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An experimental test of a greenwashing inoculation intervention: Effects on identification, trust and intentions

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Abstract

Misleading claims about the environmental performance of a product or service (i.e. "greenwashing) hinders consumers from making informed choices and penalises genuinely sustainable companies. We pre-tested a greenwashing inoculation intervention using a student sample (N = 206) and then ran a pre-registered replication using a nationally representative sample (N = 2,000). Participants were randomised to learn about greenwashing and ways to identify it or to read more generally about climate change. They then judged six real advertisements (three greenwashed and three that made genuine environmental claims) on whether they were greenwashed, their trust in the brand and their willingness to purchase from the brand. The intervention increased greenwashing ratings to two of the three greenwashed advertisements, with corresponding decreases in brand trust and purchase intentions. The unaffected greenwashed advertisement was for a dairy-free milk alternative from a familiar brand, suggesting that familiarity and product sustainability may counteract greenwashing interventions. However, participants also judged two of the three genuine advertisements as greenwashed, implying a broadly-applied scepticism of environmental claims, particularly towards unfamiliar brands. Despite difficulty distinguishing between greenwashed and genuine advertisements, participants were more confident in their ability to identify greenwashing and had stronger resolves to act in pro-environmental ways in the future. The findings have implication for policy to address the harms of greenwashing.

Growing concern about climate change has increasingly led to consumers seeking more sustainable products and services. This demand incentivises companies to market their offerings as 'green.' One analysis of over 1,600 advertisements across 15 EU countries showed that 80% featured some form of environmental claim (European Commission, 2020). However, most consumers do not have the expertise or resources to evaluate the veracity of such claims. This deficit provides opportunity for companies to mislead consumers about the environmental performance of their product or service (i.e., to "greenwash"; Delmas & Burbano, 2011). Over half of the advertisements surveyed by the European Commission featured claims that were vague, misleading or unfounded.

Greenwashing can take many forms. One systematic analysis of greenwashing practices differentiated between greenwashing claims on two dimensions (de Freitas Netto et al., 2020). The first dimension is whether the company's general performance is greenwashed or whether claims are made about a specific product. The second is whether an explicit claim is made or whether environmental friendliness is implied through nature-based imagery, known as "executional" greenwashing. Other research has differentiated further between the explicit claims that are made. Perhaps the most influential is the framework developed by TerraChoice (2010), which identifies seven types of greenwashing claims (see Table 1.1).

Table 1.1

TerraChoice (2010) Greenwashing Framework

Type	Description	Example
Hidden Trade-Offs	A product or company highlights a specific attribute but ignores its overall environmental impact.	A cleaning product that is manufactured using hazardous materials in a recyclable bottle highlights only the latter.
No Proof	A company makes an environmental claim without	A water bottle advertised as made from 90% recycled material without supporting evidence.

	providing credible evidence or third-party certification.	
Vague or Ambiguous Claims	A product or company is advertised using language that are loosely defined with the aim that consumers will infer positive environmental impact.	An electronics company advertises its new phone as "green technology" without specifying what makes it environmentally friendly.
Irrelevance	A company promotes an environmental attribute that is unrelated to the actual product or is insignificant in terms of its overall environmental impact.	Aerosol products advertised as “CFC Free” despite longstanding regulation in place to ban the use of CFCs.
Lesser of Two Evils	A company promotes a harmful product as environmentally-friendly compared to alternatives.	A Sports Utility Vehicle (SUV) is advertised as “fuel-efficient” compared to other SUVs, ignoring the high fuel usage compared to other cars and the environmental impact of production.
False Labels	Fake or self-created eco-labels are used to give the impressed that products have been certified or endorsed by reputable environmental organisations.	A household cleaning product displays a "Green Earth Approved" logo on its label, but there is no legitimate organization associated with that label.
False Claims	Straightforward deceit about environmental claims.	A clothing brand claims that its entire production process is "carbon-neutral," but there is evidence to suggest that they haven't taken the

	necessary steps to offset their carbon emissions.

Greenwashing can clearly be classified as a market failure. The lack of accurate information on environmental impact leads to information asymmetry, hindering consumers' ability to differentiate between genuinely sustainable products and those that are not and inhibiting informed choices based on environmental preferences. Given additional costs associated with operating sustainably, pro-environmental companies are adversely selected as they struggle to compete against companies that engage in deceptive marketing. More broadly, greenwashing risks eroding consumer trust in all environmental claims, reducing support for genuinely sustainable products and hence hindering the growth of a more sustainable market. The breadth and pervasiveness greenwashing claims demonstrated by TerraChoice's framework present a challenge for policy.

Combatting some types of claims hence requires regulation, lest consumers be expected to research (1) the manufacturing process of each product they purchase (*Hidden Trade-offs, No Proof*), (2) the nature and evaluation reports of each of the 400+ environmental certificates[1] that can be applied to products (*False Labels, False Claims*) or (3) each regulated chemical that can potentially cause environmental harm (*Irrelevance*). However, the market failure could perhaps be corrected by equipping consumers with tools to identify other forms of greenwashing (e.g., *Vague or Ambiguous Claims, Lesser of Two Evils* or *Executional*), which may be a more attractive policy tool for those in favour of liberal markets. If consumers who value sustainability can better identify greenwashed claims, this demand pressure should result in fewer greenwashed claims and allow genuinely green companies to benefit.

Our aim was to develop and test such a tool to help consumers discriminate between advertisements that feature genuine environmental claims and those that are greenwashed. We take an 'inoculation' approach, whereby controlled exposure to greenwashing is expected to boost capability to identify

[1] https://www.ecolabelindex.com/

future instances of it. In the following section, we review literature on the effects of greenwashing, other inoculation interventions and previous attempts to educate consumers about greenwashing.

