Who is reducing their material consumption and why? A cross-cultural analysis of dematerialisation behaviours

Lorraine Whitmarsh[1], Stuart Capstick[2] & Nicholas Nash[3]

1 School of Psychology & Tyndall Centre for Climate Change Research, Cardiff University, Tower Building, 70 Park Place, Cardiff, CF10 3AT, UK
ORCID: orcid.org/0000-0002-9054-1040
2 School of Psychology & Tyndall Centre for Climate Change Research, Cardiff University, Tower Building, 70 Park Place, Cardiff, CF10 3AT, UK
3 School of Psychology, Cardiff University, Tower Building, 70 Park Place, Cardiff, CF10 3AT, UK

Summary

The environmental and economic imperatives to dematerialise economies, or 'do more with less', have been established for some years. Yet, to date little is known about the personal drivers associated with dematerialising. This paper explores the prevalence and profile of those who are taking action to reduce consumption in different cultural contexts (UK and Brazil) and considers influences on dematerialisation behaviours. We find exemplar behaviours (avoiding buying new things and avoiding packaging) are far less common than archetypal environmental behaviours (e.g., recycling), but also that cultural context is important (Brazilians are more likely to reduce their material consumption than people in the UK). We also find the two dematerialisation behaviours are associated with different pro-environmental actions (more radical action versus green consumption, respectively); and have distinct, but overlapping, psychological (e.g., identity) and socio-demographic (e.g., education) predictors. Comparing a more traditional value-identity model of pro-environmental behaviour with a motivation-based (self-determination) model, we find the latter explains somewhat more variance than the former. However, overall little variance is explained, suggesting that additional factors at the personal and structural levels are important for determining these consumption behaviours. We conclude by outlining policy implications and avenues for further research.

1.   Introduction

1.1   Why reduce material consumption?

The environmental impacts of material production, processing and consumption are profound and increasing (Allwood et al., 2011). In the same way that there is a need for energy efficiency and demand reduction to address climate change, there is a need for material efficiency and demand reduction – through action on both production and consumption sides – to address depleting physical resources and the impacts of their extraction, processing, transport and disposal on the environment and communities (Allwood et al., 2011; Ekins, 2008). The environmental and economic imperatives to dematerialise economies, or 'do more with less', have been established for some years (e.g., Rosenberg, 1982) but have recently been most clearly formulated in Allwood et al's (2011) 'White Paper' for material efficiency, outlining various strategies for reducing material demand (e.g., building longer-lasting products; reusing components; designing products with less material). These are consistent with the 'waste hierarchy' of reduce, reuse and recycle (e.g., UNEP, 2013) – with the most beneficial being reduction in consumption and material use. While these material efficiency strategies are largely technically feasible, there remain major social barriers to their implementation (e.g., economic preference for materials over labour in terms of input expenditure; social norms and aspirations to consume; Allwood et al., 2013; Cooper, 2004).

There are also *psychological* reasons to dematerialise. While there is a widespread and implicit belief that consumption may improve well-being (the so-called 'happiness-consumption myth'; Brannigan, 2010), there is now clear evidence that – beyond a certain point – material consumption does not lead to happiness; but rather the opposite may be true (Kasser, 2002; Wilkinson & Pickett, 2009). While a certain level of consumption is required to fulfil basic needs (and, arguably, certain higher order needs, e.g., social identity and status; Braun & Wicklund, 1989), beyond this level, increased material consumption does not yield greater fulfilment or satisfaction, and may even increase subjective dissatisfaction with one's life (Brannigan, 2010; Dittmar et al., 2014). Consistent with this, there are increasing calls to measure societal progress by less materialist metrics (Jones et al., 2016) and to explore new, more sustainable, meanings of 'prosperity' (Jackson, 2011) and less materialist, low-carbon forms of society (Urry, 2013). Understanding how material (non-)consumption is impacted by individuals' identity and need satisfaction is an important challenge which this paper seeks to address by examining, bringing together and comparing different psychological theories (e.g., value-identity, self-determination).

While the arguments for dematerialisation are well supported by research, they are not widely understood by the public. For example, though the need to recycle is now largely recognised, few citizens are moving up the 'waste hierarchy' to take actions to reduce their consumption (Whitmarsh, 2009) – and indeed, the prevailing norm to consume and the desirability of high-consumption lifestyles present a huge challenge for dematerialisation; the evidence suggests that the option to recycle resources may even increase consumption levels (Catlin & Wang, 2013). This inertia has furthermore not been challenged by the tendency of 'simple and painless' actions to be emphasised in policy and by campaigning organisations as responses to environmental problems, rather than more radical and substantive approaches (Thøgersen & Crompton, 2009; Capstick et al., 2015). Yet, more research is needed to understand the social and psychological barriers to, and drivers of, reducing material consumption (Burroughs et al., 2013). The current paper addresses this deficit in the literature by exploring the prevalence and profile of dematerialisers and influences on dematerialisation behaviours. Ultimately, it is hoped this will inform socially robust and publically acceptable material efficiency policies (Allwood et al., 2011).

1.2   Who is reducing their material consumption and why?

We know relatively little about who reduces their material consumption. Clearly, there is an important distinction between those who *choose* to reduce their consumption and those who, due to low income or other factors, do so out of necessity. Even within these categories, there appears to be heterogeneity. Some research has suggested that those who *elect* to reduce their material consumption – sometimes described as 'voluntary simplifiers' – may be motivated to do so for a number of reasons, including a desire to increase life satisfaction as well as reduce their impact on the environment (McDonald et al., 2006; Zavestoski, 2002). Indeed, while there may be a strong environmental imperative to reduce consumption, qualitative research indicates frugal and low-carbon lifestyles are often motivated by factors other than pro-environmental concern (Evans &

*Author for correspondence (Whitmarshle@cardiff.ac.uk).
†Present address: School of Psychology, Cardiff University, Cardiff CF10 3AT, UK

Abrahamse, 2008; Howell, 2013; Whitmarsh, 2009). Rationales for reducing consumption include ecological responsibility, social responsibility or supporting local community, and maintaining a spiritual life (Huneke, 2005). Marchand et al. (2010) have argued that for some consumers, 'self-interest' in the form of seeking a higher quality of life and greater personal freedom (e.g. from the demands of work and the need to spend money) can motivate sustainable consumption. Other work has identified 'types' of voluntary simplifiers: 'conservers' (acting out of a desire to reduce waste); 'conformists' (acting out of a response to personal guilt or pleasure), and 'crusaders' (motivated by social concern; Leonard-Barton & Rogers, 1980). Different levels of intensity have also been identified, ranging from 'downshifters' who make superficial or piecemeal changes (e.g., buying goods with simple designs; more home-oriented); through 'strong simplifiers' who attempt to redress a perceived imbalance between money and time (e.g., reducing working hours to pursue more personally fulfilling activities); to 'holistic simplifiers' who adopt a 'simple living' philosophy underpinned by social, ethical and environmental values (Etzioni, 1998; 1999). This research appears to indicate that the more intense (and often difficult) forms of voluntary simplicity are driven more by pro-environmental or pro-social values than by self-interest (Hurst et al., 2013). Likewise, other studies affirm the role of value-based considerations in more demanding pro-environmental behaviours (PEBs; Howell, 2013; Buchs, 2016).

More generally, we also know that people are relatively inconsistent in respect of pro-environmental behaviours – e.g., they may recycle but not reduce driving – and use a range of discursive or psychological strategies to reconcile these inconsistencies (e.g., Barr et al., 2010). Indeed, it may be that the trade-offs discussed in the material efficiency literature (Allwood et al., 2011) between recycling and dematerialisation are evident at the behavioural level – i.e., that individuals justify continued (or increased) consumption by recycling or reusing (as suggested by Thøgersen, 1999 and Catlin & Wang, 2013). We know, for example, that those who reuse carrier bags are no more likely to do any other waste reduction or pro-environmental behaviours including buying products with less packaging, recycling, or repairing items instead of buying something new (Poortinga et al., 2013); and that recycling all possible domestic waste can be used to alleviate guilt about not undertaking more difficult pro-environmental behaviours like flying less (Barr et al., 2010). This 'moral licensing' effect and its converse, behavioural spillover (where adopting one pro-environmental behaviour leads to adoption of additional, pro-environmental behaviours), are attracting increasing attention in the environmental social science literature (Thomas et al., 2016; Whitmarsh & O'Neill, 2010; Thøgersen, 1999; Thøgersen & Olander, 2003), but especially in relation to material consumption behaviours are little understood. There is some evidence that green consumption behaviours are offset by less sustainable choices as a result of moral licensing (Panzone et al., 2012). However, the literature suggests a negative relationship between environmentalism and materialism (Banerjee & McKeage, 1994).

As well as understanding how dematerialisation fits into broader patterns of behaviour or lifestyles, it is also critical to understand what might *drive* or predict dematerialist behaviours. Social and self-identity is a key component of consumption (Belk, 1988; Dittmar, 2008); that is, people signal aspects of who they are, or aspire to be, and develop bonds with others, through their material possessions and often through 'conspicuous consumption' (i.e., signalling wealth and power through consuming recognisably expensive goods; Braun & Wicklund, 1989). The close connections between identity, social meanings and consumption pose a serious challenge for dematerialising society. Indeed, reducing consumption (and associated 'embedded emissions') is acknowledged as one of the most difficult challenges for behavioural scientists and policy-makers alike (Capstick et al., 2015) and often ignored in studies of pro-environmental or low-carbon behaviour change and policy (e.g., Dietz et al., 2009). Yet, consumer identities are not the only salient identities in respect of consumption behaviours: pro-environmental (or 'green') identity (i.e., seeing oneself as a green person) has been shown to be a good predictor of buying environmentally-friendly products (Whitmarsh & O'Neill, 2010; Gatersleben et al., 2012) and certain other (generally easier, more symbolic) pro-environmental behaviours, such as recycling (Gatersleben et al., 2012). Yet, the link between pro-environmental identity (or indeed other identities) and *avoiding* consumption is less clear, particularly since it would be more difficult to signal any identity (including being green) through *not* doing or having something. However, consumption-focused identity formation has been reported as a central component of anti-consumption practices (Cherrier, 2009).

