The Relationship Between Social Norms and Travel Behavior, and the Mediating Effect of Personal Norms

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This thesis has been written as a study assignment under the supervision of an Utrecht University teacher. Ethical permission has been granted for this thesis project by the ethics board of the Faculty of Social and Behavioral Sciences, Utrecht University, and the thesis has been assessed by two university teachers. However, the thesis has not undergone a thorough peer-review process so conclusions and findings should be read as such.

Abstract

Introduction: Climate change is a societal problem, influenced by travel behaviors such as air travel and car use. Travel emissions can be reduced by changing consumer behavior. Social and personal norms influence behavior and may reduce travel behavior. Their influence on air travel and car use, and a possible mediation effect, are under-researched. This study aims to fill the gap and provide policy leads by examining the relationship between social norms and travel behavior, focusing on air travel and car use, and the mediation of personal norms. The Reasoned Action Approach (RAA), Value-Beliefs-Norms Theory (VBN), and a theory explaining internalization were used as a theoretical framework.

Method: This quantitative, cross-sectional study used an online survey amongst a Dutch sample (n = 1039). Covariates included age, sex, education, and income. Simple linear regressions and mediation analyses using Hayes PROCESS Macro model 4 were conducted.

Results: Results showed social norms were significantly positively related to air travel and car use. A partial mediation effect of personal norms for both behaviors was found.

Discussion: The results showed (1) a positive relationship between car use and air travel in one's social surroundings and one's use and (2) this effect was partly mediated by how important one deems a reduction of car use and air travel in general. The findings of this research are in line with the hypotheses, previous findings in the literature, the RAA, the VBN, and the theory regarding internalization. It shows social norms can be targeted to achieve a travel reduction to reduce climate change impact. Based on these findings, future research should examine various norms, travel behaviors, and the mediation relationship in more detail, to improve knowledge as a base for interventions, to combat climate change.

Keywords: social norms; personal norms; travel behavior; Reasoned Action Approach; Value-Belief-Norms theory

Introduction

Problem statement

Climate change is a major social challenge (UNGA, 2015). Rising global temperatures, rising sea levels, and ocean acidification are endangering communities' survival and the planet's life support systems. International and national actions are taken, including the Paris Agreement and the Dutch Climate Agreement (Rijksoverheid, n.d.; UNFCCC, n.d.).

Travel contributes to climate change. Aviation is a growing source of greenhouse gas emissions (European Commission, n.d.), nitrogen oxides, water vapor, sulfate, and soot particles, significantly impacting the climate (European Commission, 2020). Car use also contributes to greenhouse gas emissions, nitrogen, and particulate matter (Milieu Centraal, n.d.-a).

Changing consumer behavior can reduce travel. Regarding air travel, consumers can reduce flying and choose pro-environmental transportation, including the train (Juvan & Dolnicar, 2017; Ullström et al., 2021). Regarding car use, consumers can switch to more pro-environmental transport modes including walking, cycling, and public transport (Milieu Centraal, n.d.-a, Milieu Centraal, n.d.-b).

Societal relevance

Social norms influence consumer behavior regarding air travel and car use (Gardner & Abraham, 2008; Gössling & Dolnicar, 2023; Soza-Parra & Cats, 2024), and personal norms (Gardner & Abraham, 2008; Javaid et al., 2020). Social norms refer to acceptable or permissive behavior in a group or society (Fishbein & Ajzen, 2011). Personal norms are internal standards for behavior (Kallgren et al., 2000).

Understanding travel behavior's determinants is critical, as these can contribute to reducing the impact on climate change (Soza-Parra & Cats, 2024). This knowledge can be

used by policymakers for legislation and interventions. That way, a societal transition can be achieved (Grin et al., 2010), causing a reduction of people's impact on climate change, and combating the threat to many communities and species (UNGA, 2015).

Scientific relevance and existing literature

Several reviews have found social norms influential in air travel and car use (Gardner & Abraham, 2008; Gössling & Dolnicar, 2023; Soza-Parra & Cats, 2024). Regarding car use, the more normalized one perceives it, the higher the chances they will drive (Gardner & Abraham, 2008; Soza-Parra & Cats, 2024). Another review, however, found inconclusive results regarding car use (Javaid et al., 2020). Social norms are partly composed of environment-related societal expectations and reinforced by positive motives, including symbolic value, and status signaling (Soza-Parra & Cats, 2024). Regarding air travel, social norms are an important factor in reduction (Gössling & Dolnicar, 2023; Ministry of Infrastructure and Water Management, 2023). The social norm regarding air travel is changing to increased shame and stigma (Cohen et al., 2011), however, people still deem themselves unaccountable for their flight emissions (Gössling & Dolnicar, 2023), possibly because it takes time before a norm impacts behavior (Gössling et al., 2020). However, this changing social norm did lead to increased support for flying cost increases, and policies forcing airlines to reduce emissions (Gössling et al., 2020).

Personal norms are positively associated with car use (Gardner & Abraham, 2008; Javaid et al., 2020), indicating the higher one's personal norm to drive, the more one will drive. An even stronger relation was found for personal norms reducing future car use (Javaid et al., 2020). Reviews found personal norms positively related to hospitality and tourism behaviors (Lin et al., 2022), however, little evidence examined the relationship between personal norms and flying.

Social and personal norms can interact, with personal norms acting as a possible mediator via internalizing social norms (Legros & Cislaghi, 2020). This relationship was found for pro-environmental behaviors (Doran & Larsen, 2016; Helferich et al., 2023; Kim & Seock, 2019; Pristl et al., 2021). To the author's knowledge, few studies examined air travel and car use specifically.

