Using the Theory of Planned Behaviour to Predict Intentions to Reduce the Environmental Impact of Travel

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Abstract

The use of private cars is responsible for a large amount of the world's CO_2 emissions and the amount of pollution produced by the aviation industry is also growing at an alarming rate. Thus, it is important to understand the factors that can lead to pro-environmental behaviours (PEB), such as choosing more environmentally friendly options for air and car travel. I explored whether the Theory of Planned Behaviour (TPB) variables of environmental attitudes, subjective norms, and perceived behavioural control (PBC) predicted individuals' willingness to change their travel behaviour. A sample of 327 participants from New Zealand and the United States of America completed an online questionnaire measuring TPB variables for low-, medium- and high-cost behaviours which were defined as short, medium, and long trips by both car and plane. I hypothesised that, in line with the A-B-C model, the TBP variables would be most predictive of intentions to reduce the environmental impact of medium-cost behaviours, rather than low- or high-cost behaviours. Attitudes, subjective norms, and PBC almost always significantly predicted behavioural intention for the NZ sample, whilst only subjective norms and PBC were significant predictors for the USA sample, however, there was no support for the low-cost hypothesis or A-B-C model. Findings may influence and inform interventions and policy aimed at behavioural change in different contexts and that it may be beneficial for interventions to be tailored to specific populations based upon the strength of correlating variables.

Key Words: A-B-C model, attitudes, environment, low-cost hypothesis, Theory of Planned Behaviour, travel behaviour, pro-environmental behaviour

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Contents

List of Tables and Figures

Using the Theory of Planned Behaviour to Predict Intentions to Reduce the Environmental Impact of Travel

The pressing issue of climate change is one of the biggest problems of modern society, and according to the Intergovernmental Panel on Climate Change (2022), changes need to be made to our everyday lives to help mitigate the effects of global warming. Petrol and diesel-based transport remains one of the main contributors to greenhouse gasses and pollution and is a severe threat to the environment (IEA, 2022). In order to meet the world climate change target of restricting climate change to less than 2 degrees Celsius, 2900 billion tonnes of CO_2 were estimated to be the absolute limit of worldwide carbon emissions, and by 2015, the world had already emitted two-thirds of this estimated number (Ministry for the Environment, 2015). Curbing climate change on a global scale is a large undertaking and requires intervention at numerous levels. Spending on clean energy initiatives has been on the rise globally since 2015, and 1.74 trillion USD worldwide was estimated to be spent on clean energy and fossil fuel alternatives in 2023 (IEA, 2023). Emission and fuel taxes have been shown to be one of the most effective interventions but are also strongly resisted by the public (Raux, 2008). The transport sector in New Zealand (NZ) accounts for the some of the country's highest emissions, alongside industry and agriculture, and almost entirely relies on oil as its primary fuel source. Recent policies regarding the promotion of electric vehicles (EV) means that the NZ government has identified the need for transport alternatives, but no other clear long-term plans are in place to mitigate oil dependency (IEA, 2023).

In 2015, most NZ greenhouse gas emissions were due to agriculture (44%) with energy accounting for 22% and transport coming in as the third highest contributor to greenhouse gas emissions at 17%. The majority of NZ public transport is powered by diesel (47%) and gasoline (46%) with only 1% fuelled by biofuel and electricity (IEA, 2023). Whilst public transport does require a lot of NZ's energy, on a macro-economic level it is far

outweighed by the amount that individuals use and spend on personal vehicles (IEA, 2023). Logically it follows that initiatives should be taken to move more people from personal vehicles to public transport which would save money, reduce energy use, and reduce pollution.

Aside from the fact that it is beneficial for the environment, there are other reasons for promoting public transport. As cities become more crowded and road networks and motorways become more congested, other negative effects come about because of more cars on the road. Traffic congestion, higher rates of road incidents, and more government spending on roadworks due to more wear and tear are all examples of the negative impact of personal car use. Problems occur in both developed and developing countries (Vasconcellos, 2001). Traffic can lead to an increase in stress and increased mental load, leading to poorer physical health (Venkatesh & Pushpa, 2014). Randal et al. (2022) showed that pollution also had an effect on New Zealanders' physical health; less exposure to pollution, reduced traffic incidents, and increased physical activity from walking/cycling instead of driving would not only increase individual life expectancy but also save the healthcare system billions of dollars.

Air travel is also a massive contributor to air pollution due to its high emissions (Pawlak et al., 2022). Carbon emissions from aviation have grown faster than any other mode of transport and the annual amount has more than doubled within the last 20 years. That rate is set to further double by 2050 (Transport and Environment, 2024). In 2022, under NZ's emission trading scheme (ETS), Air NZ was obligated to pay for 557 thousand tonnes of CO_2 which is concerning as they are only one of many airlines offering domestic and international services in NZ (Air New Zealand, 2023). The number of passengers travelling by plane has also increased dramatically over the last two decades and is estimated to steadily increase by approximately 4% annually (Statista, 2018). Not only is air travel harmful to the environment

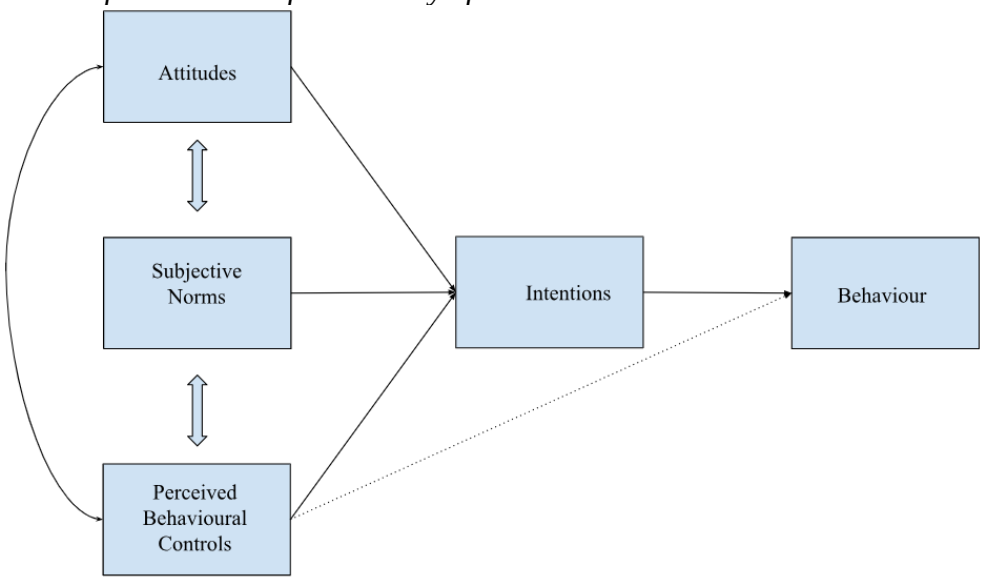
but it could also lead to increased health risks; Müller (2019) showed that noise pollution from small planes can lead to an increased risk of stroke. There is also a causal relationship between noise and air pollution from flights and illnesses including respiratory conditions and central nervous system disorders (Beghelli et al., 2023).

Theory of Planned Behaviour

Since transport is a huge contributor to emissions, it is important to identify ways to reduce the use of private transport. Aside from alternate fuel types and new modes of clean transport, another solution is to promote the use of alternate means of travel instead of private cars. Behaviour is affected by many variables and research exploring these variables is integral to understanding the effects of any potential interventions. It is especially important in the case of social psychology, as these interventions are often implemented on a local or national scale in the form of policies to cause behavioural change in society. The theory of planned behaviour (TPB) is one of the most widely used models in social psychology. It proposes that subjective norms, attitudes, and perceived behavioural control (PBC) predict an individual's intention to engage in a behaviour as shown in Figure 1 (Fishbein & Ajzen, 2010). The TPB was first developed in the 1980s and has since been used for a variety of research topics such as health, consumer goods, and sustainability (Arvola et al., 2008; Kumar, 2019; Norman & Conner, 2006).

Figure 1

Visual Representation of the Theory of Planned Behaviour



Note. Reproduced from Ajzen, I. (1985). From intentions to actions: A theory of plannedBehavior. In Kuhl J, and Beckmann J (Eds.), *Action-Control: From Cognition to Behavior*.

