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Cakes in plastic: a study of implicit associations of compostable bio-based versus plastic food packaging

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Cakes in plastic: a study of implicit associations of compostable bio-based *versus* plastic food packaging

Abstract

This paper explores disjuncture between consumers' expressed preference for ecologically benign packaging and subsequent purchase decisions. We investigate consumers' attitudes towards single-use plastic food packaging, in contrast to compostable bio-based packaging, framing our study within analysis of implicit attitudes. Specifically, across four implicit associations tests (IATs) we analyse the relationship between implicit and explicit attitudes, relating packaging associations with consumers' behavioural intentions. Gaps in the literature led us to particularly investigate the moderating role of consumers' self-reported health consciousness in explaining an apparent attitude-behaviour gap. Overall, findings confirm positive implicit and explicit perceptions of compostable packaging (vs. single-use plastic) regardless of the healthiness of the food contained. This is reflected in consumers' purchase intentions. We build on this to provide new insights into linkages between plastic packaging and health awareness by finding that consumers' self-reported health consciousness moderates this relationship - low health-conscious consumers are more guided by their unconscious attitudes and automatic health-packaging associations when indicating their intentions toward buying food in compostable packaging. We have contributed to policy discussion about effective ways of reducing single-use plastic packaging and note that health claims for non-plastic alternatives aimed at consumers with low-health consciousness should make appeals aimed at evoking unconscious responses, thereby tapping into implicit attitudes.

Keywords: implicit associations, IAT, food packaging, healthiness, health consciousness, single-use plastic, bio-plastics, compostable, bio-based

Highlights

- – add one point on implicit preferences from resultsThis study investigates implicit and explicit attitudes towards compostable packaging
- Compostable food packaging was explicitly perceived as more positive and healthy than conventional plastic food packaging
- replace with another finding
- Consumers' health consciousness moderates the relation between implicit and explicit attitudes and purchase intentions

Cakes in plastic: a study of implicit associations of compostable bio-based *versus* plastic food packaging

1. Introduction

There is now a consensus that the manufacture and disposal of plastics can be associated with ecological harm. Packaging is estimated to account for about 40 percent of plastic use (Plastics Europe, 2021). Because of its short period of use relative to durability as potentially harmful waste, policy priorities for reducing plastic use have focused on packaging, especially single-use plastic packaging. In the UK alone, it is estimated that the per capita use of plastic packaging is 34.21 kgs per annum (Statistica, 2021).

Policy aims to reduce plastic packaging waste have been pursued through several initiatives. One route to change has been through regulatory controls on producers of packaging materials – for example, in the UK, the Producer Responsibility Obligations (Packaging Waste) Regulations 2007 set requirements on packaging materials, including provisions for recycling. An alternative approach, which we focus on in this paper, is through demand-side manipulations, to encourage consumers' preference for products which use more environmentally benign packaging materials. (Eurostat, 2020). We further focus on food packaging, which is commonly made of single-use plastics. Although these are increasingly recycled, some types of plastics and in some areas are not recycled, leading to long-term problems associated with planned disposal of plastic waste, and further problems where plastic waste accidentally escapes into natural eco-systems (Borrelle et al., 2020).

Attempts to change consumers' attitudes to plastic packaging waste takes various forms. One broad framework, sometimes referred to as "nudge" is conceptualised as a "choice architecture" comprising all the outside forces that may subtly guide an individual's behavioural decisions (Thaler and Sunstein, 2008). This process typically works through changing an individual's attitude to an object, through passive or active learning processes (Fazio, 2007; Wegener et al., 2018) such that the attitude becomes congruent with external cues presented within this choice architecture. This is seen as more effective than supply side regulation as a means of implementing government policy (Arno and Thomas, 2016). It is attitude change that we focus on in this study. However, although several studies have sought to assess the outcomes of attitude change programmes, for example in respect of attitudes to tobacco use, diet and physical exercise (Marteau et al., 2011; Reynolds et al., 2019; Van Gestel et al., 2018),

evidence about their effectiveness in changing behaviour remains ambiguous. One cause of ambiguity may be disparity between an individual's stated attitude to an object and their subsequent behaviour in relation to it.

Although people often report positive attitudes towards sustainable products and behaviours (Prothero et al., 2011), behavioural responses to these goods in the marketplace are not uniformly positive (e.g., Haws et al., 2014; Luchs et al., 2010), and it can be difficult to encourage individuals to consistently act in a sustainable manner (Steg and Vlek, 2009). In this regard, scholars have called for deeper understanding of the relationship between attitude and behaviour (Bray et al., 2011; Carrington et al., 2010; Kristensson et al., 2017). One possible cause of disjuncture between attitudes and behaviour may be that attitude is typically measured as an explicitly stated, socially conditioned construct, rather than an implicitly held attitude. In other words, people might explicitly state what they believe to be socially acceptable attitudes in response to a question, but these responses might not reflect their underlying attitudes (Dirzyte and Rakauskiene, 2016).

In this paper we pursue investigation of disjuncture between attitudes which are expressed and those which are deeply held but may nevertheless influence behaviour towards packaging choices. We compare conventional single-use plastic packaging, with more recent innovations in bio-based and bio-degradable packaging. While plastic packaging is typically associated with a range of functional benefits, such as safety, durability and protection, these may be augmented or contradicted by attributes which arise through associations. These associations may arise through the "choice architecture", including the context of use and the nature of the contents being linked to the packaging materials.

We contribute to debate about the best way for firms and government agencies to change consumers' behaviours in their choice of packaging materials. For example, although firms may emphasise ecological benefits in their promotion of non-plastic food packaging, a closer study of implicit attitudes may reveal that consumers hold stronger associations with health benefits. Publicly, an individual may express a socially conditioned attitude which focuses on ecological benefits. However, their deeper attitudes which may to concerns about the health effects of plastic packaging. While these may not be expressed explicitly, they may nevertheless be important evaluatory criteria when choosing food with different types of packaging. In order to elicit a purchase decision, firms' messaging may appeal to implicitly held attitudes relating to health, rather than explicitly expressed attitudes relating to ecological issues.

The plan of this paper is as follows. First, we review the literature on plastic packaging waste to give an indication of the nature and magnitude of the "problem" that we address. We then review literature on attitudes relevant to understanding associations between packaging composition and the food contained in the packaging. From this review of literature, we identify gaps in knowledge from which we specify refined research objectives. This informs our methodology, which comprises 4 linked studies which pursue questions identified in the literature review and we adapt our later studies to learnings from our preceding studies. We analyse the results of each study and synthesise these in a discussion of their generalisability and implications for behaviour change in the use of plastic food packaging.

2. Background

2.1 The "problem" of single-use plastic food packaging

Fossil-based plastics, including packaging, are increasingly recognised as depleting natural resources, being ecologically harmful in their production and causing ecological harm in their disposal, taking up to 1,000 years for conventional plastics to decompose (Statista, 2021; Sumrin et al., 2021). Global plastics production worldwide amounted to 368 million tonnes in 2019, with packaging accounting for 39.6% of total plastic usage (PlasticsEurope, 2021). In 2018, 1.53 million tonnes of new plastic packaging was placed in the market - mostly single-use (Ellen Macarthur Foundation, 2017)- for consumption by UK households (Statista, 2021). The subsequent amount of plastic packaging waste generated in the UK is around 34.21 kilograms per capita (Statista, 2021).

Encouraging consumers' adoption of ecologically friendly packaging is a growing topic of interest in the academic literature (e.g., Friedrich, 2020; Karmarkar and Bollinger, 2015; Rhein and Schmid, 2020; Wang, 2013) reflecting growing public concerns about ecological harm caused by waste plastic (Dilkes-Hoffman, Pratt, et al., 2019; Statista, 2021). Within this literature, there is emerging evidence of growing segments of consumers increasingly demanding packaging in a form which can be recycled or reused (Magnier and Schoormans, 2015), and it is suggested that significant segments of consumers expect all packaging to be environmentally friendly (Olsen et al., 2014).

