



Consumer reactions to circular packaging: The impact of disgust, guilt, and value on adoption intentions

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1. Introduction

Packaging is a major issue when considering the transition to a circular economy (Silva and Pålsson, 2022; Weinrich et al., 2024). Most packaging currently used in many industries is plastic, accounting for about 70% of the 350–400 million metric tons of yearly plastic waste (Zero Waste Europe, 2022). However, the design of plastic packaging is not always thought to be made to be recycled, according to the “take-make-use-waste” linear process, not a circular one; thus, this is reflected in over 30% of plastic going toward packaging production, which is not entirely recycled (Grand View Research, 2022), producing every year a “sheer volume of waste” (Mielinger and Weinrich, 2024). Thus, this is reflected in over 30% of plastic going toward packaging production, which is not entirely recycled (Grand View Research, 2022). This contrasts with the upcoming EU Packaging and Packaging Waste Regulation (PPWR, see, e.g., (Krahl, 2024), whose primary goal is to address the constant increase in packaging waste. The main objective is to reduce packaging waste in the EU by at least 15% by 2040 compared to 2018.

The regulation focuses on improved recyclability of packaging, mandatory quotas for reusable packaging, and minimum recycled material content in packaging. Accordingly, increasing efforts are being devoted to identifying viable solutions to more sustainable packaging, one of which is the substitution of packaging materials such as plastic with circular materials, particularly for food packaging, which accounts for over two-thirds of total packaging production (Axelsson-Bakri et al., 2020).

Among the circular materials with the highest potential for packaging are bioplastics, produced entirely from biomass, renewable

sources (i.e., corn, sugarcane), or organic waste (Scarpi et al., 2021). One of the closest bioplastics soon to be marketed on a large scale is polyhydroxyalkanoates (PHA), “natural biodegradable polyesters synthesized by microorganisms” (Li et al., 2016). It is obtained in line with circular principles from organic food waste, including that produced at the household and retail level and by the food service sector. In line with the circular principle that “waste is a resource,” PHA is denoted by relevant environmental benefits than its traditional counterparts (e.g., Saavedra del Oso et al., 2023) and can be valorized with available technologies and practices to produce food packaging (Russo et al., 2019).

In this study, we take the case of PHA packaging to investigate the “consumer’s contribution as a customer of the circular economy” (Shevchenko et al., 2023, p. 2). Indeed, a major challenge for a circular transition, apart from the technological one, is the engagement of end consumers (Chenavaz and Dimitrov, 2024). They are primary stakeholders of the circular economy (Ghisellini et al., 2024) in that for actual circularity to take place, they must be actively involved in several processes (e.g., the sharing, reusing, and refurbishment of existing materials and products) to extend the life cycle of materials and products for as long as possible, ultimately “creating further value” (European Parliament, 2023). Not surprisingly, the role of consumers is being widely debated in the attempt to “frame, clarify and measure” (Shevchenko et al., 2023, p. 2) their actual contribution to the circular transition; recent evidence suggests that, despite a broader increase of the collective consciousness of ecological issues, consumers’ support of circular products should not be taken for granted (Ghisellini et al., 2024), particularly when products involve sensitive issues for individuals (e.g.,

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health-related issues). Hence, there is a need to clarify 1) how consumers feel about the circularity of products (i.e., how consumers perceive reusing products and materials that have been already used in the past or are obtained from used resources) (Baird et al., 2022), and 2) how such perceptions affect their decision-making processes with regards to circular products (e.g., Bigliardi et al., 2022).

PHA food packaging embeds the potential ambivalence consumers may experience when facing the foundational circular concept that “waste is a resource”. While being, on the one hand, aware of the need to change consumption habits in favor of more sustainable alternatives, on the other hand, consumers may express concern about the quality and the origins of the raw materials employed in circular production (e.g., various sources of waste) (Aydin and Mansour, 2023); the picture might be even more complicated for some purchases involving health-related issues (e.g., food purchases).

We tackle this ambivalence through the lenses of the theory of cognitive dissonance (Ghingold, 1981), which posits that people’s behaviors derive from the fundamental individual need to maintain internal cognitive consistency. Accordingly, on the one hand, we start with the consideration that the nature of circular materials like PHA (i.e., deriving from organic waste) may generate feelings of disgust in consumers, especially when used to shelf products such as food (e.g., Baird et al., 2022). We therefore advance that, from a consumer decision-making perspective, such feelings may negatively affect consumers’ perceived value of PHA packaging, reducing, in turn, the likelihood of adopting it.

On the other hand, we also advance that such negative feelings might be -at least partially-offset by guilt. Prior studies (e.g., Nuojuua et al., 2022) documented that this negative emotional state frequently accompanies consumer choices not oriented toward more sustainable alternatives (e.g., Shimul and Cheah, 2022). Following the increasingly compelling pressure of environmental issues in society, guilt has recently been proposed as a critical driver of consumer adoption of more sustainable behavior (e.g., Haj-Salem et al., 2022).

Furthermore, this research compares consumers’ reactions when PHA is used for high- and low-contact products, showing how the level of contact between the organic waste bioplastic and consumers’ bodies can interact with the amount of perceived disgust and its impact on consumers’ willingness to adopt circular alternatives.

This research provides some contributions. First, it takes a consumer’s perspective on the circular economy, tackling the problem of circular transition from the perspective of a stakeholder group that has been, so far, quite under-researched (Shevchenko et al., 2023). Second, by focusing on bioplastic packaging, it further extends consumer-based research on the circular economy that, so far, has been largely focused on specific industrial sectors (e.g., refurbished consumer electronics, Bigliardi et al., 2022; Govindan et al., 2024). Third, it aims to contribute to research understanding consumers’ drivers of adoption of circular products by exploring the antecedents of some key consumer outcomes (i.e., perceived value, Findrik and Meixner, 2023; willingness to choose circular alternatives, Coderoni and Perito, 2020). Fourth, it delves into the issue of “how people feel” (Baird et al., 2022, p. 1) about circular products, shedding light on the role of consumers’ emotions in fostering the adoption of circular alternatives (Hellali and Korai, 2023).

