Consideration of environmental factors in reflections on car purchases: Attitudinal, behavioural and sociodemographic predictors among a large UK sample

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Highlights

- UK respondents were asked what they considered important when buying a car or van.
- Three factors emerged: ‘utilitarian’, ‘image’ and ‘environmental’, considerations.
- Climate concern and engagement were positively related to environmental considerations.
- Daily environmental behaviours were positively related to environmental considerations.
- Environmental considerations differed significantly across sociodemographic groups.

Abstract

Encouraging the purchase of low-emission vehicles could reduce the environmental impact of growing global car ownership. To date, however, there is relatively little research into the degree to which environmental features, such as reduced CO_2 emissions, are considered important when reflecting on car purchase decisions using large representative samples. This issue was explored using data from wave four (2013/14) of the UK Household Longitudinal Study, weighted to be representative of the UK population (N = 12,895). Principal components analysis identified three types of considerations during car purchase reflections: Utilitarian, Image-conscious and Environmental. Logistic and Ordinary Least Squares regressions identified attitudinal, behavioural and sociodemographic predictors of reporting environmental considerations during car purchase. Consideration of environmental factors during reflections on car purchases was more likely among those with higher climate change concerns and topic engagement, as well as self-reported pro-environmental behaviours more generally. Environmental considerations were also higher amongst women, older adults, non-white ethnic groups, urban residents and among individuals in Scotland (vs. London). Contrary to previous findings, richer and more educated respondents were less likely to consider environmental factors, with income positively related to image factors such as brand. Although our findings offer some support for the pro-environmental attitude–behaviour consistency hypothesis, they also highlight key non-attitudinal, sociodemographic factors underlying car purchase reflections that may help social-marketers and policy makers identify key audiences to more effectively promote low-emission vehicle purchases.

Keywords: Car purchase reflections; Climate change concern; Pro-environmental behaviours; Attitude behaviour consistency; Spillover effects

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1. Introduction

1.1. Background

There is little indication that growth in private car ownership globally will be reversed in the foreseeable future (PricewaterhouseCoopers, 2016). For instance, United Kingdom's (UK) private car ownership increased by 2.2% between 2014 and 2015, the fastest year-on-year increase since 2004 (Department for Transport (DfT), 2016). This meant 30.3 million cars being licensed in the UK in 2015, 19% of new car registrations in the European Union (DfT, 2016). This trend creates serious risks to the environment (International Energy Agency, 2016), and human health and wellbeing (World Health Organisation, 2016). There is, therefore, an urgent need to reverse this trend and for more research into how this can be achieved.

To date, two key strategies have been adopted. First, reducing private car journeys by encouraging public or active transport. This is successful particularly where accessible private car use alternatives exist (e.g., Arentze, Borgers, Ponjé, Stams, & Timmermans, 2001; Bamberg, 2006). Second, encouraging Ultra Low Emission Vehicle (ULEV) purchases to reduce vehicular environmental impact. However, it has limited success, as just 0.9% of new vehicle purchases in UK during 2015 were ULEVs, despite the introduction of subsidies to encourage the uptake (DfT, 2016). Better understanding of car purchase decisions is needed to steer car buyers towards 'low carbon' options. While these are two distinct policies, the distinction between their psychological underpinning is less clear-cut.

1.2. Factors influencing car purchasing decisions

For most consumers, buying a new car is an infrequent behaviour,with high financial costs. Consequently, compared to many regular, smaller-scale purchasing decisions for which habit can be important, there may be an increased likelihood of deliberative cost-benefit thought processes (Gao, Rasouli, Timmermans, & Wang, 2014; Hafner, Walker & Verplanken, 2017; Lieven, Mühlmeier, Henkel, & Waller, 2011; Steg, 2005). More specific contextual influences include both utilitarian considerations, such as purchase price, size, performance and running costs (Banerjee, 2010; Lane & Potter, 2007), and more image (e.g., colour) and status-related issues (e.g., brand), which are linked to normative and identity concerns (Choo & Mokhtarian, 2004;; Peters, de Haan, & Scholz, 2015). There is also evidence that the environmental impact of one's car purchases, for example CO_2 and particulate emissions, is an important consideration (Coad, de Haan, & Woersdorfer, 2009; Kahn, 2007). However, this environmental consideration may be made informed by an incomplete understanding of real environmental impact of vehicles (Rocco, Casalegno, & Colombo, 2018) and/or rated less importantly than utility- and image-related concerns (Thornton et al., 2011).

To improve our understanding of when, where and why individuals consider environmental factors during car-related decisions, researchers have utilised several existing theoretical models and constructs. For instance, Kassim and colleagues (2017) used the Theory of Planned Behaviour (Azjen, 1991) to study the purchase of cars with more advanced safety features. Similarly, Bamberg and Möser (2007) integrated the Theory of Planned Behaviour and Norm Activation Model (Schwartz, 1977; Schwartz & Howard, 1981) to predict eco-car purchases. This was later adapted

by Peters, Gütscher, and Scholz (2011) when they added symbolic motives to predict fuel-economical car purchases.

Of particular relevance for environmental concerns during car purchasing is work by Klöckner and colleagues which has framed car purchase behaviours within a broader set of ecological behaviours using the Comprehensive Action Determination Model (CADM, Klöckner & Blöbaum, 2010; Klöckner, 2013). Klöckner and colleagues (2013) found that people in Norway who felt unable to reduce their car use but had a conscience about doing so may realise that by purchasing and using an electric car.