1.1 Relevant Literature

1.1.1 Effects of Greenwashing

Despite consumers reporting scepticism towards sustainability claims made by corporations (Naderer, Schmuck & Matthes, 2017), most are unable to identify greenwashing in advertisements (Fernandes, Segev & Leopold, 2020). Some forms of greenwashing (e.g., executional) have even been shown to bolster evaluations of a company's ecological image (Parguel, Benoit-Moreau & Russell, 2015). Hence, despite rising consumer demand for reducing environmental harm, companies have greater incentives to claim superior environmental practices rather than investing in genuine ones (Delmas & Burbano, 2011).

However, when consumers perceive advertisements to be greenwashed, there are negative consequences for demand. Research in multiple countries shows that when consumers judge environmental claims in advertisements to be deceptive, they report decreased trust in the business' credibility and lower intentions to purchase from the brand (Chen & Chang, 2013; Newell, Goldsmith & Banzhaf, 1988; Schmuck, Matthes & Naderer, 2018). Importantly, these effects are driven by *perceptions* of greenwashing rather than objective evaluations. Hence consumer-based greenwashing interventions should seek not only to boost consumer ability to identify deceptive claims, but also to help consumers distinguish between greenwashed advertisements and those that feature accurate claims about sustainability practices to avoid penalising genuine companies.

The effect of greenwashing on specific purchasing intentions is driven by emotional reactions to feeling cheated, which inhibits trust in the brand (Zhang, Li, Cao & Huang, 2018). However, we could locate no literature that has investigated whether learning about greenwashing is linked to broader pro-environmental intentions. There are plausible mechanisms for a causal effect. For example, violating moral norms (such as honesty about environmental impact) can lead to moral

outrage (Batson et al., 2007). While outrage is often costly (Crockett, 2017), it can also galvanise collective action, leading people to make individual sacrifices in order to benefit the collective good (Spring, Cameron & Cikara, 2018). The fight against climate change is a complex collective action problem that requires such motivation (e.g., Ostrom, 2010). Hence, in addition to measuring the effects of greenwashing on brand trust and purchase intentions, we also sought to measure whether perceptions of greenwashing motivate individual behaviour change to mitigate climate change.

1.1.2 Inoculation Against False Claims

Misinformation inoculation is a methodology that stems from the social–psychological theory of attitudinal inoculation. The theory proposes that forewarning people of imminent persuasive arguments and exposing them to (weakened) versions of those arguments reduces the likelihood of attitude change (e.g., Banas & Rains, 2010). Applied to misinformation, warning people of attempts to mislead them, giving examples of misinformation strategies and presenting ways to identify misinformation has been shown to strengthen peoples' ability to identify "fake news" (e.g., Lewandowsky & van der Linden, 2021; Traberg, Roozenbeek & van der Linden, 2022). Doing so has been applied to environmental issues, such as "pre-bunking" efforts to reduce beliefs in the scientific consensus for climate change (van der Linden, Leiserowitz, Rosenthal & Maibach, 2017).

One previous study has attempted to apply inoculation methodology to greenwashing (Bingaman, Kipkoech & Crowley, 2022). However, the approach in this study was to first inform undergraduate participants that a specific company engage in greenwashing before then asking participants to rate a video by that company. While results were positive, experimenter demand effects are likely and it's unclear whether the inoculation strategy might generalise to advertisements by other companies. Our aim was to test whether warning consumers about greenwashing and providing tips to identify it more generally helps them to identify greenwashing in a range of different advertisements.

1.1.3 Other Greenwashing Education Interventions

While there have been no other attempts to inoculate consumers against greenwashing, three previous studies have tested greenwashing "literacy" interventions, with mixed success. Eng et al. (2021) tested the format of exemplars describing instances of greenwashing on social media posts. Mturk participants were randomised to see general information on greenwashing or to see this information paired with one of three exemplar formats (an image, a quote or an image with quote). Participants were subsequently asked to identify whether short vignettes described examples of greenwashing (e.g., a crisp manufacturer planning to use the label of "Natural"). Results showed a benefit of including imagery on perceived vividness of the intervention, but no format improved identification of greenwashing compared to baseline information on greenwashing. Importantly, however, there was no control group to test whether the exemplars improved ability to identify greenwashing, nor did participants evaluate real advertisements.

Fernandes et al. (2020) used a text-based intervention to inform participants about two types of greenwashing: ambiguous claims and misleading comparative claims (e.g. "20% less plastic" with no reference category). Real advertisements were manipulated to have both deceptive and non-deceptive versions, and Mturk participants judged the deceptiveness of a random selection of advertisements after being randomised to the intervention or control. Results showed that the intervention increased confidence in ability to identify greenwashing. However, it improved objective ability for just one product type (baby diapers) and not others (e.g., hair conditioner) when participants were asked to evaluate multiple advertisements. Hence there is considerable scope to test an intervention that can generalise to multiple types of advertisements.

Naderer and Opree (2021) present a greenwashing intervention that comes closest to our approach. They recruited 335 participants from a voluntary online panel who were randomised to see control information, text-based information about four types of greenwashing (vagueness, false labels, irrelevance and 'lesser of two evils' claims), or the same information accompanied with a quiz that provided feedback. Participants were then required to identify the type of greenwashing on 10 fictitious advertisements. Results showed that both interventions improved identification, with a higher point estimate on the text plus quiz condition.