2. Theoretical framework and hypotheses development

2.1. Consumer behavior and the circular economy

Consumer-based research on the circular economy is rapidly gaining momentum (Govindan and Hasanagic, 2018). It is acknowledged that the consumer behavior field has produced extensive knowledge on consumer behavior and sustainability (e.g., on consumers’ pro-environmental behavior); however, scholars agree that the issue of circular consumer behavior requires specific theoretical speculation and empirical evidence in that the circular paradigm implies “essential

changes in consumer behaviors and current consumption patterns to increase conscious consumption practices and green product and service demand in line with circular economy principles” (Shevchenko et al., 2023, p. 5).

Recent research (see, e.g., Shevchenko et al., 2023, for a review on circular consumer behavior) points out that a large number of studies on circular consumption has focused on consumer acceptance of circular products, as this is the initial point of any circular consumption process. The contribution of consumers to the development of CE and CE-oriented strategies has been investigated from different perspectives, ranging from consumer awareness of circular products (Cordova-Pizarro et al., 2020) and consumer knowledge and culture (Siminelli, 2017) to the barrier involved in consumers’ perception of CE and related activities (De Jesus and Mendonça, 2018).

However, existing studies still appear largely focused on specific domains of circular economy, particularly consumer acceptance of remanufactured or refurbished products (e.g., consumer electronics, Coughlan et al., 2018; clothing, Testa et al., 2024); much less attention has been devoted to examining consumer acceptance of recycled products (Shevchenko et al., 2023), including products obtained entirely from recycled sources like bioplastics, whose success largely depends upon “changes in consumer behavior” (Fletcher et al., 2024); this includes also the domain of circular packaging, and particularly, of plastic food packaging (Du Rietz and Kremel, 2024), for which still “minimal evidence exists” (Corsini et al., 2024) relating to its adoption from end users.

This research explores the role of consumers’ evaluation of circular packaging, specifically food packaging, a key domain for an academically under-investigated circular economy. In particular, the research borrowed the suggestion of the literature on sustainable consumption that a gap may exist between consumer goodwill and “noble intentions” (Ketelsen et al., 2020, p. 3) regarding sustainable alternatives and actual choices. We propose that this suggestion could be even more compelling in circular settings. On the one hand, we posit that the “waste is a resource” idea may not necessarily appeal to consumers. Recent research seems to support this consideration; for instance, Aydin and Mansour (2023) reported that consumers are likely to show ambivalent perceptions toward circular materials, particularly because of concerns about the overall quality of products made from such materials. We argue that this might be more relevant for food packaging, given the significance of food products to consumers (i.e., having profound implications for human life) and the origin of circular materials employed in circular food packaging (i.e., bioplastics obtained from food waste and animal by-products). However, on the other hand, we also predict that consumers’ choices regarding circular products might also be driven by external forces, particularly by the increasing pressures of environmental issues in society, urging consumers to embrace sustainable consumer patterns to avoid a sense of guilt (e.g., Haj-Salem et al., 2022). In this vein, Findrik and Meixner (2023) provide a fresh perspective on the complexities surrounding packaging decisions within food supply chains, particularly by addressing the conflicts of interest in packaging logistics (Pålsson et al., 2022). Thus, in response to recent research calls (Findrik and Meixner, 2023), we explore perceptual factors that can hinder or encourage consumer choice toward circular products.

We tackle this potential ambivalence through the lens of cognitive dissonance theory (Ghingold, 1981), which describes individual behaviors as deriving from the individual’s need to maintain internal cognitive consistency (Burnett and Lunsford, 1994). In other words, the theory posits that individuals tend to develop opinions and attitudes that reflect a set of internal consistencies; hence, inconsistencies can be interpreted as psychological discomfort (i.e., dissonance; Festinger, 1957). By applying these insights to circular settings, consumers might be repulsed by the nature of the raw material from which the products are obtained. However, on the other hand, we also predict that these negative effects might be offset by the individual’s need to avoid situations that would amplify cognitive dissonance (Burnett and Lunsford,

1994; Festinger, 1957), specifically feeling guilty for not having embraced sustainable consumer alternatives.

2.2. The role of disgust in packaging derived from organic food waste

Izard (1977) developed the differential emotions theory and identified 10 fundamental emotions: interest, joy, surprise, contempt, sadness, fear, anger, disgust, shame, and guilt. Since then, several scholars have deepened the study of emotions and usually consider disgust a fundamental emotion (see Shimp and Stuart, 2004 for a review).

Over the years, the definition of disgust has evolved from a basic perspective of disgust as revulsion related to unpleasant smells and tastes (e.g., Rozin and Fallon, 1987) to a broader definition that also encompasses a moral and social sentiment (Burlington et al., 1997). However, despite much debate, scholars currently agree that the emotion of disgust is based more on beliefs about the origin of an object than on oral or olfactory sensations from that item (Shimp and Stuart, 2004).

While this interpretation of disgust might appear narrow, it resonates with “the fundamental notion that disgust represents a feeling of visceral repulsion to an offensive object” (Shimp and Stuart, 2004, p. 45). Furthermore, such a definition also allows for disgust to include moral and social considerations (Rozin and Fallon, 1987). As previously mentioned, this research considered feelings of disgust toward products made of bioplastic derived from organic waste. These products are identical to traditional products in all but their ability to easily biodegrade. Thus, they perfectly fit the definition of disgust: not stemming from an oral or olfactory sensation but instead based on beliefs about the object’s origin (in this case, organic waste).