A further theoretical starting point is the notion of behavioural spillover effects (Truelove et al., 2014; Nash et al., 2017), which argues that while many factors may come between the endorsement of pro-environmental attitudes and the enactment of pro-environmental behaviours (e.g., lack of perceived efficacy), the exhibition of pro-environmental behaviours in one life domain may increase the likelihood of pro-environmental behaviours in other life domains (Thøgersen & Ölander, 2003). This occurs because one has demonstrated to oneself that such behaviours are possible and behavioural consistency is likely to reduce potential cognitive dissonance (Thøgersen, 2004). Here, we might predict that individuals who are more concerned about climate change and willing to adapt their behaviours as a consequence, as well as those reporting more actual pro-environmental everyday behaviours are more likely to report environmental considerations when asked to think about their car purchases, than those who merely report being environmentally concerned (e.g., Thøgersen and Ölander, 2006; Whitmarsh and O'Neill, 2010). Using data from the UK Household Longitudinal Survey, Lynn (2014) identified a positive behavioural spillover in purchase behaviours, reporting that people who are more

environmentally-friendly at home also tend to be more environmentally-friendly in their (small, everyday) purchases.

However, an inverse behavioural spillover (or 'rebound') effect has also been observed. For instance, although Lynn (2014) identified positive behavioural spillovers in household and purchase behaviours, he also found that pro-environmental travel behaviours showed less consistency. A lack of consistency (although no evidence of an actual rebound) was also reported by Alcock et al. (2017) with respect to recreational flights. One reason for this discrepancy is 'moral licensing', where people place less emphasis on environmental factors during transport-related decisions because they believe their existing pro-environmental behaviours in other domains mitigate the potential environmental impact generated by their travel behaviour (Meijers, Noordewier, Avramova, & van Trijp, 2013; Nilsson, Bergquist, & Schultz, 2017). This has also been observed among electric cars owners in Norway who reported lower moral obligation to act pro-environmentally compared to conventional car owners (Klöckner, Nayum, & Mehmetoglu, 2013).

Although intruiging, the case of Norway may be an exception given the strong leglislation and financial incentives encouraging electric car use (Bjerkan, Nørbech, & Nordtømme, 2016; Figenbaum, 2017) and excellent recharging infrastructure (Lorentzen, Haugneland, Bu, & Hauge, 2017). It is also notable that the most popular electric car in Norway in 2017 was the Tesla (Turula, 2017) and this might, being one of the more expensive and exclusive electric car currently available, be due to its associations with status and image, as much as, environmental concerns surrounding car use (Lévay, Drossinos, & Thiel, 2017). Despite the growing literature in pro-environmental spill-overs, Klöckner and colleagues' (2013) study remains one of the few to consider these issue surrounding car purchases. Thus, there is scope to explore

these in other contexts and countries. In particular, using large representative samples to identify not just attitudinal and behavioural correlates of environmental considerations during car purchases but also key sociodemographic predictors to identify particular groups we might focus on for interventions (Bamberg, 2013).

1.3. Research Questions

Building on these ideas, the present research extends previous studies examining environmental considerations during car purchases, or at least during reflections on car purchases, using a large, representative UK sample provided by the UK Household Longitudinal Study (UKHLS). We focused on respondents who were involved in, and had an active influence on, car purchase decision-making to address four research questions (RQs):

RQ1) How often are environmental factors (e.g., CO_2 emissions) rated as important, compared to utilitarian (e.g., cost) or image (e.g., brand) related factors, when asked to consider their car purchase decisions?;

RQ2) To what extent do individuals exhibit pro-environmental attitude-behaviour consistency in this domain, e.g., are individuals with higher climate change concerns also more likely to report environmental factors as important in car purchase decisions?;

RQ3) To what extent do individuals exhibit pro-environmental behaviour consistency across domains, e.g., are individuals who report more pro-environmental household behaviours also more likely to report environmental factors as important in car purchase decisions?; and

RQ4) What are the sociodemographic correlates of individuals who report that environmental factors are important to them during car purchase decisions?

Of note, the UKHLS includes few clear operationalisations of the many theoretical constructs in models such as the CADM. Consequently, we were not able to unpack the links between these constructs and our main outcome variable, which is why our central questions focus on patterns of attitude-behavioural consistency and sociodemographic predictors instead.

2. Methods

2.1. Data source and sample

The sample was drawn from wave 4 (2013/14; n = 47,517) of UKHLS (University of Essex, 2015), where 40,000 UK households are surveyed annually (since 2009) via computer-assisted personal interviews to monitor social and economic changes longitudinally. Lynn (2011) details UKHLS's methodolgy. Wave 4 included three modules of interest, specifically the 'environment', 'environmental behaviour' and 'transport behaviour' modules. Here we only included respondents who were involved in and had an active influence in car purchase decision-making (n = 21,992). The sample sizes reported are weighted respondent samples rounded to integer values as we applied the appropriate UKHLS cross-sectional weights to improve the sample's population representativeness[1]. Compared to analyses with only demographics, sample sizes for analyses including pro-environmental attitudes and

[1] As the UKHLS has a complex sample design, a weighting strategy ensures that data analysis results are closely representative of the UK population. The cross-sectional weights used here reduce bias caused by under-coverage, probability of selection and non-response. Lynn and Kaminska (2010) and Buck and McFall (2011) details how the weights were derived.

behaviours are smaller because only a sub-set of respondents were asked these questions (n = 12,895). To explore the implications of this, we include (in supplementary materials) comparisons of estimates based only on demographics for both the full and reduced samples.

