Heidbreder et al., accepted manuscript, to appear in 'Science of the Total Environment', https://doi.org/10.1016/j.scitotenv.2019.02.437

Tackling the plastic problem: A review on perceptions, behaviors, and interventions

Lea Marie Heidbreder[a,b*], Isabella Bablok[a*], Stefan Drews[c,d], Claudia Menzel[c‡]

[a] Interdisciplinary Research Group for Environmental Studies, University of Koblenz-Landau, Germany

[b] Personality, Psychological Assessment, and Psychological Methods, Department of Psychology, University of Koblenz-Landau, Germany

[c] Social, Environmental, and Economic Psychology, Department of Psychology, University of Koblenz-Landau, Germany

[d] Institute of Environmental Science and Technology, Universitat Autònoma de Barcelona, Spain

* these authors contributed equally to this work

[‡] corresponding author: Claudia Menzel, menzel@uni-landau.de, Social, Environmental, and Economic Psychology, Department of Psychology, University of Koblenz-Landau, Fortstraße 7, 76289 Landau, Germany

Heidbreder et al., accepted manuscript, to appear in 'Science of the Total Environment', https://doi.org/10.1016/j.scitotenv.2019.02.437

Abstract

The excessive production and consumption of plastic has serious consequences on the environment and human health. The reduction of plastic has therefore become a major global challenge. As technical solutions might be insufficient to curb the problem, a perspective highlighting the impact of human behavior is needed. The current literature review provides an overview of the existing social-scientific literature on plastic, ranging from risk awareness, consumers' preferences, and predictors of usage behavior to political and psychological intervention strategies. By reviewing the literature, we aim to identify potential factors for future interventions to reduce plastic consumption. The 187 studies reviewed show that people much appreciate and routinely use plastic, despite a pronounced awareness of the associated problems. Habits, norms, and situational factors seem to be especially predictive for plastic consumption behavior. Both political and psychological interventions are potentially effective, although long-term effects are often uncertain. The review closes with implications for behavior-based solutions and future research, which should combine interdisciplinary approaches and take into account cultural differences.

Keywords: plastic pollution; problem awareness; consumer behavior; behavior-based solutions; environmental psychology

1 Introduction

Today we live in an era that some have called the "Plastic Age" (Thompson, Swan, Moore, & Vom Saal, 2009). The production of plastic has markedly increased over the last decades, currently reaching about 350 million tons per year (PlasticsEurope, 2018). Many advantages of the material, such as durability, flexibility, and cheapness, make plastic

ubiquitous and indispensable in daily life, and thus it is distributed globally. However, there is growing evidence that the current use and disposal of plastic leads to substantial pollution of terrestrial and aquatic ecosystems (Bläsing & Amelung, 2018; Horton, Walton, Spurgeon, Lahive, & Svendsen, 2017), already discussing plastic waste as a new planetary boundary threat (Galloway & Lewis, 2016; Rockström et al., 2009). Over 250,000 tons of plastic are estimated to float in the sea (Eriksen et al., 2014), adversely affecting marine wildlife and humans by plastic entering the food chain (W. C. Li, Tse, & Fok, 2016; Rochman et al., 2016; Seltenrich, 2015; Sigler, 2014). In addition, the widespread use of plastic in agriculture has been postulated as a relevant source of soil degradation and microplastics (i.e., plastic particles smaller than 5mm) in soil (e.g., Liu, He, & Yan, 2014; Steinmetz et al., 2016). Furthermore, lab experiments demonstrate plastic to be a source of anthropogenic climate change as the most commonly used plastics might produce greenhouse gases when exposed to sunlight (Royer, Ferrón, Wilson, & Karl, 2018). Thus, plastic has a tremendous effect on various aspects of the environment, including wildlife, through diverse routes.

The most discussed risk to human health associated with the use of plastic is the exposure to harmful chemicals that are used as plastic additives (e.g., Hodson, Duffus-Hodson, Clark, Prendergast-Miller, & Thorpe, 2017; Rist, Almroth, Hartmann, & Karlsson, 2018; Smith, Love, Rochman, & Neff, 2018). Moreover, plastic particles may act as vehicles of persistent pollutants (Peng, Wang, & Cai, 2017). The potential danger to human health might therefore arise from the uptake of food products that were in contact with plastic or contain microplastic.

As the entire production and application of plastic is of human origin, human solutions to the plastic problem are both necessary and feasible. Therefore, various societal actors (e.g., consumers, producers, policy makers, industries) need to be involved in the solutions (e.g., Löhr et al., 2017). Although a number of technical approaches of alternative materials or infrastructure have been developed to curb the problem (e.g., the production of biodegradable

plastic or appropriate recycling procedures), there are two major obstacles: First, it is unlikely that technical approaches will solve the plastic problem comprehensively and in the required time. Second, there are well-known psychological effects that often undermine technical solutions, such as increased usage after an intervention (i.e., rebound effects; Hertwich, 2005) or increased littering of biodegradable products (Haider, Völker, Kramm, Landfester, & Wurm, 2018). Thus, efficiency strategies (e.g., recycling) can save resources at first glance but may eventually lead to a change in people's behavior as they consume more and thus reduce the resource savings. Moreover, technical approaches require people's acceptance, thus bringing additional factors into play. Hence, although technical solutions are definitively needed, a focus on human behavior is necessary to tackle the plastic problem from a multidisciplinary approach. To develop effective solutions, insights on perceptions, attitudes, and behaviors related to plastic is needed. As there is, to our knowledge, no compilation of social-scientific literature on the described issue, we aim at providing one that is useful for researchers and stakeholders.

2 Aims

In the current review, we provide an overview of the existing empirical social-scientific literature on human perception and behavior related to plastic use and disposal. Plastic is defined as a synthetic material composed of polymers. In the review, we did not give special attention to plastic additives, such as Bisphenol A, although they might affect risk awareness. Since the research field of plastic-related perception and behavior is relatively new and very diverse, the review is of a narrative nature. The main part of this review summarizes the studies and their findings. In the discussion, we integrate these findings to identify promising factors important for behavior-based solutions to the plastic problem and to reveal research gaps that future studies should address. This review, thus, provides both an overview

of the existing literature helping to identify promising research questions, and useful information for practitioners and those developing interventions.

3 Methods

To identify relevant studies for the present review, we used several databases (PsychINFO, PsychArticles, Pubmed, and Web of Science). A first search using a set of keywords and their combinations (e.g., "plastic", "waste", "consumer behavior", "packaging", "recycling") led to an initial collection of studies. An article identified in the search was considered relevant if a) plastic was addressed as a material (ignoring other meanings, such as plastics in arts or plastic surgery), b) plastic was explicitly studied (and not just mentioned as an example or to specify the material of something that was not studied further), and c) attitudes, perceptions, or behaviors were examined. The list of studies was then extended using a snowball strategy of searching backward and forward citations (Wohlin, 2014) and again applying the above criteria. Only articles published before September 27, 2018 were considered. The final pool comprised 187 articles that were included in this review. Figure 1 shows the worldwide distribution of the samples described in the reviewed literature.

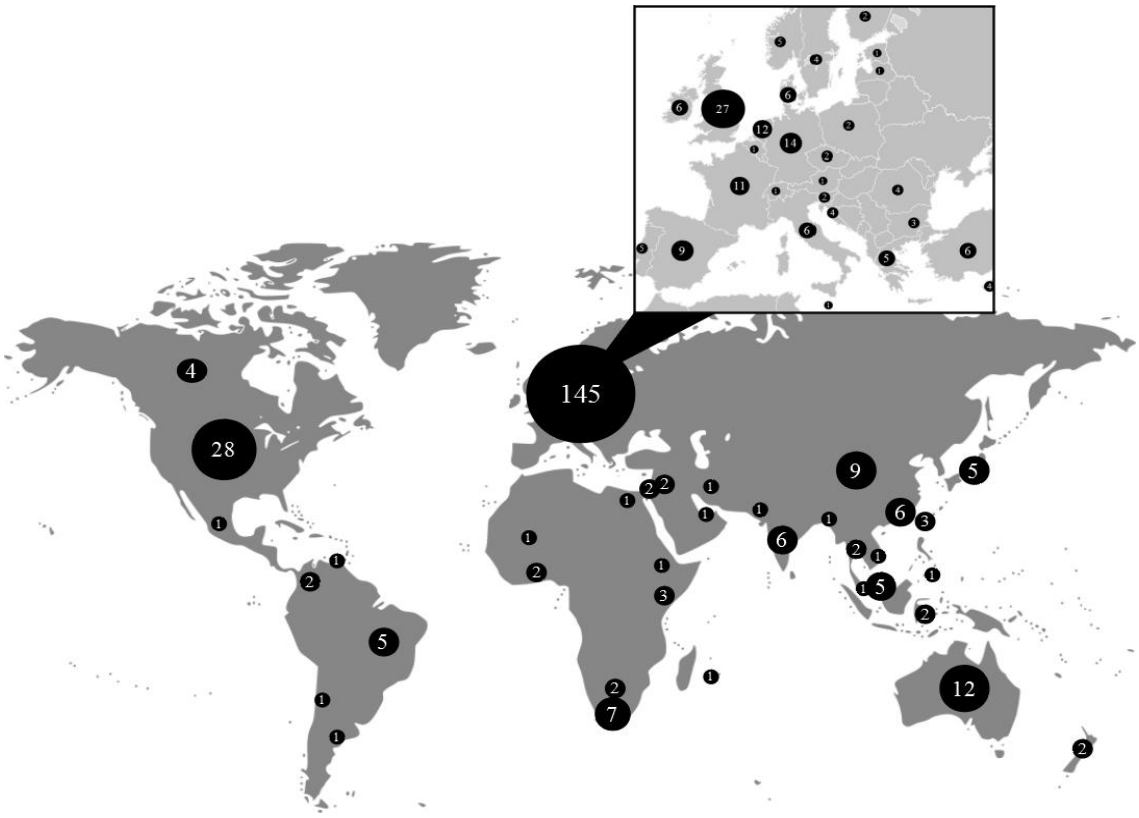

Figure 1. Countries represented by reviewed studies. Numbers indicate amount of studies investigating a sample from a particular country (several countries per article possible; same original sample might be counted repeatedly when presented in different articles). One article (Clapp et al., 2009) was excluded because no sample was investigated.

4 Results

Based on the literature found, we structured the review in three sections: problem awareness and perception of plastic (section 4.1), plastic consumption behavior (section 4.2), and solutions to the plastic problem (section 4.3 and Discussion).

4.1 Perception of plastic

As outlined above, the increasing use of plastic has a severe impact on the environment and involves certain risks for human health. In the first part of this section, we review available literature on the awareness of such impacts. In the second part, we examine the perception of plastic in the context of consumption. Knowledge about problem awareness and preferences helps to identify predictors of plastic consumption behavior and thus leads to potential starting points for solutions. Note that within this chapter, perceptions were described and that these may not be in line with the real circumstances (e.g., the perceived environmental impact might diverge from the actual one).

4.1.1 Problem awareness

4.1.1.1Perceived impacts of plastic pollution on the environment

Plastic used as a material for packaging and bags is generally seen as environmentally problematic (e.g., Adane & Muleta, 2011; Fernqvist, Olsson, & Spendrup, 2015; Otsyina, Nguhiu-Mwangi, Mogoa, Mbuthia, & Ogara, 2018; van Dam & van Trijp, 1994). Furthermore, in social media "plastic" is discussed and associated with "sustainability" and "waste", indicating certain problem awareness (Richardson, Grose, Nelmes, Parra, & Linares, 2016). In an earlier Danish study (Bech-Larsen, 1996), environmental problems due to (packaging) waste were considered as less serious compared to other societal and environmental issues. However, as might be expected by the increased use and disposal of plastic ever since, more recent and large-scaled surveys conducted on citizens in several countries (e.g., Portugal, UK, Germany, Canada, Kenya) show that pollution in general and plastic waste in particular are perceived as major environmental problems (Gelcich et al., 2014; Hartley, Pahl, Veiga, et al., 2018; Lotze, Guest, O'Leary, Tuda, & Wallace, 2018). The immense use of plastic (esp. in packaging) and related human behavior are perceived as

significant causes of pollution (Hartley, Pahl, Veiga, et al., 2018; I. R. Santos, Friedrich, Wallner-Kersanach, & Fillmann, 2005). In fact, problem awareness is already high among school children from different countries (United Arab Emirates: Hammami et al., 2017; UK: Hartley, Thompson, & Pahl, 2015; Hong Kong: So, Cheng, Chow, & Zhan, 2016). Plastic litter is highly abundant at most coastlines worldwide and often beach visitors and locals are perceived to be the source of such litter (Beeharry, Bekaroo, Bokhoree, Phillips, & Jory, 2017; Brennan & Portman, 2016; Campbell, Slavin, Grage, & Kinslow, 2016; Hartley, Pahl, Veiga, et al., 2018; Kiessling, Salas, Mutafoglu, & Thiel, 2017; Rangel-Buitrago, Williams, & Anfuso, 2018; Santos et al., 2005). However, the amount of former fishing and aquaculture utensils (e.g., fishing lines, buoys, pipes) made from plastic is also very high both in the sea and at beaches, and this debris is perceived as a major threat for marine wildlife, boats, and humans (Barnett, Wiber, Rooney, & Curtis Maillet, 2016; Pearson, Mellish, Sanders, & Litchfield, 2014). Additionally, plastic waste is perceived to negatively affect terrestrial animals (Adane & Muleta, 2011; Otsyina et al., 2018).

Although microplastic has become a hot topic in media and environmental science, social-scientific studies on the perception of microplastic and its risks are rare to date. By definition, such plastic particles are small and thus difficult to see and retrieve from the environment compared to macrodebris (cf., Barnett et al., 2016, for such an observation by Candian fishermen). Interviews with beauticians, students, and environmentalists show that only the latter were aware of microplastics in facial scrubs (Anderson, Grose, Pahl, Thompson, & Wyles, 2016). The majority of participants indicated awareness that these particles will go into the ocean after use. After participants of this UK study were made aware of these issues, they reported environmental concerns, especially risks for marine fauna. However, for them these environmental problems are not as pressing as others (Anderson et al., 2016). Overall, (macro- and micro-) plastic is generally seen as an environmental hazard, though to a varying degree.

178

179 *4.1.1.2Perception of human health and well-being risks*

180 Besides the perceived environmental risks, people are concerned about hazards related
181 to their health and well-being. For example, litter is associated with reduced preference for
182 and perceived restorative quality of a given place and this is especially true when the litter
183 originates from the general public (e.g., plastic bottles) compared to fishing-related litter (e.g.,
184 fishing ropes; Ballance, Ryan, & Turpie, 2000; Kiessling et al., 2017; Wyles, Pahl, Thomas,
185 & Thompson, 2016). Furthermore, potentially health-threatening litter items (e.g., syringes
186 and condoms) were perceived as more offensive than other beach litter (Tudor & Williams,
187 2003). In general, coastal scenic quality seems to be negatively affected by the amount of
188 (plastic) litter but it is noted that this appeal might be restored by beach clean-ups (Corraini,
189 de Souza de Lima, Bonetti, & Rangel-Buitrago, 2018; Rangel-Buitrago et al., 2018; Williams,
190 Rangel-Buitrago, Anfuso, Cervantes, & Botero, 2016), which are being carried out with
191 increasing frequency nowadays (e.g., Loizidou, Loizides, & Orthodoxou, 2018; see also
192 4.3.2.3 for more information on clean-up interventions). In a Spanish study, beach litter was
193 perceived as higher the more plastic was seen and the more often one visits the beach (Rayon-
194 Viña, Miralles, Gómez-Agenjo, Dopico, & Garcia-Vazquez, 2018).

195 Although the beaches investigated in an Australian study were relatively clean, about
196 22% of beach goers experienced injuries (e.g., small cuts) from litter which mainly consisted
197 of plastic items (Campbell et al., 2016; see also I. R. Santos et al., 2005, for similar results).
198 The majority of respondents, however, did not perceive plastic litter as a human (but rather an
199 environmental) hazard, and previous injuries did not affect the perception of litter (Campbell
200 et al., 2016). However, in a similar – but older – study human risks were rated higher than or
201 similar to environmental hazards (I. R. Santos et al., 2005). The difference between these two
202 studies might illustrate the increased awareness of the environmental hazards described
203 above.

Although US consumers of facial scrubs considered the products safe to use, most of them deny purchasing or using it when confronted with the fact that it contains plastic (M. Chang, 2015), and others reported both health (related to the skin while using the scrub and accumulation in the food chain) and environmental concerns (see above, Anderson et al., 2016).

Consumers from different countries (Turkey, Sweden, India, and Ghana) expressed concerns about health-affecting properties of plastic, such as harmful substances in plastic and reduced food quality due to the packaging (Aday & Yener, 2014; Fernqvist et al., 2015; Joseph, Kumar, Majgi, Kumar, & Prahalad, 2016; Omari & Frempong, 2016; Omari, Frempong, & Arthur, 2018). However, compared to cans made from metal, plastic is perceived as safe (e.g., Peters-Texeira & Badrie, 2005). In fact, compared to glass bottles or cans made from metal, plastic is reported to cause less injuries when opening a package (Caner & Pascall, 2010). In a Ghanaian study, the degree of worry about leaking substances from plastic packaging into food is similar to other chemical-related risks, such as those from pesticides or artificial coloring (Omari et al., 2018). While the majority of participants from a Hawaiian study on plastic alternatives preferred microwavable containers for takeout food (Barnes, Chan-Halbrendt, Zhang, & Abejon, 2011) other participants of a Swedish study reported concern related to plastic food packages designed for microwave use (Fernqvist et al., 2015). Additionally, plastic bag use is associated with health risks that were not further specified in an Ethiopian study (Adane & Muleta, 2011). Not only were consumers worried about potential health hazards of plastic but regulatory officials were also concerned and uncertain as pointed out in an UK case study (Rothstein, 2003). In general, the risk perception of plastic (pollution) has changed within the few last decades and some characteristics of plastic (e.g., its highly abundant and thus involuntary exposure, unnecessary use, and uncontrollable spread) have lead to high risk perception (Syberg, Hansen, Christensen, & Khan, 2018).

