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Air travel attitudes and behaviours: The development of environment-based segments☆

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A B S T R A C T

In an era when the transport sector is increasingly contributing to environmental damage there is a need to better understand the behavioural response of consumers. Theories such as the Theory of Planned Behaviour and the Norm-Activation Model have had some success in explaining pro-environmental behaviours; this paper examines the application of these to air travel. It utilises insights from previous attitude behaviour research to develop a more detailed understanding of how normative influences, individual values and other psychological factors are affected by individual attitudes to air travel attitudes and how these influence behaviour. This informs recommendations for a policy response, which emphasises the need to bring air travel behaviour in line with other energy saving household behaviours.

1. Introduction

There are on-going environmental pressures to reduce resource use and consumer waste, which is supported by central policy and local action. Transport makes a growing contribution to climate change, with carbon dioxide emissions from air travel predicted to increase by a factor of between 1.6 and 10 from 1992 until 2050 dependent upon growth scenarios (Intergovernmental Panel on Climate Change, 1999). Historically there have been effective efficiency improvements in air service provision; however, growth, assisted by changes such as liberalisation of the market (Doganis, 2002), is absorbing and exceeding these savings. Further technological advances are unlikely to make a significant difference in the short term. Arguably, therefore, emission reduction relies on changes in behaviour.

However, there is a current disharmony between how consumers and indeed policy-makers view travel and transport, in relation to other energy-intensive activities (European Commission, 2008). Researchers have frequently discussed the existence of a value-action or attitude-behaviour gap, whereby expressed pro-environmental attitudes or values are not reflected in the behaviours that individuals actually perform (Blake, 1999; Kollmuss and Agyeman, 2002). It is now widely acknowledged by social-psychological researchers (Abrahamse et al., 2005; Blake, 1999) that the information-deficit model, whereby the provision of information about an issue of concern and action that can be taken is believed to lead to relevant behaviour being performed, does not adequately explain or necessarily influence the performance of those behaviours. Howarth et al. (2009) highlight that an individual's awareness and understanding of climate change is often not reflected in their actions with respect to transport, concluding that there is greater need for measures which support change rather than provide information. In terms of air travel, this gap between awareness and understanding, and an individual's actions, is arguably reinforced by political decisions which prioritize the advantages provided through airport connectivity and national competitiveness over the need to reduce emissions from air travel. In the UK, one example concerns airport expansion in London and the South East of England and the related debate about whether to build a third runway at Heathrow Airport.

This paper is based on an 'Air travel and the environment' household survey across five local authorities in the East Midlands region of the UK, conducted in spring 2009. It builds upon previous mail and internet household surveys designed to deliver a stated choice modelling capability and a greater understanding of air travel market segments. This survey has a clear environmental focus expanding upon attitudinal and behavioural questions from previous surveys. For instance, earlier research identified a small segment of 8% who were trying to reduce the number of flights taken for environmental reasons but a larger, price sensitive segment of 63% who would reduce the number of flights taken in response to an increase in fare of £50 (Davison and Ryley, 2010).

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To provide context for the study, air travel in the UK increased five-fold between 1970 and 2000 (Department for Transport, 2003), with future growth expected to continue albeit at a lower rate (Department for Transport, 2011). Low cost airlines have played a growing role in air transport provision, particularly from the regional airports, following the liberalisation of the market in the 1980s (Civil Aviation Authority, 2006). Legislatively The Climate Change Act (United Kingdom Parliament, 2008) recognises UK emissions from aviation and shipping as coming under the auspices of sources of emission for reduction. With the legally binding target for 2050 being an 80% reduction based on 1990 levels, emissions from other sectors would have to be cut dramatically to allow aviation to follow the existing trajectory (Bows et al., 2006; House of Commons Environmental Audit Commission, 2006).

The objective of this paper is to identify which members of the population have the greatest propensity to adapt their air travel choices and therefore limit increases in emissions. The application of segmentation techniques to attitudes and behaviour around air travel provides fresh insight into air travel choices. By examining the behavioural intentions and behaviour of different market segments with respect to their views on air travel and its impact on the environment, this paper utilises insights from previous attitude-behaviour research to develop a more detailed understanding of the effect of normative influences, individual values and other psychological/attitudinal, recognised as psychological constructs.

The identification of different segments within the population using cluster analysis, and characterisation of intentions and behaviours in relation to the attitudes and behaviours within those segments, will allow future policy and interventions aimed at reducing the reliance on air travel to target the segments of the population that are most likely to produce those reductions. By including variables identified by a range of attitude-behaviour frameworks as possible influences on individual behaviour, that segmentation analysis will be able to understand their influence on clearly-defined segments within the population.

The remainder of the section will introduce market segmentation with particular reference to air travel and environmental behaviour. Next is a discussion of the psychological constructs which provide the basis for this paper, leading into the methodology section. The results section presents the market segments based on responses to statements measuring air travel and environmental attitudes, and examines the behavioural intentions and behaviours of each segment through the application of path analysis. These results, together with the socio-demographic make-up of each group, inform the subsequent sections. These include a discussion of how this research contributes to existing knowledge and a conclusion which links to the primary policy and research implications.

1.1. Air travel market segmentation

In order to understand air travel behaviour, the aviation industry acknowledges that market segments behave differently in response to price changes, typically split into business (further split into 'routine' and 'urgent') and leisure (further split into 'holidays' and 'visiting friends and relations') passengers (Doganis, 2002). However, there are other ways the air travel market can be segmented with respect to willingness to pay. For instance when examining how holidays influenced quality of life Dolnicar et al. (2013) found a segment, equating to 10% of the population, to be crisis-proof given the importance of holidays to their wellbeing, thus highlighting a psychological reliance on leisure travel, and linked to this air travel.