Our approach extends these previous studies, with important changes to the experiment design. For our main study, the experimental design and analysis plan was pre-registered and we used a market research agency to recruit a large, nationally representative sample. As in Eng et al. (2021), participants viewed information about different types of greenwashing in the form of social media posts, but we also include a control group and, similar to Fernandes et al. (2020), we requested judgements of advertisements instead of vignettes. However, rather than manipulating the advertisements, we use a sample of advertisements that were legally judged as greenwashing and a real sample of non-greenwashed advertisements, thereby more accurately representing the kinds of greenwashed and genuine advertisements consumers face in the market. We also supplement our information using a quiz, similar to Naderer and Opree (2021), but instead of requesting participants to identify the *type* of greenwashing, our participants judged simply whether the ad was an example of greenwashing or not. Our rationale is that it is more important for consumers to identify that an advertisement is greenwashed rather than to identify the type of greenwashing. Hence, our contribution to the literature is to test an intervention that builds on previous ones but with a larger, nationally representative sample that evaluate the presence of greenwashing on real greenwashed and genuine advertisements.

1.2 Hypotheses

We pre-registered our hypotheses[2] that, compared to the control condition, consumers exposed to the greenwashing inoculation intervention would:

H1: … better distinguish between greenwashed and genuine advertisements.

H2: … trust greenwashed brands less.

H3: … be less willing to purchase from greenwashed brands.

H4: … report stronger pro-environmental intentions for the future.

[2] We pre-registered further hypotheses on the moderation effects of political ideology and quiz performance. There was no interaction between political ideology and intervention, but those who performed best in the quiz showed stronger effects. In the interest of space, these are reported in the Online Supplementary Materials.

We also measured confidence in ability to spot greenwashing before and after the exposure to the intervention but omitted this measure from the pre-registration.

2. Method

2.1 Pre-Test

The intervention and experimental design were first pre-tested using a student sample ($N = 206$), with findings reported in the Online Supplementary Material. The pre-test showed that, compared to control participants, participants exposed to the greenwashing intervention better identified the six greenwashed advertisements, rated greenwashed brands as less trustworthy and gave lower purchase intentions. There were no between-group differences on the two genuine advertisements. Participants exposed to the greenwashing intervention also reported significantly stronger pro-environmental intentions. Following this pre-test, we made some minor changes to the design. These included balancing the number of greenwashing and genuine advertisements, to three of each. Selecting genuine advertisements posed a challenge for the design of the study, because we could locate genuine advertisements only from brands we suspected were less well known to participants than the advertisements that were independently judged to be greenwashed. Hence, we added a smaller "no contact" group to the design, who were asked to judge the familiarity of the brands without reference to environmental issues. Following these design changes, we pre-registered the main study.

2.2 Full Study

The full study was programmed in Gorilla Experiment Builder (Anwyl-Irvine et al., 2020). It proceeded after an unrelated study on attitudes towards disabled people, reported in Timmons, Carroll and McGinnity (2023). Data were collected between 31 March and 4 April 2022. The study was conducted in line with institutional ethics policy and was pre-registered at https://osf.io/xuymn.

2.2.1 Participants

Two thousand participants were recruited from a large online panel held by a leading market research and polling company to be representative of the adult population in Ireland.[3] Sample size was determined by a study on disability policy that was run in conjunction with the greenwashing intervention (Timmons et al., 2023). Participants were paid €3 for undertaking the entire study, which took 10 minutes to complete on average. In order to complete the study, participants had to correctly answer an attention-check question (which was failed by 39 additional participants). Attrition during this part of the study was low (n = 35) with no differences by experimental condition. Socio-demographic characteristics of the 2,000 complete respondents are summarised in Table 2.1. They are within 2%-points of relevant CSO estimates on each characteristic.

Table 2.1 Socio-Demographic Characteristics of Participants

		N	%	Population[a] %
Gender	Men	961	48.1	48.9
	Women	1029	51.5	51.1
	Non-Binary[b]/Other	10	0.5	-
Age	18-39 years	786	39.3	40.4
	40-59 years	696	34.8	35.1
	60+	518	25.9	24.5
Educational Attainment	Below Degree	1175	58.8	58.0
	Degree or above	825	41.3	42.0
Employment	In Labour Force	1339	67.0	65.2
	(Of Which, Employed)	(1276)	(95.3)	(95.2)
	(Of Which, Unemployed)	(63)	(4.7)	(4.8)
	Not in Labour Force	661	33.1	34.8
Living Area	Urban	1274	63.7	63.3
	Rural	726	36.3	36.7

[3] RED-C Research & Marketing (https://www.redcresearch.ie/product/red-c-live/)

[a] Population estimates are based on 2021 Central Statistics Office (CSO) data where possible and 2016 Census data otherwise, except for Employment which is based on Q2 2022 data from the EU Labour Force Survey. [b] There are currently no population estimates for non-binary individuals.

2.2.2 Materials and Design

Of the 2,000 participants, 1,794 were selected at random by the software to complete the inoculation experiment (control and inoculation groups) with the remaining 206 providing a 'no-contact' control on some measures of interest. Table 2.2 displays all measures with information on which groups saw each. Participants who completed the inoculation experiment were first provided a brief definition of greenwashing as a "form of marketing or advertising, where companies present a false impression about how environmentally friendly they or their products are." They then rated how strongly they agreed or disagreed with a statement about their understanding of greenwashing and ability to spot it, on a scale from 1 to 7.

