R^2 = .44$		

In sum, the results are consistent with H2a, that the perceived importance of waste avoidance and resource conservation goals mediates the positive spillover between recycling and buying circular products, and with H2b, that perceived goal progress

mediates the spillover between recycling behavior and buying circular products. However, the latter mediation, and especially the finding that is also positive, contradicts the proposition that perceived goal progress hinders positive spillover. Instead, it is consistent with the proposition that perceived goal progress increases outcome efficacy and therefore may lead to positive spillover.

6. Discussion

Among the different things consumers can do to contribute to a circular economic system, this paper focuses on two of the most important: source-separation for recycling and buying circular products. These behaviors are both necessary for the "circulation" in a circular economy. Recycling behavior is extensively studied and reported in the literature, but not in combination with the buying of circular products. The reported findings support the proposition that there is a positive spillover from recycling behavior to buying circular products in both countries, and also a positive spillover the other way in the Portuguese case. Specifically, performing one of them at T1 increases the likelihood of performing the other behavior at T2. Since recycling is the most common and institutionalized among the two behaviors, this is consistent with the proposition that consumers who are used to source-separate their household waste for recycling perceive the acceptance of products with reused materials as a "continuation" of their recycling behavior. The insignificant direct spillover effect from buying circular products to recycling in Denmark is seconded by a very high stability of recycling behavior in the Danish context (beta = .79), which theoretically and statistically leaves little room for other influence factors in this case, including spillover from other waste-reducing behaviors.

The findings also confirm the importance of the person's waste-related goals for the spillover between the two behaviors. The more a person performs the two behaviors, the more important the goals of resource conservation and waste prevention are to them (goal importance) and the more successful they feel in relation to waste prevention and resource conservation (goal progress) at a later time. And the more important these goals are to the individual and the more successful they feel with regard to these goals, the more they perform the two behaviors in the future. More importantly in this connection, the spillover effects of one of these behaviors at T1 on the other behavior at T2 are indeed fully (in Denmark) or partly (in Portugal) mediated through goal importance and

perceived goal progress. Hence, we conclude that the spillover between the two circular economy behaviors is at least partly due to doing one of them activating or reinforcing waste prevention and resource conservation goals that are shared by the two behaviors and increasing perceived goal efficacy (i.e., perceived success in striving for the goal).

Fishbach et al. (2006) suggested that perceived progress towards a goal can have a negative effect on continued goal striving, because people might focus less on that goal if they perceive it (on its way to be) achieved. However, this is not what we found with regard to recycling and buying circular products. In our case, it appears that individuals who recycle or buy recycled products do not feel that they have done enough towards their waste reduction goals. More importantly, perceived progress towards that goal is positively related towards doing more and, hence, the spillover between the two behaviors can partially be attributed to the impact of the first of them on perceived progress towards the goal.

Past research has found that both positive and negative spillover are possible following pro-environmental behavior (Maki et al., 2019; Sorrell et al., 2020; Thøgersen & Ölander, 2003). Hence, it is important to understand when and why positive or negative spillover occur (Truelove et al., 2014). We show the importance of performing different behaviors for the transformation to a circular economy (Stangherlin & Thøgersen, 2021), and that performing one of these behaviors can increase the likelihood of performing other important behaviors as well. Also, we show that the activation and/or reinforcement of a person's waste-related goals account for a substantial part of the spillover between the two analyzed behaviors. Hence, this study underlines the importance of individuals' waste reduction goals being strong and salient, which suggests the need for a continued communication and education effort by relevant authorities and others. Both recycling and buying circular products are important for the circular economy, but if many consumers habitually perform both of them, the chances of achieving their joint goals are much greater.

It is also import to consider the differences between the two studied countries. Whereas in the Portuguese case we found positive spillover going both ways, in the Danish case a direct positive spillover effect was only found from recycling to the buying of circular products. We can speculate that, since recycling in Denmark is well-stablished and common, its high stability between the two waves is due to the behavior being strongly habituated in this context (Ouellette & Wood, 1998). This further suggests that

a habitual behavior is more likely to be the source of than being influenced by behavioral spillover effects. Further research is needed to replicate and confirm this finding.

6.1 Limitations and suggestions for further research

An important limitation of this study is that our results are based on self-reporting behaviors, which may be influenced by social desirability bias (Kormos & Gifford, 2014). However, with the employed method, a systematic tendency to overreport socially desirable behavior should be captured in the stabilities and hence not inflate the estimations of spillover effects. Still, it would be useful to confirm the findings using experimental field studies. We also encourage research that experimentally manipulates goals in order to control for possible confounding factors. We measured participants' waste-related goals (goal importance and goal progress), but different goals might be manipulated, testing strategies or campaigns directed, for example, at more superordinate goals (Höchli et al., 2019).

Another limitation is the small number of covered countries. It is important to note that Denmark and Portugal have significantly different traditions and infrastructures regarding recycling and buying circular products, which strengthens the validity of findings that are common across the two contexts. However, we recommend future studies in different countries to further validate our findings.

