Tackling the academic air travel dependency. An analysis of the (in)consistency between academics' travel behaviour and their attitudes

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ABSTRACT

Current trends in air transport are inconsistent with international climate goals. Without substantial changes from business-as-usual travel demand, neither new technologies nor alternative fuels will reduce emissions at the required rate. Air transport demand is highly skewed towards a small share of frequent flyers in all aviation users. While the unsustainability of aviation is well-recognised in academia, academics themselves are often frequent flyers – generating the emissions many of them also problematise. To investigate this contradiction, we survey 1,116 staff members from University College London (UK). We cluster academics based on their opinions of academic travel and international conference organisation, and examine how these groups participate in, and travel to, academic activities. Five clusters are identified: 1) *Conservative frequent flyers*, 2) *Progressive infrequent flyers*, 3) *In-person conference avoiders*, 4) *Involuntary flyers*, and 5) *Traditional conference lovers*. Despite some levels of similarity between academic travel attitudes and behaviour, results show that certain types of academics seem forced to regularly fly to distant conferences. In fact, members of our largest cluster (*Involuntary flyers*) have negative attitudes towards flying, yet have the plane as dominant travel mode. To reduce academic air travel (dependency), we provide tailored policy instruments for each cluster, aimed at reducing the need to travel to lowering the impact of travel.

1. Introduction

The transport sector is widely seen as a hindrance to global decarbonisation in line with the Paris Agreement goals (Creutzig et al., 2015). Within transport, it is often noted that aviation is especially challenging to decarbonise. According to Lee et al. (2021), this subsector accounted for 1/40 of total anthropogenic CO_2-eq emissions in 2019. However, due to contrail cirrus and nitrous oxides (NOx), aviation's overall contribution may be as high as 7 %, and emissions from aviation are growing faster than any other mode (EASA, 2022; IEA, 2022). To stay below the 1.5 °C climate target, deep reductions in emissions from aviation are required, which attend to both carbon dioxide (CO_2) and non-CO_2 climate effects (Brazzola et al., 2022), over and above large reductions in CO_2-eq emissions in land and maritime transport (Hickman et al., 2010). Alternative aviation fuel pathways (Dray et al., 2022), coupled with more energy efficient aircraft and other technologies (Bergero et al., 2023), are unlikely to achieve net-zero aviation without sustained demand reduction (Gössling & Humpe, 2023). Simply put, air travel needs to reduce, and particularly for those who fly frequently. Reasons for flying vary, including for work, leisure/tourism and to visit friends and relatives (see, Cass, 2022). Across these trip purposes, there are different attitudes, norms, values, and perceptions of behavioural control related to flying. This paper focuses on air travel behaviours among one group for whom air transport has become socially embedded, academics.

Academics feature prominently among frequent flyers because flying is deeply embedded in how the global academic system functions (Stephenson, 2023). Similar to business travel in general, long-distance academic travel is widely recognised as necessary, in particular to generate and share knowledge, build and maintain networks, and develop careers (Gössling & Dolnicar, 2023; Hopkins et al., 2019; Kreil, 2021; Storme et al., 2017). Despite ever-increasing volumes of academic research and teaching on environmental sustainability, and the attention paid (and money committed) to progressing sustainability agendas across

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academic institutions, air transport remains a large contributor to academic carbon footprints (ALLEA, 2022), even among scholars researching environmental or climate topics (Whitmarsh et al., 2020). Academic scholarship and travel is thereby often fossil fuel dependent (Arsenault et al., 2019; Ciers et al., 2019).

Previous research has pointed towards a degree of inconsistency between academics' attitudes towards (academic) air travel and their actual flying for academic purposes. They often acknowledge the unsustainability of flying but not necessarily reduce their own flying frequency accordingly (Schrems & Upham, 2020; Whitmarsh et al., 2020). Yet, studies of academic flying to date have tended to treat the academic community largely as a homogenous entity, often without recognising the diversity of attitudes and practices (as well as personal and professional characteristics) that inform travel behaviour. This paper provides the first detailed clustering of a large and diverse academic population based on attitudes towards academic travel and conference organisation. Using the actual travel behaviour and conference attendance of these clusters, we show where interventions could be targeted for greatest impact to reduce fossil fuel consumption in academic practice.

In this paper, we present the findings of a large sample (n = 1,116) of University College London (UCL, United Kingdom) staff to examine conference travel behaviours. This is the first study of this size to collect detailed information on academic travel (attitudes) including researchers from different disciplines and at all career stages in a globally leading university. We investigate the (in)compatibilities between academics' perceptions of conference travel, vis-à-vis potential environmental sustainability measures, and their own travel behaviours. This provides novel insights into the challenges that lie ahead in decarbonising academic conference travel and overcoming the contradiction between frequent flying and sustainability goals. Since UCL generally encourages international mobility, similar to many other universities in the Global North, results from this study can provide valuable policy recommendations which go beyond the scope of one university. Results and related policy recommendations may reduce academic air travel dependency, and may also provide insights concerning how to lower air transport for other groups of frequent flyers.

2. Literature review

Aviation emissions are produced by a small minority of the global population (Gössling & Humpe, 2020) and therefore represent a particularly unjust dimension of the global emissions profile. Academics are one of the groups with privileged, yet highly unsustainable, lifestyles including international networks and frequent air travel. This privilege can be gleaned from the observations that professor-grade academics fly significantly more frequently compared to more junior academics (Arsenault et al., 2019; Ciers et al., 2019; Whitmarsh et al., 2020). Additionally, men are more likely than women to frequently attend distant academic activities, in part because women often shoulder additional childcare responsibilities (e.g., Cohen et al., 2020; Jöns, 2011).

The rise of international academic mobility mainly took place in the 1990 s and was enabled by the emergence and uptake of long(er)-haul and low(er) cost air travel, and a focus of universities on knowledge diffusion and internationalisation (Gössling et al., 2019; Storme et al., 2013). While academic travel took place before this, it was more often dependent on slower modes, and was therefore less frequent and for longer durations (Fent et al., 2022). While this produced fewer emissions and other harmful environmental effects, it was also limited to fewer academics who had the status, finances and support to travel and collaborate with colleagues in countries or even continents other than their own (Hopkins, 2024). More affordable air travel allowed a wider segment of the academic community to participate in international events and collaborations (see Nevins et al., 2022, for a discussion of the limits to this inclusion), but did so with a heavy environmental cost.

Over time, frequent air travel, also referred to as 'hypermobility',[1] became entrenched in academic practice, reflected by university employment policy (including promotion requirements) that incentivises and rewards academics with international networks which are often dependent on air travel (e.g., Hopkins et al., 2016).