Marketing scholars have shown that appraisals stemming from emotions are typically related (Bagozzi et al., 1999) and, ultimately, collapse into two separate dimensions or factors: positive emotions and negative emotions (Pantano and Scarpi, 2022); disgust falls unambiguously in the latter group (Shimp and Stuart, 2004). Consistently, scholars have found that positive emotions lead to a higher perceived value. The latter is a multidimensional construct encompassing functional, conditional, social, emotional, and epistemic dimensions. Perceived value can impact decision-making (Jagdish N. Sheth et al., 1991), willingness to purchase or adoption intention, and satisfaction (e.g., Pantano and Scarpi, 2022). On the other hand, negative emotions lead to brand switching and dissatisfaction (e.g., Bagozzi and Dholakia, 2006).

The concept of consumers’ perceived value is crucial for the circular economy. The primary aim of the circular model is to extend the value of resources by keeping them in loops; circular products are designed according to this aim (den Hollander et al., 2017). However, positively impacting consumers’ value perceptions with this feature of circular products is not straightforward. According to the literature on consumers, products perceived as already used or touched are likely to be devalued by customers (e.g., Belk, 1988). Similarly, past research reported that consumers’ willingness to pay decreases for reused or refurbished products (Harms and Linton, 2016). For circular products, the re-introduction of post-consumer waste negatively impacts consumers’ value perceptions, particularly in the case of products with a high level of functional risk, like those that come into close contact with the human skin or body (e.g., van Weelden et al., 2016). Notably, in this latter case, value perceptions are more likely to be affected by disgust, which is indeed likely to grow the more products get close “to bodily intake” (Testa et al., 2022, p. 3).

In summary, disgust is a fundamental emotion that has evolved beyond mere sensory revulsion to encompass moral and social sentiments. This broader definition aligns with the notion that disgust can arise from beliefs about the origin of an object rather than just from sensory experiences (Shimp and Stuart, 2004). In the context of circular packaging made from organic waste, disgust is likely to be elicited due to the perceived contamination from waste materials, even though these

products are functionally equivalent to traditional alternatives. The theory of cognitive dissonance suggests that when consumers encounter products that challenge their existing beliefs or values, such as those made from waste materials, their negative emotional response—disgust in this case—can hinder their willingness to adopt these products (Rozin and Fallon, 1987). Therefore, we hypothesize that the negative emotion of disgust will lead to lower adoption intentions for circular packaging:

H1. Disgust negatively affects consumers’ adoption intentions for circular packaging.

Furthermore, the abovementioned considerations suggest that perceived value encompasses multiple dimensions, including functional, emotional, and social (Jagdish N. Sheth et al., 1991). Disgust, as a negative emotion, tends to decrease perceived value by emphasizing the undesirable aspects of a product (Shimp and Stuart, 2004). In the case of circular packaging, especially when it involves high bodily contact (e.g., packaging for food or skincare products), the perception of contamination can significantly impact how consumers evaluate the product’s value. The negative emotional response associated with disgust can overshadow the functional and environmental benefits of the packaging, leading to a decreased perceived value. This aligns with existing literature indicating that products perceived as used or touched are devalued, particularly when there is a high risk of functional contamination (Harms and Linton, 2016; van Weelden et al., 2016). Thus, we hypothesize that disgust will negatively affect consumers’ perceived value of circular packaging:

H2. Disgust negatively affects consumers’ perceived value of circular packaging.

2.3. Perceived value of circular packaging

Consumers’ perception of value in green products is not a new finding (de Medeiros et al., 2016). Previous research found that perceived value significantly impacts environmental-related consumer behavior, such as adoption intention (Gonçalves et al., 2016). In other words, the perceived green value represents a key driver of sustainable consumption behavior.

Previous research presented heterogeneous findings regarding green products: Lin and Huang (2012) found that emotional, conditional, and epistemic dimensions of value impact green products more than traditional ones, while Khan and Mohsin (2017) found that functional, social, and environmental values positively affect consumers’ behavior toward green products.

Recent research has found that consumers prefer circular products over traditional products with identical characteristics (Boyer et al., 2021). However, they are not always willing to pay more for them (Boyer et al., 2021), and it has been suggested that the key to explaining adoption intention is perceived value (Confente et al., 2020). Despite the heterogeneity in the studies addressing the possible components of value, there is a consensus that the overall perceived value is a suitable construct to understand consumers’ adoption of green products (e.g., Gonçalves et al., 2016), and circular products in particular (Scarpi et al., 2021). About circular products, consumers could pay great attention to key determinants of the related derived value (Abbey et al., 2015). For instance, beyond factors such as price, quality becomes a determinant of perceiving value in such products. Based on this, ensuring and measuring drivers such as quality, reliability, and durability constitute the basis for creating functional value for circular products, which could be perceived as less durable or inferior. Beyond functional value, another dimension of value that could be relevant to consumers of circular products is the utility derived from an alternative association with one or more specific social groups (Sheth et al., 1991), namely, social value (Quintelier et al., 2023). Adopting a circular product or packaging could help consumers feel more accepted in their community or improve others’ perception of them as they feel they are better people when

making more sustainable choices.

Moreover, choosing a circular product or packaging could contribute to perceived emotional value via the feeling of contributing to something better and making the right decision. The value dimension generates utility from an alternative capacity to arouse feelings or affective states (Joshi et al., 2021). Overall, the perceived value of circular products and packaging is a determinant of fostering consumers' willingness to purchase/adopt circular products (Confente et al., 2020). Hence, this research predicted a positive link between the perceived value of circular packaging and adoption intention.