In our estimation sample, 45.1% were women and the mean (*sd*) age was 50.19 (16.50) years. Majority of respondents were White British (93.72%), followed by Asian British or from Asia (4.07%), White mixed or Black British (1.60%) and Arab or from other ethnic groups (0.61%). Most respondents resided in urban areas (72.83%) and about half (49.88%) had access to one car in their households, while 37.44% and 12.68% had access to two cars and three or more cars respectively. In addition, 13.58% of respondents reported having one or more child under 14 years in the household. Detailed sample demographics are provided in Supplementary Table 1.

2.2. Dependent variables: Considerations during car purchase

In the transport behaviour module, respondents with at least one car in the household and reported being involved in car/van purchases decisions were asked, "Which of these things are important to you when buying a car or van?" with the choice to select their responses from a list of twelve features (see Table 1). All features correlated at least .3 with at least one other feature, suggesting reasonable factorability (see Supplementary Table 2)[2]. Principal component analysis conducted on the responses elicited three principal components with eigenvalues >1. Varimax rotation was conducted, because of the independence between factors, and the final three-factor solution explained 58% of variance (see Table 1 for the rotated solution and Supplementary Table 3 for further details).

[2] Using polychoric (tetrachoric) correlations as the features were dichotomous and the latent trait underlying their considerations can be viewed as continuous (Ekström, 2011).

Table 1. Factor analysis results of features considered during car purchase reflections.

Component	Items	Varimax-rotated factor loadings		
Image-conscious	Large engine	.798		
	Speed/performance	.789		
	Features (e.g., sat nav)	.680		
	Style/design/image of brand/model	.663		
	Comfort	.523		
	Variance explained	*.25*		
Utilitarian	Reliability		.763	
	Safety		.705	
	Cost - purchase/running/resale value/tax/insurance		.668	
	Functionality/interior space/boot size		.556	
	Variance explained		*.20*	
Environmental	Electric - one that's plugged directly into an electricity supply			.858
	Environmentally-friendly/low CO_2 emissions			.621
	Small engine			.505
	Variance explained			*.13*

The first factor, following earlier research (Hafner, Walker, & Verplanken, 2017), was labelled ‘image-conscious’. The second factor was labelled ‘utilitarian’. The third factor, central to our research questions, was labelled ‘environmental’. Figure 1 illustrates the frequency each factor was mentioned in isolation and in combination with other factors, and answers RQ1. Although <1% of individuals mentioned only environmental features, 50.24% considered at least one environmental feature in their car purchases, alongside either image-conscious or utilitarian features, or both. Next, we derived three key variables of interest: a) Whether the individual mentioned *any* environmental features (a binary variable: Yes, n = 11,048; No, n = 10,944); b) How many of pro-environmental features were considered (ranging 0-3); and c) The ratio of environmental to total considerations using the formula:

$$Ratio = \frac{\frac{n_{environmental}}{3}}{\frac{n_{environmental}}{3} + \frac{n_{utility}}{4} + \frac{n_{image}}{5}}$$

The ratio score accounts for the possibility that high environmental scores could simply be achieved by mentioning a lot of different factors, rather than specifically pro-environmental ones. Though beyond our study's scope, similar analyses for utility and image-concious considerations were conducted and presented in the supplementary documents.

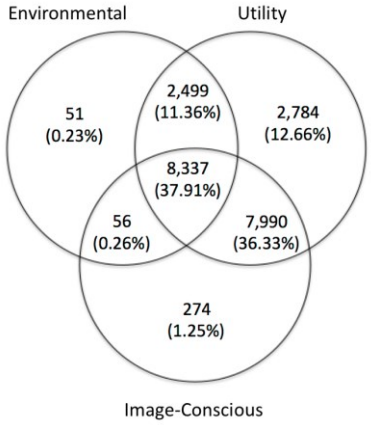

Figure 1. Frequency distribution of features considered during car purchase reflections.

2.3. Independent variables

Respondents completed questions regarding lifestyle and pro-environmental behaviours in the 'environment' and 'environmental behaviour' modules from which we derived the following variables. The questions for each variable is found in Supplementary Table 4.

2.3.1. Climate change concern

Climate change concern was computed by summing the responses (1 = No, don't believe; 2 = Yes, believe) to two questions about whether respondents believed

that 'People in the UK will be affected by climate change in the next 30 [and 200] years'. Higher scores indicate higher levels of climate change concern, (range = 2-4, mean (*sd*) = 3.69 (0.62)).