More research is needed to understand how spillover effects differ between specific behaviors that differ in similarity, costs, habituation, and in other ways. We selected two behaviors that are particularly important to the circular economy. However, as mentioned, consumers can have different roles when contributing to the achievement of a circular economic model. We encourage that future studies explore different behaviors and roles that consumers can have (see Table 3).

This study captured two important mediators (goal importance and goal progress) of the spillover between our selected behaviors. Nevertheless, further research is needed shed light on different boundary conditions and processes driving or limiting behavioral spillover in the environmental domain.

7. Conclusion

Positive behavioral spillover is a possible amplifier of environmentally friendly behavior when performing one such behavior increases the likelihood of performing another. Behavioral spillover is a well-known phenomenon (Maki et al., 2019), but strategies for utilizing this mechanism actively, for example, to increase consumers' active participation in a circular economic system, are still lacking. In this study, we have focused on spillover between different behaviors that consumers need to do in a circular economy; arguably two of the most relevant behaviors that consumers can engage in to help the transition to a circular economy (Stangherlin & Thøgersen, 2021).

We analyzed if performing one behavior (recycling or buying circular products) would increase the likelihood of performing a second one (buying circular products or recycling). We found that individuals that recycle tend to increase their purchase of circular products both in Denmark and Portugal, and the other way around, but only in Portugal. Results are important, since strategies to promote and facilitate recycling behavior are well known whereas we have insufficient knowledge on how to promote and facilitate the acceptance of products made with reused materials. This study provides important pieces to this puzzle.

Second, we showed that behavioral spillover can to a high extent be explained by the first behavior's impact on how important a shared goal of the behaviors in question are to the individual (goal importance) and by how successful they feel in relation to goal achievement (goal progress). Together, these results contribute important insights into whether and why behavioral spillover happens and can be facilitated to achieve, among others, waste reduction and resource conservation goals and, thereby, progress towards a circular economy.

Chapter 5

Conclusion and theoretical contributions

The main goal of this dissertation was to depict the different factors that affect consumers inferences of circular economy products and to analyze how to overcome the negative inferences that consumers may have. We aimed to gain knowledge of consumer behavior inside the circular economy. Literature shows divergent results related to the acceptance (or not) of products made with reused materials (Abbey, Meloy, Guide Jr., et al., 2015; Bardhi & Eckhardt, 2012; Baxter et al., 2017; Camacho-Otero et al., 2018; Catulli et al., 2013; Chamberlin & Boks, 2018; Farooque et al., 2019; Gaur et al., 2015; Harms & Linton, 2016; Hazen et al., 2017; Holmström & Böhlin, 2017a, 2017b; Jiménez-Parra et al., 2014; Matsumoto et al., 2018; Mugge et al., 2017; Rozin et al., 2015; Sun et al., 2018; van Weelden et al., 2016). In this way, we decided to advance in a consumer theory inside the circular economy to reduce ambiguity.

In this dissertation, we combined different strategies to answer the main research question. First, we decided to build an initial knowledge by understanding the different variables that affect the acceptance of products made with reused materials (paper 1). By answering the following research question *"What are the main motivations to consumers acceptance of products made with reused materials?"*, we discussed the main barriers and opportunities for the acceptance of circular economy products. By answering this question, we tried to shed light in the divergence between the studies mentioned above (Abbey, Meloy, Guide Jr., et al., 2015; Bardhi & Eckhardt, 2012; Baxter et al., 2017; Camacho-Otero et al., 2018; Catulli et al., 2013; Chamberlin & Boks, 2018; Farooque et al., 2019; Gaur et al., 2015; Harms & Linton, 2016; Hazen et al., 2017; Holmström & Böhlin, 2017a, 2017b; Jiménez-Parra et al., 2014; Matsumoto et al., 2018; Mugge et al., 2017; Rozin et al., 2015; Sun et al., 2018; van Weelden et al., 2016).

The first contribution of this dissertation is the systematic understanding of the roles that consumers can have inside the circular economy. More specifically, we tried to understand which behaviors consumers can engage to increase their participation in a circular economic model. Inspired by Maitre-Ekern and Dalhammar (2019), who detailed different roles that consumers can have in the circular economy (purchaser, maintainer, repairer, seller, sharer and collaborator, engaging with waste sorting and re-use), we

reviewed in the main literature of circular economy and consumer behavior and categorized/classified these studies inside each role that consumers can have. Table 1 and Figure 2 provide us the summary of the findings (paper 1). The most important thing to understand in this analysis is that each of these roles implies different activities and these activities can be overlapping. Which means that the achievement of one behavior can be dependent or correlated to a second behavior inside the circular economy. For example, to consumers accept and buy products made with reused materials, it is important that companies offer this type of product. Companies, to produce these products, have to stimulate consumers (in a different phase of their consumption phase) to give products to recycle. This material is used as an input to the production process. This is just a simple explanation of what means the correlation or dependence between behaviors inside the circular economy. This is an extremely important finding, since studies inside the circular economy usually analyze behaviors in an isolated way. It is important to understand the impact that other behaviors can have in the behavior being analyzed. This study, therefore, is a first movement in trying to consolidate a consumer theory inside the circular economy.