Furthermore, the perceived value of circular packaging might also mitigate the negative effect of disgust on adoption intention. For instance, in the case of circular packaging derived from organic waste, consumers might feel uncomfortable buying a product with such packaging. So, perceiving value from such packaging might reduce the negative influence of disgust on consumers' buying intentions.

In summary, the relationship between perceived value and adoption intention for circular packaging is grounded in the notion that perceived value is a critical driver of consumer behavior, especially in green and circular products. Previous research has established that perceived value significantly impacts environmental-related consumer behaviors, such as adoption intention (Gonçalves et al., 2016). This is consistent with the broader understanding that perceived value encompasses multiple dimensions—functional, social, emotional, and epistemic—that collectively influence consumer preferences and behaviors towards green products (Lin and Huang, 2012; Khan and Mohsin, 2017). In circular packaging, perceived value is particularly crucial due to the inherent challenges associated with such products. Consumers might be hesitant to adopt circular products, especially those derived from organic waste, due to potential concerns about quality, cleanliness, and overall acceptability. To address these concerns, perceived value must encompass more than just functional attributes. It should also integrate social and emotional dimensions that could influence consumer perceptions. Thus:

H3. The perceived value of circular packaging positively affects adoption intention.

Hypothesis H3 posits that when consumers perceive high value in circular packaging—whether through its functional benefits, social acceptability, or emotional satisfaction—they are more likely to express a positive adoption intention. The perceived value includes factors such as quality, reliability, and durability, which are essential in overcoming skepticism about the efficacy and attractiveness of circular packaging (Abbey et al., 2015). Additionally, the social value derived from adopting sustainable practices and the emotional satisfaction associated with making environmentally friendly choices further enhance the overall perceived value (Sheth et al., 1991; Joshi et al., 2021). As a result, higher perceived value leads to a stronger intention to adopt circular packaging.

Finally, the perceived value of circular packaging influences consumer behavior, particularly when addressing negative emotions like disgust. Previous research has established that perceived value is a significant driver of sustainable consumption behaviors, including adoption intentions for green products (Gonçalves et al., 2016; Scarpi et al., 2021). In turn, perceived value integrates multiple dimensions—functional, social, emotional, and epistemic. Functional value pertains to the practical benefits and quality of the product. Social value involves the consumer's sense of belonging and social acceptance through sustainable choices. Emotional value relates to personal satisfaction from contributing positively to the environment (Sheth et al., 1991; Joshi et al., 2021). Thus, we posit that disgust, a strong negative emotion, can detract from the perceived benefits of circular packaging, especially when the packaging is derived from organic waste. This emotion can overshadow the product's functional and environmental advantages, decreasing adoption intentions (Shimp and Stuart, 2004; van Weelden et al., 2016).

However, the negative effects of disgust can be mitigated when consumers perceive high value in circular packaging—whether through enhanced quality, social prestige, or emotional satisfaction. The perceived value may shift the focus from the unpleasant aspects of the product to its positive attributes, thereby reducing the impact of disgust on adoption intentions. Thus, we advance that high perceived value can buffer against the negative influence of disgust, making consumers more willing to adopt circular packaging despite initial negative reactions.

H4. The perceived value of circular packaging negatively mediates the effect of disgust on adoption intention.

2.4. The role of guilt in reducing the effect of disgust

Guilt is a moral emotion that arises when an individual has a negative evaluation or an undesirable self-perception (Pontes et al., 2021) due to a moral failure in behavior (Tangney et al., 1996). In particular, guilt emerges when an individual feels responsible for an action perceived as falling short, leading to a moral transgression (Izard, 1977), which drives a tendency to adopt reparative behavior (Pontes et al., 2021).

Cognitive dissonance (Festinger, 1957) is a theoretical perspective that can offer an interpretative key for the relationship between guilt and reparative behavior. Cognitive theory is based on an individual's need to maintain cognitive consistency in opinions, attitudes, and behaviors (Burnett and Lunsford, 1994). Inconsistencies can be interpreted as psychological discomforts, which constitute dissonance (Festinger, 1957). When experiencing such feelings, an individual tries to reduce these inconsistencies or avoid situations that amplify the dissonance (Festinger, 1957; Burnett and Lunsford, 1994).

Guilt is often described as violating an individual's norms, values, or internal standards (Burnett and Lunsford, 1994). Thus, it can easily be related to dissonance (Burnett and Lunsford, 1994). Indeed, consumers react to guilt by doing "good" activities as moral compensation (Ding et al., 2016). For instance, they avoid complaining following a negative consumption outcome (Soscia, 2007), resolve to buy more sustainable products after buying unsustainable ones (Antonetti and Maklan, 2014), or donate to charity (Strahilevitz and Myers, 1998).

Previous literature supports the role of guilt in encouraging sustainable behavior. For instance, guilt-driven moral compensation can take the form of engaging in sustainable consumption (Antonetti and Maklan, 2014) and buying green products (e.g., Barbarossa and de Pelsmacker, 2016). These moral activities and obligations (Sharma and Lal, 2020) can cleanse consumers' consciences. Consequently, guilt is often associated with individuals' intentions to adopt pro-environmental behavior (Lacasse, 2016). Furthermore, recent research on domestically made products found that guilt can affect consumers' willingness to buy (Malhotra and Ramalingam, 2022).

Based on cognitive dissonance theory, this research predicted that a similar mechanism may also exist for adopting circular packaging, despite its difference from sustainable packaging (see Blum et al., 2020). Accordingly, guilt could be perceived as higher or lower when referring to circular products. To the authors' knowledge, such a sentiment has not been investigated in circular products, particularly packaging. Thus, we posited that guilt might affect value perceptions and behavioral intentions for adopting organic waste packaging. Specifically, this study hypothesized that guilt would weaken the effect of disgust on the perceived value of organic waste packaging because when consumers feel guilty, they will also have the urge to behave more morally. Similarly, we anticipated that guilt would weaken the negative effect of disgust on adoption intention. Hence, we hypothesized that:

H5a. Guilt negatively moderates the relationship between disgust and perceived value for circular packaging, such that higher levels of guilt weaken the negative impact of disgust on perceived value.