Similarly, values may be important predictors of dematerialisation. According to post-materialism theory (Inglehart, 1990), which is based on Maslow's (1954) hierarchy of needs, societies which are at a more developed state (i.e., whose basic needs have been met) are predicted to be more concerned about higher-order needs (including environmental quality) and potentially to reduce their environmental impact. There is some evidence for this: Domazet and Jeromilov (2014), for example, found that amongst European countries income correlated with attitudes of environmental concern. However, this attitudinal relationship does not appear to translate straightforwardly into actual patterns of consumption: there is little evidence of economies dematerialising or decoupling their material consumption from economic growth (Ekins, 2008). Similarly, studies at the individual level exploring post-materialism indicate those who endorse less materialist priorities (e.g., by prioritising values such as freedom of speech over lower prices) are more likely to have greener

attitudes (Inglehart, 1990, though see Carlisle & Smith, 2000 for a counter-perspective) but not necessarily adopt greener behaviours. On the contrary, studies show that total energy consumption tends to *increase* with income (Poortinga et al., 2004; Druckman & Jackson, 2010; Brandon & Lewis, 1999); in some cases, there may also be a positive relationship between pro-environmental attitudes and actual levels of consumption and/or carbon emissions; that is, those who profess greater concern about climate change are also those who have higher carbon footprints (Kennedy et al., 2015). Thus, energy conservation and other environmentally beneficial behaviours may be motivated more by environmental concern than economic gain amongst higher income groups, but these groups are likely to be consuming more energy in the first place (Whitmarsh, 2009; DEFRA, 2001). These findings together are indicative of complex and sometimes counter-intuitive relationships between attitudes and material consumption.

Other work on values would suggest that, while there may be cultures for whom a strong connection with the natural world is more important, individual differences within cultures are at least as important in predicting pro-environmental values (Schwartz, 1992). According to the dominant social psychological theory of values, there are two dimensions of values – self-enhancement versus self-transcendence, and openness to change versus conservatism – which encompass ten motivational values. Within self-transcendence, the motivational values are universalism (i.e., care for non-human life and environmental concern) and benevolence (i.e., care for other people). Universalism (or 'biospheric' values, as conceptualised elsewhere; Stern, 2000; DeGroot & Steg, 2008) has been shown to predict pro-environmental attitudes and certain 'green' behaviours, such as support for pro-environmental policies (e.g., Schultz & Zelezny, 1999). Analysis shows that identity may moderate the relationship between values and behaviour in the environmental domain, such that Gatersleben et al (2012, p.1) conclude that 'identities may be broader concepts which incorporate values'. In the current research, we examine the efficacy of this integrated value-identity model of pro-environmental behaviour in respect of dematerialisation actions.

On the other hand, the prediction of specific pro-environmental behaviours from a person's more abstract values can be problematic (Maio, 2011; Kollmuss & Agyeman, 2002). Many so-called 'private-sphere' behaviours (e.g., waste disposal behaviours; Stern, 2000) are also closely related to demographic or contextual factors (e.g., income, household composition, location; Whitmarsh, 2009; Whitmarsh & O'Neill, 2010). The relative importance of psychological variables (e.g., identity, values) and such contextual factors (e.g., income) in predicting low-consumption lifestyles has been little explored, but is a central focus of the present research. Furthermore, very little cross-cultural research has been conducted on material reduction behaviours, or indeed pro-environmental behaviours in general (Hurst et al., 2013). Some research suggests that, despite differences in levels of material consumption across cultures, the importance of consumption as a marker of social status remains stable (Eastman et al., 1997). Given the importance of cultural norms and systems of provision to shaping consumption behaviours (Shove, 2003; Sanne, 2002), we adopted a cross-cultural design and selected two countries with distinct cultural value orientations and social-environmental contexts: the UK and Brazil.

Our rationale for selecting the UK and Brazil to compare is based on evidence that these cultures differ, firstly, along important social psychological dimensions, and secondly, along various environmental, economic and political dimensions. In terms of cultural values, Schwartz (2008) establishes the grounds for consistent differences in values between the UK and Brazil. The UK as a culture is higher in 'affective autonomy' (that is, the culture supports people's pursuit of pleasurable or exciting activities) and mastery (relating to self-assertion and ambition) and lower in harmony (accepting the world as it is) and social embeddedness (respect for social order and tradition), consistent with individualist cultures. Brazil, by contrast, is higher in the values of embeddedness and hierarchy (likewise, relating to respect for authority and the social order), consistent with collectivist cultures. Studies show that these cultural values are significant predictors of environmental attitudes and behaviours (Schultz & Zelezny, 1999), and specifically find higher biospheric values in South America than in Europe or the US where egoistic concerns are higher (Schultz et al., 2005). Latin American societies diverge from European and Anglo-American societies in their environmental worldviews with the former being more holistic (non-dualist, combining ecological and anthropogenic worldviews; Corral-Verdugo et al., 2013; Bechtel et al., 2009) and having greater emotional attachments to nature and other people (Corral-Verdugo & Pinheiro, 2009) due to the blending of indigenous and colonial traditions. Further, belief in and concern about climate change appears to be much higher in Brazil than the UK (e.g., 90% in Brazil stated global warming is a 'very serious problem', compared with 50% in the UK; Pew Centre, 2009; also Pew Centre, 2015). Furthermore, work showing that individualistic and collectivist cultures differ in their willingness to work towards common goals (Schultz, 2002) highlights the importance of comparing different cultural types in their pro-environmental behaviours. Since more cooperation has been demonstrated in collectivist than individualist cultures, we might expect greater adoption of pro-environmental behaviours in Brazil than in the UK. One might also expect more motivation to take pro-environmental action in Brazil than in the UK since the former have greater exposure to environmental problems (e.g., pollution, deforestation, freshwater depletion) and to diverse flora and fauna (e.g., rainforest species; Corral-Verdugo et al., 2013; Dick et al., 2014; Aklin et al., 2013). On the other hand, these countries also differ markedly in their socio-economic context, with Brazil still an industrialising country, with more economic reliance on agriculture (e.g., cattle farming,

sugarcane) and lower income and literacy levels than the UK (Simões, 2011). From a post-materialist perspective, this might then lead us to expect lower adoption of pro-environmental behaviours in Brazil than in the UK. Consequently, while there is good reason to expect pro-environmental values and attitudes to be stronger in Brazil than the UK, there are also reasons to expect these will not necessarily be translated into pro-environmental behaviours. Indeed, recent work indicates that values may be more predictive than other (external) factors of environmental protection behaviours in wealthier countries, where barriers to sustainable behaviours are likely to be lower (Milfont & Markowitz, 2016); consequently we examine the hypothesis that values are more predictive of dematerialisation behaviours in the UK than they are in Brazil.

While values-based models are typically used in environmental psychology to predict green behaviours (Stern, 2000), work in social psychology increasingly points to the importance of different types of motivation in understanding the drivers and durability of behaviour (Deci & Ryan, 1985; Kasser, 2002; Webb et al., 2013), including pro-environmental behaviour (Thøgersen & Crompton, 2009). Pelletier et al (1998) argue that conventional models of pro-environmental behaviour tend to focus on superficial behavioural reinforcement (e.g., incentives, social pressure), which leads to short-term behaviour change. Durable behaviour change is more likely where action is underpinned by intrinsic (action is appreciated for its own sake) than extrinsic motivations (behaviour is undertaken for some external reward or avoidance of punishment; De Young, 2011). These motivational types exist on a spectrum with extrinsic motivations encompassing the potential for self-determination: given a supportive interpersonal context, external reinforcement can give way to internal behavioural control, emotional reinforcement (e.g., guilt) and identification with the behaviour. According to self-determination theory (SDT; Deci & Ryan, 1985), intrinsically motivated behaviour better satisfies our psychological needs (for, e.g., personal growth, community) than extrinsically motivated action; and intrinsic motivations have been linked to higher psychological wellbeing and behavioural persistence. Given the observed link between materialism and extrinsic life aspirations (Kasser, this issue) and the limitations of value-based models of pro-environmental behaviour (e.g., Webb et al., 2013), it seems important to consider different types of motivations for dematerialisation behaviours. From this theoretical perspective, we might expect that more demanding dematerialisation behaviours (e.g., avoiding consumption) require more intrinsic motivation, while it is sufficient for simpler behaviours (e.g., recycling) to be extrinsically motivated. In the current research, we explore whether motivational models (e.g., SDT) explain adoption of dematerialisation behaviours better than the more widely used (in environmental psychology) value-identity models.

1.3   Research questions and hypotheses

Our research questions are as follows:
1. How prevalent are dematerialisation behaviours in diverse cultural contexts (specifically, the UK and Brazil)?
2. How does dematerialisation relate to other 'pro-environmental' behaviours in terms of their co-occurrence?
3. What predicts dematerialisation behaviours? How important are psychological variables, including motivation, aspirations, values and identity, relative to socio-demographic factors?
4. Which psychological model is a better predictor of dematerialisation behaviours: a motivation-based model (based on self-determination theory; Deci & Ryan, 1985) or Gatersleben et al's (2012) values-identity model?

