# Flying in the Face of Climate Change

## *Quantitative psychological approach examining the social drivers of individual air travel*

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Link to the corresponding author's Github repository containing commented R and Python code relating to the study: https://github.com/lfoswald/flying_itfo_climate_change.

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## Abstract

Aviation contributes substantially to anthropogenic climate change. This paper situates individual behaviour changes alongside technological efficiency gains and policy processes in the search for significant emission reduction in the aviation sector.

Using online survey methodology (N = 393) and expanding upon existing psychological perspectives on individual attitudes and behaviours, this study focuses on the social influence on air travel.

Considering social identity and global social networks, two new instruments, the Cosmopolitan Identity Scale (CIS) and the Global Social Interconnectedness Score (GSIS), were introduced to capture the social drivers of air travel within standardized questionnaires. Different subgroups of travellers were clustered and compared along external and psychological variables, to allow the construction of more effective policies in the aviation sector.

Overall, the awareness of environmental problems caused by flying led to a perceived dilemma between environmental attitudes and travel, which resulted in the engagement with carbon offsets. The global social interconnectedness, built through international experience, led to increased travel to visit friends and family, and an overall increase in flight kilometres. The social identification as a cosmopolitan was related to social media use and predicted flight kilometres directly, implying a particular sensitivity to social norm messages in online campaigns.



## Keywords

Travel, flying, environmental attitude, social identity, social interconnectedness, social media


## Highlights

- Ecological attitudes predict problem awareness and dilemma perception related to flying, which in turn predict the consideration of carbon offsetting.
- Three groups of travellers identified: cosmopolitans, settled travellers, and a young mainstream.
- The Cosmopolitan Identity Scale (CIS), covering various aspects of social identity in the travel context, developed and validated using factor analysis, predicts total flight kilometres.
- The Global Social Interconnectedness Score (GSIS) is related to studies abroad and travel to visit friends and relatives.

# 1. Introduction

According to the Intergovernmental Panel on Climate Change (2015) report on the mitigation of climate change, 14% of the global greenhouse gas emissions in 2010 were caused by transportation. Comparing the emissions for each transport mode in Germany, planes rank first with 201g $CO_2$-equivalent[2] per person kilometre, followed by cars with 139g $CO_2$e/pkm and public long-distance services like trains and busses with around 35g $CO_2$e/pkm (German Environment Agency, 2018). Despite most governments' agreement to heavily reduce carbon emissions by 2020 and the warnings of UNWTO, UNEP, and WMO (2008) that tourism and especially air travel have become significant contributors to climate change, emissions in the aviation sector continuously increased over the past decades (IATA, 2017). Even though the heavily restricted individual mobility during the COVID-19 pandemic caused a major dip in transport related emissions, they are expected to rise back to normal rates with possible catch-up effects once the travel restrictions are revoked (Henriques, 2020). Some fear a slow-down of policy efforts to cut airlines' emissions as a consequence of the COVID-19 pandemic (Plumer & Tabuchi, 2020).

Despite the evident climate impact of air travel, there is a noticeable discrepancy between environmental concern and travel behaviour, particularly with regard to transcontinental flying among young adults (Schipperges, Gossen, Holzhauer & Scholl, 2019; IATA, 2017; Howe & Strauss, 2000). A parallel development to this phenomenon is the increasing demand for geographic mobility to enhance career options resulting in a perceived pressure to gain international experience (McKenna & Richardson, 2003). Furthermore, social scientists consider the property of "being well travelled" a novel indicator of social status (Urry, 2012). Others define travelling as a form of consumption to perform, refine, or modify social and personal identities (Gram, 2005), and suggest that all tourist experiences are somewhat motivated by identity needs (Bond and Falk, 2013). The concept of global citizenship, as described by Reese (2016), provides a possible explanation for the apparent gap between young adults' environmental attitudes and their carbon-intensive travel behaviour. Those with a high expression of the so-called "Common

[2] Including greenhouse gases such as methane, perfluorocarbons, and nitrous oxide (Intergovernmental Panel on Climate Change, 2015)

Human Identity" have a stronger perception of environmental injustice relating to the unequal distribution of climate change consequences between the Global North and the Global South. Therefore, they develop a stronger pro-environmental attitude. Conversely, they may also have a greater motivation to travel as an expression of their connectedness to the global community. Hibbert, Dickinson, Gössling, and Curtin (2013) argue in line with Reese (2016) that the gap between environmental attitudes and travel behaviour could be caused by competing identities requiring different actions. While taking a long-haul flight (e.g. to visit family members) poses a threat to an ecologically aware identity, the family identity can be emphasized to justify the behaviour.

Although the relevant literature suggests a complex set of social and psychological drivers that motivate individual travel in addition to external and economic factors, these assumptions remain largely under-researched with systematic quantitative methods. While economic factors like cost and time and social factors like family commitment and the personal desire to "see the world" can outweigh the consideration of a travel's impact on climate change (Frew & Winter, 2009), it is highly important to systematically examine the social and psychological drivers of air travel. Therefore, this study examines the quantitative effects of psychological variables identified in the literature such as identity and social interconnectedness through an online survey. We differentiate between subgroups of travellers and control for external effects of social media use and studies abroad when examining the perceived dilemma between environmental attitudes and travel, the reported purchase of carbon offsets, and, most importantly, an individual's reported travel behaviour. From the existing literature, covering mostly qualitative investigations, we derive three exploratory research questions to be addressed in a quantitative environmental psychology approach. We (1) examine psychological factors influencing travel behaviour, (2) identify and compare various subgroups of travellers, and (3) investigate the internal structure of social identity related to travel. Within the method section, we introduce the survey data and the methods used for the analyses. For better readability, the technical details of the statistical methods are reduced to a minimum, but the full statistical code is available on the author's GitHub repository[3] with extensive comments on the methodology.