Claims of the necessity of flying for career success were initially challenged by Wynes et al. (2019), although more recent scholarship presents an alternative view, with Berné et al. (2022) suggesting that scientific visibility through aeromobilities contributes to a stronger publication rate and h-index (although see Hopkins, 2024). Kreil (2021) indicates that, although some academics feel that flying less would not harm research, the dominant assumption is that reduced air travel would negatively impact academics' visibility and success of their work. Whether physical mobility is needed, however, is unclear. Chen et al. (2022) find that the long-distance collaborations that are important for scientific breakthrough can be supported by the improved communication technologies adopted in the last 20 years. In particular, they note that, since 2010, improvements in technologies have facilitated international collaborations and scientific discovery. Yet the idea that travel is necessary for collaboration remains pervasive in many academic communities.

Academic travel is also undertaken to disseminate academic research and network with colleagues at (international) conferences and symposia, the organisation of which is a long held academic tradition (Collins et al., 2023). Yet the growth and frequency of conferences has become environmentally unsustainable, particularly given the status given to the large 'international' conferences which often demand international/intercontinental air transport for at least some attendees, rapidly increasing the events' carbon footprint (Klöwer et al., 2020). To reduce the environmental impact of academic conferences, measures such as online or hybrid facilitation (particularly since the COVID-19 pandemic), reduced frequency, multi-hub structure, and locations accessible by lower carbon modes, have all been proposed and to some extent adopted (Klöwer et al., 2020; Sarabipour et al., 2021; Wenger & Turi, 2023). However, studies have shown that, for many scholars, virtual mobility cannot adequately replicate physical presence and may only be seen as a viable alternative when obligations conflict (Higham et al., 2019; Storme et al., 2017). Academic institutions have also instigated a number of different approaches, including flying levees, to disincentivise air transport while supporting virtual attendance and low emission modes (ALLEA, 2022).

As well as actions and interventions from conference organisers and academic institutions, there is also some evidence of a movement towards 'no-fly' and 'slow travel' academic practice (Katz-Rosene & Paske, 2024). This is largely dependent on the – mostly voluntary – actions of individuals operating against the dominant culture, leading to debates on its effectiveness, but also relies upon a few scholars seeking to show that an alternative pattern of collaboration and academic work is possible (e.g., Görlinger et al., 2023). Nevertheless, research has indicated strong concern amongst academics about climate change (Stavrianakis and Farmer, 2023; Stavrianakis and Ramos, 2022), even if their flying frequency is only marginally affected by these concerns and attitudes. A discrepancy thus exists between 'normalised' academic (travel) behaviour and environmental attitudes (Caset et al., 2018; Schrems & Upham, 2020; Whitmarsh et al., 2020), leading to claims of hypocrisy (Brierley, 2024; Tseng et al., 2023), and impacting credibility for researchers and their given attitudes relative to behaviours (Attari et al., 2016). In fact, it seems – to a certain extent – that behaviour is not a direct outcome of attitudes (as outlined in the well-known Theory of Planned Behaviour (TPB; Ajzen, 1991)), but that a value-action gap exists, where people do not always act in accordance with their attitudes

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[1] Hypermobile travellers are individuals who take frequent trips, often over great distances, and account for a large share of the overall distance travelled, especially by air (Gössling et al., 2009).

(e.g., Blake, 1999).

The current study probes the discrepancy between behaviours and attitudes and is the first to do so for different groups of academics. These groups are derived from data on academic travel attitudes for a large sample of academics at different career stages. This mode of analysis enables the identification of tailored policy recommendations, which may be more effective in lowering academic air travel dependency compared to standardised policy interventions.

3. Data and methodology

3.1. Data collection and sample characteristics

The data used in this study originates from a 2023 UCL travel survey [self-citation]. UCL is ranked as one of the top universities worldwide (ranked 9th and 17th according to the 2024 QS World University Ranking and Shanghai Ranking, respectively), with more than 16,000 staff and 50,000 students from over 150 different countries. Similar to many other universities, mainly in the Global North, UCL has extensive international collaborations and ample research funding, enabling (and even stimulating) international travel. As in most other universities, air travel is not restricted, and recommendations to travel sustainably (e.g., by train) or to offset carbon emissions are non-binding. Hence, results of this study based on a large sample of UCL students/staff can provide insights into academic travel which go beyond the case of UCL. The survey collected data from UCL students and staff, to create insights into how students and staff travel and how they experience it, with the ultimate goal of making travel generated by UCL more sustainable and convenient. The first part of the survey (for all respondents) mainly focused on how participants travel to campus, and how this travel is perceived. The second part, which is used for the current study, focused on (attitudes towards) academic travel. Questions were asked to participants who are likely to perform academic travel (defined as "travel required for attending certain academic activities such as conferences, seminars and (project) meetings"). As a result, PhD students, assistant/associate/full professors, and teaching/research staff received these questions, while undergraduate/postgraduate students and administrative/technical staff did not.

Data was collected during the last four weeks of term 2 at UCL, i.e. from February 27 until March 27, 2023. The survey was distributed via UCL social media pages (Instagram, Facebook, and Twitter) and multiple UCL newsletters for staff and students. As a financial incentive, eight £50 multi-store gift vouchers (One4all vouchers) were raffled among respondents completing the survey. In the end, 2,912 UCL staff members and students started the survey, and 2,593 participants completed the survey. Since most questions were mandatory (except some sensitive questions), these respondents answered the majority of questions. In this study on academic travel – focusing on PhD students, research/teaching staff and professorial staff – we use data from 1,116 respondents, excluding survey participants not likely to perform academic travel (under/postgraduate students, and administrative staff).

Most respondents are early-career academics, as almost 60 % are younger than 40 years, while 18 % are between 40 and 49 years, and 22 % are 50 years or older (Table 1). Women are slightly overrepresented, as 58 % of the respondents identify as woman, while only 39 % identify as man (3 % identify as non-binary or unsure, or prefers not to identify their gender). Around 20 % of respondents in this study are PhD students, while just over half of the respondents are research or teaching staff (42 % and 9 %, respectively), and 29 % are professors. The faculties of Medical Sciences, Population Health Sciences and Engineering Sciences are best represented, while the majority (85 %) of respondents are full-time students or staff members at UCL.

3.2. Methodology

According to the TPB (Ajzen, 1991), attitudes are regarded as

Table 1
Sample characteristics.