In the TPB, attitudes refer to an individual's personal beliefs surrounding the behaviour and take into account their previous lived experiences, their knowledge, as well as their ethical and moral predispositions. Regarding PEB, this may include their beliefs on climate change, sustainable products, and the effect of carbon emissions on the environment. Subjective norms highlight the individual's perception of how society views the behaviour. Social pressure is one of the underpinnings of the TPB and influences how others' views will impact the individual's intention to perform the behaviour. An example relating to PEB might be carbon footprints, as this is different for individuals based on the products they use, their travelling behaviours and how much energy they use. Finally, PBC refers to an individual's judgement of their ability to carry out the target behaviour successfully. PBC includes factors that might prevent a person from performing the behaviour as well as the individual's ability to control these factors and mitigate them (Fishbein & Ajzen, 2010). Examples of this for PEB may include how easy it is for people to recycle, switch to reusable products, or how

convenient it might be to switch to public transport as a more environmentally friendly option rather than private travel.

The TPB not only highlights links between internal psychological variables and intention to perform behaviours, but it is also a useful tool in understanding what might stop or promote these behaviours. By gaining insight into prior knowledge and beliefs about the behaviour and how the behaviour might be viewed in a societal and cultural context, it is possible to identify the most important determinants of behaviour which may help in the formulation of behavioural interventions. The TPB assumes that people will act based on their prior beliefs (Ajzen, 2015). However, the relationship between attitudes, subjective norms, and PBC may differ depending on the behaviour and its context.

Several researchers have demonstrated the usefulness of the TPB in predicting intention to adopt pro-environmental behaviours (PEB). Tobler et al. (2012) asked participants from Switzerland what behaviours would have the greatest impact on climate change and whether they would be willing to engage in these behaviours and support legislative policies surrounding climate change. They also asked about numerous other variables such as participants' attitudes towards climate change and environmental sustainability as well as their beliefs on individual impact on the environment. Perceived climate benefit and PBC were the best predictors of intention to change behaviour and adopt environmentally-conscious policies. Political allegiance was also a strong factor in willingness to support climate change policy, however, this variable did not influence low-cost behaviours. Wang et al. (2022) explored the TPB and intention to purchase 'green' (environmentally friendly) cars amongst millennials. They measured subjective norms, PBC, green purchase attitude, and intention to purchase green cars. They found that all three variables were positively correlated with intention to purchase green cars. Fu and Juan (2017) explored the TPB and its ability to predict intention to use public transit in China, as well as

the actual use of public transit. They found that intentions were correlated with subjective norms and PBC, and that intention was also significantly correlated with the actual public transport use. However, attitude did not directly influence behavioural intention.

Abrahamse et al. (2009) used the TPB to explore the effect of internal psychological variables on intention to travel. They gave a self-report questionnaire to a sample of Canadian office workers. They measured the participants' attitudes, subjective norms, and PBC about car use for travelling to work. Researchers asked questions about car travel behaviour and intention to change those behaviours. Car use for travelling to work was largely explained by attitudes and PBC but not subjective norms and participants' intentions to reduce car travel was largely influenced by attitudes. While internal factors such as attitudes can predict intention to engage in PEB, external factors, such as the cost or difficulty of the behaviour, also affect whether people engage in the behaviour. Two major approaches - the low-cost hypothesis and the A-B-C model - hypothesize an interaction between internal and external factors.

Low-cost Hypothesis

The low-cost hypothesis states that the impact of internal factors such as attitudes on PEB decreases as the associated behavioural costs rise (Diekmann & Preisendörfer, 2003). For example, the internal psychological variable of environmental attitudes is expected to be highly predictive of behavioural intentions when the behavioural cost is low but is not a good predictor when behavioural cost is high. When behavioural costs are low, then behavioural intentions will be affected by attitudes. However, when behavioural costs are high, the behaviour will not change regardless of the strength of environmental attitudes because it is simply too inconvenient to change. It should be noted that in this context, low- and high-cost behaviours do not only refer to the economic or financial cost of the behaviour, but also to other factors such as time, effort, and convenience. The low-cost hypothesis has been tested

in numerous studies on environmentally-conscious subjects (Diekmann & Preisendörfer, 2003). In one of these studies, Stern (1992) concluded that there is a greater effect of psychological variables on behaviours that are identified as being low-cost. Farjam et al.'s (2019) data supported the low-cost hypothesis when they used a collective risk social dilemma to ask participants to contribute financially to an environmental fund to positively impact the environment. The monetary units were real and the impact to the environment was also real as the researchers believed immersing the participants in a real-world scenario would yield better results. They found that behaviour was only affected by environmental attitudes in low-cost situations. Another study by Starke et al. (2020) showed that attitudes are more likely to influence an individual's behaviour when the behavioural cost is low. Their study investigated whether generic advice given to individuals would be as effective as tailored advice on energy-saving measures. Whilst they did not specifically test the low-cost hypothesis, they concluded that participants who scored higher on environmental attitudes were more willing to adopt low-cost behaviours due to their relatively low inconvenience, whereas for high-cost behaviours, attitudes were not a significant predictor of behavioural intention.

A-B-C Model

Although the low-cost hypothesis predicts a linear relationship between cost and attitudes such that attitudes are more predictive of the intention to engage in low-cost behaviours, the Attitude-Behaviour-Context (A-B-C) model proposed by Stern and Oskamp (1987) holds that the effect of attitudes will be greatest at a medium cost rather than at low or high costs. The logic is that, in low-cost situations, the behaviour is performed by almost all people because the cost is low, and in high-cost scenarios, the cost is too high so almost nobody engages in the behaviour. Therefore, medium-cost behaviours are the most affected by internal psychological variables such as attitudes. Like the TPB, the A-B-C model links

internal psychological variables (e.g., attitude) and behavioural intention, but builds upon it by postulating how these variables might interact with specific behavioural costs. It takes into account external factors such as financial cost, environmental cost, time, effort etc. (i.e., contextual factors). Combining internal and external factors may allow for better understanding of how to change behaviour which can then be used to develop behavioural interventions.

Guagnano et al. (1995) tested the A-B-C model in their study on recycling behaviours amongst a sample of over 250 participants from the USA. They designed a telephone questionnaire with items that measured environmental attitudes, community environmental behaviours, and recycling behaviours as well as perceived costs of those behaviours. The researchers found an interaction between pro-recycling attitudes and participants who had a recycling bin, and also found an effect between participants who had a recycling bin and increased awareness of environmental consequences. The results supported the A-B-C model by showing that there was an interaction between internal and external variables.

More recently, Keizer et al. (2019) explored the relationship between personal attitudes and perceived behavioural costs of changing behaviour, and how they influence intention to change behaviour in response to changing policies regarding car travel. They tested the low-cost hypothesis and A-B-C model with large samples of residents from seven European countries. Keizer et al. (2019) described two methods to change behaviour: a ‘push’ method and a ‘pull’ method. These methods were reflected in the form of policies where the ‘push’ method would impose external constraints such as increased tax for car users whilst the ‘pull’ method imposed fewer external constraints, such as policies to improve public transport access and infrastructure to promote alternative and more efficient transport methods. They first explored how attitudes predicted the acceptability of the push and pull policies. Because the pull method would be generally acceptable to most participants without

resulting in any constraints, this option was the low-cost scenario, whilst the high-cost scenario was the push method (taxes on car users) due to the additional expense for those engaging in the target behaviour. The data did not support the low-cost hypothesis and instead found that attitudes were more predictive of the acceptability of car use tax rather than an improvement of public transport; in other words, they were less predictive of participants accepting pull rather (low-cost) than push policies (high-cost) and attitudes accounted for much higher variance in acceptability in the 'push' policy. The next portion of the study explored whether attitudes were predictive of acceptability of the push policy between participants who feel that they are able to change their behaviour and find alternate means of transport (medium cost) and participants who would find it very difficult to reduce the amount they drive (high cost). Attitudes predicted acceptability of reducing car-use more for participants who identified the target behaviour as being medium cost rather than for high-cost participants. The findings support the A-B-C theory and provide evidence that environmental attitude has a greater effect on medium-cost behaviour compared to low- or high-cost behaviour.

Busche and Sargisson (2020) tested the ability of the TPB to predict intentions to reduce the impact of short- and long-haul flights. Prior research showed that flying behaviour may be altered by pricing strategies (Mason, 2005), and so Busche and Sargisson (2020) investigated which internal psychological variables would impact behavioural intentions to reduce the impact of flying. Participants were primarily students from European countries such as Germany and Netherlands. Busche and Sargisson (2020) measured participants' environmental attitudes, subjective norms, PBC, and intentions to change travel behaviour regarding air travel for both low- and high-cost flying behaviours. Items measuring attitudes were based around whether participants thought they should be taking alternative modes of transport and pay for carbon emissions, as well as how important climate change was

compared to travelling to different countries. Items on subjective norms were based around what the participants' friends and family thought about their behaviour and whether they would engage in more environmentally conscious behaviours if those people did too. PBC was measured as participants' perceived ability to change behaviour by asking how convenient and easy it would be to alter their behaviour. The low-cost behaviour was short-haul flights which were defined as journeys that would take up to 15 hours by car, and the high-cost behaviour was long-haul flights that would take over 15 hours by car.