[3] Hyperlink will be included after peer review (not anonymous)

# 2. Theoretical Background

## 2.1. The role of behaviour change for effective emission reduction

In order to achieve the "well below 2°C" target set in the Paris agreement, emissions must be reduced dramatically (United Nations, 2016). Within the transportation and aviation sector, significant emission reductions can be achieved through a mixture of technological efficiency gains, policies that regulate the aviation market (e.g. by including aviation into the EU Emission Trading Scheme (ETS)[4] or establishing a carbon tax) and by individual behaviour changes. Nevertheless, efficiency gains are likely to be offset by rebound effects, as previously demonstrated by various examples in the field of transportation (Santarius & Soland, 2018; Evans & Schäfer, 2013; Wang, Zhou & Zhou, 2012; Hymel, Small & Van Dender, 2010). In the case of aviation, an improvement in fuel efficiency could lead to a further decrease in flight prices, incentivizing customers to fly more often or to choose further destinations. To prevent such development with a regulatory framework, public policy support is a key factor in democratic systems. Especially in the context of environmental governance, the consequences of lacking public support for progressive environmental policies was observed in various examples, such as the country wide proposal of a "veggie day" or the large-scale installation of wind farms in Germany (Cordts, Nitzko & Spiller, 2014; Jobert, Laborgne & Mimler, 2007). Also, a lack of public support is often driven by emotions (Smith & Leiserowitz, 2014) and can lead to the failure of environmental policies (Laitos & Okulski, 2017), losses of green parties in elections (Rüdig, 2014), or a prevention of regulation implementation in the first place. Therefore, some consider citizen involvement as one of the most important conditions for effective environmental governance (Jeong, 2002). Nevertheless, some policies actually follow a change of public consensus: for example, in the case of the abolition of corporal punishment which was only

[4] Another critical political issue in the field of aviation is the continuing inability to include air transport and tourism into global emission trading schemes (ETS) (European Federation for Transport and Environment, 2019). Although aviation was introduced into the EU emission trading scheme (EU-ETS) in 2012, covering all flights to and from EU airports, the scope was reduced to intra-EU flights only, as a response to significant international and industry pressure, known as "stop the clock" (European Federation for Transport and Environment, 2019). This status implies that airlines are not required to report emissions and surrender allowances. Following many years of discussions, ICAO (International Civil Aviation Organization) agreed to implement a global market-based measure, called CORSIA (Carbon Offset and Reduction Scheme for International Aviation). Unfortunately, this measure will be voluntary until 2026 and is mainly based on offsetting measures, leaving many important questions open (European Federation for Transport and Environment, 2019; Filzmoser, Todts, & Johnson, 2018).

formally abolished by Sweden in 1979, Germany in 1998, the Netherlands in 2007, Ireland in 2015 and France in 2019, long after the public norm shifted (Zolotor & Puzia, 2010; Durrant & Olsen, 1997). In the environmental context, the efforts of various governments to phase out nuclear energy after the Fukushima disaster are another example of public attitudes, their risk assessment in particular, motivating regulation (Arlt & Wolling, 2016; Kunsch & Friesewinkel, 2014; Kim, Kim & Kim, 2013; Schreurs, 2013; Goebel, Krekel, Tiefenbach & Ziebarth, 2015). Furthermore, in liberal democracies, policies are closely linked to market regulation which reacts to consumer needs. For example, alongside individual behaviour changes, a shift in public opinion previously triggered market reactions and policy processes in the case of genetically modified food (Baker & Burnham, 2001).

Consequentially, when considering the role of individual behaviour and psychology as the science of understanding emotions, motivations, and behaviours of socially embedded individuals, this study's aim is to shed light on the impact of social influence on air travel. Following a quantitative environmental psychology approach, drivers of individual behaviour and key barriers to effective governance and market regulation for emission reduction in the aviation sector are examined.

**Research Question 1:** What are the psychological factors that influence travel behaviour, particularly flying?

## 2.2. The psychology of air travel in the face of climate change

In order to choose specific psychological constructs for the following analyses, an extensive literature review of psychological investigations of travel behaviour and environmental concern was conducted. Looking at behaviour predictors, travel appears to be substantially different from other environmentally relevant behaviours (Alcock et al., 2017; Böhler et al., 2006). This apparent discrepancy between environmental attitudes and travel behaviour has primarily been analysed within tourism and marketing research. Underlying psychological variables have hardly been discussed so far, and if so, mostly in the form of qualitative interviews. In the case of tourism, including flying, climate change awareness has little effect on consumption (Anable, Lane, & Kelay, 2006; Dickinson, Robbins, & Fletcher, 2009; Eijgelaar, Thaper, & Peeters, 2010; Hares, Dickinson, & Wilkes, 2010; McKercher, Prideaux, Cheung, & Law, 2010). As one of very

few quantitative psychological approaches to examine travel behaviour with regard to environmental attitudes, Alcock et al. (2017) found that attitudes, namely pro-environmental value orientation and concerns about the risks of climate change, are related to overall household behaviour in the UK but do not affect decisions on air travel. They focused on leisure flights, where voluntary behaviour changes might occur. McDonald, Oates, Thyne, Timmis, and Carlile (2015) made use of qualitative interviews to investigate "self-picked green" consumers' own rationales for the intention-behaviour gap in terms of flying behaviour. In their sample, journey duration was by far the most common justification related to the travel product. Another common justification of travel was the attribution to external forces, such as visiting family or attending conferences. The third subgroup of rationales, justifications related to personal identity, included explicit evaluations of the competing ideal of being "well-travelled" by cumulating experiences of taking many flights over time.

There are several approaches to predict and explain everyday travel mode choice in the field of environmental psychology. Heath and Gifford (2002) extended the Theory of Planned Behaviour (TPB) (Ajzen, 1991), a theoretical framework including attitudes, subjective norms, and perceived behaviour control, to predict and explain the use of public transportation. Davison, Littleford, and Ryley (2014) used a similar approach to model air travel. They identified four different segments of participants according to their attitudinal statements towards flying and climate change, ranging from a segment with a positive attitude towards alternatives to flying and a high level of agreement that air travel affects climate change, to a segment of frequent flyers with correspondingly contrary beliefs. Including the additional construct 'awareness of consequences and world view' and the 'intentions to reduce flight dependency, accept higher airfares, adapt everyday behaviours and select alternatives to flying' the best prediction was achieved for the sub-group having difficulties to find alternatives to flying, but an understanding of air travel's impact on climate change ($R^2 = .26$). Based on their findings, in our study, an extended TPB model was used with the additional component of desire to travel, as suggested in the Theory of Behaviour Choice (TBC) Framework of Gifford, Lacroix, and Chen (2018).

Findings in the field of tourism research point to a high-income, environmentally conscious group of people with a tendency towards frequent long-haul travel, and therefore with an exceptionally high carbon footprint. Böhler, Grischkat, Haustein, and Hunecke (2006) identified four travel groups, that varied according to socio-demographics, psychological factors, number of

holiday trips and travel mode when examining the kilometres travelled and the choice of transportation mode of German citizens ($N$ = 1991). The smallest group (10.7%) – the long-haul travellers – travelled more often to distant destinations, using air travel for more than 60% of their trips. They were responsible for 80% of the greenhouse gas emissions of the whole sample. The group showed the highest level of education and mainly consisted of young adults before starting a family (26-35 years), and of working adults after the children moved out (51-65). In this sample, ecological awareness was not related to refraining from overseas travel. It seemed more like the opposite: 38.7% of the long-haul travellers attached very high importance to saving the environment and respecting earth, resulting in a high score on the construct self-transcendence.