A study by Ipsos MORI (2007) examined air travel behaviour of segments based on the receptiveness to policy approaches such as, information provision, leading by example, government regulation and increases in total flight cost (fares or taxes). Segments range from the 'ultra greens' to the 'disengaged'. However, while the ultra greens are classed as frequent flyers that regularly use low cost airlines to fly for short breaks, the 'disengaged' are not really frequent flyers, demonstrating the value-action or attitude-behaviour gap, with particular reference to air travel. Research by Barr and colleagues, which applied market segmentation techniques to examine the influence of context on attitudes and behaviour found 'cognitive dissonance' within general environmental behaviour (Barr et al., 2010) and mode preferences and choice (Barr and Prillwitz, 2012). Specifically the segments exerting the highest degree of environmental concern in the household context were often those who were more flight dependent in a tourism context. It was often the groups with restricted mobility whose behaviour could be described as more environmentally conscious, for example the 'reluctant public transport users' when compared to the 'committed green travellers', the latter having the most pro-environmental stance.

1.2. Psychological constructs

A number of frameworks have been developed by researchers to attempt to explain these relationships. Two such approaches that have proved influential are the rational-actor models and moral/normative models (Kollmuss and Agyeman, 2002; Steg and Vlek, 2009).

Rational-actor models assume that individuals make reasoned choices based on the information available to them, choosing to act in the way that is most likely to return high benefits while incurring low costs (e.g. in money, time, effort or social approval) (Steg and Vlek, 2009). Perhaps the most widely used of these models is the Theory of Planned Behaviour (Ajzen, 1991), which identifies attitudes towards the behaviour, subjective norms and perceived behavioural control as influences on the formation of an intention to carry out a particular behaviour. The Theory of Planned Behaviour has had some success in explaining travel behaviour choices, particularly in explaining willingness to reduce car use (Abrahamse et al., 2009; Bamberg and Schmidt, 2003) and increased use of public transport (Heath and Gifford, 2002). However, researchers have also identified that individuals do not always act in their own rational self-interest, and that a mixture of self-interest and pro-social motives may provide a better explanation of individual behaviour (Bamberg and Möser, 2007).

Research examining pro-social motivations for behavioural choices which limit environmental impacts, such as reducing resource use and emissions, has frequently adopted a moral/normative approach, emphasising the influence that underlying values, beliefs and feelings of responsibility and obligation have on individual behaviour (Steg and Vlek, 2009). One influential theoretical model within this approach is the Norm-Activation Model (Schwartz, 1977), which identifies the influence on individual behaviour both from the individual's own beliefs and values, and from their perception of others' expectations and their own responsibilities to behave in a certain way. The personal norm is key to this process, and is influenced by an awareness of the consequences of the individual's actions, and the ascription of responsibility to act themselves. Schwartz's (1977) model was designed primarily to measure altruistic behaviour, but the subsequent Values-Beliefs-Norms theory (Stern et al., 1999) was developed from Schwartz's model to explain pro-environmental behavioural choices, including values and worldviews in a causal chain leading to the performance of behaviour.

Subsequent studies (Bamberg and Schmidt, 2003; Steg and Vlek, 2009; Wall et al., 2007) suggest that each of these approaches can explain different types of behaviour. For Wall et al. (2007) and

Bamberg and Schmidt (2003), the Theory of Planned Behaviour and Norm-Activation Model are complementary, offering different insights into the processes leading to the performance of behaviours. Steg and Vlek (2009), however, argue that the Theory of Planned Behaviour is better at explaining high-cost or highly constrained behaviours such as changes in travel mode, while Values-Beliefs-Norms, based on Norm-Activation Model, is better at explaining low-cost behaviours such as agreement with environmental policies.

A number of researchers have sought to develop a model of behaviour for examining environmental behaviour that includes both the moral/normative influences identified by the Norm-Activation Model or Values-Beliefs-Norms, and the more rationalist approach of the Theory of Planned Behaviour. For some researchers, this has taken the form of an extension to the Theory of Planned Behaviour to include normative or moral aspects (Harland et al., 1999; Kaiser, 2006). However, other researchers have expanded their models to include influences that are not purely psychological or attitudinal in nature. One criticism that has been levelled at both the moral/normative approach and the more rationalist approach to explaining individual behaviour is that neither place great emphasis on contextual factors (Steg and Vlek, 2009). Contextual factors can include both societal influences that set up expectations or norms of behaviour, and situational influences that constrain the ability to carry out a behaviour. One approach that includes a range of influences on behaviour (Barr and Gilg, 2007; Barr et al., 2001) sees situational variables, psychological variables, and social and environmental values as having an effect both on the intention to perform behaviour and directly on the performance of that behaviour. Barr and Gilg (2007) identify that environmental action is structured around people's everyday lifestyles, with a range of different variables influencing different behaviours. This approach allows a broad range of variables to be used in the research, including many elements familiar from the Theory of Planned Behaviour and the Norm-Activation Model.

2. Methodology

2.1. Questionnaire design and sampling strategy

The household survey upon which this paper is based examined response to low-cost air travel in the East Midlands region of the United Kingdom, for both flyers and non-flyers. It was part of a larger project designed to understand the influence of liberalisation of the market on demand for air travel from the UK regions. This questionnaire was designed to examine the influence of psychological constructs and environmental attitudes upon air travel behaviour. Accordingly, it examined existing and potential air travel behaviour; attitudes to air travel, including willingness to adapt behaviour to reduce environmental impact; response to statements measuring agreement with psychological constructs from the Theory of Planned Behaviour and Norm-Activation Model, adapted from a study by Barr and Gilg (2007); and household and personal characteristics. A number of the questions included in the survey had been included in earlier studies, specifically Barr and Gilg (2007) and Davison and Ryley (2010); in addition, the survey was piloted as part of the design process.

