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Perspectives: Advertising and climate change – Part of the problem or part of the solution?

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ABSTRACT

The advertising industry has a direct carbon footprint but also contributes to climate change by stimulating unsustainable economic growth, promoting climate-harmful consumerism, and greenwashing polluting products and companies. However, advertising can also play a pivotal role in fighting climate change. The advertising industry can reduce its carbon footprint, fight greenwashing, and cut ties with polluting clients and industries. Green advertising can shift consumers away from climate-harmful consumption patterns toward a low-carbon culture by providing accurate information and leveraging psychological processes such as moral satisfaction, nature experiences, and fear responses, among others. For advertising research to play a significant role in this paradigm shift, it should focus more specifically on climate-relevant behaviours instead of on general green consumer behaviour, and adopt a more holistic approach to analyze the role of advertising not only in influencing individual consumers' decisions but also in sustaining a cultural narrative that promotes climate protection.

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Green advertising; climate change; greenwashing; green consumer; carbon footprint

Introduction

There is a broad consensus among scientists that the climate crisis is one of the greatest challenges of our time and the carbon emissions caused by our consumption habits are the primary cause of climate change, with more than 70% of global greenhouse gas emissions directly arising from household consumption decisions (Ivanova et al. 2016; Hertwich and Peters 2009). Advertising has been shown in practice and research to affect consumer behaviour. Changes in unsustainable consumption patterns could substantially reduce households' carbon footprint (Moran et al. 2020), particularly in high-income countries where consumers have a wide range of options (Dubois et al. 2019). Advertising can affect consumer choice between different alternatives, but it can also motivate purchases that in absence of advertising would not have taken place. Although it is yet unclear whether advertising can increase overall aggregate consumption, there is evidence supporting advertising's role in driving economic

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growth and, thus, consumption (Kopf, Torres, and Enomoto 2011; Molinari and Turino 2018). While the emissions caused by advertisement production and dissemination—including its impact on the communication sector—constitute the industry's direct carbon footprint, advertising may also have a significant influence on climate change through its effect on consumer behaviour. However, there is yet scarce literature on the relationship between advertising and climate change. Does advertising contribute to climate change? Can, on the contrary, advertising help mitigate climate change?

Departing from the premise that advertising plays an active role in shaping public tastes and habits beyond influencing purchases, this article aims to provide a perspective on whether and how advertising and climate change are connected. The

Table 1. Research areas covered in each section (*section headings are in italic*).

Advertising as part of the problem	*The carbon footprint of the advertising industry* Advertising production and media campaigns cause a significant amount of carbon emissions (e.g. energy consumption). *Advertising's role in driving the internet's carbon emissions* The advertising industry indirectly contributes to the carbon emissions caused by advertising-driven online businesses (e.g. social networks). *Advertising and aggregate consumption* Advertising's impact on aggregate consumption remains disputed, but individual-level studies show that materialism and consumerism increase consumption and are negatively related to pro-environmental behavior. *Greenwashing* Deceptive and ambiguous claims about products' environmental impact hinder consumers' green choices and increase their skepticism.
Advertising as part of the solution	*Greening the advertising industry* This section underscores the pressure and the initiatives within the advertising industry to decarbonize its activities. *Promoting climate-friendly consumption through green advertising* Accessibility to accurate information, emotional appeals, and heuristics are key to motivating low-carbon consumption. *Demarketing climate-harmful consumption* Advertising can help reducing the consumption of climate-harmful products.
What's next for the industry	*Toward a climate-friendly paradigm shift* Advertising professionals are proactively supporting a shift toward climate-friendly business practices. *Fighting greenwashing* Greenwashing needs to be addressed through self-regulation, certification systems, bans, and interventions to increase greenwashing literacy. *Leveraging low-carbon media campaigns and advertising carbon footprint information* Companies will demand climate-friendly advertising campaigns because they will need to report their overall carbon footprint. *Cutting ties with climate-harmful companies* Advertising agencies will increasingly refuse to work for climate-harmful clients.
What's next for advertising research	*Defining and operationalizing concepts and constructs* Since definitions of many sustainable advertising concepts and constructs are still vague, they need to be unified to allow theory development and empirical study. *Assessing the impact of advertising on climate change* Further research is needed to quantify the industry's direct, indirect, and consumer behavior-mediated contribution to carbon emissions. *Focusing green advertising research on mitigating climate change* Future research needs to address specific antecedents, processes, and outcomes of climate-relevant behavior because most studies to date have only analyzed general environmental behavior. Also, the excessive focus on individual behavior change has diverted attention from advertising's ability to shape society-wide climate-aware consumer culture.

article is organized as follows (Table 1): We start by examining the direct and indirect environmental impacts of advertising, along with the widespread practice of greenwashing (i.e. the use of deceptive or ambiguous green messages). We then explore the advertising industry's plans to green its sector and the green advertising strategies aimed at conveying and strengthening pro-environmental attitudes and behaviours among consumers. We conclude this paper by discussing upcoming challenges the research community and the advertising industry will need to address to make advertising part of the solution to the climate crisis.

Advertising as part of the problem

The carbon footprint of the advertising industry

Advertising and media agencies cause a significant amount of carbon emissions when designing and implementing their clients' advertising and communication campaigns. Carbon emissions are not only generated by industry's operational activities like air traveling and events, but also by the communication sector that transmits advertising messages through media of any kind. Print media, electronics, and other means to convey messages consume material and energy resources that add to the carbon footprint of the advertising industry. For instance, based on data from the Bristol City Council (2019), campaigners in the UK estimated that a double-sided digital bus stop advertising screen consumes four times more electricity than the average British home (Adblock Bristol 2019). Because of energy consumption and carbon emissions, several US municipalities are implementing restrictions on lighted on-premise signs (Taylor and Sarkees 2016).

Despite agencies and professionals acknowledging the environmental impact of the sector (Timperley 2021), advertising production increases year by year driven by clients' demands: From 2020 to 2021, global advertising spending increased by $78bn to a total of $657bn (Barker 2021) and market predictions point to a rapid increase in spending that will surpass $1 trillion by 2025 (Goetzen 2021). This spending boom has been largely driven by the omnipresence of online advertisements. Advertising underpins many business models on the internet. As soon as web-based applications became mainstream, advertisers contributed to social media growth by allocating a growing proportion of their media budgets to online advertising (Knoll 2016; Okazaki and Taylor 2013), as they could reach consumers online at any time due to the extensive adoption of smartphones (Truong, McColl, and Kitchen 2010; Martins et al. 2019). Since messages that previously had to be delivered through traditional more resource-intensive channels such as print media were being transmitted through digital media (Lee and Cho 2020), the environmental impact of advertising in terms of carbon emissions should have decreased. However, that was not the case. On the one hand, digital advertising consumes large amounts of energy that are still mostly generated by fossil fuels. On the other hand, even though the virtualization of a significant part of the advertising industry could reduce advertising's resource consumption, the number of online advertisements is also growing due to personalization and opportunities to engage with consumers more often (Andrews et al. 2016).