Despite the current findings, multiple gaps in the literature remain. Firstly, the results regarding social norms and car use provide mixed results. Secondly, the relationship between air travel and personal norms has received little attention. Lastly, no articles have examined the mediation of personal norms regarding air travel and car use, whilst these would have high value (Javaid et al., 2020).

In addition, several limitations were identified for the studies that examined the mediation effect. Doran and Larsen (2016) solely examined the likelihood of engaging in several behaviors and recommended examining data on self-reported behavior as well, to prevent distorted results from a gap between behavioral intention and actual behavior. Furthermore, the authors recommended specifying the reference group that provides the social norms (e.g. friends and family), to understand which groups have strong normative social influences on travel choices. Another study recommended including more high-impact pro-environmental behavior (Helferich et al., 2023), including transport modes (Nielsen et al., 2021), to better address campaigns' impact.

This research aims to fill the gaps mentioned to better understand the determinants of air travel and car use. This is critical, as these contribute to climate change (Soza-Parra & Cats, 2024). Enriching existing literature provides insights into behavioral determinants, which can inform interventions. Interventions have been found effective in promoting pro-environmental behavior (Semenescu, 2020; Yamin et al., 2019).

Research aims

This study examines the relationship between social norms and travel behavior (air travel and car use), and the potential mediating role of personal norms, aiming to fill literature and methodological gaps and provide clarity about leads for interventions reducing air travel and car use.

Theoretical framework

The section below describes a theoretical framework providing a comprehensive overview and explanation of how social and personal norms might influence behavior. The social-psychological Theory of Planned Behavior (TPB) is a useful framework in the social and behavioral sciences (Bosnjak, 2020), frequently used to address social norms (Gardner & Abraham, 2008; Gössling & Dolnicar, 2023), and predict behavior (Zulkepeli et al., 2024), effective for developing interventions regarding pro-environmental behavior (Yuriev et al., 2020). Therefore, it is a suitable framework for this research. This study uses the most recent theory extended from the TPB: the Reasoned Action Approach (RAA) (Fishbein & Ajzen, 2011).

To predict individual pro-environmental behavior, it is essential to integrate this theory with another prominent theory of pro-environmental behavior (Zulkepeli et al., 2024), like the Value-Beliefs-Norms Theory (VBN) (Zulkepeli et al., 2024), making it applicable to combine these for this study.

To explain the mediation of personal norms, a theory regarding the internalization of social norms (Legros & Cislaghi, 2020; Thøgersen, 2006) is used.

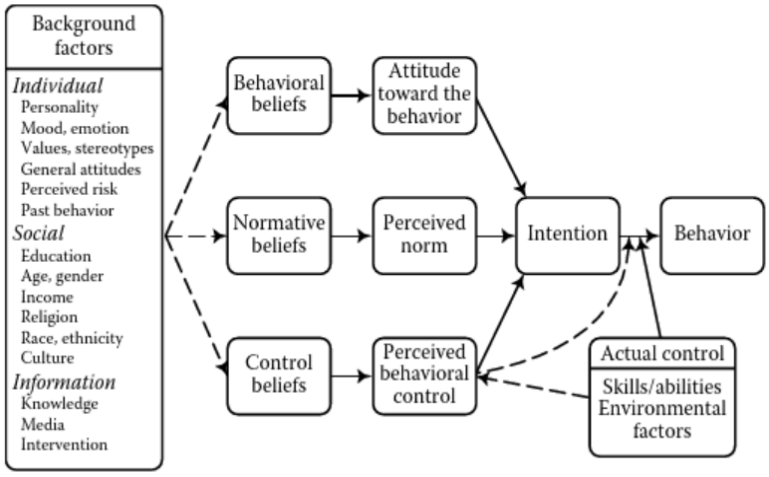
Reasoned Action Approach

The RAA defines social norms as perceived social pressure to (not) perform certain behaviors. Stronger pressure increases the likelihood of forming an intention to act. The

theory differentiates two social norm types: injunctive and descriptive (Cialdini et al., 1990; Fishbein & Ajzen, 2011). Injunctive norms refer to one's perception of what should be done according to others, whereas descriptive norms refer to what others are doing. Descriptive norms function as mental shortcuts for decision-making by providing cues to imitate others (Cialdini, 1988), whereas injunctive norms work via expectations of social sanctions resulting from others' disapproval (Helferich et al., 2023). The RAA model includes more factors predicting behavior, but the current study focuses on the social-norm-path. Figure 1 shows a schematic presentation of the model.

Figure 1

Schematic presentation of the Reasoned Action Model (Fishbein & Ajzen, 2011)



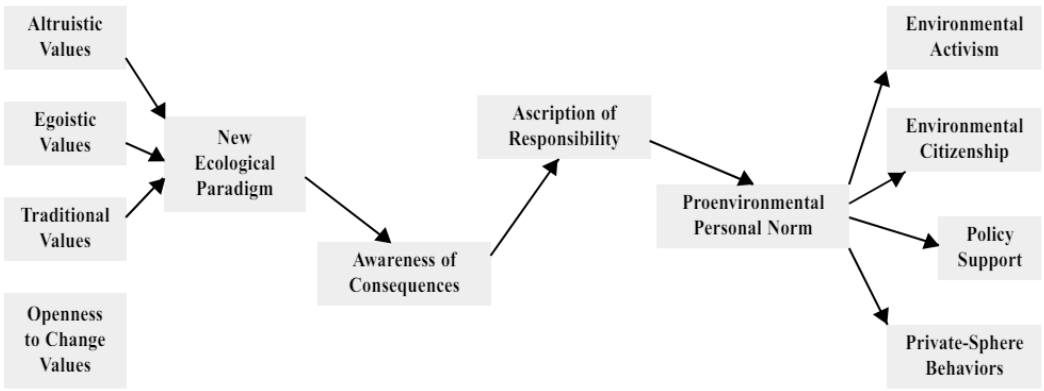
The social norm regarding flying is changing (Cohen et al., 2011). Its conflict with climate goals leads to increased stigmatization and negativity, resulting in shame (flight shame) (Gössling et al., 2020). Since social pressure causes people to adhere to social norms, this norm change can impact whether people choose to travel by plane. Driving is a status symbol, increasing pressure to own a car to avoid being called poor (Soza-Parra & Cats, 2024). On the other hand, environmental concerns may lead to social pressure not to own or use a car.