Assuming that an individuation of policies for different groups can lead to more effective strategies of environmental governance (Hine et al., 2014), in our study, we included psychological variables into the clustering process of refining the segmentation of travellers, in order to facilitate efficient, accurate, and individualized policy making.

**Research question 2:** Can different groups of travellers be identified according to demographic and psychological factors?

## 2.3 Social identity and global social networks

Referring back to McDonald et al.'s (2015) finding that explicit evaluations of the competing ideal of being "well-travelled" by cumulating experiences of taking many flights over time served as justification for the gap between environmental attitude and flying behaviour, the construct of identity comes into play. According to the social identity theory, individuals derive a significant part of their identity from their attachment to certain social groups (Tajfel, Turner, Austin, & Worchel, 1979). They categorise themselves as components of social units of higher order that vary in their level of inclusion from lower (e.g. family, friends, sports clubs) to higher (e.g. country). According to Reese (2016), this level of inclusion rises up to a superordinate level that represents all humans, implying a "Common Human Identity" (CHI). Various studies support that identification on this highest level is related to pro-social behaviours with the potential to lead to pro-environmental behaviour mediated by the stronger perception of global environmental injustice (Buchan et al., 2011; McFarland, Webb, & Brown, 2012; Reysen & Katzarska-Miller,

2013). Nevertheless, international contact is an antecedent for the formation of a common human identity, implying that air travel is a related factor (Römpke, Fritsche & Reese, 2019).

Social identity was also considered in tourism research by Urry (2012) who showed that an individual's standing in society can be reflected in mobility patterns which, in consequence, incentivises air travel from a status perspective. Supporting the idea of social status achieved by travelling, Pearce and Lee (2005) developed the so-called "travel career ladder", stating self-actualisation and self-development, the realisation or fulfilment of one's potentials, as major motivators for travel to culturally different destinations. Furthermore, Desforges (2000) examined the forces of travel consumption by analysing the decision of British travellers to take their first long-haul trip and their homecomings under the aspect that experiences are used to present new self-identities. Using in-depth interviews, he discovered that most travellers imagine long-haul travel as an opportunity to accumulate experience, which is further used to re-narrate and represent a youthful self-identity, and to provide an important, informal qualification for several professions.

In line with enlarging global social networks (Mau, Mewes & Zimmermann, 2008), the phenomenon of VFR travel, trips taken to visit friends and relatives, started gaining attention in the scientific community. Hibbert et al. (2013) conducted an interview study dealing with the influence of identity on the environmental attitude-behaviour gap in the case of tourism mobility, emphasising the desire to travel in order to maintain relationships with friends and family members. Visiting significant others can enable more adventurous travels because of a higher perceived security at the travel destination, or even lead people to undertake travels to undesirable destinations, e.g. in case of long-distance relationships (Andersen & Chen, 2002). Consequentially, in our study, we constructed an estimate for an individual's global social interconnectedness to enable the inclusion of this social factor into our quantitative model to explain individual travel.

Due to the young age of the apparent high-impact subgroup of frequent travellers, in our study, we also accounted for social media use in the travel context. Lo and McKercher (2015) targeted this field with a tourism research perspective and focused on the selection of photos for social media, which appeared to be intimately linked to impression management. It extended up to the decision of whether to take a camera on a trip. They suggested that social media facilitates social comparison, which contributes to the rapid redefinition of the tourist gaze, including destination image and travel decisions (Lo & McKercher, 2015). Previous studies related the

motivation structure behind the behaviour of sharing travel experiences on social media to self-centred motivations, such as gaining respect and recognition or increasing social ties, as well as community-related motivations, like sharing reviews and giving recommendations for others (Munar & Jacobsen, 2014). They found rather low agreement to the 'motivation for gaining recognition' but accentuate that this could be due to the 'Scandinavian attitudes' of their sample and the specificity of Mallorca, the examined travel destination, as well-known mainstream holiday destination, and call for future research on these specific self-centred motivations.

The reviewed literature concerning social identity in the context of tourism suggests that there is more that drives travel behaviour than the individual psychological variables suggested by the TPB (Ajzen, 1991). To systematically uncover the internal structure of social identity concepts in the context of young adults' travel behaviour, this study examines a third research question:

**Research question 3:** How is social identity structured in the context of air travel, and how does it shape travel related attitudes and behaviour?

# 3. Methods

Following a quantitative environmental psychology approach, this study was conducted as non-experimental online survey. Participants self-reported all variables on visual analogue scales or by selecting multiple choice categories. Both allowed a direct quantitative analysis of answers. Due to a lack of extensive prior findings in a comparable context at the time of the study that would have allowed the formulation of clear outcome expectations, research questions were formulated instead of strictly testable hypotheses. Consequentially, the analysis pipeline of this paper follows a more exploratory approach.

## 3.1. Questionnaire

Generally, one psychological construct, measured on a scale, consists of various items or questions that are aggregated when certain statistical assumptions are met. These assumptions were tested with item analysis for scales that were adapted from existing literature, such as the Theory of Planned Behaviour (Ajzen, 1991) or the Theory of Behaviour Choice (Gifford et al., 2018).

With the exception of the Common Human Identity (Reese, 2016), the identity related constructs were a novelty of this study. Therefore, their structure was statistically explored within a pre-study using exploratory factor analysis and validated within the main study using confirmatory factor analysis. Table 1 provides an overview of all measured constructs.

Table 1

*Scales included in the questionnaire*

| **Scale** | **Number of items** |
|---|---|
| Attitude towards flying[1] | 6 |
| Problem awareness of the environmental impact of flying[1] | 5 |
| Environmental attitude[1,3] | 15 |
| Common human identity[2,4] | 5 |
| Social norm to travel[2] | 4 |
| Professional norm to travel[2] | 5 |
| Social pressure to travel[2] | 7 |
| Perceived dilemma between environmental attitude and flying[1] | 3 |
| Subjective norm of flying[1] | 4 |
| Perceived Control - travel mode and destination choice[1] | 3 |
| Desire to fly[1,5] | 3 |
| Openness for alternatives to flying[1] | 6 |
| Experience of negative effects of flying[1] | 5 |

*Note.* [1]related to the Theory of Behaviour Choice or Theory of Planned Behaviour (TPB, Ajzen, 1991); [2] subscales of the Cosmopolitan Identity Scale (CIS).[3] (Roser-Renouf et al., 2008). [4] (Reese, 2016). [5](Gifford et al., 2018).

The pre-study was conducted on a Canadian student sample ($N = 105$) and investigated the furthest six trips taken in the past two years and the furthest four future trips planned for the next

year, including various transport modes. This study already included most of the scales that are presented in the present work.

The main study ($N$ = 393) was conducted on an international, mainly German, sample. Participants were recruited via Facebook, academic networks, and private contacts. This non-representative sample suits the research objective because the theoretical assumptions focus on the subgroup of highly educated young adults in wealthy industrialized countries. The questionnaire was launched in German and English. After testing for differences in the language subsamples, the data sets were combined.