Alternatives to fossil-based plastic packaging have become available and can significantly reduce ecological harm, in that these are typically made out of recycled cardboard or plant-based materials (e.g., corn starch or recycled sugarcane). For instance, bio-based and biodegradable packaging is usually made from renewable resources, has similar durability as fossil-based plastics, is safe, less toxic than petroleum-based materials and can reduce the amount of packaging waste sent to landfill (Herbes et al., 2018; van den Oever et al., 2017). An example in this regard is bio-based plastics (e.g., PLA - polylactic acid), which are increasingly used in the food packaging industry (Sundqvist-Andberg and Åkerman, 2021). Most of bioplastics are produced from renewable biomass sources (i.e., derived from plants or microorganisms), thus representing an environmentally alternative to fossil-based plastics, due to the renewable origin and potential biodegradability (Álvarez-Chávez et al., 2012). However, some critiques have been raised since the cultivation of agricultural biomass can cause negative environmental impacts, including conflicts with food production and fresh water use, thus not yet ideally aligned with the UN's sustain-able development goals (SDGs) (Karan et al., 2019; Rujnić-Sokele and Pilipović, 2017).

In this study we focus on compostable bio-based packaging, which we define as packaging made from bio-derived materials such as corn-starch, recycled sugarcane, cellulose, chitosan, proteins and polymers produced from bio-based monomers which naturally break down when micro-organisms act on the materials (Sijtsema et al., 2016). Following the European Standard EU 13432 "Requirements for packaging recoverable through composting and biodegradation – Test scheme and evaluation criteria for the final acceptance of packaging", in order to be considered compostable, a material can be recycled through organic recovery (composting and anaerobic digestion). This applies also to plastic packaging. According to this standard, compostability comprises more than just biodegradability: a product that is compostable is always biodegradable, while a product that is biodegradable is not per se compostable. Whilst the market for ecological packaging materials is growing, consumers' knowledge of compostable materials is relatively poor, especially regarding their disposal methods (Dilkes-Hoffman, Ashworth, et al., 2019; Meeks et al., 2015; Otto et al., 2021; Taufik et al., 2020). As highlighted by Taufik *et al.* (2020), different reasons might explain this phenomenon. First, regarding how correctly dispose compostable packaging, consumers seem more familiar with recyclable packaging, even when non-biodegradable, than with compostable one. It follows that consumers dispose compostable bio-based packages more often incorrectly than recyclable (bio-based and fossil-based) packages. Second, a crucial role is played by symbols and logos on packaging, in that it has been shown that consumers are more familiar with the recycling symbol on packaging, but less with the compostability symbol (Boesen et al., 2019). Finally,

very often consumers seem not being able to distinguish between bio-based and fossil-based plastic packages when they are both recyclable, with the former not being erroneously perceived to have additional environmental benefits relative to fossil-based packages (van den Oever et al., 2017).

Attempts to shift attitudes and behaviour on food packaging must recognize the multiple purposes of packaging. Food packaging not only protects the contents for transportation and storage, but the way food is presented and packaged also shapes consumers' perceptions and expectations about the product, such as taste, healthiness and sustainability (Ares and Deliza, 2010; Carrillo et al., 2012). However, despite this increasing attention, there is limited research specifically on consumers' preferences toward eco-friendly packaging and associations with its contents. Prior studies have mainly focused on its communicative characteristics (e.g., labelling, functionality, colour, size), as determinants of consumers' intention to buy (Orth and Malkewitz, 2008). There is some evidence that packaging made from ecologically-friendly material is perceived as more natural, which in turn signals associations with higher quality (Magnier et al., 2016), while plastic food packaging which is chemical-based is viewed as less natural and less healthy. However, research on consumer perceptions of compostable bio-based food packaging as an alternative to fossil-based plastic food packaging is scarce (Herbes et al., 2018, 2020; Zwicker et al., 2021).

We further pursue evidence that some forms of packaging are perceived as more natural than others by investigating transfer of effects between the packaging and its contents and in the following section we review this possibility within a theoretical framework of attitude development.

2.2 Attitudes and behaviour

Marketers have traditionally measured attitudes by reference to respondents' verbalised expressions, allowing for recorded results to be influenced by perceived social norm, among other things. It may therefore be unsurprising that stated intention often does not correlate with subsequent behaviour and this may help to explain disjuncture between expressed preference for ecologically friendly packaging, and actual choice. The purchase of packaged food typically involves complex processes of evaluating the substantive food contents and the aesthetics and messaging of its packaging (Popovic et al., 2019). A number of frameworks have been used to distinguish between those elements of the choice process which involve habits and routines versus conscious deliberation (Dual Process theory of System 1 v System 2); or between choice elements which are vocalized and those which remain latent (implicit versus explicit attitudes) (e.g., Conner et al., 2007; Richetin et al., 2007).

Attitudes can exist outside of conscious awareness and control (Greenwald and Banaji, 1995), and are able to shape an individual's automatic reactions to attitude objects and consequently their interactions with them. The concept of implicit attitudes emerged to capture individuals' automatically activated evaluations of an object in an indirect and associative manner (Greenwald et al., 2009).. Importantly, measures of implicit attitudes tap into evaluative associations without requiring subjects to consciously introspect on their feelings (Nosek et al., 2007). Because they are free of conscious reasoning, they are less likely to be influenced by external social influences and desire to conform to peer group norms. Implicit attitudes are therefore considered in some contexts to be a better predictor of behaviour than explicitly expressed attitudes which are the outcome of a process of deliberate and socially considered reasoning (Govind et al., 2019). Measures of implicit attitudes have been used in a variety of studies in the domains of social sciences and psychology, e.g. studies of race, self-esteem, stereo-types such as gender (Petty et al., 2009)

We believe the use of implicit measures of attitude is particularly useful in our study because of its associative abilities. Consumers frequently use food packaging attributes as heuristics/cognitive shortcuts in their evaluation processes (Marozzo et al., 2019), assessing food packaging by affective feelings rather than cognitive reasoning based on scientific facts (Otto et al., 2021), and use salient cues which might be unrelated to objective environmental impacts (Steenis et al., 2017). We seek to extend knowledge by exploring explicit and implicit associations with plastic and compostable food packaging and the relationships between packaging and food contents.

2.3 Associations between packaging and its contents

Several scholars have investigated the effects of sustainable packaging on consumers' perceptions and evaluations of the contained products (e.g., Ketelsen et al., 2020; Koenig-Lewis et al., 2014; Magnier and Crié, 2015; Magnier and Schoormans, 2015; Magnier et al., 2016; Rees et al., 2019; Seo et al., 2016; Steenis et al., 2017). Steenis et. al. (2017) noted a "spill-over" effect of packaging impressions to the contained products. In the same vein, a consistent stream of consumer research highlights that the usage of more sustainable packaging positively influences consumers' attitudes (Martinho et al., 2015; Prakash and Pathak, 2017; Rees et al., 2019; Rokka and Uusitalo, 2008; van Birgelen et al., 2008) and likelihood of purchase and willingness to pay (Hao et al., 2019; Magnier and Schoormans, 2015; Tseng et al., 2020).

Building on cue utilisation theory (Olson, 1978; Olson and Jacoby, 1972), packaging attracts consumers' attention and leads them to form perceptions of various food products (Donato et

al., 2021; Tijssen et al., 2017; Wang, 2013). Judgments of product perceived quality, healthiness, naturalness, and sustainability could be based on a wide range of packaging cues classified as structural (e.g., size and material of the packaging); informational (e.g., text and numbers); visual (e.g., colour and shape); or sensory (e.g., smell and texture). It follows that the use of sustainable packaging plays a key role in consumers' perceptions of food, allowing consumers to draw inferences about the product or its attributes using both intrinsic (e.g., material) and extrinsic (e.g., eco-label) attributes (Herbes et al., 2020). For instance, it has been shown that product quality perception increases when it is protected by a sustainable package (Lee et al., 2013; Magnier et al., 2016). Similarly, consumers seem more willing to trade off many product attributes, except for taste and price, in favour of ecologically friendly packaging (van Birgelen et al., 2008). Other studies have focused on the effect of the transparency of packaging material - namely, the visibility of the contents to the consumer - on product perception and purchase intention (Chandran et al., 2009; Simmonds et al., 2018; Vilnai-Yavetz and Koren, 2013), while others have shown that packaging colours have effects on consumers' perceptions of a product's authenticity and quality, and on consumers' willingness to pay (Mai et al., 2016; Marozzo et al., 2019; Seo et al., 2016). Labels and logos (e.g., eco-labels) have also been identified to affect choice (Magnier and Crié, 2015; Magnier and Schoormans, 2015; Meis-Harris et al., 2021; Rettie and Brewer, 2000; Van Dam and De Jonge, 2015).