230

231 **4.1.2 Consumer Perceptions**

232 Much of the plastic waste found in the environment consists of food-related
233 packaging, including bottles, bags, and eating accessories (e.g., Carpenter & Wolverton,
234 2017; see also Marsh & Bugusu, 2007). Moreover, one third of the worldwide plastic
235 production is for packaging (PlasticsEurope, 2017). Therefore, knowledge about the
236 perception and preferences of consumers is necessary to tackle the plastic problem.

237

238 *4.1.2.1Perception of the environmental impact of plastic packaging and bags*

239 Packaging fulfills a number of functions, including protection of the product and
240 communication of product characteristics (as reviewed by Lindh, Williams, Olsson, &
241 Wikström, 2016; Marsh & Bugusu, 2007). Although the product itself and other aspects of
242 production and transportation usually have a larger impact on the environment than the
243 packaging *per se* (Jungbluth, Tietje, & Scholz, 2000; Wikström, Williams, Verghese, &
244 Clune, 2014, but see also Pasqualino, Meneses, & Castells, 2011), unsuitable packaging
245 increases the amount of food waste and therefore packaging should be appropriate to reduce
246 environmental impacts (e.g., Silvenius et al., 2014; Williams, Wikström, Otterbring, Löfgren,
247 & Gustafsson, 2012). For example, when Norwegian consumers were unsatisfied with the
248 packaging, they may use their own plastic bag to maintain the freshness of bread and thereby
249 reduce food waste (Østergaard & Hanssen, 2018).

250 Although appropriate packaging is important for the protection and environmental
251 impact of a product, its material plays only a minor role in the preference of one product over
252 another (Eldesouky & Mesias, 2014; Gelici-Zeko, Lutters, ten Klooster, & Weijzen, 2013;
253 Silayoi & Speece, 2004, but see also Rokka & Uusitalo, 2008, for different results when
254 recyclability of the material was made salient for the choice, and also Widaningrum, 2014, for
255 divergent findings). Other properties of the product or package, such as price, visual and

functional aspects of the package, size, and previous experience with the product or brand are rated as more important (Draskovic, Temperley, & Pavicic, 2009; Eldesouky & Mesías, 2014; Gelici-Zeko et al., 2013; Isa & Yao, 2013; Koutsimanis, Getter, Behe, Harte, & Almenar, 2012; Peters-Texeira & Badrie, 2005; Scherer, Emberger-Klein, & Menrad, 2017; Silayoi & Speece, 2004; Young, 2008)When directly asked about the packaging material, respondents of a study from Thailand stated in interviews that it should be non-toxic, convenient, and prolong high product quality (Silayoi & Speece, 2004).

The negative environmental impacts of plastic packaging are considered disadvantageous (Aday & Yener, 2014; Fernqvist et al., 2015). Plastic-only packaging was ranked medium for environmental friendliness by both Dutch consumers and a life cycle analysis (Steenis, van Herpen, van der Lans, Ligthart, & van Trijp, 2017). In the same study, bioplastic (which was not specifically defined) and glass were rated as especially sustainable by consumers, while a life cycle analysis ascertains that carton and mixed carton-plastic packages are more sustainable in the example of a soup package. Similarly, respondents of other studies rated glass (and sometimes also paper-based materials) most environmentally friendly, while plastic and metal were rated most negative (Lindh, Olsson, & Williams, 2016; van Dam, 1996). Note, however, as mentioned in van Dam (1996, p. 612) that "consumers judge environmental friendliness only from their beliefs concerning the post-consumption treatment of the packaging waste", and therefore consumer perception and results of life cycle analyses may diverge (e.g., Jungbluth et al., 2000; Steenis et al., 2017; van Dam, 1996; Wikström et al., 2014).

In line with this focus on post-consumption, consumers focus more on recyclability, biodegradability, and reusability than on the origin of the raw material when evaluating the environmental friendliness of a material. However, there were also differences among the different nationalities investigated (Germany, USA, and France; Herbes, Beuthner, & Ramme, 2018). Recyclability of the package is generally perceived positively and in

282 experimental studies consumers were willing to pay more for a product with recyclable
283 (plastic) packaging material (Barnes et al., 2011; Klaiman, Ortega, & Garnache, 2016; Rokka
284 & Uusitalo, 2008; Vones, Allan, Lambert, & Vettese, 2018; Young, 2008). However,
285 recyclability of the package is rarely a reason to buy a product (Aday & Yener, 2014;
286 Koutsimanis et al., 2012; but see Rokka & Uusitalo, 2008). This might have various reasons
287 as, for example, post-consumer recycling is sometimes perceived as difficult (e.g., Venter,
288 van der Merwe, de Beer, Kempen, & Bosman, 2011) or impossible (Y. Li et al., 2010). The
289 need to clean a package hinders people from recycling a package (irrespective of material;
290 Klaiman, Ortega, & Garnache, 2017). Furthermore, the environmental attitudes of consumers
291 affect their perception of a packaging made from recycled materials as was indicated by an
292 experimental study showing that French participants with low environmental concern
293 perceived it negatively (i.e., as 'green washing') when there was a claim "made from recycled
294 material" on a plastic bottle compared to an ecologically looking non-plastic bottle (Magnier
295 & Schoormans, 2015).

296 Generally, biobased materials (i.e., made from plant or other renewable material;
297 irrespective of biodegradability) were preferred over conventional plastic (Kainz, Zapilko,
298 Decker, & Menrad, 2013; Koutsimanis et al., 2012; Magnier & Schoormans, 2015, 2017).
299 Similarly, biodegradable materials (i.e., degradable with the help of microorgansims and/or
300 sunlight) were also preferred over conventional plastic and people may be willing to pay more
301 for it (Muizniece-Brasava, Dukalska, & Kantike, 2011; Yue et al., 2010).The preference for
302 biodegradable and other (seemingly) environmental friendly materials might be due to the
303 perceived advantages of reduced pollution and health hazards (Magnier & Crié, 2015).
304 However, a Romanian study indicated that biodegradable plastic (compared to paper,
305 cardboard, or glass) was rated as the least preferred environmentally friendly packaging
306 material (Orzan, Cruceru, Bălăceanu, & Chivu, 2018). This discrepancy highlights that
307 consumers lack knowledge about the properties of both biodegradable and biobased plastic

(Kainz et al., 2013; Koutsimanis et al., 2012; Mohamed, 2015). For example, consumers confound characteristics of bioplastic (i.e., biobased) and biodegradable materials and thus have incorrect associations to them (Blesin, Jaspersen, & Möhring, 2017; see also Young, 2008, for similar findings on recyclability vs. recycled source material). The lack of knowledge might furthered derived from the facts that those materials are both rarely in use and its environmental effects were understudied so far (Rujnić-Sokele & Pilipović, 2017; Spierling et al., 2018). Relatedly, a Bangladeshi study by Synthia and Kabir (2015) showed that characteristics of plastic alternatives were unknown and the authors highlighted the need for more education when banning plastic products. Their study revealed that after a ban of certain plastic bags, new alternative bags (e.g., net, nylon, or polyethene bags designed differently to the banned ones) were used increasingly and considered more environmentally friendly although the latter was not always true.

4.1.2.2Perceived advantages of plastic packaging and bags

Preference for plastic as a packaging material is based on its functional aspects (e.g., Bech-Larsen, 1996). Several studies from all over the world showed that plastic is preferred due to its convenience, light weight, transparency, resistance, option for resealability, as well as hygienic and protective properties (e.g., Aday & Yener, 2014; Draskovic, 2010; Draskovic & Guszak Cerovecki, 2014; Draskovic et al., 2009; Hollywood, Wells, Armstrong, & Farley, 2013; Phillips, 2016; Venter et al., 2011). The consumers' perception of these advantages is in line with those of Croatian employees of a soft drink company and Australian salespersons (Drašković, 2010; Phillips, 2016). For bags, plastic is the preferred material, because such bags are perceived as convenient, easily available, waterproof, and cheap (Adane & Muleta, 2011; Madara, Namango, & Wetaka, 2016; Musa, Hayes, Bradley, Clayson, & Gillibrand, 2013; Negussie & Mustefa, 2017; Nittala, 2014; Prendergast, Wai Ng, & Lee Leung, 2001).

4.1.2.3Packaging preferences depending on contextual factors

Although plastic is generally appreciated for several advantages (see above), preference for a certain packaging differs depending on several factors, such as the product category. For example, fruits and vegetables are preferred to be bought loose without any packaging (Ali & Kapoor, 2008; van Herpen, Immink, & van den Puttelaar, 2016). If participants were asked to choose between several materials for fruit and vegetable packaging, they preferred biobased and degradable materials (e.g., cotton or paper) over conventional plastic (Ali & Kapoor, 2008; Fernqvist et al., 2015; Koutsimanis et al., 2012). These findings are in contrast to the approach used by many supermarkets. When Danish consumers were asked to rate different packages for fresh carrots (plastic bag, plastic or cardboard box with plastic foil), they preferred the boxes over the bag due to higher perceived value and quality (and thus favoring over-packaging; Nørgaard Olesen & Giacalone, 2018). The majority of these respondents mentioned the transparency of the packaging as most important, while environmental friendliness was only mentioned by 15% of the participants. Note that these results were not compared to no packaging. Willingness to pay for less packaging of shampoo was rather low (Yamaguchi & Takeuchi, 2016). Thereby, the motivation to buy a refill-shampoo bottle was mainly a price argument rather than concern for the environment. In addition, these Japanese participants perceived refillable bottles as unsightly or troublesome when reusing them (Yamaguchi & Takeuchi, 2016).

When explicitly confronted with different kinds of cheese packages, Spanish consumers preferred plastic – mainly because of its transparency (Eldesouky, Mesías, Elghannam, Gaspar, & Escribano, 2016; Eldesouky & Mesías, 2014; see Peters-Texeira & Badrie, 2005, for a similar result on fruit preserves). However, some consumers indicated in a word completion task a disfavor of a particular cheese when packed in plastic, likely due to perceived overpackaging and hence its contribution to pollution (Eldesouky, Pulido, & Mesías, 2015). Additionally, Malaysian consumers preferred vinegar in glass rather than

plastic bottles although they liked plastic lids more than metal ones (Latiff, Mokhtar, Soon, & Ayob, 2018). For milk and other cold chain products, plastic (and glass) bottles or Tetra Briks (i.e., typical cuboid plastic-coated carton of the Tetra Pak company) with a cap were the preferred packaging materials (Gómez, Martín-Consuegra, & Molina, 2015; Hollywood et al., 2013; Van der Merwe, Viljoen, De Beer, Bosman, & Kempen, 2013 but see also van Dam & van Trijp, 1994, for divergent findings when consumers were asked for perceived environmental friendliness). However, as indicated above, packaging preference depends partly on the context. For drinks, plastic bottles are preferred generally, and especially on the go, but clearly not in the context of cafés and restaurants where glass is preferred, as was suggested by Croatian studies (Drašković, 2010; Drašković & Cerovečki, 2014; Draskovic et al., 2009).

Besides the described contextual and product-related factors, the consumers' cultural background, age, and environmental attitude influence preferences for plastic as a packaging material (e.g., Draskovic et al., 2009; Lal, Yambrach, & McProud, 2015; van Dam & van Trijp, 1994), see also below in 4.2 for predictors of plastic-related behavior).

4.1.2.4 Priming effects of plastic

The material of a package provides more than its functionality; it also affects the consumers' perception of the product and subsequent consumption. For example, plastic packaging is associated with different characteristics of the product such as higher (compared to carton) or lower (compared to glass) hygienic properties (Drašković & Cerovečki, 2014; Venter et al., 2011). Some Croatian and South African consumers perceive products packed in plastic as relatively expensive and assume retained food quality, while others associate it with being cheaper and of lower quality (Drašković & Cerovečki, 2014; Venter et al., 2011). The product itself is perceived as more environmentally friendly when packed in biobased material compared to a plastic alternative as suggested by a French study (Magnier &

Schoormans, 2017). Another French study showed that while over-packaging seems to be associated with better quality of the product, it is also perceived as environmentally unfriendly (Elgaaïed-Gambier, 2016).

Besides these more general associations evoked by the packaging, it directly affects the taste and quality of a product. Croatian consumers stated that plastic negatively affects the taste and quality of carbonated drinks due to gas migration (Draskovic et al., 2009). Furthermore, the material of eating utensils influences the perception of a product, whereby plastic is often perceived as less favorable compared to other materials (Piqueras-Fiszman & Spence, 2011; Schifferstein, 2009; Spence & Wan, 2015; Tu, Yang, & Ma, 2015). In addition, tactile perceptions differ between plastic and other bottle materials (Lefebvre et al., 2010).

Moreover, waiving plastic consumption by bringing one's own shopping bag instead of using offered plastic bags affects subsequent behavior by priming (i.e., buying organic food) or licensing (i.e., buying indulgent products) effects, as was shown by an US study (Karmarkar & Bollinger, 2015). Relatedly, an Indian study showed that positive attitudes towards plastic bags negatively affect the willingness to buy environmentally friendly products (Nittala, 2014).

4.2 Plastic-related behavior and its antecedents

Despite high awareness of the problem, usage rates of plastic products such as bags are generally high (Arı & Yılmaz, 2017; Musa et al., 2013; Shao, Cai, & Chen, 2014; Sharp, Høj, & Wheeler, 2010; see also section 4.1). When investigating the relationship between awareness and behavior explicitly, awareness of harmful effects of plastic had no effect on usage behavior (Hammami et al., 2017). To identify predictors of plastic-related behavior, we review studies that investigated possible predictors for the consumption, avoidance, and waste behavior related to plastic.

411

412 **4.2.1 Factors influencing plastic consumption behavior**

413 *4.2.1.1Sociodemographic variables*

414 Gender differences were reported for plastic bag use in a study by Hohmann et al.,
415 (2016), though without specifying in which direction. Other studies reported in more detail
416 that women were more willing to accept and apply alternatives to plastic bags than men
417 (Madigele, Mogomotsi, & Kolobe, 2017; Ryan & Jewitt, 1996; Sharp et al., 2010), and
418 showed overall more practices of reusing, reducing, and recycling than men – as do older
419 people in most cases (Kurisu & Bortoleto, 2011).

420 Older participants were more likely to participate in a no-plastic-bag-campaign (Afroz,
421 Rahman, Masud, & Akhtar, 2017). In contrast, a study on overpackaging showed that younger
422 participants were more willing to give up their convenience in order to help the environment
423 (Elgaaïed-Gambier, 2016). A Croatian study reported that younger participants favored plastic
424 and carton bottles over glass and metal, while older participants were not concerned about the
425 packaging material during purchase (Draskovic et al., 2009).

426 Higher educated people were less willing to pay for plastic bags (Madigele et al.,
427 2017) and more likely to participate in a no-plastic-bag-campaign (Afroz et al., 2017), thus
428 showing stronger plastic avoidance than less educated people.

429

430 *4.2.1.2Environmental attitudes*

431 People (esp. women) with higher environmental attitudes and education stated that
432 they more often avoided disposable plastic packaging (Jeżewska-Zychowicz & Jeznach,
433 2015). Food-related environmental attitudes were also associated with avoiding plastic
434 packaging and bags (and thus bringing one's own bag more often; Lea & Worsley, 2008).
435 Notably, in another study on reusable bags, social desirability significantly predicted
436 environmental attitudes (Yeow, Dean, & Tucker, 2014). Therefore, it is always advisable to

take social desirability into account when looking at self-reported plastic-related behavior (see also below in 4.2.1.7).

4.2.1.3Convenience

As outlined in 4.1.2.2, convenience is associated with plastic. Convenience is also a main reason for plastic bag usage (Braun & Traore, 2015) with respondents especially emphasizing easy availability and low price of such bags (Adane & Muleta, 2011; Otsyina et al., 2018). Similarly, having no alternative option at hand was the most frequently reported reason for using plastic bags (Avallone, Giraldi, & de Oliveira, 2012). Convenience outperformed the classical factors of the theory of planned behavior (i.e., attitudes, subjective norms, and perceived behavioral control; Ajzen, 1991) by being most strongly associated with the intention of using plastic bags (Sun, Wang, Li, Zhao, & Fan, 2017). Relatedly, alternatives to plastic products (e.g., zero packaging grocery stores) were seen as inconvenient and thus rendering the plastic option more attractive (Beitzen-Heineke, Balta-Ozkan, & Reefke, 2017).

4.2.1.4Context factors

Generally, the perceived advantages of plastic products seem to be more important than other psychological variables at the moment of making a decision as was indicated by a Taiwanese study on plastic bags (Lam & Chen, 2006). While both buying and reusing intentions were related to attitudes, environmental concern, and personal norms, the actual purchase behavior was not correlated with such psychological variables. Instead, only situational variables (e.g., the amount of goods being greater than expected) had predictive value (Lam & Chen, 2006). Notably, here the perceived advantages of using plastic bags are probably not inherent to plastic itself but rather due to its availability compared to alternatives. In other conditions, specific characteristics of plastic were reported to be more relevant (e.g., transparency of plastic packaging; Nørgaard Olesen & Giacalone, 2018).