The scope of the travel behaviour was reduced to flights only. Participants were asked to state all of their past and future flights in a one-year range. To economise the coding process of travel destinations, the distances were calculated within a Python programme, automatizing a web scrape request to a distance calculator website, using the start and destination points the participants entered as free text. For technical reasons, the numbers of past flights and future flights were limited to 25 flights each. Some participants noted that their number of flights taken or planned exceeded this limit. We also considered the level of voluntariness (measured on a visual analogue scale ranging from “not at all voluntary” to “fully voluntary”) for every flight, the overall estimated percentage of flights taken to visit friends and relatives (VFR travel), fear of flying, and the considered or past purchase of carbon offsets. Following the flight question block, all psychological constructs were captured in the form of visual analogue scales, ranging from “strongly disagree” to “strongly agree” in randomized order. To control a conscientious answering of the questionnaire, three attention items were included. In addition to the demographic variables like age, gender, city of residence and education, at the end of the questionnaire, we also enquired the use of social media in the travel context and the financial situation, with three items each. Furthermore, a multiple-choice question was included to ask whether participants took most flights for leisure or professional reasons and if participants have ever lived or studied abroad.

## 3.2. Global social network

In the pre-study, we found an enormous variation within the estimation of a global social network, investigated with the number of friends, relatives and professional contacts abroad. Very few participants indicated to have up to 100 friends or relatives in different countries, whereas the

majority had no or maximum three international contacts. Following this finding, the measure was further elaborated. Between the flight question block and the psychological variables, participants were asked to name the location and perceived closeness of relationships to friends, relatives and professional contacts abroad. This closeness of ties represents a proxy for the travel motivation to visit a person. With the aim to compare the social interconnectedness of participants, we were interested in calculating a comprehensible value for global social interconnectedness that allows meaningful interpretation in regression models. We were not particularly interested in the links between named individuals, but in the range of the global social network from the participants' perspective. In order to meet those requirements, a score for global social interconnectedness (GSIS) was developed:

$$GSIS = \sum_{l=1}^{k} d_l \left( \sum_{i=1}^{m} c_{li} \right)$$

- Places: $P = p_1, p_2, \ldots, p_k,\ 1 \leq l \leq k$
- People: $F = f_1, f_2, \ldots, f_m,\ 1 \leq i \leq m$
- Distances of places with people: $d_l$ (km)
- Closeness of connection with person: $c_{li} \in \{R \mid 1 \leq c_{li} \leq 101\}$

According to the equation, firstly the closeness scores ($c_{li}$) for people ($f_i$) in one place ($p_l$) are summed up. Then the closeness sum is multiplied with the distance ($d_l$) of the place. Secondly, the products of all places are summed up.

## 3.3. Traveller profiles

According to Hine et al. (2014), audience segmentation procedures that minimise within-group differences and maximise between-group differences can help to construct effective policies

for diverse groups of people. The motivations and drivers for air travel can differ enormously between people, implying different inhibitors and facilitators of behaviour change.

In order to identify homogeneous subgroups within our heterogeneous sample consisting of different types of frequent or less frequent travellers, a latent class model was used. Latent class models relate multivariate observed constructs to a set of latent variables. In our case, the observed constructs are: the problem perception of the environmental impact of flying, the expression of a cosmopolitan identity, social media use, age, the financial situation, and the amount of travel to visit friends and relatives. The latent variables in latent class models are discrete, enabling the nomination of classes, in our case, different groups of flyers. A group is characterised by a pattern of conditional probabilities, indicating a chance that the observed variables take on certain values (Collins & Lanza, 2010). The widely used method of latent class analysis (LCA) requires discrete answers in the observed variables. As our observed variables have mixed scales—most of them are metric variables—a latent profile analysis (LPA), in the form of model-based cluster analysis, was applicable in our case.

In order to validate the classification, the differences in flight kilometres, the experienced negative effects of travel, the expression of the perceived dilemma, the openness for alternative travel modes, and the extent of voluntariness of flights were tested using univariate Analyses of Variance (ANOVA).

## 3.4. Power Analysis

In order to determine the optimal sample size for this study, an a priori power analysis was calculated (Faul, Erdfelder, Lang, & Buchner, 2007). Assuming a small to medium effect size of 0.1 (Cohens $f^2 = \frac{R^2}{1-R^2}$ ), setting the power to 0.95 and the alpha-error probability to 0.05, and assuming around 10 predictors for the regression analysis, a sample size of 254 participants was suggested. Considering that different effects might occur between the traveller groups, another power analysis was calculated, assuming an ANCOVA model with two groups and 10 predictors and a model with three groups and 10 predictors. Expecting a rather small to medium size effect, we decided to aim for a sample of $N > 300$.

### 3.5. Sample

The sample included the answers of $N = 393$ participants, collected via the online survey platform SoSciSurvey (Leiner, 2016). 135 participants reported male, 254 female, and three participants indicated "other" when gender was asked; the mean age was $M = 30.21$ ($SD = 10.72$). The educational level was distributed as follows: Six participants completed grade school, 20 completed secondary school, 84 indicated to have some university or college degree, 141 had a bachelor's and 122 a master's or professional degree, 20 participants indicated PhD as their highest degree. 328 participants filled out the German version of the survey, whereas 65 chose the English version. The English version was provided in order to reach a wider sample and to control for language effects between the pre-study and the present study. 46.06% of participants indicated to have studied at least one semester abroad, 55.47% have lived in another country for a longer period of time.

## 4. Results

All statistical analyses were calculated within the open source software for statistical computing, R, version 3.5.1 (R Core Team, 2018). The R code (with extensive comments on the methodology) is available online.

The following paragraphs describe the reported travel pattern, the analysis of participants' global social interconnectedness, and the statistical comparison of differences in the reported social network between participants who did or did not study abroad in the past, in order to obtain a first estimate of the effect of studies abroad on the global social interconnectedness. Afterwards, the research questions are addressed (in reversed order), starting with the internal structure of social identity in the travel context, followed by the identification of different traveller groups, and finally examining the psychological variables driving young adults' travel behaviour and their relationships between each other.