Table 2.2

Measures by Group

Measure	Items	Scale	Groups
Confidence	*Pre:* I have a good understanding of what greenwashing is and how to spot it.	1 – 7 rating scale	Intervention and Control
	Post: After taking part in this study, my understanding of what greenwashing is and how to spot it has improved.	1 – 7 rating scale	
Quiz Score	Number of correctly answered quiz questions	0 to 5	Intervention
Greenwashing rating	This advertisement engages in greenwashing	1 – 7 rating scale for six ads	Intervention and Control
Familiarity	I am familiar with this brand	1 – 7 rating scale for six ads	No Contact

Trust	This brand is trustworthy about its environmental promises	1 – 7 rating scale for six ads	Intervention, Control, No Contact
Purchase	I would be happy to purchase this brand's products/services	1 – 7 rating scale for six ads	Intervention, Control, No Contact
Intentions	I intend to take concrete steps to do something to mitigate the negative effects of global warming/climate change Concerns about global warming/climate change will guide my voting behaviour at the next election I intend to travel by car less often and use buses, trains, or cycling and walking more often	Average of four 1 – 7 rating scales	Intervention and Control

Approximately half (n = 892) were then randomly assigned by the software to see the greenwashing inoculation intervention. The intervention comprised of a series of infographics and a short, multiple-choice quiz. The infographics were designed in a social media post style that explained what greenwashing is and three of the forms it can take (vague or ambiguous claims, lesser of two evils, executional; Figure 2.1). The quiz consisted of five product descriptions and participants were asked to identify if it was a form of greenwashing and, if so, the kind of greenwashing. All participants received feedback on the correct answer immediately after making their guess. Table 2.3 shows the product descriptions alongside the correct answer. The control group (n = 902) read a short opinion piece about climate change adapted from a news website (theJournal.ie). Median time spent on the inoculation intervention and news article were similar (58.6s ad 55.7s, respectively).

Figure 2.1 Greenwashing inoculation infographics.

Table 2.3

Contents of the Greenwashing Quiz Intervention

Product Description	Correct Answer and Feedback
A disposable razor made with 25% less plastic	The correct answer is **lesser of two evils**. While the razor above may be made with 25% less plastic, disposable razors and other single-use plastics more generally are harmful to the environment.
An eco-friendly, all-natural cleaning product	The correct answer is **vague or ambiguous claim**. Phrases such as "eco-friendly" and "all-natural" lack clear definition and are likely to be misunderstood by consumers.
A refillable, plant-based cleaning product in a 100% recycled container	The correct answer is **no greenwashing**. This is a genuine green advertisement. Plant-based materials are clearly identifiable and using recycled, refillable containers is good for the environment.
A haircare product that comes packaged in a bottle covered with images of natural landscapes.	The correct answer is **executional**. Nature-based imagery is intended to encourage consumers to associate the product and the brand with greenness and sustainability.
A packet of "nicotine-free, organic" cigarettes	The correct answer is **lesser of two evils**. This product may be better for the environment than other non-organic options. However, the tobacco industry is a major contributor to climate change and other forms of environmental damage.

After the intervention stage, all participants were presented with a series of six real advertisements in randomised order (see Online Supplementary Material). Three advertisements were genuine pro-environmental advertisements, due to the nature of the product (KeepCup), the credentials of the company and the sufficiency of the detail provided on the ad (Lush and Patagonia). The remaining three advertisements were examples of greenwashing, as determined by the UK's Advertising Standards Authority and independent reports. One of the advertisements consisted of a 'climate-friendly' product (Alpro oat milk) but had been deemed as greenwashing, whereas the other were not pro-environmental products (Coca Cola, Ryanair). Participants were asked to rate whether they agreed that the advertisement engaged in greenwashing, as well as their trust in the brand and their willingness to purchase the product. The no-contact group saw the same advertisements but were asked to rate their familiarity with the brand, their trust in it and their willingness to purchase the product. All responses were made on 7-point rating scales.

Participants in the inoculation experiment were then asked about their pro-environmental intentions in the future[4] and they were again asked their agreement with a statement about their understanding of greenwashing and their ability to spot it. All participants then completed standard socio-demographic questions.

[4] The intention items were: I intend to take concrete steps to do something to mitigate the negative effects of global warming/climate change; Concerns about global warming/climate change will guide my voting behaviour at the next election; I plan to try to use less energy, for example, less heat in winter; I intend to travel by car less often and use buses, trains, or cycling and walking more often.

3. Results

Here we report the effects of the inoculation intervention on perceptions of greenwashing. We then report the effects of the intervention on trust in the brand and purchase intentions, with comparisons also against the no contact group. We then show the familiarity ratings provided by the no contact group, followed by the effects of the inoculation intervention on general future intentions and confidence in their ability to spot greenwashing.

3.1 Greenwashing

Figure A1 in the Supplementary Online Material shows the distribution of greenwashing evaluations for each advertisement. In general, participants suspected the Coca Cola and Ryanair advertisements of greenwashing (M = 5.67, SD = 1.70; M = 5.34, SD = 1.79) while responses to the remaining advertisements were closer to the midpoint of the scale (Patagonia: M = 4.49, SD = 1.84; KeepCup: M = 4.39, SD = 1.76; Lush: M = 4.14, SD = 1.98; Alpro: M = 4.09, SD = 1.94). Wilcoxon Signed-Rank tests showed all comparisons to be significant, all ps < .038, except for the difference between Alpro and Lush, Z = 0.60, p = .550. Table A1 in the appendix shows the correlations between each of the advertisements, which are statistically significant but weak, particularly between Alpro and the other two greenwashing advertisements. Cronbach's alphas for the greenwashing advertisements and the genuine advertisements were too low (α = .40 and .45, respectively) to allow for advertisements to be combined into greenwashing and genuine evaluation scores; we model the effect of the intervention on each advertisement independently.