463

464 *4.2.1.5Habits*

465 Additionally and related to convenience, habits are important for plastic consumption.
466 In a study on Brazilian immigrants in Canada, the participants indicated that plastic usage in
467 their homeland had been "just a habit" (Romero, Laroche, Aurup, & Ferraz, 2018, p. 8).
468 Having moved, they changed their behavior by showing greater plastic bag avoidance and
469 waste separation (Romero et al., 2018). Notably, pro-environmental attitudes remained
470 unchanged throughout the process of habitual change (Romero et al., 2018). Changed norms
471 and/or external conditions might have facilitated a change of habits in this case (see also
472 below in 4.2.1.7), which highlights the importance of cultural factors for the emergence of
473 habits.

474 Even when participants were willing to reduce their plastic consumption, they partly
475 failed because they were not able to apply new habits, as was suggested by two studies in
476 which the most common reason reported for the use of plastic bags was forgetting to bring
477 one's own bag (Bartolotta & Hardy, 2018; Musa et al., 2013). Similarly, in a Malaysian study
478 on a plastic-free-day-campaign, about 60% of the respondents regularly forgot to bring their
479 own bags during the campaign (Zen, Ahamad, & Omar, 2013).

480

481 *4.2.1.6Diffusion of responsibility*

482 Another reason that consumers do not act in line with their risk perception might be
483 that they shift responsibility to other actors like politicians (Synthia & Kabir, 2015). In
484 interviews on plastic bag pollution, Malian women emphasized structural problems (e.g., the
485 lack of appropriate waste collection services) and called for political solutions (Braun &
486 Traore, 2015). Intriguingly, when policy makers were interviewed, they emphasized the
487 consumers' responsibility (Braun & Traore, 2015).

488

4.2.1.7Social factors

Several studies suggested that social pressure is an important variable influencing the use of plastic (Arı & Yılmaz, 2017; Carrigan, Moraes, & Leek, 2011; Musa et al., 2013). Furthermore, social desirability seems to be relevant for reporting plastic avoidance behavior (Sharp et al., 2010; Yeow et al., 2014).

Initial evidence showed that guilt affects plastic avoidance (Muralidharan & Sheehan, 2017). For example, people reported both feelings of guilt and the fear of being judged or criticized by other customers, when taking plastic bags at a counter (Cherrier, 2006).

Avoidance of plastic is further utilized as a symbolic action conveying a certain social identity, as suggested by Australian consumers reporting to use reusable bags to be visibly identified as part of an environmentally friendly group (Cherrier, 2006). Similarly, avoiding plastic might be a deliberate act to firm one's cultural identity, as it was reported by women in Mali (Braun & Traore, 2015). This effect was influenced by age, as older women were more concerned about preserving their cultural heritage by avoiding plastic bags, while younger women felt rather proud of being "modern" by using plastic bags (Braun & Traore, 2015). Relatedly, fans of a certain shoe brand that promotes its plastic shoes as especially flexible and robust due to its material, form their own identity including their own name (Ferreira & Scaraboto, 2016). Similar to the emotionality of these fans of the plastic shoes, another study indicated that emotions play a larger role than rational evaluations for purchasing a product in an environmental-friendly package (Koenig-Lewis, Palmer, Dermody, & Urbye, 2014; see also Phillips, 2016, for qualitative data on affective responses towards plastic use).

Since social desirability and identity are relevant for plastic use and avoidance, it is likely that related norms are important too. When analyzing the case of a town in England where a plastic bag ban had been enforced by local traders, Carrigan and colleagues (2011) reported a shift in community norms for plastic bags throughout the process of becoming plastic bag free. Additionally, ethical evaluations had a direct (R. Y. K. Chan, Wong, &

Leung, 2008) or indirect influence on the intention to bring one's own bag (Chang & Chou, 2018).

Clapp and Swanston (2009) pointed out that anti-plastic norms first occurred in Southern countries, driven by simultaneous, non-networked bottom-up initiatives. Notably, changes in anti-plastic-norms usually go hand in hand with structural changes. Therefore, it is often difficult to attribute behavioral changes to changed norms or to facilitating external conditions as was shown in the study on immigrants by Romero and colleagues (2018; see above).

4.2.2 Factors influencing plastic waste handling

Dealing with plastic does not only include the consumption or avoidance of plastic products but also handling its waste, which includes recycling, littering, and reusing. The behavior shown depends strongly on the respective country and its cultures and infrastructure. For example, open dumping or burning is reported to be common in African countries or China (e.g., Madigele et al., 2017; Otsyina et al., 2018), whereas studies from Europe usually rate plastic as one of the most commonly recycled materials (e.g., Jones, Jackson, Bates, & Tudor, 2016). In an Indian study, households with lower income reused waste themselves, while households with higher income gave it away for reuse and recycling, suggesting that socioeconomic differences within a country might play a role as well (Pandey, Surjan, & Kapshe, 2017). There are further studies on creative waste disposal (e.g., the production of art from of recycled plastics; McKay & Perez, 2018), which are not reported here due to their individual case character. As the majority of studies addressed recycling or littering, we will focus on these.

4.2.2.1Recycling

Several studies focused on predicting recycling behavior or its intention using the theory of planned behavior. By doing so, between 29% (Knussen, Yule, MacKenzie, & Wells, 2004) and 44% (Chan, 1998) of the variance of recycling intention could be explained. Contrary to the findings mentioned above on the avoidance of plastic, social norms had no (Knussen et al., 2004; Pakpour, Zeidi, Emamjomeh, Asefzadeh, & Pearson, 2014; Tonglet, Phillips, & Bates, 2004; Tonglet, Phillips, & Read, 2004) or only weak (K. Chan, 1998; Tih & Zainol, 2012) influence on recycling intention and behavior. Examining norms further, one study found that descriptive (i.e., perception of how others actually behave) but not injunctive (i.e., perception of how others expect somebody to behave) norms predicted the intention to engage in household recycling (White, Smith, Terry, Greenslade, & McKimmie, 2009).

Constructs having an influence exceeding the constructs of the theory of planned behavior were past behavior (Knussen et al., 2004; Pakpour et al., 2014; Tonglet, Phillips, & Bates, 2004), habits (Klöckner & Oppedal, 2011; Knussen et al., 2004; Ofstad, Tobolova, Nayum, & Klöckner, 2017), action planning (Pakpour et al., 2014), moral norms, and self-identity (Pakpour et al., 2014; White et al., 2009), as well as green practice consequences (i.e., knowledge of the outcomes associated with one's green practices; Tih & Zainol, 2012).

Tonglet, Phillips, and Bates (2004) reported that recycling attitudes are the main determinant of recycling behavior, and that opportunities, knowledge, and not feeling deterred by behavior costs are antecedents of pro-recycling attitudes. Similarly, convenience or cost of recycling (e.g., the necessity of cleaning packaging before recycling; Ahmad, Bazmi, Bhutto, Shahzadi, & Bukhari, 2016; Klaiman et al., 2016), and context factors, such as the availability of waste bins (Madigele et al., 2017) or waste bins being overloaded (Vogt & Nunes, 2014), were considered important. Mass communication was identified as an antecedent of subjective norms (Chan, 1998). Unlike individual personal decisions, where environmental reasons seemed more relevant than financial incentives (Afroz et al., 2017), financial

565 considerations played a crucial role in company decisions (Meng, Klepacka, Florkowski, &
566 Braman, 2015).
567
568 *4.2.2.2Littering*
569 Sociodemographic variables predicting littering are gender, income, and education.
570 Men took stronger action against littering (Rayon-Viña et al., 2018) though findings are
571 inconsistent as in another study where women reported more concern about litter and had
572 greater personal motivation and competence to reduce it (Hartley, Pahl, Veiga, et al., 2018).
573 Littering amount per day at beaches was higher in a region frequented by people with lower
574 income and literacy degree (I. R. Santos et al., 2005).
575 People from less littered regions showed more engagement in waste reduction
576 strategies (Kiessling et al., 2017), although elsewhere concern and willingness to act were
577 higher the more litter people noticed (Hartley, Pahl, Veiga, et al., 2018). Another study found
578 no correlation between the perception of and action against littering (Rayon-Viña et al.,
579 2018).
580 Social norms were found to be an important predictor for the act of littering, and
581 awareness of the anti-social nature of littering was strongly related (Shimazu, 2018).
582 Interestingly, environmental awareness was less predictive for reported littering behavior
583 (Shimazu, 2018). Tourists were found to be primarily responsible for littering – again
584 implying the relevance of social norms as tourists might have different norms than locals (I.
585 R. Santos et al., 2005). However, this finding may also be explained by the fact that tourists
586 feel less responsible for their travel destination than locals as they stay for shorter time and
587 take less consequences, or because being on holiday may activate certain behavior patterns.
588 In summary, dealing with plastic is highly influenced by social factors (e.g., social
589 desirability and norms), context factors, convenience, and habits. As far as the handling of
590 plastic waste is concerned, there are mainly studies on recycling and littering. Recycling

591 behavior can be well predicted by the constructs of the theory of planned behavior, with social
592 norms being least important. In turn, social factors are particularly significant for littering.
593 The studies reviewed imply to consider cultural differences when studying plastic-related
594 behavior. These differences can arise because distinct external conditions prevail in different
595 countries, but they may also be explained by varying norms, among others.
596

597 ## 4.3 Solutions to tackle the plastic problem

598 In view of the huge challenges elicited by plastic consumption, solutions to tackle the
599 plastic problem are needed. First, we introduce a variety of regulatory and economic policy
600 instruments aimed at reducing plastic use which either already exist or are considered for
601 implementation in countries around the world. Second, we will review "softer" and more
602 psychological intervention strategies which are currently tested.
603

604 ### 4.3.1 Regulatory and economic policy instruments to reduce plastic use

605 There are two main types of policy instruments aimed at reducing plastic use. While
606 some countries have imposed full or partial bans on plastic bags or other plastic items, other
607 countries prefer economic policy instruments such as fees, levies, or taxes that are paid either
608 by the retail industry or the consumers (Ritch, Brennan, & MacLeod, 2009; Saidan, Ansour,
609 & Saidan, 2017; Syberg et al., 2018; Wagner, 2017). The implementation of these instruments
610 varies between and within countries with respect to policy details (e.g., the size and thickness
611 of plastic bags). Here, we provide a brief overview of the two types of policy instruments and
612 discuss some related psychological and political aspects. It is still unclear which instruments
613 are most environmentally effective and politically acceptable (Ritch et al., 2009). In addition,
614 note that another policy strategy, namely the so-called 'Extended Producer Responsibility',
615 aims to return the responsibility for products after their use back to the producers, for example

by taking back, reusing, or recycling products (optionally by a third party; see Hanisch, 2000; McKerlie, Knight, & Thorpe, 2006). However, as we focus on consumers in this review it is not elaborated here.

4.3.1.1Bans

Bans of some kind are a widely adopted policy action and they are, by their nature, an effective way to reduce plastic use. Nevertheless, it is important to consider some potential unintended consequences, such as the use of alternative bags (e.g., of paper). The latter may be as harmful for the environment as plastic bags, but may be judged by consumers as more environmentally friendly (Synthia & Kabir, 2015; and see above in section 4.1.2.1). This effect can be countervailed by also imposing fees or taxes on alternative bags, which was done successfully in many US local governments (Wagner, 2017). Another problem associated with bans is that they may evoke strong consumer resistance. This, in turn, may reduce the political acceptability of this policy instrument. However, research from Australia indicates that those consumers who strongly relied on plastic bags before a ban became supportive of the policy after its introduction, which may be due to visibility of their positive environmental effects (Sharp et al., 2010). A study from Brazil also showed high approval ratings after the ban was introduced, with over 86% of the participants considering the new law important or very important (Santos, Sousa, Sampaio, & Fagundes, 2013).

4.3.1.2Plastic charges and other types of economic incentives

The seemingly most widespread policy instrument to reduce plastic use is the introduction of a charge (alternatively referred to as "tax" or "fee", depending on context). Several studies have examined the effectiveness of a charge in changing behavior as well as its acceptance by customers and industry. With respect to effectiveness, studies from various high- and low-income countries indicated that disposable plastic bag use dropped by 40% to

642 90% after implementing a charge (e.g., Convery, McDonnell, & Ferreira, 2007; Dikgang,
643 Leiman, & Visser, 2012; Dikgang & Visser, 2012; He, 2012; Poortinga, Whitmarsh, &
644 Suffolk, 2013; Thomas, Poortinga, & Sautkina, 2016). For example, Wales introduced a 0.07€
645 charge for "single-use carrier bags" in 2011. The distribution of such bags fell by over 80%,
646 while the number of people "always" bringing their own shopping bag increased by over 20%
647 (Poortinga et al., 2013; Thomas et al., 2016). Noteworthy, such changes were not observed in
648 other UK countries where no charge was introduced during that time. Moreover, the results
649 from Thomas and colleagues (2016) suggest that the plastic charge had additional
650 environmental effects, namely insofar as the use of one's own bag seemed to have increased
651 the adoption of other, unrelated types of pro-environmental behaviors and attitudes (see also
652 Truelove, Carrico, Weber, Raimi, & Vandenbergh, 2014, for a theoretical review on spillover
653 research).

654 Some authors, however, suggested that the impact of a plastic charge might be
655 overestimated, because unobserved factors such as changes in social norms are often not
656 accounted for when comparing simple differences before and after the implementation of a
657 charge (Rivers, Shenstone-Harris, & Young, 2017). In other words, it may not just be the
658 monetary incentive that drives the behavioral changes, but also anti-plastic norms which
659 inspire the introduction of the policy, but arguably may also be a consequence of it. This
660 relates to research investigating the underlying motives of behavioral change resulting from a
661 plastic charge. For example, a study from Portugal showed that for most of the participants
662 indeed the main reason for not using plastic bags was to avoid the payment, but other reasons
663 associated with convenience and environmental concern were mentioned as well (Martinho,
664 Balaia, & Pires, 2017). Another issue related to the policy effectiveness is the long-term
665 dynamics. That is, in some countries such as South Africa it was observed that demand for
666 plastic bags went down as a consequence of introducing a charge, but after approximately a
667 year increased again, though never completely to initial levels (Dikgang et al., 2012; Dikgang

& Visser, 2012; Hasson, Leiman, & Visser, 2007). While this particular case can partially be explained by the fact that the initial charge levels were decreased, these observations certainly suggest the need for more long-term research to assess the instrument effects.

Finally, plastic charges are relatively accepted by consumers as well as the retail industry. For example, the Irish plastic bag levy is very well perceived by retailers because of financial savings, whereas almost all consumers perceived positive environmental benefits and no negative effects in terms of convenience (Convery et al., 2007; see also Zen et al., 2013). Nevertheless, research from Argentina indicates somewhat lower levels of acceptance by consumers, which may be due to differences in environmental concern or in terms of how the government has implemented and communicated the policy (Jakovcevic et al., 2014).

Another type of economic incentive is provided by deposit-refund systems, which compensate consumers monetarily for returning plastic products. For example, research from the US and Australia shows that coastal debris is approximately 40% lower in states that have such a refund system compared to others without it (Schuyler, Hardesty, Lawson, Opie, & Wilcox, 2018). Relatedly, we present additional findings on recycling schemes below in section 4.3.2.1.

To conclude, regulatory and economic public policies are effective in reducing plastic use. While bans are evidently most effective, they may not be politically feasible in every context. Plastic charges are a promising alternative, though more research is needed to investigate their long-term effects.

4.3.2 Psychological interventions

Beyond regulatory and economic interventions less coercive ones, such as educational approaches or improvement of infrastructure, are aimed at increasing awareness and to encourage behavior change. Guided by the three R's of waste management (recycle, reuse,

693 and reduce; Thompson, Moore, vom Saal, & Swan, 2009), we now provide an overview of
694 psychological interventions that aim at tackling the plastic problem.
695
696 *4.3.2.1Recycle*
697 In the 1980's, many studies examined recycling and littering behavior as well as the
698 influence of personal and situational factors on them (for reviews, see Schultz, Oskamp, &
699 Mainieri, 1995; Huffman, Grossnickle, Cope, & Huffman, 1995). Later meta-analyses have
700 focused on recycling in different settings such as at the workplace (Oke, 2015) or at home
701 (Varotto & Spagnolli, 2017). However, most studies did not explicitly focus on plastic. Yet, a
702 generalization over materials might be problematic when predicting recycling behavior
703 (Schultz et al., 1995). In the following, only studies that investigated plastic explicitly are
704 reviewed.
705 *Accessibility of recycling schemes*. Most of the studies investigated interventions at
706 the point of action. The implementation of recycling stations in university settings encouraged
707 recycling behavior (McCoy, Oliver, Borden, & Cohn, 2018; O'Connor, Lerman, Fritz, &
708 Hodde, 2010; Ofstad et al., 2017). While lower distances to recycling bins enhanced
709 recycling, a mere increase of bin quantity did not (O'Connor et al., 2010). Recycling amount
710 of household plastic waste was higher when people had to bring it to public places, compared
711 to when it was collected at the sidewalk, although more people participated in the latter
712 (McDonald & Ball, 1998). In other studies, the recycling rate for household collection was
713 higher than for "bring" schemes (Struk, 2017; Viscusi, Huber, & Bell, 2012). Additionally,
714 incentives increased the overall recycling rate of plastic (Struk, 2017). Similarly, deposit
715 systems for plastic bottles increased the attractiveness of "bring" schemes (Viscusi et al.,
716 2012). Although, higher density of drop-off sites for "bring" schemes had only small effects
717 (Struk, 2017), recycling rates decreased markedly when they were more than five miles away
718 (Viscusi et al., 2012). In a Japanese study, people had a higher willingness to pay for less

719 packaged shampoo when a unit-based pricing system of waste collection existed in their
720 municipality. However, the general willingness to pay was quite low. When unit-based
721 pricing was combined with plastic separation, willingness to pay decreased suggesting that
722 recycling can lessen plastic reduction behavior (Yamaguchi & Takeuchi, 2016).