Busche and Sargisson (2020) found that attitudes and subjective norms predicted intention to change travel behaviour for both low- and high-cost behaviours. PBC was a significant predictor of intention to reduce the impact of short-haul flights (low-cost behaviour) but not long-haul flights (high-cost behaviour). Although attitudes were a better predictor of intention-to-change in the short-haul condition, subjective norms became a better predictor as PBC increased. Participants who were more environmentally conscious (scored higher on environmental attitudes) were more willing to find an alternate means of travel rather than by plane as opposed to those who scored low on environmental attitudes who were less willing to change modes of travel. Like Keizer et al. (2019), Busche and Sargisson (2020) obtained data which failed to support the low-cost hypothesis. They speculated that the results were more in line with the A-B-C model, however, since they only explored low- and high-cost behaviours and not medium-cost behaviours, they could not conclude that the data supported the A-B-C model.

Present Research

I aimed to build on the study by Busche and Sargisson (2020) to test the low-cost hypothesis and the A-B-C model. Similar to Busche and Sargisson, I measured willingness to reduce the impact of flying, however, I included questions on driving in addition to flying. I included short-, medium-, and long-distance trips rather than just short and long distances so

that I could test whether the TPB variables of attitudes, subjective norms, PBC, and intention to change behaviour were more predictive of willingness to reduce the impact of travel at low costs (short distances/low-cost hypothesis) or medium costs (medium distances/A-B-C model).

There were some differences in my study as compared to Busche and Sargisson's (2020): firstly, my participants were primarily from the USA and NZ whereas participants from the previous study were from European countries. In comparison to Europeans, New Zealanders and Americans are heavily reliant on individual cars for transport; in the USA, 75.9% of the working population reported using private cars as their main mode of transport, whilst public transport was the third most popular, being utilised by only 5% (Burrows et al., 2021). Similarly, between 2015-2018 in NZ, 73.5% of all people travelling to work used a private vehicle while only 6.5% used public transport (Ministry of Transport, 2023). In a study on transport behaviour, Sargisson (2018) reported a total of 71% of commuters to the Hamilton campus of the University of Waikato utilised private cars as their main mode of transport.

Secondly, I explored two different transport modes – flying and driving. Driving was included as there may be fewer options for New Zealanders and Americans to choose alternatives to flying compared to Europeans, but it may be possible for them to avoid driving. While I sought to replicate the study by Busche and Sargisson (2020) which focused on flying behaviours, I included driving to ensure that it was possible to explore the A-B-C model for driving if participants were unwilling (or unable) to change their flying behaviour.

Hypothesis

My main purpose was to test the effectiveness of the TPB as a model for predicting behavioural intentions for PEB. The main hypothesis is that environmental attitudes,

subjective norms, and PBC would significantly predict willingness to reduce the impact of driving and flying.

My second hypothesis tested the low-cost hypothesis. I hypothesized that the TPB variables of attitudes, subjective norms, and PBC would be more predictive of willingness to reduce the impact of flying and driving for low-cost behaviour (medium distances) rather than medium- (short distances) or high-cost (long distances) behaviour. The low-cost hypothesis would be supported if the TPB variables were more predictive at low distances, and gradually became less predictive as the distance increased.

Method

Ethics Approval

This study received approval (FS2023-27) from the Art, Law, Psychology, and Social Sciences Human Research Ethics committee of The University of Waikato, NZ (Appendix A).

Pre-Registration

Pre-registration for this study was completed on the Open Science Framework website (https://doi.org/10.17605/OSF.IO/UW5H7).

Participants

Through G*Power (Universität Düsseldorf: G*Power (hhu.de)), I ascertained that 110 subjects would be required for a multiple linear regression with three predictors and effect size $f^2 = 0.1$ where $\alpha < .05$. Allowing for withdrawals, and unusable or duplicate entries, I aimed for approximately 150 participants from each participant pool.

The questionnaire was completed by 200 participants through the University of Waikato while 450 participants completed the questionnaire through Mechanical Turk (MTurk). Unfortunately, some entries from Mechanical Turk were unsuitable for data

analysis due to a software issue. After removing any bots and participants who took more than 3 SDs of the average time required to complete the questionnaire, there were 191 entries from the NZ student data and 136 entries from Mechanical Turk resulting in a total of 327 participants. NZ student participants had an average age of 22.8 years (SD = 7.03 years) with 155 of them being women, 30 men, and 6 non-binary. Of the student participants, 98% were from NZ with the rest reporting as being from other countries. For the MTurk data, 70 participants were men, and 66 were women, and the mean age was 35.6 years (SD = 8.98). Of the MTurk participants, 97% were from USA and 0.7% were from NZ, while the rest identified as being from other countries.

Questionnaire Design

Items were taken from previous studies: air-travel related items from the study by Busche and Sargisson (2020) who developed their items from scales by Davison et al. (2014), and car-travel items were taken from the study by Keizer et al. (2019). For the full list of items, refer to the complete questionnaire (Appendix B). Items were measured on a Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly Agree). PBC items were arranged into separate blocks for short, medium, and long trips by car and plane, and the blocks were presented in a random order by the Qualtrics software to prevent fatigue and repetitive entries from participants. Participants also answered basic demographic questions such as age, gender, and country of residence. As per the variables that constitute the TPB, items measured personal attitudes and environmental conscientiousness, subjective societal norms, PBC, and intention to change travel behaviour.

Environmental attitudes

Items on environmental attitudes were based on the individual's attitude toward environmental impact of pollution from travel as well as their attitude toward alternative means of travel. Participants were asked to indicate their level of agreement with statements

such as: ‘Commuters should pay more to use petrol/diesel-based transport because of the negative environmental aspects of pollution.’ There was a total of nine items for attitudes towards car travel and six items for air travel.

Subjective Norms

Participants were asked whether they agreed with statements regarding the beliefs and behaviour of people in their social networks regarding transportation. Participants were asked to indicate their level of agreement with statements such as: ‘People who are important to me would support me in reducing the amount I drive.’ There was a total of eight items for car travel and seven items for air travel.

PBC

PBC items measured the behavioural costs that the participant perceived they would incur if they were to alter their behaviour. These items were not asking the participant to change their behaviour but rather how difficult it might be to do so. Items were repeated for each distance (short, medium, and long) as behavioural costs may vary depending on the distance the participant needs to travel. In this category, there were three items per distance for each mode of travel. For example, for long flights the items were: ‘I find reducing long trips is convenient’, ‘I find reducing long trips is easy’, ‘Using other modes of transport instead of driving for long trips is easy for me if I want to’.

Intention to Change Behaviour

Items measured how willing the participant was to change their current behaviour to be more environmentally friendly. There was a total of four items per distance per transport type. For example, the items for long driving trips were: ‘I am willing to pay to offset the cost of carbon emissions from driving for long trips’, ‘I am willing to pay to use a less polluting mode of transport than driving for long trips’, ‘I am willing to choose a more energy efficient

mode of transport than driving for long trips', 'I am willing to choose any other mode of transport other than driving for long trips'.

The criteria for car trips in NZ were as follows: short trip (less than 15 minutes), medium trip (between 15 minutes and 30 minutes), and long trips (over 30 minutes). Short-haul flights were classified as being less than 1.5 hours, mid-haul flights between 1.5 to 2.5 hours, and long-haul flights over 2.5 hours long. For the participants from USA, short car trips were classified as being less than 30 minutes, medium trips between 30 minutes and 1 hour, and long trips over 1 hour. Short-haul flights were classified as being less than 2 hours, mid-haul flights between 2 to 5 hours, and long-haul flights over 5 hours. The reason for the difference in criteria was that NZ is a much smaller country- an example of this is that any flights over 5 hours would be classified as an international flight which is not necessarily the case compared to the USA. By reducing the values, I aimed to keep some alternative travel options available for NZ participants which would be much more difficult when considering international travel.

The questionnaire was posted on University of Waikato's Introduction to Psychology Research Program (IPRP) system. This system allows undergraduate psychology students to participate in research for course credits. For participating in this study, students were awarded one course credit. The same questionnaire was also posted on Amazon Mechanical Turk (MTurk) - a system which allows people to assign tasks for others to complete for a small reward. Those who participated in this study from MTurk received compensation of $0.30 USD. Participants who signed up for the study were told to answer all questions. The questionnaire itself was created on Qualtrics and participants were able to access it through links from IPRP and MTurk.