Therefore, the increase in digital advertisement production outweighs the resource efficiency gains of the virtualization of the industry.

Five factors inherent to end-to-end online advertising drive the high energy consumption and carbon footprint estimates of online advertising (Pärssinen et al. 2018): (i) online advertisements increase the time required to access the payload content, (ii) the amount of downloaded data, (iii) the number of active connections required, (iv) the energy consumption of data centres, and (v) any other active code related to advertising (e.g. tracking a user's browsing behaviour). Reliable data on the energy consumption of online advertising are scarce. Simons and Pras (2010) estimated that online advertising was responsible for 3.4% of the average computer's total energy consumption while browsing the web. In 2016, online advertising consumed an estimated 106 TWh of energy worldwide and generated 60 million tons of CO2 emissions, with a wide confidence interval between 12 and 159 Mt of CO2e (Pärssinen et al. 2018). Good-loop's carbon calculator (Good-Loop 2021), a platform for net-zero advertisements, estimates that the average online advertising campaign in the UK emits 5.4 tons of carbon dioxide. Reducing the carbon emissions of online advertising is necessary to lower advertising's overall carbon footprint.

Advertising's role in driving the internet's carbon emissions

Although reducing online advertising traffic could improve the energy efficiency of the Internet, it would also hamper the most current business model of free internet services, based on advertising (Pärssinen et al. 2018). The advertising industry indirectly drives and finances these free media content and communication services. Advertising indirectly contributes to the carbon emissions caused by these advertising-driven communication services and content. Regarding the carbon footprint of social media, Derudder (2021) provides an aggregate estimate based on Greenspector, a software company that measures the performance of digital mobile services. Greenspector estimated the carbon emissions of ten common social media platforms (Twitter, Facebook, Tik Tok, Reddit, Pinterest, Instagram, Snapchat, LinkedIn, Twitch, and YouTube) generated during one minute of usage (i.e. scrolling the news feed). On average, these ten social media platforms, which are all partly or entirely financed by online advertising, caused 1.15 gEqCO2 (gram equivalent of CO2) every minute per user (Derudder 2021). Considering an average daily social media usage of 2 hours and 24 minutes per person in 2021, the carbon footprint of online advertising-powered social media adds up to 165.6 gEqCO2 per user and day (Derudder 2021). Even though the advertising industry is not directly responsible for the carbon emissions of social media platforms, it enables a business model that has a considerable carbon footprint.

Advertising and aggregate consumption

The question whether advertising exacerbates environmental problems is connected to the debate on whether, at the macro-economic level, advertising increases overall consumption levels or only redistributes consumption without increasing it (Reekie and Allen 1983). The former would imply that advertising increases emissions and contributes to resource depletion, while, according to the latter, advertising would

only shift consumer behaviour toward or away from more climate-harmful consumption behaviours. So far, this debate has not been settled. Taylor (2013) called for more research on this subject because there was no conclusive evidence of an overall effect of advertising on aggregate consumption.

Mixed empirical results on the macro-economic impact of advertising make it difficult to establish a direct relationship between advertising expenditure and the negative environmental impact caused by consumption-driven economic growth. On the one hand, several case studies and historical evidence at the macro level found limited effects of advertising concerning aggregate consumption (e.g. Broadbent 2008; Wilcox and Gangadharbatla 2006). On the other hand, several studies have confirmed the influence of advertising on aggregate consumption, investment, hours worked, economic activity (Brulle and Young 2007), and economic growth (Kopf, Torres, and Enomoto 2011; Molinari and Turino 2018).

Furthermore, advertising's impact on climate change may be mediated by its relationship with materialism and consumerism. In line with Kasser (2016), we refer to 'materialism' as the priority individuals place on goals and values to accumulate possessions and wealth, often fuelled by status or image motives. 'Consumerism' refers to the idea that the consumption of goods and services—including experiential consumption such as flying to a vacation destination—enhances well-being and happiness. Both materialism and consumerism motivate purchasing (Lee et al. 2022) and the creative sector of the advertising industry exploits this to encourage consumption (e.g. the 'Your world awaits' campaign, launched by Air Canada in 2015 to promote flying using slogans including 'The world is not an oyster, it's a 10,075 km pearl'). Studies showing that advertising can increase materialism (Chia 2010; Moldes and Ku 2020; Twenge and Kasser 2013; Opree et al. 2014) and consumerism (Frick et al. 2021) confirm the effectiveness of such strategies. There is also significant empirical support for a negative relationship between materialism and pro-environmental attitudes and behaviour. Individuals who prioritize materialistic values and goals do not only consume more but also act in less environmentally friendly ways (Hurst et al. 2013; Kasser 2016; Unanue et al. 2016). Several recent studies have corroborated this relationship in China (Gu et al. 2020), Finland (Lundberg et al. 2019), the UK (Gatersleben et al. 2018), Spain (Diaz-Ruiz, Costa-Font, and Gil 2018), Sweden (Andersson and Nässén 2016) and the US (Segev, Shoham, and Gavish 2015). Thus, despite the literature not being conclusive on a direct macro-economic impact of advertising, there is evidence supporting an indirect relationship between advertising and climate change: Advertising exposure can increase materialism and consumerism which, in turn, disincentives climate-friendly behaviour.

Greenwashing

Advertising can change consumer perceptions of the environmental impact of companies, products, and services. Green advertising—by portraying a company or brand as environmentally friendly—improves consumers' corporate and brand attitudes and drives purchase intention (Hartmann and Apaolaza-Ibáñez 2009). However, green advertising has frequently been utilized for greenwashing purposes. 'Greenwashing' refers to a product's environmental communication that is false, deceptive, ambiguous,

Table 2. Overview of research on greenwashing.

Topic	Contribution	Studies
A conceptual review of greenwashing	Studies identify misleading and deceptive claims in green ads and define the phenomenon.	Bowen and Aragon-Correa (2014), de Freitas Netto et al. (2020), Delmas and Burbano (2011), Kangun, Carlson, and Grove (1991).
Green cues and greenwashing	Nature images, green color, eco-labels, and some packaging cues can give the impression of a product being environmentally friendly even in the absence of supportive facts.	D'Souza (2004), Gershoff and Frels (2015), Grimes (2008), Hahnel et al. (2015), Hartmann and Apaolaza-Ibáñez (2009), Magnier and Schoormans (2015), Matthes, Wonneberger, and Schmuck (2014), Pancer, McShane, and Noseworthy (2017), Seo and Scammon (2017), Sörqvist et al. (2015).
Greenwashing practices of oil companies	Apart from using deceptive and ambiguous claims, oil companies' PR and advertising campaigns have also downplayed the need and urgency of climate action. Responsibility for taking action, if any, is placed on individuals rather than businesses.	Beder (2002), Bonneuil, Choquet, and Franta (2021), Boussalis and Coan (2016), Brulle, Aronczyk, and Carmichael (2020), Dunlap and McCright (2011), Jaworska (2018), Kent (2009), Megura and Gunderson (2022), Plec and Pettenger (2012), Schlichting (2013), Supran and Oreskes (2017, 2020, 2021).
Consumers' reaction to greenwashing	Untrained consumers hardly recognize greenwashing in advertising, but its widespread use has increased consumers' skepticism and distrust, lowering consumers' intentions to buy green products.	D'Souza, Taghian, and Lamb (2006), do Paço and Reis (2012), Fernandes, Segev, and Leopold (2020), Goh and Balaji (2016), Gorissen and Weijters (2016), Parguel, Benoit-Moreau, and Russell (2015), Schmuck, Matthes, and Naderer (2018), Smith (2014).

or that omits relevant product information (Kangun, Carlson, and Grove 1991). Table 2 summarizes the greenwashing studies discussed in this section.