## 4.1. Travel pattern

On average, participants travelled 11,844.40 km (*SD* = 15,517.54 km) by plane in the past year and planned to fly 7,804.75 km (*SD* = 13,536.55 km) in the next year. The total number of reported past and planned flights was *M* = 6.3 (*SD* = 6.76), 26.39% (*SD* = 31.99) of which were taken to visit friends and family members. 59 participants indicated to have taken most flights for work or educational reasons, the majority, 206 participants flew to their holiday destinations, 3 participants mainly flew to take part in international sports events, 68 flew for their political or social engagement, 51 flew to visit friends and family, and 6 participants indicated to refuse flying in general. Within our sample, only 26.72% of participants did not take any flight in the past year. Among the flights taken (*N* = 2,474), 34.88% were national flights (below 1,000 km), 41.31% were considered as continental flights (between 1,000 km and 5,000 km), and 23.81% were intercontinental flights (between 5,000 km and 20,000 km). Within the environmental attitude scale (Roser-Renouf & Nisbet, 2008), one item asked whether participants intended to "take fewer trips by plane", which was checked by 44.53% of the participants.

## 4.2. Global Social Interconnectedness Score - GSIS

The mean number of reported international contacts was *M* = 2.54 (*SD* = 2.64). Based on the locations of friends, family members or work contacts and the participants' city of residence, the distance to reach their contacts by plane was calculated with the help of a Python script (code is available online). The mean overall distance to reach all international contacts was 12,220.21 km per participant (*SD* = 16,317.55 km). Based on this distance and the reported closeness of the relationship, the Global Social Interconnectedness Score (GSIS) was calculated for each participant. For illustrative reasons, the GSIS value was divided by 100,000. There was a significant difference in GSIS for people who studied a semester abroad (*M* = 11.02, *SD* = 12.63) and those who did not (see figure 3, *M* = 4.33, *SD* = 7.89) ($F(1, 391) = 40.82$, $p < .001$). Furthermore, GSIS was positively correlated with the amount of VFR travel ($r = .203$, $p < .001$) and the expression of the Cosmopolitan Identity (CIS) ($r = .201$, $p < .001$).

## 4.3. Cosmopolitan Identity

To answer the third research question, concerning the internal structure of the social identity in the context of international travel, the "cosmopolitan identity", 25 items enquiring various aspects of the social drivers of travel were grouped into sub-factors of the cosmopolitan identity, based on the statistical characteristics of their answering pattern. The aim of this procedure is the creation of a robust and valid scale with subscales that can be used in future questionnaires to further examine the social influence on air travel.

While the first version of the Cosmopolitan Identity Scale (CIS) was constructed on a Canadian student sample, this study aimed at validating this identified structure with a new, larger sample using Confirmatory Factor Analysis. The final CIS consists of four factors: the Social travel norm (7 items) that also contains the TPB (Ajzen, 2002) subjective norm items, Professional travel norm (6 items), Common human identity (Reese, 2016) (5 items) and Social Pressure to travel (7 items). The item "Travelling shows that you are independent." did not fit into any of the four factors and was therefore excluded from the CIS item pool. Table 2 shows the fit indices of the Confirmatory Factor Analysis (CFA), and Table 3 presents the item wordings of the final subscales of the cosmopolitan identity scale, except the common human identity scale that was adopted from Reese (2016).

Table 2

*Comparison of the model fit criteria for CFA models*

| Indices | **Empirical model** **4-factor solution** | General CIS 1-factor model |
|---|---|---|
| *Chi²/df* (*p-value*) | **2.944 (< .001)** | 6.812 (< .001) |
| *CFI* | **0.81** | 0.435 |
| *RMSEA [90% CI]* | **.077 [.071; .082]** | .128 [.123; .133] |
| *SRMR* | **0.089** | 0.156 |
| *BIC* | **88057** | 92898 |

Note. The *BIC* is reported with sample size adjustment. For good model fit, the cut-off value for the *RMSEA* and the *SRMR* is < .08, the *CFI* should be

> .90, a significant $Chi^2$ result rejects the null hypothesis of a perfect model fit.

The empirical model's RMSEA and SRMR indicate a good model fit (< .08), whereas the CFI is slightly below the cut-off criterium for good model fit (> .90) (Hooper, Coughlan, & Mullen, 2008). The $Chi^2$ result rejects the null hypothesis that the model fits the data perfectly but is highly sensitive to sample size, which is why more weight was given to the RMSEA and SRMR. Although the model considering a G-factor of cosmopolitan identity does not show sufficient fit indices in CFA, the CIS aggregate was used as proxy for some further analyses. Cronbach's Alpha of the overall construct is 0.796, indicating an "acceptable" or "good" internal consistency of the construct (Lavrakas, 2008).

Table 3

*Item wordings of the Cosmopolitan Identity Scale*

| **Subscale** | **Items** |
|---|---|
| **Social Norm of Travelling** | 1. One should see as much of the world as possible.<br>2. Interesting people have been to a lot of exotic places.<br>3. We should travel while we are young.<br>4. Most people like me approve of long-haul travel.<br>5. Most people who are important to me refuse to take long-haul flights. (reversed)<br>6. Most people like me would never choose a travel destination that can only be reached by aircraft. (reversed)<br>7. Most people who are important to me prefer to use alternative travel modes instead of flying. (reversed) |
| **Professional Norm of Travelling** | 1. Having travel experience is an important unstated qualification.<br>2. My career options improve when I am open to travelling a lot.<br>3. Flexibility concerning the workplace is a main requirement for success.<br>4. I should have at least one long-term international experience.<br>5. Successful people travel a lot for their jobs.<br>6. Most people who are important to me have recently taken long-distance flights. |

| | |
|---|---|
| **Social Pressure to Travel** | 1. Others judge me based on my travel experience.<br>2. I feel social pressure to travel the world.<br>3. I wish I had travelled to more exciting places.<br>4. I am impressed by people who travel a lot.<br>5. In certain conversations about travel I felt excluded at one time or another.<br>6. I feel ashamed that I have travelled less than most others.<br>7. I think I did not travel enough to be interesting. |

*Note.* For item wordings of the Common Human Identity factor, see Reese (2016).

## 4.4. Classification of traveller groups

To address the second research question on whether different groups or "market segments" of travellers can be identified, the next section describes the results of a procedure to determine groups, based on a statistical model. The variables included in the model in order to determine the groups were chosen based on theoretical assumptions, whereas the model parameters themselves were determined statistically[5].

The model predicts the probability of membership for each participant in each profile. Figure 1 displays the mean values and their standard errors on each profiling variable for each profile (Rosenberg et al., 2018).

We found three groups of travellers with different profiles that appear as follows: Travellers corresponding to Class 1 are rather young, have a high expression of cosmopolitan identity, use social media rather intensively, have a comparably low financial budget and travel frequently to visit friends and relatives. The group corresponding to Class 1 includes 70 participants that will be further referred to as "cosmopolitans". Participants in Class 3 ($N = 47$) are older than the remaining sample, show a lower expression of cosmopolitan identity, do not use social media frequently, have a rather high income and show rather low VFR travel. This group will be termed "settled". As to the psychological variables and the travel variables, the remaining sample ($N = 276$) ranges somewhere in between, but it has about the same age as the

[5] According to the optimal fit criteria determined in the Analytic Hierarchy Process (AHP; Saaty, 1990), and a non-significant BLRT (Stanley, Kellermanns, & Zellweger, 2017) of the four-profile model, a model with three classes, varying means, equal variances, and equal covariances of the profiling variables, was chosen.