H5b. Guilt negatively moderates the relationship between disgust and

adoption intention for circular packaging, such that higher levels of guilt weaken the negative impact of disgust on adoption intention.

Overall, hypotheses 1 to 5 translate into the moderated mediation model shown in Fig. 1, where disgust is the independent variable, adoption intention is the dependent variable, and perceived value moderates the relationship between disgust and adoption intention. Furthermore, guilt moderates both the relationship between disgust and adoption intention and the relationship between disgust and perceived value.

3. Method

3.1. Sample and measurements

Because of its environmental and biological richness and complexity, Europe is particularly sensitive to the transition to a circular economy (e. g., BBI JU, 2021). This sensitivity is reflected in the issue of packaging as well. Increasingly, European countries are introducing more restrictive regulations to replace traditional packaging with circular alternatives (e. g., World Economic Forum, 2021). Therefore, a European sample was recruited by a market research company and invited to take the survey.

An online Qualtrics-developed questionnaire was used to collect the data. The questionnaire used measurements for disgust from White et al. (2016), adoption intention from Yoo and Donthu (2001), and guilt from Dahl et al. (2005). For perceived value, the scale by Lin and Huang (2012) was used to capture the full extent of value's multiple facets. The survey items were measured using a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) and can be found in the Appendix (Table A.2).

Two studies were developed. In Study 1, the participants received information regarding low-contact packaging (i.e., a shopping bag) made from PHA material. In Study 2, the participants received information regarding high-contact packaging (i.e., cracker film packaging) made from PHA material.

For Study 1, 150 European consumers were recruited. The market research company ensured the sample was representative of the reference population of gender, age, and geographical distribution. The participants were provided with a brief explanation of biobased PHA plastics; a timer ensured they could not skip this introductory text without reading it. Then, they were shown a shopping bag made from PHA material (see the Appendix for the scenario and description provided to the participants).

For Study 2, another 150 European consumers were recruited through the same market research company, ensuring the sample's representativeness for the reference population. As with Study 1, the participants were provided with a brief explanation of biobased PHA plastics, and a timer ensured they could not skip the introductory text without reading it. Then, they were shown a type of food packaging made from PHA material (i.e., packaging for crackers; see the Appendix for the scenario and description provided to the participants). In both studies, the procedure of giving information to participants followed the guidelines detailed in MacKenzie and Podsakoff (2012) and Fowler (2013).

3.2. Procedure

The model in Fig. 1 was estimated using the PROCESS macro for SPSS, an ordinary least square (OLS) and logistic regression modeling tool for path analysis using observable variables. The PROCESS macro is among the social sciences' most frequently employed modeling tools. It is particularly suited to estimating direct and indirect effects and regions of significance for probing interactions in moderated mediation models with single or multiple mediators or moderators (Hayes, 2017).

Specifically, the mean composite scores on the items were used for each variable (Hayes, 2018). Guilt was entered as a moderator of the

relationship between disgust and perceived value and the relationship between disgust and adoption intention. The analysis assessed the effects of disgust on adoption intention (both directly and indirectly, through perceived value, as moderated by guilt) and the effect of perceived value on adoption intention. The statistical significance of the direct and indirect effects was evaluated using 5000 bootstrap samples to create bias-corrected confidence intervals of 95%.

4. Results for study 1: Low-contact packaging

4.1. Measurement validity

Results from a confirmatory factor analysis (CFA) with AMOS 18 ($\chi^2/df < 3$; RMSEA = 0.07; CFI = 0.96) and Cronbach's alphas ranging between 0.85 and 0.95 supported the validity of the measures. Anderson and Gerbing's (1988) adequacy of measurements procedure was followed in Study 1. The CFA further supported the convergent validity of the measures: the composite reliability (CR) and the average variance extracted (AVE) exceeded the 0.7 and 0.5 thresholds, respectively (Fornell and Larcker, 1981). Specifically, in Study 1, the minimum CR was 0.91, and the minimum AVE was 0.55. Details are provided in Table A.2 in the Appendix.

4.2. Model estimation

Disgust negatively impacted adoption intention ($\beta = -0.64, p < 0.001$), as predicted in H1. Disgust led to a lower perceived value ($\beta = -0.89, p < 0.001$), supporting H2. In turn, perceived value positively affected adoption intention ($\beta = 0.52, p < 0.001$), supporting H3. Overall, this evidence supports the notion of perceived value as a partial mediator of the relationship between disgust and adoption intention, thus supporting H4. Furthermore, as posited in H5a, guilt significantly moderated the effect of disgust on perceived value ($\beta = 0.13, p < 0.001$). In turn, guilt significantly moderated the effect of disgust on adoption intention ($\beta = 0.09, p < 0.01$); thus, H5b was supported.

5. Results for study 2: High-contact packaging

5.1. Measurement validity

Results from a CFA with AMOS 18 ($\chi^2/df < 3$; RMSEA = 0.069; CFI = 0.92) and Cronbach's alphas ranging between 0.84 and 0.96 supported the measures' validity.

Anderson and Gerbing's (1988) adequacy of measurements procedure was followed, as in Study 1. The CFA further supported the convergent validity of the measures: the CR and AVE exceeded the 0.7 and 0.5 thresholds, respectively (Fornell and Larcker, 1981). Specifically, in Study 2, the minimum CR was 0.94, and the minimum AVE was 0.65. Details are provided in Table A.2 in the Appendix.