In the second part of the first paper, we analyzed the main barriers and opportunities to the acceptance of circular economy products. We discussed consumer responses to the use of recycled, recovered, or used materials, where products are remanufactured or made of recycled content from post-consumer products and post-consumer waste. We tried to understand the most important positive and negative consumer associations to products made with reused materials identified by extant research and their implications for consumer motivation to buy these products. In the end, we could identify the most important barriers and opportunities regarding the acceptance of products with reused materials.

Several factors may hinder the acceptance of these products, such as the comparison of a new version of the product (Abbey, Meloy, Guide Jr., et al., 2015; Khor & Hazen, 2017), the perception of a higher perceived risk and lower benefits/value of the products (Matsumoto et al., 2018; Mugge et al., 2017; Sun et al., 2018; van Weelden et al., 2016; Wang & Hazen, 2016), quality perceptions (Abbey, Meloy, Guide Jr., et al., 2015; Achabou & Dekhili, 2013; Gan & Chen, 2019; Kuah & Wang, 2019; Vafadarnikjoo et al., 2018; Wang & Hazen, 2016), financial risks (Holmström & Böhlin, 2017b; Wang & Hazen, 2016), uncertainty about the use history of the product (Ovchinnikov, 2011; van Weelden et al., 2016), product categories (Hamzaoui-Essoussi & Linton, 2014;

Magnier et al., 2019), risks of contamination (Abbey, Meloy, Guide Jr., et al., 2015; Magnier et al., 2019), lack of knowledge and misunderstanding of what refurbishment and recycling entails (van Weelden et al., 2016), and lack of availability (Tunn et al., 2019; van Weelden et al., 2016). One could believe that reducing the price of these products could compensate consumers' negative beliefs, being a stimulus to consumers to buy these products (Guide & Li, 2010; van Weelden et al., 2016; Wang & Hazen, 2016). However, it is important to note that this strategy can also amplify negative associations to the product (Abbey, Meloy, Guide Jr., et al., 2015), leading to lower quality perceptions and increased perceived risks (Ovchinnikov, 2011; van Weelden et al., 2016). Hence, results of main barriers to the acceptance of these products are extremely important when designing campaigns, specially to balance the trade-offs between strategies to stimulate consumption.

It is important to note that we also found several opportunities to the acceptance of these products, where companies and policy makers should focus to the progress of a circular economic model. Some studies found positive responses to products with reused materials (Holmström & Böhlin, 2017b; Magnier et al., 2019), demonstrated by a positive attitude and intentions to purchase products with recycled content (Sun et al., 2018). Also, specific consumer segments (Mugge et al., 2017) can be explored to the acceptance, such as consumers with high environmental consciousness (Gaur et al., 2015), expertise, higher age, education and income (Magnier et al., 2019).

Other opportunities are related to increase consumers knowledge (Mugge et al., 2017; Vafadarnikjoo et al., 2018), educational strategies (Abbey, Meloy, Guide Jr., et al., 2015), experience with the product before buying it (van Weelden et al., 2016), increase social acceptance (Gaur et al., 2015; van Weelden et al., 2016), and communication of the product (Mugge et al., 2017; van Weelden et al., 2016). Whereas knowledge is an important thing to increase the acceptance, it is important to understand the best way to communicate about these products. Companies could, for example, stimulate consumers to have an experience with the product before buying it (Guide & Li, 2010; Hamzaoui-Essoussi & Linton, 2014). They could also provide balanced information about these products (Savchenko et al., 2018), information about the nature of the production process (Abbey et al., 2017), make the past history of the product transparent (Kamleitner et al., 2019), and make consumers think about the transformation of recyclables into new products (Winterich et al., 2019). Moreover, quality assurance and warranties (Magnier et al., 2019; Michaud & Llerena, 2011; Ovchinnikov, 2011; Vafadarnikjoo et al., 2018),

quality labels (Abbey et al., 2017; van Weelden et al., 2016), performance classification systems (Mugge et al., 2017), and product warranty (van Weelden et al., 2016) should be explored.

This paper provides us the perspective that products with reused materials are sometimes viewed favorably by consumers, but they can also be perceived negatively. We must to apply and test different strategies to promote and facilitate the broad acceptance of circular products. We conclude that a single action will not be effective. It is necessary to develop a combination of strategies, using different levels of behaviors and roles, to increase the acceptance of circular economy products.

Continuing our strategy to answer the main research question of this dissertation, we selected one of the barriers found in our first study to explore in depth in our second study. As aforementioned, one of the reasons that consumers reject these products is due to contamination concerns (Abbey, Meloy, Blackburn, et al., 2015; Magnier et al., 2019; Meng & Leary, 2021). In our second paper, we tried to understand how contamination operates in the case of products with reused materials, by answering the following research question: *What is the role of product contamination in the acceptance of circular economy products?* The literature shows that feelings of contamination can lead consumers to decrease their evaluations of the products (Morales & Fitzsimons, 2007), especially when they know that they were previously touched by another person (Argo et al., 2006). In order to overcome the negative inferences consumers may have about circular products, our second paper is designed to understand the nature of this specific negative association: product contamination.