The sampling strategy involved a combination of stratified-random and clustered sampling, with the objective of enabling a response from a range of different areas and sub areas, differentiated by distance from an airport, population density, and the level of deprivation, determined by the index of multiple deprivation for England and Wales (Office for National Statistics, 2004). The basis of this index includes scores for deprivation across 7 domains, namely income; employment; health and disability; education; crime; barriers to housing and services; and living environment. These are based on the Super Output Area (SOA) of initial postcode, with quintile 1 incorporating the 20% most deprived SOAs and quintile 5, the 20% least deprived. Therefore the sample includes response from a range of different households and areas across the East Midlands. This sampling, accompanied by collection of household and personal socio-demographics allows for a limited range of contextual factors to be examined to ascertain the extent to which these influence attitudes. Procedures were put in place in order to maximise response, these influenced the design of the questionnaire and the process for delivery and response (Dillman et al., 1974). Of the 5000 questionnaires posted out, 560 usable questionnaires were returned, representing an overall response rate of 11%.

The analysis in this paper focuses in particular on three elements of the survey:

1. Responses to five statements measuring attitudes to air travel and the environment, these were used to identify market segments using cluster analysis;
2. Responses to 14 questions measuring psychological constructs, to identify latent constructs relating to the behavioural theories using principal component analysis; and
3. Responses to nine questions examining a range of behavioural intentions, to identify relationship between a range of behavioural intentions using principal component analysis.

Analysis also considers how response varies according to the socio-demographic characteristics of each market segment and how constructs influence behavioural intentions and revealed behaviour. Specific details of the questions asked and the options for response are outlined in the results sections.

2.2. Cluster analysis

Cluster analysis, described in Hair et al. (1998), is an exploratory statistical technique for developing meaningful subgroups of individuals or objects. Due to the nature of cluster analysis as a non-parametric test, there are not strict assumptions, although the variables must be independent. Analysis should be undertaken without any pre-conceptions of the user, but the results do depend on their judgement. It is acknowledged that the cluster analysis technique generates suggested groups for review rather than definite solutions. A hierarchical clustering technique was applied to the factor scores using Ward's method which minimizes within-group variations, resulting in clusters of a similar size. A dendrogram was used to determine the number of clusters to maintain. The generated segments are defined according to the response to the questions included in the cluster analysis.

The behavioural and socio-demographic characteristics of each segment are examined using the appropriate tests to identify significant relationships between variables. For categorical variables this is achieved using Pearson's chi-squared tests, to determine whether the observed frequencies are significantly different from the expected frequencies (Urdan, 2005). For ordinal and Likert-scale data Analysis of Variance (ANOVA) is applied to examine the differences between group means (for a discussion on the suitability of ANOVA for scalar data see Norman, 2010). This extends to Welch's test where Levene's test highlights homogeneity of variance (Field, 2005).

2.3. Principal component analysis

Principal component analysis, a form of factor analysis assuming all variance can be accounted for, is used to identify the 'underlying

constructs or dimensions that provide a condensed statement of the relationship between a set of variables' (Kline, 1994). Analysis is applied to identify the 'latent factors' (Thompson, 2004) that firstly influence response to the 14 'pro-environmental' statements measuring psychological constructs and secondly underpin the response to questions examining behavioural intentions Respondents answering each of the statements are included in the analysis (455 respondents, 81% of the sample). Components with an eigenvalue over 1.0 are maintained, in keeping with Kaiser's criterion, and reference is made to the scree plot to confirm the number of components to maintain. A direct oblimin rotation is used to recognise correlation between responses and determine the final factor loadings, with loadings of >.5 retained (Hair et al., 1998). Results of Bartlett's test are used to demonstrate that the correlation matrix, which underlies the analysis, is statistically significant and a scale reliability analysis (Cronbach's alpha) outlines the internal consistency for the components. Factor scores, indicating the relationship between the individual and each component, are calculated using the regression method.

2.4. Path analysis

Path analysis is based on the premise that a variable can be both a dependent and an independent variable, and therefore, have the capacity to have direct and indirect effects upon an outcome (Hair et al., 1998). It is closely related to structural equation modelling, each realising a 'structure' to the relationship between variables, but unlike structural equation models, which are based on latent constructs, path analysis is based on measured variables (Schumacher and Lomax, 2004).

In this research the relationships outlined in Fig. 1 are explored to test the relationship between psychological constructs, behavioural intentions and behaviour. The main purpose of this is to understand how this varies across the environmental segments. Psychological constructs and behavioural intentions are based on the exploratory factor analysis (principal component analysis); this is preferred to the alternative approach of using confirmatory factor analysis as it does not superimpose an outcome (Child, 1990). Propensity to fly based on flight frequency provides an indication of behaviour.

Recommendations for a response to manage the long-term effects of air travel upon the environment are based primarily on the results presented in the path analysis with consideration for the socio-demographic and behavioural characteristics of each segment.

3. Results

3.1. Market segments based upon environmental attitudes

Hierarchical cluster analysis was applied to responses to five air travel and environment attitudes in order to identify segments sharing a similar response. Statistical differences in the socio-demographic characteristics are identified in order to assess the potential to target recommendations. The cluster analysis identified four clusters as summarised in Fig. 2 and detailed in Table 1. Table 1

Fig. 1. Path analysis overview.
Source: Adapted from Ajzen (1991) and Schwartz (1977).