Value-Beliefs-Norms theory of environmentalism

The VBN suggests that values, beliefs, and personal norms influence individuals to support environmental social movements (Stern et al., 1999). It proposes three key factors for a personal pro-environmental norm: acceptance of personal values, beliefs that things important to those values are threatened, and beliefs that personal actions can mitigate the threat and restore the values. Personal pro-environmental norms were defined as an obligation for the individual and other social actors to alleviate environmental problems. The current study focuses specifically on the relationship between personal norms and behavioral outcomes and does not focus on the factors predicting personal norms. Figure 2 shows a schematic model of the theory.

Figure 2

Schematic model of Value-Belief-Norm theory (Stern et al., 1999)



The study focused on policy support, referring to accepting cuts in living standards. Car travel is associated with affluence (Soza-Parra & Cats, 2024), and air travel is seen as a necessary part of life (Ullström et al., 2021), both therefore related to certain standards in life, meaning travel behavior is possibly implicitly included in the model.

Norms becoming internal obligations

Legros & Cislaghi (2020) suggest an assimilation process of social norms until these become internally driven motivation (personal norms), shaping one's beliefs of how to act. Three intersecting and nonexclusive paths for complying exist: (1) people believe the social norms reflect their values, (2) following the social norm contributes to self-understanding or identity, or (3) the lack of other options limits people's ability to imagine alternatives, leading them to comply willingly with the social norm because it is deemed the only available option.

Applied to travel behavior, social norms regarding air travel and car use become internalized via one (or a combination) of the pathways. For example, a social norm of car use related to affluence can lead to internalization and lead one to believe it to be their own values, therefore buying a car and driving more often.

Research question and hypothesis

This research examines the following questions:

1. Is there a relation between perceived social norms and air travel and is this relation mediated by personal norms?
2. Is there a relation between perceived social norms and car use and is this relation mediated by personal norms?

Based on findings in the literature and various theories stating a relation between social norms and (travel) behavior, and mediation of personal norms, the hypotheses are:

- H1a. There is a positive relationship between social norms and air travel;
- H1b. The positive relationship between social norms and air travel is partially mediated by personal norms;
- H2a. There is a positive relationship between social norms and car use,
- H2b. The positive relationship between social norms and car use is partially mediated by personal norms.

Conceptual models are presented in Figures 4 and 5.

Figure 4

Conceptual Model of Hypotheses 1a and 1b

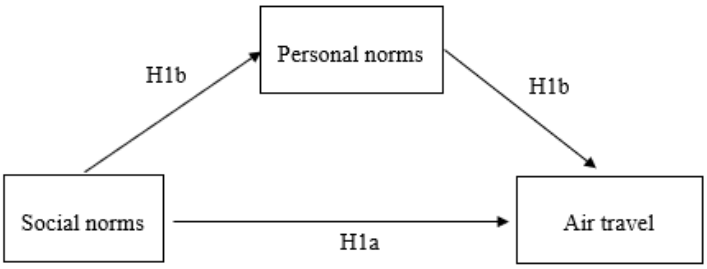
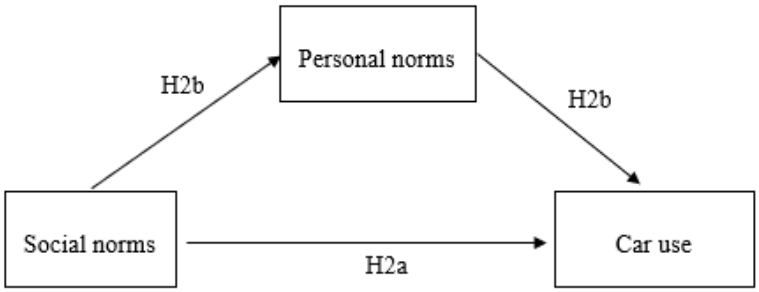


Figure 5

Conceptual Model of Hypotheses 2a and 2b



Methods

Data and study design

The current quantitative study uses secondary data analysis of data collected in a cross-sectional survey design by Motivaction, commissioned by Milieu Centraal, for the "Monitor Sustainable Living 2023" (Geeris et al., 2023). Data was obtained via Judith Roumen (info@milieucentraal.nl). A quantitative, "cross-sectional design" (Bryman, 2012, p. 59) allows for using survey data to examine association patterns, suitable for this research's objective. The online survey was conducted in Dutch. Data were anonymized, and securely stored on an Utrecht University drive (Bos, 2020).

Participant sample

Participants (n = 1039) were Dutch respondents between ages 18-80. StemPunt, Motivaction's online research panel (Motivaction, n.d.-a), collected the data. The panel has 70.000 participants, recruited on- and offline (Motivaction, n.d.-b). Specialist panel suppliers are used for difficult-to-reach target groups. Samples are drawn using propensity sampling, allowing correction for self-selection. Participants get rewarded with points to save for gift cards, days out, or charity donations. Informed consent was given upon panel registration by agreeing with the privacy statement and participation conditions. Ethical approval for this study was granted by the Ethical Review Board of the Faculty of Social and Behavioural Sciences of Utrecht University (24-1084).