Contamination is largely associated with disgust feelings in the literature, being the explaining mechanism to perceived contamination (Argo et al., 2006; Meng & Leary, 2021; Morales & Fitzsimons, 2007). Disgust is described as a basic emotion associated with avoidance systems (Rozin et al., 1986). In this way, it is considered an emotive reaction to something. However, our first paper shows the importance of product quality to the acceptance of these products (Abbey, Meloy, Guide Jr., et al., 2015; Wang & Hazen, 2016). If consumers have doubts about the quality of the product, probably they will refuse to buy it. Product quality is formed by evaluative processes (Golder et al., 2012). So, it is likely to be driven by cognitive reactions. In our second paper, we combine both quality and disgust to understand how contamination affects the acceptance of products made with reused materials. We advance in the literature by integrating two different possible mechanisms of reaction to products made with reused materials: the

first reaction, called "cognitive route", is explained by perceived quality, and second the one, called "emotional route", is driven by feelings of disgust. Previous studies have covered these two reactions separately, but have failed to produce a comprehensive understanding. We, therefore, try to offer a more holistic approach by combining both routes of reaction.

Extending our study of contamination, we found that perceived contamination is higher with products that have close physical contact with the body (Bodur et al., 2014; Morales & Fitzsimons, 2007) and this effect can be extended to products made with reused materials (Abbey, Meloy, Blackburn, et al., 2015; Magnier et al., 2019; Meng & Leary, 2021; Mobley et al., 1995). Therefore, we assumed that the acceptance of products with reused materials would be influenced by how close the product is to the user's body. In the end, this paper analyzed how contamination operates in the acceptance of products made with reused materials by using a boundary condition to this effect (proximity to the body) and two different mechanisms of influence, a more emotive one (disgust), and a more cognitive one (perceived quality).

In an experimental study (one-way between-subjects experimental design with degrees of physical contact - high vs low - as the experimental factor), contrary to our beliefs, we found that respondents presented higher intentions to purchase products made with reused materials that have high contact with the body, even if they are perceived as more contaminated (Argo et al., 2006; Morales & Fitzsimons, 2007). Previous studies showed that consumers have lower intentions to purchase products with reused materials that are close to the body (Meng & Leary, 2021). Perhaps the products we used in our study have influenced our results (Magnier et al., 2019). So, we refute our first idea that consumers would have lower intentions to purchase products made with reused materials that are more proximal to the body.

The most interesting finding of this study is that we found a significant indirect effect for purchase intentions through perceived quality and disgust. However, the effect is mainly explained by perceived quality, and not through disgust. This effect brings a new perspective in the literature, which usually relates contamination with emotional reactions, such as disgust (Argo et al., 2006; Morales & Fitzsimons, 2007), and tend to overlook the role of perceived quality. Based on our first study, we can say that perceived quality is extremely important in the acceptance of products made with reused materials (Magnier et al., 2019). Our second study provides a new and integrative explanation for consumers' responses to products made with reused materials that draws from the

existence of both routes of reaction: a cognitive route via perceived quality and an emotive route via disgust. This adds a new discussion to product contamination: not only emotional factors interact with contamination (Kapitan & Bhargave, 2013; Rozin & Fallon, 1987), but also cognitive ones.

So far, this dissertation has given several contributions to the circular economy literature. First, we understood the several roles and behaviors that consumers can have in the progress of a circular economic system. We also explored main barriers and opportunities to the acceptance of products made with reused components (one of the strategies inside the circular economy) and discussed some ways to overcome these barriers. We analyzed in deep the role of contamination in the acceptance of products made with reused components (a key barrier to the acceptance) and found that considering negative emotional reactions could be reduced when in combination with cognitive aspects, such as product quality. To complement the analysis of our main goal (to depict the different factors that affect consumers inferences of circular economy products and to analyze how to overcome the negative inferences that consumers may have), our last paper was designed to give to the literature a different strategy to change consumer behavior and to support the progress of a circular economy. Based on the behaviors described in the first study, in the third paper we explored how behaviors inside the circular economy correlate and if performing one of the behaviors could help individuals to accept circular products. By answering the following research questions *"How to overcome the negative inferences that consumers have about circular economy products?"* and *"How behaviors inside the circular economy interact and what it represents in the acceptance of products made with reused materials?"*, we explored a different way to increase consumers acceptances of these products.