723 *Appearance of recycling stations.* People in Greece associate certain colors of public
724 bins with different waste materials; while yellow was preferred for used plastic water bottles
725 in particular, orange, yellow, or purple was chosen for plastic or packaging in general
726 (Keramitsoglou & Tsagarakis, 2018). However, only changing the color of the bin had no
727 effects on recycling rate as a US study indictaed (O'Connor et al., 2010). Moreover, covered
728 bins with special drop slots and lids were preferred (Keramitsoglou & Tsagarakis, 2018).
729 Other studies showed that signs prompting recycling increased correct recycling even when
730 proximity to the bin decreased, and hence highlight the role of messages on the bins,
731 especially in combination with the implementation of recycling schemes (Fritz et al., 2017;
732 Miller, Meindl, & Caradine, 2016). Furthermore, positive messages such as "thank you" or
733 those referring to the environment encouraged people to continue recycling (Keramitsoglou &
734 Tsagarakis, 2018).

735 *Informational campaigns.* Recycling behavior was strengthened when information
736 campaigns were added to the implementation of recycling schemes (Cheung et al., 2018;
737 Ofstad et al., 2017; Pearson et al., 2014). Information campaigns using posters, TV screens,
738 flyers, websites, or broader environmental campaigns increased awareness, knowledge, and
739 self-reported disposal behavior (Cheung et al., 2018; Ofstad et al., 2017; Pearson et al., 2014).
740 In contrast, informational treatments using text or video did not increase recycling behavior
741 but rather changed using preferences from plastic packaging to paper and boxboard (Klaiman
742 et al., 2016). Nevertheless, a lack of instructions might be a barrier to recycle plastic (Vogt &
743 Nunes, 2014). While pushy requests (e.g., "You must recycle plastic container") were
744 persuasive for recipients who already valued recycling as important, suggestive appeals (e.g.,

745 "It's worth recycling plastic containers") were more effective to initiate recycling intention
746 for those who find recycling less important (Kronrod, Grinstein, & Wathieu, 2012). When
747 participants were asked to plan and visualize when, where, and how to recycle their used
748 plastic cups and old paper, this type of implementation intention increased recycling rates and
749 thus decreased the number of cups in the dustbins by roughly 75% (Holland, Aarts, &
750 Langendam, 2006). An awareness campaign including knowledge transfer and vocational
751 training was also proposed to increase recycling in refugee camps in Jordan (Saidan, Drais, &
752 Al-Manaseer, 2017).

753 *Rebound effects.* In an online experiment participants were asked to do their typical
754 grocery shopping in an online supermarket. After shopping they got fictitious feedback
755 independent of their real shopping behavior. When people were told that they were considered
756 as "green shoppers" (in comparison to a bogus peer group), participants recycled less of
757 disposed material they got for a creativity task before (Longoni, Gollwitzer, & Oettingen,
758 2014). The decreased motivation to gain a green identity in this group indicates a self-
759 licensing effect, signifying people who feel save in their goal achievement (e.g., being a green
760 consumer) makes people to worry less about other unsustainable behavior (Longoni et al.,
761 2014). Similarly, US students were experimentally triggered to either recycle a water bottle,
762 to throw it in the trash, or neither. Those who identified as Democrats and recycled their
763 bottle were less willing to support a green fund compared to the control condition (Truelove,
764 Yeung, Carrico, Gillis, & Raimi, 2016). This effect was mediated by environmental identity,
765 indicating that for Democrats (who already show a high recycling baseline) recycling might
766 be too easy to increase environmental identity. Thus, promoting recycling in certain groups
767 could lead to a decrease in pro-environmental behavior in general (Truelove et al., 2016).

768 *Conclusion.* Implementing recycling schemes are necessary to increase recycling.
769 However, it needs to be well planned, especially with a view on local conditions (i.e.,
770 proximity of bins, combination with incentives and information) and rebound effects of

771 recycling policy. An elaborate but powerful approach is implementation intention to tackle
772 habit change for a concrete behavior.
773
774 *4.3.2.2Reuse*
775 One main characteristic of plastic is its durability. In a somewhat paradoxical contrast,
776 it is mostly used in a disposable manner. Increasing the reuse of plastic products might
777 therefore provide a solution to the wastage of this durable material. For example, in
778 interviews, respondents stated to use plastic bottles "for a purpose other than that for which it
779 was initially designed" (Caner & Pascall, 2010, p. 418) when a screw-type closure is used and
780 bottles could be easily cleaned and refilled. However, only a few studies, which we review in
781 this section, evaluated interventions related to reuse in order to avoid plastic waste. Most of
782 them focus on beverage containers or plastic bags.
783 *Provision of alternatives.* US students who received a reusable water bottle and plastic
784 cutlery for their matriculation used less disposable bottles and supported the bottle ban at the
785 university (Santos & Van der Linden, 2016). Similarly, information about the reduction of
786 plastic bottles before implementing a water refill system helped to increase the willingness to
787 pay, environmental awareness, and responsibility attribution in Japanese students (Uehara &
788 Ynacay-Nye, 2018). In the UK, different interventions on reusable coffee cups were evaluated
789 and the study authors concluded that providing a reusable cup increased its use, even in the
790 long run (Poortinga & Whitaker, 2018). Furthermore, a charge on disposable cups – but not a
791 discount – increased the use of the reusable cup. The single intervention had only small
792 effects but they increased when combining interventions, in particular when message framing
793 is added (Poortinga & Whitaker, 2018).
794 *Rewards and framing.* The interventions using a ban or taxes leading to the reuse of
795 plastic bags were already mentioned above. Another program successfully encouraged
796 consumers – even in the long run – to use reusable instead of plastic bags via monetary

797 rewards and peer pressure (Jiang, 2016). Advertisements in a US supermarket encouraging
798 consumers to bring reusable bags were either formulated as a gain "Bring reusable bags and
799 avoid a fee" or as a loss "Bring reusable bags or pay the tax". While both ads worked, the first
800 was less effective for people with low self-transcendence values (i.e., higher egoistic needs
801 and low environmental awareness; Muralidharan & Sheehan, 2016, 2017). Vones, Allan,
802 Lambert, and Vettese (2018) presented another option to build awareness for the reuse of
803 plastic (without evaluating the project) by doing a beach-clean-up with a subsequent 3-D-
804 printing workshop reusing the collected waste.

805 *Conclusion.* Providing alternatives such as reusable coffee cups or refillable bottles are
806 promising approaches to reduce plastic waste. However, they are quite expensive and thus
807 charges or bans may be more attractive for stakeholders. Moreover, alternatives have only
808 selective effects with regard to a concrete product questioning the broader scope. Regulations
809 of prices yielded to more reuse – not only due to the money benefit but also because of a
810 subsequent shift in norms. Similar to recycling, a combination of available options and
811 information campaigns seem to be promising.

812

813 *4.3.2.3Reduce*

814 While both recycling and reuse practices lower the plastic waste in the environment,
815 they cannot alleviate resource use in general. Thus, reducing plastic use and production are
816 critical. Both consumers and salespersons play essential roles for demand and supply.
817 Recently, so called "zero waste" grocery stores emerged, and both advantages and
818 disadvantages thereof are discussed in the literature (Beitzen-Heineke et al., 2017). However,
819 most of the studies focusing on plastic reduction behavior refer to education on marine litter
820 and address children, educators, and public.

821 *Educating school children.* School education programs increased both knowledge
822 about causes and impacts of marine litter and environmental behavior intention in children

(Hartley et al., 2015; Owens, 2018; So et al., 2016; Veiga et al., 2016). Active learning elements such as gaming simulations with role plays in a simulated city (Yeung, So, Cheng, Cheung, & Chow, 2017), inquiry learning strategies including independent learning with experiments (Hartley et al., 2015; Yeung et al., 2017), collecting of marine debris and report writing for a state legislator (Owens, 2018), and video contests about marine litter in different European countries (Hartley, Pahl, Holland, et al., 2018; Veiga et al., 2016) were used to change knowledge and behavior. Gaming simulation further induced attitude change via cognitive dissonance (i.e., psychological discomfort due to inconsistency between one's beliefs and behaviors; Yeung et al., 2017). Inquiry learning strategies focusing on the classification of plastics failed to increase waste-related behavior (i.e., reduce, reuse, and recycle) but led to an increase in knowledge about plastic types (So et al., 2016). Inquiry learning strategies including experiments, artworks, and demonstrations on marine litter revealed some overarching effects, as school children's self-reported behavior on littering and buying plastic packaging was reduced while the motivation to encourage others to do so increased (Hartley et al., 2015).

Training of stakeholders. Some programs did not address school children directly but aimed at teaching educators. After working with an online tool that included learning about marine litter and pedagogical skills, knowledge and perceived skills of educators increased and they expressed high intentions to integrate marine litter education in future classes (Hartley, Pahl, Holland, et al., 2018; see Cheung et al., 2018, for a similar study). Moreover, art presentation in an educational context was discussed to initiate useful conversations with children about mass consumption and pollution (O'Gorman, 2017).

Educating the public. To raise awareness for plastic pollution, several countries have implemented campaigns. For example, activities developed by the MARLISCO initiative (e.g., public exhibitions, stakeholder meetings, and education tools) increased the feeling of being part of the solution as well as societal awareness and engagement related to marine

litter (Veiga et al., 2016). An online campaign for adolescents that included tailored information (e.g., small action steps) increased knowledge, attitude, or behavior intention depending on the respective participants' stage of change (Chib, Chiew, Kumar, Choon, & Ale, 2009). When different councils in Australia were compared, those with educational campaigns on why and how to dispose waste correctly had less waste on their coastlines (Willis, Maureaud, Wilcox, & Hardesty, 2018). Furthermore, Greek informational campaigns aimed to reduce plastic bags raised the willingness to pay for protection of coastal environments but had no effect on the willingness to take action (Latinopoulos, Mentis, & Bithas, 2018).

Participation in plastic-reduction activities. Citizen science projects in which people are asked to participate in beach clean-ups increased the awareness of marine littering (Syberg et al., 2018; Yeo et al., 2015). Knowledge and positive attitudes were underlying factors for the willingness to participate in "plastic-free"-campaigns in Malaysia (Afroz et al., 2017). When fishermen encouraged others not to litter and participated also in beach clean-ups they developed a sense of ownership for "their" beaches along with a feeling of responsibility (Brennan & Portman, 2017). Involving school students in plastic-free practices, in which they helped to organize activities as co-researchers, led to an improvement in their awareness and behavior of littering (Mapotse & Mashiloane, 2017).

Interventions at the point of consumption. Looking at the product presentation, a non-overpacked product tagged with "No excess packaging" increased the purchase of these products. When this tagged product was additionally combined with a premium brand the purchase rate was highest (Elgaaïed-Gambier, 2016). A voice prompt by the salesperson during the purchase situation (i.e., customers were asked whether they wanted a free plastic bag instead of automatically handing them one) lead to a 5% decrease in plastic bag consumption (Ohtomo & Ohnuma, 2014). To motivate shop owners in Indonesia to sell reusable instead of plastic bags, information activating authority endorsements (i.e., head of

875 the village supports the idea of distributing reusable bags) was more effective than
876 information activating social norms or monetary incentives (Spranz, Schlüter, & Vollan,
877 2018). Such social influence of role models is also important for recipients indicated by the
878 finding that the intention to reduce plastic waste was increased when recipients have read a
879 media report with an actor behaving ecologically, whereas the actor's social proximity was
880 relevant when recipients had low environmental consciousness (Arlt, Kuhlmann, & Wolling,
881 2012). Furthermore, making one's intention public helps to reduce plastic consumption via
882 social pressure. Participants who signed a commitment to refuse free plastic bags were more
883 likely to reduce their use afterward (Rubens, Gosling, Bonaiuto, Brisbois, & Moch, 2015).
884 Reese and Junge (2017) used a game in which people could mark a plastic consumption
885 pattern on a card after its realization (e.g., using a bag for purchase or making a purchase
886 without plastic packaging) and then give it to another person of choice. When the task was
887 perceived as moderately difficult, participants' collective efficacy (i.e., their feeling that
888 acting together helps reach a goal) was highest and most predictive for behavioral intentions.

889 *Conclusion*. Participation in clean-up activities and educational approaches was
890 effective to raise awareness and partly also to change behavior intention. Focusing on school
891 children and their educators is promising to create awareness for environmental challenges at
892 an early age. Overall, inquiry learning strategies and gaming approaches encouraging people
893 to get active themselves seem most promising. The role of social norms became apparent as
894 far as the concrete purchase situation is concerned. Making one's purpose public via
895 commitment or introducing role models were successful approaches to reduce plastic
896 consumption. Nevertheless, more research is needed to identify factors for a general
897 transformation in purchase or reduction behavior.

898

5 Discussion

5.1 Summary

The current review gave a comprehensive overview of the available social-scientific literature addressing plastic with a focus on risk awareness, consumer preferences, plastic use and disposal behavior, and behavior-oriented intervention strategies. By reviewing 187 articles from all over the world, this review provides a summary of the existing knowledge for researchers and stakeholders worldwide. Further, it identifies promising behavior-based solutions for the plastic problem.

The literature search revealed that interest in the plastic problem has markedly increased in social science in the last few years (Figure 2). These studies were from different countries worldwide. Although large-scaled surveys were relatively rare and focused mostly on countries in Europe or the US (Gelcich et al., 2014; Hartley, Pahl, Veiga, et al., 2018; Herbes et al., 2018), single studies were from all over the world and lead to a relatively weak bias for industrialized nations compared to other areas of research in which this bias is stronger. As plastic pollution is most often perceived as a threat for marine ecosystems (see Lotze et al., 2018, for a worldwide comparison), our review also indicates that most studies originate from countries with a coastline (Figure 1). The visibility of the problem in marine areas might have led to a stronger interest in this field. In total, across the 187 studies reviewed samples from 57 countries were investigated (Figure 1). Similarly, the first authors of the reviewed studies had an affiliation in 49 different countries (see S1 for an overview of all reviewed studies, the location of data collection, and the country where the first author was based at the time of publication). Although this diversity of study samples is important and much appreciated, drawing general conclusions is – so far – difficult due to the yet limited number of studies per country and their associated culture(s), laws, infrastructure, and further situational factors.

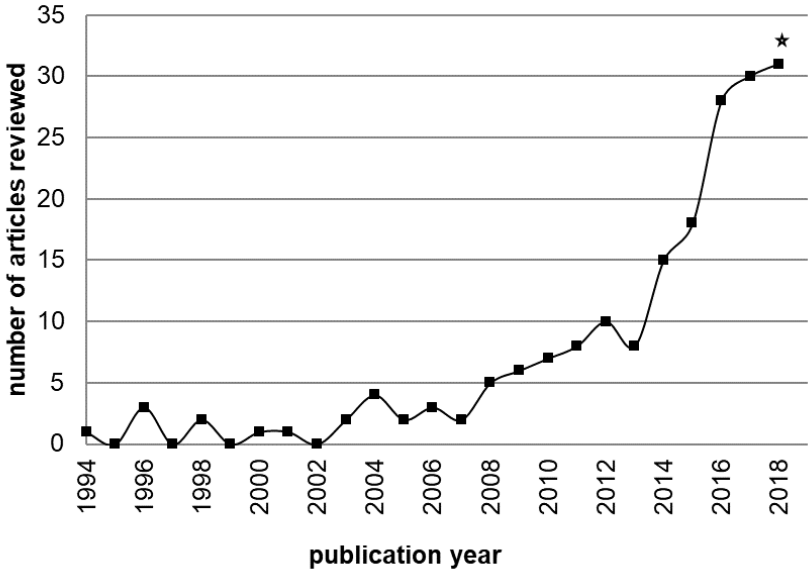

Figure 2. Number of articles reviewed by year of publication. * Note that only articles published before September 27, 2018 were considered in this review.

Overall, the studies reviewed were from different (sub-)disciplines, including marketing, consumer studies, psychology, educational science, and environmental science, presenting a diversity of perspectives on the present topic. The articles covered various methodological approaches making comparisons and general conclusions difficult. Many studies, especially those focusing on awareness, perception, and attitudes, were of a qualitative nature. Moreover, most studies on behavior either focused on intention or self-reported behavior rather than actual behavior – although there are well-known gaps between attitudes, intentions, and behavior (see Kollmuss & Agyeman, 2002).

The studies identified high problem awareness of plastic pollution. In addition, people perceive certain health hazards related to plastic consumption. Although plastic is perceived as rather environmentally unfriendly, it is frequently used and appreciated for its practical functions and availability. Thus, plastic consumption is generally high, but this also seems to

940 vary between contexts and cultures. Similarly, this might be the case for reusing plastic as, for
941 example, people with lower income tend to reuse plastic more often (Pandey et al., 2017). The
942 reviewed studies showed that knowledge about alternatives to plastics and their characteristics
943 is relatively low. Behaviors related to the use of plastic seem to be most affected by habits and
944 (social) norms. Both political (e.g., bans, charges) and psychological (e.g., inquiry learning
945 strategies, implementation intention) intervention strategies aim to change these by focusing
946 on habits, availability, costs, situational factors, and awareness.
947

948 ## 5.2 Implications for behavior-based solutions

949 Although problem awareness is high, behavior change does not follow automatically,
950 mainly because of the following obstacles: 1) perceived practicability and convenience in the
951 consumption context, 2) lack of knowledge on how to implement alternatives or lack of
952 opportunities, 3) strong habits, and 4) shift of responsibility. Therefore, behavior-based
953 solutions need to approach these issues. This may be done in an interdisciplinary manner. For
954 example, by designing (by engineers), evaluating (by material, environmental, and social
955 scientists) and promoting (by media) alternative materials that do have the appreciated
956 properties of plastic but are more environmentally friendly (e.g., see Haider et al., 2018, for a
957 good example considering some of these aspects). Consumers have not only insufficient
958 knowledge about alternative materials but also about what an environmentally friendly
959 material is, as indicated by the divergence of consumer perception and life cycle analyses (see
960 chapter 4.1.2.1). Since consumers focus mainly on post-consumption (e.g., recyclability),
961 more information about environmental impacts in the whole life cycle of a product may
962 increase the knowledge about environmentally friendly materials and guide the consumer to
963 better alternatives. However, since awareness and knowledge are not the only relevant factors
964 influencing behavior, an increase in these does not necessarily imply a change in behavior.