5.2. Model estimation

Once more, a significant negative direct effect emerged for disgust on adoption intention ($\beta = -0.59, p < 0.001$), as predicted in H1. Furthermore, disgust led to a lower perceived value ($\beta = -0.59, p < 0.001$), supporting H2. In turn, perceived value positively affected adoption intention ($\beta = 0.61, p < 0.001$), thus supporting H3. Again, this evidence supported the notion of perceived value as a partial mediator of the relationship between disgust and adoption intention, thus supporting H4. Furthermore, as posited in H5a, guilt significantly moderated the effect of disgust on perceived value ($\beta = 0.07, p < 0.01$). Additionally, guilt significantly moderated the effect of disgust on adoption intention ($\beta = 0.07, p < 0.01$); thus, H5b was supported for Study 2.

The results of the PROCESS macro are shown in Fig. 2 and Table A.1.

6. Discussion

6.1. Theoretical implications

This research explored the drivers of consumers' acceptance of circular materials through the lenses of the theory of cognitive dissonance. It examined the relationship between disgust, perceived value, guilt, and intention to adopt circular packaging. Furthermore, this research compared products that differ in the degree of contact with the consumers' bodies.

This research makes several theoretical contributions. First, it contributes to the literature on circular economy from a consumer perspective. It does so by focusing on packaging, which represents a critical issue for the transition to a more sustainable economy -and for circularity to take place. A large body of literature has considered the issue of packaging within the circular economy framework; however, mostly from a production perspective. This is not without a strong rationale: indeed, for a circular transition to take place, first and foremost, many technological issues must be addressed (e.g., introducing novel materials and supply chain management approaches). However, as increasing technologies are reaching a marketable state, researchers increasingly suggest that the focus on the problem is shifting toward a demand-side perspective (Shevchenko et al., 2023). In other words, while in extant research, the role of consumers is still quite neglected, they are a primary stakeholder group of the circular economy whose actual contribution is crucial for the diffusion of the circular paradigm. However, from an individual perspective, the circular transition appears to be a complex phenomenon in that it "calls for essential changes in consumer behaviors and current consumption patterns to increase conscious consumption practices and green product and service demand in line with circular economy principles" (Shevchenko et al., 2023, p. 5).

Second, by focusing on circular packaging, particularly bioplastics-based circular packaging, the present research extends the consumer perspective of circular economy to other relevant domains than those on which extant research is largely focused (e.g., fast fashion, Brydges, 2021; consumer electronics, Bigliardi et al., 2022). Extending the domain to the food industry, we had the opportunity to investigate how the level of contact between the organic waste bioplastic and consumers' bodies can interact with the amount of perceived disgust and its impact on consumers' willingness to adopt circular alternatives. This was possible through the comparison between study 1 and study 2 results, providing researchers interested in this topic with a comprehensive picture of how consumers react when evaluating low versus high levels of contact with the organic waste bioplastic.

Third, the present research investigated the drivers of some key consumer outcomes of the circular economy, i.e., the perceived value of circular products and the willingness to adopt circular alternatives. In doing so, it integrated previous research findings to identify psychological drivers that can be beneficial and detrimental to such consumer outcomes (Testa et al., 2022). Specifically, the present study shed light on the role of emotions in fostering (hampering) consumer adoption of circular product alternatives (Shimul and Cheah, 2022). Particularly, the finding that feelings of disgust can put consumers' value perceptions at stake within circular settings highlights the need to consider rational and emotional factors when designing and marketing circular packaging. This finding complements evidence from prior research on the perceived value of circular products and provides new insights into the interplay between emotions and circular products (Confente et al., 2020; Russo et al., 2019). Contrary to previous research (e.g., Meng and Leary, 2021), the present research found that disgust plays a crucial role in adopting circular packaging regardless of the products' physical contact with the consumers' bodies.

Furthermore, by applying insights from the theory of cognitive dissonance, the research highlighted that a sense of guilt might partially mitigate feelings of disgust but not significantly. In the context of consumer decision-making, cognitive dissonance can arise when consumers

face choices that challenge their existing beliefs or values (i.e., feelings of guilt and perceived disgust). The present research provided an operationalization of the potential ambivalence that will likely arise when consumers assess alternative solutions to traditional, non-sustainable products (e.g., Aydin and Mansour, 2023). Particularly, the present study suggests that, in circular settings, such ambivalence may refer to the mixed or conflicting feelings that consumers may experience when considering such alternatives. On the one hand, consumers may recognize the environmental benefits of circular packaging, where waste materials are recycled or repurposed into new products, aligning with the idea that "waste is a resource." This perception may generate positive attitudes toward circular alternatives and an initial intention to choose circular products. However, on the other hand, consumers may also have reservations or negative emotions about circular packaging. In other words, when considering circular packaging, guilt may not be as determinant in driving consumer behavior as in other pro-environmental/green settings (e.g., travel behavior; Bahja and Hancer, 2021).

6.2. Managerial implications

Insights from this research can drive the evolution of circular economy models and provide actionable managerial and practical guidance along five main directions. First, regarding consumer role and education, our results suggest that consumers should be viewed not merely as end users but as essential partners in the circular economy. Their involvement goes beyond willingness to pay, impacting the recovery, reuse, and recycling of materials central to the circular supply chain. However, the study reveals that consumers' evaluations of circular alternatives, particularly those made from organic waste, may be influenced by feelings of disgust. To address this, managers should focus on educating consumers about the benefits of circular packaging. For example, Sainsbury's faced criticism in 2023 for its new vacuum-packed minced beef packaging, which some customers found unpleasant (Butler, 2023). This underscores the importance of moving beyond general sustainability claims. Clear, step-by-step explanations of circular packaging's technical and ecological benefits, including detailed material composition, performance advantages, and disposal methods, can help shift consumer perceptions. Effective communication strategies will be crucial in addressing and mitigating negative reactions to circular packaging.