Table 3.1 presents ordinal logistic regression models on each advertisement, testing for the effect of the inoculation intervention on greenwashing evaluating with controls for sociodemographic variables (gender, age, educational attainment, working status, living area, socioeconomic status and political

ideology) and time spent on reading the materials.[5] The models show that the inoculation intervention increased belief that the Coca Cola and Ryanair advertisements were examples of greenwashing, although the effect on the Alpro advertisement was non-significant. The inoculation intervention also decreased belief that the Lush advertisement was greenwashing, although it amplified the incorrect belief that the KeepCup and Patagonia advertisements were greenwashed. Effect sizes are illustrated in Figure 3.1, which shows the percentage of participants in each condition who rated the advertisement as a 4 or above on the 7-point scale.

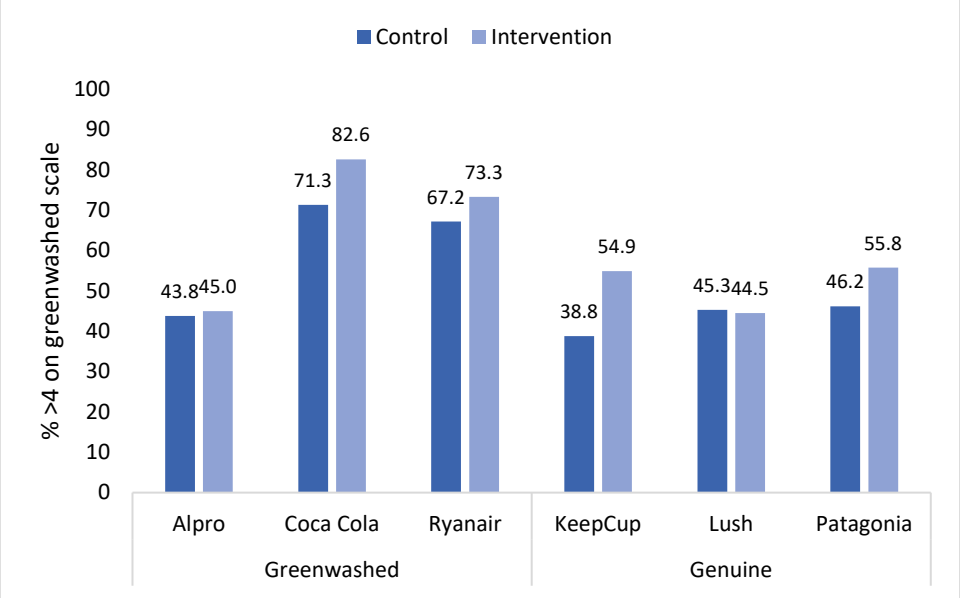

Figure 3.1. Percentage of participants rating each advertisement as a 4 or above on the greenwashing scale.

Table 3.1

Ordinal Logistic Regression Models Predicting Greenwashing Evaluation

	Greenwashed			Genuine		
	Alpro	Coca Cola	Ryanair	KeepCup	Lush	Patagonia
Inoculation	-0.02	0.62	0.22	0.46	-0.17	0.32
Intervention	[-0.18, 0.14]	[0.43, 0.79]	[0.05, 0.39]	[0.30, 0.63]	[-0.33, -0.01]	[0.15, 0.48]
(Ref: Control)	$p = .768$	$p < .001$	$p = .010$	$p < .001$	$p = .038$	$p < .001$

[5] Our modelling approach deviates from the pre-registration, which was to use a mixed effects ordinal logistic regression with random effects at the participant level and advertisement fixed effects. Given low agreement between the greenwashing and genuine scores, using a dummy variable for advertisement type would not be appropriate for the response distributions.

Socio-Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	1,784	1,784	1,784	1,784	1,784	1,784

Note. 95% confidence intervals are in brackets. The results are the same if the fastest 10% of participants from both conditions are excluded.

3.2 Trust

We take a similar approach to analysing responses to trust in the brand's environmental promises, due to low Cronbach's alphas for the greenwashed (α = .58) and genuine (α = .56) advertisements. Figure 3.2 presents the average trust ratings to each brand. Wilcoxon Signed Rank tests showed all comparisons to be significant, *p*s < .001, except for between Lush and Patagonia, $Z = 1.65$, $p = .100$, and between Coca Cola and Ryanair, $Z = 1.78$, $p = .075$.