Although a limited number of previous studies have investigated health associations of ecologically friendly packaging, these have tended not to probe underlying attitudes, nor to investigate possible differences between consumers in the effects of health associations. We address this gap in our study.

2.4 Health consciousness and packaging

Health consciousness assesses the degree to which a person takes an active role in sustaining their health (Gould, 1988). Scholars claim that highly health-conscious consumers are more sensitive to health-related information (e.g., the naturalness, nutrition, and freshness of a product) placing greater emphasis on health-related attributes and being sensitive to cues indicating health benefits (Mai and Hoffmann, 2012, 2015; Naylor et al., 2009).

Consumers increasingly understand the health consequences of their food choices paying more attention to the potential health benefits of food (Silchenko et al., 2020). Previous research demonstrated that health consciousness influences food attitudes and purchase intentions (Buhrau and Ozturk, 2018; Mai and Hoffmann, 2015; Tarkiainen and Sundqvist, 2005). Similarly, it has been suggested that consumers buy environmentally friendly products not only because of

their environmental concern but also because of concern for their own health (Padel and Foster, 2005; Wandel and Bugge, 1997). Therefore, consumers' health consciousness influences their attitudes toward green products (Goetzke et al., 2014; Prakash et al., 2019), with highly health-conscious consumers being more prone to exhibit eco-friendly behaviour than others (Rana and Paul, 2020; Zanoli and Naspetti, 2002).

While most prior works have focused on the role of packaging informational cues (e.g., labels) in conveying healthfulness and in affecting consumer health-related behaviours (e.g., Mauri et al., 2021), less attention has been devoted to the role of packaging material. However, a sustainable packaging (e.g., a compostable pack) is commonly used to suggest healthiness when selling food products, thus strengthening the implicit association between sustainable packaging and healthy foods (Donato et al., 2021). Moreover, a sustainable package is expected to be beneficial, safe and healthy for individuals and communities throughout its life cycle (Sustainable Packaging Coalition, 2011). Accordingly, consumers tend to positively perceive sustainable packaging, in that it is seen as being "homely", "nice" and giving a "feeling of healthiness" (Fernqvist et al., 2015).

Based on the above, we propose that compostable bio-based packaging is perceived as healthier compared to fossil-based plastic, as consumers may implicitly associate packaging sustainability with perceived healthiness. Due to the halo effect, consumers might also be prone to infer that products with compostable bio-based packages are healthier (Steenis et al., 2017; van Rompay et al., 2016). Prior works have extensively used the halo effect to explain perceptual biases consumers might have because of a salient signal or external cue (e.g., packaging sustainability, labels; Bui et al., 2017; Donato et al., 2021). Specifically, the presence of an external cue leads consumers to form favourable overall evaluations, which in turn guide inferences about unknown or missing attributes (e.g., Chandon and Wansink, 2007; Sundar and Kardes, 2015). Accordingly, we propose that a compostable bio-based package will lead consumers to perceive them as healthier compared to the fossil-based counterpart.

2.5 Summary of knowledge gap and research aims

The literature review presented several knowledge gaps, which we aim to fill. By exploring consumers' attitudes towards bio-based and bio-degradable food packaging in contrast to single-use plastic food packaging, we respond to calls for further empirical research to understand attitudes towards specific packaging solutions (rather than environmentally friendly packaging in general) (Ketelsen et al., 2020).

Previous studies have investigated the effectiveness of food packaging in conveying product messages (Ares and Deliza, 2010; Carrillo et al., 2012); consumers' positive attitudes towards sustainable packaging (Martinho et al., 2015; Prakash and Pathak, 2017; Rees et al., 2019; Rokka and Uusitalo, 2008; van Birgelen et al., 2008); and preference in purchase intention and willingness to pay a higher price (Magnier and Schoormans, 2015; Pancer et al., 2017). However, there is less evidence of the *mechanisms* by which favourable attitude and preference arises, and especially explanations of an apparent gap between expressed attitudes and subsequent behaviour. Based on this, we investigate this apparent disjuncture through the lens of *implicit* attitudes. By understanding these deeper and more enduring attitudes, we may be in a better position to understand what forms of nudge will be most effective in changing attitudes and behaviour regarding purchase of food with single-use plastic packaging.

A simple appeal based on ecological harm may not be as powerful a nudge to reduce use of single-use plastic packaging as appeals based on implicit attitudes relating to health. Although perceptions of product quality have been shown to be associated with sustainable packaging (Lee et al., 2013; Magnier et al., 2016), associations between sustainable packaging and health benefits are less clear. While previous studies have investigated the effects of packaging cues on consumers' perceptions of the healthiness of food (Gomez et al., 2015), this has largely focused on the messaging and imagery created by packaging, rather than the composition of the packaging.

Based on gaps in knowledge, our research aims can be summarised as:

1. What are the links between packaging composition and associations with healthiness?
2. Are the effects of implicit association of health benefits with packaging greater for consumers with high reported health consciousness than low?

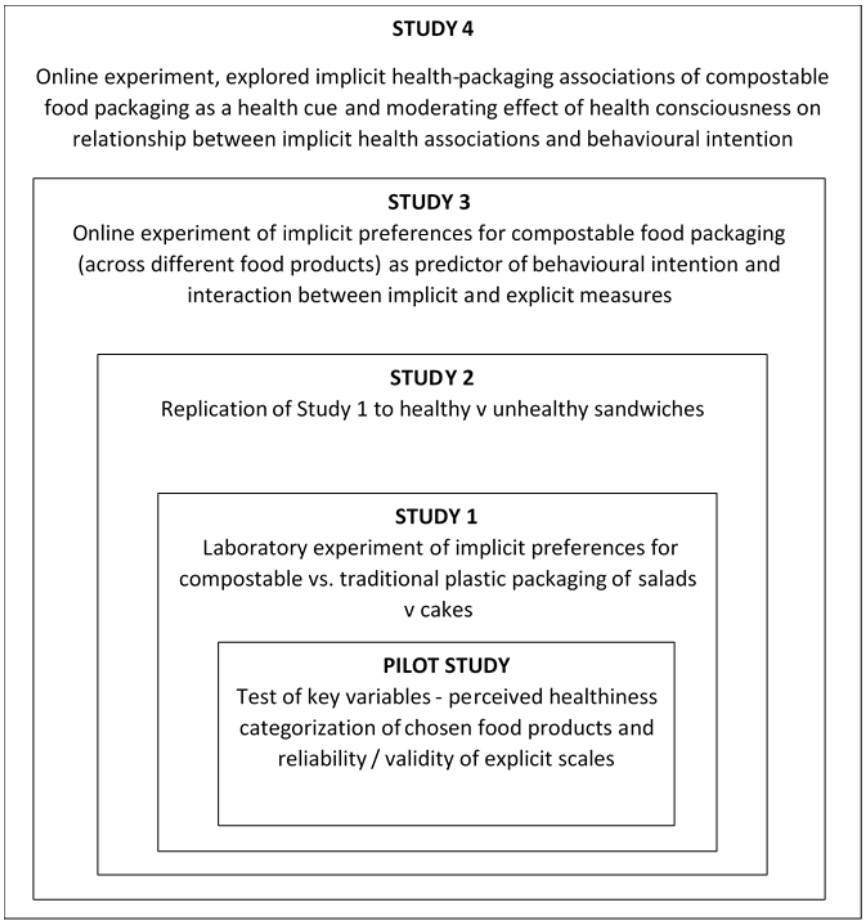
3. Overview of Studies

Four implicit association tests (IATs) were conducted to explore consumers' automatic associations with compostable food packaging (vs. traditional plastic packaging), and to further examine if these differ between healthy and unhealthy food products contained in the packaging. In a pilot study, we tested the perceived healthiness of our chosen food products to ensure that these adequately represent the two food categories. Studies 1 and 2 were computer-based self-administered laboratory experiments and explored if implicit preferences for compostable food packaging vs. traditional plastic food packaging differed between cakes/bakery products and salad, and between healthy and unhealthy sandwiches. Study 3 examined in an online experiment to what extent implicit preferences for compostable food

packaging (across different food products) can predict behavioural intention, and to what extent implicit and explicit measures interplay in the prediction of intended choice of compostable packaging. Finally, Study 4, an online experiment, explored the role of compostable food packaging as a subtle health cue (i.e., implicit health-packaging associations) and assesses to what extent the relationship between implicit health associations and behavioural intention is moderated by an individual's self-reported health consciousness.