Second, our research provides insights into addressing the negative consumer response to circular products. These negative reactions highlight the need for targeted marketing strategies. Companies must provide specific information about how circular packaging differs from traditional options. For instance, Emmi's partnership with Tetra Pak to redesign packaging circularly demonstrates how detailed communication about materials and processes can enhance consumer acceptance (Tetra Pak, 2023). Additionally, UEFA's initiative to use circular packaging during events, in collaboration with partners like PepsiCo and Heineken, illustrates the potential for strategic partnerships to boost the acceptance of circular alternatives (UEFA, 2023). Businesses should leverage these examples to create transparent, informative marketing campaigns that clearly outline the benefits and safety of circular packaging.

Third, our findings suggest practitioners must enhance consumer awareness and differentiate their circular products from other sustainable options to counteract negative perceptions and consumer confusion. This involves improving production and supply chain transparency and providing clear information about why specific materials are used, their performance, and disposal guidelines. Developing marketing strategies that emphasize the unique aspects of circular packaging and address common misconceptions will be crucial for boosting consumer acceptance. Providing clear, accessible information about the benefits and disposal of circular products can help consumers make informed choices and increase the likelihood of adoption.

Fourth, our findings show practitioners that designing packaging with circularity in mind is essential for effective closed-loop supply chains. Packaging should be designed to be easily disassembled, recycled, or repurposed. Ensuring compatibility with existing recycling infrastructure is critical for the success of circular packaging solutions. Companies should utilize life cycle assessment tools to evaluate the environmental impact of their packaging throughout its lifecycle and identify areas for improvement. For example, Baird et al. (2022) highlights the importance of enhancing reverse logistics infrastructure to reclaim and reintegrate materials into the supply chain. Collaborating with municipalities and recycling organizations to ensure sufficient collection and processing capabilities for circular materials is also necessary.

Finally, policymakers are instrumental in advancing transitions to a circular economy. Our results highlight the need to develop clear regulatory frameworks, technical standards, and incentives to promote circular packaging. In this vein, the upcoming EU Packaging and Packaging Waste Regulation aims to advance circular packaging initiatives by enforcing stricter standards and encouraging innovation (Krahl, 2024). Policymakers should also focus on understanding consumer behavior and addressing psychological drivers that impact adoption. For example, campaigns that raise awareness and counteract negative emotions, such as disgust, through education about the safety and quality of circular materials can be effective. Additionally, implementing key performance indicators (KPIs) to track circularity metrics, such as material recovery rates and carbon footprint reductions, will help measure the success of circular packaging solutions.

Our findings show that businesses should prioritize consumer education, address negative perceptions, enhance transparency, and design packaging with circularity in mind. Policymakers must develop supportive regulations and track progress through measurable outcomes. By integrating these strategies, companies can improve consumer acceptance of circular packaging and contribute to a more sustainable, closed-loop supply chain.

7. Limitations and future research

The following identifies some limitations of the research. First, although the packaging examined in Studies 1 and 2 differed in their level of physical contact with consumers' bodies, the packaging was that of low-involvement products. In this sense, additional research may examine the role of diverse psychological connections between consumers and products (e.g., involvement, self-congruity; Confente et al., 2020) in shaping consumers' acceptance of circular packaging.

This research utilized cognitive dissonance theory to explore the gap

between consumer interest in sustainable alternatives and their adoption. This framework helped identify key variables affecting the adoption of circular products. However, this approach may limit the generalizability of the findings. Future research should consider alternative models within cognitive dissonance theory and explore other theoretical perspectives to understand better why some sustainable solutions succeed or fail and how they impact consumer engagement with circular products and packaging.

Future research should examine how policymakers drive circular economy transitions by evaluating global standardization of circular packaging regulations. Studying the impact of different regulatory frameworks on adoption across various cultural and economic contexts will help design effective policies that reflect local consumer behaviors and economic conditions.

Finally, in line with extant literature on consumers' reactions, this study relied on self-reported data, which the literature deems appropriate for exploring subjective perceptions such as disgust. Nonetheless, we welcome future research triangulating these insights with behavioral methods to provide a more comprehensive understanding of consumer reactions.

CRediT authorship contribution statement

Francesco Raggiotto: Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Ilenia Confente:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Daniele Scarpi:** Writing – review & editing, Writing – original draft. **Ivan Russo:** Writing – review & editing, Writing – original draft.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Ivan Russo reports financial support was provided by European Commission. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

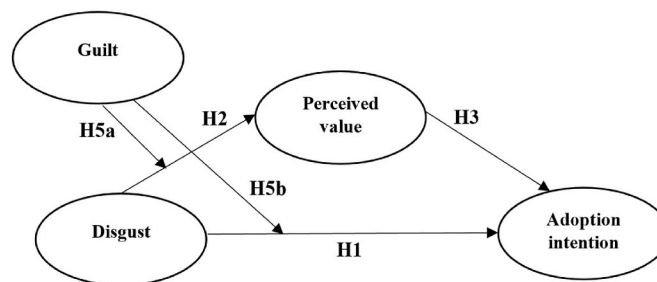


Fig. 1. The conceptual model.

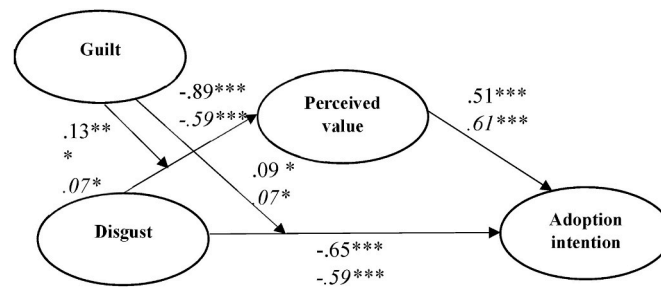


Fig. 2. The model with estimates.