		%
Age	20–29	27.5
	30–39	32.2
	40–49	18.2
	50+	22.1
Gender	Woman	58.0
	Man	38.9
	Non-binary/questioning/unsure	1.6
	Prefer not to say	1.5
Role at UCL	PhD student	20.2
	Research staff	41.9
	Teaching staff	9.3
	Assistant professor	5.8
	Associate professor	8.5
	Professor	14.3
UCL faculty	Medical Sciences	19.7
	Population Health Sciences	16.5
	Engineering Sciences	12.5
	Mathematical and Physical Sciences	10.6
	Life Sciences	8.2
	Social and Historical Sciences	7.4
	Other faculties	25.1
Employment/student status	Fulltime	85.0
	Parttime	15.0

important predictors of behaviour (through intention). To examine how academic travel behaviour is influenced by attitudes, we have created profiles of respondents based on their answers on 17 statements regarding academic travel and the organisation of conferences. Therefore, we have performed a factor analysis followed by a cluster analysis, a two-step method that has long since been used in travel behaviour research (De Vos et al., 2019; Mokhtarian et al., 2009). First, an exploratory factor analysis is performed. This commonly used data reduction technique reduces a large number of variables into a more manageable number of factors which correspond to a significant portion of the variability of the original variables (Rogerson, 2019). This data reduction is necessary since some of the used statements may be correlated and a cluster analysis with too many variables can complicate the interpretability of clusters. Hence, a factor analysis has been applied to reduce the number of attitudinal statements into a limited number of factors representing attitudes towards academic travel and conferences. To identify the latent constructs that are underlying the attitudinal statements, principal axis factoring is used, while an oblique rotation (promax rotation) is applied to maximise the degree of association between the statement and the factor. Second, a k-means cluster analysis – one of the most intuitive and widely used cluster analysis methods – has been performed on the created factors. This analysis classifies respondents into clusters, where both the similarities between members of the same cluster and the differences between each cluster are maximised (Wu & Wu, 2012). By doing so, homogenous groups of respondents in terms of academic attitudes are created. In a final step, we have explored the clusters' academic travel and academic activity participation (e.g., frequency, travel mode and destination of recent academic trips), and examined how this behaviour differs between groups of academics with similar attitudes.[2] All analyses have been conducted in SPSS 28.0 (IBM, 2021).

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[2] An alternative approach would have been to perform a cluster analysis incorporating both attitudes and behaviour. However, doing so would not have enabled us to include all detailed information on respondents' travel/conference behaviour since some of these variables are related with each other, are measured in a different way as attitudes, and are often strongly skewed. These elements complicate the performance and interpretability of a cluster analysis, and also prevented us from performing a factor analysis on the behavioural variables (and using the obtained factors in the cluster analysis).

4. Findings

4.1. Attitudes towards academic travel and conferences

Respondents were asked to indicate to what extent they agree on 17 statements. These statements were developed by the authors to gain detailed information on academics' attitudes towards academic travel and the organisation of academic conferences (Fig. 1). Four statements refer to (academic) flying, four statements relate to train use, five statements focus on online or hybrid organisation of conferences, and four statements refer to the frequency and location of conferences. More than 80 % of respondents agree that flying has a detrimental impact on our planet. However, only 39 % of respondents feel guilty when flying, while around 40 % oppose more expensive flying or UCL making carbon offsetting mandatory. Instead, participants appear to be in favour of improving train travel, with 80 to 90 % of the respondents stating that the development of high-speed rail networks should be stimulated, that they like to travel by train, and that high-speed train use should be made cheaper. On the other hand, only 40 % find that UCL should make (high-speed) train use mandatory for destinations reachable in one day. In terms of conference organisation, around 80 % of respondents (strongly) agree that in-person conferences/meetings are important for networking

and that online conferences/meetings do not provide the same quality as in-person conferences/meetings. Only 40 % think that online conferences/meetings are good alternatives for in-person conferences/meetings. Despite two thirds of the respondent indicating that international conferences should be hybrid, only 10 % feel that they should be fully online. Concerning the frequency and location of conferences, more than one third of respondents are receptive to less frequent international conferences, or conferences at multiple locations (e.g., a hub model). A bigger focus on regional research in one continent, however, appeals to only some 20 % of the respondents. Three quarters of the respondents find that international conferences should be organised in cities easily accessible by (high-speed) train.

4.2. A factor and cluster analysis

The factor analysis resulted in four factors explaining 63.7 % of the variance in academic travel/conference attitudes (Table 2). The KMO test (0.84) and Bartlett test of sphericity ($p < 0.001$ level) indicate that a factor analysis is useful for this dataset (i.e., that there are at least some significant correlation between variables). High scores on the first factor, i.e. *Anti-flying*, represent negative attitudes towards flying and a positive stance towards making flying more expensive. High scores on
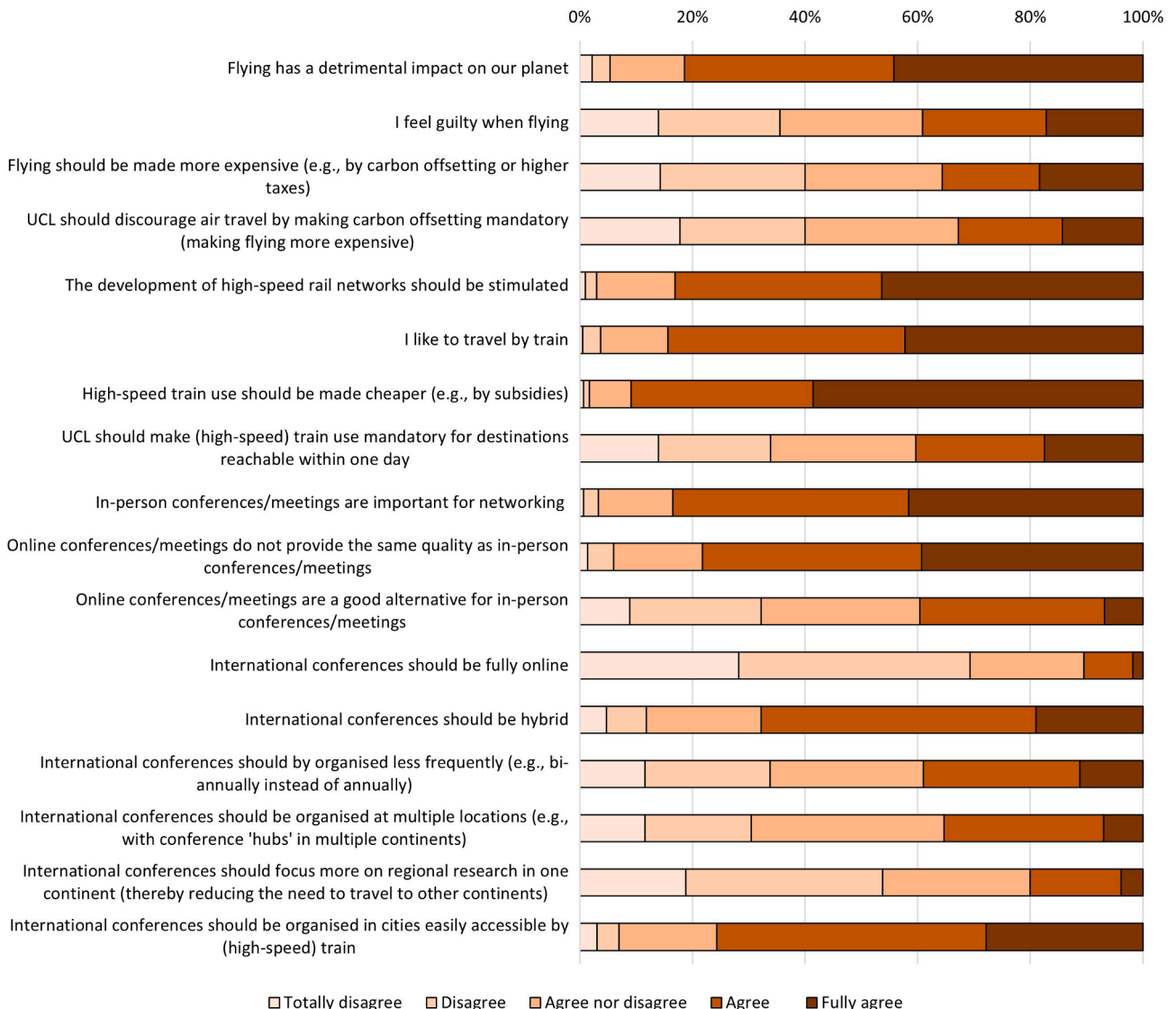