All studies formed part of a larger research project, conducted in the UK and approved by the university's ethics committee. Respondents gave informed consent before participation and were debriefed after the session. Figure 1 shows the evolution of the study stages and the intended contribution of each stage.

Figure 1: Overview of Studies



4. Pilot Study

Studies 1 and 2 explored whether implicit associations towards compostable and traditional plastic food packaging differed between healthy and unhealthy food categories. To ensure that the food adequately represented healthy and unhealthy categories, an online pilot study (n=68, 59.4% female, main occupation: 40.4% students (full/part-time), 53.1% employment (full/part-time), 6.6% other (e.g. retired), age: 29.7% 18-21, 43.8% 25-34, 17.2% 35-44 and 9.4% over 45 years) was conducted to measure the perceived healthiness. Respondents rated different food products (3 to 4 per category, e.g., croissants, strawberry cupcakes, ready-to-eat salad, chicken salad, turkey salad sandwich on brown bread; beef, bacon, mayo sandwich) on a scale from 1 (very unhealthy) to 7 (very healthy). The order in which the items were presented was randomised to avoid an order effect. The results confirmed a significant difference between the two food categories with regard to their perceived healthiness (M_{salad}=4.80, SD_{salad}=.94, M_{bakery}=2.01, SD_{bakery}=.88, t(67)=16.53, $p \leq .000$; $M_{healthy_sandw}$=5.21, $SD_{healthy_sandw}$=1.23, $M_{unhealthy_sandw}$=2.44, $SD_{unhealthy_sandw}$=1.05, t(67)=16.65, $p \leq .000$).

We also asked participants to list three words which come spontaneously to their mind when thinking about plastic food packaging. These have been displayed in Figure 2 as a wordcloud. Participants mainly perceived plastic food packaging as wasteful, polluting, toxic, overused, harmful, bad and unhealthy, however, they also acknowledged that it can be recycled, is cheap and convenient.

Figure 2: Wordcloud of perceptions of plastic food packaging[1]

[1] Wordcloud created by authors with www.jasondavies.com/wordcloud/

5. Study 1

Study 1 explores implicit and explicit attitudes towards compostable versus plastic food packaging for cakes/bakery products and salad.

5.1 Procedure and Materials

Participants. Ninety-three participants were recruited through opportunity sampling to take part in a laboratory study of which 88 were deemed usable. The sample consisted of students and staff of a large UK university (67% female, age: 75% 18-21 years old, 14.8% 22-24 years old, 10.2% 25 years and over, main occupation: 92% full-time students). Participants received a small incentive (a £5 study-neutral monetary online voucher) and were recruited via posters/flyers distributed at the university, and by various means of online communication, e.g., posting of an invitation on the staff and student intranet noticeboard. For studies involving IAT, which is an intensive technique in terms of input from participants, 90 participants is considered a relatively high number in comparison to previously published studies (Gibson, 2008).

*Measures – Implicit Preferences***.** Implicit attitudes were measured using the Implicit Association Test (IAT, Greenwald et. al., 1998) using Direct RT software (Jarvis, 2004) which measured participants' reaction speed (an indicator of implicit attitudes). Participants completed two IAT tests for two different food categories contained in the packaging, i.e., cakes & bakery products (IAT 1) and ready-to-eat salads (IAT 2), corresponding respectively to unhealthy and healthy food. To ensure that participants had the same level of knowledge

about the two different packaging materials and were familiar with the labels used in the study, a short, balanced introduction was provided at the beginning of the study (see Appendix 1).

The IAT assesses how quickly participants categorise stimuli from four categories (two target categories: compostable food packaging and traditional plastic food packaging; two attribute categories: 'good' (e.g., excellent, pleasant, wonderful) and 'bad' (e.g., horrible, unpleasant, awful) (see Ackermann and Palmer, 2014). Participants are required to pair one target with one attribute by pressing one of two response keys. The target categories included labels to clearly distinguish and represent the packaging composition categories (see Appendix 1).

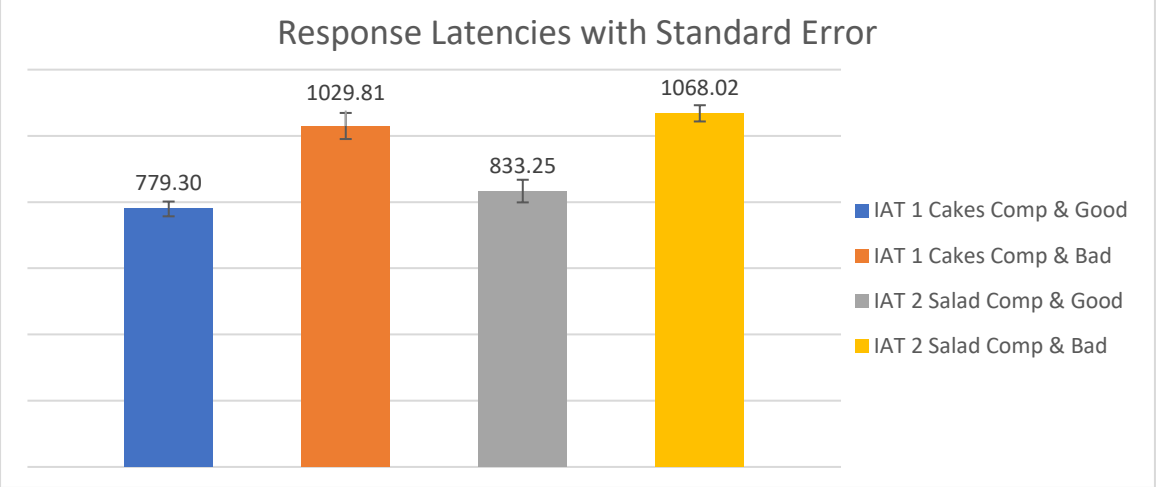
Each IAT included a total of five blocks with 140 trials in total, with the third and the fifth block being critical stages and of interest in the present study (see Appendix 2).[2] If the respondent completes the task more quickly when images of compostable food packaging and 'good' words share the same keyboard key than when traditional plastic packaging images and 'good' words share the same keyboard key, this reflects a difference between the implicit attitudes with respect to the compostable packaging versus the traditional plastic one. The participants then completed the second IAT which followed the same procedure, except that this time, they categorised images of ready-to-eat salad meals in compostable and traditional plastic food packaging. To avoid method artifacts, we randomized the order of both IATs as well as the order of the initial combined (i.e., compatible) and reversed combined (i.e., incompatible) discrimination tasks.

5.2 Results

Figure 3 shows that participants were significantly quicker when compostable food packaging was paired with 'good' words (M_{Cakes_good}=779.3ms, SD_{Cakes_good}=209.17ms, M_{Salad_good}=833.25ms, SD_{Salad_good}=229.58ms), than when paired with 'bad' words (M_{Cakes_bad}=1029.8ms, SD_{Cakes_bad}=369.75ms, M_{Salad_bad}=1068.0ms, SD_{Salad_bad}=320.66ms, $t(87)_{Cakes=}$-8.31, $p\leq.001$, $t(87)_{Salad}$=-8.50, $p\leq.001$), thus indicating to an associative strength between 'compostable food packaging' and 'good'.