Measurements and Analyses

Data analyses were conducted using Jamovi 2.4.8.0 (https://www.jamovi.org/). Individual items were grouped together and scores were averaged into single scale scores (Appendix C). Reliability analyses were conducted on these scale variables. Linear regressions were conducted with intentions to change travel behaviour as the outcome variable with environmental attitudes, subjective norms, and PBC as the predictor variables. PBC varied depending on the length of travel. Regression models predicted whether the aforementioned variables were significant predictors of intention to change travel behaviour.

Table 1 shows the results of the reliability analysis on all the scale variables using Cronbach's alpha (α). All variables for the NZ data achieved $\alpha > .7$ except for environmental attitudes. The MTurk scale scores were less reliable with most achieving $\alpha > .6$ except for PBC for medium car journeys and short haul flights. It was expected that all scales would be reliable as they were taken from previous studies, and removal of items did not increase Cronbach's alpha for any of the scales.

Table 1

Reliability Analysis showing Cronbach's Alpha Scores for Scaled Variables

Variable	NZ Data (α)	MTurk Data (α)
Environmental Attitudes (Car Travel)	.68	.76
Environmental Attitudes (Air Travel)	.57	.74
Subjective norms (Car Travel)	.82	.83
Subjective Norms (Air Travel)	.83	.80
PBC Short (Car)	.80	.63
Intentions Short (Car)	.82	.73
PBC Medium (Car)	.84	.58
Intentions Mid (Car)	.83	.65
PBC Long (Car)	.82	.68
Intentions Long (Car)	.78	.64
PBC Short (Air)	.80	.52
Intentions Short (Air)	.82	.68
PBC Medium (Air)	.86	.66
Intentions Mid (Air)	.81	.70
PBC Long (Air)	.81	.65
Intentions Long (Air)	.81	.68

Results

The mean scores for environmental attitudes and subjective norms for the NZ data and the MTurk data are in Tables 2 and 3 respectively. An independent samples *t* test was run between the NZ and MTurk data for environmental attitudes and subjective norms to determine whether the scores on these variables differed across samples (Table 4). Table 4 shows that all means except car environmental attitudes were significantly different across the two samples. The NZ sample had higher scores than the MTurk sample regarding environmental attitudes for air travel, however, the USA data showed that they scored higher on subjective norms for both car and air travel.

Table 2

Item Scores for Environmental Attitudes and Subjective Norms- NZ data

	Car EA	Flight EA	Car SN	Flight SN
Mean	3.24	2.92	2.62	2.41
95% CI lower	3.17	2.84	2.52	2.30
95% CI upper	3.32	3.01	2.73	2.51
SD	.54	.57	.76	.74

Note. The CI of the mean assumes sample means follow a *t* distribution with *N* - 1 degrees of freedom.

Table 3

Item Scores for Environmental Attitudes and Subjective Norms- MTurk Data

	Car EA	Flight EA	Car SN	Flight SN
Mean	3.16	2.72	3.89	3.83
95% CI lower	3.11	2.66	3.79	3.73
95% CI upper	3.21	2.77	3.99	3.94
SD	.27	.32	.59	.60

Note. The CI of the mean assumes sample means follow a *t* distribution with *N* - 1 degrees of freedom.

Table 4

Independent Samples t test for Environmental Attitudes and Subjective Norms

	Car EA	Flight EA	Car SN	Flight SN
t Statistic	-1.67	-3.88	16.20	18.57
p	.095	<.001	<.001	<.001
Effect Size	.19	.44	1.82	2.08

Note. Cohen's *d* has been used for effect size.

Figure 2 shows the mean scores for PBC. The PBC scores for the MTurk data were consistent across distances, however for the NZ data, the highest scores were recorded in the short-distance category, decreasing at a medium distance, and decreasing even further for long distance. This means that NZ students reported that it became more difficult to change their behaviour at longer distances (as shown by the decreasing PBC scores).

Figure 2

Mean PBC scores for NZ and MTurk data with 95% CI

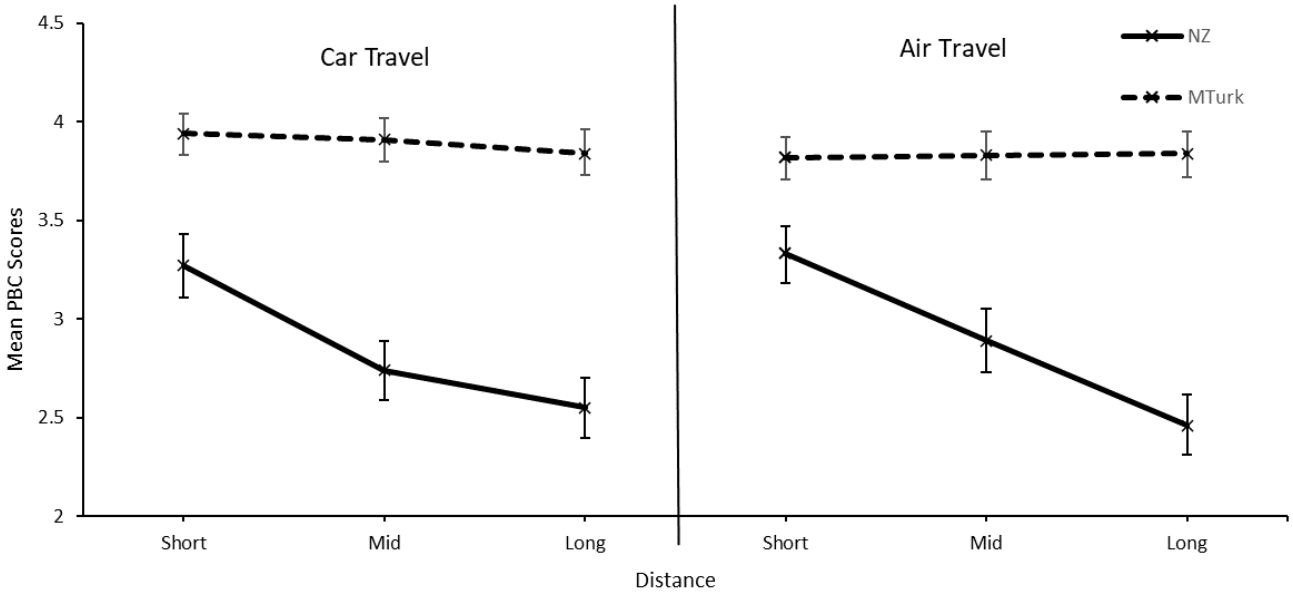


Table 5 displays the results of an independent samples *t* test between the NZ and MTurk samples for PBC at every distance for both car and air travel. The table shows that all means are significantly different.

Table 5

Independent Samples t-test for PBC

	Short Car	**Mid Car**	**Long Car**	**Short Air**	**Mid Air**	**Long Air**
t Statistic	6.37	11.49	12.40	5.03	8.70	13.12
p	<.001	<.001	<.001	<.001	<.001	<.001
Effect Size	.72	1.29	1.39	.57	.98	1.472

Note. Cohen's *d* has been used for effect size.

Figure 3 shows most participants used petrol/diesel vehicles as their daily mode of transport in both datasets, however there was a higher proportion in the NZ student data (71%) compared to the MTurk sample (36%). The MTurk sample showed more variation across modes, whereas the NZ data was very polarised with very few participants choosing other modes other than petrol based private transport.