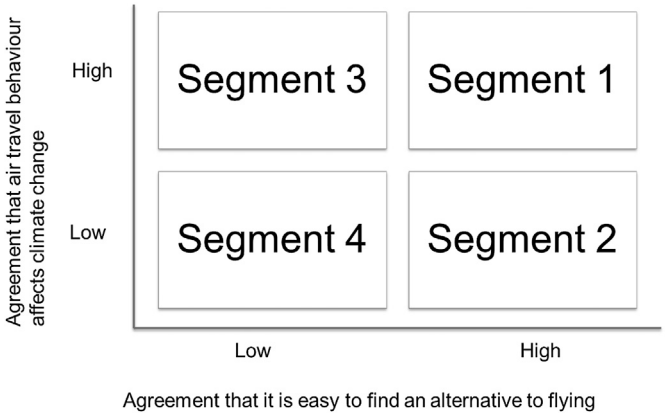

Fig. 2. Summary of segment characteristics based on attitudes.

also includes a summary of flight frequency in order to prioritise response.

The cluster means demonstrate that segments 1 and 3 hold a greater degree of belief that air travel behaviour has a significant effect upon the environment and that the media portrayal does not overstate this effect. Segments 2 and 4 are more sceptical of the extent of the causal link, believing the media to over-emphasise this. Between the segments there is a difference in levels of agreement as to whether individuals have the efficacy to find an alternative to flying. This translates to segments 1 and 2 being proportionately more likely to agree that alternatives can be found, whereas segments 3 and 4 dispute this. In line with the agreement to pay more to counter the environmental impact of flying, segment 1 agrees that conserving energy is important and therefore the desire to experience different cultures and locales should be moderated.

The cluster analysis highlights a conflict between environmental perspectives and behaviours; segments 1 and 3 held the same perspective regarding the impact of flying on the environment yet they perceive the ability to find an alternative to flying differently. A similar distinction can be made for segments 2 and 4, with both segments questioning the level of impact that flying has on the environment, yet whilst segment 2 holds a less flight dependent view segment 4 demonstrates the strongest belief that people are flight dependent. When reviewing what this actually means in terms of travel behaviour, there is a significant difference in the flight frequency of each segment (Welch's $F = 15.130$, (3,236), $p = .000$). On average, respondents in segment 4, who are sceptical of the impact that flying has on the environment and see challenges in finding alternatives to travel, fly most frequently and respondents in segment 1 who hold the converse attitudes fly least. Whilst the findings for these segments are quite intuitive, the association between opinions and behaviour is interesting in that the behaviours of segments 2 and 3 highlight that flight frequency is influenced more by believing that there is an alternative to flying than it is by trusting that air travel is doing significant damage to the environment.

An examination of the socio-demographic characteristics only shows significant differences for age and housing. As summarised in Table 2 segments 1 and 2, the less flight-dependent groups, are proportionately younger and a higher proportion of segment 4, the most flight-dependent group, are aged between 35 and 64. In terms of housing type, respondents in segment 3 are most likely to live in detached accommodation and segment 1 in terraced or semi-detached. Whilst a low proportion of respondents lived in apartments or flats overall, segment 4 included a higher proportion of respondents than expected living in this type of accommodation.

Table 1
Segments generated from the response to attitudinal statements.

Segment	Segment 1		Segment 2		Segment 3		Segment 4		All	
Number of respondents	118 (26%)		85 (19%)		135 (30%)		117 (26%)		455 (100%)	
Attitudes to the environment and air travel[a]	M	S.D.	M	S.D.	M	S.D.	M	S.D.	M	S.D.
Air travel is a significant contributor to climate change	1.64	.565	2.65	.855	1.99	.566	3.00	.799	1.99	.566
The UK media tends to over-state the effects of climate change	3.70	1.024	2.31	.787	3.19	1.023	2.74	1.043	3.19	1.023
Passengers should pay more to fly because of the negative environmental aspects of aviation	2.53	1.002	3.60	.727	2.73	.767	4.22	.645	2.73	.767
It is easy for people to find an alternative to flying if they really want to	2.22	.601	2.31	.598	3.72	.594	4.04	.635	3.72	.594
Experience of different cultures and destinations is more important than saving natural resources	4.01	.673	3.07	.799	3.19	.874	3.22	.832	3.19	.874
Revealed behaviour	M	S.D.	M	S.D.	M	S.D.	M	S.D.	M	S.D.
Total number of flights in previous 12 months	1.10	1.263	1.59	1.576	1.91	1.586	2.31	1.605	1.91	1.586

[a] Measured on a 5-point Likert scale where, 1 = Strongly Agree, 2 = Agree, 3 = Neither Agree nor Disagree, 4 = Disagree, 5 = Strongly Disagree.

3.2. Latent factors based on psychological constructs

The first application of principal component analysis considers the underlying influences upon psychological constructs; the factor scores relating to these constructs are included in the path analysis. Principal component analysis of the 14 variables identified two components with eigenvalues higher than 1.0. However, the scree plot suggests that four components should be maintained; these four components account for 64% of the variance between variables. Table 3 summarises the response to these variables and provides an overview of the results of the factor analysis of psychological constructs. Response to the psychological constructs demonstrates a high level of agreement with the pro-environmental statements.

The factor loadings largely support the psychological constructs being tested. Component 1 is based on six variables relating to three constructs from the Norm-Activation Model: Awareness of Consequences, Worldview and Ascription of Responsibility. Component 2 is based on the response to two variables measuring Perceived Behavioural Control from the Theory of Planned Behaviour. Component 3 highlights the response to a further Theory of Planned Behaviour construct measuring the influence of subjective norms, namely 'most of my friends are environmentally friendly'. The fourth and final component is based on one further construct

Table 2
A summary of socio-demographic characteristics of the segments.