Despite the attitudes of the consumers, situational factors such as an appropriate infrastructure for alternatives need to be considered. Moreover, social and personal factors as well as habits play a crucial role, as suggested by the studies on plastic-related behavior. To initiate a habit change, 'windows of opportunity' (Schäfer, Jaeger-Erben, & Bamberg, 2012) – periods where people are open for new behaviors as external conditions change (e.g., relocation) – may be preferably used. As windows of opportunity are not always available, a change in situational factors such as the provision of alternatives should also be used to initiate new behavior. Individuals that start a new behavior, might lead others to follow, can hence change norms, and set a spiral of action in motion. Thus, reaching a critical mass of acting people is helpful.

For all behavior-based solutions, it is important to consider structural, situational, and cultural factors. Although, the available literature is insufficient to make a final conclusion, awareness of the situation in a specific region (e.g., whether there is infrastructure for recycling) and what problems are most pressing (e.g., health hazards and thus importance of hygienic packaging) helps to identify the change of behavior that is most promising (cf., Steg & Vlek, 2009). Moreover, depending on particular circumstances and/or cultural background, demands of situational factors and infrastructure need to be considered (e.g., waste management in refugee camps vs. residential complexes; cf., O'Connor et al., 2010; Saidan, Drais, et al., 2017).

The reviewed literature shows that plastic consumption and avoidance is generally similar to other environmental behaviors as 1) it affects several aspects in life (as does mobility, for instance), 2) there is a conflict between problem awareness and behavior, and 3) it is predicted by situational factors as well as personal factors such as sociodemographics, habits, control beliefs, moral, and social norms. Therefore, models explaining pro-environmental behavior, such as the so-called SIMPEA which addresses social identity processes that affect appraisal and response to collective environmental challenges (Fritsche, Barth, Jugert, Masson, & Reese, 2017), might be helpful to further understand and study

991 plastic-related behavior. Additionally, knowledge from available behavior-based solutions on
992 other environmental behaviors can be used to create interventions – and *vice versa*. For
993 example, the success of plastic bag bans, fees, and taxes may motivate bans of other
994 environment-damaging products. However, so far, the field lacks studies evaluating the long-
995 term effects of such political interventions. What makes plastic-related behavior special is its
996 diversity (consumption of alternatives, avoidance, reuse, recycling). Thus, a close look at
997 specific behavioral antecedents as well as examining the impact of political measures as bans
998 or change in infrastructure becomes therefore necessary in intervention context.

999 Citizen science and organized clean-ups appear to be promising approaches to raise
1000 awareness and responsibility, motivate reuse, and change behavior since, for example, people
1001 residing near clean beaches engage more in waste-reduction approaches (Kiessling et al.,
1002 2017). Further, organized clean-ups might be successful due to two other factors: creating a
1003 new habit by doing it once with instructions and strengthening the social norm by doing it
1004 with others. Since humans are social beings, social norms play a major role in
1005 (environmental) behavior. As it was pointed out throughout the review, norms predict
1006 different forms of plastic-related behavior although they were not as strong as in classical
1007 studies using the theory of planned behavior. Moreover, successful intervention studies with
1008 role models and voice prompts by salespersons highlight the social factor. Therefore,
1009 interventions that change norms are promising. When combined with adjusted situational
1010 factors and information they might have even bigger effects. Overall, intervention strategies
1011 should be combined since, so far, no strategy alone is sufficient to reduce the immense use of
1012 plastic. Moreover, the interventions need to be well-planned to reduce unwanted effects (e.g.,
1013 licensing effects, perceived green-washing, or rebound-effects) and to meet the needs of the
1014 target group and therefore gain their acceptance.

1015 Furthermore, different actors are needed to approach the plastic problem from various
1016 directions. While educators, media directors, and organizers of activities, such as beach clean-

ups, are in positions to raise awareness, increase knowledge, and train alternative behavior patterns, stakeholders, politicians, and salespersons are capable to adjust general circumstances and situational factors to change consumption and waste behavior. For example, promoting a 'circular economy' or implementing an 'Extended Producer Responsibility' might be fruitful to make producers accountable and thus should be pursued by politics and public. Despite recently introduced laws on the national level that contribute to tackling the plastic problem (e.g., prohibition of plastic microbeads in cosmetics, U.S. Government Publishing Office, 2015), present developments (e.g., China's recent decision to stop accepting plastic from other countries) underline the pressing need for global, integrated solutions.

5.3 Implications for future research

The current review and conclusions have some limitations which, on the one hand, are due to the nature of plastic and behavior related to it, and on the other hand due to characteristics of the available literature. Plastic-related behavior is diverse and thus difficult to delineate. Although we reviewed a large amount of studies, only few focused on a particular behavior (e.g., avoiding plastic) and thus conclusions on these are limited. In contrast, recycling behavior is very well studied but plastic was explicitly considered only sparsely. This diversity, non-specificity, and the limited amount of studies might lead to different predictors of behavior and a low comparability of findings. Therefore, future studies should further investigate plastic-specific behavior and focus on real instead of reported or intended behavior. Furthermore, methods measuring (plastic) avoidance behavior should be developed. Moreover, research should endeavor to study breaking habits, since this is needed to change plastic-related behavior in the long-term.

In general, most studies investigating perception and consumption focused on plastic as packaging material or bags, while littering and recycling studies often did not classify waste origin or type. Interestingly, we found only a few studies investigating attitudes or behaviors related to microplastics, although this issue is hotly debated in both science and media. So far, the social-scientific literature largely ignored plastic types other than packaging or bags. We therefore recommend that future studies focus also on microplastics and other origins of plastic waste (e.g., from fishing utensils, electronic devices, or agriculture).

Noteworthy, some studies were interdisciplinary, combining for example psychology and environmental science. However, the field lacks studies in the areas of media and communication science although plastic became more and more abundant in the media and thus scientific work on the effects of such media presence is much needed. Since plastic-related perception and behavior and the research of these is so diverse, this review is rather descriptive, and may not sufficiently cover the entire literature relevant. Furthermore, the quality of the studies reviewed varied strongly and was generally rather low compared to the standard of current psychological research. Therefore and because of the limitations above, conclusions should be taken with caution and future studies are needed to confirm the findings.

5.4 Conclusion

The plastic problem is a major challenge of our times and needs interdisciplinary and global solutions. This review provides a first overview of the social-scientific literature and can serve as a basis for both researchers and stakeholders to develop further investigations and implement behavior-based solutions. The current work shows that the research field is growing, very diverse, originating from different countries and disciplines, and using a wide range of methods. Because of the limitations mentioned above, general conclusions are

difficult. Nevertheless, the reviewed literature suggests that, although problem awareness is high, the perceived advantages of plastic, consumer habits, and situational factors make it difficult for people to act accordingly. Bans and increased costs of plastic products as well as a combination of psychological interventions seem to be promising measures to reduce plastic consumption and waste. All actors from science, policy, industry, trade, and the general public have to work together to avoid a shift of responsibility. More research is needed to improve current interventions and to create additional powerful, immediate, and global solutions to limit the amount of plastic waste in the environment.

6 Acknowledgments

The authors would like to thank Katherine Muñoz for her valuable input to the natural scientific problem description. We thank Manfred Schmitt, Gerhard Reese, and Zacharias Steinmetz for helpful comments on a previous version of the manuscript, as well as Michaela Maier, Jutta Milde, Gabriele Schaumann, and Kristen Werling for fruitful discussions. Furthermore, we like to thank Sophie Dickel for her support in reference management. The authors have no competing interests to declare.

7 Funding

This work was supported by the European Research Council [grant number 741087].

8 Author statement

Lea Marie Heidbreder: Conceptualization, Methodology, Investigation, Writing - Original Draft, Visualization. **Isabella Bablok**: Conceptualization, Methodology,

Investigation, Writing - Original Draft, Visualization. **Stefan Drews**: Investigation, Writing - Original Draft. **Claudia Menzel:** Conceptualization, Methodology, Investigation, Writing - Original Draft, Visualization.

9 References

*Adane, L., & Muleta, D. (2011). Survey on the usage of plastic bags, their disposal and adverse impacts on environment: A case study in Jimma City, Southwestern Ethiopia. *Journal of Toxicology and Environmental Health Sciences*, *3*(8), 234–248.

*Aday, M. S., & Yener, U. (2014). Understanding the buying behaviour of young consumers regarding packaging attributes and labels. *International Journal of Consumer Studies*, *38*(4), 385–393. https://doi.org/10.1111/ijcs.12105

*Afroz, R., Rahman, A., Masud, M. M., & Akhtar, R. (2017). The knowledge, awareness, attitude and motivational analysis of plastic waste and household perspective in Malaysia. *Environmental Science and Pollution Research*, *24*(3), 2304–2315. https://doi.org/10.1007/s11356-016-7942-0

*Ahmad, M. S., Bazmi, A. A., Bhutto, A. W., Shahzadi, K., & Bukhari, N. (2016). Students' Responses to Improve Environmental Sustainability Through Recycling: Quantitatively Improving Qualitative Model. *Applied Research in Quality of Life*, *11*(1), 253–270. https://doi.org/10.1007/s11482-014-9366-7

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

*Ali, J., & Kapoor, S. (2008). Consumers' perception on fruits and vegetables packaging in India. In *18th Annual World Symposium of the International Food and Agribusiness Management Association (IAMA) on Meeting Food System Challenges through Innovation and Entrepreneurship* (pp. 1–12). Monterey, California.

*Anderson, A. G., Grose, J., Pahl, S., Thompson, R. C., & Wyles, K. J. (2016). Microplastics in personal care products: Exploring perceptions of environmentalists, beauticians and students. *Marine Pollution Bulletin*, *113*(1–2), 454–460. https://doi.org/10.1016/j.marpolbul.2016.10.048

*Arı, E., & Yılmaz, V. (2017). Consumer attitudes on the use of plastic and cloth bags. *Environment, Development and Sustainability*, *19*(4), 1219–1234. https://doi.org/10.1007/s10668-016-9791-x

*Arlt, D., Kuhlmann, C., & Wolling, J. (2012). Ecological role models? The effect of the depiction of ecological activities in the media on the behavioral intentions of the recipients. *Studies in Communication and Media*, *1*(3–4), 411–442. https://doi.org/10.5771/2192-4007-2012-3-411

*Avallone, I. V., Giraldi, J. D. M. E., & de Oliveira, S. V. W. B. (2012). Conscious consumption: A study on plastic bags' consumers in Brazil. *International Journal of Psychological Studies*, *4*(1), 122–134. https://doi.org/10.5539/ijps.v4n1p122

*Ballance, A., Ryan, P. G., & Turpie, J. K. (2000). How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula, South Africa. *South African Journal of Science*, *96*, 210–213.

*Barnes, M., Chan-Halbrendt, C., Zhang, Q., & Abejon, N. (2011). Consumer preference and willingness to pay for non-plastic food containers in Honolulu, USA. *Journal of Environmental Protection*, *2*(9), 1264–1273.

*Barnett, A. J., Wiber, M. G., Rooney, M. P., & Curtis Maillet, D. G. (2016). The role of public participation GIS (PPGIS) and fishermen's perceptions of risk in marine debris mitigation in the Bay of Fundy, Canada. *Ocean and Coastal Management*, *133*, 85–94. https://doi.org/10.1016/j.ocecoaman.2016.09.002

*Bartolotta, J. F., & Hardy, S. D. (2018). Barriers and benefits to desired behaviors for single use plastic items in northeast Ohio's Lake Erie basin. *Marine Pollution Bulletin*, *127*,

576–585. https://doi.org/10.1016/j.marpolbul.2017.12.037

*Bech-Larsen, T. (1996). Danish Consumers' Attitudes to the Functional and Environmental Characteristics of Food Packaging. *Journal of Consumer Policy*, *19*, 339–363.

*Beeharry, Y. D., Bekaroo, G., Bokhoree, C., Phillips, M. R., & Jory, N. (2017). Sustaining anti-littering behavior within coastal and marine environments: Through the macro-micro level lenses. *Marine Pollution Bulletin*, *119*(2), 87–99. https://doi.org/10.1016/j.marpolbul.2017.04.029

*Beitzen-Heineke, E. F., Balta-Ozkan, N., & Reefke, H. (2017). The prospects of zero-packaging grocery stores to improve the social and environmental impacts of the food supply chain. *Journal of Cleaner Production*, *140*, 1528–1541. https://doi.org/10.1016/j.jclepro.2016.09.227

Bläsing, M., & Amelung, W. (2018). Plastics in soil: Analytical methods and possible sources. *Science of The Total Environment*, *612*, 422–435.

*Blesin, J.-M., Jaspersen, M., & Möhring, W. (2017). Boosting Plastics' Image? Communicative Challenges of Innovative Bioplastics. *Journal of Historic Polymeric Materials, Plastics Heritage and History*, *3*, 1–5.

*Braun, Y. A., & Traore, A. S. (2015). Plastic bags, pollution, and identity: Women and the gendering of globalization and environmental responsibility in Mali. *Gender & Society*, *29*(6), 863–887. https://doi.org/10.1177/0891243215602101

*Brennan, R. E., & Portman, M. E. (2017). Situating Arab-Israeli artisanal fishermen's perceptions of marine litter in a socio-institutional and socio-cultural context. *Marine Pollution Bulletin*, *115*(1–2), 240–251. https://doi.org/10.1016/j.marpolbul.2016.12.001

*Campbell, M. L., Slavin, C., Grage, A., & Kinslow, A. (2016). Human health impacts from litter on beaches and associated perceptions: A case study of "clean" Tasmanian beaches. *Ocean and Coastal Management*, *126*, 22–30. https://doi.org/10.1016/j.ocecoaman.2016.04.002

1166 *Caner, C., & Pascall, M. A. (2010). Consumer complaints and accidents related to food
1167 packaging. *Packaging Technology and Science*, *23*(7), 413–422.
1168 https://doi.org/10.1002/pts.908
1169 *Carpenter, E., & Wolverton, S. (2017). Plastic litter in streams: The behavioral archaeology
1170 of a pervasive environmental problem. *Applied Geography*, *84*, 93–101.
1171 https://doi.org/10.1016/j.apgeog.2017.04.010
1172 *Carrigan, M., Moraes, C., & Leek, S. (2011). Fostering responsible communities: A
1173 community social marketing approach to sustainable living. *Journal of Business Ethics*,
1174 *100*(3), 515–534. https://doi.org/10.1007/s10551-010-0694-8
1175 *Chan, K. (1998). Mass communication and pro-environmental behaviour: waste recycling in
1176 Hong Kong. *Journal of Environmental Management*, *52*(4), 317–325.
1177 https://doi.org/10.1006/jema.1998.0189
1178 *Chan, R. Y. K., Wong, Y. H., & Leung, T. K. P. (2008). Applying ethical concepts to the
1179 study of ``green'' consumer behavior: An analysis of chinese consumers' intentions to
1180 bring their own shopping bags. *Journal of Business Ethics*, *79*(4), 469–481.
1181 https://doi.org/10.1007/s10551-007-9410-8
1182 *Chang, M. (2015). Reducing microplastics from facial exfoliating cleansers in wastewater
1183 through treatment versus consumer product decisions. *Marine Pollution Bulletin*, *101*(1),
1184 330–333. https://doi.org/10.1016/j.marpolbul.2015.10.074
1185 *Chang, S.-H., & Chou, C.-H. (2018). Consumer intention toward bringing your own
1186 shopping bags in Taiwan: An application of ethics perspective and theory of planned
1187 behavior. *Sustainability (Switzerland)*, *10*(6), 1–14. https://doi.org/10.3390/su10061815
1188 *Cherrier, H. (2006). Consumer identity and moral obligations in non-plastic bag
1189 consumption: a dialectical perspective. *International Journal of Consumer Studies*,
1190 *30*(5), 515–523.
1191 *Cheung, T. Y., Fok, L., Cheang, C. C., Yeung, C. H., So, W.-M. W., & Chow, C. F. (2018).

University halls plastics recycling: a blended intervention study. *International Journal of Sustainability in Higher Education*, *19*(6), 1038–1052. https://doi.org/10.1108/IJSHE-10-2017-0175

*Chib, A., Chiew, H. J., Kumar, C., Choon, L. G., & Ale, K. (2009). [minus]plastic: influencing pro-environmental attitudes among Singaporean youth. *Environmental Education Research*, *15*(6), 679–696. https://doi.org/10.1080/13504620903296001

*Clapp, J., & Swanston, L. (2009). Doing away with plastic shopping bags: International patterns of norm emergence and policy implementation. *Environmental Politics*, *18*(3), 315–332. https://doi.org/10.1080/09644010902823717

*Convery, F., McDonnell, S., & Ferreira, S. (2007). The most popular tax in Europe? Lessons from the Irish plastic bags levy. *Environmental and Resource Economics*, *38*(1), 1–11. https://doi.org/10.1007/s10640-006-9059-2

*Corraini, N. R., de Souza de Lima, A., Bonetti, J., & Rangel-Buitrago, N. (2018). Troubles in the paradise: Litter and its scenic impact on the North Santa Catarina island beaches, Brazil. *Marine Pollution Bulletin*, *131*, 572–579. https://doi.org/10.1016/j.marpolbul.2018.04.061

*Dikgang, J., Leiman, A., & Visser, M. (2012). Analysis of the plastic-bag levy in South Africa. *Resources, Conservation & Recycling*, *66*, 59–65. https://doi.org/10.1016/j.resconrec.2012.06.009

*Dikgang, J., & Visser, M. (2012). Behavioural response to plastic bag legislation in Botswana. *South African Journal of Economics*, *80*(1), 123–133.