Figure 3

Frequency of Daily Modes of Transport

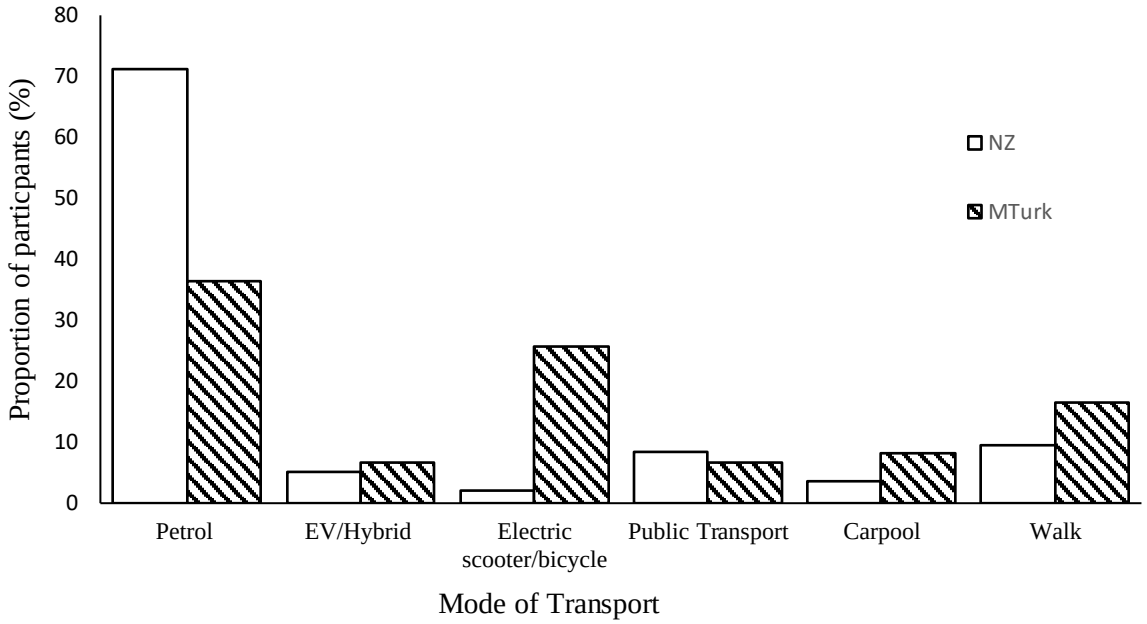
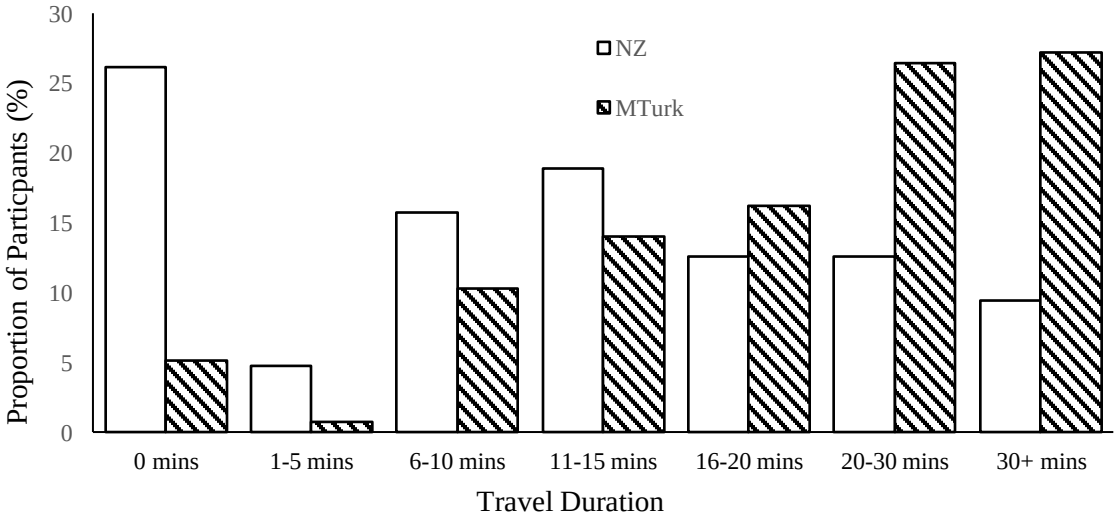


Figure 4 shows the time taken for participants to travel to work. Most participants in the NZ sample were students who were not employed in paid work thus were categorised under a daily commute of 0 minutes. Of those who were employed, the majority spent between 6-15 minutes on their work commute. Conversely, most MTurk participants spent longer than 20 minutes on their daily commute.

Figure 4

Duration of Daily Work Commute



Twelve linear regression models were all significant ($p < .001$) at short, medium, and long distances for both car and air travel in both the MTurk and NZ data. However, the extent to which the variables predicted intention to change behaviour in these models varied. For the MTurk car travel data in Table 6, the *p* values show that subjective norms and PBC were always significant predictors of intention to change travel behaviour, whilst environmental attitudes were not significant for any distances. The beta values show that subjective norms were the stronger predictor in the short-distance model whilst PBC was the stronger predicting variable for medium- and long-distance travel.

Table 6

MTurk Car Travel Linear Regression Results

				95% CI					
	t	*p*	*β*	Lower	Upper	R^2	*F*	*df*	*p*
Short						.524	50.5	132	<.001
SN	5.87	<.001	.50	.33	.67				
EA	1.20	.234	.07	-.05	.20				
PBC	2.97	.004	.25	.08	.42				
Medium						.674	91.0	132	<.001
SN	6.21	<.001	.42	.29	.56				
EA	-.78	.435	-.04	-.14	.06				
PBC	7.19	<.001	.48	.35	.62				
Long						.566	59.6	132	<.001
SN	5.07	<.001	.38	.23	.53				
EA	.61	.545	.04	-.08	.15				
PBC	5.87	<.001	.44	.29	.59				

Note. SN=Subjective norms, EA= Environmental attitudes, PBC = Perceived behavioural controls.

For the MTurk flight data (Table 7), subjective norms and PBC were always significant predictors. The beta values show that subjective norms were the stronger predictor of intention-to-reduce travel at all distances. Environmental attitudes were only significant for short haul flights and produced negative beta values meaning that participants who scored

higher on this variable scored lower on their intentions-to-change behaviour. The R^2 values for the MTurk data were highest for medium distance for both car and air travel.

Table 7

MTurk Flight Travel Linear Regression Data

				95% CI					
	t	*p*	*β*	Lower	Upper	R^2	*F*	*df*	*p*
Short						.595	67.2	132	<.001
SN	6.30	<.001	.48	.33	.63				
EA	-2.10	.038	-.13	-.25	-.01				
PBC	3.88	<.001	.29	.14	.44				
Medium						.648	83.8	132	<.001
SN	8.04	<.001	.60	.45	.75				
EA	-1.40	.163	-.08	-.20	.03				
PBC	2.83	.005	.22	.07	.37				
Long						.539	53.5	132	<.001
SN	5.76	<.001	.51	.33	.68				
EA	-1.32	.190	-.09	-.22	.04				
PBC	2.58	.011	.23	.05	.41				

Note. SN=Subjective norms, EA= Environmental attitudes, PBC = Perceived behavioural controls.

In Table 8 showing the NZ car travel data, all variables were significant predictors at all levels. The beta values show that PBC was the strongest predictor at short- and medium-distance travel, however environmental attitudes were the strongest predictor for long-distance travel. In Table 8, the R^2 value is the highest for medium distance car travel.

The NZ flight data in Table 9 shows that environmental attitudes and PBC were significant predictors at all distances, however, subjective norms were only a significant predictor for short- and mid-haul flights. The beta values show that PBC was the strongest predicting variable at all distances. Table 9 shows the R^2 value is the highest for short-haul flights.

Table 8

NZ Car Travel Linear Regression Data

				95% CI					
	t	*p*	*β*	Lower	Upper	R^2	*F*	*df*	*p*
Short						.477	56.8	187	<.001
SN	3.52	<.001	.22	.10	.35				
EA	4.88	<.001	.30	.18	.42				
PBC	7.24	<.001	.40	.29	.51				
Medium						.505	65.5	187	<.001
SN	3.38	<.001	.21	.09	.33				
EA	5.78	<.001	.34	.23	.46				
PBC	7.68	<.001	.42	.31	.52				
Long						.457	54.3	187	<.001
SN	2.76	.006	.18	.05	.31				
EA	5.98	<.001	.37	.25	.49				
PBC	6.05	<.001	.35	.24	.47				

Note. SN=Subjective norms, EA= Environmental attitudes, PBC = Perceived behavioural controls.