Measuring instruments

Measuring items are presented in Table 1. The social norms item was used in previous research for different behaviors (Fishbein & Ajzen, 2011), others were not used before. All variables, except "age", are scale variables, but will be treated as continuous variables (Norman, 2010; Johnson & Creech, 1983; Zumbo & Zimmerman, 1993).

Table 1

Measuring items for studied variables

Construct	Type of variable	Measurement items	Answer options
Air travel	Dependent variable	To what extent do you plan on taking the plane in the coming 2 years (for example for vacation, a weekend away, family visits, or business)?	1. Definitely not 2. Probably not 3. Maybe 4. Probably yes 5. Definitely yes
Air travel social norm	Independent variable	Most people in my surroundings (family, friends) take the plane to holiday destinations at a 400-700 kilometers distance.	1. Strongly disagree 2. Disagree 3. Do not agree, do not disagree 4. Agree 5. Strongly agree 6. I do not know
Air travel personal norm	Mediator	I think it is important that people fly less often.	1. Strongly disagree 2. Disagree 3. Do not agree, do not disagree 4. Agree 5. Strongly agree 6. I do not know
Car use	Dependent variable	Do you ever use the car for short drives (less than 7,5km), for example for groceries, going to sports, to work in the same city, to friends, dropping off/picking up	1. Yes, more than 10 short drives per week 2. Yes, 5-10 short drives per week 3. Yes, 2-5 short drives per week 4. Yes, 1-2 short drives per month 5. Yes, 1 short drive per month or less

Construct	Type of variable	Measurement items	Answer options
		children, etc.? This does not have to be your car, it also counts when you borrow a car, rent it, or drive along with someone.	6. No, never
Car use social norm	Independent variable	Most people in my surroundings (family, friends) take the car for short drives.	1. Strongly disagree 2. Disagree 3. Do not agree, do not disagree 4. Agree 5. Strongly agree 6. I do not know
Car use personal norm	Mediator	I think it is important that people take the car less often.	1. Strongly disagree 2. Disagree 3. Do not agree, do not disagree 4. Agree 5. Strongly agree 6. I do not know

Covariates

Various variables included in the dataset can influence personal norms or travel behavior. Age and education (Van Liere & Dunlap, 1980), income (Xu et al., 2020), and gender (Pourhashem et al., 2022) were therefore included in the analysis as covariates, also treated as continuous. These items are presented in Table 2.

Table 2

Measuring items for the covariates

Covariate	Categories	
Age	*Continuous variable (min = 18, max = 80)*	
Sex	1. Male	
	2. Female	
Education level	1. High	Master HBO/University level or post-doctorate
		Bachelor HBO/University level
	2. Middle	First-year HBO/University
		Senior general secondary education (Havo) or pre-university education (VWO)
		Secondary vocational education (MBO) 2, 3, 4 or before 1998
		Pre-vocational secondary education (VMBO) (theoretic/mixed) or junior general secondary education (Mavo)
	3. Low	Pre-vocational secondary education (VMBO) (vocationally focused) or secondary vocational education (MBO) 1
		Primary education
		No education
Income	1. Below average	Minimum
		Below average
		Almost average
	2. Average	Between 36.500-43.499 euros
	3. Above average	Between 1-2x average
		Twice average
		More than twice the average
	4. Unknown	Do not want to answer
		Income unknown

Statistical Analyses

Data were analyzed using SPSS statistical software (SPSS Inc., version 29) and Hayes PROCESS Macro (Hayes, 2012). A post-hoc power analysis was conducted using G*Power. Certain variables were recoded, which can be found in Table 3.

Table 3

Recoded measuring items

Variable	Initially coded	Recoded
Car use	0. Yes, more than 10 short drives per week 1. Yes, 5-10 short drives per week 2. Yes, 2-5 short drives per week 3. Yes, 1-2 short drives per month 4. Yes, 1 short drive per month or less 5. No, never	1. No, never 2. Yes, 1 short drive per month or less 3. Yes, 1-2 short drives per month 4. Yes, 2-5 short drives per week 5. Yes, 5-10 short drives per week 6. Yes, more than 10 short drives per week
Air travel personal norm	1. Strongly disagree 2. Disagree 3. Do not agree, do not disagree 4. Agree 5. Strongly agree 6. I do not know	1. Strongly agree 2. Agree 3. Do not agree, do not disagree 4. Disagree 5. Strongly disagree Missing: I do not know
Car use personal norm	1. Strongly disagree 2. Disagree 3. Do not agree, do not disagree 4. Agree	1. Strongly agree 2. Agree 3. Do not agree, do not disagree 4. Disagree

Variable	Initially coded	Recoded
	5. Strongly agree 6. I do not know	5. Strongly disagree Missing: I do not know
Sex	1. Male 2. Female	0. Male 1. Female
Education level	1. High 2. Middle 3. Low	1. Low 2. Middle 3. High
Income level	1. Below average 2. Average 3. Above average 4. Unknown	1. Below average 2. Average 3. Above average Missing: unknown

First, descriptive statistics and Pearson correlations were calculated using pairwise deletion, per Pallant (2016).

Second, assumptions for mediation analysis (multicollinearity, linearity, normality, homoscedasticity) were tested (Pallant, 2016, pp. 159-160). None were violated. For multicollinearity, VIF < 10 and Tolerance > 0.10 (Pallant, 2016, p.159). Normal P-P Plots and Skewness and Kurtosis analysis showed no normality deviations. Scatter plots showed no data pattern.