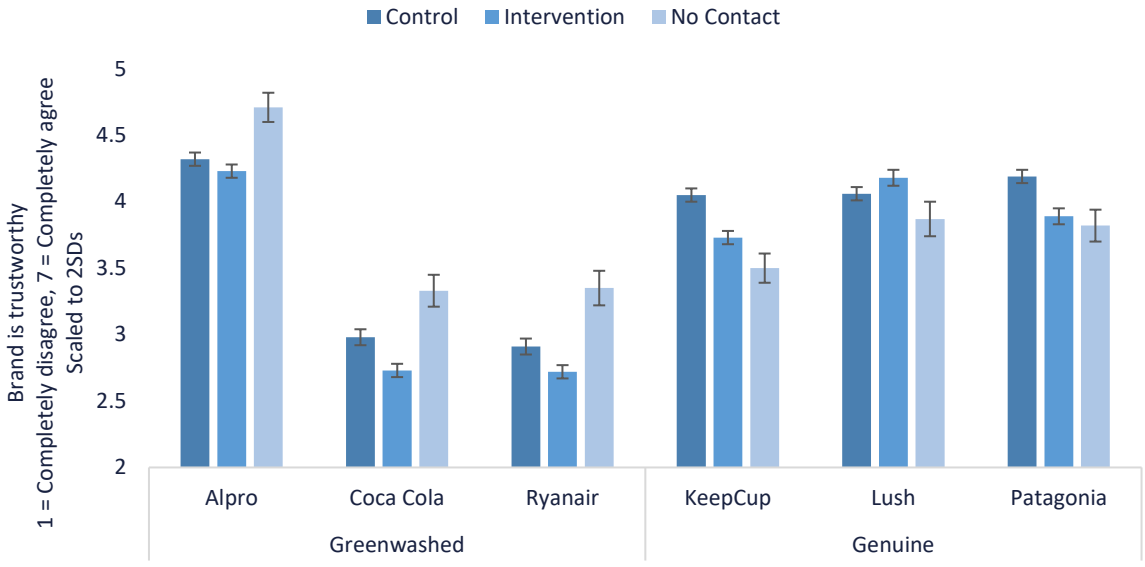

Figure 3.2 Average trust ratings to each advertisement by condition. Error bars are the standard error.

Table 3.2 presents ordinal logistic regression models on trust ratings, this time including responses from the "no-contact" group, who were not shown any environmental information before rating the advertisements. The models show that, compared to the control intervention, the inoculation intervention decreased trust in Coca Cola and Ryanair but not Alpro. The no-contact group rated all three greenwashed brands as more trustworthy than the two groups who were primed to think about

greenwashing (tests of coefficients against the intervention group: $\chi^2_{Alpro} = 14.48$, $p < .001$; $\chi^2_{CocaCola} = 23.70$, $p < .001$; $\chi^2_{RyanAir} = 25.71$, $p < .001$).

The inoculation intervention also decreased trust in two of the three genuine advertisements (from KeepCup and Patagonia) compared to the control intervention. The no contact group also gave lower trust ratings than the control intervention to these advertisements but there was no difference between the no-contact group and the inoculation intervention group on any of the advertisements according to further tests of coefficients ($\chi^2_{KeepCup} = 3.29$, $p = .070$; $\chi^2_{Lush} = 3.43$, $p = .064$; $\chi^2_{Patagonia} = 0.01$, $p = .914$).

Table 3.2

Ordinal Logistic Regression Models Predicting Brand Trust

	Greenwashed			Genuine		
	Alpro	Coca Cola	Ryanair	KeepCup	Lush	Patagonia
Condition (Ref: Control)						
Intervention	-0.08 [-0.24, 0.09] $p = .363$	-0.25 [-0.41, -0.08] $p = .003$	-0.21 [-0.37, -0.04] $p = .013$	-0.39 [-0.55, -0.22] $p < .001$	0.11 [-0.06, 0.27] $p = .202$	-0.38 [-0.55, -0.21] $p < .001$
No Contact	0.45 [0.18, 0.72] $p = .001$	0.43 [0.16, 0.70] $p = .002$	0.50 [0.23, 0.77] $p = < .001$	-0.64 [-0.91, -0.37] $p < .001$	-0.15 [-0.42, 0.12] $p = .272$	-0.39 [-0.66, -0.12] $p = .005$
Socio-Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2,000	2,000	2,000	2,000	2,000	2,000

Note. 95% confidence intervals are in brackets.

3.3 Purchasing

Cronbach's alphas for intentions to purchase the greenwashed ($\alpha = .50$) and genuine ($\alpha = .60$) companies were similarly low. Wilcoxon Signed Rank tests shows that intentions to purchase from Alpro were significantly higher than from all other companies (ps < .001) and significantly lower from Coca Cola than all others (ps < .001). Intentions to purchase from Lush were not higher than from Alpro, Ryanair or Patagonia (ps > .075) but they were higher than KeepCup (and Coca Cola; ps < .002). No other comparisons were significant.

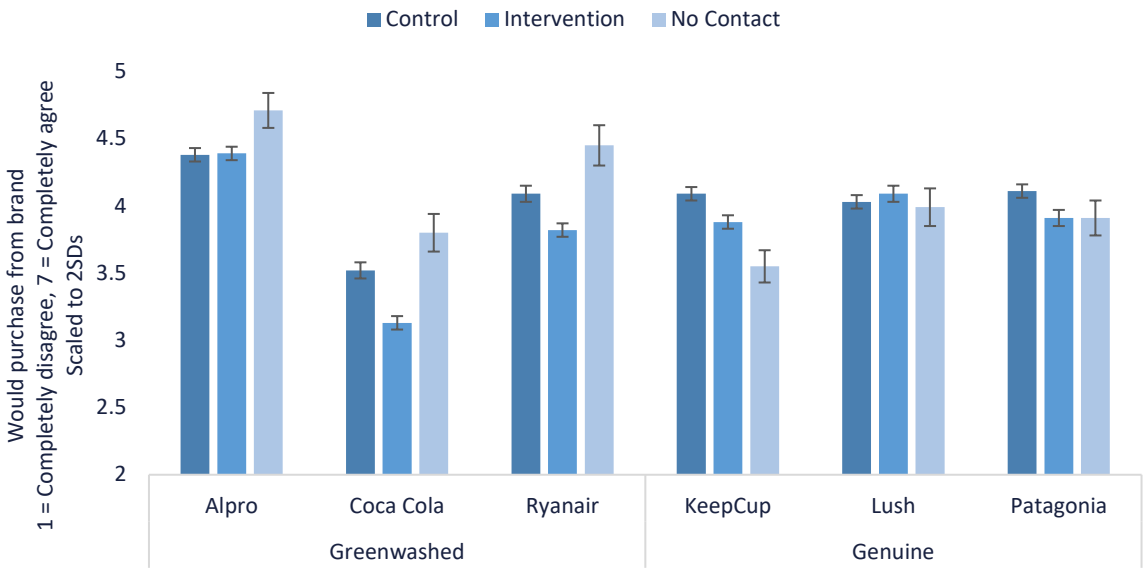

Figure 3.3. Average willingness to purchase ratings to each advertisement by condition. Error bars are the standard error.