2.3.2. Climate change engagement/detachment

Nine questions assessed respondents' engagement with climate change and the distinction between climate change engagement and detachment was investigated using principal components analysis. All items correlated at least .3 with at least one other item, suggesting reasonable factorability (see Supplementary Table 5). Two principal components with eigenvalue >1 were identified. Direct oblimin rotation was conducted because both factors are correlated. The final two-factor solution explained 55% of total variance (see Supplementary Table 4 and 6 for detailed results). The first factor, labelled 'climate change detachment', consisted of six items measured on a 5-point Likert scales (1 = Strongly disagree; 5 = Strongly agree; $\alpha = .77$) and explained 34% of variance. Higher scores indicated greater scepticism of, or lack of interest in, climate change issues (range = 6-30, mean (*sd*) = 16.80 (4.23)). The second factor, labelled 'climate change engagement', comprised of three items measured on5-point Likert scales (1 = Strongly disagree; 5 = Strongly agree; $\alpha = .64$) and explained 21% variance. Higher scores indicated stronger belief in and engagement with climate change issues (range = 3-15, mean (*sd*) = 9.64 (2.25)).

2.3.3. Pro-environmental behaviours

The self-reported frequencies of eleven pro-environmental behaviours were measured on 5-point Likert scales (0 = Never; 4 = Always) with higher scores indicating higher frequencies of each behaviour. The mean score for each behaviour is provided in Supplementary Table 4. Lynn (2014) previously suggested that these eleven pro-environmental behaviours represent three distinct factors (at-home,

transport-related and purchasing behaviours). However, our preliminary analyses here showed that they do not form reliable sub-scales (i.e., they have Cronbach's alphas below 0.48). We, therefore, modelled each behaviour separately for greater analytic specificity.

2.4 Sociodemographic variables

The following sociodemographic variables were included in our analyses to account for potentially observable confounds identified previously when investigating recreational flight behaviours using this dataset (e.g., Alcock et al., 2017): sex (reference category [ref] = male), age, ethnic group (ref = White: British/English/Scottish/Welsh/Northern Irish), monthly household income (quintiles equivalised using the OECD's modified scale, ref = lowest quintile), labour market status (ref = employed), educational attainment (ref = no qualifications), presence of work-limiting illness or disability (ref = no illness), number of cars in the household (ref = one car), number of children under 14 years of age in the household (ref = none), locality of dwelling (ref = rural), and region of dwelling (ref = London).

2.5 Statistical analysis

We analysed environmental considerations during car purchase reflections in three stages. First, multivariate logistic regressions were conducted to investigate whether those reporting i) higher levels of climate change concern, ii) higher engagement as a consequence of climate concern, and iii) higher frequency of pro-environmental behaviours were also more likely to report environmental considerations. The first two models explored attitude-behaviour consistency between climate change attitudes and purchasing considerations (RQ2), and the third model explored cross-domain behvioural consistency between everyday behaviours and

purchase considerations (RQ3). Controlling for the range of sociodemographic variables enabled us to explore sociodemographic correlates of RQ4.

Next, multivariate linear regressions were used to explore relationships between environmental and sociodemographic variables, and frequency of environmentalal considerations, first using the continuous outcome variable and then the ratio score to identify, if any, changes in relationships after accounting for utility and image-conscious considerations.

In each case several models were tested. The first model regressed sociodemographic variables using the full sample. The second model regressed sociodemographic variables with a reduced sample accounted for missing data from the environmental variables (full results are provided in supplementary materials). The third model added climate change concern, engagement and detachment, and pro-environmental behaviour. By first regressing sociodemographic variables, significant relationships that emerge when environmental variables are added suggest that they influence considerations over and above sociodemographic influences, highlighting potential the additional importance of climate change concern, engagement and detachment, and pro-environmental behaviours.

All analyses were undertaken using Stata 13 and appropriate sampling probability weights from UKHLS to allow inferences to the UK population.

3. Results

Only the final logistic and linear regressions models are presented in Table 2 and Figure 2. The full results are presented in Supplementary Tables 7 to 9.

3.1 Predicting environmental considerations

The final multivariate logistic regression model exploring environmental and sociodemographic predictors of environmental considerations during car purchase

reflections is presented in Table 2 (Model 1) and graphically in Figure 2 (see Supplementary Table 7 for full results).

The odds of environmental considerations increased significantly with each unit increase in climate change concern and engagement (RQ2). The reverse was true for climate change detachment (RQ2). Environmental considerations were also significantly more likely among respondents who engaged in eight of eleven pro-environmental behaviours (RQ3). Of the three remaining pro-environmental behaviours, two concerned transport: 'using public transport' and 'walking/cycling for short journeys'.

Amongst sociodemographic variables (RQ4), female respondents (compared to males), and White-mixed or Black and Asian/Asian British respondents (compared to White British respondents) were significantly more likely to report environmental considerations. Respondents above 35 years old were also significantly more likely to report environmental considerations than those between 16 and 25 years. While household income was non-significant overall, respondents in the highest, compared to the lowest, quintile were less likely to report environmental considerations. Environmental considerations were also significantly less likely as the number of cars and children under 14 years old within the household increased. Finally, respondents living in urban (compared to rural) areas, and elsewhere in the UK (apart from the West Midlands, Wales and Northern Ireland), compared to London, were all more likely to report environmental considerations.

Table 2. Regression results investigating associations between environmental and sociodemographic variables and environmental considerations during car purchase reflections (n = 12,895).