Table 9

NZ Flight Travel Linear Regression Data

				95% CI					
	t	*p*	*β*	Lower	Upper	R^2	*F*	*df*	*p*
Short						.592	92.8	187	<.001
SN	2.56	.011	.14	.03	.24				
EA	6.08	<.001	.32	.22	.43				
PBC	10.86	<.001	.54	.44	.64				
Medium						.581	88.7	187	<.001
SN	3.84	<.001	.21	.10	.31				
EA	7.04	<.001	.38	.27	.48				
PBC	8.99	<.001	.44	.35	.54				
Long						.507	64.1	187	<.001
SN	1.42	.157	.09	-.03	.21				
EA	5.57	<.001	.32	.21	.44				
PBC	9.09	<.001	.51	.40	.62				

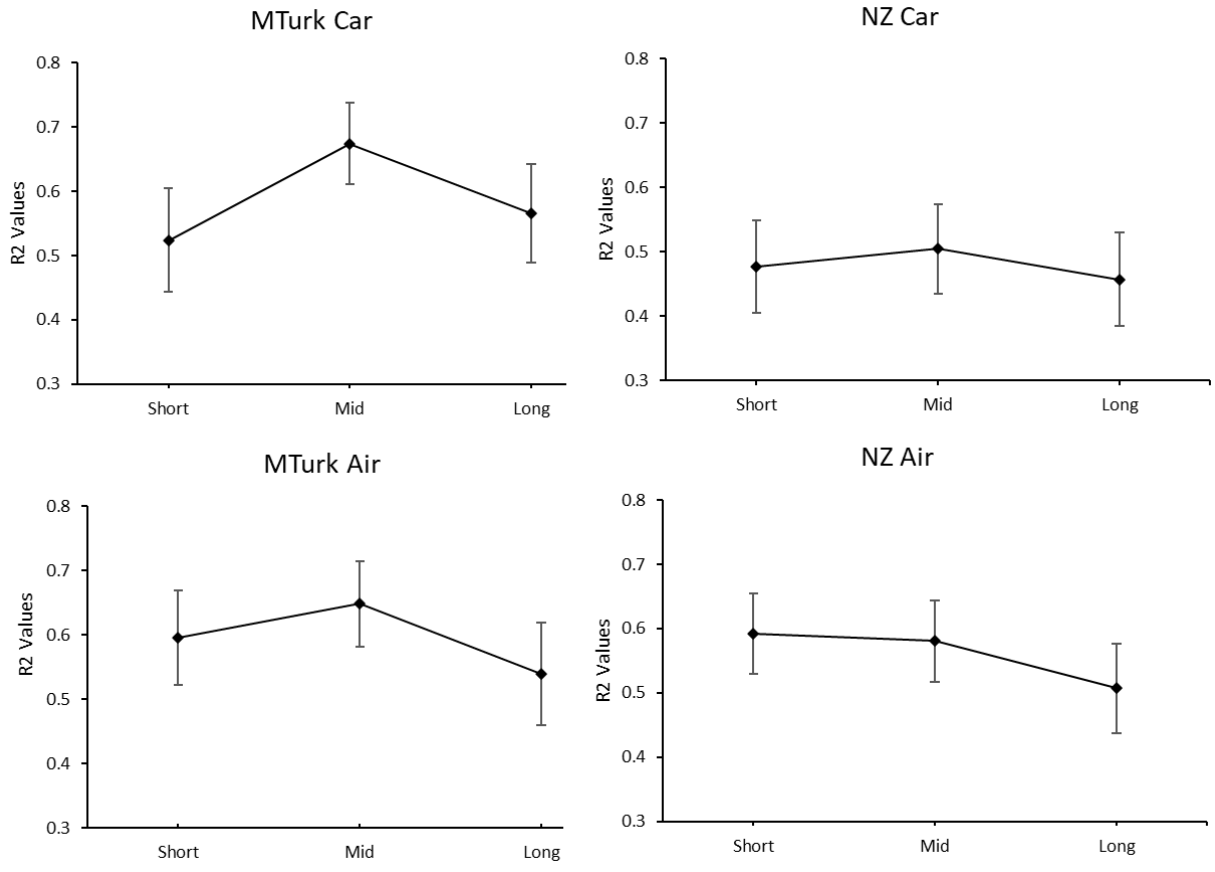
Note. SN=Subjective norms, EA= Environmental attitudes, PBC = Perceived behavioural controls.

Confidence Intervals (CI) were calculated for the R^2 values for each of the models as Keiser et al. (2019) did (Figure 5). While 95% CI result in a more conservative analysis, 84%

confidence intervals equate to a significance test where α = .05, as long as standard errors are approximately equal (Keiser et al., 2019). If the R^2 values do not overlap then the R^2 values are significantly different. If the values are highest at the short distances (low-cost behaviour) and decrease as the distance increases (increasing behavioural cost), then it shows support for the low-cost hypothesis, however, if they are highest at medium distances, then that will show support for the A-B-C model. I found that the standard errors in this study were approximately equal. Figure 5 displays this data in a graphical form to show the overlapping confidence intervals.

Figure 5

R^2 Values with 84% Confidence Intervals



Discussion

TPB

The results show that the TPB can be used to predict intention to alter travel behaviour which supports Hypothesis 1. All models for short-, medium-, and long-distance travel for both car and air travel were significant. Even though the strength of predictors (attitudes, subjective norms, PBC) varied across models, at least one of these variables was a significant predictor of behavioural intentions in every category.

The independent samples *t* tests comparing the variable means between the NZ student and MTurk samples showed that the mean scores of environmental attitudes and subjective norms for both car and air transport were significantly different except for environmental attitudes for car transport. NZ students scored significantly higher on environmental attitudes for air travel with a moderate effect size. MTurk participants scored higher on subjective norms for both car and air travel with high effect sizes. NZ students displayed attitudes more in-line with pro-environmental beliefs whilst the MTurk sample displayed a higher importance of how their behaviour was perceived and judged by other people.

The independent samples *t* test for PBC values showed that NZ participants scored lower on PBC than the USA participants for both car and air travel, meaning that they perceived it would be harder to make changes to their behaviours. Figure 2 shows that while the mean PBC scores for NZ participants decreased as distance increased, the MTurk participants showed almost no change in their mean PBC scores. This means that NZ participants perceived behaviour to be more and more difficult to change as distance increased, however MTurk participants reported that it would be just as easy to change behaviour for short distances as it would be for medium and long distances. It is possible that the USA participants perceived all these distances to be quite short and therefore the criteria

defining short-, medium- and long-distance travel may not have been appropriate for the MTurk sample. Added to the data showing that USA participants reported longer commute times, it is possible that this study may not have accurately tested an interaction between internal and external variables for the MTurk sample.

MTurk Sample

In the case of the MTurk data, environmental attitudes significantly predicted behavioural intention only once (short-haul flights). Subjective norms were always significant predictors of behavioural intention for all categories. The β-values show that subjective norms were the strongest predictor for intention to reduce impact of short-distance car travel, whereas PBC was the strongest predictor of intention to reduce impact of medium and long journeys. However, for air travel, subjective norms were the strongest predictor for all travel categories, having the greatest effect on intentions to reduce impact of short journeys by car and mid-haul flights. The MTurk data also showed that the highest R^2 values for both car and air travel were observed for intention to reduce impact of medium-distance travel, however the R^2 values were not significantly different across distances for either car or air travel.

PBC was a significant predictor at all distances for both intentions to reduce impact of car and air travel, but the β-value was considerably lower for air travel. The strength of subjective norms as a predictor remained quite high for both car and air travel.

NZ Sample

For the NZ student data, attitudes and PBC were significant predictors of behavioural intention in all categories. For car travel, subjective norms were significant predictors in all categories but, for air travel, subjective norms only significantly predicted intentions for mid-haul flights. As indicated by the β-values, the strongest predictor was always PBC except for long-distance journeys by car where environmental attitudes was a slightly stronger predictor.

For car travel, the R^2 value was highest for medium journeys, whereas it was highest for short-haul flights, yet values were not significantly different across distances for either car or air travel.

There are some differences between car and air travel for the NZ student sample such as the change in the β-values for the predictors. The β-values for subjective norms were lower for air travel compared to car travel, but they were higher for PBC.

Secondary Findings

The descriptive results showed that most participants from both samples travelled daily using private cars, however the proportion of participants in the NZ sample was over double compared to the proportion in the USA sample. Comparing the findings of this study to the results obtained by Sargisson (2018) who also measured how NZ students commuted to university, the percentage of NZ students using private cars for travel was the same (71%). This comparison indicates that the proportion of students travelling by private cars has remained the same over the last six years.

The majority of NZ participants also had much shorter commute times than their USA counterparts. In figure 4, the NZ sample shows an approximate normal distribution when disregarding those who do not travel, however, the MTurk sample showed the majority of participants selected the two highest options (20-30 mins and 30+ mins) for travel duration, which could indicate that the options were not entirely suitable for the USA sample. Over 50% reported they spent more than 20 minutes travelling to work and 27% of participants reported that they spent more than 30 minutes travelling to work which could indicate that the USA sample needed more categories- extending possibly up to an hour- to ensure a more accurate description of daily commute duration. This is an indicator as to the differences in what might be classified as short, medium and long trips for participants in different countries

and perhaps indicates that my distance manipulation may not have represented low-, medium-, and high-cost behaviours for my US participants.