*Drašković, N. (2010). Packaging convenience: Consumer packaging feature or marketig tool? *International Journal of Management Cases*, *12*(2), 267–274. https://doi.org/10.5848/APBJ.2010.00061

*Drašković, N., & Cerovečki, I. G. (2014). Moderating variables of consumer perception of packaging material. In *7th Annual EuroMed Conference of the EuroMed Academy of*

Business (pp. 609–620).

*Draskovic, N., Temperley, J., & Pavicic, J. (2009). Comparative perception(s) of consumer goods packaging: Croatian consumers perspective(s). *International Journal of Management Cases*, *11*(2), 154–163. https://doi.org/10.5848/APBJ.2009.00028

*Eldesouky, A., & Mesías, F. (2014). An insight into the influence of packaging and presentation format on consumer purchasing attitudes towards cheese: A qualitative study. *Spanish Journal of Agricultural Research*, *12*(2), 305–312. https://doi.org/10.5424/sjar/2014122-5520

*Eldesouky, A., Mesías, F. J., Elghannam, A., Gaspar, P., & Escribano, M. (2016). Are packaging and presentation format key attributes for cheese consumers? *International Dairy Journal*, *61*, 245–249. https://doi.org/10.1016/j.idairyj.2016.06.011

*Eldesouky, A., Pulido, A. F., & Mesías, F. J. (2015). The Role of Packaging and Presentation Format in Consumers' Preferences for Food: An Application of Projective Techniques. *Journal of Sensory Studies*, *30*(5), 360–369. https://doi.org/10.1111/joss.12162

*Elgaaïed-Gambier, L. (2016). Who Buys Overpackaged Grocery Products and Why? Understanding Consumers' Reactions to Overpackaging in the Food Sector. *Journal of Business Ethics*, *135*(4), 683–698. https://doi.org/10.1007/s10551-014-2491-2

Eriksen, M., Lebreton, L. C. M., Carson, H. S., Thiel, M., Moore, C. J., Borerro, J. C., … Reisser, J. (2014). Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea. *PLoS ONE*, *9*(12), 1–15. https://doi.org/10.1371/journal.pone.0111913

*Fernqvist, F., Olsson, A., & Spendrup, S. (2015). What's in it for me? Food packaging and consumer responses, a focus group study. *British Food Journal*, *117*(3), 1122–1135. https://doi.org/10.1108/BFJ-08-2013-0224

*Ferreira, M. C., & Scaraboto, D. (2016). "My plastic dreams": Towards an extended

1244 understanding of materiality and the shaping of consumer identities. *Journal of Business*
1245 *Research*, *69*(1), 191–207.
1246 Fritsche, I., Barth, M., Jugert, P., Masson, T., & Reese, G. (2017). A social identity model of
1247 pro-environmental action (SIMPEA). https://doi.org/http :/ /dx.doi.org/
1248 10.1037/rev0000090
1249 *Fritz, J. N., Dupuis, D. L., Wu, W. L., Neal, A. E., Rettig, L. A., & Lastrapes, R. E. (2017).
1250 Evaluating increased effort for item disposal to improve recycling at a university.
1251 *Journal of Applied Behavior Analysis*, *50*(4), 825–829. https://doi.org/10.1002/jaba.405
1252 Galloway, T. S., & Lewis, C. N. (2016). Marine microplastics spell big problems for future
1253 generations. *PNAS*, *113*(9), 2331–2333. https://doi.org/10.1073/pnas.1600715113
1254 Gelcich, S., Buckley, P., Pinnegar, J. K., Chilvers, J., Lorenzoni, I., Terry, G., & Guerrero, M.
1255 (2014). Public awareness, concerns, and priorities about anthropogenic impacts on
1256 marine environments. *PNAS*, *111*(42), 15042–15047.
1257 https://doi.org/10.1073/pnas.1417344111
1258 Gelici-Zeko, M. M., Lutters, D., ten Klooster, R., & Weijzen, P. L. G. (2013). Studying the
1259 Influence of Packaging Design on Consumer Perceptions (of Dairy Products) Using
1260 Categorizing and Perceptual Mapping. *Packaging Technology and Science*, *26*(4), 215–
1261 228. https://doi.org/10.1002/pts.1977
1262 *Gómez, M., Martín-Consuegra, D., & Molina, A. (2015). The importance of packaging in
1263 purchase and usage behaviour. *International Journal of Consumer Studies*, *39*(3), 203–
1264 211. https://doi.org/10.1111/ijcs.12168
1265 Haider, T. P., Völker, C., Kramm, J., Landfester, K., & Wurm, F. R. (2018). Plastics of the
1266 future? The impact of biodegradable polymers on the environment and on society.
1267 *Angewandte Chemie International Edition*, *58*(1), 50–62.
1268 *Hammami, M. B. A., Mohammed, E. Q., Hashem, A. M., Al-Khafaji, M. A., Alqahtani, F.,
1269 Alzaabi, S., & Dash, N. (2017). Survey on awareness and attitudes of secondary school

students regarding plastic pollution: implications for environmental education and public health in Sharjah city, UAE. *Environmental Science and Pollution Research*, *24*(25), 20626–20633. https://doi.org/10.1007/s11356-017-9625-x

Hanisch, C. (2000). Is Extended Producer Responsibility Effective? *Environmental Science & Technology*, *34*(7), 170–175.

*Hartley, B. L., Pahl, S., Holland, M., Alampei, I., Veiga, J. M., & Thompson, R. C. (2018). Turning the tide on trash: Empowering European educators and school students to tackle marine litter. *Marine Policy*, *96*, 227–234. https://doi.org/10.1016/j.marpol.2018.02.002

*Hartley, B. L., Pahl, S., Veiga, J., Vlachogianni, T., Vasconcelos, L., Maes, T., … Thompson, R. C. (2018). Exploring public views on marine litter in Europe: Perceived causes, consequences and pathways to change. *Marine Pollution Bulletin*, *133*, 945–955. https://doi.org/https://doi.org/10.1016/j.marpolbul.2018.05.061

*Hartley, B. L., Thompson, R. C., & Pahl, S. (2015). Marine litter education boosts children's understanding and self-reported actions. *Marine Pollution Bulletin*, *90*, 209–217. https://doi.org/10.1016/j.marpolbul.2014.10.049

*Hasson, R., Leiman, A., & Visser, M. (2007). The economics of plastic bag legislation in South Africa. *South African Journal of Economics*, *75*(1), 66–83. https://doi.org/10.1111/j.1813-6982.2007.00101.x

*He, H. (2012). Effects of environmental policy on consumption: Lessons from the Chinese plastic bag regulation. *Environment and Development Economics*, *17*(4), 407–431. https://doi.org/10.1017/S1355770X1200006X

*Herbes, C., Beuthner, C., & Ramme, I. (2018). Consumer attitudes towards biobased packaging - A cross-cultural comparative study. *Journal of Cleaner Production*, *194*, 203–218. https://doi.org/10.1016/j.jclepro.2018.05.106

Hertwich, E. G. (2005). Consumption and the Rebound Effect: An Industrial Ecology Perspective. *Journal of Industrial Ecology*, *9*(1–2), 85–98.

https://doi.org/10.1162/1088198054084635

Hodson, M. E., Duffus-Hodson, C. A., Clark, A., Prendergast-Miller, M. T., & Thorpe, K. L. (2017). Plastic Bag Derived-Microplastics as a Vector for Metal Exposure in Terrestrial Invertebrates. *Environmental Science and Technology*, *51*(8), 4714–4721. https://doi.org/10.1021/acs.est.7b00635

*Hohmann, R., Wattana, C., Sracheam, P., Siriapornsakul, S., Ruckthum, V., & Clapp, R. (2016). An exploration of the factors concerned with reducing the use of plastic carrier bags in Bangkok, Thailand. *ABAC ODI Journal : Vision. Action. Outcome.*, *3*(2), 162–181.

*Holland, R. W., Aarts, H., & Langendam, D. (2006). Breaking and creating habits on the working floor: A field-experiment on the power of implementation intentions. *Journal of Experimental Social Psychology*, *42*(6), 776–783. https://doi.org/10.1016/j.jesp.2005.11.006

*Hollywood, L., Wells, L., Armstrong, G., & Farley, H. (2013). Thinking outside the carton: attitudes towards milk packaging. *British Food Journal*, *115*(6), 899–912. https://doi.org/10.1108/BFJ-Jul-2010-0127

Horton, A. A., Walton, A., Spurgeon, D. J., Lahive, E., & Svendsen, C. (2017). Microplastics in freshwater and terrestrial environments: Evaluating the current understanding to identify the knowledge gaps and future research priorities. *Science of the Total Environment*, *586*, 127–141. https://doi.org/10.1016/j.scitotenv.2017.01.190

Huffman, K. T., Grossnickle, W. F., Cope, J. G., & Huffman, K. P. (1995). Litter Reduction: A Review and Integration of the Literature. *Environment and Behavior*, *27*(2), 153–183.

*Isa, S. M., & Yao, P. X. (2013). Investigating the preference for green packaging in consumer product choices: A choice-based conjoint approach. *Business Management Dynamics*, *3*(2), 84–96.

*Jakovcevic, A., Steg, L., Mazzeo, N., Caballero, R., Franco, P., Putrino, N., & Favara, J.

(2014). Charges for plastic bags: Motivational and behavioral effects. *Journal of Environmental Psychology*, *40*, 372–380. https://doi.org/10.1016/j.jenvp.2014.09.004

*Jeżewska-Zychowicz, M., & Jeznach, M. (2015). Consumers' Behaviours Related To Packaging And Their Attitudes Towards Environment. *Journal of Agribusiness and Rural Development*, *3*(37), 447–457. Retrieved from https://ideas.repec.org/a/ags/pojard/253597.html

*Jiang, J. (2016). Peer Pressure in Voluntary Environmental Programs: A Case of the Bag Reward Program. *Journal of Industry, Competition and Trade*, *16*(2), 155–190.

*Jones, J., Jackson, J. I., Bates, M., & Tudor, T. (2016). Factors influencing corporate pro-environmental behaviour – a case study from the UK construction sector. *Int. J. Environment and Sustainable Development*, *15*(1), 1–15. https://doi.org/10.1504/IJESD.2016.073314

*Joseph, N., Kumar, A., Majgi, S. M., Kumar, G. S., & Prahalad, R. B. Y. (2016). Usage of Plastic Bags and Health Hazards : A Study to Assess Awareness Level and Perception about Legislation Among a Small Population of Mangalore City. *Journal of Clinical and Diagnostic Research*, *10*(4), 1–4. https://doi.org/10.7860/JCDR/2016/16245.7529

Jungbluth, N., Tietje, O., & Scholz, R. W. (2000). Food purchases: Impacts from the consumers' point of view investigated with a modular LCA. *The International Journal of Life Cycle Assessment*, *5*(3), 134. https://doi.org/10.1007/BF02978609

*Kainz, U., Zapilko, M., Decker, T., & Menrad, K. (2013). Consumer-relevant information about bioplastics. In J. Geldermann & M. Schumann (Eds.), *First International Conference on Resource Efficiency in Interorganizational Networks* (pp. 391–402). Universitätsverlag Göttingen.

*Karmarkar, U. R., & Bollinger, B. (2015). BYOB: How bringing your own shopping bags leads to treating yourself and the environment. *Journal of Marketing*, *79*, 1–15.

*Keramitsoglou, K. M., & Tsagarakis, K. P. (2018). Public Participation in Designing the

Recycling Bins to Encourage Recycling. *Sustainability (Switzerland)*, *10*(4), 16–18. https://doi.org/10.3390/su10041240

*Kiessling, T., Salas, S., Mutafoglu, K., & Thiel, M. (2017). Who cares about dirty beaches? Evaluating environmental awareness and action on coastal litter in Chile. *Ocean and Coastal Management*, *137*, 82–95. https://doi.org/10.1016/j.ocecoaman.2016.11.029

*Klaiman, K., Ortega, D. L., & Garnache, C. (2016). Consumer Preferences and Demand for Packaging Material and Recyclability Kimberly. *Resources, Conservation and Recycling*, *115*, 1–25.

*Klaiman, K., Ortega, D. L., & Garnache, C. (2017). Perceived barriers to food packaging recycling: Evidence from a choice experiment of US consumers. *Food Control*, *73*, 291–299. https://doi.org/10.1016/j.foodcont.2016.08.017

*Klöckner, C. A., & Oppedal, I. O. (2011). General Versus Domain Specific Recycling Behaviour - applying a multilevel comprehensive action determination model to recycling in Norwegian student homes. *Resources, Conservation and Recycling*, *55*(4), 463–471. https://doi.org/10.1016/j.resconrec.2010.12.009

*Knussen, C., Yule, F., MacKenzie, J., & Wells, M. (2004). An analysis of intentions to recycle household waste: The roles of past behaviour, perceived habit, and perceived lack of facilities. *Journal of Environmental Psychology*, *24*, 237–246. https://doi.org/10.1016/j.jenvp.2003.12.001

*Koenig-Lewis, N., Palmer, A., Dermody, J., & Urbye, A. (2014). Consumers' evaluations of ecological packaging – Rational and emotional approaches. *Journal of Environmental Psychology*, *37*, 94–105. Retrieved from https://core.ac.uk/display/29204991

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why Do People Behave Environmentally and What are the Barriers to Pro-Environmental Behaviour. *Environmental Education Research*, *8*(3), 239–260. https://doi.org/10.1080/1350462022014540

*Koutsimanis, G., Getter, K., Behe, B., Harte, J., & Almenar, E. (2012). Influences of packaging attributes on consumer purchase decisions for fresh produce. *Appetite*, *59*(2), 270–280. https://doi.org/10.1016/j.appet.2012.05.012

*Kronrod, A., Grinstein, A., & Wathieu, L. (2012). Go Green! Should Environmental Messages Be So Assertive? *Journal of Marketing*, *76*(1), 95–102. https://doi.org/10.1509/jm.10.0416

*Kurisu, K. H., & Bortoleto, A. P. (2011). Comparison of waste prevention behaviors among three Japanese megacity regions in the context of local measures and socio-demographics. *Waste Management*, *31*(7), 1441–1449. https://doi.org/10.1016/j.wasman.2011.03.008

*Lal, R. C., Yambrach, F., & McProud, L. (2015). Consumer Perceptions Towards Package Designs: A Cross Cultural Study. *Journal of Applied Packaging Research*, *7*(2), 61–94. https://doi.org/10.14448/japr.04.0004

*Lam, S. P., & Chen, J. K. (2006). What makes customers bring their bags or buy bags from the shop? A survey of customers at a Taiwan hypermarket. *Environment and Behavior*, *38*(3), 318–332. https://doi.org/10.1177/0013916505278327

*Latiff, Z. A. A., Mokhtar, S. I., Soon, S. W., & Ayob, M. A. (2018). Study on the Customer Perception of the Tropical Fruit Vinegar in Kelantan and Kuala Lumpur. *Journal of Food Products Marketing*, *24*(3), 263–279. https://doi.org/10.1080/10454446.2017.1266557

*Latinopoulos, D., Mentis, C., & Bithas, K. (2018). The impact of a public information campaign on preferences for marine environmental protection. The case of plastic waste. *Marine Pollution Bulletin*, *131*, 151–162. https://doi.org/10.1016/j.marpolbul.2018.04.002

*Lea, E., & Worsley, A. (2008). Australian consumers' food-related environmental beliefs and behaviours. *Appetite*, *50*(2), 207–214. https://doi.org/10.1016/j.appet.2005.07.012

*Lefebvre, A., Bassereau, J. F., Pensé-lheritier, A. M., Rivère, C., Harris, N., & Duchamp, R. (2010). Recruitment and training of a sensory expert panel to measure the touch of beverage packages: Issue and methods employed. *Food Quality and Preference*, *21*(1), 156–164. https://doi.org/10.1016/j.foodqual.2009.08.020

Li, W. C., Tse, H. F., & Fok, L. (2016). Plastic waste in the marine environment: A review of sources, occurrence and effects. *Science of the Total Environment*, *566–567*, 333–349. https://doi.org/10.1016/j.scitotenv.2016.05.084

*Li, Y., Muthu, S. S., Hu, J., Pik-Yin, M., Ding, X., Wang, L., & Chen, W. (2010). Eco-Impact of Shopping Bags: Consumer Attitude and Governmental Policies. *Journal of Sustainable Development*, *3*(2), 71–83. https://doi.org/10.5539/jsd.v3n2p71

*Lindh, H., Olsson, A., & Williams, H. (2016). Consumer Perceptions of Food Packaging: Contributing to or Counteracting Environmentally Sustainable Development? *Packaging Technology and Science*, *29*(1), 3–23. https://doi.org/10.1002/pts.2184

Lindh, H., Williams, H., Olsson, A., & Wikström, F. (2016). Elucidating the Indirect Contributions of Packaging to Sustainable Development: A Terminology of Packaging Functions and Features. *Packaging Technology and Science*, *29*(4–5), 225–246. https://doi.org/10.1002/pts

Liu, E. K., He, W. Q., & Yan, C. R. (2014). "White revolution" to "white pollution" - Agricultural plastic film mulch in China. *Environmental Research Letters*, *9*(9), 13–16. https://doi.org/10.1088/1748-9326/9/9/091001

Löhr, A., Savelli, H., Beunen, R., Kalz, M., Ragas, A., & Van Belleghem, F. (2017). Solutions for global marine litter pollution. *Current Opinion in Environmental Sustainability*, *28*, 90–99. https://doi.org/10.1016/j.cosust.2017.08.009

*Loizidou, X. I., Loizides, M. I., & Orthodoxou, D. L. (2018). Persistent marine litter: small plastics and cigarette butts remain on beaches after organized beach cleanups. *Environmental Monitoring and Assessment*, *190*(414), 1–10.