	Model 1c[a]		Model 2c[b]	Model 3c[c]
	Odds ratio (95% CI)	Wald	*B*	*B*
Environmental Variables				
Climate change concern	1.12 (1.04, 1.21)**		0.03 (0.01, 0.06)**	0.01 (0.00, 0.01)*
Climate change engagement	1.09 (1.07, 1.11)***		0.03 (0.02, 0.04)***	0.01 (0.01, 0.01)***
Climate change detachment	0.96 (0.95, 0.98)***		-0.01 (-0.01, -0.01)***	-0.00 (-0.00, -0.00)***
Pro-environmental behaviour (higher scores = higher frequency)				
Turn TV off standby	1.04 (1.01, 1.06)**		0.01 (0.00, 0.02)**	0.00 (0.00, 0.00)**
Switch off lights	1.09 (1.04, 1.15)***		0.03 (0.01, 0.04) ***	0.01 (0.00, 0.01)**
Water conservation	1.07 (1.04, 1.10)***		0.02 (0.01, 0.03)***	0.01 (0.00, 0.01)***
Use less heating	0.99 (0.96, 1.03)		0.00 (-0.01, 0.01)	0.00 (-0.00, 0.00)
Buy less packaging	1.09 (1.04, 1.15)**		0.03 (0.01, 0.05)***	0.01 (0.00, 0.01)***
Buy recycled paper products	1.08 (1.04, 1.12)***		0.03 (0.02, 0.04)***	0.01 (0.00, 0.01)**
Bring own shopping bags	1.08 (1.05, 1.12)***		0.02 (0.01, 0.03)***	0.00 (0.00, 0.01)**
Using public transport	1.04 (0.99, 1.09)		0.01 (-0.01, 0.03)	0.00 (-0.00, 0.01)
Walk/cycle short journeys	1.02 (0.98, 1.06)		0.00 (-0.01, 0.01)	0.00 (-0.00, 0.01)
Car share	1.07 (1.03, 1.12)**		0.02 (0.01, 0.04)***	0.00 (0.00, 0.01)*
Fewer flights	1.07 (1.02, 1.12)**		0.02 (0.01, 0.04)**	0.00 (0.00, 0.01)**
Sociodemographic Variables				
Sex		52.47***		
Male	1		0	0
Female	1.40 (1.28, 1.53)***		0.12 (0.09, 0.15)***	0.03 (0.02, 0.04)***
Age		6.22***		
16-25	1		0	0

26-35	1.12 (0.90, 1.40)		0.04 (-0.02, 0.11)	0.00 (-0.01, 0.02)
36-45	1.26 (1.01, 1.56)*		0.08 (0.02, 0.15)*	0.01 (-0.00, 0.03)
46-55	1.58 (1.28, 1.95)***		0.15 (0.09, 0.22)***	0.03 (0.01, 0.05)***
56-65	1.58 (1.26, 1.98)***		0.17 (0.10, 0.24)***	0.03 (0.02, 0.05)***
66-75	1.60 (1.21, 2.11)**		0.17 (0.08, 0.25)***	0.04 (0.02, 0.06)***
over 75	1.72 (1.25, 2.37)**		0.23 (0.12, 0.33)***	0.06 (0.03, 0.09)***
Ethnic group		14.46***		
White	1		0	0
White Mixed or Black/African/Carribean/Black British	1.86 (1.37, 2.53)***		0.21 (0.11, 0.30)***	0.04 (0.02, 0.07)***
Asia/Asian British	1.77 (1.45, 2.16)***		0.25 (0.17, 0.32)***	0.06 (0.04, 0.08)***
Arab or Any other ethnic group	1.44 (0.89, 2.34)		0.19 (0.01, 0.37)*	0.05 (0.00, 0.10)*
Equivalised household income (5ths)		1.88		
1 Lowest	1		0	0
2	0.93 (0.78, 1.11)		-0.03 (-0.08, 0.03)	-0.01 (-0.02, 0.01)
3	0.99 (0.84, 1.17)		-0.03 (-0.08, 0.03)	-0.01 (-0.02, 0.01)
4	0.92 (0.78, 1.08)		-0.05 (-0.10, 0.01)	-0.02 (-0.03, -0.00)*
5 Highest	0.84 (0.72, 0.99)*		-0.08 (-0.13, -0.02)**	-0.02 (-0.04, -0.01)***
Labour market status		0.65		
Employed	1		0	0
Unemployed	1.04 (0.83, 1.30)		0.01 (-0.06, 0.09)	0.00 (-0.01, 0.02)
Retired	1.08 (0.91, 1.27)		0.03 (-0.03, 0.08)	0.00 (-0.01, 0.02)
In education	1.11 (0.75, 1.64)		0.02 (-0.10, 0.14)	0.01 (-0.03, 0.04)
Family carer	0.88 (0.70, 1.09)		-0.07 (-0.14, -0.00)*	-0.02 (-0.03, 0.00)
Highest qualification		1.09		
No qualification	1		0	0
other	0.94 (0.77, 1.16)		0.00 (-0.07, 0.07)	-0.01 (-0.03, 0.00)