Fig. 1. Responses on statements regarding academic travel and conferences.

Table 2
Pattern matrix with factor loadings (ICs = international conferences; factor loadings < 0.4 are not presented for greater readability; n = 1116).

Factor	Statement	Factor loading[a]
Anti-flying (cronbach's α = 0.86)	Flying should be made more expensive (e.g., by carbon offsetting or higher taxes)	0.89
	UCL should discourage air travel by making carbon offsetting mandatory (making flying more expensive)	0.81
	I feel guilty when flying	0.77
	UCL should make (high-speed) train use mandatory for destinations reachable within one day by train	0.58
	Flying has a detrimental impact on our planet	0.53
Pro-online conferences (cronbach's α = 0.75)	In-person conferences/meetings are important for networking	−0.78
	Online conference/meetings do not provide the same quality as in-person conferences/meetings	−0.78
	ICs should be fully online	0.48
	Online conferences/meetings are a good alternative for in-person conferences/meetings	0.44
Pro-train (cronbach's α = 0.72)	The development of high-speed rail networks should be stimulated	0.84
	High-speed train use should be made cheaper (e.g., by subsidies)	0.67
	I like to travel by train	0.46
Pro-alternative organisation (cronbach's α = 0.63)	ICs should be organised at multiple locations simultaneously (e.g., with conference 'hubs' in multiple continents)	0.85
	ICs should focus more on regional research in one continent (thereby reducing the need to travel to other continents)	0.53
	ICs should be hybrid	0.44

[a] A factor loading represents the degree of association between the statement and the factor.

the second factor, i.e., *Pro-online*, represent positive attitudes towards the online organisation of conferences, and on the third factor, i.e. *Pro-train*, reflect positive attitudes towards the use and network development of (high-speed) trains. Finally, high scores on the fourth factor, i.e. *pro-alternative organisation*, signal positive attitudes towards more local and hybrid organisations of conferences. Hence, high scores on all factors represent sustainable academic travel attitudes. The number of factors was based on the scree plot (eigenvalue greater than 1) and interpretability. Two statements were removed from the factor analysis (i.e., 'International conferences should be organised less frequently (e.g., bi-annually instead of annually)' and 'International conferences should be organised in cities easily accessible by (high-speed) train') since they did not strongly relate to the factors (factor loadings < 0.4 on all factors), and lowered the interpretability of the factors.

In a second step, a k-means cluster analysis has been performed on the four factors to group study participants into clusters with similar attitudes towards academic travel. To determine the most appropriate number of clusters, we produced solutions for predefined numbers of clusters ranging from two to six. In the end, the five-cluster solution was chosen, mainly based on the criteria of interpretability and maintenance of statistically robust segment sizes. The ANOVA table (with p < 0.01 for all four factors) indicates that all clusters significantly differ from each other in terms of average scores on the four factors. Cluster sizes range from 12 % of the sample (smallest cluster) to 26 % of the sample (largest cluster). The five clusters are presented in Fig. 2, where the circles represent the cluster centroids, i.e., the average value of the factors presented in Table 2. The first cluster is the most conservative, with respondents (n = 140) having a positive attitude towards flying and negative attitudes towards alternatively organised or online conferences. The second cluster (n = 130) is the most progressive and represents those who like online and alternatively organised conferences and

dislike flying. Those who dislike train use but like online conferences are concentrated in the third cluster (n = 293), while the fourth cluster (n = 294) represents people who prefer to travel by train rather than flying. Members of this cluster mainly differ from those in the second cluster in that they do not have a strong attitude toward conference organisation. Finally, cluster five (n = 259) mainly contains respondents who do not like online or alternative organised conferences. Compared to cluster 1, with similar attitudes towards conference organisation, cluster 5 members tend to have a more negative stance towards flying and a more positive stance towards train use. The cluster names, incorporating members' academic travel and conference participation, are explained in the next section.

4.3. Clusters' academic travel and conference participation

Based on a combination of the cluster members' attitudes, and their academic travel and academic activity participation (Table 3), the five clusters have been labelled as follows: 1) *Conservative frequent flyers*, 2) *Progressive infrequent flyers*, 3) *In-person conference avoiders*, 4) *Involuntary flyers*, and 5) *Traditional conference lovers*. The *conservative frequent flyers, involuntary flyers* and *traditional conference lovers* are more likely to have attended an academic conference or meeting in the past 12 months compared to the *progressive infrequent flyers* and *in-person conference avoiders* (Table 3). The plane was frequently used by *involuntary flyers* and *traditional conference lovers*, and especially by *conservative frequent flyers* with almost 40 % of cluster members having flown at least twice in the past year. The train was the most popular mode for *in-person conference avoiders* and especially *progressive infrequent flyers*, although its use is relatively low (and not high compared to other clusters) as many of them did not travel for academic purposes. High-speed train is used less frequently and mostly by *progressive infrequent flyers* and *involuntary flyers*. Although for all clusters most of the trips were within the UK and Ireland, the *involuntary flyers, traditional conference lovers*, and especially *conservative frequent flyers* also frequently travel to continental Europe and the rest of the World. The average number of trips per cluster by plane and outside of Europe clearly show that *progressive infrequent flyers*, and *in-person conference avoiders* do not frequently fly or travel outside of Europe, while especially the conservative frequent flyers regularly fly to distant destinations. On average, a *conservative frequent flyer* flies more than seven times as much as an *in-person conference avoider* and travels more than six times as much outside of Europe.