*Longoni, C., Gollwitzer, P. M., & Oettingen, G. (2014). A green paradox: Validating green choices has ironic effects on behavior, cognition, and perception. *Journal of Experimental Social Psychology*, *50*(1), 158–165. https://doi.org/10.1016/j.jesp.2013.09.010

*Lotze, H. K., Guest, H., O'Leary, J., Tuda, A., & Wallace, D. (2018). Public perceptions of marine threats and protection from around the world. *Ocean and Coastal Management*, *152*, 14–22. https://doi.org/10.1016/j.ocecoaman.2017.11.004

*Madara, D. S., Namango, S. S., & Wetaka, C. (2016). Consumer-Perception on Polyethylene-Shopping-Bags. *Journal of Environment and Earth Science*, *6*(11), 12–36.

*Madigele, P. K., Mogomotsi, G. E. J., & Kolobe, M. (2017). Consumer willingness to pay for plastic bags levy and willingness to accept eco-friendly alternatives in Botswana. *Chinese Journal of Population Resources and Environment*, *15*(3), 255–261. https://doi.org/10.1080/10042857.2017.1369243

*Magnier, L., & Crié, D. (2015). Communicating packaging eco-friendliness: An exploration of consumers' perceptions of eco-designed packaging. *International Journal of Retail and Distribution Management*, *43*(4/5), 350–366. https://doi.org/10.1108/IJRDM-04-2014-0048

*Magnier, L., & Schoormans, J. (2015). Consumer reactions to sustainable packaging : The interplay of visual appearance , verbal claim and environmental concern. *Journal of Environmental Psychology*, *44*, 53–62. https://doi.org/10.1016/j.jenvp.2015.09.005

*Magnier, L., & Schoormans, J. (2017). How Do Packaging Material, Colour and Environmental Claim Influence Package, Brand and Product Evaluations? *Packaging Technology and Science*, *30*(11), 735–751. https://doi.org/10.1002/pts.2318

*Mapotse, T. A., & Mashiloane, T. K. (2017). Nurturing learners' awareness of littering through environmental campaigns: An action research approach. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(10), 6909–6921.

https://doi.org/10.12973/ejmste/76658

Marsh, K., & Bugusu, B. (2007). Food packaging - Roles, materials, and environmental issues: Scientific status summary. *Journal of Food Science*, *72*(3). https://doi.org/10.1111/j.1750-3841.2007.00301.x

*Martinho, G., Balaia, N., & Pires, A. (2017). The Portuguese plastic carrier bag tax : The effects on consumers ' behavior. *Waste Management*, *61*, 3–12. https://doi.org/10.1016/j.wasman.2017.01.023

*McCoy, K., Oliver, J. J., Borden, D. S., & Cohn, S. I. (2018). Nudging waste diversion at Western State Colorado University: application of behavioral insights. *International Journal of Sustainability in Higher Education*, *19*(3), 608–621. https://doi.org/10.1108/IJSHE-05-2017-0063

*McDonald, S., & Ball, R. (1998). Public participation in plastics recycling schemes. *Resources, Conservation and Recycling*, *22*(3–4), 123–141. https://doi.org/10.1016/S0921-3449(97)00044-X

*McKay, D., & Perez, P. L. (2018). Plastic masculinity: How everyday objects in plastic suggest men could be otherwise. *Journal of Material Culture*, *23*(2), 169–186. https://doi.org/10.1177/1359183517742424

McKerlie, K., Knight, N., & Thorpe, B. (2006). Advancing extended producer responsibility in Canada. *Journal of Cleaner Production*, *14*(6–7), 616–628.

*Meng, T., Klepacka, A. M., Florkowski, W. J., & Braman, K. (2015). What drives an environmental horticultural firm to start recycling plastics? Results of a Georgia survey. *Resources, Conservation and Recycling*, *102*, 1–8. https://doi.org/10.1016/j.resconrec.2015.04.011

*Miller, N. D., Meindl, J. N., & Caradine, M. (2016). The Effects of Bin Proximity and Visual Prompts on Recycling in A University Building. *Behavior and Social Issues*, *25*, 4–10. https://doi.org/10.5210/bsi.v.25i0.6141

*Mohamed, N. A. (2015). Promoting of Environment Friendly Packaging Utilizing in the Egyptian Market "Study on Grocery Bags by Carrefour Egypt." *Civil and Environmental Research*, *7*(4), 54–61.

*Muizniece-Brasava, S., Dukalska, L., & Kantike, I. (2011). Consumer's knowledge and attitude to traditional and environmentally friendly food packaging materials in market of Latvia. In *In The 6th Baltic Conference on Food Science and Technology "FoodBalt - 2011"* (pp. 187–192).

*Muralidharan, S., & Sheehan, K. (2016). "Tax" and "fee" message frames as inhibitors of plastic bag usage among shoppers: A social marketing application of the theory of planned behavior. *Social Marketing Quarterly*, *22*(3), 200–217. https://doi.org/10.1177/1524500416631522

*Muralidharan, S., & Sheehan, K. (2017). "Tax" and "Fee" Frames in Green Advertisements: The Influence of Self-Transcendence in Reusable Bag Usage. *Journal of Promotion Management*, *23*(6), 851–871. https://doi.org/10.1080/10496491.2017.1323260

*Musa, H. M., Hayes, C., Bradley, M. J., Clayson, A., & Gillibrand, G. (2013). Measures Aimed at Reducing Plastic Carrier Bag Use: A Consumer Behaviour Focused Study. *Natural Environment*, *1*(1), 17. https://doi.org/10.12966/ne.06.02.2013

*Negussie, B., & Mustefa, J. (2017). Community's perception of utilization and disposal of plastic bags in Eastern Ethiopia. *Pollution*, *3*(1), 147–156. https://doi.org/10.7508/pj.2017.01.013

*Nittala, R. (2014). Green consumer behavior of the educated segment in India. *Journal of International Consumer Marketing*, *26*(2), 138–152. https://doi.org/10.1080/08961530.2014.878205

*Nørgaard Olesen, S., & Giacalone, D. (2018). The influence of packaging on consumers' quality perception of carrots. *Journal of Sensory Studies*, *33*(1), 1–8. https://doi.org/10.1111/joss.12310

*O'Connor, R. T., Lerman, D. C., Fritz, J. N., & Hodde, H. B. (2010). Effects of Number and Location of Bins on Plastic Recycling At a University. *Journal of Applied Behavior Analysis*, *43*(4), 711–715. https://doi.org/10.1901/jaba.2010.43-711

*O'Gorman, L. (2017). Sustainability, the Arts and Big Numbers: The Challenge of Researching Children's Responses to Chris Jordan's Images. *International Journal of Early Childhood*, *49*(3), 321–332. https://doi.org/10.1007/s13158-017-0199-z

*Ofstad, S. P., Tobolova, M., Nayum, A., & Klöckner, C. A. (2017). Understanding the mechanisms behind changing people's recycling behavior at work by applying a comprehensive action determination model. *Sustainability (Switzerland)*, *9*(2). https://doi.org/10.3390/su9020204

*Ohtomo, S., & Ohnuma, S. (2014). Psychological interventional approach for reduce resource consumption: Reducing plastic bag usage at supermarkets. *Resources, Conservation and Recycling*, *84*(November), 57–65. https://doi.org/10.1016/j.resconrec.2013.12.014

Oke, A. (2015). Workplace waste recycling behaviour: A meta-analytical review. *Sustainability (Switzerland)*, *7*(6), 7175–7194. https://doi.org/10.3390/su7067175

*Omari, R., & Frempong, G. (2016). Food safety concerns of fast food consumers in urban Ghana. *Appetite*, *98*, 49–54. https://doi.org/10.1016/j.appet.2015.12.007

*Omari, R., Frempong, G. K., & Arthur, W. (2018). Public perceptions and worry about food safety hazards and risks in Ghana. *Food Control*, *93*, 76–82. https://doi.org/10.1016/j.foodcont.2018.05.026

*Orzan, G., Cruceru, A. F., Bălăceanu, C. T., & Chivu, R.-G. (2018). Consumers' Behavior Concerning Sustainable Packaging : An Exploratory Study on Romanian Consumers. *Sustainability (Switzerland)*, *10*, 1–11. https://doi.org/10.3390/su10061787

*Østergaard, S., & Hanssen, O. J. (2018). Wasting of Fresh-Packed Bread by Consumers — Influence of Shopping Behavior, Storing, Handling, and Consumer Preferences.

Sustainability (Switzerland), *10*(7), 1–16. https://doi.org/10.3390/su10072251

*Otsyina, H. R., Nguhiu-Mwangi, J., Mogoa, E. G. M., Mbuthia, P. G., & Ogara, W. O. (2018). Knowledge, attitude, and practices on usage, disposal, and effect of plastic bags on sheep and goats. *Tropical Animal Health and Production*, *50*(5), 997–1003. https://doi.org/10.1007/s11250-018-1523-9

*Owens, K. A. (2018). Using experiential marine debris education to make an impact: Collecting debris, informing policy makers, and influencing students. *Marine Pollution Bulletin*, *127*, 804–810. https://doi.org/10.1016/j.marpolbul.2017.10.004

*Pakpour, A. H., Zeidi, I. M., Emamjomeh, M. M., Asefzadeh, S., & Pearson, H. (2014). Household waste behaviours among a community sample in Iran : An application of the theory of planned behaviour. *Waste Management*, *34*, 980–986. https://doi.org/10.1016/j.wasman.2013.10.028

*Pandey, R. U., Surjan, A., & Kapshe, M. (2017). Exploring linkages between sustainable consumption and prevailing green practices in reuse and recycling of household waste: Case of Bhopal city in India. *Journal of Cleaner Production*, *173*, 49–59. https://doi.org/10.1016/j.jclepro.2017.03.227

Pasqualino, J., Meneses, M., & Castells, F. (2011). The carbon footprint and energy consumption of beverage packaging selection and disposal. *Journal of Food Engineering*, *103*(4), 357–365. https://doi.org/10.1016/j.jfoodeng.2010.11.005

*Pearson, E., Mellish, S., Sanders, B., & Litchfield, C. (2014). Marine wildlife entanglement: Assessing knowledge, attitudes, and relevant behaviour in the Australian community. *Marine Pollution Bulletin*, *89*(1–2), 136–148. https://doi.org/10.1016/j.marpolbul.2014.10.014

Peng, J., Wang, J., & Cai, L. (2017). Current understanding of microplastics in the environment: Occurrence, fate, risks, and what we should do. *Integrated Environmental Assessment and Management*, *13*(3), 476–482. https://doi.org/10.1002/ieam.1912

*Peters-Texeira, A., & Badrie, N. (2005). Consumers' perception of food packaging in Trinidad, West Indies and its related impact on food choices. *International Journal of Consumer Studies*, *29*(6), 508–514. https://doi.org/10.1111/j.1470-6431.2005.00419.x

*Phillips, C. (2016). Alternative food distribution and plastic devices: Performances, valuations, and experimentations. *Journal of Rural Studies*, *44*, 208–216. https://doi.org/10.1016/j.jrurstud.2016.02.006

*Piqueras-Fiszman, B., & Spence, C. (2011). Do the material properties of cutlery affect the perception of the food you eat? An exploratory study. *Journal of Sensory Studies*, *26*(5), 358–362. https://doi.org/10.1111/j.1745-459X.2011.00351.x

PlasticsEurope. (2017). *Plastics - the facts 2017: An analysis of European plastics production, demand and waste data*. Retrieved from https://www.plasticseurope.org/application/files/5715/1717/4180/Plastics_the_facts_2017_FINAL_for_website_one_page.pdf

PlasticsEurope. (2018). *Plastics - the facts 2018: An analysis of European plastics production, demand and waste data*. Retrieved from https://www.plasticseurope.org/download_file/force/2387/319

*Poortinga, W., & Whitaker, L. (2018). Promoting the use of reusable coffee cups through environmental messaging, the provision of alternatives and financial incentives. *Sustainability (Switzerland)*, *10*(3), 1–10. https://doi.org/10.3390/su10030873

*Poortinga, W., Whitmarsh, L., & Suffolk, C. (2013). The introduction of a single-use carrier bag charge in Wales : Attitude change and behavioural spillover effects. *Journal of Environmental Psychology*, *36*, 240–247. https://doi.org/10.1016/j.jenvp.2013.09.001

*Prendergast, G., Wai Ng, S., & Lee Leung, L. (2001). Consumer perceptions of shopping bags. *Marketing Intelligence and Planning*, *19*(7), 475–481. https://doi.org/10.1108/EUM0000000006217

*Rangel-Buitrago, N., Williams, A., & Anfuso, G. (2018). Killing the goose with the golden

1582 eggs: Litter effects on scenic quality of the Caribbean coast of Colombia. *Marine*
1583 *Pollution Bulletin*, *127*, 22–38. https://doi.org/10.1016/j.marpolbul.2017.11.023
1584 *Rayon-Viña, F., Miralles, L., Gómez-Agenjo, M., Dopico, E., & Garcia-Vazquez, E. (2018).
1585 Marine litter in south Bay of Biscay: Local differences in beach littering are associated
1586 with citizen perception and awareness. *Marine Pollution Bulletin*, *131*, 727–735.
1587 https://doi.org/10.1016/j.marpolbul.2018.04.066
1588 *Reese, G., & Junge, E. A. (2017). Keep on Rockin' in a (plastic-)free world: Collective
1589 efficacy and pro-environmental intentions as a function of task difficulty. *Sustainability*
1590 *(Switzerland)*, *9*(2), 1–13. https://doi.org/10.3390/su9020200
1591 *Richardson, J., Grose, J., Nelmes, P., Parra, G., & Linares, M. (2016). Tweet if you want to
1592 be sustainable: a thematic analysis of a Twitter chat to discuss sustainability in nurse
1593 education. *Journal of Advanced Nursing*, *72*(5), 1086–1096.
1594 https://doi.org/10.1111/jan.12900
1595 Rist, S., Almroth, B. C., Hartmann, N. B., & Karlsson, T. M. (2018). A critical perspective on
1596 early communications concerning human health aspects of microplastics. *Science of the*
1597 *Total Environment*, *626*, 720–726. https://doi.org/10.1016/j.scitotenv.2018.01.092
1598 *Ritch, E., Brennan, C., & MacLeod, C. (2009). Plastic bag politics : modifying consumer
1599 behaviour for sustainable development. *International Journal of Consumer Studies*, *33*,
1600 168–174. https://doi.org/10.1111/j.1470-6431.2009.00749.x
1601 *Rivers, N., Shenstone-Harris, S., & Young, N. (2017). Using nudges to reduce waste? The
1602 case of Toronto's plastic bag levy. *Journal of Environmental Management*, *188*, 153–
1603 162. https://doi.org/10.1016/j.jenvman.2016.12.009
1604 Rochman, C. M., Browne, M. A., Underwood, A. J., van Franeker, J. A., Thompson, R. C., &
1605 Amaral-Zettler, L. A. (2016). The ecological impacts of marine debris: unraveling the
1606 demonstrated evidence from what is perceived. *Ecology*, *97*(2), 302–312.
1607 Rockström, J., Steffen, W., Noone, K., Persson, Å., Iii, F. S. C., Lambin, E., … Liverman, D.

(2009). Planetary Boundaries : Exploring the Safe Operating Space for Humanity. *Ecology and Society*, *14*(2).

*Rokka, J., & Uusitalo, L. (2008). Preference for green packaging in consumer product choices – Do consumers care? *International Journal of Consumer Studies*, *32*(5), 516–525. https://doi.org/10.1111/j.1470-6431.2008.00710.x

*Romero, C. B. A., Laroche, M., Aurup, G. M., & Ferraz, S. B. (2018). Ethnicity and acculturation of environmental attitudes and behaviors: A cross-cultural study with Brazilians in Canada. *Journal of Business Research*, *82*, 300–309. https://doi.org/10.1016/j.jbusres.2017.09.009

*Rothstein, H. (2003). Neglected risk regulation: The institutional attenuation phenomenon. *Health, Risk & Society*, *5*(1), 85–103. https://doi.org/10.1080/1369857031000066023

Royer, S.-J., Ferrón, S., Wilson, S. T., & Karl, D. M. (2018). Production of methane and ethylene from plastic in the environment. *PLoS ONE*, *13*(8), 1–13. https://doi.org/10.1371/journal.pone.0200574

*Rubens, L., Gosling, P., Bonaiuto, M., Brisbois, X., & Moch, A. (2015). Being a Hypocrite or Committed While I Am Shopping? A Comparison of the Impact of Two Interventions on Environmentally Friendly Behavior. *Environment and Behavior*, *47*(1), 3–16. https://doi.org/10.1177/0013916513482838

Rujnić-Sokele, M., & Pilipović, A. (2017). Challenges and opportunities of biodegradable plastics: A mini review. *Waste Management & Research*, *35*(2), 132–140. https://doi.org/10.1177/0734242X16683272

*Ryan, P. G., & Jewitt, D. (1996). The "free" shopping bag debate: Costs and attitudes. *South African Journal of Science*, *92*, 163–164.