Advertising claims are often ambiguous, such as Body Shop's 'Nature's way to beautiful' slogan. There are numerous examples of communication campaigns portraying companies and products deceptively as environmentally friendly (Bowen and Aragon-Correa 2014; Delmas and Burbano 2011), even when they are indeed environmentally harmful (Plec and Pettenger 2012). For instance, several airline campaigns (KLM, Lufthansa, and Ryanair's 'Lowest fares, lowest emissions') were banned for misleading claims about carbon emissions (Baazil 2022; Oakes 2022). Danone's 2020 'Good for the planet' message for their Alpro almond drinks and Danish Crown's 2021 'climate-controlled pigs' claim have been reported as cases of greenwashing, the first for misleading claims and the second for a self-accredited eco-label (Provenance 2022).

The most polluting industries, such as oil companies, have widely and frequently utilized greenwashing (Megura and Gunderson 2022). Apart from greenwashing products and corporate images, highly carbon-emitting industries (oil companies, in particular) have also downplayed the urgency of climate action. Together, the five major oil companies, ExxonMobil, Shell, ChevronTexaco, British Petroleum, and ConocoPhillips spent nearly $3.6 billion in advertising from 1986 to 2020 (Brulle, Aronczyk, and Carmichael 2020). Document-by-document textual content analysis and comparison of 187 climate change communications from 1989 to 2004 showed that ExxonMobil 'advertorials'—paid, editorial-style advertisements—in The New York Times routinely expressed doubt about climate change as real

and human-caused (Supran and Oreskes 2017). In contrast, most peer-reviewed papers and internal reports authored by ExxonMobil's scientists acknowledged that burning fossil fuels caused global warming. Paradoxically, ExxonMobil's scientists' academic publications advanced climate science, while the company launched advertising campaigns to promote doubt and mislead the public (Supran and Oreskes 2020). Moreover, a big portion of oil companies' advertising budgets has been spent on delaying climate legislation. Brulle, Aronczyk, and Carmichael (2020) showed that major oil companies' advertising expenditure correlated with the levels of US congressional action and media attention to climate change. According to Brulle, Aronczyk, and Carmichael (2020), these companies spent $315 million in 2010 alone, when the likelihood of binding climate legislation in the US was very high.

These practices have not been limited to advertising campaigns but have also been an integral part of many climate-harmful companies' public relations (PR) programs. These PR activities aim to improve companies' public image and avoid regulations and public pressure. PR strategies have also shaped the public debate on climate change. For example, think-tank information denying climate change increased exponentially from 1998 to 2013 (Beder 2002; Boussalis and Coan 2016). Industry PR has significantly shaped the common public narratives and framings of climate change (Schlichting 2013). The most common frame is the use of uncertainty and doubt to deny climate science and delay action by oil companies (Dunlap and McCright 2011; Jaworska 2018; Supran and Oreskes 2017). As a recent study on ExxonMobil's strategies to shape public discourse on climate change shows, the company used selective environmental framings (i.e. emphasizing some terms and topics while avoiding others), and referred to scientific uncertainty with terms such as 'climate risk' to downplay the reality and seriousness of climate change (Supran and Oreskes 2021). Climate change has also been framed as an individual responsibility to deflect the industry's responsibility (Kent 2009). In Europe, oil companies used a similar strategy by emphasizing uncertainty about climate change and downplaying its urgency, as an analysis of Total oil company's communications from 1971 to 2021 shows (Bonneuil, Choquet, and Franta 2021).

A common feature of greenwashing communication is the use of vague and unspecific terms (de Freitas Netto et al. 2020). Instead of concrete technical terms and information (e.g. 100% biodegradable, organic agriculture, made from 80% recycled plastics, etc.), greenwashed advertisements use ambiguous and uninformative claims (e.g. green, eco-friendly, sustainable, natural, etc.), which are subject to interpretation (D'Souza 2004). These terms can signal a factual environmental certification or come down to self-declarations by companies or self-created environmental labels. As a result, most consumers are unable to tell apart specific from ambiguous terms (D'Souza, Taghian, and Lamb 2006) and they misinterpret the environmental impact of products (Smith 2014).

Moreover, advertising generally involves low-effort rather than high-effort mental processing, as consumers process it while they are performing other tasks, such as scrolling social media or watching television (Grimes 2008). In the case of green advertising, instead of focusing on the veracity of the green claims, consumers often use mental shortcuts that focus attention on certain cues such as nature images

(Hartmann, Apaolaza, and Alija 2013), green colours (Pancer, McShane, and Noseworthy 2017), labels (Hahnel et al. 2015) or product packaging (Seo and Scammon 2017). These cues trigger positive emotional arousal and motivate consumers to perceive any product having these features as environmentally friendly (Gershoff and Frels 2015; Magnier and Schoormans 2015). The effect of these visual cues is so strong that, for example, consumers may perceive a product as not environmentally friendly just because its label does not use green colour (Pancer, McShane, and Noseworthy 2017). On the other hand, images of nature alone can enhance positive product perceptions while textual environmental information alone does not (Hartmann and Apaolaza-Ibáñez 2009; Matthes, Wonneberger, and Schmuck 2014). Yet, none of these visual cues reflects environmental performance and thus advertisers can easily use them to give the false impression of a product being environmentally friendly.

Therefore, it does not come as a surprise that consumers—even those with high environmental concern or knowledge—are frequently unable to recognize greenwashing in advertising. Unless they are specifically trained to spot deceptive messages (e.g. Fernandes, Segev, and Leopold 2020), the majority of consumers do not perceive greenwashing claims as misleading (Parguel, Benoit-Moreau, and Russell 2015). Moreover, in situations when individuals with high knowledge may detect false green claims, associating such claims with nature-evoking images activates an affective persuasive mechanism that appeals to consumers' affinity for nature. This cue can be strong enough to offset the negative impression caused by the perceived greenwashing (Schmuck, Matthes, and Naderer 2018). As consumers perceive products with 'green' attributes positively (Sörqvist et al. 2015), the presence of green claims—even if they are misleading or vague—might lead them, for instance, to underestimate the carbon emissions associated with their purchase (Gorissen and Weijters 2016). By purchasing greenwashed products and services, consumers may believe they are lowering their consumption-related emissions, while they actually might be doing the opposite.