Italics: Study 2

Table A.1
Model estimates

| | Hyp. | Group | Coeff | se | t | p | LLCI | ULCI |
|---|------|--------------|-------|------|-------|------|-------|------|
| Disgust on perceived value | H2 | Low contact | -.89 | .16 | -5.67 | .000 | -1.20 | -.58 |
| | | High contact | -.59 | .17 | -3.45 | .000 | -.93 | -.25 |
| Perceived value on adoption intention | H3 | Low contact | .51 | .084 | 6.11 | .000 | .35 | .68 |
| | | High contact | .61 | .06 | 9.12 | .000 | .47 | .73 |
| Moderation of guilt for the disgust - perceived value relationship | H5a | Low contact | .13 | .03 | 4.79 | .000 | .077 | .18 |
| | | High contact | .07 | .03 | 2.40 | .02 | .01 | .12 |
| Moderation of guilt for the disgust - adoption intention relationship | H5b | Low contact | .09 | .030 | 2.87 | .004 | .02 | .14 |
| | | High contact | .07 | .024 | 3.05 | .003 | .03 | .12 |
| Direct effect of disgust on adoption intention | H1 | Low contact | -.65 | .18 | -3.63 | .004 | .03 | .15 |
| | | High contact | -.59 | .14 | -4.14 | .000 | -.88 | -.31 |
| Indirect effect of disgust on adoption through perceived value | H4 | Low contact | -.14 | .05 | | | -.24 | -.05 |
| | | High contact | -.24 | .05 | | | -.34 | -.13 |

Note. Coeff = coefficient; SE = standard error; LLCI = lower-limit confidence interval; ULCI = upper-limit confidence interval.

Table A.2

| Measures | Loadings | | CR | | AVE | | Chronbach alfa | |
|---|----------|-----|-----|-----|-----|-----|----------------|-----|
| | S1 | S2 | S1 | S2 | S1 | S2 | S1 | S2 |
| Disgust (adapted from White et al., 2016) | | | .91 | .94 | .78 | .85 | .84 | .91 |
| Compared to traditional packaging, I expect that PHA packaging is: | | | | | | | | |
| Not at all dirty/dirty | .92 | .93 | | | | | | |
| Not at all unsanitary/very unsanitary | .82 | .91 | | | | | | |
| Not at all contaminated/contaminated | .89 | .92 | | | | | | |
| Perceived value (adapted from Lin and Huang, 2012) | | | .91 | .94 | .55 | .65 | .89 | .92 |
| This packaging appears to have consistent quality | .61 | .80 | | | | | | |
| This packaging seems to be well made | .76 | .82 | | | | | | |
| This packaging appears to have an acceptable standard of quality | .80 | .85 | | | | | | |
| This packaging would perform consistently | .79 | .86 | | | | | | |
| Adopting this packaging would help me to feel more accepted in my community | .71 | .73 | | | | | | |
| Adopting this packaging would improve the way that I am perceived by others | .78 | .75 | | | | | | |
| Adopting this packaging this chair would make a good impression on other people | .77 | .73 | | | | | | |
| Adopting this packaging instead of a conventional one would feel like making a good personal contribution to something better | .72 | .83 | | | | | | |
| Adopting this packaging instead of a conventional one would feel like the morally right thing | .72 | .85 | | | | | | |
| Adoption intention (adapted from Yoo and Donthu, 2001) | | | .98 | .98 | .96 | .96 | .95 | .96 |
| I am willing to adopt this type of packaging | .97 | .98 | | | | | | |
| I am likely to use this type of packaging | .98 | .98 | | | | | | |
| Guilt (adapted from Dahl et al., 2005) | | | .97 | .96 | .96 | .92 | .95 | .84 |
| I have a bad conscience toward the environment when I frequently use plastic packaging | .97 | .96 | | | | | | |
| I am feeling guilty for using plastic packaging | .97 | .96 | | | | | | |

S1: Fit: $\chi^2/df = 1.95$; RMSEA = 0.07; $p(\text{RMSEA} < 0.05) < 0.001$; CFI = 0.96.

S2: Fit: $\chi^2/df = 2.1$; RMSEA = 0.07; $p(\text{RMSEA} < 0.05) < 0.001$; CFI = 0.97.

Scenario for Study 1

In the following, you will see a shopping bag made with organic bio-based plastic.

This shopping bag and its characteristics will be the object of the questionnaire.

Organic bio-based products are derived from organic waste. That is, solid food waste (i.e., from households, restaurants, caterers, retail premises,

etc.) is cleaned and transformed into raw bioplastic material.

All kinds of food waste are used in this process, including meat, dairy, and other foods that are not vegan, kosher, or halal friendly.

Bio-based products are made using approximately 50–75 % of recaptured material (i.e., from solid food waste). It takes 25 tons of organic food waste to make 1 ton of bioplastic. Compared to traditional products, bio-based products can save up to 30–50% of CO₂ emissions to make, which significantly reduces negative influences on the environment.



This retail shopping bag is made with organic bio-based plastic a new organic plastic material to create an item of bag with die cut handles that are good quality for daily use. Those bags reduce landfill volume and greenhouse gas effects. Made with organic bio-based plastic, those bags disintegrate at a substantially faster rate than regular plastic bags.

Scenario for Study 2

In the following, you will see packaging for crackers made with organic bio-based plastic. This packaging and its characteristics will be the object of the questionnaire.



This packaging for crackers is made with organic bio-based plastic. This packaging reduces landfill volume and greenhouse gas effects. Made with organic bio-based plastic, this packaging disintegrates at a substantially faster rate than regular plastic bags.

Data availability

The data that has been used is confidential.

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