In terms of hypotheses, we make the following predictions based on our review of the literature above:
- H1. We predict that both psychological (e.g., identity, motivation) and demographic (e.g., gender, education) factors will predict dematerialisation behaviours. With respect to psychological factors, we predict specifically that higher pro-environmental identity, self-transcendence and post-materialism values, and intrinsic life goals will positively predict dematerialisation behaviours.
- H2. We predict that different behaviours will have different (but overlapping) sets of predictors: specifically, less demanding (e.g., green consumption) behaviours will be better predicted by a value-identity model, while more demanding (e.g., consumption avoidance) behaviours will be better predicted by a motivational (SDT) model.
- H3. We predict that values will be more predictive of dematerialisation behaviours in the UK than they are in Brazil.

To address these questions and hypotheses, we conducted a survey with quota samples of the UK and Brazilian public in Spring 2016.

2 Methods

2.1 Participants and design

Participants were recruited via a research panel provider (Qualtrics) and given a reward (e.g., credits, non-profit donations, vouchers) for participation. In wave 1 (February 2016 UK, April 2016 Brazil), a quota sample of 1,068 participants was recruited in the UK and 1,104 in Brazil, with age, gender and income representative of the public (based on census data). The age quota was relaxed in the Brazil dataset due to difficulties recruiting older respondents. In both countries, the sample is more educated than the general public. In the UK, 38% are graduates, compared to 47% in our sample (see: www.ons.gov.uk/ons/dcp171776_337841.pdf). In Brazil, 11% of the population is a graduate, compared to 66% of our sample (www.ons.gov.uk/ons/dcp171776_337841.pdf).

Two months later, the same sample was re-contacted to invite them to complete a similar survey (several items were not repeated and three additional items were included; see below). In total, 632 participants provided complete datasets for this second wave in the UK and 438 in Brazil. Demographic breakdown of the samples is shown in Table 1.

2.2 Measures

2.2.1 Materialism and post-materialism

Materialism was measured with a three-item scale (short-form 'success' subscale of the Material Values Scale, Richins & Dawson 1992) comprising three statements: *'I admire people who own expensive homes, cars, and clothes', 'The things I own say a lot about how well I'm doing in life'* and *'I like to own things that impress people'* and a seven-point agreement scale from 'Entirely agree' (7) to 'Entirely disagree' (1). The items formed a reliable scale ($\alpha[3]$=.85).

Post-materialism was measured with an item assessing perceived national priorities (from Carlisle & Smith, 2000): *'Which of the following do you think should be the UK's highest priority, the most important thing it should do? Which do you think should be the UK's next highest priority, the second most important thing it should do?'* with four response options: *'Maintain order and stability in the country' (1); 'Give people more say in government decisions' (2); 'Fight rising prices' (3); and 'Protect freedom of speech'* (4). Post-materialism score was calculated as follows: people who selected the two post-material goals (options 2 and 4) as most important were given the score of '4'; people who chose a post-material goal as most important and a material goal (1 and 3) as second most important were scored '3'; those who chose a material goal as most important and a post-material goal second were scored '2'; and those selecting both material goals as most important were scored '1'.

Interestingly, post-materialism and materialism are only weakly negatively correlated (UK: r=-.09, p=.03) – perhaps because of the different scales at which the measures are framed (societal versus social) and because of the different measurement types (Likert scale versus ranking four options); thus, both are included in the regression analyses.

2.2.2 Intrinsic life goals

The second wave of data collection included a reduced form of the Aspiration Index developed by Kasser and Ryan (1996). The 12-item measure is designed to assess intrinsic (self-development, community involvement and affiliation) versus extrinsic (money, image, fame) goal orientation, and asks participants 'How important it is to you that each of the following will happen in your life in the future'. It includes the following items on a 5-point scale from 'Extremely important' (5) to 'Not at all important' (1): *'You will donate time or money to charity', 'You will work to make the world a better place', 'You will help others improve their lives', 'You will have good friends that you can count on', 'You will have people who care about you and are supportive', 'You will have good friends that you can talk to about personal things', 'You will have a job that pays well', 'You will have a job with high social status', 'You will be financially successful', 'Your name will be known by many people', 'You will be admired by many people',* and *'You will do something that brings you much recognition'.* The order in which the items were presented was randomized. The final six items were reversed scored, and a mean score of all 12 items was calculated for each respondent indicating their intrinsic orientation. The scale was moderately reliable ($\alpha[12]$=.61); there was minimal alpha improvement by removing items, so the full 12-item scale was used in analysis.

2.2.3 Green identity

Green identity, comprising general pro-environmental and more specific waste-conscious identity statements, was measured with six items adapted from previous research (e.g., Whitmarsh & O'Neill, 2010): *'Taking action to protect the environment is an important part of who I am'*, *'I would describe myself as an 'environmentalist''*, *'I would not want anyone to think of me as someone who is concerned about reducing waste' (rev)*, *'I would not want my family or friends to think of me as someone who is concerned about environmental issues' (rev)*, *'I am the type of person who tries not to be wasteful'*, and *'I would be embarrassed to be considered a 'waste-conscious' person' (rev)*. Responses were provided on a seven-point agreement scale. The scale was found to be reliable ($\alpha[6]=.72$).

2.2.4 Values

Values were measured with the short-form Portrait Value Questionnaire (PVQ-11; Schwartz et al., 2011). This measure has been widely used and validated cross-culturally (e.g., Milfont & Markowitz, 2016) and captures values in a manner that can be divided into four distinct clusters varying along two axes: openness to change (comprising self-direction and stimulation values) versus conservatism (comprising tradition, security and conformity); and self-transcendence (comprising universalism and benevolence) versus self-enhancement (comprising power and achievement). Since the 11-item scale only includes only one direct measure of pro-environmental values (classified as 'universalism'), we added a second one from the longer PVQ scale, in order to ensure robust measurement. The measure is introduced with the following text: *'I will briefly describe some people. Would you please indicate for each description whether that person is very much like you, like you, somewhat like you, not like you, or not at all like you?'* with responses on a seven-point scale from 'Very much like me' to 'Not at all like me'. Items are tailored to the gender of the respondent.

Self-transcendence values have been shown to predict pro-environmental attitudes and behaviour (e.g., Corner et al., 2014), so we focus on this cluster in our analysis. We developed a 'self-transcendent values' scale using the following four items: *'It is important to him/her to do something for the good of society'*; *'It is important for him/her to help other people nearby; to care for their well-being'*; *'Looking after the environment is important to him/her; to care for nature and save resources'*; and *'It is important to him/her to prevent pollution; to take care of the environment around him/her'*. The items were centred to individuals' overall mean value score (following Schwartz ref), and formed a reliable scale (Brazil $\alpha[4]= .69$; UK $\alpha[4]= .66$).

2.2.5 Motivations to take environmental action

We used a 13-item version of the Motivation Toward the Environment Scale (MTES; Pelletier et al., 1998) that applies self-determination theory's six types of motivation to pro-environmental action. Each motivational type is measured with two items: Identified (e.g., 'Because it's a sensible thing to do in order to improve the environment'), Integrated (e.g., 'Because it's part of the way I've chosen to live my life'), Intrinsic (e.g., 'For the pleasure I experience when I find new ways to improve the quality of the environment'), Introjected (e.g., 'Because I would feel guilty if I didn't'), External (e.g., 'Because other people will be upset if I don't') and Amotivated (e.g., 'Honestly, I don't know; I truly have the impression that I'm wasting my time doing things for the environment'). The measure is preceded with this introduction: *'There are many things that one can do for the environment. Listed below are several statements concerning possible reasons why people might take action to protect the environment. Using the scale from 1-7 below, please indicate the degree to which the proposed reasons correspond to your reasons for taking action to protect the environment.'* Responses were on a seven-point scale from 'Corresponds exactly' (=7) to 'Does not correspond at all' (=1). Correlation analysis found that all 'internal' types of motivation (intrinsic, identified, introjected, and integrated) were highly correlated, so they were scaled to form a reliable Internal motivation scale (Brazil $\alpha[8] = .87$; UK $\alpha[8]= .91$). The 'external' motivation items formed a reliable scale (Brazil = .71; UK = .76). The amotivation items also formed a reliable scale (Brazil = .63; UK = .75), but were excluded from subsequent analysis because they were highly correlated with other motivational types (Brazil: amotivation-external regulation r=.40, p<.01); UK: amotivation-internal motivations r=-.43, p<.01).

2.2.6 Socio-demographics

Demographic factors, including age, gender, income and education, were measured (see Table 1).

2.2.7 Dematerialisation and other pro-environmental behaviours

Dematerialisation or material efficiency behaviours can be measured in a variety of ways. For example, there appears to be no agreement in the literature on which specific behaviours are most indicative of voluntary simplifiers, with examples including 'making gifts instead of buying them' (Leonard-Barton, 1981), 'avoiding impulse purchases' and 'recycling' (Huneke, 2005). Here, we opted to apply measures used in more recent work (e.g., Whitmarsh & O'Neill, 2008), which operationalises reduced material consumption at a more general level, but that could encompass actions of the kind identified in voluntary simplicity research (e.g., gift making). Specifically, we used two items: 'Bought products with less packaging' and 'Avoided buying new things (e.g. clothes, luxury items)'. These items did not form a reliable scale ($\alpha[2]$ =.51) so were analysed separately.