Further evidence shows that many years of widespread use of greenwashing have increased consumers' scepticism and distrust of green advertising (do Paço and Reis 2012). The most sceptical consumers are typically those with higher environmental knowledge and involvement, which are also the ones more interested in reducing their consumption-related emissions (Matthes, Wonneberger, and Schmuck 2014). Green advertising scepticism leads consumers to decrease their intention to buy green products (Goh and Balaji 2016). Hence, greenwashing represents a significant barrier to emissions reduction. With greenwashing practices getting by unchecked, many consumers will keep purchasing climate unfriendly products and services instead of shifting to low-carbon alternatives.

Advertising as part of the solution

Greening the advertising industry

Debates around sustainability in advertising often focus on the creative part of the industry, namely on its role in conveying and inspiring behavioural changes to address climate change. However, the greening of the industry also implies reducing its carbon footprint. Among the industry-wide initiatives aimed at providing a blueprint for

reducing emissions, the UK Advertising Association's Ad Net Zero initiative is gaining momentum, especially after hosting a two-day global summit in Glasgow during the COP26 UN Climate Change Conference in 2021. This initiative is the cornerstone of the UK advertising industry's plan to reach net-zero by 2030. The Ad Net Zero best practice guide outlines a wide range of actions for green media supply chains. Reducing the industry's communication sector's carbon footprint requires curbing production emissions, making sustainable media choices, and including sustainability criteria in awards and events (Advertising Association 2020). Although achieving net-zero implies a transformation in current working procedures, the industry could drop some of the most polluting activities—such as traveling—without much disruption. Unlike flying less frequently, greening most of the operative aspects and core production activities of the industry will likely increase costs. Business as usual will be costly too because clients will increasingly demand agencies take responsibility for the carbon emissions they generate. Moreover, retaining talent will become harder. Of a sample of advertising professionals surveyed in the UK, 91% thought their job satisfaction would improve if their organization took climate action, 71% worried about the negative environmental impact of the industry, and 45% questioned working in the industry due to its environmental impact (Advertising Association 2020).

Increasing pressure from within and outside the advertising industry should nudge brands, media, agencies, production companies, and other marketing service providers towards the decarbonization of their core activities. This transition needs industry-wide commitment. For instance, as part of the Ad Net Zero plan, a consortium of companies launched AdGreen to collectively work on measuring the carbon footprint of advertising production and taking action to reduce its impact. By leveraging the entire media supply chain, initiatives like AdGreen seek to empower the industry to reduce its carbon footprint.

Promoting climate-friendly consumption through green advertising

Green advertising has a significant potential to help shift consumers towards more climate-friendly consumption behaviours. The term 'Green advertising' refers to advertising that explicitly or implicitly addresses the relationship between products/services and the biophysical environment to promote a green lifestyle or present a corporate image of environmental responsibility (Banerjee, Gulas, and Iyer 1995). A wider perspective sees green advertising as advertising promoting environmentalism, conservationism, human welfare ecology, preservationism and ecologism (Kilbourne 1995; Kilbourne 2004). Green campaigns, such as Adidas's 2020 'End Plastic Waste', evoke an implicit relationship between the purchase of the product and the environment.

Given the increasing environmental concern among consumers, green advertising has become an effective promotion strategy because it provides an opportunity for consumers to express their environmental preferences with their purchases. Consumers attach higher social and ethical values to products that are promoted as green (Mazar and Zhong 2010). As a result, claiming a product is green increases some consumers' willingness to pay for that product (Laroche, Bergeron, and Barbaro-Forleo 2001). Table 3 summarizes the green advertising studies discussed in this section, organized by either theoretical developments or empirical research on green advertising

Table 3. Overview of green advertising research.

Topic	Contribution	Studies
Theoretical development	This body of research covers early attempts to define green advertising and provides a framework to assess the greenness of advertising, identify consumers who are likely to pay more for green products, and discuss marketing strategies to target them.	Banerjee, Gulas, and Iyer (1995), Kilbourne (1995), Kilbourne (2004), Laroche, Bergeron, and Barbaro-Forleo (2001), Zinkhan and Carlson (1995)
Accurate information provision	To inform consumers' choices and avoid suspicions of greenwashing, green advertising should prioritize clarity, specificity, and salience of environmental facts using substantive claims instead of vague image-enhancing cues.	Carlson, Grove, and Kangun (1993), Chan (2000), Davis (1993), Kangun and Polonsky (1995), Hartmann and Apaolaza-Ibáñez (2009), Scammon and Mayer (1995).
Promotion-focused appeals	Studies testing gain-oriented green advertising have mainly focused on three strategies: First, anticipating a positive affect from helping the environment (i.e. warm glow) can motivate pro-environmental action. Second, consumers' willingness to signal a socially desirable identity can be exploited by linking green consumption to social approval. Third, advertisements using the green color or showing nature scenes activate an environmental schema for the consumer leading to positive emotional experiences that can encourage green consumption.	Bhatnagar and McKay-Nesbitt (2016), Hartmann and Apaolaza-Ibáñez (2008, 2009, 2010, 2012), Hartmann et al. (2017), Matthes, Wonneberger, and Schmuck (2014), Mazar and Zhong (2010), Nyborg, Howarth, and Brekke (2006), Pancer, McShane, and Noseworthy (2017), Policarpo and Aguiar (2020), Sachdeva, Jordan, and Mazar (2015).
Prevention-focused emotional appeals	Green advertising strategies based on negative emotions can effectively influence consumers. They may act pro-environmentally to avoid feelings of guilt and shame. Fear activation can also increase pro-environmental intentions. Climate change-related images activate fear by highlighting the severity of nature degradation and increasing the level of perceived threat.	Amatulli et al. (2019), Chang (2012), Hartmann et al. (2014), Homar and Knežević Cvelbar (2021), O'Neill et al. (2013), Pittman, Read, and Chen (2021).
Heuristics	Green advertising can exploit consumer heuristics, that is, mental shortcuts which simplify decisions. For instance, the 'green halo effect' caused by green labels can improve perceptions of product performance even in aspects unrelated to sustainability. Another heuristic, familiarity bias, leads to consumers more consistently making green purchases when repeatedly exposed to green advertising.	Apaolaza et al. (2018), Juhl, Fenger, and Thøgersen (2017), Park and Lessig (1981), Sörqvist et al. (2015).

strategies: Accurate information provision, promotion-focused appeals leveraging positive emotions, prevention-focused appeals leveraging negative emotions, and heuristics.