GCSE etc	0.83 (0.69, 0.99)*		-0.05 (-0.11, 0.01)	-0.03 (-0.05, -0.01)***
A levels	0.89 (0.75, 1.06)		-0.02 (-0.08, 0.04)	-0.03 (-0.04, -0.01)**
Other higher cert	0.87 (0.72, 1.06)		-0.03 (-0.10, 0.03)	-0.03 (-0.05, -0.01)**
Degree	0.90 (0.75, 1.08)		-0.04 (-0.10, 0.02)	-0.03 (-0.05, -0.02)***
Longstanding illness or disability		0.01		
Yes	1		0	0
No	1.00 (0.91, 1.09)		-0.01 (-0.05, 0.02)	-0.00 (-0.01, 0.01)
Number of cars in household		5.44**		
1	1		0	0
2	0.89 (0.81, 0.99)*		-0.05 (-0.08, -0.02)**	-0.01 (-0.02, -0.00)**
3 or more	0.79 (0.68, 0.92)**		-0.07 (-0.12,-0.02)**	-0.02 (-0.03, -0.01)**
Children under 14 in household		6.12***		
0	1		0	0
1	0.86 (0.72, 1.02)		-0.06 (-0.12, -0.01)*	-0.01 (-0.03, -0.00)*
2	0.86 (0.71, 1.03)		-0.06 (-0.12, 0.00)	-0.02 (-0.03, -0.00)*
3 or more	0.49 (0.35, 0.69)***		-0.22 (-0.32, -0.13)***	-0.05 (-0.07, -0.02)***
Locality		12.60***		
Rural	1		0	0
Urban	1.20 (1.08, 1.32)***		0.06 (0.03, 0.10)***	0.02 (0.01, 0.02)***
Region		1.83*		
London	1		0	0
North East	1.45 (1.09, 1.93)*		0.10 (0.01, 0.19)*	0.02 (-0.00, 0.04)
North West	1.27 (1.03, 1.57)*		0.08 (0.01, 0.15)*	0.01 (-0.01, 0.03)
Yorkshire and the Humber	1.33 (1.06, 1.67)*		0.09 (0.02, 0.17)**	0.02 (-0.00, 0.04)
East Midlands	1.35 (1.08, 1.69)**		0.11 (0.03, 0.18)**	0.01 (-0.01, 0.03)
West Midlands	1.22 (0.98, 1.51)		0.07 (0.00, 0.15)	0.01 (-0.01, 0.03)
East of England	1.32 (1.06, 1.63)*		0.09 (0.02, 0.16)**	0.02 (-0.00, 0.03)

South East	1.30 (1.07, 1.59)*	0.10 (0.03, 0.16)**	0.01 (-0.00, 0.03)
South West	1.31 (1.06, 1.62)*	0.08 (0.01, 0.15)*	0.01 (-0.01, 0.02)
Wales	1.10 (0.87, 1.39)	0.02 (-0.05, 0.10)	0.01 (-0.01, 0.03)
Scotland	1.51 (1.21, 1.88)***	0.15 (0.08, 0.22)***	0.03 (0.01, 0.04)**
Northen Ireland	1.22 (0.96, 1.56)	0.07 (-0.01, 0.15)	0.01 (-0.01, 0.03)

Note:

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

[a] Multivariate logistic regression predicting environmental consideration versus non-consideration (reference category)

[b] Multivariate linear regression with frequency of environmental considerations as outcome

[c] Multivariate linear regression with the ratio of environmental over total considerations as outcome