In addition, a battery of 20 other items assessing various PEBs was examined. These items were derived from previous studies of PEBs (e.g., Whitmarsh & O'Neill, 2008) and from qualitative research (in prep.) conducted across seven countries to identity more culturally universal measures of PEBs than previously developed. PEBs are shown in Table 2. This battery includes recycling, which has in the past been included as an indicator of voluntary simplicity (Leonard-Barton, 1981; Huneke, 2005; Ballantine & Creery, 2009) but is now widespread in many countries so less likely to be diagnostic of a dematerialist lifestyle.

All behaviours were measured on a 10-point frequency response scale with the preceding instruction text: '*In the past 12 months, how often have you done each of the following? Please indicate how often you have taken the following actions in the past year. If you are not sure, please state approximately how often you recall doing them*' and response options from 'Not at all in the past year' (1) to 'At least once a day' (10).

3 Results

3.1 Prevalence of dematerialisation

As shown in Figure 1, the largest proportion of respondents in both countries (29.6% UK, 16.9% Brazil) stated that they have never avoided buying new things, around double the proportion (15.4% UK, 9.4% Brazil) saying they never bought products with less packaging. Relative to other PEBs (see Table 2), both dematerialist behaviours are only moderately popular, with a mean around the scale mid-point (5.15 UK and 5.77 Brazil for buying products with less packaging, and 4.07 UK and 5.04 Brazil for avoiding buying new things), representing between 2-3 times per month to 4-6 times per year. By contrast, in both countries, simple private-sphere behaviours such as turning off lights and not littering are adopted by most people most of the time; while political activities are most rare. Of course, some caution should be exercised in comparisons of frequency of these self-reported activities, especially given that some are essentially effortless and likely to occur often (such as relating to appliance use in the home) as compared to more effortful public sphere behaviours.

Comparing the two cultures (Table 2), it is clear that PEBs in general are more frequently adopted in Brazil than in the UK, with the notable exception of recycling, which is probably more due to lack of infrastructure provision than individual motivations. Consistent with this, both dematerialisation behaviours are more common in Brazil than in the UK.

3.2 Relationship between dematerialisation and other PEBs

As shown in Table 3a, oblique rotation ('oblimin') principal components analysis of the 22 PEBs indicates four distinct groups in the UK sample: component 1 represents more committed (and largely political or 'public-sphere') behaviours; component 2 represents low-cost conservation and waste behaviours; component 3 represents mostly consumer behaviours; while component 4 is a less interpretable group involving meat-eating and fitting low-energy lightbulbs. Notably, we find the two dematerialisation behaviours loading on different components: avoiding buying new things loads most strongly on the first component (committed/political behaviours), while buying products with less packaging is very clearly in the consumer behaviour group (component 3). This suggests that the two behaviours may be conceptually and behaviourally distinct; the former being seen and performed as a political or socially-oriented action, the latter as a more generic consumer behaviour.

A very similar picture emerges in the Brazil dataset (Table 3b), where buying products with less packaging is again in the green consumption component (component 3) and avoiding buying new things loads with more committed, primarily public-sphere, actions in component 1. Component 2 is again a waste/conservation set of actions. Here, though, there is no fourth component, with avoiding meat-eating loading on component 3, and fitting energy-saving lightbulbs loading most highly on component 1.

In both countries, the two dematerialisation behaviours are only weakly correlated (Brazil r=.29, p<.01; UK r=.35, p<.01).

3.3   Predictors of dematerialisation

Regression analyses (Table 4a) of the wave 2 UK data (which included the Aspiration Index) indicate that both demographic and psychological factors predict dematerialisation behaviours. Specifically, education significantly predicts both behaviours, while age and income are also negative predictors of avoiding buying new things. Gender and income are marginally significant predictors of buying products with less packaging. In addition, in model 2 (motivations), post-materialist values are a predictor of buying products with less packaging, but not of avoiding buying new things. Self-transcendence values, green identity, and intrinsic motivations are strong positive predictors of both behaviours, while extrinsic environmental motivations are a negative predictor of both. The Aspiration Index (indicating intrinsic goals) did not significantly predict the behaviours, despite correlating with them, suggesting the relationship may be mediated by one of the other included factors. (Note that materialism was highly correlated with aspiration (r=-.48, p<.001), and when entered in the regressions after aspiration rendered it non-significant, but had similar predictive value for both behaviours. To avoid multicollinearity it was excluded from the main analyses.)

In other words, those with higher education, strong self-transcendence values, green identity and those with intrinsic (but not extrinsic) motivations to take green behaviours, are more likely to buy products with less packaging. Overall, for this behaviour, slightly more variance was explained by the motivation model (22%) than by the value-identity model (18%), with intrinsic environmental motivation being the strongest predictor (closely followed by self-transcendence values). Younger, more educated and lower income people, and those with strong self-transcendence values, green identity and intrinsic (but not extrinsic) motivations to take green behaviours, are more likely to avoid buying new things. For this behaviour, the value-identity model explained the same amount of variance (11%) as the motivation model, although here self-transcendent values were the strongest overall predictor. However, it should be noted that the models explained relatively little variance overall, suggesting additional predictors of the behaviours (particularly the more demanding behaviour of avoiding consumption) have not been measured here.

Table 4b shows regression analysis for the Brazil dataset. Here, age is a negative predictor of buying products with less packaging, while income is a positive predictor; and income and education positively predict avoiding buying new things. While self-transcendence values, green identity and intrinsic motivation positively predict both behaviours, post-materialism, extrinsic motivation, and Aspiration Index do not.

In other words, younger and wealthier people, and those with stronger self-transcendence values, green identity and intrinsic motivations to do green things are more likely to buy products with less packaging. On the other hand, more educated and wealthier people and those with stronger self-transcendence values, green identity (marginally), and intrinsic motivations towards green behaviours are more likely to avoid buying new things. Self-transcendence values are the strongest predictor of both behaviours. Again, relatively little variance is explained, although like the UK somewhat more is explained for buying products with less packaging than for avoiding consumption. Comparing the two theoretical models, as in the UK, the motivation model does better (14%) than the values-identity model (9%) for buying products with less packaging, and also for avoiding consumption (5% versus 4%, respectively).

Notably, overall fewer variables are significant in the Brazil model than in the UK one, perhaps because of the slightly smaller sample in Brazil. Contrary to predictions, values are no less predictive of dematerialisation behaviours in Brazil than in the UK.

Due to the expected mediated relationships between the psychological variables in the models (e.g., Gatersleben et al., 2012), we conducted mediation analysis using the PROCESS macro for SPSS (Hayes, 2012; Figure 2). In the UK, we find a direct effect of intrinsic life goals on avoiding packaging, as well as a significant indirect effect of life goals on behaviour via intrinsic motivations (MTES) suggesting environmental motivations partially mediate life goals. Similarly, there is both a direct and indirect effect (via green identity) of self-transcendence values on avoiding packaging. In the case of avoiding buying new things, we find a fully mediated model: there is no direct effect of life goals on behaviour; rather, it is fully mediated by environmental motivations. The values-identity model is, as before, partially mediated: there is a direct effect of values on avoiding buying new things, and an indirect effect of values on behaviour via green identity. Less variance is explained for this behaviour than for the avoided packaging models.

In Brazil, we find a fully-mediated motivations model for avoiding packaging with respect to the life goals/motivations model; however, very little variance is explained; and life goals appear to *inversely* predict MTES. For the values-identity model, as in the UK, this is a partially mediated model, with both direct and indirect effects (via green identity) of values on avoiding packaging. The models for avoiding buying new things are very poor with little variance explained.

Overall, the mediation analysis indicates a better fit and more explained variance for the values-identity model than the motivation model; for buying products with less packaging than avoiding buying new things; and for the UK than for Brazil.

4   Discussion

The environmental and economic imperatives to dematerialise economies, or 'do more with less', have been established for some years; and there is increasing psychological evidence of the value of dematerialisation in order to improve wellbeing. Yet, to date little is known about who is willing to dematerialise and why. This paper explored the prevalence and profile of two dematerialisation behaviours in different cultural contexts (UK and Brazil) and influences upon these. We find that the exemplar dematerialisation behaviours (avoiding packaging, avoiding buying new things) are far less common than archetypal environmental behaviours (e.g., recycling), and a notable three in 10 people sampled in the UK (17% in Brazil) never avoid buying new things, perhaps reflecting a general social norm to consume – or at least, the *absence* of a social norm to avoid consuming. It is noteworthy, however, that this social norm to consume may be weaker in Brazil than in the UK, and/or other social and structural factors (e.g., systems of provision) may lead Brazilians to consume less and to avoid packaged products more often. Our rationale for selecting these two cultures to compare was based in part on observed social psychological differences in their cultural values, environmental worldviews and attitudes (e.g., Schwartz, 2008; Schultz et al., 2005) as well as on important socio-economic and environmental differences between these cultures (e.g., Corral-Verdugo et al., 2013). Our findings that PEBs, including dematerialisation behaviours, are more prevalent in Brazil than the UK are consistent with previous evidence demonstrating greater environmental concern in Brazil than the UK (e.g., Pew Center, 2015). In explaining these cross-national differences in PEBs, while higher egalitarian and biospheric values might explain greater adoption of green behaviours in Brazil, equally other factors may also be relevant (e.g., social capital, political context, infrastructure, service provision). In any case, contrary to predictions (H3) and previous work (Milfont & Markowitz, 2016), we found values to be no less predictive of dematerialisation behaviours in Brazil than in the UK. This may be due to the indicators used here, which reflect self-reported behaviours whereas previous work has used an attitudinal proxy (support for environmental protection) rather than a behavioural measure. This may also reflect similar consumption-related values common to Brazil and Europe as found in other studies (Schäfer et al., 2011).