Given that the literature has given many ways strategies to recycling behaviors (Jackson et al., 1993; Park & Ha, 2014; Phulwani et al., 2020; Thøgersen, 1994, 1996), we selected this behavior to understand how it interacts with buying products made with reused materials. In our last study, we show how buying circular products can be considered a continuation of behavior of recycling. Given that both behaviors are necessary to the progress of the circular economy (Stangherlin & Thøgersen, 2021), we investigated whether positive and/or negative spillover exists and which direction dominates between recycling behavior and the acceptance of circular products. We assumed that people who recycle would become more inclined to buy products with reused materials, that is, it would have a positive "spillover" from recycling behavior to

buying circular products occurs (Lanzini & Thøgersen, 2014; Thøgersen, 1999). A goal-theoretical perspective was applied to explain positive spillover between these behaviors. It was hypothesized that positive spillover between the two behaviors would occur when one behavior makes a superordinate goal motivating both behaviors more salient, and/or strengthens the consumers' perceived efficacy with regard to reaching an important, superordinate goal.

We used a panel study and repeated the same survey in the capitals of two countries, Denmark (Copenhagen) and Portugal (Lisbon), primarily for cross-country validation. Our main contribution is the confirmation that there is a positive spillover from recycling behavior to buying circular products in both countries. Results show that performing one of the behaviors (recycling or buying recycled products) increases the likelihood of performing the other behavior sequentially. It is also important to analyze consumers' waste-related goals. Results show that the more a person performs the two behaviors, the more important the goals of resource conservation and waste prevention are to them, which are represented as goal importance, and the more successful they feel in relation to waste prevention and resource conservation, represented my goal progress, at a later time. And the more important these goals are to the individual and the more successful they feel with regard to these goals, the more they perform the two behaviors in the future.

This dissertation has important contributions to the literature. Past research showed that perceived progress towards a goal can have a negative effect on continuing that goal. This is due to the fact that people might focus less on that goal if they perceive the goal was achieved in some way (Fishbach et al., 2006). However, in the case of our study, consumers who recycle or buy recycled products do not feel that they have done enough towards their waste reduction goals (Emmons & King, 1988; Freitas et al., 2009). More importantly, perceived progress towards that goal is positively related towards doing more and, hence, the spillover between the two behaviors can partially be attributed to the impact of the first of them on perceived progress towards the goal. In the end, we can say that at least partly of the positive spillover between the two behaviors is due to the activation of one of them in activating waste prevention and resource conservation goals. Both goals are shared by the two behaviors and by the perceived success in striving for the goal.

Ultimately, these three papers bring several theoretical contributions. First, we contribute to the understanding of consumer's role in the circular economy, a gap

(Camacho-Otero et al., 2018) identified as missing in the literature. . Since consumers have important decisions inside this system (Stangherlin & Thøgersen, 2020), it is important to bring their perspective to the analysis and understand how they can contribute to the advance of the circular economy. Specifically, our first paper integrates both consumers' role and the main barriers and opportunities to the acceptance of products made with reused materials. This is a first movement towards building a consumer theory inside circular economy.

This dissertation also contributes to the contagion literature. By knowing that one of the barriers to the acceptance of circular products is concerns to product contamination (Abbey, Meloy, Blackburn, et al., 2015; Magnier et al., 2019; Meng & Leary, 2021), we used the theory of product contagion (Morales & Fitzsimons, 2007) to understand how contamination operates in the case of circular economy products. The role of disgust and its influence on contamination is frequently studied in the literature (Argo et al., 2006; Meng & Leary, 2021; Morales & Fitzsimons, 2007). We added to the analyzes the effect of quality (considered a more cognitive reaction) in this effect, bringing original contributions. The combination of both emotive (disgust) and cognitive (quality) elements can affect consumers acceptance of circular products, representing a progress in this theory.

This study also adds the behavioral spillover theory (Truelove et al., 2014) and goal activation for behavioral spillover. Results of the third paper showed the importance of the person's waste-related goals for the spillover between the two behaviors. By seeing the acceptance of products made with reused materials as a "continuation" of their recycling behavior (Stangherlin & Thøgersen, 2021), we found a possible way to reduce the negative inferences consumers may have toward these products and also to impact sustainability in a general way (Thøgersen, 1994): to stimulate that one of these two behaviors became a habit in consumers' routine. If consumers habitually perform one of them, the chances of achieving their joint goals are much greater. White, Habib and Hardisty (2019) agree that actions encouraging repetition can strengthen positive habits. Therefore, public policies and private strategies able to make recycling or buying recycled products easy, by utilizing prompts, incentives, and feedback are deemed to contribute to increasing overall sustainability.

Likewise, we showed the importance of individuals' waste reduction goals being strong and salient, which suggests the need for a continued improvement on how to communicate and educate consumers toward this end.