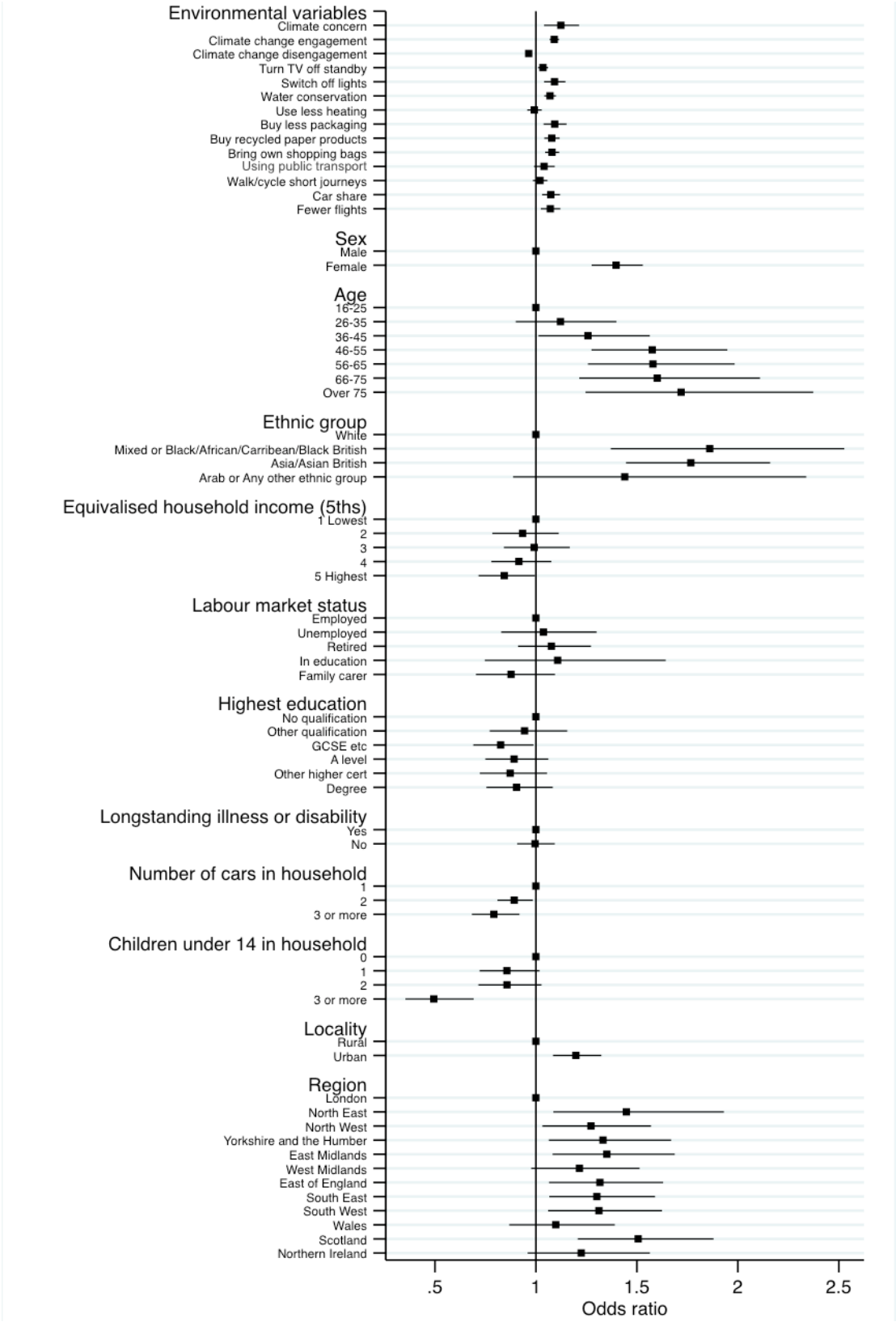

Figure 2. Forest plot of multivariate logistic regression results reporting how environmental and sociodemographic variables predicted environmental considerations during car purchase reflections.

3.2. Frequency of environmental considerations

The final multivariate linear regression exploring the number of environmental considerations during car purchase reflections is presented as Model 2 in Table 2, with full results in Supplementary Table 8.

Results for the environmental variables replicated those in the logistic regressions. Climate change concern and engagement were significantly positively related with environmental considerations while climate change disengagement was significantly negatively related (RQ2). The same three pro-environmental behaviours from the logistic model (using less heating; using public transport; and walking/cycling short) were again not significantly related to environmental considerations while the remaining eight continued to have significant positive relationships (RQ3).

Sociodemographic findings (RQ4) were largely similar to the logistic model. Female and urban respondents reported greater environmental considerations. Significantly higher levels of considerations were also observed with older and non-White respondents. However, environmental considerations were lower amongst family carers or those in the highest household income quintile, and as the number of cars and children under 14 years old in the household increased. It was again observed that respondents living elsewhere in the UK, compared to London, reported significantly higher levels of considerations apart from those in the West Midlands, Wales and Northern Ireland.

3.3. Environmental compared to utility and image-conscious considerations

Results from the final multivariate linear regression model using the ratio score is presented as Model 3 in Table 2; with the full results in Supplementary Table 9.

Findings for the environmental variables were consistent with previous regressions, even after accounting for utility and image-conscious considerations (RQ2 & 3). Note, the size of Bs in Models 2 and 3 in Table 2 are not directly comparable because they use different versions of the dependent variable. However, two distinct differences were observed among the sociodemographic variables (RQ4). First, the ratio of environmental considerations was significantly lower among those with at least General Certificate of Secondary Education (GCSE) qualifications. Second, only respondents in Scotland reported significantly higher ratios than those in London. These suggest that individuals with higher education tend to simply report more considerations of all types, not just environmental ones, and that individuals in some regions tend to consider more factors (or are perhaps more loquacious) than those in other regions.

4. Discussion

4.1. Summary of results

The current research explored four main questions surrounding environmental considerations during reflections on car purchase decisions using a large representative survey of the UK population. Our first question concerned the prevalence of environmental, alongside utility and image-conscious, considerations. These self-reported considerations were useful proxies for thought processes during real decisions as, like actual car purchases, utility was considered important more often than environmental features (Thornton et al., 2011). Half our sample considered at least one environmental feature, alongside utility and image, reflecting the complex and multi-faceted nature of car purchases (Hensher, Rose, & Black, 2008; Mairesse, Macharis, Lebeau, & Turcksin, 2012; Whitmarsh & Xenias, 2015). Nonetheless, it was concerning that the other half did not consider environmental features during

decision-making, given that ULEVs contribute towards mitigating global energy demand growth and CO_2 and particulate emissions (Garcia-Sierra, van den Bergh, & Miralles-Guasch, 2015).

Our second research question explored environmental attitude-behaviour consistency (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007), specifically whether greater climate change concern and engagement, and lower climate change detachment were associated with greater environmental considerations. Consistent with previous research, e.g., in recycling research (Thomas, Poortinga, & Sautkina, 2016), such a consistency was found. Individuals who engaged with climate change (i.e., higher engagement to, concern for, and lower detachment from climate change) were more likely to consider electric, environmentally-friendly and/or smaller engine cars.