As the dependent variables (air travel and car use) were treated as continuous variables, linear regressions were used for the analyses. First, simple linear regressions were performed to examine the relationship between social norms and travel behaviors (Zou et al., 2003). Both behaviors were examined in separate analyses, using two models per analysis to compare results before and after adding covariates. In model 1, the dependent and independent variables were added. In model 2, the dependent, independent, and covariates (age, sex, education, income) were added. Listwise deletion was used to be consistent with the mediation analysis, where it is the default and only option (Hayes, n.d.). This resulted in air travel: $n_{model1} = 771$, $n_{model2} = 561$, and car use: $n_{model1} = 839$, $n_{model2} = 597$.

Hayes PROCESS model 4 was used for the mediation analyses (Hayes, 2012). Both behaviors were examined in separate analyses, using two models per analysis to compare results before and after adding covariates. In model 1, the dependent, independent, and mediator variables were added. In model 2, the dependent, independent, mediator, and covariates were added. Heteroskedasticity correction was applied (Davidson-McKinnen). Bootstrapping (5000 resamples) and 95% confidence intervals were used. Listwise deletion resulted in air travel $n_{model1} = 755$, $n_{model2} = 550$, car use, $n_{model1} = 812$ and $n_{model2} = 587$.

Results

Simple linear regressions examined the relationship between social norms and travel behavior. Mediation analyses assessed the mediating role of personal norms. The results are presented below.

Descriptive statistics

A post-hoc power analysis showed power (1-β) = 1 ($f^2 = 0.15$, $\alpha = 0.05$, $n = 1039$, 2 predictors). Descriptive statistics are presented in Table 4.

Table 4

Descriptive Statistics

Variable	*n*	%	Mean	SD
Sex				
Male	538	51.8		
Female	501	48.2		
Age				
Total	1039	100	54.04	14.82
Education level				
Low	243	23.4		
Medium	499	48.0		
High	297	28.6		
Income level				
Below Average	312	30.0		
Average	127	12.2		
Above Average	297	28.6		
Unknown	303	29.2		
Air travel				
Definitely not	239	28.2		

Variable	*n*	%	Mean	SD
Probably not	212	20.4		
Maybe	172	16.6		
Probably yes	173	16.7		
Definitely yes	189	18.2		
Air travel social norm				
Strongly disagree	91	8.8		
Disagree	154	14.8		
Do not agree, do not disagree	201	19.3		
Agree	257	24.7		
Strongly agree	69	6.6		
I do not know	267	25.7		
Air travel personal norm				
Strongly agree	253	24.4		
Agree	316	30.4		
Do not agree, do not disagree	283	27.2		
Disagree	73	7.0		
Strongly disagree	52	5.0		
I do not know	62	6.0		
Car use				
No, never	197	19.0		
Yes, 1 short drive per month or less	92	8.9		
Yes, 2-3 short drives per month	116	11.2		
Yes, 1-2 short drives per week	255	24.5		
Yes, 2-5 short drives per week	187	18.0		
Yes, 5 to 10 short drives per week	111	10.7		
Yes, more than 10 short drives per week	81	7.8		
Car use social norm				
Strongly disagree	46	4.4		
Disagree	150	14.4		

Variable	*n*	%	Mean	SD
Do not agree, do not disagree	272	26.2		
Agree	308	29.6		
Strongly agree	57	5.5		
I do not know	206	19.8		
Car use personal norm				
Strongly agree	189	18.2		
Agree	387	37.2		
Do not agree, do not disagree	301	29.0		
Disagree	73	7.0		
Strongly disagree	40	3.8		
I do not know	49	4.7		

Note: *n* = 1039

Bivariate associations

Correlations between the variables are presented in Table 5. Most correlations show low to medium relationships, except for personal norms, showing a strong mutual relationship (Pallant, 2016).

Table 5

Pearson Correlations for Study Variables

Variable	1	2	3	4	5	6	7	8	9	10
1. Air travel	—									
2. Air travel social norm	.240**	—								
3. Air travel personal norm	.371**	.235**	—							
4. Car use	.101**	.005	.181**	—						
5. Car use social norm	−.012	.162**	.115**	.214**	—					
6. Car use personal norm	.081*	.073*	.618**	.294**	.214**	—				
7. Sex	−.256**	−.070	−.088**	−.019	−.022	−.042	—			
8. Age	.024	.058	.023	−.061*	−.004	−.019	−.075*	—		
9. Education level	.258**	.010	−.074*	.011	−.135**	−.114**	−.257**	−.161**	—	
10. Income level	.327**	−.003	.078*	.210**	.039	.031	−.173**	−.211**	.426**	—

*$p < .05$ (2-tailed). **$p < .01$ (2-tailed).

Statistical analyses

Results for the simple regression and mediation analyses are presented per behavior, starting with air travel, followed by car use.

Air travel

The regression table for the simple regression and mediation is presented in Table 6.

Table 6

Output of Regression Analyses for Air Travel

		Model 1							Model 2						
		Unstandardised Coefficients		Standardized Coefficients			95% Confidence Interval for B		Unstandardised Coefficients		Standardized Coefficients			95% Confidence Interval for B	
		B	Std. Error	β	t	Sig.	LL	UL	B	Std. Error	β	t	Sig.	LL	UL
1[a,d]	(Constant)	1.975	.146		13.566	<.001	1.689	2.261	1.665	.373		4.469	<.001	.933	2.397
	Air travel social norm	.303	.044	.240	6.854	<.001	.216	.390	.272	.048	.214	5.683	<.001	.178	.366
	Age								-.018	.004	-.186	-4.729	<.001	-.026	-.011
	Sex								.228	.116	.076	1.971	.049	.001	.456
	Education								.191	.088	.092	2.172	.030	.018	.363
	Income								.446	.069	.272	6.473	<.001	.311	.581
2[b,e]	(Constant)	1.133	.145		7.819	.000	.849	1.418	.565	.400		1.412	.159	-.221	1.352
	Air travel social norm	.195	.043	.153	4.572	.000	.111	.278	.182	.048	.143	3.781	.000	.088	.277
	Air travel personal norm	.498	.045	.376	11.007	.000	.409	.587	.464	.051	.342	9.118	.000	.364	.563
	Age								-.015	.004	-.151	-3.988	.000	-.022	-.008