Variable	Segment 1	Segment 2	Segment 3	Segment 4	All	Chi-square value segment and socio-demographic characteristics
Number of respondents	118 (26%)	85 (19%)	135 (30%)	117 (26%)	455 (100%)	
Gender						
Male	42 (36%)	36 (42%)	49 (37%)	52 (44%)	179 (39%)	$\chi^2(3, N = 454) = 2.723$, $p = .436$
Female	76 (34%)	49 (58%)	85 (63%)	65 (56%)	275 (61%)	
Age						
18–34	19 (16%)	12 (14%)	13 (10%)	5 (4%)	49 (11%)	$\chi^2(6, N = 454) = 13.535$, $p = .035$
35–64	68 (57%)	51 (60%)	89 (66%)	89 (76%)	297 (65%)	
65	31 (26%)	22 (26%)	32 (24%)	23 (20%)	108 (24%)	
Property						
Flat/apartment	3 (3%)	2 (2%)	4 (3%)	5 (4%)	14 (3%)	$\chi^2(9, N = 453) = 21.998$, $p = .009$
Terraced	19 (16%)	10 (12%)	11 (8%)	15 (13%)	55 (12%)	
Semi-detached	54 (46%)	31 (37%)	35 (26%)	35 (30%)	155 (34%)	
Detached	41 (35%)	42 (49%)	84 (63%)	62 (53%)	229 (51%)	
Home circumstance						
Own home	101 (86%)	76 (89%)	127 (95%)	104 (90%)	408 (90%)	$\chi^2(6, N = 452) = 8.744$, $p = .188$
Private rented home	8 (7%)	4 (5%)	6 (5%)	4 (3%)	22 (5%)	
Social rented home	8 (7%)	5 (6%)	1 (1%)	8 (7%)	22 (5%)	
Multiple deprivation[a]						
Quintile 1	9 (8%)	11 (13%)	9 (7%)	11 (9%)	40 (9%)	$\chi^2(12, N = 454) = 17.624$, $p = .128$
Quintile 2	30 (25%)	19 (22%)	40 (30%)	33 (28%)	122 (27%)	
Quintile 3	22 (19%)	11 (13%)	16 (12%)	9 (8%)	58 (13%)	
Quintile 4	20 (17%)	21 (25%)	27 (20%)	37 (32%)	105 (23%)	
Quintile 5	37 (31%)	23 (27%)	42 (31%)	27 (23%)	129 (28%)	
Status						
Self employed	7 (6%)	4 (5%)	13 (10%)	11 (10%)	35 (8%)	$\chi^2(12, N = 439) = 9.080$, $p = .696$
Employed full time	40 (36%)	30 (36%)	43 (33%)	36 (32%)	149 (34%)	
Employed part time	22 (20%)	16 (19%)	26 (20%)	23 (20%)	87 (20%)	
Retired	29 (26%)	27 (33%)	42 (32%)	36 (32%)	134 (31%)	
Other	14 (13%)	6 (7%)	6 (5%)	8 (7%)	34 (8%)	

Note: Individual percentages have been rounded up or down, so may not sum to 100. Missing responses have been excluded from table and chi-square tests.
[a] Index of multiple deprivation based on deprivation across 7 domains, namely income; employment; health and disability; education; crime; barriers to housing and services; and living environment. Measured by Super Output Area of initial postcode (1 = most deprived 20%, 5 = least deprived 20%).

Table 3
Components identified from psychological constructs.

Psychological constructs[a]	Descriptive		Components		
	Mean	Standard deviation	Factor loading	Label	Cronbach's alpha
Environmental problems caused by over-use of resources is a threat to me and my family	2.30	.810	.812	Awareness of Consequences and Worldview (AoC & Wv)	.810
Choosing more energy efficient forms of transport helps reduce global warming	2.16	.819	.749		
Each person's behaviour can have a positive effect on society and the environment	1.88	.652	.687		
Limiting our travel needs ensures a healthier environment	2.67	.923	.598		
I am very concerned about environmental issues	2.30	.775	.595		
I feel it is my responsibility to help the environment in the best way possible	2.11	.716	.546		
I find helping the environment is convenient	2.84	.826	.894	Perceived Behavioural Control (PBC)	.719
I find helping the environment easy	2.54	.830	.851		
Most of my friends are environmentally friendly	2.66	.789	.880	Subjective Norm (SN)	N/A
When other people around me help the environment I feel I should too	2.35	.750	−.877	Personal Norms and Subjective Norm (PN & SN)	.744
I feel guilty when I don't make an effort to conserve resources	2.40	.867	−.607		
I like people to think of me as environmentally friendly	2.33	.700	−.602		
It makes me feel good when I do something to help the environment	2.23	.726	−.590		

[a] Measured on a 5-point Likert scale where, 1 = Strongly Agree, 2 = Agree, 3 = Neither Agree nor Disagree, 4 = Disagree, 5 = Strongly Disagree.

measuring subjective norms ('When other people around me help the environment I feel I should too') and four constructs measuring personal norms from the Norm-Activation Model. The loadings of the constructs measuring subjective norms are unusual as they do not load on the same component, which is supported by low internal consistency between the constructs (Cronbach's alpha = .419). A possible reason for this is that the referent for each construct is different, whilst one is a descriptive norm, referring to 'people', the other is an injunctive norm, referring specifically to 'friends'.