Respondents who indicated that they had travelled for academic reasons in the past 12 months (n = 663) were also asked for information about their most recent academic trip (Table 3). The plane was used most frequently by *conservative frequent flyers*, followed by *traditional conference lovers*, while the train is the most used mode for *progressive infrequent flyers*, and *in-person conference avoiders*. *Progressive infrequent flyers* also regularly travel by high-speed train. The *progressive infrequent flyers* and *in-person conference avoiders* mostly travelled to nearby destinations (in UK or Ireland). *Involuntary flyers* and *traditional conference lovers* most frequently travel to Continental Europe or other parts of the world, while *conservative frequent flyers* are those most often travelling to destinations outside of Europe. *In-person conference avoiders* often had an academic trip below or equal to four hours, while trips longer than eight hours were most common for *conservative frequent flyers, progressive infrequent flyers*, and *involuntary flyers*. A conference (with more than 50 participants) was the most common type of academic activity to which members travelled for all clusters, while (project) meetings were also often attended by *progressive infrequent flyers*.

On the statement 'My participation in in-person conferences/meetings in the past 12 months is lower compared to pre-COVID' the differences in answers between clusters are limited. A majority of respondents of all clusters indicated to have lowered their in-person conference participation, except for *in-person conference avoiders* who already may had low conference participation before the pandemic. Considerable differences between the clusters were found on the
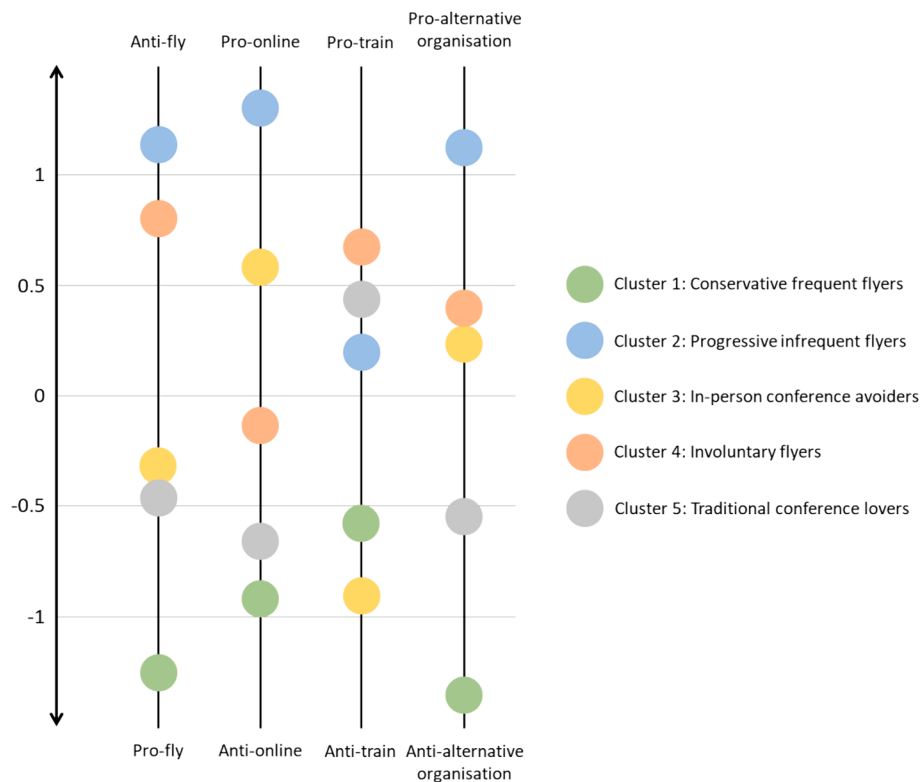
Fig. 2. Cluster centroids (i.e., the average factor value per cluster).

statement 'I now frequently attend online international conferences/ meetings'. *Conservative frequent flyers* appear to attend online conferences least frequently, while especially *progressive infrequent flyers* seem to have adopted online conferences/meetings well.

To assess the link between attitudes and behaviour, and see whether a value-action gap exists, we focused on the relationship between flying attitudes (measured by the *anti-flying* factor) and the number of conferences/meetings attended by plane in the past 12 months. In general, respondents with positive flying attitudes (negative *anti-flying* factor scores) fly more than those with negative flying attitudes (positive *anti-flying* factor scores), i.e., 0.84 versus 0.63 conferences/meetings attended by plane, respectively. Despite a one-way ANOVA indicating that this difference is statistically significant (F=4.99, p = 0.03), the effect of attitudes on behaviour seems limited (effect size (η^2) = 0.004), suggesting action-value gaps for at least some respondents. To measure whose attitudes do not match behaviour, we examined in which clusters respondents are located who frequently fly (at least to two academic activities in the last year), but have negative flying attitudes (positive *anti-flying* factor scores). In total, 91 respondents (8.2 %) can be regarded as 'hypocritical flyers'. The majority of hypocritical flyers (63.7 %) can be found in the *involuntary flyer* cluster, followed by the *traditional conference lovers* (19.8 %) and the *progressive infrequent flyers* (12.1 %).

The five clusters do not only display differences in terms of academic travel and conference participation, they also show differences in terms of socio-demographics and other characteristics (Table 4). There is a small level of variation on age between the clusters; with the oldest cluster being the *progressive infrequent flyers* and the youngest cluster being the *traditional conference lovers*. While women constitute the majority in all clusters, their overrepresentation is most pronounced among the *in-person conference avoiders* and weakest among the *progressive infrequent flyers*. PhD students are mainly found among *traditional conference lovers*, while research and teaching staff are often *progressive infrequent flyers* or *in-person conference avoiders*. Professors are more highly represented among *conservative frequent flyers*, *involuntary flyers* and *traditional conference lovers*, although the differences between

clusters are only significant for full professors.

5. Discussion and conclusions

Using a large sample of academics at University College London (UK), we show the contradictions between stated attitudes towards the environmental sustainability of academic travel and activities, the need for action on lowering conference-related emissions, and their own academic travel behaviours. The findings suggest that acceptability of actions to reduce the volume of academic travel may be met with some resistance. However, our findings also indicate where support may lie. These findings offer critical insights to aid the development of plausible actions to increase the environmental sustainability of academic conference attendance, valuable to academic institutions, conference organisers, disciplinary organisations and funding bodies.