*Saidan, M. N., Ansour, L. M., & Saidan, H. (2017). Management of Plastic Bags Waste: An Assessment of Scenarios in Jordan. *Journal of Chemical Technology and Metallurgy*, *52*(1), 148–154.

*Saidan, M. N., Drais, A. A., & Al-Manaseer, E. (2017). Solid waste composition analysis and recycling evaluation: Zaatari Syrian Refugees Camp, Jordan. *Waste Management*, *61*, 58–66.

*Santos, I. R., Friedrich, A. C., Wallner-Kersanach, M., & Fillmann, G. (2005). Influence of socio-economic characteristics of beach users on litter generation. *Ocean and Coastal Management*, *48*, 742–752. https://doi.org/10.1016/j.ocecoaman.2005.08.006

*Santos, J. M., & Van Der Linden, S. (2016). Changing Norms by Changing Behavior: The Princeton Drink Local Program. *Environmental Practice*, *18*(2), 116–122. https://doi.org/10.1017/S1466046616000144

*Santos, S. C., Sousa, C. V. e, Sampaio, D. de O., & Fagundes, A. F. A. (2013). The impact of using compostable carrier bags on consumer behaviour in the City of Belo Horizonte, Brazil. *Ambiente and Sociedade*, *16*(4), 1–20. https://doi.org/10.1590/S1414-753X2013000400002

Schäfer, M., Jaeger-Erben, M., & Bamberg, S. (2012). Life Events as Windows of Opportunity for Changing Towards Sustainable Consumption Patterns? *Journal of Consumer Policy*, *35*(1), 65–84. https://doi.org/10.1007/s10603-011-9181-6

*Scherer, C., Emberger-Klein, A., & Menrad, K. (2017). Biogenic product alternatives for children: Consumer preferences for a set of sand toys made of bio-based plastic. *Sustainable Production and Consumption*, *10*, 1–14. https://doi.org/10.1016/j.spc.2016.11.001

*Schifferstein, H. N. J. (2009). The drinking experience: Cup or content? *Food Quality and Preference*, *20*(3), 268–276. https://doi.org/10.1016/j.foodqual.2008.11.003

Schultz, P. W., Oskamp, S., & Mainieri, T. (1995). Who recycles and when? A review of personal and situational factors. *Journal of Environmental Psychology*, *15*(2), 105–121. https://doi.org/10.1016/0272-4944(95)90019-5

*Schuyler, Q., Hardesty, B. D., Lawson, T., Opie, K., & Wilcox, C. (2018). Economic

incentives reduce plastic inputs to the ocean. *Marine Policy*, *96*, 250–255.

Seltenrich, N. (2015). New Link in the Food Chain? Marine Plastic Pollution and Seafood Safety. *Environmental Health Perspective*, *123*(2), A34–A41. https://doi.org/10.1289/ehp.123-A34

*Shao, Y., Cai, H., & Chen, G. (2014). Rethinking plastic bag pollution problems in China. *Environmental Science: An Indian Journal*, *9*(6), 215–222.

*Sharp, A., Høj, S., & Wheeler, M. (2010). Proscription and its impact on anti-consumption behaviour and attitudes: The case of plastic bags. *Journal of Consumer Behaviour*, *9*(6), 470–484. https://doi.org/10.1002/cb.335

*Shimazu, H. (2018). Littering Behavior Analysis Based on Survey and Questionnaire About Littering in the Nagase River. *International Journal of GEOMATE*, *14*(41), 95–101. https://doi.org/10.21660/2018.41.59010

Sigler, M. (2014). The effects of plastic pollution on aquatic wildlife: Current situations and future solutions. *Water, Air, and Soil Pollution*, *225*, 2184. https://doi.org/10.1007/s11270-014-2184-6

*Silayoi, P., & Speece, M. (2004). Packaging and purchase decisions: An exploratory study on the impact of involvement level and time pressure. *British Food Journal*, *106*(8), 607–628.

*Silvenius, F., Grönman, K., Katajajuuri, J.-M., Soukka, R., Koivupuro, H.-K., & Virtanen, Y. (2014). The Role of Household Food Waste in Comparing Environmental Impacts of Packaging Alternatives. *Packaging Technology and Science*, *27*(4), 277–292. https://doi.org/10.1002/pts

Smith, M., Love, D. C., Rochman, C. M., & Neff, R. A. (2018). Microplastics in Seafood and the Implications for Human Health. *Current Environmental Health Report*, *5*(3), 375–386.

*So, W. M. W., Cheng, N. Y. I., Chow, C. F., & Zhan, Y. (2016). Learning about the types of

plastic wastes: effectiveness of inquiry learning strategies. *Education 3-13*, *44*(3), 311–324. https://doi.org/10.1080/03004279.2014.976239

*Spence, C., & Wan, X. (2015). Beverage perception and consumption: The influence of the container on the perception of the contents. *Food Quality and Preference*, *39*, 131–140. https://doi.org/10.1016/j.foodqual.2014.07.007

Spierling, S., Knüpffer, E., Behnsen, H., Mudersbach, M., Krieg, H., Springer, S., … Endres, H.-J. (2018). Bio-based plastics - A review of environmental, social and economic impact assessments. *Journal of Cleaner Production*, *185*, 476–491. https://doi.org/10.1016/j.jclepro.2018.03.014

*Spranz, R., Schlüter, A., & Vollan, B. (2018). Morals, money or the master: The adoption of eco-friendly reusable bags. *Marine Policy*, *96*, 270–277. https://doi.org/10.1016/j.marpol.2018.01.029

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

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004

Steinmetz, Z., Wollmann, C., Schaefer, M., Buchmann, C., David, J., Tröger, J., … Schaumann, G. E. (2016). Plastic mulching in agriculture. Trading short-term agronomic benefits for long-term soil degradation? *Science of The Total Environment*, *550*, 690–705. https://doi.org/10.1016/j.scitotenv.2016.01.153

*Struk, M. (2017). Distance and incentives matter: The separation of recyclable municipal waste. *Resources, Conservation and Recycling*, *122*, 155–162. https://doi.org/10.1016/j.resconrec.2017.01.023

*Sun, Y., Wang, S., Li, J., Zhao, D., & Fan, J. (2017). Understanding consumers' intention to use plastic bags: Using an extended theory of planned behaviour model. *Natural Hazards*, *89*(3), 1327–1342. https://doi.org/10.1007/s11069-017-3022-0

*Syberg, K., Hansen, S. F., Christensen, T. B., & Khan, F. R. (2018). Risk Perception of Plastic Pollution: Importance of Stakeholder Involvement and Citizen Science. In M. Wagner & S. Lambert (Eds.), *Handbook of Environmental Chemistry* (Vol. 58, pp. 203–221). Springer, Cham. https://doi.org/10.1007/978-3-319-61615-5

*Synthia, I. J., & Kabir, S. (2015). An Investigation of Consumer Attitudes Towards New Varieties of Shopping Bags: Exploring Eco-Awareness and the Possibility of Behavior Change. *The Journal of Developing Areas*, *49*(5), 183–196. https://doi.org/10.1353/jda.2015.0062

*Thomas, G. O., Poortinga, W., & Sautkina, E. (2016). The Welsh Single-Use Carrier Bag Charge and behavioural spillover. *Journal of Environmental Psychology*, *47*(2880), 126–135. https://doi.org/10.1016/j.jenvp.2016.05.008

Thompson, R. C., Moore, C. J., vom Saal, F. S., & Swan, S. H. (2009). Plastics, the environment and human health: Current consensus and future trends. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1526), 2153–2166. https://doi.org/10.1098/rstb.2009.0053

Thompson, R. C., Swan, S. H., Moore, C. J., & Vom Saal, F. S. (2009). Our plastic age. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1526), 1973–1976. https://doi.org/10.1098/rstb.2009.0054

*Tih, S., & Zainol, Z. (2012). Minimizing Waste and Encouraging Green Practices. *Jurnal Ekonomi Malaysia*, *46*(1), 157–164.

*Tonglet, M., Phillips, P. S., & Bates, M. P. (2004). Determining the drivers for householder pro-environmental behaviour : waste minimisation compared to recycling. *Resources, Conservation and Recycling*, *42*, 27–48. https://doi.org/10.1016/j.resconrec.2004.02.001

1738 *Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the Theory of Planned Behaviour
1739 to investigate the determinants of recycling behaviour: A case study from Brixworth,
1740 UK. *Resources, Conservation and Recycling*, *41*(3), 191–214.
1741 https://doi.org/10.1016/j.resconrec.2003.11.001
1742 Truelove, H. B., Carrico, A. R., Weber, E. U., Raimi, K. T., & Vandenbergh, M. P. (2014).
1743 Positive and negative spillover of pro-environmental behavior : An integrative review
1744 and theoretical framework. *Global Environmental Change*, *29*, 127–138.
1745 https://doi.org/10.1016/j.gloenvcha.2014.09.004
1746 *Truelove, H. B., Yeung, K. L., Carrico, A. R., Gillis, A. J., & Raimi, K. T. (2016). From
1747 plastic bottle recycling to policy support: An experimental test of pro-environmental
1748 spillover. *Journal of Environmental Psychology*, *46*, 55–66.
1749 https://doi.org/10.1016/j.jenvp.2016.03.004
1750 *Tu, Y., Yang, Z., & Ma, C. (2015). Touching tastes: The haptic perception transfer of liquid
1751 food packaging materials. *Food Quality and Preference*, *39*, 124–130.
1752 https://doi.org/10.1016/j.foodqual.2014.07.001
1753 *Tudor, D. T., & Williams, A. T. (2003). Public Perception and Opinion of Visible Beach
1754 Aesthetic Pollution: The Utilisation of Photography. *Journal of Coastal Research*, *19*(4),
1755 1104–1115.
1756 U.S. Government Publishing Office. (2015). *Microbead-Free Waters Act, Public Law 114-
1757 114 §*.
1758 *Uehara, T., & Ynacay-Nye, A. (2018). How water bottle refill stations contribute to campus
1759 sustainability: A case study in Japan. *Sustainability (Switzerland)*, *10*(9), 1–19.
1760 https://doi.org/10.3390/su10093074
1761 *van Dam, Y. K. (1996). Environmental assessment of packaging: The consumer point of
1762 view. *Environmental Management*, *20*(5), 607–614. https://doi.org/10.1007/BF01204134
1763 *van Dam, Y. K., & van Trijp, H. C. M. (1994). Consumer perceptions of, and preferences

1764 for, beverage containers. *Food Quality and Preference*, *5*(4), 253–261.
1765 https://doi.org/10.1016/0950-3293(94)90050-7
1766 *Van der Merwe, D., Viljoen, S., De Beer, H., Bosman, M., & Kempen, E. (2013).
1767 Consumers' experiences of cold chain food packaging : A qualitative study among
1768 women in South Africa. *International Journal of Consumer Studies*, *37*(6), 650–657.
1769 https://doi.org/10.1111/ijcs.12052
1770 *van Herpen, E., Immink, V., & van den Puttelaar, J. (2016). Organics unpacked: The
1771 influence of packaging on the choice for organic fruits and vegetables. *Food Quality and
1772 Preference*, *53*, 90–96. https://doi.org/10.1016/j.foodqual.2016.05.011
1773 *Varotto, A., & Spagnolli, A. (2017). Psychological strategies to promote household
1774 recycling. A systematic review with meta-analysis of validated field interventions.
1775 *Journal of Environmental Psychology*, *51*, 168–188.
1776 https://doi.org/10.1016/j.jenvp.2017.03.011
1777 *Veiga, J. M., Vlachogianni, T., Pahl, S., Thompson, R. C., Kopke, K., Doyle, T. K., …
1778 Alampei, I. (2016). Enhancing public awareness and promoting co-responsibility for
1779 marine litter in Europe: The challenge of MARLISCO. *Marine Pollution Bulletin*,
1780 *102*(2), 309–315. https://doi.org/10.1016/j.marpolbul.2016.01.031
1781 *Venter, K., van der Merwe, D., de Beer, H., Kempen, E., & Bosman, M. (2011). Consumers'
1782 perceptions of food packaging: an exploratory investigation in Potchefstroom, South
1783 Africa. *International Journal of Consumer Studies*, *35*(3), 273–281.
1784 https://doi.org/10.1111/j.1470-6431.2010.00936.x
1785 *Viscusi, W. K., Huber, J., & Bell, J. (2012). Alternative policies to increase recycling of
1786 plastic water bottles in the united states. *Review of Environmental Economics and Policy*,
1787 *6*(2), 190–211. https://doi.org/10.1093/reep/res006
1788 *Vogt, J., & Nunes, K. R. A. (2014). Recycling behaviour in healthcare: Waste handling at
1789 work. *Ergonomics*. Taylor & Francis. https://doi.org/10.1080/00140139.2014.887786

*Vones, K., Allan, D., Lambert, I., & Vettese, S. (2018). 3D-printing 'Ocean plastic'–Fostering childrens' engagement with sustainability. *Materials Today Communications*, *16*, 56–59. https://doi.org/10.1016/j.mtcomm.2018.04.001

*Wagner, T. P. (2017). Reducing single-use plastic shopping bags in the USA. *Waste Management*, *70*, 3–12. https://doi.org/10.1016/j.wasman.2017.09.003

*White, K. M., Smith, J. R., Terry, D. J., Greenslade, J. H., & McKimmie, B. M. (2009). Social influence in the theory of planned behaviour : The role of descriptive, injunctive, and ingroup norms. *British Journal of Social Psychology*, *48*(1), 135–158.

*Widaningrum, D. L. (2014). The Importance of Take-Out Food Packaging Attributes: Conjoint Analysis and Quality Function Deployment Approach. In *EPJ Web of Conferences* (Vol. 68, p. 36). EDP Sciences.

Wikström, F., Williams, H., Verghese, K., & Clune, S. (2014). The influence of packaging attributes on consumer behaviour in food-packaging life cycle assessment studies - a neglected topic. *Journal of Cleaner Production*, *73*, 100–108. https://doi.org/10.1016/j.jclepro.2013.10.042

*Willis, K., Maureaud, C., Wilcox, C., & Hardesty, B. D. (2018). How successful are waste abatement campaigns and government policies at reducing plastic waste into the marine environment? *Marine Policy*, *96*, 243–249. https://doi.org/10.1016/j.marpol.2017.11.037

*Williams, A. T., Rangel-Buitrago, N. G., Anfuso, G., Cervantes, O., & Botero, C. M. (2016). Litter impacts on scenery and tourism on the Colombian north Caribbean coast. *Tourism Management*, *55*, 209–224. https://doi.org/10.1016/j.tourman.2016.02.008

*Williams, H., Wikström, F., Otterbring, T., Löfgren, M., & Gustafsson, A. (2012). Reasons for Household Food Waste With Special Attention to Packaging. *Journal of Cleaner Production*, *24*, 141–148. https://doi.org/10.1016/j.jclepro.2011.11.044

Wohlin, C. (2014). Guidelines for snowballing in systematic literature studies and a replication in software engineering. In *Proceedings of the 18th International Conference*

on Evaluation and Assessment in Software Engineering - EASE '14. London, United Kingdom: ACM. https://doi.org/10.1145/2601248.2601268

*Wyles, K. J., Pahl, S., Thomas, K., & Thompson, R. C. (2016). Factors That Can Undermine the Psychological Benefits of Coastal Environments: Exploring the Effect of Tidal State, Presence, and Type of Litter. *Environment and Behavior*, *48*(9), 1095–1126. https://doi.org/10.1177/0013916515592177

*Yamaguchi, K., & Takeuchi, K. (2016). Consumer preferences for reduced packaging under economic instruments and recycling policy. *Waste Management*, *48*, 540–547. https://doi.org/10.1016/j.wasman.2015.11.015

Yeo, B. G., Takada, H., Taylor, H., Ito, M., Hosoda, J., Allinson, M., … McGrath, J. (2015). POPs monitoring in Australia and New Zealand using plastic resin pellets, and International Pellet Watch as a tool for education and raising public awareness on plastic debris and POPs. *Marine Pollution Bulletin*, *101*(1), 137–145. https://doi.org/10.1016/j.marpolbul.2015.11.006

*Yeow, P., Dean, A., & Tucker, D. (2014). Bags for Life: The Embedding of Ethical Consumerism. *Journal of Business Ethics*, *125*(1), 87–99. https://doi.org/10.1007/s10551-013-1900-2

*Yeung, S.-K., So, W.-M. W., Cheng, N.-Y. I., Cheung, T.-Y., & Chow, C.-F. (2017). Comparing pedagogies for plastic waste management at university level. *International Journal of Sustainability in Higher Education*, *18*(7), 1039–1059. https://doi.org/10.1108/14676371311312905

*Young, S. (2008). Packaging and the Environment: A Cross-Cultural Perspective. *Design Management Review*, *19*(4), 42–48. https://doi.org/10.1111/j.1948-7169.2008.tb00140.x

*Yue, C., Hall, C. R., Behe, B. K., Campbell, B. L., Dennis, J. H., & Lopez, R. G. (2010). Are consumers willing to pay more for biodegradable containers than for plastic ones? Evidence from hypothetical conjoint analysis and nonhypothetical experimental

auctions. *Journal of Agricultural and Applied Economics*, *42*(4), 757.

*Zen, I. S., Ahamad, R., & Omar, W. (2013). No plastic bag campaign day in Malaysia and the policy implication. *Environment, Development and Sustainability*, *15*(5), 1259–1269. https://doi.org/10.1007/s10668-013-9437-1

*article met review criteria