Constructs load positively on the components with the exception of Component 4, Personal Norms and Subjective Norm, where all constructs load negatively. Given that each construct loads negatively on the component, rather than some constructs loading negatively and other positively, the negative loadings are maintained, i.e. the constructs are not recoded. Where this influences the results it is highlighted as a footnote and considered in the discussion. With the exception of the third component, which comprises only one statement, the Cronbach's alpha for each factor is acceptable.

3.3. Latent factors based on behavioural intentions

The second application of factor analysis is designed to highlight responses to variables measuring willingness to engage across a range of behaviours that have the potential to reduce energy use. Specifically, respondents were asked how willing they were to undertake these actions for environmental reasons. Principal

Table 4
Components identified from behavioural intentions.

Behavioural intention[a]	Descriptives		Components		
	Mean	Standard deviation	Factor loading	Label	Cronbach's alpha
Not fly in the next 12 months	3.41	1.261	.901	Reduce flight dependency	.781
Holiday in Britain instead of overseas	2.85	1.286	.833		
Pay to offset the carbon emissions from my flight(s)	3.02	1.019	.895	Pay more to fly	.740
Pay more to fly on a less polluting aeroplane	2.82	1.020	.880		
Choose a more energy efficient airline	2.30	.838	.542		
Reduce energy used in the home	1.78	.811	.880	Adapt everyday behaviours	.537
Choose a more energy efficient way to travel everyday	2.27	1.070	.675		
Choose to travel Euro-rail rather than fly	2.18	1.112	−.837	Select alternatives to flying	.663
Choose to travel by ferry rather than fly	2.53	1.243	−.836		

[a] Measured on a 5-point Likert scale where, 1 = Very willing, 2 = Willing, 3 = Neither Willing nor Unwilling, 4 = Unwilling, 5 = Very Unwilling.

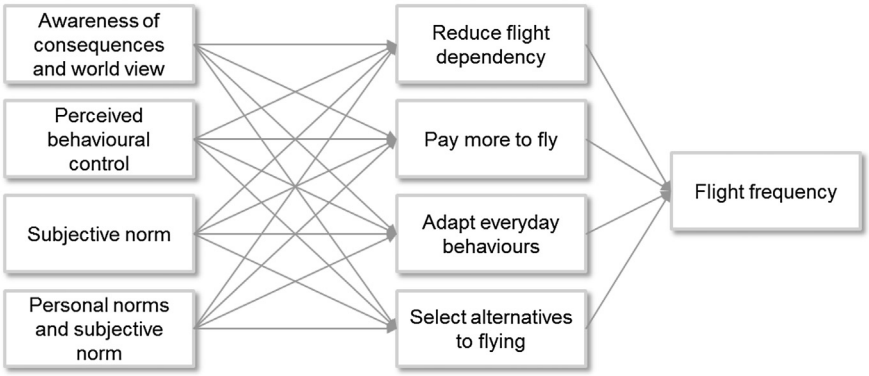

Fig. 3. Path diagram.
Source: Adapted from Ajzen (1991) and Schwartz (1977).

component analysis of the nine variables measuring behavioural intentions identified three components with eigenvalues higher than 1.0. However, the scree plot suggests that four components are maintained; these four factors account for 73% of the variance between variables. Table 4 summarises the responses to these variables and provides an overview of the results of the factor analysis of the behavioural intentions. As outlined in the table, these latent factors identify an intention to respond to the environmental impact of air travel and other behaviours in four discrete ways, namely to reduce flight dependency, to pay more to fly, to adapt everyday behaviour and to seek alternatives to air travel. This reinforces the potential behaviours which the statements were designed to examine.

Factor loadings for components 1, 2 and 3 are uniformly positive, and therefore demonstrate a willingness to engage in the behaviour; the factor loading for component 4 is negative, so the reverse is true. The Cronbach's alphas are acceptable for components 1 and 2 but are lower for the components 3 and 4 and they should be treated with caution. In the case of component 3 the contexts for the behaviour are different, although they are distinct in that they relate to everyday behaviour rather than behaviours relating to tourism and annual travel. Regarding component 4 it can be argued that some respondents would be more open to selecting one of the alternatives to flying than the other. In support of the decision to keep the components with the lower levels of internal consistency the alphas are calculated using a low number of variables (Tavakol

Table 5
Path analysis for all respondents and environmental segments.

Dependent variable	Independent variable	All		Segment 1		Segment 2		Segment 4		Segment 3	
		R^2	ß	R^2	ß	R^2	ß	R^2	ß	R^2	ß
Reduce flight dependency		.12		.06		.08		.24		.03	
	AoC & Wv		.315***				.282**		.094**		
	PBC		.098**						.086**		
	SN		−.085*		−.189**						
	PN & SN[a]										
Pay more to fly		.22		.09		.19		.21		.15	
	AoC & Wv		.300***		.265**		.223**		.265**		
	PBC										
	SN										
	PN & SN[a]		−.263***				−.315***				−.325**
Select alternatives to air travel[a]		.17		.13		.11		.16		.11	
	AoC & Wv		−.359***		−.207**		−.202**		−.207**		−.374***
	PBC										
	SN		.100**		.241**				.241*		
	PN & SN[a]										
Adapt everyday behaviours		.29		.43		.16		.32		.25	
	AoC & Wv		.390***		.514***		.204**		.514**		.411***
	PBC		.107**		.228**		.150*				
	SN				.152**						
	PN & SN[a]		−.160***				−.168*		−.109***		
Flight frequency	Direct effects	.24		.20		.16		.20		.26	
	Reduce flight dependency		.496***		.418***		.359***		.418***		.914***
	Pay more to fly										−.252*
	Indirect effect										
	AoC & Wv		.146**				*.115		.127**		
	PBC		.047**						.122***		
	SN		*-.41		-.142**						*-.078
	PN & SN[a]										

*** p-value < .01; ** p-value < .05; * p-value < .10.
AoC & Wv = Awareness of Consequences and Worldview, PBC = Perceived Behavioural Control, SN = Subjective Norm, PN & SN = Personal Norms and Subjective Norm.
Goodness of Fit: Chi squared = 12.438, df = 20 p = .9; GFI = .997; RMSEA = .000; CFI = 1.
[a] Factors where 100% of factor loading are negative.

and Dennick, 2011) and all components are part of a wider story indicating that behavioural intentions vary according to context and the lifestyle implications of change.