[2] The first discrimination task comprised categorizing images from two target categories (compostable versus plastic packaging). Respondents were asked to distinguish as quickly and as accurately as possible when a picture was presented in the centre of the screen. They then had to respond by hitting either key E or key I, these keys corresponding to the category labels at the top of the screen. Key E always corresponded to the 'compostable packaging' and key I always corresponded to 'traditional plastic packaging'. All images were equal in size. In the second stage, respondents were asked to complete the same task, however, this time it involved distinguishing contrasted attribute categories, 'bad' and 'good' (key E corresponded to 'good' words; whilst key I corresponded to 'bad' words. In the third stage, the category labels from the previous two stages were combined. This meant that key E now corresponded to images of food in compostable packaging and 'good' words. Similarly key I corresponded to images of food in plastic packaging and 'bad' words. The fourth stage repeated the previous second stage, however, the category labels were changed and now appeared on opposite sides (key E corresponded to 'bad' words and key I corresponded to 'good' words). In stage five (i.e., 'reversed combined task), the category labels were combined. Key E corresponded to pictures of compostable packaging and 'bad' words. Similarly key I corresponded to pictures of traditional plastic packaging and 'good' words.

Figure 3: Mean response latencies in ms for each critical IAT block



To specify whether implicit attitudes towards compostable packaging differed between healthy and unhealthy food categories (cakes/bakery products vs. salad), two IAT D-scores have been calculated. Prior to computing this score, any trials with response times greater than 10,000ms have been deleted, in addition to removing subjects for whom more than 10% of the trials had latencies than 300ms (Greenwald et al., 2003). An IAT D-score can be interpreted similar to Cohen's *d* - measure of effect-size - (Cohen, 1988; Greenwald et al., 2003). Therefore, an implicit preference is said to be strong, medium or slight if the IAT D-score meets the conventional criteria for small (below .2), medium (between .2 and .5) and large (above .8) effect sizes.

Both IAT D-scores indicate a medium preference for compostable food packaging: cakes: $M_{d\text{-}score}$=.47, $SD_{d\text{-}score}$=.38, salad: $M_{d\text{-}score}$=.42, $SD_{d\text{-}score}$=.38. These values were both significantly different from zero: for the unhealthy food category ($t(87)_{cakes}$=11.59, $p\leq$.000) and the healthy food category ($t(87)_{salad}$=10.29, $p\leq$.000). There was no significant difference between the D-scores for the unhealthy and healthy food categories, i.e. cakes and salad ($t(87)$=1.27, $p\leq$.21) suggesting that participants held a positive implicit preference for compostable packaging in contrast to traditional plastic food packaging across the two different food categories.

6. Study 2

Study 2 assesses the implicit and explicit attitudes towards compostable versus plastic food packaging for unhealthy and healthy sandwiches.

6.1 Procedure and Materials

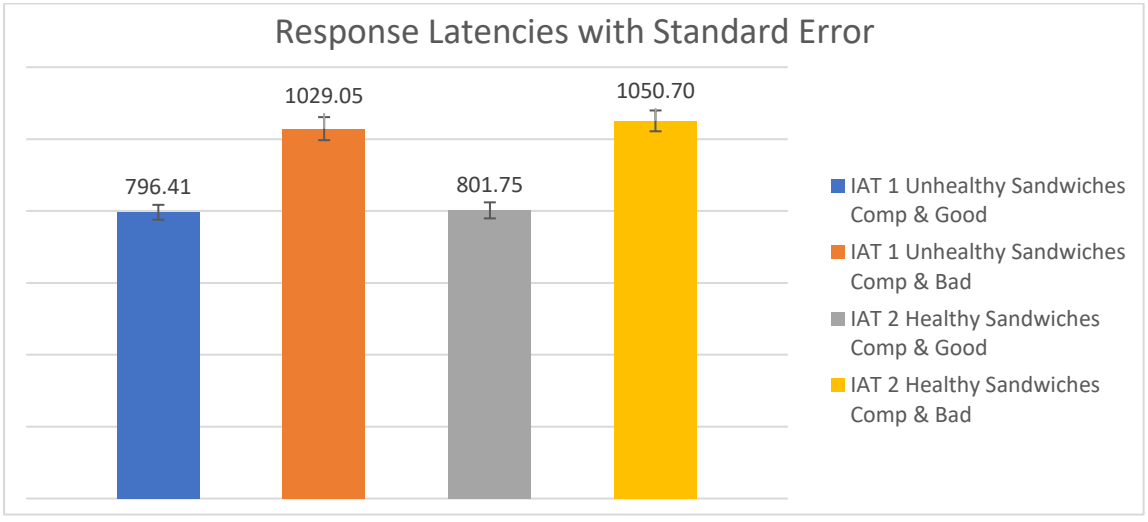
Participants. Ninety-one participants were recruited following the same procedure as for Study 1, and of these 90 were deemed usable. The sample consisted of university students and staff (64% female, age: 82% 18-21 years old, 9% 22-24 years old, 9% 25 years and over, main occupation: 94.4% full/part-time students).

Measures – Implicit Preferences. The same protocol and target attributes were used as for Study 1, but with different target stimuli. Participants completed two IAT tests; one for images of healthy sandwiches (IAT 1) and one for images of unhealthy sandwiches (IAT 2) in compostable and traditional plastic food packaging. To ensure that participants had information on the type of sandwiches in the packaging, a description has been provided under the image.

6.2 Results

As in Study 1, Figure 4 confirms that participants responded significantly faster when compostable food packaging was paired with 'good' words ($M_{UnhealthySandw}$=796.4ms, $SD_{UnhealthySandw}$=196.78ms, $M_{HealthySandw}$=801.75ms, $SD_{HealthySandw}$=211.76ms), than when paired with 'bad' words ($M_{UnhealthySandw}$=1029.7ms, $SD_{UnhealthySandw}$=304.40ms. $M_{HealthySandw}$=1050.70ms, $SD_{HealthySandw}$=275.03ms, $t(89)_{UnhealthySandw}$=-7.04, $p\leq.001$, $t(89)_{HealthySandw}$= -11.12, $p\leq.001$).

Figure 4: Mean response latencies in ms for each critical IAT block



IAT D-scores indicate a medium preference for compostable food packaging for both IATs: unhealthy sandwiches: $M_{d\text{-}score}$=.39, $SD_{d\text{-}score}$=.40, healthy sandwiches: $M_{d\text{-}score}$=.46, $SD_{d\text{-}score}$=.34. These values were both significantly different from zero: for the unhealthy food category ($t(89)$=9.22, p<.000) and the healthy food category ($t(89)$=12.80, p<.000). There were

no significant differences between the D-scores for the two different food categories, i.e. healthy and unhealthy sandwiches (t(89)=-1.45, *p*=.15). This confirms that participants held a positive implicit preference for compostable food packaging in contrast to traditional plastic food packaging across these two different food categories, healthy and unhealthy sandwiches.

7. Study 3

Studies 1 and 2 confirmed that implicit associations with compostable and plastic food packaging did not significantly differ between 'healthy' and 'unhealthy' food products. Thus, the packaging content had no significant impact on the implicit associations with the food packaging. Study 3 examines the implicit and explicit attitudes towards compostable versus plastic food packaging (drawn from different food categories) and tests to what extent these can predict purchase intentions.

7.1 Procedure and Materials

Participants. Data were collected through an online survey platform and participants were recruited via the Qualtrics UK consumer panel. Qualtrics set quotas based on UK census data in terms of age, gender, UK regions. One-hundred and five participants fully completed the online study and of those 93 were usable (49.5% females, Age: 25.8% under 34, 24.7% 35-49, 23.7% 50-64 and 25.8% over 65 years). Appendix 4 presents an overview of the sample demographics and the UK population demonstrating that the sample includes a good representation of gender, age and UK regions. Participants first completed one survey-based IAT (administered with IATgen via Qualtrics, https://iatgen.wordpress.com/, see Carpenter et al., 2019), followed by online survey questions.