The lower prevalence of avoiding buying new things altogether compared to buying things with less packaging is consistent with our finding that these two behaviours are associated with different types of pro-environmental actions: avoiding buying new things is associated with committed/political behaviours, while buying products with less packaging is in the consumer behaviour group of green actions. Furthermore, the two behaviours are only weakly correlated. This seems to suggest these are perceived in different ways, by the public - rather than as part of an overarching 'dematerialisation' behavioural (or conceptual) cluster. Indeed, in buying a product with less packaging this still fulfils the need for consumption, whereas avoiding consumption altogether is a more committed position. This finding is consistent with previous studies on pro-environmental behaviour, which have repeatedly shown that very few people demonstrate a consistent 'green' lifestyle; rather, behaviours which are environmentally-beneficial are often contextually-driven and motivated by a range of (often non-environmental) rationales (Shove, 2003; Whitmarsh, 2009; Whitmarsh & O'Neill, 2010). This is also broadly consistent with previous research on voluntary simplicity which shows there are different motivations for reducing consumption and adopting frugal practices, including pro-environmental, pro-social, self-deterministic and economic rationales (e.g., Craig-Lees & Hill, 2002; Huneke, 2005; Leonard-Barton & Rogers, 1980). There is little evidence for the 'sustainable consumer' and it is likely that individuals adopt a 'patchwork' of dematerialisation (and other sustainability-relevant) behaviours that are driven by different motivations and impinge upon each other to varying degrees (Brand, 2000). On the other hand, while the two behaviours are not strongly linked, we did not find evidence of moral licensing (i.e., that adopting one behaviour negates the need for the other).

Consistent with expectations (H1), we found both demographic and psychological predictors of dematerialisation behaviours. We also found, as expected (H2) the two behaviours had different, but overlapping, predictors. Partly consistent with H2, we found that in both countries identity was a stronger predictor for conspicuous consumption (avoiding packaging) than non-consumption. However, in both countries, values and intrinsic motivation were even stronger influences for both behaviours, suggesting that dematerialisation behaviours are value-driven (cf. Buchs, 2013) and can be inherently fulfilling and rewarding.

Overall, the motivation model (based on SDT) was more predictive of the dematerialisation behaviours than the value-identity model. This opens up an important theoretical strand of inquiry for pro-environmental behaviours since SDT has barely been applied to the environmental domain to date (Pelletier et al., 1998; Kasser, 2002). Consistent with other domains, we find intrinsic motivations positively predict dematerialisation behaviours, while (in the UK) extrinsic motivations negatively predict them. This suggests that extrinsic pressure to take pro-environmental action (e.g., social obligation) may backfire in the case of dematerialisation behaviours, which are more likely to be taken out of personal choice and internally driven (due to intrinsic rewards, identification or guilt).

Our analysis also showed that post-materialism values were only predictive of buying products with less packaging, and not of avoiding consumption, in the UK. In Brazil, this measure was not a significant predictor at all. This may be because of the level at which this value is operationalized, namely societal, whereas the other psychological measures included were operationalized at the personal level. It may also be reflective of the low proportions of Brazilians expressing post-material values in comparison to those aspiring to increase materialism (Shäfer et al., 2011). This finding also challenges the post-materialism assumption that more developed countries (e.g., the UK) would have more sustainable lifestyles than less developed ones (e.g., Brazil). Indeed, while we did not measure environmental concern here, our analysis suggests Brazilians live less resource-intensive lifestyles on average than UK citizens, thus highlighting the important distinction between pro-environmental attitudes and behaviours noted previously (e.g., Whitmarsh, 2009).

Different demographic predictors were significant in the two countries and across the behaviours: in the UK those who purchased products with less packaging had spent more time in formal education; while those who avoided consumption were younger, spent more time in formal education and were on lower incomes. In Brazil, people avoiding packaged products were younger and on lower incomes, whereas those who avoided consumption spent longer in formal education and had higher incomes, broadly in line with Shäfer et al, (2011). This highlights the importance of cultural context in understanding and predicting dematerialisation (and pro-environmental) behaviours: It is likely that consumption practices (including production, transportation, purchasing, use and disposal) differ significantly between cultures. For example, it may be that cheaper products in Brazil have less packaging, which is not the case in the UK. However, it is also interesting to note the relatively consistent positive effect of education across cultural contexts (see also Milfont & Markowitz, 2016). This suggests that awareness of problems associated with consumption (e.g., waste and disposal) might impact on behaviour, although the relationship between education and other pro-environmental behaviours has not always been observed (Whitmarsh, 2009).

We also find that relatively little variance overall is explained by our predictors suggesting the need for further research to identify what else is likely to determine dematerialisation behaviours. Here, we are mindful that material consumption is only partly (and arguably minimally) about individual choice and may be more about structural constraints that lock people in to consumption-rich lifestyles (Sanne, 2002). For example, per capita consumption in Brazil has increased significantly over recent decades for many, though not all, oriented toward Western lifestyle models, including energy use, car ownership and red meat consumption (Shäfer et al, 2011).

Related to this, our findings are based on self-reported behaviours, which are inevitably more consistent with values and other psychological predictors than actual (observed) behaviours. Indeed, a recent meta-analysis found a correlation of only .46 between self-reported and actual PEBs and only 20% shared variance between these constructs (Kormos & Gifford, 2014); while the relationship was significant and the effect size large, there is clearly a significant disparity between people's reported and observed behaviours in relation to the environment. Other work similarly finds that the significant relationship found between certain psychological variables (including green identity) and self-reported pro-environmental behaviours (e.g., domestic energy saving) is not always evident for observed behaviours (e.g., domestic heating schedules, thermostat use; Weeks et al., 2017). This disparity between self-reported and observed PEBs may be due to social desirability bias (i.e., wanting to present oneself as more environmentally-friendly than one really is), imperfect recall, and lack of awareness of others' actions that may affect one's actual environmental impact (e.g., other household members' energy use, which may undermine one's own energy saving actions; Gifford, 2014). This reliance on self-reported PEB for largely practical reasons (e.g., cost, intrusion) is a perennial problem for environmental psychology. Future research should therefore include measures of actual consumption or avoided consumption, as far as this is possible.

Future work should also use more robust multi-item measures of dematerialisation behaviours; this study employed less reliable single-item measures, but did so in the context of a broader battery of pro-environmental behaviours, which enables us to place these particular self-reported behaviours in the context of similar (and dissimilar) actions. We also note that some scales we used had only modest reliabilities,

particularly the Aspiration Index. While this measure has been quite widely used, much of this previous work has been conducted in the US, perhaps suggesting more cross-cultural work is needed to inform the development of more universally appropriate self-determination and identity measures.

This is one of few studies that has provided insights into the prevalence and drivers of dematerialisation behaviours across cultures. We have demonstrated that socio-demographic, psychological and cultural factors are predictors of dematerialisation behaviours, and infer that other (e.g., structural) variables we did not measure are likely to be important (cf. Marteau, this issue). Our findings are consistent with previous literature indicating the importance of green identity for predicting consumption behaviours (Whitmarsh & O'Neill, 2010), and that green identity partially mediates the relationship between values and behaviour (cf. Gatersleben et al., 2012), but also extend these findings by showing that non-consumption (which appears to be part of a more committed pro-environmental behavioural repertoire) is also strongly influenced by green identity (albeit marginally in Brazil). Put another way, voluntary simplicity and downshifting may be markers of differentiation in a consumer culture, or identity expressions of sufficient wealth to be able to eschew material consumption; by contrast, avoiding consumption may be driven by economic necessity or more pragmatic factors in other cultures and for people with fewer choices available to them. Motivational type appears to be even more important, highlighting the need to consider why people adopt more materially efficient behaviours. To a lesser extent, post-materialism is also relevant, but not consistently so. That psychological factors appear to be more significant than demographic ones reinforces the need to understand dematerialisation from a psychological perspective and also implies a need for interventions to promote green values and identity in order to shift society away from the prevailing norms to consume.

Further work is needed to follow up these relationships and exploit experimental techniques to assess the efficacy of interventions to reduce material consumption. For example, interventions might focus on developing skills in repairing rather than replacing items (e.g., sewing, mechanics, adaptation of materials for other uses) or creating ownership narratives to imbue objects with value and therefore encourage reuse (Fletcher, this issue). Such interventions would be consistent with the need to foster intrinsic motivations for dematerialisation over extrinsic motivations (e.g., via economic incentives or social obligation). In addition, more work is needed to explore and understand the cultural differences in the consumption (reduction) behaviours we observed, and to consider a broader range of cultural contexts. Finally, further work could explore dynamic relationships between different dematerialisation behaviours; for example, does adopting a less committed (e.g., packaging avoidance) behaviour lead to more demanding behaviours (e.g., consumption avoidance) consistent with behavioural spillover? Conversely, in line with moral licensing theory, might this undermine the adoption of related actions? Longitudinal and experimental designs would help elucidate these effects better than correlational designs.

Additional Information

Data Accessibility
The datasets will be deposited to the UK Data Archive once the project has been concluded (2019). Access to the data can be requested in the mean time by contacting the lead author.

Competing Interests
We have no competing interests.

Authors' Contributions

LW drafted the article. LW and SC conducted the data analysis and interpretation. LW, SC and NN designed the study, reviewed the literature and revised the article.