Overall, results indicate a (modest) link between attitudes and behaviour. For instance, respondents in the most progressive cluster (*progressive infrequent flyers*) travel mostly by train to nearby academic activities and indicate to frequently attend online activities, while members of the most conservative cluster (*conservative frequent flyers*) travel frequently by plane to distant destinations and do not engage frequently in online activities. Additionally, the *traditional conference lover* also frequently attends (and flies to) in-person conferences. However, there are also some discrepancies representing a value-action gap. Although *involuntary flyers* are more sustainable in terms of academic travel than *in-person conference avoiders*, they travel more frequently to in-person events and fly more often, probably because they travel more outside of the UK. The *involuntary flyers* can be regarded as academic travel hypocrites since the majority of frequent flyers with negative flying attitudes can be found in this cluster. Similar inconsistencies between academic travel attitudes and behaviour were also found in a German qualitative study (Schrems & Upham, 2020), and a study using an international survey (Whitmarsh et al., 2020). There could be many reasons for this dissonance, including some element of 'forced' travel for career aspirations, but also academic travel may be valued as travel to

Table 3

Academic travel and activity participation of cluster members (c/m = conferences/meetings; bold: dominant alternative)[a]

	1. Conservat. frequent flyers	2. Progressive infrequent flyers	3. In-person conference avoiders	4. Involuntary flyers	5. Traditional conference lovers
Attended an in-person c/m (n = 1,116)	75.0 % [2,3]	46.9 %[1,4,5]	39.6 % [1,4,5]	66.3 %[2,3]	71.8 %[2,3]
Academic travel in past year (n = 1,116)[b]					
At least once by:					
Plane	**56.4 %** [2,3,4]	17.7 %[1,4,5]	14.3 % [1,4,5]	**42.2 %** [1,2,3,5]	**50.2 %** [2,3,4]
Train	43.6 % [2,3]	28.5 %[1,4,5]	**24.6 %** [1,4,5]	40.1 % [2,3]	40.5 % [2,3]
High-speed train	10.7 % [3,4]	10.8 % [3,4]	2.7 % [1,2,4,5]	17.3 % [1,2,3,5]	10.8 % [3,4]
Others (e.g., bus, car)	11.4 % [3]	7.7 %	5.1 % [1,5]	7.1 % [4]	12.0 % [3,5]
At least twice by:					
Plane	**38.6 %** [2,3,4,5]	8.5 % [1,4,5]	4.4 % [1,4,5]	20.1 % [1,2,3]	24.0 % [1,2,3]
Train	21.4 % [3]	**16.2 %**	10.6 % [1,4]	16.6 % [3]	15.8 %
High-speed train	3.6 %	6.2 % [3]	0.7 % [2,4]	5.1 % [3]	3.1 %
Others (e.g., bus, car)	3.6 %	3.1 %	1.7 %	2.4 %	3.9 %
Avg. number of trips per member by plane	1.74 [2,3,4,5]	0.28 [1,4,5]	0.24 [1,4,5]	0.75 [1,2,3]	1.03 [1,2,3]
At least once to:					
UK+Ireland	**51.4 %** [2,3]	**32.3 %** [1,4,5]	29.4 % [1,4,5]	45.6 % [2,3]	49.4 % [2,3]
Continental Europe	44.3 % [2,3]	16.2 % [1,4,5]	10.9 % [1,4,5]	36.4 % [2,3]	36.3 % [2,3]
Rest of World	37.9 % [2,3,4,5]	10.0 % [1,4,5]	8.2 % [1,4,5]	24.8 % [1,2,3]	28.6 % [1,2,3]
At least twice to:					
UK+Ireland	**22.9 %** [3]	**16.9 %**	12.6 % [1,4,5]	21.8 % [3]	22.0 % [3]
Continental Europe	17.9 % [2,3]	10.0 % [1,5]	3.4 % [1,4,5]	15.0 % [3]	18.2 % [2,3]
Rest of World	16.4 % [2,3,4]	3.9 % [1,5]	1.7 % [1,4,5]	6.1 % [1,3,5]	11.2 % [2,3,4]
Avg. number of trips per member outside of Europe	0.74 [2,3,4,5]	0.16 [1,5]	0.11 [1,4,5]	0.31 [1,3,5]	0.44 [1,2,3,4]
Most recent academic trip (n = 663)					
Travel mode:					
Plane	**63.8 %** [2,3,4]	21.3 % [1,4,5]	32.8 % [1,4,5]	45.6 % [1,2,3]	**55.4 %** [2,3]
Train	25.7 % [2,3,4]	**52.5 %** [1,5]	**53.5 %** [1,4,5]	39.0 % [1,3]	32.3 % [2,3]
High-speed train	3.8 % [2,4]	18.0 % [1,3,5]	4.3 % [2,4]	12.3 % [1,3,5]	5.4 % [2,4]
Bus or car	6.7 %	8.2 %	9.5 % [4]	3.1 % [3]	7.0 %
Destination:					
UK+Ireland	**35.2 %** [2,3]	**59.0 %** [1,4,5]	**61.4 %** [1,4,5]	39.4 % [2,3]	42.7 % [2,3]
Continental Europe	32.4 %	29.5 %	21.9 % [4]	33.7 % [3]	32.4 %
Rest of World	32.4 % [2,3]	11.5 % [1,4,5]	16.7 % [1,4]	26.9 % [2,3]	24.9 % [2]
Trip duration:					
Up to 4 h	30.5 % [3]	**37.7 %**	**44.8 %** [1,4]	30.3 % [3]	**35.5 %**
4 (>) to 8 (≤) hours	31.4 %	24.6 %	27.6 %	32.8 %	34.4 %
Longer than 8 h	**38.1 %**	**37.7 %**	27.6 %	**36.9 %**	30.1 %
Type of academic activity:					
Conference (50 + participants)	**68.3 %**	**58.6 %**	**62.2 %**	**61.0 %**	**61.3 %**
Seminar/symposium (<50 participants)	14.4 %	15.5 %	18.9 %	16.9 %	21.0 %
Project meeting	11.5 %	20.7 % [3,4,5]	9.9 % [2]	11.3 % [2]	8.3 % [2]
Fieldwork/research visit	5.8 %	5.2 %	9.0 %	10.8 %	9.4 %
Self-reported participation (n = 1,116)					
My participation in in-person c/m in the past year is lower compared to pre-COVID					
Totally disagree – disagree	19.3 %	13.9 %	12.3 %	14.3 %	13.9 %
Agree nor disagree	25.7 % [3]	30.0 % [3]	**44.4 %** [1,2,4,5]	26.2 % [3]	29.7 % [3]
Agree – fully agree	**55.0 %** [3]	**56.1 %** [3]	43.4 % [1,2,4,5]	**59.6 %** [3]	**56.4 %** [3]
I now frequently attend online international c/m					
Totally disagree – disagree	37.1 % [2,3,4]	20.0 % [1]	19.5 % [1,5]	22.8 % [1]	28.6 % [3]
Agree nor disagree	25.0 % [3]	18.5 % [3]	38.9 % [1,2,4,5]	27.2 % [3,5]	18.9 % [3,4]
Agree – fully agree	**37.9 %** [2,4,5]	**61.5 %** [1,3,4]	41.6 % [2,4,5]	50.0 % [1,2,3]	52.5 %[1,3]

[a] 1,2,3,4,5 = significantly different (at p < 0.05) from clusters 1, 2, 3, 4, and 5 respectively, based on one-way ANOVAs with post-hoc multiple comparison analysis using the least significant difference (LSD) method.