Measures – Implicit Preferences. Like Study 1 and 2, the IAT consisted of five blocks. To increase generalizability, the target stimuli of compostable and plastic food packaging were drawn from different food categories, including healthy (salad, fruit, healthy sandwiches) and unhealthy food (cakes/bakery, unhealthy sandwiches). The target attributes were the same as in Study 1 and 2, i.e., 'good' and 'bad' words. A short introduction regarding the packaging materials and labels was provided to participants before the IAT to ensure the same level of knowledge (Appendix 1).

Measures – Explicit Preferences. Explicit attitudes towards compostable and plastic packaging were measured, each using five semantic differential scales adapted from Swanson, Rudman, and Greenwald (2001) and Perugini (2005), i.e. 'For me, buying food products in compostable/traditional plastic food packaging is….'. Each 7-point scale consisted of polar-opposite adjective pairs, i.e. bad-good, harmful-harmless, unpleasant-pleasant, not enjoyable-

enjoyable, unhealthy-healthy ($\alpha_{compostable}$=.87, $\alpha_{plastic}$=.89). As the IAT d-score is a relative measure indicating a positive evaluation for compostable food packaging relative to plastic food packaging, we calculated the explicit attitude score by subtracting the mean score for compostable food packaging from the mean score for plastic food packaging (see Perugini, 2005).

Behavioural intention. Purchase intention was assessed with three items adapted from Mai et. al. (2016) and Ackermann and Palmer (2014), e.g. 'I would buy food products in compostable packaging (if available)', 'I prefer to increase my purchase of food products in compostable packaging in the next three months.', M_{BI}= 6.25, SD_{BI}=.87, α= .93), measured on a 7-point scale from 1-extremely unlikely to 7-extremely likely.

7.2 Results

The IAT D-score indicated a medium preference for compostable food packaging, $M_{d\text{-}score}$ =.46, $SD_{d\text{-}score}$ =.52. This value was significantly different from zero, (t(92)=8.64, *p*<.000), confirming an implicit preference for compostable food packaging across different types of foods. Respondents' average reaction time was significantly shorter when compostable food packaging was paired with 'good' words, than when traditional plastic food packaging was paired with 'good' words. Explicit attitudes towards compostable food packaging were also significantly larger than those for plastic food packaging (M_{comp}=6.05, SD_{comp}=.94, $M_{plastic}$=2.56, $SD_{plastic}$=1.13, t(92)=17.89, *p*<.000). The explicit attitude difference score is significantly different from zero (M_{diff}=3.48, SD_{diff}=1.88, t(92)=17.89, *p*<.000). This confirms that respondents implicitly and explicitly showed a preference for compostable food packaging over traditional plastic food packaging.

Whilst we found a positive explicit attitude towards compostable food packaging in relation to plastic food packaging, the Pearson correlation coefficient with the IAT D-score was insignificant (r=-.001, *p*≤.99). This provides evidence of differences in constructs tapped by each measurement technique.

A regression analysis was conducted to assess the relationship between implicit and explicit attitudes towards compostable food packaging (independent variables) and purchase intention (dependent variable). The results show that implicit and explicit attitudes can explain 42% of the variation in purchase intention (R^2=.42, F(2)=32.88, p<.000), and specifically that implicit attitudes ($IAT_{d\text{-}score}$: β=.18, t= 2.22, *p*<.029) and the explicit difference attitude score (β=.63, t=7.80, *p*<.000) have a significant positive effect on purchase intention.

8. Study 4

Study 4 assesses the implicit and explicit health associations with compostable versus plastic food packaging and to what extent these can predict purchase intentions. In addition, study 4 examines health consciousness as a moderating factor which might weaken or enhance the link of implicit health associations with compostable food packaging and purchase intention.

8.1 Procedure and Materials

Participants. Data were collected as in Study 3. One-hundred and three participants fully completed the online study and of those 98 were usable (52% females, Age: 25.5% under 34, 25.5% 35-49, 25.5% 50-64 and 23.5% over 65 years). See Appendix 4 for an overview of the sample demographics and the UK population.

Measures – Implicit Preferences. As in Study 3, implicit associations were measured using IATgen administered via Qualtrics with the same target stimuli. However, this time the target attributes consisted of 'healthy' (e.g., fit, well) and "unhealthy" (e.g., harmful, unwell) words adopted from Mai et al. (2016).

Measures – Explicit Preferences. Explicit perception of healthiness of compostable and plastic food packaging was each measured with one item, i.e. 'For me, buying food products in compostable/traditional plastic food packaging is….'. The 7-point scale consisted of the polar-opposite adjective pair: healthy-unhealthy. As in study 3, we calculated the difference score by subtracting the mean score for plastic food packaging from the mean score for compostable food packaging (see Perugini, 2005) (M_{diff}=2.67, SD_{diff}=2.57).

Health Consciousness – We adopted a four-item, seven-point Likert scale to measure diet-related health consciousness from Siegrist, Visschers and Hartman (2015) (e.g., 'I think it is important to eat healthily', 'My health is dependent on how and what I eat', M_{health}= 4.98, SD_{health}=.92, α=.72).

Behavioural intention (M_{BI}=5.89, SD_{BI}=1.17, α=.94) was measured as in Study 3.

8.2 Results

The IAT D-score was positive and significantly different from zero ($M_{d\text{-}score}$=.37, $SD_{d\text{-}score}$=.53, (t(97)=6.97, p<.000). Thus, faster response latencies were observed when 'healthy' words were combined with compostable food packaging compared to when 'healthy' words were combined with plastic food packaging. A positive IAT D-score indicates that compostable food packaging is implicitly seen as healthier than traditional plastic food packaging.

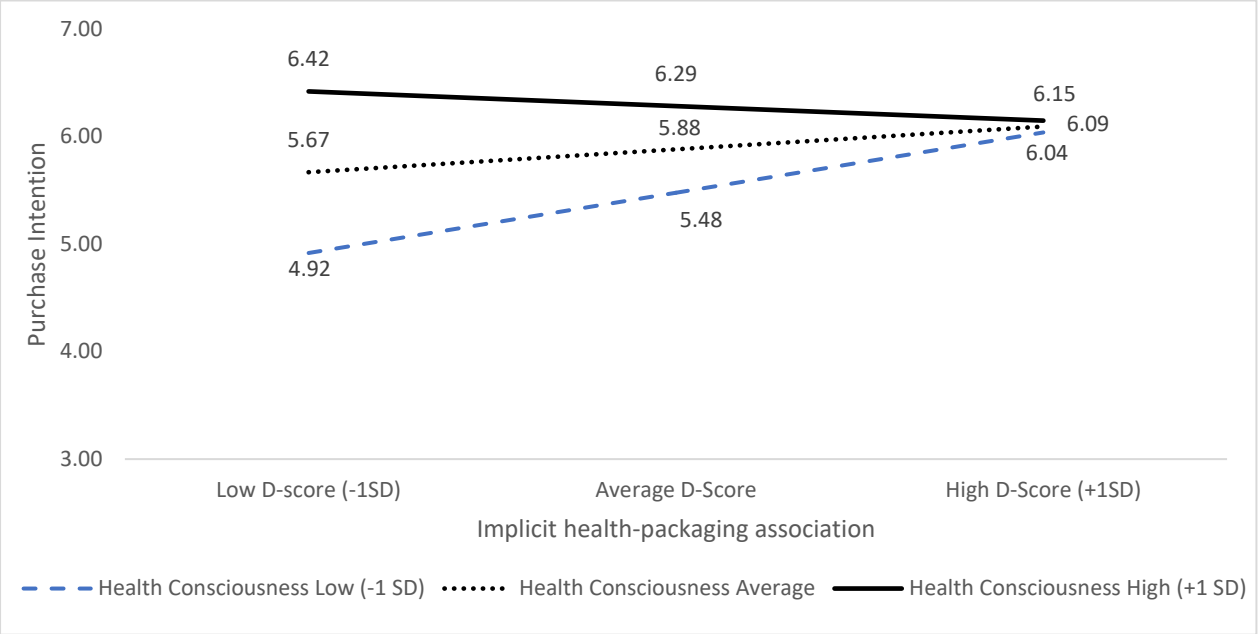
Compostable food packaging was also explicitly seen as healthier than buying food in plastic packaging (M_{comp}=5.76, SD_{comp}=1.29, $M_{plastic}$=3.08, $SD_{plastic}$=1.77, (t(97)=10.31, $p\leq$.000). The explicit healthiness perception difference score is significantly different from zero (M=2.67, t(97)=10.31, p<.000). The Pearson correlation coefficient with the IAT D-score was insignificant (r=-.011, p<.92), confirming the results from Study 3 in the context of health-packaging associations.