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Figure and table captions

Table 1. Demographic details of UK and Brazil samples (wave 1 UK, N=1,068, Brazil = 1,104)

Figure 1. Frequency of two dematerialisation behaviours in last 12 months in the UK (wave 1 N=1,068; %) and Brazil (wave 1 N=1,104; %): (a) Avoided buying new things, and (b) Bought products with less packaging

Figure 2. Mediation models of two dematerialisation behaviours: (a) Buying products with less packaging (UK), (b) Avoiding buying new things (UK), (c) Buying products with less packaging (Brazil), and (d) Avoiding buying new things (Brazil)

Table 2. Means and SDs of pro-environmental behaviours, including dematerialisation (shaded; wave 1, UK N=1,068, Brazil, N= 1,104)

Table 3a. Principal components analysis of pro-environmental behaviours, including dematerialisation (shaded; wave 1 UK data, N=1,068)

Table 3b. Principal components analysis of pro-environmental behaviours, including dematerialisation (shaded; wave 1 Brazil data, N=1,104)

Table 4a. Regression analyses of two dematerialisation behaviours (sig. IVs in bold; wave 2 UK data, N=631).

Table 4b. Regression analyses of two dematerialisation behaviours (sig. IVs in bold; wave 2 Brazil data, N=417).

Tables

Table 1.

	UK (%)	Brazil (%)
Gender		
Female	50.7	51.3
Male	49.3	48.5
Age		
18-24	11	15.5
25-34	16.9	27.2
35-44	14.2	22.6
45-54	21.1	19.0
55-64	17.9	13.0
65+	18.9	2.7
Income (gross, p.a. / p.m.)		
<£13,000 / R$1,750	23.7	25.2
£13,000 <£18,000 / R$1,750 < R$3,500	17.6	25.4
>£18,000 <£25,000 / R$3,500 < R$8,800	21.3	25.8
>25,000 <£37,000 / R$8,800 < R$17,500	21.6	18.7
>£37,000 / >R$18,000	15.7	5.0
Education		
Primary or secondary school	7.7	0.1
NVQ Foundation, NVQ1, NVQ2	21.2	1.4
NVQ3	24.2	32.2
Bachelor's degree or equivalent	34.2	46.6
Postgraduate degree or equivalent	12.6	19.7

Table 2.

	UK		Brazil	
	Mean	*SD*	*Mean*	*SD*
Turned off lights when not in use	9.25	1.77	9.58	1.27
Avoided littering (throwing rubbish on the street)	8.95	2.03	9.51	1.44
Recycled household waste (e.g. glass)	8.66	2.13	7.01	3.27
Turned off the tap when brushing teeth	8.40	2.95	9.50	1.56
Avoided wasting food (e.g. by using leftovers)	7.94	2.30	8.86	1.94
Taken short showers (less than 3 minutes long) or infrequent baths	6.10	3.37	7.70	3.02
Bought products with less packaging	5.15	2.47	5.77	2.60
Eaten organic, locally-grown or in season food	5.09	2.73	5.85	2.87
Bought environmentally-friendly products	4.70	2.32	4.96	2.69
Encouraged other people to save energy	4.13	2.76	6.78	2.78
Avoided buying new things (e.g. clothes, luxury items)	4.07	2.77	5.04	2.94
Fitted energy-saving lightbulbs at home	3.98	2.26	4.97	2.54
Avoided eating meat	3.55	3.25	3.95	3.17
Found out more about environmental issues (e.g. learning more about climate change)	3.04	2.30	5.11	2.84
Signed a petition about an environmental issue	2.03	1.82	2.72	2.36
Donated money to an environmental campaign group	1.88	1.59	2.09	1.87
Done something together with neighbours, people at work or friends to address an environmental issue	1.85	1.78	3.22	2.62
Offered support (e.g. by voting) for political action to protect the environment	1.83	1.68	2.68	2.53
Got involved in conservation work to protect natural environments (e.g. national parks, coastline)	1.71	1.72	2.78	2.67
Set up a recycling scheme at work, college or elsewhere	1.62	1.80	3.13	2.94
Written to a politician about an environmental issue	1.46	1.34	1.63	1.60
Took part in a protest about an environmental issue	1.39	1.33	1.98	1.84
Total Mean	**4.40**		**5.22**	

Table 3a.

Component	1	2	3	4
Got involved in conservation work to protect natural environments (e.g. national parks, coastline)	0.81			
Written to a politician about an environmental issue	0.81			
Offered support (e.g. by voting) for political action to protect the environment	0.79			
Took part in a protest about an environmental issue	0.77			
Signed a petition about an environmental issue	0.77			
Set up a recycling scheme at work, college or elsewhere	0.70			-0.32
Donated money to an environmental campaign group	0.69			
Done something together with neighbours, people at work or friends to address an environmental issue	0.58			
Found out more about environmental issues (e.g. learning more about climate change)	0.53			
Avoided buying new things (e.g. clothes, luxury items)	0.34			
Turned off the tap when brushing teeth		0.69		
Avoided littering (throwing rubbish on the street)		0.68		
Avoided wasting food (e.g. by using leftovers)		0.65		
Turned off lights when not in use		0.64		
Recycled household waste (e.g. glass)		0.59		
Taken short showers (less than 3 minutes long) or infrequent baths		0.48		
Avoided eating meat			-0.39	0.60
Encouraged other people to save energy			-0.47	
Bought products with less packaging			-0.78	
Bought environmentally-friendly products			-0.82	
Eaten organic, locally-grown or in season food			-0.83	
Fitted energy-saving lightbulbs at home				-0.59

Table 3b.

Component	1	2	3
Offered support (e.g. by voting) for political action to protect the environment	0.79		
Got involved in conservation work to protect natural environments (e.g. national parks, coastline)	0.78		
Signed a petition about an environmental issue	0.76		
Took part in a protest about an environmental issue	0.74		
Written to a politician about an environmental issue	0.72		
Donated money to an environmental campaign group	0.70		
Set up a recycling scheme at work, college or elsewhere	0.66		
Found out more about environmental issues (e.g. learning more about climate change)	0.54		
Done something together with neighbours, people at work or friends to address an environmental issue	0.53		-0.32
Avoided buying new things (e.g. clothes, luxury items)	0.41		
Fitted energy-saving lightbulbs at home	0.32		
Avoided littering (throwing rubbish on the street)		0.78	
Turned off the tap when brushing teeth		0.75	
Avoided wasting food (e.g. by using leftovers)		0.72	
Turned off lights when not in use		0.60	
Taken short showers (less than 3 minutes long) or infrequent baths		0.46	
Recycled household waste (e.g. glass)		0.37	
Encouraged other people to save energy			-0.47
Avoided eating meat			-0.49
Bought products with less packaging			-0.75
Bought environmentally-friendly products			-0.81
Eaten organic, locally-grown or in season food			-0.86

Table 4a.

	Bought products with less packaging							Avoided buying new things						
Model 1 (Values-identity)	Estimate	SE	Wald	Sig.	95% CI Lower	Upper	Exp(B)	Estimate	SE	Wald	Sig.	95% CI Lower	Upper	Exp(B)
Gender	0.28	0.15	3.39	0.07	-0.02	0.57	1.32	0.05	0.15	0.09	0.76	-0.25	0.34	1.05
Age	0.00	0.05	0.01	0.94	-0.11	0.10	1.00	**-0.15**	**0.05**	**7.77**	**0.01**	-0.25	-0.04	0.86
Education	**0.13**	**0.05**	**7.01**	**0.01**	0.03	0.22	1.13	**0.12**	**0.05**	**5.92**	**0.02**	0.02	0.21	1.12
Income	0.10	0.06	3.55	0.06	0.00	0.21	1.11	**-0.12**	**0.06**	**4.25**	**0.04**	-0.23	-0.01	0.89
Post-materialism	0.11	0.08	2.01	0.16	-0.04	0.27	1.12	0.08	0.08	1.05	0.31	-0.07	0.24	1.09
Self transcendence values	**0.63**	**0.13**	**21.66**	**0.00**	0.36	0.89	1.87	**0.54**	**0.14**	**15.77**	**0.00**	0.27	0.81	1.72
Green identity	**0.47**	**0.09**	**25.80**	**0.00**	0.29	0.66	1.61	**0.26**	**0.09**	**7.49**	**0.01**	0.07	0.44	1.29
Nagelkerke = 0.18								*Nagelkerke = 0.11*						
Model 2 (Motivations)	Estimate	SE	Wald	Sig.	95% CI Lower	Upper	Exp(B)	Estimate	SE	Wald	Sig.	95% CI Lower	Upper	Exp(B)
Gender	0.26	0.15	2.79	0.10	-0.04	0.56	1.29	0.01	0.15	0.01	0.93	-0.29	0.31	1.01
Age	0.05	0.05	0.82	0.37	-0.06	0.16	1.05	**-0.11**	**0.05**	**4.41**	**0.04**	-0.22	-0.01	0.89
Education	**0.15**	**0.05**	**10.16**	**0.00**	0.06	0.25	1.17	**0.13**	**0.05**	**7.49**	**0.01**	0.04	0.23	1.14
Income	0.07	0.06	1.55	0.21	-0.04	0.18	1.07	**-0.14**	**0.06**	**6.50**	**0.01**	-0.25	-0.03	0.87
Post-materialism	**0.18**	**0.08**	**5.01**	**0.03**	0.02	0.33	1.19	0.13	0.08	2.75	0.10	-0.02	0.29	1.14
Aspiration Index	0.06	0.16	0.16	0.69	-0.25	0.38	1.07	0.15	0.16	0.81	0.37	-0.17	0.46	1.16
Intrinsic env. motivations	**0.64**	**0.06**	**114.52**	**0.00**	0.52	0.75	1.89	**0.35**	**0.06**	**37.85**	**0.00**	0.24	0.46	1.42
Extrinsic env. motivations	**-0.15**	**0.05**	**9.10**	**0.00**	-0.26	-0.05	0.86	**-0.12**	**0.05**	**5.13**	**0.02**	-0.22	-0.02	0.89
Nagelkerke = 0.22								*Nagelkerke = 0.11*						

Table 4b.