Practical contributions

Governments play an important role in the progress of the circular economy. There is a combination of different strategies that can be used to increase consumer acceptance of products made with reused materials. A possibility is the use of ecolabels certifying and communicating products' environmental impact from a life-cycle perspective (Darnall et al., 2018). Third-party ecolabels are effective means to inform consumers about products' environmental characteristics and help them make better choices (Thøgersen, 2002). They can also be instrumental in educating consumers about their choice options and providing assurance of product quality. This could be used in the circular economy by trying to reduce perceived risks consumers express towards these products (Magnier et al., 2019; van Weelden et al., 2016). As one of the barriers to the acceptance of these products is the fact that consumers often cannot assess the quality of the product before using it (Michaud & Llerena, 2011; Wang & Hazen, 2016), circular economy labels or certifications could provide information to the end consumer (Mugge et al., 2017; Vafadarnikjoo et al., 2018), improving their quality perceptions (Abbey, Meloy, Guide Jr., et al., 2015), and reducing perceived risks associated with these products (Wang et al., 2013). Moreover, these labels could provide information of the past history of the product (Kamleitner et al., 2019), being a quality assurance and warranty, a strategy discussed in previous studies (Magnier et al., 2019; Michaud & Llerena, 2011; Ovchinnikov, 2011; Vafadarnikjoo et al., 2018).

When thinking about communication, is important to consider different factors before designing campaigns (Kamleitner et al., 2019). Environmental benefits are important for consumers' choice of products with reused materials. However, only stressing these benefits may backfire, since they are rarely the main reason why consumers buy a product (Abbey, Meloy, Guide Jr., et al., 2015; van Weelden et al., 2016). Especially, performance and financial risks need to be reduced to increase the acceptance. It is also important to consider that depending on how communications are designed, it can increase consumers perceptions of contamination of these products (much discussed in our second paper). It is important, therefore, to consider ways in mitigating the negative reactions consumers may have evoked by disgust and how to increase their quality perceptions of these products. The reuse of components and

materials can become a competitive advantage for companies who know how to position their products and have a good understanding of their target customers.

Moreover, since buying circular economy products can be considered a quite new behavior in some locations and has its challenges (Patwa et al., 2021), we recommend that policy makers should stimulate more well-known behaviors, such as recycling (Thøgersen, 1994, 1996). This could be a first step in the acceptance of products made with reused materials in locations or in groups of segments where they are not that common. Moreover, it is important to consider ways to make individuals perceive that they are progressing toward their waste-related goals. This can be easily be done with specific communication towards that end.

Final considerations

This dissertation contributes to the discussions about circular economy. Inside the circular economy, it is possible to find different models of production and consumption, as well as different actors can be involved to the progress of this model. In this dissertation, we decided to explore the actors involved in the micro level (product, companies and consumers). Moreover, there are different products that can be considered products from the circular economy. We specifically focused on products designed for multiple cycles / design for recovery. More specifically, we studied products made with reused materials. This dissertation focuses on the principles of the circular economy inside the phase of consumption, relating the way consumers behave and adopt products from the circular economy, in this case, products made from recycled materials.

The literature shows an ambiguity in consumers' acceptance of these products, being a challenge to the progress of the circular economy. It is known that several factors can influence their final decision. However, the literature lacks clarity on how we can contribute to the acceptance. The main goal of this dissertation was to depict the different factors that affect the consumers inferences of circular economy products and to analyze how to overcome the negative inferences that consumers may have.

This dissertation started with a discussion about the main roles that consumers can have to the progress of the circular economy. As aforementioned, the circular economy includes different possibilities to the actors involved. By understanding what roles

consumers can have, it is possible to design the best strategy to each one of them. This dissertation included a broad understanding of the role of purchaser, focusing in the purchase of products made with reused materials. These discussions provided an initial progress to building a theory of consumer behavior inside the circular economy by bringing in detail the different roles and behaviors that consumers can have to contribute to the progress of the circular economy. Moreover, by exploring main barriers and opportunities to the acceptance of products made with reused materials, we provided a complete understanding of main opportunities to be explored. It is important to highlight that an important finding is that many of the behaviors that consumers can have inside the circular economy are dependent on each other for their execution: performing one of them is associated to the execution of a different behavior. This is an interesting finding, since studies usually consider behaviors in isolation.

Several barriers may hinder the acceptance of these products. However, two of them deserve closer attention: perceived quality and product contamination. Concerns with the quality of the product and contamination impressions stand out as two important barriers to be discussed. In view of this, the role of contamination in the acceptance of these products and its relationship with quality was analyzed. The theory of product contagion supported these discussions. In this theory, disgust is the most important mechanisms that explain why contamination affect the acceptance of certain products. This dissertation analyzed this path. However, based on the literature, we also included the quality dimension in this analyzes. We analyzed the role of contamination on the acceptance of products made with reused materials, being explained by feelings of disgust and quality concerns.

With an experimental study, it was analyzed that the perception of contamination can be explained by emotional mechanisms, such as disgust, but also by cognitive mechanisms, such as perceived quality. The dissertation advances in the theory of contamination/contagion, adding to the discussions a variable that until then was not addressed in the studies (perceived quality). This is an important finding, since strategies to promote the acceptance of products made with reused materials should include the influence of these factors: contamination, feelings of disgust and perceived quality.