Providing accurate information to inform green consumer's choices

At present, many green advertisements still feature vague environmental claims that often fall into the greenwashing category (see Greenwashing section). Apart from

driving green advertising scepticism, vague claims fail to provide consumers with the necessary information to enable informed pro-environmental consumption choices (Zinkhan and Carlson 1995; Kangun and Polonsky 1995; Scammon and Mayer 1995; Kilbourne 1995; Kilbourne 2004). To adequately inform consumers' choices, green advertising claims need to be substantial. Substantive green claims inform consumers about the concrete, tangible environmental benefits of a product or service relative to less environmentally friendly alternatives, thus enabling more environmentally friendly consumption decisions (Carlson, Grove, and Kangun 1993). In cases of higher consumer involvement—when central persuasion strategies are often more effective—specific environmental claims enhance product perceptions and are more likely than vague green claims to increase purchase intention (Chan 2000; Davis 1993). Several studies have confirmed the effect of concrete informational green claims on purchase intention, particularly with climate-relevant consumption behaviours such as switching to a green energy contract at home (Hartmann and Apaolaza-Ibáñez 2008; Hartmann and Apaolaza-Ibáñez 2009; Hartmann and Apaolaza-Ibáñez 2012). Informative green advertisements should provide concrete technical information on the product's or service's environmental impact. This information could feature, for instance, data on carbon footprint, resource use, production processes, recyclability, and environmentally relevant ingredients, ideally in comparison with less environmentally friendly alternatives. To avoid vague green claims and suspicion of greenwashing, advertisers should provide relevant information in green campaigns, even when the main persuasion strategy relies on emotional appeals and heuristics.

Using emotional appeals and heuristics to motivate low-carbon consumption

Since green advertising is often targeted at less involved consumers or seen in low-involvement situations, providing only information may lead to limited effectiveness. In cases of low involvement, advertising persuasion will take place through low-effort peripheral processing with reduced cognitive elaboration, either through heuristic inference processes (Chaiken 1980; Mitchell and Olson 1981; Petty, Cacioppo, and Schumann 1983) or as a result of emotional responses (Burke and Edell 1989).

In line with regulatory focus theory, the persuasion processes involved in green advertising can be either promotion-focused, that is, goal or gain-oriented (e.g. achieving a healthy environment), or prevention-focused, that is, stressing losses from an environmental protection perspective (e.g. highlighting environmental degradation) (Higgins 1998). Promotion and prevention-focused green appeals can trigger psychological responses in consumers by means of emotional arousal (e.g. the moral satisfaction of contributing to the environment or fear of the impact of climate change), perceptions of self-benefits (or losses) from (not) consuming low-carbon products, or experiences evoked by nature images (Hartmann and Apaolaza-Ibáñez 2012).

Promotion-focused green advertising appealing to psychological and emotional motives can be very persuasive. Messages that are gain-oriented and highlight the positive aspects of striving to reach environmental goals may be more effective than loss-focused appeals in encouraging pro-environmental behaviour (Bhatnagar and McKay-Nesbitt 2016). Consumers can experience 'warm glow', an anticipated positive affect from helping the environment. Green advertising can trigger warm glow and motivate environmentally friendly consumption (Hartmann, Apaolaza Ibáñez, and

Forcada Sainz 2005; Hartmann et al. 2017). Besides, the emotional arousal triggered by environmental appeals in green advertising can be associated with tangible benefits too (e.g. organic food associated with health benefits). Feelings of well-being, fulfilment, or pride may also arise if, for example, a consumer perceives that green consumption leads to social approval, especially when individuals believe relevant others buy green products too (Nyborg, Howarth, and Brekke 2006). Since green consumption can signal a socially desirable pro-environmental identity (Sachdeva, Jordan, and Mazar 2015), green advertising should highlight the social benefits of conspicuous environmentally friendly behaviour (Policarpo and Aguiar 2020). For instance, Timberland's 'Nature Needs Heroes' appeals to consumers' feelings of pride and social approval by suggesting that buyers of its products are special because they contribute to sustainability for the benefit of all humans and nature.

Visual cues typically used in green advertising such as nature images and green colours are also central to green persuasion (Hartmann and Apaolaza-Ibáñez 2009; Hartmann and Apaolaza-Ibáñez 2010). Advertisements employing scenes of nature can trigger emotional experiences similar to those felt when in contact with nature. New Zealand power company Meridian Energy's 2005 'Water' and 'Wind' TV commercials showing pristine nature scenery are excellent examples of how advertising can evoke such *virtual nature experiences*. Nature images can lead to more positive attitudinal effects than informative environmental claims (Hartmann and Apaolaza-Ibáñez 2008; Hartmann and Apaolaza-Ibáñez 2009; Matthes, Wonneberger, and Schmuck 2014), are fixated longer than text in advertisements (Rayner et al. 2001), attract consumers' attention and improve advertising recall (Hartmann, Apaolaza, and Alija 2013). Moreover, research has shown that the use of green colour alone is associated with nature and can induce consumers to perceive a lower environmental impact of brands, triggering positive advertising attitudes and purchase intentions (Pancer, McShane, and Noseworthy 2017).

Contrary to gain-oriented appeals evoking positive feelings, prevention-focused messages in green advertising trigger negative feelings. The images of climate change-related degradation of nature—wildfires, floods, droughts, etc.—can evoke fear responses (Hartmann et al. 2014) and increase the sense of the importance of the issue (saliency) of climate change (O'Neill et al. 2013). For instance, Volvo's 2021 'The Ultimate Safety Test' advertising campaign, informing about the transition of the company to electric cars, shows in an impactful way and setting the effect of climate change on the degradation of glaciers. Advertising appeals that raise awareness of potential losses and negative consequences of climate change can increase pro-environmental intentions. The higher the threat level, the higher the fear, and thus the larger the increase in pro-environmental intentions (Hartmann et al. 2014; Pittman, Read, and Chen 2021). Also, appeals stressing present (vs. future) outcomes from environmental purchases trigger stronger consumer reactions if they focus on losses from climate change rather than gains from a reduced environmental impact (Homar and Knežević Cvelbar 2021). However, advertisers using environmental fear appeals should consider that combining fear activation with informative advertising claims on how to prevent the environmental threat may reduce the effectiveness of the fear appeals because it reduces the perceived severeness of the threat (Hartmann et al. 2014). Environmental threat appeals can also reduce consumers' perceived

self-efficacy, lowering the motivation to engage in pro-environmental behaviour (O'Neill et al. 2013). Apart from triggering primitive emotions such as fear, advertising appeals stressing losses from climate change may also evoke negative social emotions such as guilt or shame. Activation of guilt and shame about environmentally unfriendly consumption choices can act as a mechanism that increases the perceived self-benefits of green purchases (Amatulli et al. 2019; Chang 2012).

Consumer heuristics offer a further promising avenue, so far little explored, for green advertising practice and research. Examples of such heuristics are consumers associating happiness and pleasure with the consumption of organic food (Apaolaza et al. 2018), or the 'green halo effect', according to which consumers perceive green products as tasting or performing better than identical non-green alternatives (Sörqvist et al. 2015). While a lack of experience with green attributes can be one of the causes of the intention–behaviour gap in green consumption (Biswas and Roy 2015), repeated exposure to advertising increases feelings of familiarity with the brand and product (Park and Lessig 1981). Consumers make green purchases more consistently when they are repeatedly exposed to green advertising (Juhl, Fenger, and Thøgersen 2017), eventually adopting a low-carbon default in consumption as familiarity with green purchasing increases.