[b] Since respondents were asked to indicate how many times they used various modes in the past 12 months, the percentages in this section do not add up to 100 %.

wider cultural contexts; or linked to other activities, such as extended trips for visiting family, friends or holidays. This could be explored further in future research.

In terms of academic position, we found that (full) professors – mainly *conservative frequent flyers* and *involuntary flyers* – travel most frequently by plane to distant locations, which may reflect wider academic networks and increased invitations. This corroborates studies indicating that status is an important driver of academic travel, with hypermobility broadly associated with more senior scholars (Arsenault et al., 2019; Ciers et al., 2019; Whitmarsh et al., 2020). Teaching and research staff – well represented among *progressive infrequent flyers* and *in-person conference avoiders* – travel less frequently and to nearer destinations, possibly because they have fewer international links and collaborations, or may be more constrained by travel budgets. This may

partly explain the discrepancy between *in-person conference avoiders* (conservative, yet infrequent and nearby travel) and *involuntary flyers* (progressive, yet frequent and distant travel). The *traditional conference lovers* (i.e., the youngest cluster with many PhD students and assistant professors) also often travels to distant activities by plane. This may be explained by early-career researchers using in-person conferences for networking opportunities, building contacts and to seek future career opportunities (Köhler et al., 2022; Storme et al., 2013; Wenger & Turi, 2023). Not surprisingly, *traditional conference lovers* have a rather negative stance towards online conferences and alternative ways of conference organisation. In line with existing literature (e.g., Cohen et al., 2020; Jöns, 2011), we found that the cluster with an over-representation of women (i.e., the *in-person conference avoiders*) is also the cluster where members participate least frequently in in-person

Table 4
Characteristics of cluster members (n = 1,116)[a]

	1. Conservative frequent flyers	2. Progressive infrequent flyers	3. In-person conference avoiders	4. Involuntary flyers	5. Traditional conference lovers
Age (years)	39.2	40.9 [5]	38.7	39.9	37.8 [2]
Gender (women)	52.1 % [3]	50.8 % [3]	67.1 % [1,2,4]	53.7 % [3]	59.5 %
Role at UCL					
PhD student	20.7 %	13.1 % [5]	20.1 %	19.0 %	24.7 % [2]
Research staff	34.3 % [2,3]	47.7 % [1]	49.5 % [1,4,5]	38.8 % [3]	37.8 % [3]
Teaching staff	5.0 % [2,3]	12.3 % [1]	12.6 % [1,5]	8.8 %	6.9 % [3]
Assistant professor	6.4 %	3.1 %	4.1 %	7.1 %	7.3 %
Associate professor	11.4 %	10.8 %	6.5 %	8.8 %	7.7 %
Full professor	22.1 % [2,3]	13.1 % [1]	7.2 % [1,4,5]	17.4 % [3]	15.4 % [3]

[A] 1,2,3,4,5 = significantly different (at $p < 0.05$) from clusters 1, 2, 3, 4, and 5 respectively, based on one-way ANOVAs with post-hoc multiple comparison analysis using the least significant difference (LSD) method.

activities, possibly because domestic work, including childcare, is predominantly done by women.

In sum, although attitudes are to some extent congruent with academic travel behaviour, the status and role of respondents are also important. Professors and PhD students seem to prefer and attach importance to in-person events (*conservative frequent flyers, involuntary flyers*, and *traditional conference lovers* all have negative average scores on the *pro-online* factor) and therefore fly frequently to far-away destinations, independent of their attitudes to flying. Teaching and research staff, who may rely less on in-person contact, and also women, travel less frequently, and when they do travel it is largely to nearby destinations. As a result, these respondents travel mostly by train, despite the *in-person conference avoiders* not being train enthusiasts.

The relationship between (academic) attitudes and behaviour can be partly explained by psychology theories. The TPB may partly explain why clusters with conservative travel attitudes (e.g., *conservative frequent flyers*) fly more frequently than clusters with progressive travel attitudes (e.g., *progressive infrequent flyers*). For instance, the TPB indicates that subjective norms (i.e., opinions and support of significant others) can affect behaviour, which is also suggested by our results, as those feeling least guilty[3] when flying (i.e. having high factor scores on the 'anti-flying' factor), fly most frequently (i.e. *conservative frequent flyers*), and those feeling most guilty fly least frequently (i.e., *progressive infrequent flyers*). However, behaviour is also partly affected by existing opportunities and constraints (referred to as 'actual behavioural control' in the TPB, and 'facilitating conditions' in the theory of interpersonal behaviour (Triandis, 1977)). An academic may want to travel to an in-person conference by train, but if the destination is too far (or on another continent), flying may be the only option. Such an action-value gap may be the result of a context in which academic flying is normalised and stimulated. Especially for *involuntary flyers* there seems to be an inconsistency between attitudes and behaviour. Members of this cluster often acknowledge that flying should be reduced as it is bad for the environment, yet they frequently fly, potentially because they feel they have to attend these distant academic activities (Gössling & Dolnicar, 2023). *Conservative frequent flyers*, on the other hand, do not have negative flying attitudes relating to its environmental impacts. It is unlikely that this group would be unaware of the negative impacts of flying, hence, it is possible that they have adjusted their attitudes so they better match with their behaviour. By doing so, they can easier justify frequent flying and avoid feelings of discomfort and frustration linked to a dissonance between attitudes and behaviour (in line with the cognitive dissonance theory (Festinger, 1957)). On the other hand, it may be possible that they really like flying because of the network and research

opportunities it provides. Furthermore, flying habits may have developed whereby current behaviour is more strongly affected by past behaviour than by attitudes (Aarts et al., 1998). For *involuntary flyers*, for instance, this could mean that despite anti-flying attitudes and travel alternatives being available, flying is chosen because they flew to previous conferences and value this activity beyond the environmental impacts. Hence, they may be regarded as captive flyers, as they may feel that they have no other option than regularly flying. Since habits are mostly difficult to break in stable situations (Verplanken & Wood, 2006), flying frequency is unlikely to change without adequate and profound shifts in policies.