Model 1 (Values-identity)	Bought products with less packaging							Avoided buying new things						
	Estimate	SE	Wald	Sig.	95% CI		Exp(B)	Estimate	SE	Wald	Sig.	95% CI		Exp(B)
					Lower	Upper						Lower	Upper	
Gender	0.06	0.11	0.29	0.59	-0.16	0.27	1.06	0.07	0.11	0.45	0.50	-0.14	0.29	1.08
Age	**-0.14**	**0.04**	**10.13**	**0.00**	-0.22	-0.05	0.87	-0.05	0.04	1.44	0.23	-0.14	0.03	0.95
Education	0.07	0.08	0.74	0.39	-0.09	0.23	1.07	**0.19**	**0.08**	**5.79**	**0.02**	0.04	0.35	1.21
Income	**0.18**	**0.06**	**10.94**	**0.00**	0.07	0.29	1.20	**0.11**	**0.06**	**3.77**	**0.05**	0.00	0.21	1.11
Post-materialism	0.02	0.06	0.12	0.74	-0.10	0.14	1.02	-0.05	0.06	0.86	0.35	-0.17	0.06	0.95
Self transcendence values	**0.60**	**0.09**	**44.38**	**0.00**	0.42	0.78	1.82	**0.32**	**0.09**	**13.07**	**0.00**	0.15	0.50	1.38
Green identity	**0.22**	**0.07**	**10.23**	**0.00**	0.08	0.35	1.24	0.12	0.07	3.29	0.07	-0.01	0.26	1.13
Nagelkerke = 0.09								*Nagelkerke = 0.04*						

| Model 2 (Motivations)	Estimate	SE	Wald	Sig.	95% CI		Exp(B)	Estimate	SE	Wald	Sig.	95% CI		Exp(B)
					Lower	Upper						Lower	Upper	
Gender	0.00	0.18	0.00	0.99	-0.36	0.35	1.00	0.30	0.18	2.79	0.10	-0.05	0.66	1.36
Age	-0.15	0.08	3.45	0.06	-0.30	0.01	0.86	-0.07	0.08	0.70	0.40	-0.22	0.09	0.94
Education	0.10	0.13	0.56	0.45	-0.16	0.35	1.10	0.16	0.13	1.51	0.22	-0.09	0.41	1.17
Income	**0.27**	**0.09**	**8.41**	**0.00**	0.09	0.46	1.31	**0.20**	**0.09**	**4.39**	**0.04**	0.01	0.38	1.22
Post-materialism	0.12	0.10	1.57	0.21	-0.07	0.30	1.13	-0.10	0.09	1.09	0.30	-0.28	0.09	0.91
Aspiration Index	-0.07	0.20	0.13	0.72	-0.47	0.32	0.93	-0.09	0.20	0.22	0.64	-0.49	0.30	0.91
Intrinsic env. motivations	**0.57**	**0.09**	**41.38**	**0.00**	0.40	0.75	1.77	**0.20**	**0.09**	**5.25**	**0.02**	0.03	0.36	1.22
Extrinsic env. motivations	0.02	0.05	0.08	0.78	-0.09	0.12	1.02	0.05	0.05	0.76	0.39	-0.06	0.15	1.05
Nagelkerke = 0.14								*Nagelkerke = 0.05*						

Figure 1a.
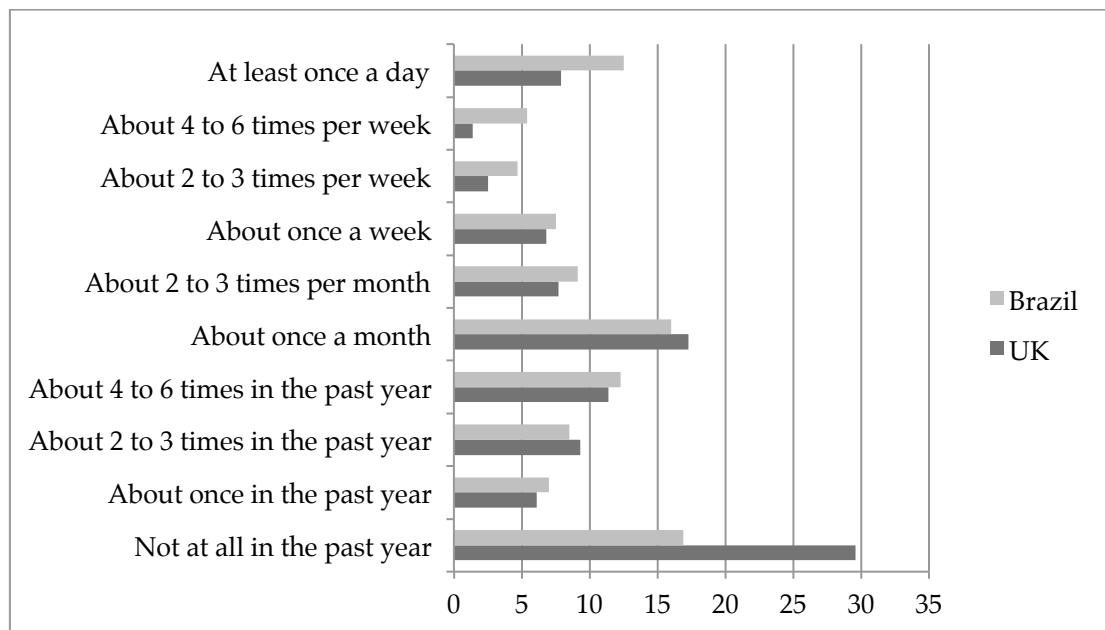
Figure 1b.
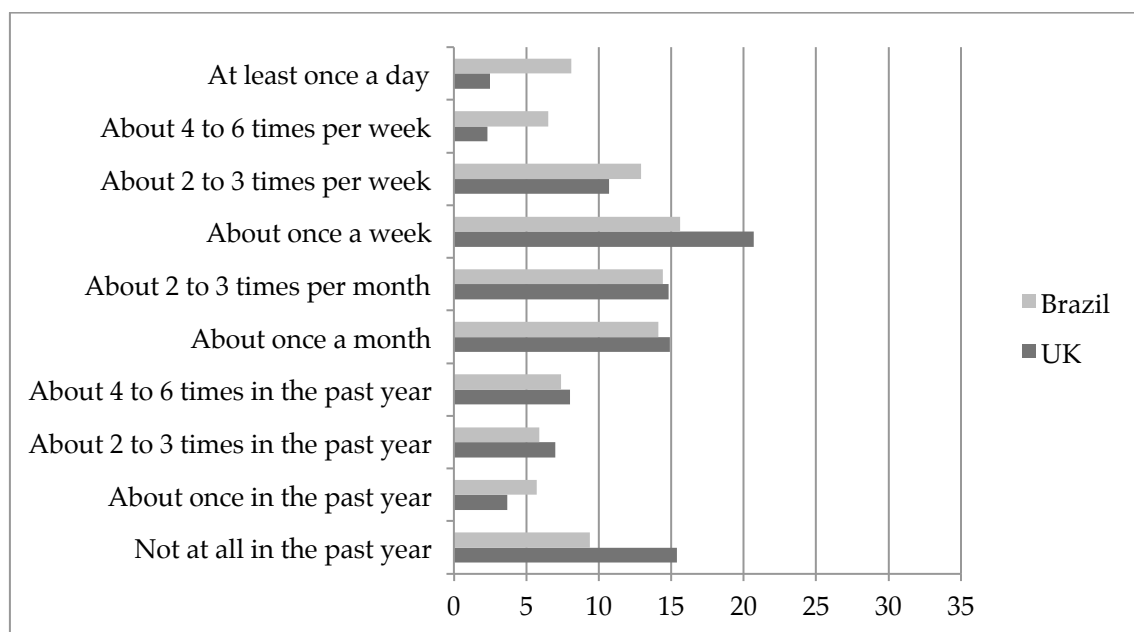
Figure 2a.
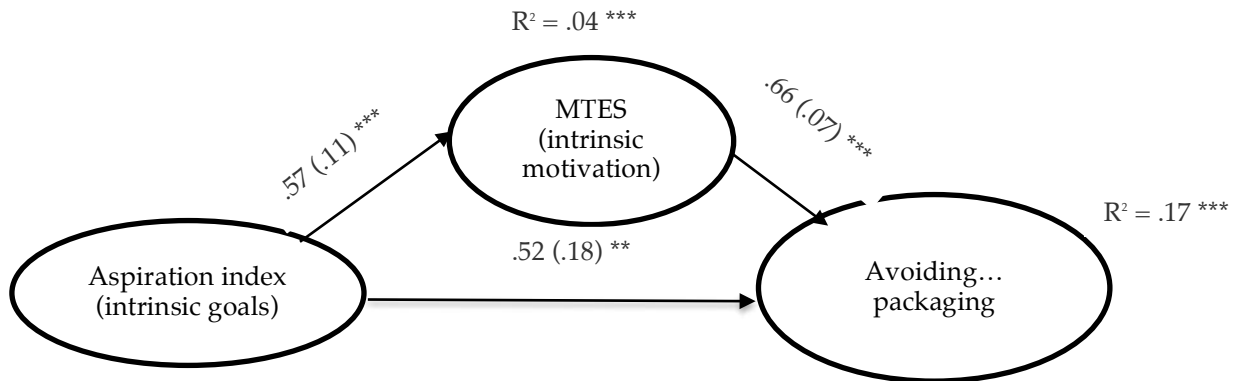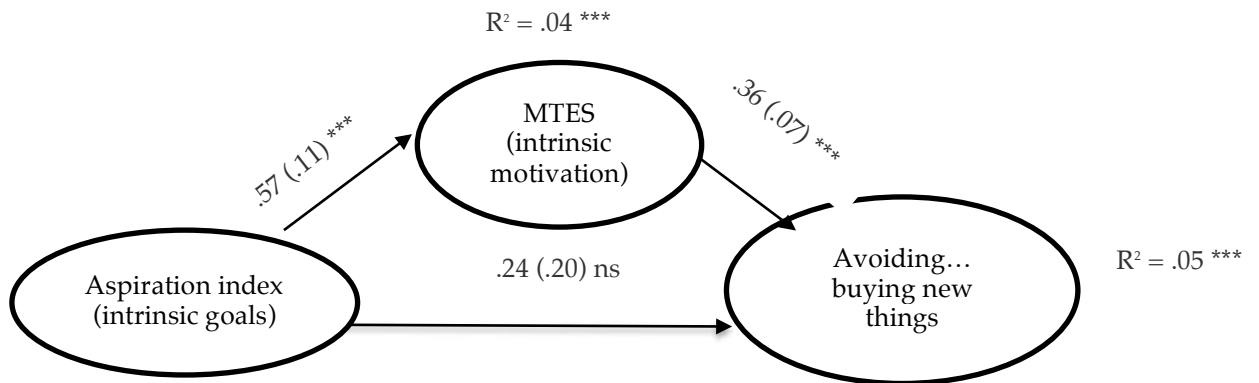