"cosmopolitans". The group corresponding to Class 2 will be referred to as young adult "mainstream". All travellers show a similar expression of problem perception.

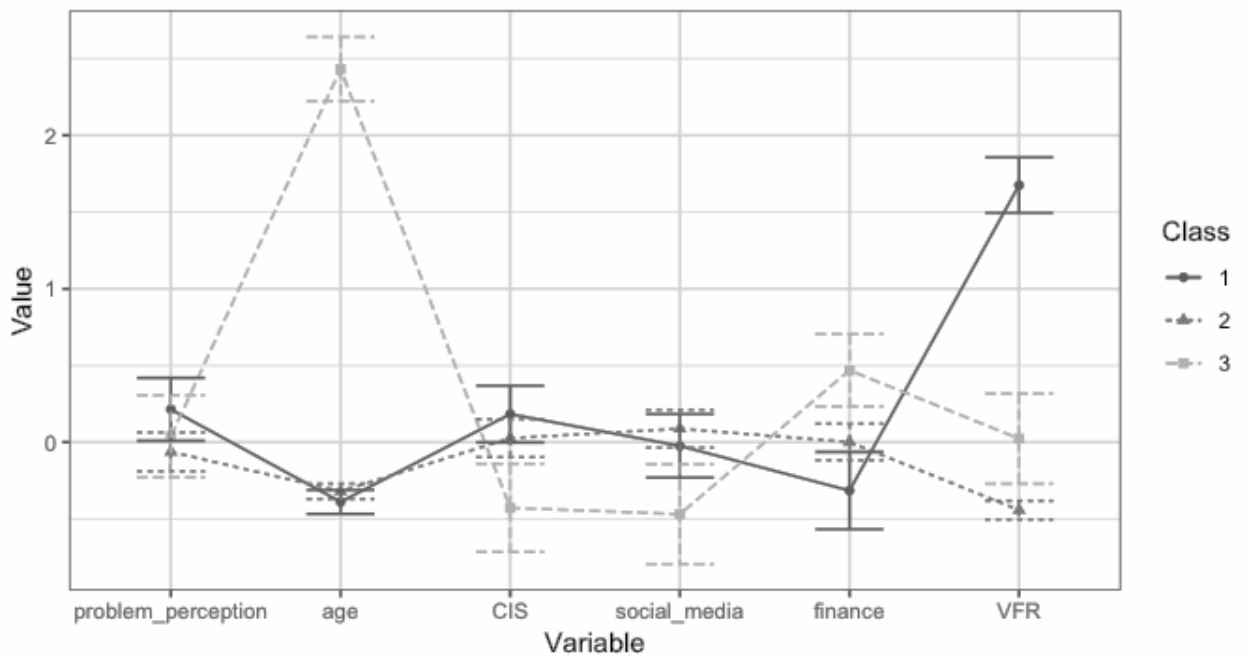


*Figure 1.* Result of the Latent Profile Analysis (LPA). Class 1: cosmopolitans, Class 2: mainstream, Class 3: settled travellers.

To control the validity of the model that identified the traveller subgroups, the groups were statistically compared using a set of variables different from the one included to build the model. These comparisons between the traveller groups were conducted in the form of one-way ANOVAs for the validation variables: flight kilometres, dilemma, negative effects of travel, openness for alternative travel modes, and voluntariness of flights. There is a significant difference in total flight kilometres for the different traveller groups ($F(2, 390) = 5.45$, $p = .004$). Cosmopolitans flew the most with 22,915 km, the mainstream group flew 20,436 km, and the settled group took only 8,489 km by plane (see figure 4). Considering the psychological variables for validation, we found a significant difference in the perceived dilemma between environmental attitudes and travel behaviour ($F(2, 390) = 18.77$, $p < .001$). Cosmopolitans experience the highest dilemma and the settled group experiences a significantly lower dilemma than both other groups. While the settled group takes the least kilometres by plane, they experience more negative effects of travelling than the mainstream ($F(2, 390) = 10.08$, $p < .001$). The cosmopolitan group is significantly more open

for alternative travel modes than both other groups ($F(2, 390) = 3.19$, $p = .04$). Both extreme groups, the cosmopolitans and the settled group, showed higher voluntariness of flights than the mainstream group, but the value did not reach statistical significance ($F(2, 390) = 2.92$, $p = .055$).

## 4.5. Structural Equation Models

Finally, in order to locate the social factors of air travel (captured with CIS and GSIS) within the context of other, external or more established individual psychological variables, the first research question concerning the psychological variables motivating young adults' air travel was analysed using a procedure that examines the effects of variables. At the same time, we considered their relations between each other. Based on relationships found in the literature, five sub-streams of effects, relating to different contexts or narratives, were defined in the form of structural equation models (see figure 2). As this study follows a more exploratory approach, the structural equation models did not aim at testing a priori stated hypotheses, although they were constructed based on theoretical assumptions.

The theoretical assumptions were visualized within a path model and then statistically explored using structural equation models in five submodels.