This dissertation ends with a discussion about possible opportunities inside the circular economy and consumer behavior. More specifically, we analyzed how behaviors within the circular economy interact and whether there is a possibility of progress between their effects. By understanding consumers' role inside the circular economy, it

was possible to have a broad view of how consumers can engage in a circular economic model. One of the possible behaviors that consumers can have is recycling behavior. The literature has significantly explored how to stimulate recycling behavior, being a mature subject of research. In this way, being supported by the behavioral spillover theory, we analyzed how the behavior of recycling influences the behavior of buying products made from recycled materials, and vice versa. In order to increase the options of strategies to help the acceptance of products made with reused materials, a longitudinal study carried out in two countries to understand the relationship between these behaviors. We advanced the theory of spillover and goals of waste reduction. More specifically, the psychological mechanisms underlying the behavioral spillover processes were analyzed, especially those related to the goals that motivate the two behaviors to adopt the behaviors under analysis. We conclude that the more consumers recycle, the more likely they are to also buy products made from recycled materials, and vice versa. Furthermore, this behavioral variation is mediated by the strengthening of individual waste reduction goals. This dissertation ends with a main discussion on how to overcome the negative inferences that consumers may have about circular economy products. By stimulating one of the behaviors within the circular economy, space can be opened for the adoption of behaviors that contribute to the progress of the circular economy.

Figure 8 shows the progress of this dissertation and in the knowledge of consumer behavior and the circular economy.

Figure 8 – Final contribution of the dissertation.
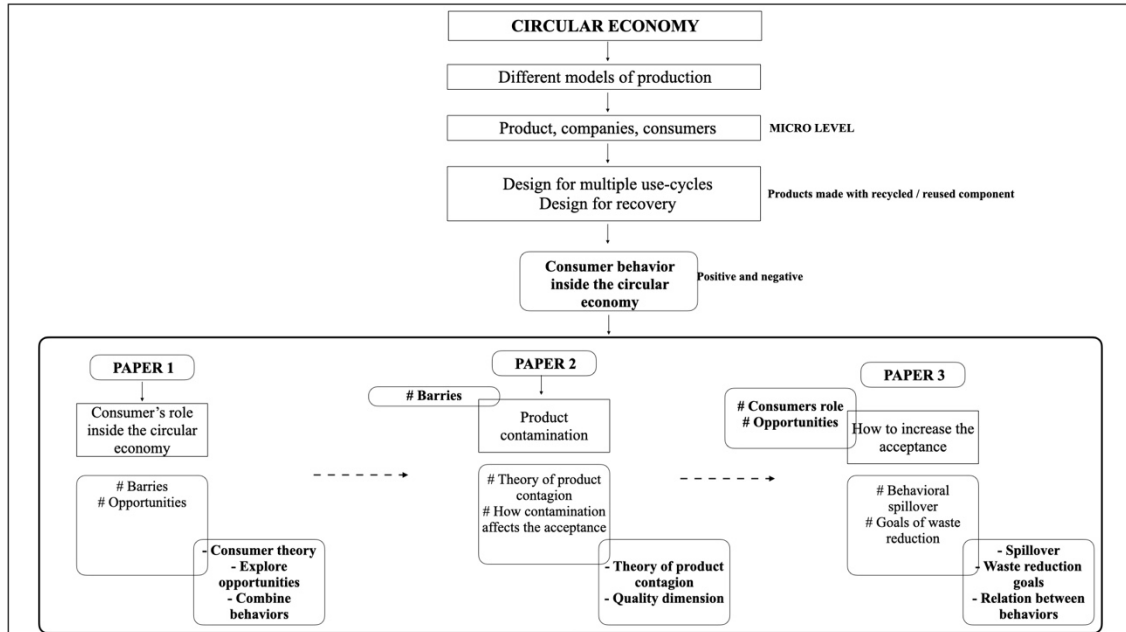
Main limitations and future studies

Several limitations of this dissertation can be used as an input for future studies. Our first paper is a first step in the consumer behavior theory inside the circular economy. The detailed description of each role that consumers can have is essential to understand where we can stimulate the behaviors and where we can promote behavior change. We recommend that future studies use different methods to complement the analyses. For example, future studies could conduct a meta-analysis in order to achieve a systematic review and a quantitative integration of the main findings (Lipsey & Wilson, 2001; Palmatier et al., 2006). The analysis of consumers role inside the circular economy in a meta-analytic model could integrate past results in a more comprehensive way through the selection of papers from several contexts. The same applies to the opportunities and barriers found to the acceptance of circular products. Future studies could integrate past results in a meta-analytic model that could be tested in quantitative models.

We understand that the second paper could be improved by running different experimental studies. For example, future studies could be inspired by our experiment and try to replicate it by using a single product. Researchers could manipulate the perception of product proximity instead of using different products to capture this variable, and to isolate the effect of contamination. It is important to note that we

understand that our results could have been influenced by the selection of the products. There is a chance that the two products with high degree of physical contact are more desirable than the other products (Magnier et al., 2019). So, we recommend that future studies should use different products in the analysis and run the same study with a single product. Additionally, the understanding of the effect of contamination is enhanced with the analysis of different products/contexts (Argo et al., 2006).