Our third question focused on pro-environmental behaviour consistency, from low cost pro-environmental everyday behaviours to high cost, infrequent car purchases. Frequent engagement in pro-environmental household (e.g., switching off lights) and shopping behaviours (e.g., buying recycled paper products) were associated with higher likelihood of environmental considerations. However, findings for pro-environmental travel behaviours were more complex. Car sharing and taking fewer flights were associated with higher likelihood of environmental considerations, but this was not true for those who consciously used public transport and walked/cycled during short journeys. These mirror observations of recreational flights (Alcock et al., 2017) and suggest that traveling pro-environmentally regularly might lead to moral licensing, where lesser emphasis on environmental factors during car purchases because people believe their existing pro-environmental travels mitigate

their cars' potential environmental impact (Meijers, Noordewier, Avramova, & van Trijp, 2013; Nilsson, Bergquist, & Schultz, 2017).

The magnitude of effects was not insubstantial. One-point increases on the climate change concern scale (3-point Likert scale) and climate change engagement scale (13-point Likert scale) corresponds with 12% and 9% increases in likelihood of environmental considerations respectively. Likewise, one-point increases in most 5-point Likert pro-environmental behaviour scales corresponded with 4-9% increases in likelihood. These suggest that we could encourage environmental considerations for infrequent purchases like cars through increasing engagement with climate change discourses and encouraging pro-environmental behaviours.

Our final question identifies key sociodemographic correlates of environmental considerations. One particularly interesting finding was that non-White ethnic respondents reported greater environmental considerations, even after considering potential confounds (e.g., income). We know of no previous research reporting similar findings but given its potential implications on transport and environmental policies and initiatives, further work exploring these differences seems warranted. We also found regional differences, with Scottish respondents, in particular, reporting greater environmental considerations than London respondents. The ambitious sustainable transport, and carbon reduction targets and policies pursued by the Scottish Parliament, and active Green representation since 1999's representative devolution may have contributed to higher awareness and environmental considerations (Scottish Government, 2011; Gray, Laing, & Docherty, 2016; MacKinnon, Shaw, & Docherty, 2008). Respondents in urban areas also reported more environmental considerations, possibly due to exposure to higher concentrations of car use-related environmental impacts (e.g., air pollution), as well as

differences in expectations of cars (e.g., engine size is less relevant when sitting in urban congestions; Mackett, 2015).

Our findings challenge the hypothesis that environmental considerations are affordability-linked (Plötz, Schneider, Globisch, & Dütschke, 2014). Respondents in the highest income quintile were least likely to report environmental considerations. Instead, image-conscious considerations increased with income (see Supplementary Tables 10 and 11). We also found no evidence that people with more cars in the household (another indicator of income) were more likely to report environmental considerations during their car purchase decisions, contrary to previous suggestions of the increased likelihood of buying electric cars as second cars (Klöckner et al., 2013), although there are contextual differences between studies (UK vs. Norway). Our findings do, however, point to the importance of specific constraints on certain consumers. For instance, those with children in the household focus on utility rather than the environment (Hensher et al., 2008). Collectively, these sociodemographic insights reflect debates surrounding resource-strapped and resource-rich segments, and regional differences within the UK (Maskileyson, 2014; Whitaker, Scott, & Wardle, 2015), and highlight the need for calibrated approaches when understanding and intervening in 'green' transport issues.

4.2. Limitations and further research

We recognise several limitations here. Using secondary data meant that we were unable to test specific theoretical models because data for the requisite constructs was not collected. Also, our categorisation of environmental considerations included small engine, electric cars and environmentally-friendly/CO_2 emission features. However, considering small engine cars may also be motivated by non-environmental cognitions, such as price or operating costs (Hensher et al., 2008;

Mairesse et al., 2012). While we were unable to rule it out, the relatively clear factor structure seems to speak against this possibility and our analyses included extensive sociodemographic variables controlling for these confounds.

The data's self-report and cross-sectional nature meant causality cannot be established, especially for the associations between environmental considerations and pro-environmental attitudes and behaviours. The current data only speak to people's reflections of car purchases, not their actual thoughts at the moment of purchase. Although their answers do appear as a reasonable proxy (Thornton et al., 2011) we are careful to avoid claiming our findings speak directly to actual purchase decisions, as it is uncertain, and beyond the limits of this data, of the eventual car purchased as other factors come into consideration leading up to the actual car purchase, such as the price and availability of ULEVs.

Due to space constraints, we focused on environmental considerations and provide findings on utility and image-conscious considerations in Supplementary Tables 8 and 9. Finally, we recognise that our findings are UK-specific and further large-scale studies are needed globally, especially closer to the time of purchase, and they would benefit from including measures such as pro-environmental values, norms, attitudes and emotions, guided by strong theoretical underpinnings (Chng, Abraham, White, Hoffmann, & Skippon, 2018).

4.3. Conclusions

These limitations notwithstanding, our study extends previous research on the sociodemographic profiles underlying environmental considerations during car purchase reflections and demonstrates consistency between environmental concerns, and pro-environmental attitudes and behaviours. Car purchases are key single decisions individuals make that can contribute towards addressing our environmental

challenges and our findings support recommendations to identify population segments that are most likely, willing and able to consider ULEVs (Plötz et al., 2014). These include women, older adults, ethnic minorities, urban residents, and those concerned about climate change and engaged in pro-environmental behaviours. Our findings challenge previous assumptions that the rich and educated consider more environmental factors. Environmental considerations were strongest in Scotland, suggesting that specific policies adopted by the Scottish Parliament have been somewhat effective, although further investigation is needed to understand how similar policies and initiatives can be introduced elsewhere.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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[Suppressed for anonymity; insert here]

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