Regression analysis revealed that implicit and explicit perceptions of healthiness of the food packaging significantly influence purchase intention (R^2=.26, F(2)=17.13, p<.000, $IAT_{d\text{-}score}$: β=.22, t=2.49, p<.015, explicit difference healthiness score: β=.46, t=5.20, p<.000).

To test whether the link between the implicit health associations with compostable food packaging and purchase intention is contingent on consumers' health consciousness, we used Process macro (Hayes, 2013) to run a moderated regression analysis (Model 1) with implicit health-packaging associations ($IAT_{d\text{-}score}$) as the independent variable, purchase intention as dependent variable and health consciousness as moderator. All variables that define the product were mean centred. For purchase intention, the overall model was statistically significant, R^2=.245, F(3,94)=10.20, p<.000.

The IAT D-score ($B_{d\text{-}score}$=.40, t=2.01, p<.047) and health consciousness ($B_{health_consciousness}$ = .437, t=3.83, p<.000) were positively related to purchase intention. In addition, health consciousness moderated the effect of the IAT d-score on purchase intention. This is demonstrated by the significant negative interaction effect ($B_{d\text{-}score*health_consciousness}$=-.711, t=-3.48, p<.001). The effect of the IAT d-score on purchase intention was significant (p< .001) when health consciousness was one SD below the mean (B=1.06, t=4.12, p<.000), at the mean (B=.40, t=2.01, p<.047), but not at one SD above the mean (B=-.26, t=-.88, p<.381). As shown in Figure 5, as the level of health consciousness increased, the strength of the relationship between the implicit IAT D-score and purchase intention decreased.

Figure 5: Moderation effect of health consciousness



The effect of the implicit health-package associations on purchase intention appears to be strongest among consumers with low and moderate levels of health consciousness. Thus, for the less health-conscious consumers, the link between implicit health-packaging associations and purchase intention is enhanced. For these consumers, health aspects of the food are less relevant, but the packaging material might still signal healthiness benefits. In other words, automatic health-packaging associations play a greater role when stating their purchase intentions for compostable food packaging, than the more health-conscious consumers.

In contrast, for highly health-conscious consumers, purchase intentions for compostable food packaging did not significantly change with implicit health-package associations, i.e. purchase intentions were high for all levels of the IAT D-score. Thus, the higher a consumer's level of health consciousness, the less likely that implicit health-packaging associations will influence their purchase intention. For these high health-conscious consumers, health aspects of the food might be more relevant than the packaging alone.

9. Discussion and Conclusion

Our investigation started with a suggestion that appeals to reduce single-use plastic food packaging waste based on ecological appeals may be insufficient on their own to change behaviour. We were particularly interested in the linkages between automatic associations with

packaging materials and food within the packaging, and whether food packaged in compostable rather than plastic-based materials has different associations.

Across four IATs studies (see Appendix 3 for a summary), the present research tests and finds evidence for the positive relation between compostable packaging and consumers' behavioural intentions. Specifically, the results show that overall explicit and implicit attitudes towards compostable packaging are generally positive regardless of the food healthiness. Studies 1 and 2 confirm that implicit associations with compostable and plastic food packaging did not significantly differ between 'healthy' and 'unhealthy' food products, while Study 3 shows that implicit and explicit attitudes towards compostable (vs. plastic food packaging) have a positive effect on consumers' purchase intentions. Based on the assumption that consumers may establish an associative linkage between the packaging sustainability and healthiness, Study 4 further investigates the role of health consciousness as a moderating factor between compostable packaging and consumers' purchase intentions.

Our findings contribute to academic literature in several ways. First, we advance previous literature on packaging cues by investigating the role of packaging material, which has been overlooked by prior studies (Lindh et al., 2016; Magnier and Crié, 2015; Nguyen et al., 2020; Steenis et al., 2017). Second, we shed lights on the interaction between food contents, packaging and associations with healthiness, by adopting a relatively novel methodology - an Implicit Association Test, across several studies with good sample sizes. Ours is one of first studies to examine implicit associations linking healthiness with plastic and compostable food packaging.

Across all studies, compostable food packaging was explicitly perceived as more positive than conventional plastic food packaging. This is in line with Dilkes-Hoffman, Ashworth et al. (2019) and Herbes at al. (2018) who also found favourable views for plastics from renewable resources. Our study provides new evidence using measures of implicit attitudes in the more contemporary context of compostable packaging, and this builds on previous studies which have compared other ecologically benign packaging, such as recycled packaging. Whilst we found positive explicit and implicit associations in all studies, there was no significant correlation between them. Perugini (2005) noted that this confirms discriminant validity between the two different types of measures; one based on self-report and cognitive explicit evaluations; the other relying on reaction speed times indicating unconscious and automatic packaging associations.

Third, when studying different types of food (i.e., unhealthy and healthy), we found consistent positive implicit associations towards compostable food packaging. Thus, whilst sustainable packaging cues might positively affect the perceptions of food contained within (Steenis et al., 2017), our study found that the positive implicit and explicit attitudes towards the

biobased and biodegradable food packaging are not dependent on the type of food contained within. The robustness of the IAT methodology was further supported by using the methodology in two settings – in a laboratory study and online.

Furthermore, our results showed that compostable food packaging was explicitly and implicitly not only perceived more positive but also more healthy than conventional plastic food packaging. This confirms previous research, which noted that sustainable packaging cues may generate inferences about health (Steenis et al., 2017; van Rompay et al., 2016), for the context of implicitly held associations.

Finally, we enrich previous literature by showing the effect of an individual's reported health consciousness on modifying intention to purchase food in single-use plastic packaging (Bui et al., 2017; Donato et al., 2021). For consumers with high health consciousness levels, purchase intentions for compostable food packaging were high for all levels of implicit health-package associations. For this group, there was already a high awareness of benefits of compostable packaging and no further policy efforts would be likely to achieve substantial further behavioural change. However, a more interesting finding emerged for respondents with lower self-reported health awareness. The effect of the implicit health-package associations on purchase intention were strongest for participants with low and moderate levels of self-reported health consciousness. Participants with lower health-consciousness were thus more guided by their unconscious and automatic health-packaging associations when indicating their intention to make food purchases with compostable packaging.

Our findings highlight the importance of understanding consumers' implicit attitudes in developing policies to reduce single-use packaging waste. Commonly expressed attitudes about the link between waste plastics and ecological degradation may not be as powerful a motivator to change as tapping into implicit attitudes which link non-plastic alternative packaging forms to specific benefits. Our study provides evidence that for consumers with low levels of health consciousness, appeals to compostable packaging may tap into underlying, but not expressed, concerns for health. Our findings build on the growing awareness of automatic and habitual processes in food choices, and therefore effective strategies to reduce single-use plastic use should target the faster, automatic system grounded in affective, moral and unconscious motives outside of conscious awareness and control (Perugini, 2005).

These findings have important managerial implications. Food manufacturers and retailers should consider selling and promoting food, especially healthy food, in compostable rather than conventional plastic packaging, as the food's perceived healthiness can be enhanced by cues relating to the packaging material. However, this is also true for unhealthy food which could lead consumers to choose more unhealthy food if this is packaged in compostable

material. Our findings are also relevant to government agencies seeking to change packaging use, and our caveat about healthy packaging potentially encouraging and justifying consumers' purchase of unhealthy food indicates a need for nuanced meaning.