A suggestion for future studies is to analyze if product history and circular process information (Wang et al., 2020) have an impact on consumer perceptions of products made with reused materials. Information about the amount of reused materials included in the product (Hunka et al., 2020) could also be a good strategy to understand consumers reaction toward these products. Past research showed that consumers respond differently to recycled packages and recycled materials in the product itself (Achabou & Dekhili, 2013). Future studies could analyze differences in perceived contamination between products that use reused materials in the product itself and between packages made with reused materials. Differences in the effect of contamination should emerge, being extremely important to companies know these differences.

We have to consider that our last study was based on self-reporting behaviors, which may be influenced by social desirability bias (Kormos & Gifford, 2014). Spillover between these behaviors should also be tested with experimental studies (Belot & Schröder, 2016; Sinclair et al., 2012). It would be possible to manipulate goals in experimental studies, reducing possible confounding effects. Moreover, different goals could be tested. In our study, we measured goal importance and goal progress, but different goals could be also important, for example, at more superordinate levels (Höchli et al., 2019). Moreover, different studies can test different boundary conditions and processes driving or limiting behavioral spillover.

Other avenues for research relate to the analysis of how different behaviors inside the circular economy interact. It would be extremely important to test if the spillover between other behaviors would also be positive. Our first study can guide decisions on which behavior to target (Stangherlin & Thøgersen, 2021). This dissertation showed several behaviors consumers can have inside the circular economy (first paper). To better understand results of our last paper, future studies could use a different pair of behaviors inside the circular economy. Finally, we also recommend to conduct studies in different countries to further validate our findings.

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Appendix A – Sample characteristics

Table 8 – Gender and age

Variable	Earphone	Electric toothbrush	Printer	Vacuum cleaner
N (%)	76 (25%)	73 (24%)	79 (26%)	76 (25%)
Male	33 (43.4%)	30 (41.1%)	33 (41.8%)	32 (41.1%)
Female	43 (56.6%)	43 (58,9%)	46 (58,2%)	44 (57.9%)
Age (mean)	36.02 (11.61)	38.03 (13.37)	38.22 (11.45)	36.43 (11.39)

Table 9 – Education

N (%)	Less than High School	High School	Some College	2-year College Degree	4-year College Degree	Master's degree	Doctoral Degree	Professional Degree (JD, MD)
Earphone	0	11 (14.5%)	15 (19.7%)	5 (6.6%)	33 (43.4%)	9 (11.8%)	2 (2.6%)	1 (1.3%)
Toothbrush	0	12 (16.4%)	14 (19.2%)	7 (9.6%)	27 (37%)	11 (15.1%)	2 (2.7%)	0
Printer	1 (1.3%)	12 (15.2%)	16 (20.3%)	13 (16.5%)	30 (38%)	3 (3.8%)	2 (2.5%)	2 (2.5%)
Vacuum	2 (2.6%)	8 (10.5%)	15 (19.7%)	8 (10.5%)	32 (42.1%)	9 (11.8%)	1 (1.3%)	1 (1.3%)

Appendix B – Stimulus paper 2

Consent form

Thank you for taking time to participate in this study. The study is conducted by
Aarhus University (Denmark) and Federal University of Rio Grande do Sul
(Brazil). We will use the information that participants provide for academic
purposes. No information regarding you personally will be published or revealed in
any way. If you have questions about the project, please write them at the end of
the survey.

Participation is on a purely voluntary basis and you may quit participation
altogether at any time. Completing the survey will take approximately 10 minutes.
Your compensation for successfully completing this study is £ 1.10.
After you have reviewed the information below, please continue to the next page if
you wish to participate in this survey.

I consent to participate in this session, which will involve answering some questions.
I understand that all data will be kept confidential by the researcher. My personal
information will not be stored with the data. I am free to withdraw at any time
without giving a reason. I consent to the publication of study results as long as the
information is anonymous so that no identification of participants can be made.

○ Yes

○ No

Introduction

In the following, we introduce you to a product. We are interested in how you
evaluate this product. There are no right or wrong answers. Please answer the
questions based on what you think and what you feel.
Imagine you are looking to buy a product in this category and give your answers
with that in mind.

High degree of physical contact conditions

EARPHONE

Features:

- Easy to handle, you can carry to different places
- Some of its parts are made with materials recycled from products that other people have discarded
- Compact size and handy design

ELECTRIC TOOTHBRUSH

Features:

- Easy to handle, you can carry to different places
- Some of its parts are made with materials recycled from products that other people have discarded
- Compact size and handy design

Low degree of physical contact conditions

PRINTER

Features:

- Easy to handle, you can carry to different places
- Some of its parts are made with materials recycled from products that other people have discarded
- Compact size and handy design

VACUUM CLEANER

Features:

- Easy to handle, you can carry to different places
- Some of its parts are made with materials recycled from products that other people have discarded
- Compact size and handy design