3.4. Path analysis variability by environmental segment

The path analysis has two main purposes: firstly to assess how psychological constructs influence behavioural intentions across a range of energy saving behaviours for the purpose of reducing the environmental impact; and secondly to examine how these constructs vary across the four environmental segments. Analysis is applied to the path diagram, as illustrated in Fig. 3, for all respondents (i.e. the unsegmented sample) and the four environmental segments simultaneously. Based on the approaches used to calculate the factor scores, all of the exogenous variables are correlated, as are the error terms of the behavioural intentions. With reference to the Theory of Planned Behaviour, earlier path analysis models also tested for a direct effect between Perceived Behavioural Control and behaviour but this was not statistically significant.

Table 5 outlines the R^2 values for behavioural intentions and behaviour and the significant standardised beta-values for the total number of respondents included in the analysis and for each of the segments. The R^2 values demonstrate that the path analysis accounts for between 3% and 43% of variance with respect to behavioural intention and between 16% and 26% with respect to actual behaviour, highlighting that whilst these constructs do account for a share of the variance there are other influences on intentions and behaviour. The models account for a greater share of variance for the behavioural intention to adapt everyday behaviours, whereas a smaller proportion is captured with respect to a willingness to reduce flight dependency.

In considering which components influence the intentions and behaviours of individual segments, all segments are positively influenced by Awareness of Consequences and Worldview, from the Norm-Activation Model. Similarly it also has an effect across behaviours. There are a limited number of exceptions to this, namely the influence upon reducing flight dependency for segments 1 and 4 and paying more to fly for segment 4. For the more flight dependent segments (3 and 4), Personal Norms from the Norm-Activation Model (plus one Subjective Norm from the Theory of Planned Behaviour) are shown to be effective at encouraging respondents to pay more to fly, and these also have an influence on willingness to adapt everyday behaviours for segment 3. On the other hand, from the Theory of Planned Behaviour Model, Perceived Behavioural Control is related to reducing flight dependency for segment 2 and adapting everyday behaviour for segment 1. Whilst most constructs exert a positive relationship upon behavioural intentions for which there is a significant relationship, the Subjective Norm relates differently depending upon context, relating positively to adapting everyday behaviours yet negatively to reducing flight dependency and selecting alternatives to air travel.

Examining the influence upon flight frequency, a willingness to reduce flight dependency is the greater predictor of behaviour. However, for segment 4 a significant negative relationship exists between the willingness to pay more to continue flying, be this in the form of offsetting or paying a greater fare to benefit from energy efficiency.

When considering the indirect effects of the psychological constructs upon flight frequency these also differ by segments. There is a positive significant correlation between Awareness of Consequences and Worldview and behaviour for the unsegmented sample, segment 2 and segment 3. This is supported by a positive significant correlation between all respondents and segment 2 for Perceived Behavioural Control. However, the Subjective Norm is negatively correlated with flight frequency for the unsegmented sample, segment 1 and segment 4.

Applying multi-group moderation using critical ratios, as recommended by Gaskin (2012) demonstrates that beta values are significantly different between segments. Most notably the influence of Awareness of Consequences and Worldview varies significantly between segment 4 and the unsegmented sample (p-value $< .001$), respondents in segment 2 (p-value $< .05$) and respondents in 4 (p-value $< .1$). For instance the coefficient relating personal norms to willingness to adapt everyday behaviours differs between segment 2 and the unsegmented sample (p-value $< .1$), segment 1 respondents (p-value $< .05$) and segment 4 respondents (p-value $< .1$). Extending this to the influence of willingness to pay more to fly and flight frequency the beta-coefficient for segment 4 is significantly different from that of segment 3 (p-value $< .001$) in particular but also the unsegmented sample and all other segments (p-value $< .1$).

4. Discussion

This paper focuses upon the air travel behaviour and behavioural intentions of households in the East Midlands region of the UK. These behaviours and behavioural intentions are more likely to be similar between East Midlands and other regions with a choice of regional airports and between areas with similar structures in place to support the range of behaviours explored. The paper examines how these are affected by environmental attitudes; it tests the influence of psychological constructs from the Theory of Planned Behaviour and Norm-Activation Model upon behaviours and behavioural intentions and how these vary by attitude-based segment. Whilst these theoretical differences were the main focus of the analysis the sampling approach was used to increase the generalizability of results. The combination of stratified-random and clustered sampling allowed the sample population to vary by population density, distance from an airport and the level of deprivation. However, the identified segments only vary significantly by age and property type. This suggests that other socio-demographic characteristics, including the level of deprivation, gender and home circumstances do not significantly influence the attitudes underpinning the segmentation.

In applying cluster analysis to identify four attitude-based segments, it is clear that respondents vary along two continuums, the first relating to the environment, the second to flight dependence. When relating this to actual behaviour, there is a more consistent relationship between revealed air travel behaviour and attitudes to flight dependency when compared to attitudes on the environmental impact of air travel. An important message to take from this is that attitudes are not always a reliable indicator of behaviour. This highlights that structural strategies are required, as opposed to informational strategies designed to change or increase awareness and thereby change attitudes, as suggested by Howarth et al. (2009).