Figure 3.3 shows the average intention ratings and Table 3.3 presents the ordinal logistic regression model. The pattern is the same as the previous sections, where the intervention decreased intentions to purchase from two of the greenwashed advertisements (Coca Cola and Ryanair) but also two of the genuine advertisements (KeepCup and Patagonia). The no contact group reported higher purchase intentions than the control group and the intervention group on all greenwashed advertisements ($\chi^2_{Alpro} = 7.20$, $p = .007$; $\chi^2_{CocaCola} = 25.23$, $p < .001$; $\chi^2_{RyanAir} = 26.74$, $p < .001$), but lower intentions to purchase from KeepCup ($\chi^2_{Alpro} = 7.97$, $p = .005$). There were no differences on the other two genuine advertisements ($\chi^2_{Lush} = 0.32$, $p = .570$; $\chi^2_{Patagonia} = 0.19$, $p = .666$).

Table 3.3

Ordinal Logistic Regression Models Predicting Purchase Intentions

	Greenwashed			Genuine		
	Alpro	Coca Cola	Ryanair	KeepCup	Lush	Patagonia
Condition (Ref: Control)						
Intervention	-0.01 [-0.17, 0.15] $p = .913$	-0.38 [-0.55, -0.22] $p < .001$	-0.28 [-0.44, -0.12] $p = .001$	-0.25 [-0.42, -0.09] $p = .003$	0.05 [-0.11, 0.22] $p = .516$	-0.25 [-0.42, -0.08] $p = .003$

No Contact	0.39 [0.12, 0.67] $p = .005$	0.33 [0.06, 0.61] $p = .019$	0.47 [0.19, 0.75] $p = .001$	-0.62 [-0.90, -0.35] $p < .001$	0.01 [-0.27, 0.28] $p = .957$	-0.18 [-0.46, -0.09] $p = .198$
Socio-Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2,000	2,000	2,000	2,000	2,000	2,000

Note. 95% confidence intervals are in brackets.

3.4 Familiarity

Ratings of familiarity by the no contact group showed that, as expected, the greenwashed advertisements were all from brands that were more familiar than the genuine advertisements (Figure 3.4). The least familiar greenwashed ad (from Coca Cola) was rated as significantly more familiar than the most familiar genuine ad (from Lush), $Z = 1.65$, $p < .001$.

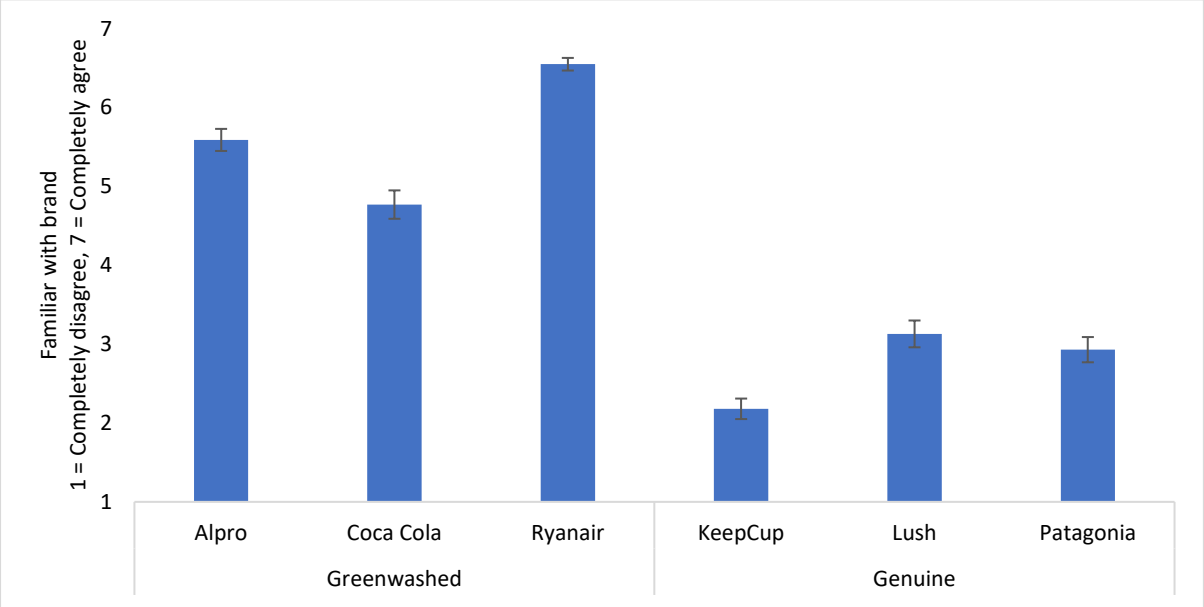

Figure 3.4. Average familiarity rating by the no contact group. Error bars are the standard error.

3.5 Future Intentions

Cronbach's alphas for the four pro-environmental intention items was adequately high to allow for combination into an intentions index ($\alpha = .77$). An OLS regression predicting this intentions index score from exposure to the inoculation condition showed a significant effect ($\beta = 0.18$, 95% CI =

[0.05, 0.30], $p = .006$), with those who completed the intervention showing greater resolve to act pro-environmentally in the future than those who read the control text ($M = 4.92$, $SD = 1.37$ vs. $M = 3.73$, $SD = 1.43$; $d = 0.14$, respectively).[6] (Note that the no contact group did not complete these items.)