Low-cost Hypothesis and A-B-C Model

The data show no clear support for either the low-cost hypothesis or the A-B-C model. There was only one significant result compared to 11 non-significant results thus showing that the R^2 values were largely not significantly different which means that the data did not support the low-cost hypothesis or the A-B-C model. Only the MTurk car travel data showed one significant difference which was that the R^2 value for the medium distance was significantly higher than for the short distance. This implies that the data were not consistent with the low-cost hypothesis and shows some very limited support for the A-B-C model, however, since there was no significant difference between the R^2 values for medium- and long-distance journeys, this finding does not show definitive support for either model. The data instead show no interaction between internal and external variables, and so the variables of the TPB have the same effect on intentions to reduce the impact of travel regardless of travel distance.

Moussaoui et al. (2020) also found no interaction between environmental attitudes and situational prompts on PEB. They stated that attitudes were correlated with higher rates of PEB, and prompts were correlated with higher rates of PEB, but there was no interaction between attitudes and prompts. Their study showed that internal and external variables correlated with behaviour separately as simple relationships, however they did not interact with each other.

Implications

My results clearly demonstrate that the TPB is effective as a predictor of intention to engage in PEB. By measuring internal psychological variables as well as the context surrounding these behaviours, it is possible to identify which variables are related

behavioural intentions. The TPB is an effective framework for identifying behavioural motivations and mechanisms to better understand and influence behaviour. Numerous researchers have demonstrated its effectiveness in identifying predictors of behaviour, and my study has shown the same (Aliabadi et al., 2020; Arvola et al. 2008; Kumar, 2019; Lizin et al., 2017; Oreg & Katz-Gerro, 2006). The comparisons made between the two samples show how the strength of the variables in the various models may change in different contexts, and highlight differences in populations for predictors of planned behaviour. This is valuable information as policymakers will then be able to use this to create specific policies based around how strongly the variables in the TPB correlate with behavioural intentions. For example, subjective norms were a strong predictor of behavioural intentions in the MTurk sample. A policymaker might make use of this intervention by using targeted campaigns aimed at pushing people to consider the individual impact they have compared to others who might be engaging in travel behaviour that reduces environmental impact. In doing so, this intervention targets the variable that participants of the MTurk data identified as being important to them. This may improve intervention efficacy and could result in a higher rate of behavioural change than a random sweeping intervention taken directly from another country (i.e. another context) or one that has very little background data to support it. Compared to the results from Busche and Sargisson (2020), the NZ sample seems to have some similar results to the European sample in that the linear regression shows similar relationships between the variables whereas the MTurk sample did not. This further demonstrates the need to include context in research surrounding the TPB as analysis of different samples has generated varying data.

The data showed no evidence to support either the low-cost hypothesis or the A-B-C model which means that there is no clear interaction between internal psychological variables and the behavioural cost. This is not to say that there are no interactions with any external

variables as the only external variable that was measured in this study was behavioural cost. It may be entirely possible that there are other external factors that may have an interaction. I recommended that future research explores other major external variables that may be barriers to transport such as infrastructure, financial cost of transport, and accessibility. Having no interaction between internal and external variables also means that changing either of these factors could promote behavioural change. If internal variables predict behavioural intentions regardless of external costs, then increasing the strength of internal factors may be effective over all levels of cost. For example, if policymakers decide to implement an intervention based upon the idea of affecting environmental opinions on travel, then it would change opinions in general rather than for specific distances.

The findings of studies like mine could be used to inform interventions such as environmental policies aimed at changing behaviour and may be used to make more economical and targeted decisions to promote PEB. Not only can it be used to create these interventions, but it can also be used to monitor and help make corrections to these interventions based upon the changes in the variables. The evidence shown for the TPB suggests that policymakers should explore interventions that target variables strongly correlated with PEB depending on the sample population. For example, the MTurk sample always showed strong correlations between subjective norms and intention to reduce impact of travel, so it may be beneficial to target social norms and comparisons, or appeal to people as being part of a group or community to influence how they are perceived by others. If such a common behaviour may be affected by using the TPB, then it may open the way for more PEB to be changed.

Limitations

The reliability analysis showed that the scales for the NZ student sample were reliable as the Cronbach's alpha for almost all scales were over 0.7. However, the MTurk sample

displayed varying reliability with scales only achieving values greater than 0.5, and some failing to achieve values of 0.6. This may be partially due to software issues during data analysis of the MTurk sample which did not affect the NZ sample, however, there is no clear reason as to why there are such stark differences between reliability of these scales.

A major limitation of this study is that there were no direct measurements or observation of the target behaviour in the real world. Instead, I relied on intention-to-change behaviour as an indication of whether people would actually change their behaviour. This point was also addressed by Busche and Sargisson (2020) when they stated that they also did not obtain any direct measurements of flight behaviour. Whilst this certainly would have been beneficial, there was simply not enough time and resources to be able to carry out a direct measurement, however, future researchers in this area should endeavour to measure actual behaviour. Additionally, the method for gathering data was a self-report questionnaire. While self-report measures are quick and effective ways to increase the sample size, this method may be subject to biases (Brenner & DeLamater, 2016; Demetriou et al., 2015), partly because participants might present answers that are more socially acceptable. The MTurk participants produced high scores for subjective norms, and if they skewed their answers towards those that are socially acceptable, it may have influenced their responses for their willingness to reduce the impact of travel.

The TPB is a flexible model; it is possible to create numerous variables under the umbrella of attitude and subjective norms. By adding more variables, it is possible for researchers to consider more aspects that may be integral to the decision-making process. As long as these variables can be measured accurately and scaled alongside any other variables included in the analysis for correlation with behavioural intention, then it is possible to identify the existence and strength of any interactions between variables. Whilst I did explore internal psychological variables related to intentions to change PEB, I did not take into

account many other variables that may have a bearing on pro-environmental intentions. For example, I did not ask about attitudes and beliefs regarding public transport. Whilst I did not set out to explore public transport in depth, it would have been useful to ask about access and convenience of public transport, and whether it would have had a impact on travel behaviour as shown by Fu and Juan (2017). This variable would have been different across samples due to differences in public transport in NZ and the USA, as well as differences in public transport by cities. There are other variables that may have also affected the results such as political ideologies, attitudes, and beliefs on environmental sustainability outside transport, level of education, and socioeconomic status (Tobler et al., 2012), although socioeconomic variables have been shown to hardly correlate with environmental values (Sargisson et al., 2020), and may therefore have little effect on intentions to change travel behaviour.

There were limitations with the samples in this study. I had hoped to compare large samples indicative of the beliefs and behaviours of American and NZ populations. The NZ sample had a mean age of 22.8 years, comprised primarily of women, and participants were drawn from only one university. The MTurk sample was more balanced in terms of gender and age and would have had a larger sample size compared to the NZ data were it not for the software issues resulting in numerous entries being omitted from data analysis. However, neither sample is representative of a general population and caution should be taken in attempting to generalise my results.

Conclusion

There are numerous studies supporting the idea that TPB can be used to predict behaviour (Abdelwahed et al., 2022; Aliabadi et al., 2020; Tobler et al., 2012; Wang et al., 2022). Overall, my study supported the effectiveness of the TPB and how it may be used in a real-world scenario. Further research could identify other factors beyond the TPB that may influence willingness to reduce the impact of travel. It may also be interesting to conduct

qualitative research to explore why there may be differences between populations as to what variables correlate more strongly with behavioural intentions. By using the TPB as a tool for identifying the strength of factors which influence behaviour, it is possible to promote PEB to ensure largescale positive change for the environment.

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Appendix A

Ethics Approval

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THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Shane Reddy

Dr Rebecca Sargisson

Te Kura Whatu Oho Maui School of Psychology

15 July 2023

Dear Shane

Re: **FS2023-27: Using the Theory of Planned Behaviour to Predict Intentions to Reduce the Impact of Travel**

Thank you for submitting your revised application to the ALPSS Human Research Ethics Committee. We have reviewed the final electronic version of your application and the Committee is now pleased to offer formal approval for your research activities as included therein.

We encourage you to contact the committee should issues arise during your data collection, or should you wish to add further research activities or make changes to your project as it unfolds. We wish you all the best with your research. Thank-you for engaging with the process of Ethical Review.