Demarketing climate-harmful consumption

Increasing consumption, even if less climate-harmful, might be at odds with climate-protective behaviour because consumption is inevitably tied to resource use. Although marketing's main objective is to increase the demand for goods or services, in certain situations it may be desirable to use marketing to reduce demand. 'Demarketing' refers to marketing actions aimed at decreasing demand (Kotler 2011). Kotler and Levy's (1971) three-category framework classifies demarketing as a means for companies to restrict the demand for their products to benefit the common good (general demarketing), to avoid attracting unwanted consumer segments (selective demarketing), and to signal a shortage or an inadequacy (ostensible demarketing). As a specific case of demarketing, 'green demarketing' (Armstrong Soule and Reich 2015) seeks to reduce the overall level of consumption and deviate consumer demand from products that are more environmentally harmful. For instance, Patagonia's 2011 'Don't buy this jacket' campaign highlighted consumers' environmental footprint and urged them to consume less (Hwang et al. 2016).

Yet, despite demarketing's potential to reduce climate-harmful consumption, experimental findings suggest that green advertising claims outperform demarketing campaigns when it comes to influencing purchase decisions (Reich and Soule 2016). Green demarketing and green advertising are not substitutes but rather complementary strategies to encourage the adoption of sustainable consumption patterns. The behavioural changes promoted by green demarketing would be more attractive to consumers if these campaigns ensured symbolic benefits for those who reduce their climate-harmful consumption. Sekhon and Armstrong Soule (2020) found that a visible signal that communicates environmental motivations for reducing consumption of climate-harmful products is necessary to engage consumers because the act of foregoing consumption does not provide evident symbolic benefits to individuals and

'anticonsumers' may even be regarded as having a lower socioeconomic status. Hence, demarketing campaigns will have to leverage 'conspicuous anticonsumption' (Sekhon and Armstrong Soule 2020) to be effective, which implies the use of visible signals that confer status without needing to make a purchase and restore the symbolic benefits that are often lost when foregoing consumption. Advertising, not least through evoking such symbolic benefits, can play an important part in green demarketing.

What's next for the industry

Toward a climate-friendly paradigm shift

An increasing number of advertising professionals are turning towards networks and associations to promote a climate protection agenda throughout the industry. To name a few, networks such as Creatives for Climate, Conscious Advertising, Clean Creatives, Purpose Disruptors, and Comms Declare connect industry professionals with a shared mission to make advertising part of the solution to climate change. The professionals gathered around these networks actively discourage climate-harmful practices using their respective platforms. At a more institutional level, the World Federation of Advertisers (WFA) is urging global marketers to champion the United Nations' Race to Zero campaign—a coalition of leading net zero initiatives. The WFA has its initiative too, called Planet Pledge, which guides agencies on how to comply with net zero commitments. The advertising industry can and should adopt a proactive role in the fight against climate change. The most pressing issues in this regard are fighting greenwashing, leveraging low-carbon media campaigns and advertising carbon footprint information, as well as cutting ties with climate-harmful companies.

Fighting greenwashing

Fighting greenwashing should be a priority for advertisers and regulatory bodies alike because, as previously discussed, greenwashing is pervasive and a significant barrier to the shift toward more climate-friendly consumption. The most prominent tools to combat greenwashing are certification systems, self-regulation, bans on advertising practices aimed at greenwashing, and interventions to increase consumers' greenwashing literacy. However, each of these approaches has drawbacks, rendering the effective eradication of greenwashing difficult.

Current certification systems provide quality standards such as environmental labels which can help consumers to verify the authenticity of green claims. However, the proliferation of non-official green labels and certificates, often using green advertising cues (e.g. green appeals, green colours, nature images, etc.), has decreased public confidence because they often do not represent credible standards (do Paço and Reis 2012). Advertisers should only use green labels that are backed by official regulations and controls.

There is an urgent need for the advertising industry to self-regulate on greenwashing. Failing to do so will likely result in public authorities stepping in with further

bans and more stringent regulations that could hinder the advertising industry's transformative potential. Research on the regulatory aspects of green advertising is however still scarce and findings are ambiguous (Agarwal and Kumar 2021). Self-regulation of green advertising is further complicated by the complexities of self-regulating digital advertising (Dickinson-Delaporte et al. 2020; Rotfeld and Taylor 2009). Green advertising self-regulation should focus on green claim specificity. Claim specificity can improve credibility in green advertising and enhance advertising effectiveness (Ganz and Grimes 2018). Significant steps, proposals, and research on greenwashing self-regulation should be an urgent priority.

Government efforts to curtail greenwashing through green advertising regulation have rapidly evolved in recent decades to include bans targeted at greenwashing (de Freitas Netto et al. 2020). Specifically, oil companies' advertising campaigns are under scrutiny. For instance, New York City sued three major oil companies for allegedly using misleading advertising campaigns that failed to disclose the climate impact of fossil fuels (Gilmer and Van Voris 2021). Some European cities are already legislating to limit advertisements that contribute to greenwashing the fossil fuel industry (Neslen 2021). Environmental organizations like ClientEarth are also using legal action to demand tobacco-style health warnings on advertisements from oil companies (UK National Contact Point for the OECD 2020). Individuals are exerting pressure too by adhering to campaigns like the European Citizen's Initiative (ECI) registered on June 16th, 2021, which proposes a ban on fossil fuel advertisements (ECI 2021). This initiative can turn into an EU law if it garners enough support.

Advertising regulations stipulate that advertising should do no harm, enhance trust in the marketing system, and hold ethical values (American Marketing Association (AMA) 2015). However, practices such as the systematic advertising of fossil fuels using positive environmental associations illustrate that authorities often fail to address greenwashing effectively. So far, clear guidelines on what makes a product 'environmentally safe' are still mostly lacking (Delmas and Burbano 2011). In practice, monitoring of advertising fails as it requires specific technologies and costly audits (Jahn, Schramm, and Spiller 2005). Moreover, the persuasion effects of green advertising stem to a significant extent from cues such as green colour and nature images, and these are difficult to regulate in advertising. Limited, uncertain, and often non-enforced regulation makes greenwashing more difficult to eradicate (Delmas and Burbano 2011). As long as anti-greenwashing efforts from governments remain uncoordinated and there are no clear guidelines of what represents an environmentally safe product, greenwashing will likely remain widespread, representing a barrier to reducing consumption emissions.

A further promising approach consists in neutralizing its effects by educating consumers to spot greenwashing. Cognitive interventions can increase consumers' greenwashing literacy so that they learn to recognize certain official standards and detect deceptive claims (Fernandes, Segev, and Leopold 2020). The advertising industry could jointly finance educational communication campaigns to counteract the noxious effects of greenwashing still practiced by many of its members.