3.6 Confidence

There was no evidence for a difference between the control and intervention group in their subjective ability to spot greenwashing at the start of the study ($M = 4.00$, $SD = 1.85$ vs. $M = 4.08$, $SD = 1.94$, respectively, $t(1791) = -0.78$, $p = .437$). An OLS regression model to compare confidence between the groups after completing the experiment, controlling for baseline confidence and sociodemographic variables, shows that the intervention group had significantly higher confidence at the end of the study ($M_{\text{Control}} = 5.12$, $SD = 1.51$ vs. $M_{\text{Intervention}} = 5.73$, $SD = 1.27$; $\beta = 0.59$, 95% CI = [0.47, 0.72], $p < .001$). Of note, however, is that the control group's confidence also increased over the course of the experiment ($t(1793) = 26.65$, $p < .001$, $d = 0.63$).

[6] If individual intention scales are retained, all are statistically significant ($p < .05$) except for intentions to travel by car less ($p = .162$, although the difference is in the same direction).

4. Discussion

Misleading environmental claims make it difficult for consumers to make informed choices. Many types of claims likely require regulation, but for others this market failure perhaps could be addressed by helping consumers distinguish between genuine and deceptive claims. Building on previous greenwashing literacy interventions, our inoculation intervention boosted consumer confidence in their understanding of greenwashing and their objective ability to identify greenwashing on two of three greenwashed advertisements (H1), with reductions in trust (H2) and purchase intentions (H3) for respective brands. The greenwashed advertisement that was unaffected by our intervention was one that employed a vague claim, but advertised a lower-emission alternative to dairy milk (oat milk). Hence it could be argued that the intervention helped consumers to identify greenwashing by companies that do not sell sustainable products, with sustainable brands afforded some protection by top-down familiarity with the brand.

However, the inoculation intervention also led participants to view two of the three genuine advertisements as greenwashing, with similar penalties applied to trust and purchase intentions. Both penalised advertisements (KeepCup and Patagonia) featured nature-based imagery and were the two least well-known brands. This lack of familiarity towards more sustainable companies reflects an important market reality that tests of greenwashing interventions should incorporate. In the absence of the protective effects of familiarity with a brand's sustainability practices or products, informing consumers about greenwashing and how to identify it risks generating broadly-applied scepticism of all environmental claims. This effect risks inhibiting the growth of sustainable markets for newer brands. As such, while Hs 1-3 were partially supported such that consumers could mostly identify greenwashing on greenwashed advertisements, consumers could not *distinguish* between greenwashed and genuine advertisements – despite increased confidence in their ability to do so.

Of note are the comparisons between the no contact group and the control group on brand trust and purchase intentions. The no contact group, who saw no information about environmental issues or greenwashing during the study, showed higher trust in our greenwashed brands than the control group, and lower trust in our genuine brands, with the same pattern on purchase intentions. While the

effect is likely driven by familiarity, the pattern suggests that without priming consumers to consider the veracity of environmental claims, corporate greenwashing may go unnoticed, leading to market distortions described earlier.

Our fourth hypothesis (H4), that learning about greenwashing would lead to stronger pro-environmental intentions was supported, replicating our pre-test study in a large, nationally representative sample. The boost in intentions was observed relative to a control condition who read a news article about the worsening effects of climate change, thereby presenting a stringent test of the effect. This discovery presents an opportunity for future research to identify the underlying mechanism. For example, learning about the specifics of greenwashing may have elicited outrage among participants, who were then motivated to take collective action against climate change (e.g. Spring et al., 2018). Alternatively, it may have decreased trust that private companies will make the necessary changes to reduce environmental damage, amplifying the perceived need for individuals to make greater changes instead.

More broadly, our findings have important implications for policy. Most types of greenwashing identified by TerraChoice (2010) likely require regulation, given constraints on the resources consumers have to evaluate the accuracy of environmental claims (Delmas & Burbano, 2011). We selected two types from their framework (Vague or Ambiguous Claims and Lesser of Two Evils) and executional greenwashing as types of greenwashing that consumers could reasonably be expected to identify once inoculated against them. However, participants struggled to distinguish even these "easier" forms of greenwashing from genuine environmental claims. Our results add to growing literature that, while there may be some benefits to informing consumers about greenwashing, generating a scalable intervention that works when applied broadly to greenwashed and genuine advertisements is difficult (Bingaman et al., 2022; Eng et al., 2021; Fernandes et al., 2020; Naderer & Opree, 2021). Importantly, ours is the first to test the applicability of such interventions to not just real greenwashed ads, but real genuine ones too. Distinguishing between them is where the problem lies. The implication is that broader policies, such as the EU Green Claims Directive, are likely required to address the market failure of greenwashing. In this way, our experiment contributes to the on-going

debate about the use of individual-level research to support system-level change (Chater & Loewenstein, 2022).

3.2 Conclusion

Increasing demand for sustainable products and services has amplified the prevalence of greenwashed advertisements in recent years, with now growing interest in developing methods to help consumers identify misleading claims (de Freitas Netto et al., 2020). Our findings suggests that such interventions may merely increase scepticism for environmental claims more broadly, meaning sustainable brands that are not already familiar to consumers will struggle to convey their message. This presents a trade-off between protecting consumers from purchasing from deceptive brands and helping sustainable brands establish a foothold in the market. Informing consumers about greenwashing strategies may motivate them to engage in general pro-environmental action, but regulations, such as some of the measures proposed by the EU Green Claims Directive, may be required instead of individual-level interventions to address the harms caused by greenwashing.

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