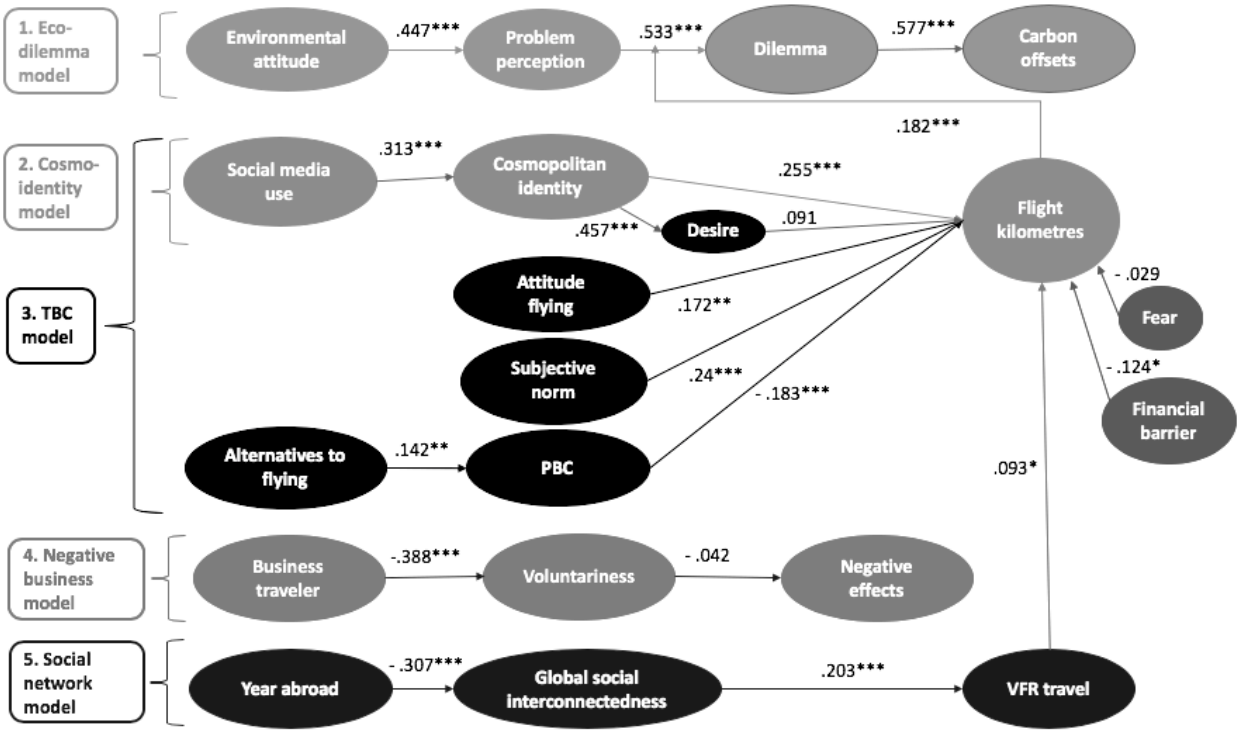

*Figure 2.* Structural equation model calculated in five submodels. *Note*: Standardised Beta coefficients. *** p < .001, ** p < .01, * p < .05. The thresholds for statistical significance vary across the submodels because of different degrees of freedom. Cosmopolitan Identity – CIS, Global Social Interconnectedness – GSIS.

We found that a high expression of environmental attitude was positively related to an increased problem perception of the environmental impact caused by flying ($\beta$ = .447, $p$ < .001). Furthermore, a high problem perception was related to an increase in the perceived dilemma ($\beta$ = .533, $p$ < .001), positively moderated by flight kilometres taken and/or planned ($\beta$ = .182, $p$ < .001). A strongly perceived dilemma resulted in the engagement with carbon offsets ($\beta$ = .577, $p$ < .001). An intensive social media use was positively related to the validated cosmopolitan identity scale ($\beta$ = .313, $p$ < .001).

Openness for alternatives to flying predicted the perceived behaviour control in the travel context ($\beta$ = .142, $p$ < .001), which negatively predicted flight kilometres ($\beta$ = -.183, $p$ < .001). The negative sign of the Beta coefficient occurred because the items of the perceived behaviour control scale were formulated in the negative direction: "Am I in control of flying *less*?". The attitude towards flying predicted flight kilometres ($\beta$ = .172, $p$ < .01) together with the subjective norm ($\beta$ = .24, $p$ < .001). The CIS significantly predicted desire ($\beta$ = .475, $p$ < .001), but desire did not significantly contribute to the prediction of flight kilometres ($\beta$ = .091, $p$ > .05). Nevertheless, we found a significant direct path from CIS to flight kilometres ($\beta$ = .255, $p$ < .001).

To control for external barriers, fear of flying and financial barriers was added to the TBC path model. Fear of flying showed a negative relation with the criterion but did not reach statistical significance ($\beta$ = -.029, $p$ > .05), unlike the financial barriers ($\beta$ = -.124, $p$ < .05). Fear of flying was generally answered to be rather low ($M$ = 16.52, $SD$ = 26.12 on visual analogue scales, ranging from 1 "strongly disagree" to 101 "strongly agree").

In order to examine the effect of the traveller category, enquired with the item "I take most flights for...", the answers "for work or education" and "for political or social engagement" were coded with 1 as business travellers. We found a significant difference in means for voluntariness between business travellers ($M$ = 66.66, $SD$ = 27.79) and recreational travellers ($M$ = 89.98, $SD$ = 18.36) ($F$(1,326) = 65.33, $p$ < .001).

The fact that particular participants studied at least one semester abroad, significantly explained variance in the Global Social Interconnectedness Score ($\beta$ = -.307, $p$ < .001). The negative sign of the coefficient between year abroad and GSIS occurred because "yes" was coded with 0, "no" was coded with 1. GSIS significantly predicted travel to visit friends and relatives ($\beta$ = .203, $p$ < .001), which in turn predicted flight kilometres ($\beta$ = .093, $p$ < .05).

# 5. Discussion

In line with the findings of Alcock et al. (2017) and Böhler et al. (2006), suggesting that the general environmental attitude transfers to household behaviour but not to travel, we only found a small negative correlation of the general environmental attitude (Roser-Renouf and Nisbet, 2008) with total flight kilometres. Consequentially, the present paper supports the assumption that general environmental attitudes alone do not substantially shape behaviour choices in the travel domain. Therefore, a distinct research focus on air travel, in contrast to other environmental behaviours, appears justified and necessary. This study provides tourism research with two new instruments, the Cosmopolitan Identity Scale (CIS) and the Global Social Interconnectedness Score (GSIS), to enquire social drivers of air travel within standardized questionnaires. Nevertheless, as this study was not conducted on a representative sample, and the model fit for CIS was not ideal. More research is needed to validate both measures across demographically diverse samples. In line with theoretical assumptions from the environmental psychology literature, following the attitude-behaviour gap line of reasoning (Hibbert et al., 2013), the ecological dilemma structural equation model suggests that the awareness of environmental problems caused by flying augments the perceived dilemma by negative emotions and the feeling of guilt, which reinforces the consideration of purchasing carbon offsets. Furthermore, when flights get more expensive through the purchase of offsets, a potential spillover effect could occur as it is likely that the financial barrier takes effect and reduces flying externally (Thøgersen, 1999).

Nevertheless, various findings within this study concerning the social aspects, particularly the relations of the cosmopolitan identity (which is an aggregate of social norms concerning social status and social comparisons), the desired career options, and the perceived behaviour of others in the travel context, underline the importance of considering the social influence and social

networks on air travel. This effect is accompanied by the Global Social Interconnectedness (GSIS) that is related to international experience and travel to visit friends and relatives. This study is among the first to provide quantitative estimates for the social drivers of air travel. Given the inherently social phenomenon of travel, with trips being motivated by the wish to visit other people or the desire to meet the expectations of a generation (Barton, Haywood, Jhunjhunwala & Bhatia; Delloite, 2019; Ketter, 2020), GSIS and CIS cover both, an external factor driving VFR travel and a more complex internal factor of social norms and social identity. Further research should monitor the development of both dimensions over time, e.g. examining the effects of the Fridays for Future movement on the perceived social norm to travel (Gössling, 2019; Gössling, Humpe & Bausch, 2020), or the effect of the travel restrictions during the COVID-19 pandemic on travel attitudes and global social networks (Higgins-Desbiolles, 2020).