5.1. Policy recommendations and future research

It is clear that flying patterns of certain groups of academics, such as some of the clusters developed in this research, will not easily be altered. Hence, universities as well as funding bodies, academic organisations and conference organisers should think carefully about policies discouraging conference-related flying. This would ideally be done by making current behaviour (i.e. frequent flying) more difficult, stimulating desirable behaviour (i.e., infrequent, nearby conference participation), and diminishing the normalisation of academic travel which stimulates flying. To do so, we suggest five policy instruments which can help in realising goals ranging from *reducing the need for travel* to *lowering the impact of travel*. First, by devaluing in-person conference attendance (and other forms of international mobility) for academic promotions and grant funding (and in turn embracing regional conferences and virtual conference presentations), universities and funding sources can help in attenuating the existing norm of travelling to distant locations. Second, a shift to virtual attendance – by organising online conferences or conferences with hybrid sessions – will lower travel demand, and particularly longer distance travel. Doing so may also facilitate participation for those unable to travel (e.g., those with caring responsibilities) and those with limited travel budgets (due to lower conference fees). Third, a shift to less frequent conferences (e.g., biannual instead of annual) will significantly reduce travel frequency. Fourth, regional conferences, or conferences taking place in multiple hubs simultaneously can substantially lower average travel distances covered by participants. Finally, a shift to lower carbon modes could be realised by increased charges for conference-related flying, e.g., in the form of mandatory carbon offsetting,[4] extra charges imposed by universities and taken from the staff's available travel budgets, or even by using researcher carbon budgets. The revenue could be used to offset the cost of train or bus usage, or to

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[3] Studies have found that subjective norms are significantly correlated with guilt and regret (both negative self-conscious emotions), and that subjective norms can impact these emotions (Ahn & Kahlor, 2020; Kaiser, 2006).

[4] It should be noted that carbon offsetting can be criticised, as it is often used to justify continued emissions, while offsetting projects also often generate emissions. Hence, it is claimed that they only have a marginal impact on climate change (see, e.g., Anderson, 2012; McAfee, 2022).

organise and subsidise online and regional conference organisation. To further reduce air travel (also for regional gatherings), international conferences and meetings should ideally be organised in cities well accessible by train, so alternatives to flying are available.

Since tailored interventions – focusing on the needs of specific groups – have proven to be more effective in realising policy goals compared to non-tailored interventions (e.g., Abrahamse et al., 2007; Klöckner and Ofstad, 2017), we suggest diversified interventions for the various clusters. Fig. 3 gives an overview of the clusters and shows, based on our findings, which policy instruments are likely to be the most impactful. *Progressive infrequent flyers* and *in-person conference avoiders* have the lowest levels of flying and participation in distant conferences; hence the urgency to intervene in their travel behaviour is relatively low. For *in-person conference avoiders*, with a positive stance towards online conferences, facilitating virtual attendance could further lower the demand to travel. For the *involuntary flyers* and *traditional conference lovers,* the urgency is higher as members of these clusters regularly fly. For both clusters, imposing flying charges, carbon budgets and organising conferences in cities well-accessible by train could make flying a less frequently-chosen option. Devaluing international mobility and changing the existing travel norms in academia could lower the (perceived) need of attending distant conferences for both clusters. For *involuntary flyers* (with negative flying attitudes), it can reduce existing action-value gaps and allow the causal efficacy of attitudes that underpin the TPB to become stronger, while virtual participation and more regional conferences could be further stimulated for them as they do not have a distinct stance towards online or alternative conference organisations. Finally, the level of urgency is highest for *conservative frequent*

flyers due to the high levels of long-distance flying. It is this group that results in the highest levels of conference-related emissions. Charging flying and choosing train-accessible locations may discourage flying, and the *conservative frequent flyers* can be progressively charged so that they are further discouraged from these behaviours. Introducing researcher carbon budgets would have similar impacts, with funds used to subsidise other travel behaviours, such as train usage. However, lowering the need for international conference attendance and a larger focus on regional, infrequent and online/hybrid conference attendance is needed, despite negative attitudes towards online/alternative conference organisation. Devaluing international mobility in the academic reward system may lower the resistance towards these conference types as attending regional, infrequent and online/hybrid conferences would no longer jeopardise academics' career opportunities. In the end, it should not be international mobility, but mainly the advancement of knowledge enabling a more sustainable, healthy and equitable society that should lead to promotions for researchers. This can be made clearer and more transparent in career frameworks.

To strengthen the above policy recommendations, we recommend future studies to not only focus on conference attendance, but also on other types of academic activities requiring long-distance mobility. These activities, including PhD defences, project assessment panels, keynote presentations, and research consortia meetings, are often performed by more senior academics and mostly expect physical presence of academics from various institutions and countries. Furthermore, new studies may provide additional information regarding academic travel in the post-pandemic era, since the reported academic travel in this study – up to 12 months before February/March 2023 – may still have

	1. Conservative frequent flyers	2. Progressive infrequent flyers	3. In-person conference avoiders	4. Involuntary flyers	5. Traditional conference lovers
Attitudes					
Flying	+ +	- -		-	
Online organisation	-	+ +	+		-
Train use	-		-	+	
Alternative organisation	- -	+ +			-
Behaviour					
In-person participation	✓✓			✓	✓
Flying	✓✓			✓	✓
Intercontinental participation	✓✓			✓	✓
Online participation		✓✓		✓	✓
Position					
PhD student	✓				✓✓
Research/teaching staff		✓	✓✓		
Assistant professor				✓	✓✓
Associate professor	✓✓	✓			
Full professor	✓✓			✓	
Level of urgency	Very high	Low	Low	High	High
Proposed policy goals/instruments *Reducing the need for travel*					
1. Devaluing international travel	✓			✓	✓
2. Shift to virtual attendance	✓		✓	✓	
3. Shift to infrequent	✓			✓	✓
4. Shift to regional	✓			✓	
5. Shift to lower carbon modes *Lowering the impact of travel*	✓			✓	✓

Fig. 3. Overview of clusters and suggested policy goals and instruments(Attitudes: + +: avg. Factor score > 1; +: avg. Factor score > 0.5; −: avg. factor score < 0.5; − −: avg. factor score < -1; Frequent behaviour: ✓✓: cluster with highest level; ✓: cluster with high level (i.e., at least 50 % in-person attendance; plane being dominant mode for most recent trip; destination at least 50 % outside of UK for most recent trip, and at least 50 % frequent online participation; see Table 3); Dominant position: ✓✓: cluster with highest representation represented; ✓: cluster with second-highest representation.).

been affected by the COVID-19 pandemic. Although this study provides relatively detailed information on academics' travel behaviour, future studies may want to calculate the emissions from academic travel in more detail, to know which group of academics (based on career stage, attitudes, etc.) have the most polluting academic travel patterns. Finally, since findings from this study come from one UK university, we recommend future studies to analyse academic travel and related attitudes at other universities, such as universities in the Global South (with limited research funding), or universities that actively try to limit air travel.

CRediT authorship contribution statement

Jonas De Vos: Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Debbie Hopkins:** Writing – review & editing, Writing – original draft, Conceptualization. **Robin Hickman:** Writing – review & editing. **Tim Schwanen:** Writing – review & editing, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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