Kind regards

Dr Oleg Medvedev, Convenor
Division of Arts, Law, Psychology & Social Sciences Human Research Ethics

Appendix B

Questionnaire

Demographic Questions

1. How old are you?
   - Manual Entry

2. Please select the option that best applies to you:
   - Male
   - Female
   - Non-Binary
   - I would prefer not to say

3. What level of study are you currently undertaking?
- Level 100
- Level 200
- Level 300
- Postgraduate
- I am not currently a student

4. What country do you currently reside in?
- New Zealand
- USA
- Other

Driving Questions

5. The media tends to overstate the effects of climate change.
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

6. What is your primary personal mode of transport?
- Petrol/Diesel Vehicle
- EV/Hybrid Vehicle
- Motorcycle
- Bike
- Electric scooter/bike
- Public Transport

- Carpool
- Walk
- Other

7. I am willing to pay to offset the cost of carbon emissions from my mode of transport
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

8. I am willing to pay more to use a less polluting mode of transport than driving
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

9. I am willing to choose a more energy efficient mode of transport than driving
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

10. I am willing to choose any other means of transport other than the one I am currently using
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

11. Petrol/diesel-based modes of transport are a significant contributor to climate change
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

12. Commuters should pay more to use petrol/diesel-based transport because of the negative environmental aspects of pollution
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

13. When other people around me reduce the amount they drive, I feel I should too
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

14. People who are important to me think that I should reduce the amount I drive
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

15. People who are important to me would support me in reducing the amount I drive
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

16. My friends try to reduce the amount they drive
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

17. My friends try to reduce the number of trips they make by car
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

18. My current primary mode of transport is the most cost-efficient for my situation
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

19. It is possible for me to reduce my car use
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

20. It would be difficult for me to reduce my car use
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

21. I can reduce my car use
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

22. My current primary mode of transport is the most convenient
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

23. My current primary mode of transport is the most cost-efficient
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

24. My primary mode of transport should be more convenient than environmentally friendly
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

25. My primary mode of transport should be more cost-effective than environmentally friendly
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

26. I feel morally obliged to reduce my car use
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

27. It would violate my principles if I did not try to reduce my car use
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

28. I feel guilty if I don't try to reduce the number of trips I make by car
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

29. On average, how long is your commute to work?
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

Flying Questions:

30. I am planning to fly (domestic or international) in the next 12 months
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

31. I am willing to pay to offset the cost of carbon emissions from my flight
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree
-

32. I am willing to pay more to fly a less polluting airplane
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

33. I am willing to choose a more energy efficient airline
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

34. I am willing to choose any other means of transport rather than flying
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

35. Passengers should pay more to fly because of the negative environmental aspects of aviation
- Strongly Disagree
- Disagree
- Somewhat
- Agree

- Strongly Agree

36. Air travel is a significant contributor to climate change
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

37. Experiences of different cultures and destinations is more important than saving natural resources
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

38. My friends try to reduce the number of flights they take
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

39. When other people around me reduce their air travel, I feel I should too
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

40. People who are important to me think that I should reduce my air travel
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

41. People who are important to me would support me in reducing my air travel.
- Strongly Disagree
- Disagree
- Somewhat
- Agree

- Strongly Agree

42. When booking flights, I prioritise convenience over being environmentally friendly
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

43. When booking flights, I prioritise cost-effectiveness over being environmentally friendly
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

44. I feel morally obliged to reduce the number of flights I take
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

45. It would violate my principles if I did not try to reduce the number of flights I take
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

46. I feel guilty if I do not try to reduce the number of flights I take
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

The following questions refer to short trips. Think about short-haul trips as trips that would take up to X hours by car. How willing are you to:

47. I find reducing the number of short trips I make is convenient
- Strongly Disagree

- Disagree
- Somewhat
- Agree
- Strongly Agree

48. I find reducing short trips is easy
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

49. Using the other modes of transport instead of driving for short trips is easy for me if I want to
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

50. I am willing to pay to offset the cost of carbon emissions from driving for short trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

51. I am willing to pay to use a less polluting mode of transport than driving for short trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

52. I am willing to choose a more energy efficient mode of transport than driving for short trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

53. I am willing to choose any other mode of transport other than driving for short trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

The following questions refer to medium trips. Think about medium trips as trips to destinations that would take between X to X hours by car. How willing are you to:

54. I find reducing medium trips is convenient
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

55. I find reducing medium trips is easy
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

56. Using the other modes of transport instead of driving for medium trips is easy for me if I want to
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

57. I am willing to pay to offset the cost of carbon emissions from driving for medium trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

58. I am willing to pay to use a less polluting mode of transport than driving for medium trips
- Strongly Disagree

- Disagree
- Somewhat
- Agree
- Strongly Agree

59. I am willing to choose a more energy efficient mode of transport than driving for medium trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

60. I am willing to choose any other mode of transport other than driving for medium trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

The following questions refer to long trips. Think about long trips as trips to destinations that would take longer than X hours by car. How willing are you to:

61. I find reducing long trips is convenient
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

62. I find reducing long trips is easy
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

63. Using the other modes of transport instead of driving for long trips is easy for me if I want to
- Strongly Disagree
- Disagree
- Somewhat

- Agree
- Strongly Agree

64. I am willing to pay to offset the cost of carbon emissions from driving for long trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

65. I am willing to pay to use a less polluting mode of transport than driving for long trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

66. I am willing to choose a more energy efficient mode of transport than driving for long trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

67. I am willing to choose any other mode of transport other than driving for long trips
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

The following questions refer to short-haul flights. Think about short-haul trips as trips that would take up to X hours by plane. How willing are you to:

68. I find reducing short-haul flights is convenient
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

69. I find reducing short-haul flights is easy

- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

70. Using the other modes of transport instead of a plane for short-haul trips is easy for me if I want to
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

71. I am willing to pay to offset the cost of carbon emissions from short haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

72. I am willing to pay to use a less polluting mode of transport than planes for short haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

73. I am willing to choose a more energy efficient mode of transport than planes for short haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

74. I am willing to choose any other mode of transport other than planes for short haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree

- Strongly Agree

The following questions refer to mid-haul flights. Think about mid-haul trips as trips to destinations that would take between X to X hours by plane. How willing are you to:

75. I find reducing mid-haul flights is convenient
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

76. I find reducing mid-haul flights is easy
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

77. Using the other modes of transport instead of a plane for mid-haul trips is easy for me if I want to
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

78. I am willing to pay to offset the cost of carbon emissions from mid-haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

79. I am willing to pay to use a less polluting mode of transport than planes for mid-haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

80. I am willing to choose a more energy efficient mode of transport than planes for mid-haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

81. I am willing to choose any other mode of transport other than planes for mid-haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

The following questions refer to long-haul flights. Think about long-haul trips as trips to destinations that would take longer than X hours by plane. How willing are you to:

82. I find reducing long-haul flights is convenient
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

83. I find reducing long-haul flights is easy
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

84. Using the other modes of transport instead of a plane for long-haul trips is easy for me if I want to
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

85. I am willing to pay to offset the cost of carbon emissions from long-haul flights
- Strongly Disagree

- Disagree
- Somewhat
- Agree
- Strongly Agree

86. I am willing to pay to use a less polluting mode of transport than planes for long-haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

87. I am willing to choose a more energy efficient mode of transport than planes for long-haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

88. I am willing to choose any other mode of transport other than planes for long-haul flights
- Strongly Disagree
- Disagree
- Somewhat
- Agree
- Strongly Agree

Appendix C

Scaled Variables

Scaled Variable	Item Makeup
Environmental Attitudes (Car travel)	6*, 7, 8, 9, 11, 12, 23, 24*, 25*
Environmental Attitudes (Air Travel)	6*, 35, 36, 37*, 42, 43
Subjective norms (Car travel)	13, 14, 15, 16, 17, 26, 27, 28
Subjective Norms (Air Travel)	38, 39, 40, 41, 44, 45, 46
PBC Short (Car)	47, 48, 49
PBC Medium (Car)	54, 55, 56
PBC Long (Car)	61, 62, 63
PBC Short (Air)	68, 69, 70
PBC Medium (Air)	75, 76, 77
PBC Long (Air)	82, 83, 84
Car Intentions Short	50, 51, 52, 53
Car Intentions Mid	57, 58, 59, 60
Car Intentions Long	64, 65, 66, 67
Flight Intentions Short	71, 72, 73, 74
Flight Intentions Mid	78, 79, 80, 81
Flight Intentions Long	85, 86, 87, 88

Note: * Denotes an inverse scale where 5 = Strongly Disagree, 4 = Disagree, 3 = Neither agree nor disagree, 2 = Agree, 1 = Strongly Agree.