The present research is not without limitations, which may provide avenues for future research. First, a main limitation lies in not measuring consumers' actual behaviours. Hence, we propose future research to include a field experiment to measure consumers' real packaging choices, providing external validity to our results. Second, all studies have been conducted in one country (i.e., United Kingdom) with two out of four studies employing University students and staff samples. Replication studies in other countries and with a wider population are necessary to ensure the generalizability of the findings and to detect possible cultural differences. Finally, we focus our research only on food packaging, while there is an increasing use of compostable vs. single-use plastic packaging also in other product categories (e.g., beauty and laundry products). Therefore, additional research could extend the understanding of consumers' reactions toward sustainable packaging considering other products.

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Appendix 1

Study 1 and 2 - Packaging information

Food packaging study

The average household in the UK produces more than a tonne of waste every year with packaging being a major source of litter.

Please read the following information on food packaging materials.

Traditional plastic food packaging is lightweight, strong, and helps to keep food safe. PET is clear, tough, and has good gas and moisture barrier properties. However, traditional plastic food packaging used today is derived from non-sustainable fossil oils and often ends in landfill. Toxins produced by decomposing landfill waste can leach into our soil and groundwater, and become environmental hazards for years.

Many compostable materials in Europe feature the seedling logo, indicating that they will naturally break. Compostable food packaging is versatile, long-lasting, easy to dispose, safe, non-toxic and has the potential to reduce the amount of waste sent to landfill. However, home composting is still a rarity in most neighbourhoods and industrial composts can be difficult to access. Compostable packaging is made from forest cardboard and organic plant-based materials, such as cornstarch or soybeans which must be farmed thus competing for land.

Study 3 and 4 - Packaging information

Please read the following paragraphs with facts about plastic and compostable food packaging.

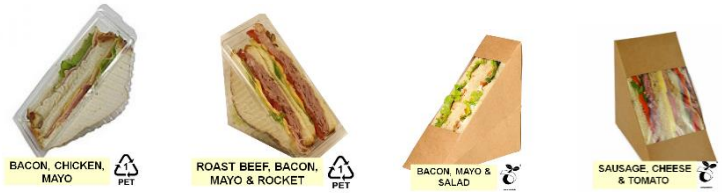
Plastic food packaging is made from non-renewable petroleum-based material. It is clear, lightweight, safe, strong, non-toxic and 100% recyclable. Many common plastic food packaging materials feature the PET 1 logo.

Compostable food packaging is made from renewable plant-based material, such as sugarcane or corn-starch. It is plastic-free, 100% natural, safe, durable and non-toxic. Many compostable materials feature the seedling logo.

Appendix 2: IAT Blocks for Study 1 – IAT 1: Cakes/Bakery Products

Sequence	Block 1	Block 2	Block 3	Block 4	Block 5
Task description	Initial target-concept discrimination	Associated attribute discrimination	Initial combined task	Reversed target-concept discrimination	Reversed combined task
Task function	Practice	Practice	Test	Practice	Test
Task Categories	*Compostable packaging Traditional plastic packaging*	*Good Bad*	*Compostable packaging *Good Traditional plastic packaging* Bad*	*Bad Good*	*Compostable packaging *Bad Traditional plastic packaging* Good*
Example stimuli (targets and attributes)	Order randomised * * * *	Order randomised *Excellent *Pleasant *Wonderful *Marvellous *Superb *Pleasure, *Beautiful *Glorious *Lovely *Joyful Horrible* Unpleasant* Terrible* Tragic* Agony* Painful* Awful* Humiliate* Nasty* Ugly*	Order randomized *Excellent * *Joyful * Awful* *	Order randomised *Horrible *Unpleasant *Terrible *Tragic *Agony *Painful *Awful *Humiliate *Nasty *Ugly Excellent* Pleasant* Wonderful* Marvellous* Superb* Pleasure* Beautiful* Glorious* Lovely* Joyful*	Order randomized Excellent* * Joyful* * Awful* *
Trials	20	20	40	20	40

Appendix 3. Overview of IAT stimuli and results

Study	Examples of IAT target stimuli	IAT target attributes	D-Score
1 n=88	IAT 1 – Cakes/Bakery – traditional plastic vs compostable packaging IAT 2 – Ready-to-eat Salad – traditional plastic vs compostable packaging 	**Implicit attitude-packaging association** Good (Excellent, Pleasant, Wonderful, Marvellous, Superb, Pleasure, Beautiful, Glorious, Lovely, Joyful) Bad (Horrible, Unpleasant, Terrible, Tragic, Agony, Painful, Awful, Humiliate, Nasty, Ugly)	IAT1 **d-score=.47** IAT2 **d-score=.42** Cakes/Bakery Products and ready-to-Eat Salads in compostable food packaging implicitly seen as better than same in plastic food packaging
2 n=90	IAT1 – Unhealthy Sandwiches – traditional plastic vs compostable packaging  IAT2 – Healthy Sandwiches – traditional plastic vs compostable packaging 	**Implicit attitude-packaging association** Good (Excellent, Pleasant, Wonderful, Marvellous, Superb, Pleasure, Beautiful, Glorious, Lovely, Joyful) Bad (Horrible, Unpleasant, Terrible, Tragic, Agony, Painful, Awful, Humiliate, Nasty, Ugly)	IAT1 **d-score=.39** IAT2 **d-score=.46** Unhealthy and healthy sandwiches in compostable food packaging implicitly seen as better than same in plastic food packaging

3 n=93	**Various food products** Traditional Plastic Packaging Compostable Packaging 	**Implicit attitude-packaging association** Good (Excellent, Pleasant, Wonderful, Marvellous, Superb, Pleasure, Beautiful, Glorious, Lovely, Joyful) Bad (Horrible, Unpleasant, Terrible, Tragic, Agony, Painful, Awful, Humiliate, Nasty, Ugly)	IAT_{online} **d-score=.46** Compostable food packaging implicitly seen as better than plastic food packaging across different food categories.
4 n=98	Same as Study 3	**Implicit health-packaging association** Healthy (fit, lively, well, vivid) Unhealthy (sick, ill, harmful, excessive, unwell)	$IAT_{online_healthiness}$ **d-score=.37** Compostable food packaging implicitly seen as healthier than plastic food packaging

Appendix 4. Sample Demographics (in %)

	UK	Study 3 (n=93)	Study 4 (n=98)
Gender[i] - Female	50.6	49.5	52.0
Age[ii]			
18-34	27.5	25.8	25.5
35-49	24.2	24.7	25.5
50-64	24.5	23.7	25.5
65 and over	23.6	25.8	23.5
UK Region[iii]			
South East	13.7	12.9	15.3
London	13.4	11.8	14.3
North West	11.0	12.9	11.2
East England	9.4	8.6	7.1
West Midlands	8.9	9.7	9.2
South West	8.4	5.4	9.2
Yorkshire and Humber	8.2	12.9	6.1
Scotland	8.2	7.5	8.2
East Midlands	7.3	6.5	7.1
Wales	4.7	4.3	5.1
North East	4.0	4.3	4.1
Norther Ireland	2.8	3.2	3.1
Highest Qualification[iv]			
Less than Primary/Primary/O-Level/GCSE	20.0	29.0	32.0
A-level/Advanced Diploma/Professional degree	40.2	33.3	28.9
Degree (UG/PG)	39.8	34.5	31.9

Note: Values are percentages

[i] https://www-statista-com.abc.cardiff.ac.uk/statistics/281240/population-of-the-united-kingdom-uk-by-gender/

[ii] https://www-statista-com.abc.cardiff.ac.uk/statistics/281174/uk-population-by-age/

[iii] https://www-statista-com.abc.cardiff.ac.uk/statistics/294729/uk-population-by-region/

[iv] http://ec.europa.eu/eurostat/en/web/products-datasets/-/EDAT_LFS_9901 (UK population figures based on 18-74 yr olds) Source: Eurostat