A finding of this study that can help decision makers to design more effective policies to address air travel is the consideration of differences between traveller groups (Hine et al., 2014). Our findings suggest that attitudes, identity concepts and behaviours differ substantially between cosmopolitans, settled travellers and the mainstream of young adults. Therefore, policies that target specific segments might be designed with the aim to raise awareness, create acceptance, and regulate the aviation section efficiently while meeting the needs of a diverse population.

An interesting side note is that in this study some participants reported airport codes instead of the actual city names for all of their flights. This might have simply been more efficient—writing three capital letters instead of a full city name—but also indicates an increasing decoupling of the perception of a place as belonging to a city and the purely technical aspect of flying from A to B (Cidell, 2015). Furthermore, the conscious use of airport codes demonstrates a certain knowledge that arises through routine flying, which is in line with previous findings on the demonstration of social status through the narration of travel experience (Urry, 2012; Gram, 2005; Pearce & Lee, 2005).

# 6. Conclusion

In conclusion, we found three major strands of psychological dynamics that relate to peoples' travel behaviour and hold potential to reduce $CO_2$ emissions. First, the awareness of

environmental problems caused by flying that leads to a perceived dilemma related to the engagement with carbon offsets. Second, the global social interconnectedness, built through international experience and leading to increased VFR travel and an overall increase in flight kilometres. Third, the social identification as a cosmopolitan that is directly related to kilometres flown reveals a subgroup of young frequent travellers that could be particularly sensitive to behaviour change campaigns on social media.

Still, flying is one of the highest cultural achievements of humankind, enabling intercontinental personal contact and direct experience of the world that is worth protecting. Demonising flying in general as the biggest individual environmental "crime" could lead to reactance behaviour (Wortman & Brehm, 1975). When confronting people with negative environmental impacts of their actions, providing information on more sustainable behaviour options is the key. A mindful way of travelling that includes the consideration of potentially slower modes of transportation could literally help countervail the fast pace of everyday lives (Dickinson, Lumsdon, & Robbins, 2011), while limiting the number of trips by plane could spill over to a more sustainable tourist behaviour at the destination (Thøgersen, 1999).

Providing empirical evidence for the social influence on air-travel is important in times of globally rising mobility patterns. Within the present generation, being "on the go" is unquestionably positively connoted (Urry, 2012; Gram, 2005; Pearce & Lee, 2005). In order to thoroughly understand why young adults travel, and to possibly find levers against the continuous rise in flight kilometres, this discussion about social drivers of travel must be led in the scientific community as well as among the public.

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# Appendix

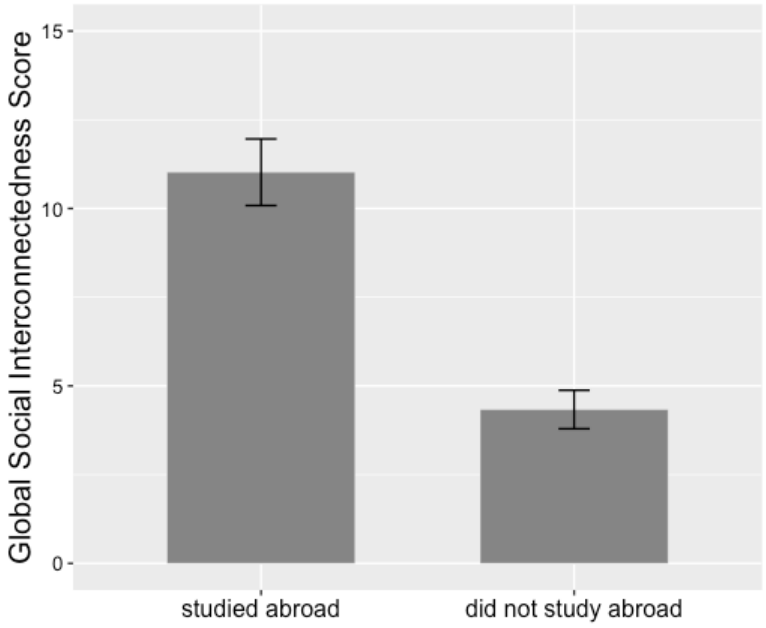


*Figure 3.* Differences in GSIS between participants who have studied a semester abroad and those who did not. *Note*: Error bars represent standard errors.

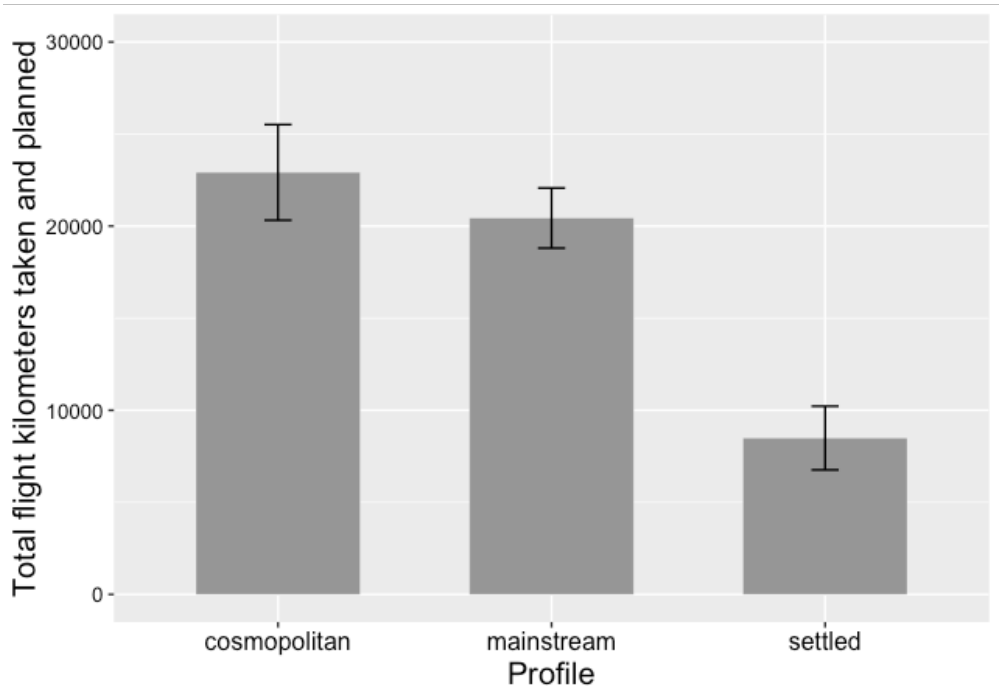


*Figure 4.* Flight kilometres of different traveller groups. *Note*: Error bars represent standard errors.