Leveraging low-carbon media campaigns and advertising carbon footprint information

Since the advertising industry works for its clients—who decide which campaigns to implement and how—, initiatives for greening the industry such as the abovementioned UK Advertising Association's Ad Net Zero initiative to reach net-zero by 2030 (Advertising Association 2020) will only be feasible if they resonate with clients' needs. But instead of being a limitation, clients' needs can potentially leverage the low-carbon transition of the industry because those corporate clients will undergo a similar process of de-carbonization, likely also driven by end-consumers' attitudes and motives concerning climate change. By curbing production emissions and choosing low-carbon media channels, advertising agencies can contribute to lowering their clients' carbon footprint. Companies increasingly report carbon footprint information in their sustainability reports (either voluntarily or driven by legislation). Advertising clients will have significant incentives to demand low-carbon advertising campaigns because reporting carbon emission savings can potentially affect corporate image and client attitudes. As a prerequisite, advertising agencies need to adopt detailed carbon accounting methods to assess campaign-related carbon emissions. Providing this information to advertising clients will enable more climate-friendly advertising campaign choices, leveraging the low-carbon transition of the advertising industry.

Cutting ties with climate-harmful companies

An increasing number of agencies and media companies refuses to produce and disseminate greenwashed fossil fuels advertisements, with executives likening this shift to the advertising industry's move away from tobacco (Hsu 2021). Both tobacco and oil companies have long used advertising to mislead the public and delay legislative action (Boyle et al. 2020; Megura and Gunderson 2022; Plec and Pettenger 2012). Kaupa (2021) argues that, since major oil companies have used advertising to block regulatory change and normalize a harmful commodity, current fossil fuel advertisements are as misleading as former tobacco advertising and, therefore, a ban on fossil fuel advertising would be the best regulatory solution. In the same vein, climate experts (Otto et al. 2020) suggest a ban on fossil fuel advertisements would constitute a social tipping point (i.e. an intervention that can activate contagious processes of rapidly spreading technologies, behaviours, social norms, and structural reorganization) to reduce carbon emissions. However, recent initiatives to ban fossil fuel advertisements are not widespread, and it is yet unclear whether this tendency will spread to media outlets. To date, only a few media outlets, such as The Guardian and the British Medical Journal in the UK, and the Swedish publications Dagens Nyheter and Dagens ETC, have imposed an outright ban on fossil fuel advertisements (Hsu 2021).

Although a ban on fossil fuel advertisements seems still politically challenging, many agencies are already refusing to work with carbon-intensive companies in general, and oil companies in particular. In the US, more than 130 agencies and 400 professionals have joined the Clean Creatives initiative (https://cleancreatives.org/) and pledged to decline future contracts with the fossil fuel industry. Recently, the

Great Reset campaign in the UK (https://greatreset.com/) encouraged its members to take responsibility for the advertisements they produce. Similarly, many communication professionals in Australia have joined the CommsDeclare initiative (https://commsdeclare.org/) and committed not to work for the fossil fuel industry. CommsDeclare also collaborated with Clean Creatives on the F-list Report (Clean Creatives and CommsDeclare 2021), which exposes advertising and PR companies that keep working with the fossil fuel industry. This report reveals that some of the biggest advertising companies still sign contracts with oil companies. Despite raising awareness in the broader creative community, mainly in small agencies though, big advertising firms are stepping away from oil companies at a slower pace (Hsu 2021). Agencies interested in cutting ties with climate-harmful companies can publish Client Disclosure Reports (e.g. Futerra 2022) detailing the percentage of their annual turnover that comes from high-carbon clients. Agencies that have decided to step away from oil companies before a—rather distant—ban is enacted by law foresee that working with these clients will be culturally less acceptable in the future (Hsu 2021). In the short term, agencies will have to position themselves because remaining ambivalent will become more difficult as the climate crisis worsens. Agencies heavily reliant on the revenue from highly polluting clients will need to keep working with them, dealing with accusations of contributing to a high-carbon lifestyle. Conversely, agencies wanting to spur cultural change will have to diversify their client portfolio, which will imply renouncing lucrative contracts. The industry will not be able to play both sides credibly because the entire supply chain, down to the individual consumer, is increasingly becoming aware of the advertising industry's ambivalent role in the climate crisis.

What's next for advertising research

Defining and operationalizing concepts and constructs

Advertising research can and should play a pivotal role in lowering the carbon footprint of the advertising industry and activity, as well as of society as a whole (Table 4 provides an overview of future research avenues). Concrete construct definitions are a precondition for adequate future research. However, current definitions of many concepts and constructs related to sustainable or green advertising are still vague due to changes in definitions and operationalizations over time and between studies (e.g. green/sustainable advertising, greenwashing, etc.). Constant changes undermine the comparability of empirical findings and challenge the integration of insights into existing theory. Future research needs to unify green advertising terminology based on recent theoretical developments regarding the definition and operationalization of concepts and constructs (e.g. Bergkvist and Eisend 2022; Bergkvist and Eisend 2021; Bergkvist and Taylor 2022).

Assessing the impact of advertising on climate change

Except for some notable exceptions (e.g. Pärssinen et al. 2018), reliable data are lacking on the direct and indirect carbon emissions generated by the advertising industry. Currently, professionals from the advertising industry themselves elaborate

Table 4. Further research agenda.

Topic	What we know	Research gap	Further research avenues
Construct definitions	The current literature provides diverse definitions and construct operationalizations concerning green advertising.	Vague definitions of concepts and constructs concerning sustainable advertising (e.g. green/ sustainable advertising, greenwashing, etc.).	Unified definitions and operationalizations based on recent theoretical developments in the definition and operationalization of concepts and constructs.
Advertising's carbon footprint	Activist and industry-based studies have intended to quantify advertising's carbon emissions.	Existing data are scarce, industry-sourced, and not backed by systematic research.	The carbon footprint of advertising campaigns (advertising management, production, media choice).
Advertising's indirect role in the internet's carbon footprint	Advertising enables online business models. Internet activity causes carbon emissions.	Scarce data and conceptual development.	Advertising's role in enabling advertising-driven online business models that have a significant carbon footprint (e.g. social networks).
Advertisings' effect on aggregate consumption	Some studies support that advertising stimulates consumption.	Ongoing discussion on whether advertising drives aggregate consumption, for instance through materialism and consumerism.	The extent to which advertising increases aggregate consumption and boosts economic activity. The magnitude of the additional carbon emissions attributable to advertising.
Green advertising research's climate change focus	Green advertising research has addressed the effects of advertising claims on pro-environmental consumer behavior.	The focus of extant green advertising research is on environmentally friendly consumption in general. Lack of specific theoretical underpinnings on how to mitigate climate change.	Development and empirical test of specific theoretical models of the relationship between green advertising claims and climate-friendly behavior.
Research focus on carbon-intensive systemic behaviors	Isolated studies have assessed advertising effects on carbon-intensive behavior such as energy choice.	Existing research focuses on more easily influenceable behaviors while avoiding hard-to-manipulate, carbon-intensive systemic behaviors (e.g. mobility and energy).	Extend green advertising research scope to the promotion of low-carbon alternatives to systemic carbon-intensive products, services, and behaviors (e.g. adoption of green electricity at home, public transport, etc.).
Demarketing climate harmful behavior	Research recognizes the need to decrease the consumption of some goods under certain circumstances and has revealed related mechanisms.	Scarce research on green demarketing and on how to restore the symbolic benefits that are lost when foregoing consumption. Lack of a climate change focus.	Development and empirical test of specific theoretical models focused on discouraging climate harmful behavior (e.g. flying, individual transport, meat consumption, etc.).
Psychological and sociological processes involved in climate-related persuasion	Several mediating and moderating processes have been revealed for green advertising effects.	Lack of knowledge on mediating processes explaining specific climate-related advertising effects.	Theoretical proposition and empirical test of specific psychological and sociological processes involved in climate protective behavior (e.g. mediating variables social emotions pride, shame, and guilt, climate anxiety, norm activation, social- and self-identity, personality traits and situational moderators).