		Model 1							Model 2						
		Unstandardised Coefficients		Standardized Coefficients			95% Confidence Interval for B		Unstandardised Coefficients		Standardized Coefficients			95% Confidence Interval for B	
		B	Std. Error	β	t	Sig.	LL	UL	B	Std. Error	β	t	Sig.	LL	UL
	Sex								.249	.110	.082	2.264	.024	.033	.464
	Education								.315	.090	.151	3.482	.000	.137	.492
	Income								.373	.068	.227	5.498	.000	.240	.506
3[c,e]	(Constant)	1.677	.114		14.666	.000	1.452	1.901	2.346	.300		7.831	.000	1.757	2.934
	Air travel social norm	.225	.037	.235	6.089	.000	.153	.298	.193	.042	.206	4.570	.000	.110	.276
	Age								-.007	.003	-.096	-2.294	.022	-.013	-.001
	Sex								-.043	.095	-.019	-.452	.651	-.228	.143
	Education								-.245	.076	-.159	-3.240	.001	-.393	-.096
	Income								.142	.058	.117	2.443	.015	.028	.256

a. Outcome variable: Air travel intention

b. Outcome variable: Air travel intention

c. Outcome variable: Air travel personal norm

d. $n_{model1} = 771$, $n_{model2} = 561$

e. $n_{model1} = 755$, $n_{model2} = 550$

Simple regression analyses

Model 1. Social norms accounted for 5.8% of the variance in air travel (R^2 = .058, F(1,770) = 46.977), p < .001. The effect of social norms on air travel was significant (see Table 6).

Model 2. Social norms and covariates accounted for 22.0% of the variance in air travel (R^2 = .220, F(5, 556) = 31.387), p < .001. The effect of social norms on air travel was significant (Table 6).

The covariates account for the increase in variance from 5.8% to 22.0%. The standardized coefficient changed from β = .24 to β = .21.

The findings are in line with hypothesis 1a: "There is a positive relationship between social norms and air travel".

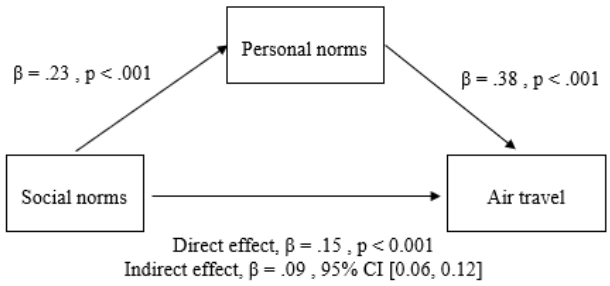
Mediation analyses

Model 1. The variables accounted for 19.21% of the variance in air travel (R^2 = .1921, F(2,752) = 98.512), p < .001.

The direct effect of social norms on air travel was significant (Table 6 and Figure 6). The effect of social norms on personal norms was significant, as well as the effect of personal norms on air travel (Table 6). A significant indirect effect was found (Figure 6).

Figure 6

Conceptual Model for Air Travel with Standardized Coefficients for Model 1

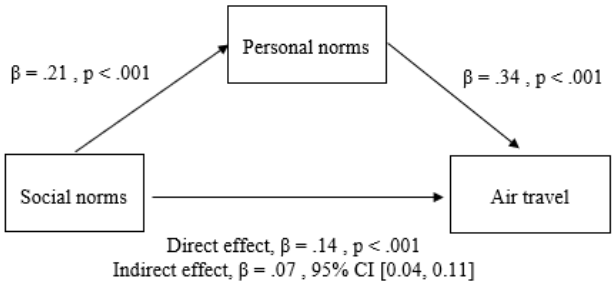


Model 2. The variables accounted for 32.64% of the variance in air travel (R^2 = 0.3264, F(6,543) = 58.264), p < 0.001.

The direct effect of social norms on air travel was significant (Table 6 and Figure 7). The effect of social norms on personal norms was significant, as well as the effect of personal norms on air travel (Table 6). A significant indirect effect was found (Figure 7).

Figure 7

Conceptual Model for Air Travel with Standardized Coefficients for Model 2



The covariates account for the increase in variance from 19.21% to 32.64%. For the direct effect, the standardized coefficient changed from β = .153 to β = .143, for the indirect effect, it changed from β = .088 to β = .070.

The findings are in line with hypothesis 1b: “The positive relationship between social norms and air travel is partially mediated by personal norms.

Car use

The regression tables for the simple regression and mediation are presented in Table 7.