The application of principal component analysis to pro-environmental psychological constructs largely supported the findings of Wall et al. (2007), that latent factors could primarily be attributed to either the Theory of Planned Behaviour (Ajzen, 1991) or the Norm-Activation Model (Schwartz, 1977), but rarely both. This supports the idea that these theories can complement each other. In this research, however, there is a small exception; the statement, ‘When other people around me help the environment I feel I should too’, corresponds more with constructs measuring personal norms than with the construct measuring other subjective norms: ‘Most of my friends are environmentally friendly’. Wall et al. (2007) also found that constructs measuring subjective norms did not form a reliable scale, identifying the influence of using different

'referents' in statements. This emphasises a need to better understand potential overlaps, in particular the influence of descriptive and injunctive norms on response and indeed behavioural intentions and behaviour.

The second application of principal component analysis builds upon the findings of Barr et al. (2010), highlighting the difference between air travel behaviour and other environmental behaviours. By identifying four distinct factors it also emphasises the differing levels of willingness to engage in activities which either reduce, or compensate for, energy use related to air travel and tourism choices. Of the identified factors, only one suggests a willingness to reduce air travel; the remainder highlight a greater willingness to pay for the impact, reduce impacts from other activities not related to tourism or air travel, and to substitute travel mode whilst still consuming, thus highlighting the importance of holidays.

When considering the path analysis, it is clear from the greater proportion of variance accounted for, that these theories are more successful in explaining everyday behaviour and less effective at explaining willingness to reduce flights. Furthermore, in relation to the findings of Steg and Vlek (2009), the Theory of Planned Behaviour is better at explaining high-cost or highly constrained behaviours, while Values-Beliefs-Norms, based on the Norm-Activation Model, are better at explaining low-cost behaviours. Results suggest willingness to reduce flight dependency is a high cost behavioural change, when compared to willingness to pay more to fly, for example. That said, the prominent role of the values and beliefs held within the construct Awareness of Consequences and Worldview and the positive relationship with intentions directly and behaviour indirectly, suggest a core role for this model across environmental behaviours. Therefore, broadly targeted interventions should be designed in a manner which reinforces such Awareness of Consequences and fosters a sympathetic Worldview, thereby activating Personal Norms. Interestingly, significant differences exist between each of the segments and the unsegmented sample, which brings into question the applicability of such theories across population subgroups, noting that all subsamples comprise over 80 respondents.

Considering which of the segments to target and how to respond, segment 3 is a priority as it comprises the greatest proportion of the sample (30%) and highlights value-action or attitude-behaviour gap (Blake, 1999; Kollmuss and Agyeman, 2002). Therefore, policies which change behaviour are preferred over those solely providing information. For this segment, Personal Norms have a positive association with a willingness to pay more to fly and willingness to adapt everyday behaviour. This reinforces the need to align a desire to reduce reliance on air travel with these energy saving behaviours, increasing the influence of personal norms upon willingness to reduce air travel and flight frequency.

The most flight dependent segment, segment 4, provides the greatest challenge in meeting policy goals in that the willingness to pay more to offset the environmental impact of aviation is negatively correlated with actual behaviour, not just the behavioural intentions. Furthermore there is no evidence that the psychological constructs which have demonstrated some success in explaining pro-environmental behaviours in other research (Steg and Vlek, 2009) and indeed other segments for this research, can explain an intention to reduce air travel behaviour. This highlights that some holiday segments are indeed 'crisis proof' as discussed by Dolnicar et al. (2013) with a psychological reliance on leisure travel to ensure quality of life.

Of the less flight dependent segments, the constructs relating to the Theory of Planned Behaviour are significant in explaining all behaviours with the exception of paying more to fly, suggesting that for these segments that behaviour relating to air travel and other energy saving behaviour is viewed as high cost (Steg and Vlek, 2009). Interestingly, the Subjective Norm 'Most of my friends are environmentally friendly' bears a significant negative direct relationship with intentions relating to air travel and indirectly with flight frequency for the less flight dependent groups, but a significant positive relationship regarding adaptations to everyday behaviour. Again, this highlights a need to better understand the influence of the referent upon response to subjective norms – whether the construct refers to 'people' or a specific group of people, e.g. 'friends' – but also to emphasise that peer influence upon individual or household air travel behaviour is limited.

5. Conclusion

This paper presents a novel application of two behavioural theories to better understand attitudes, behavioural intentions and behaviour relating to air travel, and how this differs by segment. This is driven by the need to reduce the transport contribution to climate change, which relies predominantly on behavioural change with recognition that segments behave differently.

This paper brings into question the effectiveness of such theories in explaining the behavioural intentions and behaviour of all segments and as a result of this, the ability of policy approaches based on changing attitudes to engender change in the most flight dependent segment. For other segments, the results highlight a cognitive dissonance between attitudes and behaviour. This is particularly apparent for the largest segment, who are flight dependent, despite recognising the environmental impacts of their air travel. This is also demonstrated from the path analysis, which suggests activating personal norms as a policy to overcome this. Research challenges associated with this concern the personal nature of the norms.

These findings reinforce the difficulties in achieving government targets for emission reductions in a context where cognitive dissonance remains between how consumers view travel and transport, in particular air travel, in relation to other energy–intensive activities. Aligning views on air travel with other behaviours is the breakthrough policy-makers require to facilitate behavioural change, to potentially reduce the transport impact on the environment.

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