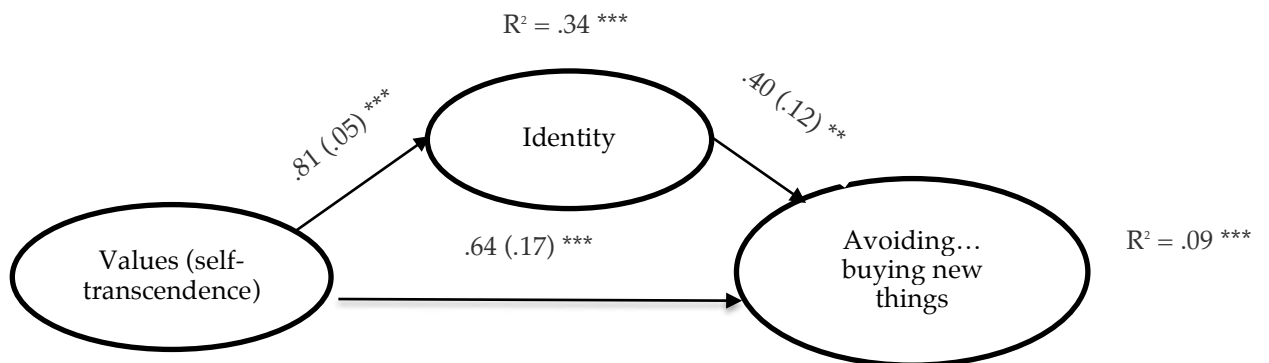Indirect of AI via MTES on behaviour: .38 (.08), 95% CI (.23, .54)
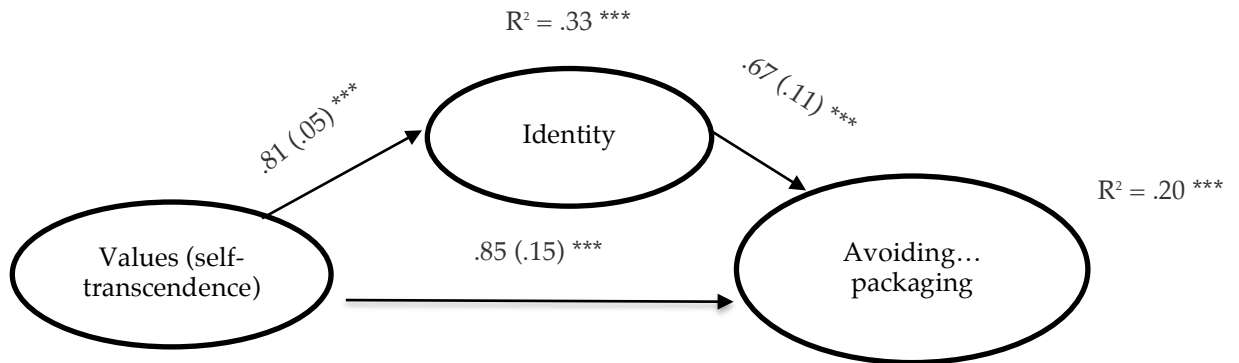
Indirect effect of values on behaviour via identity: .54 (.10), 95% CI (.36, .74)

Figure 2b.

Indirect of AI via MTES on behaviour: .21 (.06), 95% CI (.11, .34)

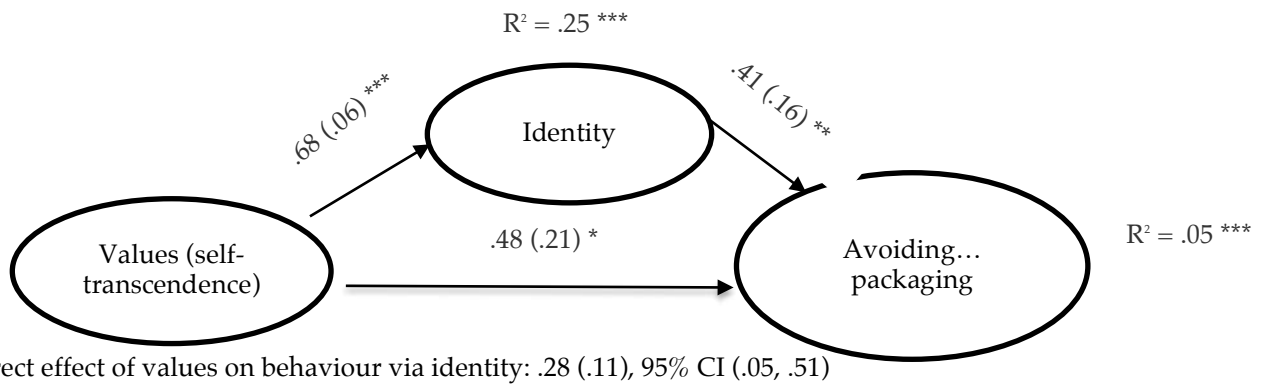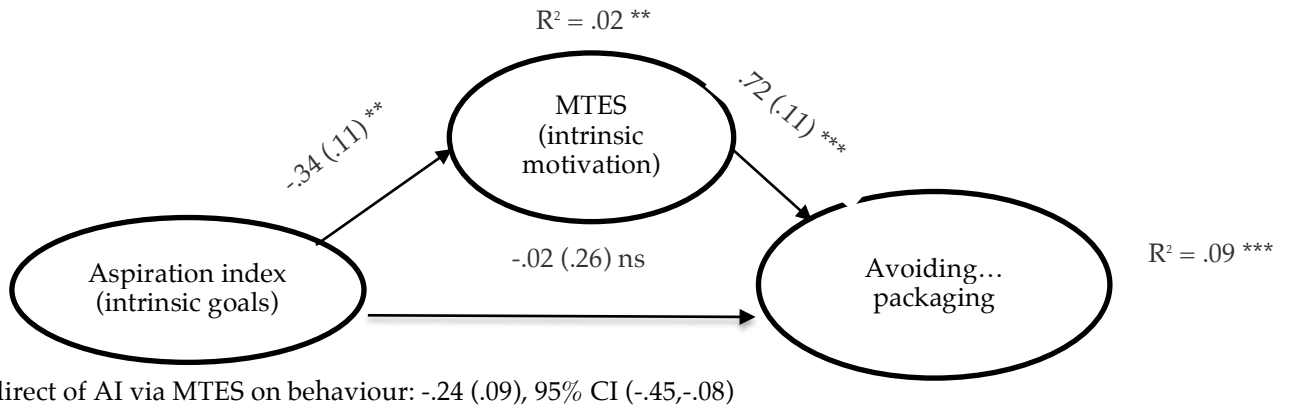Indirect effect of values on behaviour via identity: .33 (.10), 95% CI (.13, .53)

Figure 2c.

R² = .02 **

MTES (intrinsic motivation)

-.34 (.11) **

.72 (.11) ***

Aspiration index (intrinsic goals)

-.02 (.26) ns

Avoiding… packaging

R² = .09 ***

Indirect of AI via MTES on behaviour: -.24 (.09), 95% CI (-.45,-.08)

R² = .25 ***

Identity

.68 (.06) ***

.41 (.16) **

Values (self-transcendence)

.48 (.21) *

Avoiding… packaging

R² = .05 ***

Indirect effect of values on behaviour via identity: .28 (.11), 95% CI (.05, .51)

Figure 2d.

R² = .02 **

MTES (intrinsic motivation)

-.34 (.11) **

.20 (.13) ns

Aspiration index (intrinsic goals)

-.51 (.30) ns

Avoiding… new things

R² = .01 ns

Indirect of AI via MTES on behaviour: -.06 (.06), 95% CI (-.23,.01; ns).

R² = .25 ***

Identity

.68 (.06) ***

.26 (.18) ns

Values (self-transcendence)

.18 (.24) ns

Avoiding… buying new things

R² = .01 ns

Indirect effect of values on behaviour via identity: .18 (.12), 95% CI (-.07, .42; ns)