Table 7

Output of Regression Analysis for Car Use

		Model 1							Model 2						
		Unstandardised Coefficients		Standardized Coefficients			95% Confidence Interval for B		Unstandardised Coefficients		Standardized Coefficients			95% Confidence Interval for B	
		B	Std. Error	β	t	Sig.	LL	UL	B	Std. Error	β	t	Sig.	LL	UL
1[a,d]	(Constant)	2.496	.213		11.698	<.001	2.077	2.914	1.487	.505		2.945	.003	.495	2.479
	Car use social norm	.401	.063	.214	6.323	<.001	.276	.525	.441	.073	.239	6.076	<.001	.298	.583
	Age								.000	.005	.003	.065	.949	-.010	.010
	Sex								.045	.149	.012	.303	.762	-.248	.338
	Education								-.082	.115	-.032	-.714	.476	-.307	.144
	Income								.487	.089	.239	5.487	<.001	.313	.662
2[b,e]	(Constant)	1.737	.225		7.721	.000	1.295	2.178	.472	.546		.863	.389	-.602	1.545
	Car use social norm	.287	.066	.154	4.340	.000	1.57	.417	.345	.077	.186	4.507	.000	.195	.495
	Car use personal norm	.475	.070	.254	6.738	.000	.336	.613	.446	.084	.241	5.289	.000	.280	.611
	Age								.004	.005	.029	.711	.477	-.006	.014
	Sex								.137	.149	.036	.924	.356	-.155	.429
	Education								-.002	.112	-.001	-.017	.987	-.222	.219
	Income								.441	.089	.216	4.978	.000	.267	.615
3[c,e]	(Constant)	1.679	.120		14.004	.000	1.444	1.914	2.350	.283		8.314	.000	1.795	2.905
	Car use social norm	.214	.038	.215	5.583	.000	.139	.289	.213	.045	.212	4.724	.000	.124	.301

	Model 1							Model 2						
	Unstandardised Coefficients		Standardized Coefficients			95% Confidence Interval for B		Unstandardised Coefficients		Standardized Coefficients			95% Confidence Interval for B	
	B	Std. Error	β	t	Sig.	LL	UL	B	Std. Error	β	t	Sig.	LL	UL
Age								-.007	.003	-.108	-2.696	.007	-.013	-.002
Sex								-.117	.082	-.057	-1.422	.156	-.278	.045
Education								-.205	.065	-.148	-3.152	.002	-.333	-.077
Income								.091	.051	.082	1.802	.072	-.008	.190

a. Outcome variable: Car use behavior

b. Outcome variable: Car use behavior

c. Outcome variable: Car use personal norm

d. $n_{model1} = 839$, $n_{model2} = 597$

e. $n_{model1} = 812$, $n_{model2} = 587$

Simple regression analyses

Model 1. Social norms accounted for 4.6% of the variance in car use (R^2 = .046, F(1,831) = 39.977), p < .001. The effect of social norms on car use was significant (Table 7).

Model 2. Social norms and covariates accounted for 11.4% of the variance in car use (R^2 = .114, F(5, 592) = 15.208), p < .001. The effect of social norms on car use was significant (Table 7).

The covariates account for the increase in variance from 4.6% to 11.4%. The standardized coefficient changed from β = .21 to β = .24.

The findings are in line with hypothesis 2a: "There is a positive relationship between social norms and car use".

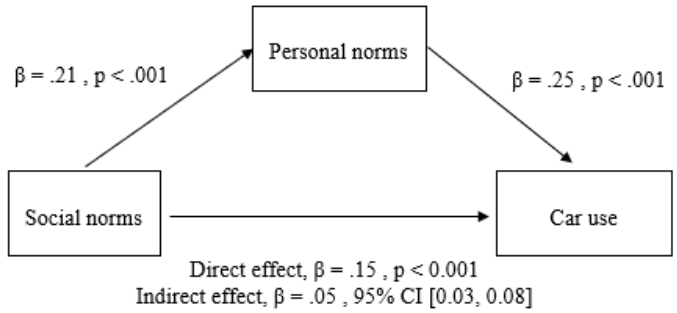
Mediation analyses

Model 1. The variables accounted for 10.5% of the variance in car use (R^2 = .105, F(2,809) = 46.329), p < .001.

The direct effect of social norms on car use was significant (Table 7 and Figure 8). The effect of social norms on personal norms was significant, as well as the effect of personal norms on car use (Table 7). A significant indirect effect was found (Figure 8).

Figure 8

Conceptual Model for Car Use with Standardized Coefficients for Model 1

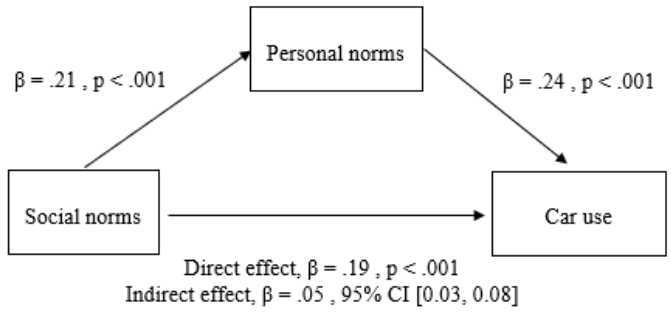


Model 2. The variables accounted for 16.47% of the variance in car use (R^2 = 0.1647, F(6,580) = 17.599), p < 0.001.

The direct effect of social norms on car use was significant (Table 7 and Figure 9). The effect of social norms on personal norms was, as well as the effect of personal norms on air travel (Table 7). A significant indirect effect was found (Figure 9).

Figure 9

Conceptual Model for Car Use with Standardized Coefficients for Model 2



The covariates account for the increase in variance from 10.5% to 16.47%. For the direct effect, the standardized coefficient changed from β = .15 to β = .19, and the indirect effect remained β = .05.

The findings are in line with hypothesis 2b: “The positive relationship between social norms and car use is partially mediated by personal norms.”

Discussion

Main findings

This research aimed to contribute to research combating climate change, by examining the relationship between social norms and traveling by plane and by car, and the mediation of personal norms.

The research questions were:

1. Is there a relation between perceived social norms and air travel and is this relation mediated by personal norms?
2. Is there a relation between perceived social norms and car use and is this relation mediated by personal norms?

Each sub-question had two hypotheses.