(*Continued*)

Table 4. Continued

Topic	What we know	Research gap	Further research avenues
Greenfluencers	Extant research has addressed the effects of influencer traits. Greenfluencer communication has been assessed by content analysis.	Lack of research on the effects of greenfluencers on climate-relevant behavior.	Impact of greenfluencers on consumer's carbon footprint. Effects of greenfluencer traits and appeals. Identification of mediating variables to explain greenfluencer persuasion processes.
Systemic change to promote climate protection	Most theories of social change focus on individual responsibility to mitigate climate change.	Scarce interdisciplinary research on the systemic impacts of advertising on how consumer options are structured by governments, infrastructures, and economic institutions.	A more holistic approach to the role of advertising in sustaining a society-wide culture and narrative that promotes climate protection.

most reports about the environmental impact of advertising (Timperley 2021). For example, an organization of industry insiders advocating for making advertising greener released the 'Advertised emissions' report during COP26 2021 in Glasgow, claiming that the uplift in sales generated by advertising in 2019 in the UK accounted for over 186 million tons of CO2, which constitutes an increase of 28% to the annual carbon footprint of every UK citizen (Purpose Disruptors 2021). However, the report was not subject to peer-review and hence will not significantly add to the academic debate. Advertising scholars need to start by collecting and sharing data on the industry's direct, indirect, and consumer behaviour-mediated impact on climate change. Firstly, research needs to address the direct emissions of the advertising industry's communication sector to ascertain how media choice affects carbon emissions (i.e. physical resource use and energy consumption of digital media). Secondly, as online advertising finances energy-intensive companies such as online platforms, assessing the emissions the advertising-driven business models generate is key to estimating the indirect impact of advertising on the climate. Lastly, scholars need to assess the consumer behaviour-mediated impact of advertising, which accounts for the full extent of the extra economic activity—and thus carbon emissions—driven by advertising.

Focusing green advertising research on mitigating climate change

As yet, most green advertising research has focused on promoting environmentally friendly consumption behaviours in general but has not adopted a specific focus on mitigating climate change. Existing theories lack a specific theoretical underpinning on how to mitigate climate change from the consumer's perspective beyond the promotion of green purchases in general. Encouraging green purchases does not necessarily imply that green advertising is targeting the kind of climate-protective behaviours needed to mitigate climate change. An examination of the dependent variables measured in research reveals that green advertising studies mainly focus on unspecific green behaviours or on the purchase of products that are not particularly carbon-intensive. The literature referenced in this article exemplifies this. Most

of the empirical work about green advertising that we cited draws its conclusions from studies that feature products that are not very relevant to mitigating climate change, such as plastic bottles (Bhatnagar and McKay-Nesbitt 2016; Schmuck, Matthes, and Naderer 2018), refillable glass bottles and reusable bags (Pittman, Read, and Chen 2021), trash bags made with recycled plastic (Reich and Soule 2016), laundry detergent (Ganz and Grimes 2018; Matthes, Wonneberger, and Schmuck 2014; Pancer, McShane, and Noseworthy 2017; Schmuck, Matthes, and Naderer 2018), coffee (Schmuck, Matthes, and Naderer 2018), toothpaste (Pancer, McShane, and Noseworthy 2017), reusable chopsticks (Chang 2012), and plastic utensils and styrofoam cups (Laroche, Bergeron, and Barbaro-Forleo 2001), among others.

Experimental research will often concentrate on more easily influenceable behaviours—where significant results are more likely—while avoiding hard-to-manipulate systemic behaviours that are carbon-intensive and entrenched in consumers' daily lives. Consumer behaviours with the greatest carbon emissions saving potential (e.g. mobility or energy) have been mostly neglected, except for some research studying advertising's impact on flying (Frick et al. 2021), the adoption of low-emission vehicles (Hartmann, Apaolaza Ibáñez, and Forcada Sainz 2005) and renewable energy (Hartmann and Apaolaza-Ibáñez 2008; Hartmann et al. 2017; Hartmann and Apaolaza-Ibáñez 2012). Green advertising research could have a higher impact on climate change mitigation if the targeted behaviours investigated were more climate-relevant. Apart from addressing climate-related dependent variables, a research focus on climate-relevant behaviours will likely lead to the development of a more specific theoretical framework of advertising effects on climate-relevant behaviour.

Future green advertising research should therefore prioritize, on the one hand, promoting low-carbon alternatives to conventional products and services (e.g. adoption of home green electricity, usage of public transport, etc.) and, on the other hand, discouraging climate harmful behaviour (e.g. flying, using individual transport, consuming meat, etc.). New theoretical frameworks are needed to address specific antecedents, processes, and moderators that lead to both of these outcomes. Future theoretical approaches should dig deeper into the psychological and sociological processes involved in climate-protective behaviour. Despite their strong potential for climate-related persuasion, the mediating role of social emotions such as pride, shame and guilt has so far been insufficiently researched. Based on Social Norms Theory (e.g. Goldstein, Cialdini, and Griskevicius 2008), future research should also study how to trigger climate-related normative processes and how these may affect the individual through social- and self-identity. In this context, advertising research on the persuasion effects of social media and influencers should focus on specific climate-related issues and climate-activist influencers as role models (e.g. the 'Thunberg effect'). Further research should also assess the influence of personality traits and situational factors as moderators of these processes. It is yet unclear under which circumstances a gain-frame-based green persuasion appeal versus a loss-frame using for instance climate-crisis-related images as threat appeals will be more effective. Digital advertising allows a real-time adaptation of advertising claims to specific targets and situations. Research should explore the effect of real-time climate nudges on the purchase decision process during online shopping. Besides, the role of heuristic processing in response to climate-related advertising appeals should be further studied.

The current focus of most theories of social change and green consumer studies on individual-level decisions constitutes a further limitation of research on advertising's role in addressing climate change. Because the responsibility for fighting climate change is assumed to lie with individuals, most studies focus on individual action and personal responsibility, and there has been scarce research examining the systemic impacts of advertising on how consumers' climate mitigation options are structured by governments, infrastructures and economic institutions (Shove 2010). Advertising research needs a more holistic approach to understand the role of advertising not only in influencing consumer decisions but also in sustaining a society-wide culture and narrative that promotes climate protection.

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