Hypothesis 1a “there is a positive relationship between social norms and air travel” was accepted, meaning holiday air travel of people in one’s social surroundings is positively associated with one’s flying intention.

Hypothesis 1b “the positive relationship between social norms and air travel is partially mediated by personal norms” was accepted. Both direct and indirect effects were significant, indicating a partial mediation (Baron and Kenny, 1986), meaning a respondent’s intention to fly in the next two years is related to vacation air travel behavior of people in their surroundings, partly determined by how important they deem a reduction in aviation in general.

Hypothesis 2a “there is a positive relationship between social norms and car use” was accepted, meaning car use for short drives of people in social surroundings is positively associated with one’s car use for short drives.

Hypothesis 2b “the positive relationship between social norms and car use is partially mediated by personal norms” was accepted. Both direct and indirect effects were significant, indicating a partial mediation (Baron and Kenny, 1986). This means that a respondent’s car use for short drives is related to car use for short drives of the people in their surroundings, partly determined by how important they deem a reduction in car use in general.

Concluding, both research questions can be answered:

1. There is a significant relation between perceived social norms and air travel, which is partially mediated by personal norms.

2. There is a significant relation between perceived social norms and car use, which is partially mediated by personal norms.

When corrected for covariates, the explained variance for air travel was 33.03% and 17.39% for car use, indicating other factors play a role, including childhood experience, political views, and religion (Gifford & Nilsson, 2014), which are to be examined in further research.

Previous studies

Below, the results will be discussed in light of previous studies and theories mentioned in the theoretical framework.

In line with this study's results, previous studies found a relationship between social norms and travel behavior (Gardner & Abraham, 2008; Gössling & Dolnicar, 2023; Soza-Parra & Cars, 2024), as for personal norms and car use (Javaid et al., 2020). For the mediation, most studies also found a partial mediation effect (Doran & Larsen, 2016; Helferich et al., 2023; Kim & Seock, 2019).

The current study's findings are in line with the Reasoned Action Approach (RAA) (Fishbein & Ajzen, 2011), stating the stronger the social pressure (social norm), the more likely an intention to perform certain behavior is formed, predicting behavior. Unlike air travel, car use was based on past and current habits, not intention. However, the RAA implies intention is a strong predictor of behavior (Fishbein & Ajzen, 2011), therefore, findings for both behaviors are in line with the RAA.

This study's findings are in line with the Value-Belief-Norm theory (Stern et al., 1999), as a significant relation between personal norms and travel behavior was found.

Regarding mediation, the current study's findings are in line with the theory by Legros & Cislaghi (2020) explaining social norm internalization leads to personal norms via three paths

(social norms reflecting values, self-understanding, and lack of alternatives), which guide behavior.

More variance in air travel than car use was explained. Behavioral control might play a role here, as Dütschke et al. (2022) found that people who felt control over choosing a pro-environmental transportation mode for holiday travels, were less likely to have flown. This aligns with the RAA, stating behavioral control influences whether intention translates into behavior. Since car use is more often a necessity than air travel, behavioral control is low, suggesting related factors influence car use. This study only measured car use behavior instead of behavioral intention, possibly implicitly including behavioral intention, explaining the lower variance.

Strengths

There are several strengths to this study. Firstly, a broad sample was used, open to people between 18-80 with all education and income levels. Along with the large sample size (n = 1039) (Burmeister & Aitken, 2012), this improved the result's generalizability (Charter, 1999), despite the "non-random sample" (Bryman, 2012, p. 187).

Furthermore, the use of covariates improved the internal validity (Flannelly, 2018).

Moreover, the sample was all-Dutch, making this study a valuable addition to scientific literature, as the effects of social norms on pro-environmental behavior depend on cultural factors (Culiberg & Elgaaied-Gambier, 2016; Helferich et al., 2023).

Lastly, the interdisciplinary character. The studied variables fall within several subdisciplines, including social and environmental psychology for social norms (Legros & Cislaghi, 2020), making it necessary to combine insights from across the social and behavioral sciences (Stern, 2000). This study combined insights from social and environmental psychology to gain new insights into the influence of society and social norms on specific personal

environmental behavior, and to deepen the behavior-related knowledge regarding climate change (Lin et al., 2021).

Limitations and recommendations for future research

The results should be interpreted with several limitations, leading to recommendations for further research, presented below.

Firstly, solely descriptive social norms were measured. Investigating both injunctive and descriptive separately to examine differences has been recommended (Kim & Seock, 2019). However, solely examining descriptive norms impedes comparisons, leaving a gap for further research to examine the same relationship for injunctive social norms. If a relationship is found, a mediation mechanism proposed by Thøgersen (2006), stating injunctive social norms are internalized forming two types of personal norms (introjected and integrated) might be valid. To effectively target norms in interventions, injunctive social norms and the two personal norms should be examined in further research.

Furthermore, all constructs were operationalized single-item, lowering "construct validity" (Bryman, 2012, p. 172), and increasing measurement error (Thøgersen, 2006). Future research should apply multi-item measures.

Also, differences in measurement for travel behavior (behavioral intention for air travel and behavior for car use), made results harder to compare. Asking people about their air travel intentions rather than past behavior might be more useful, as it is not habitual and the social norm is changing (Cohen et al., 2011), making air travel intention an accurate behavioral indicator. Nevertheless, taking notice of the difference is important. Including both intention and behavior could have improved comparability and is recommended for future research, also to see if behavioral control does indeed play a role as discussed previously.

Moreover, another operationalization difference possibly distorted the interpretation. Air travel intention and personal norms included all reasons and distances for air travel, whereas social norms included vacation and specific distances (400-700 km). Uniform measures are recommended for future research.

Additionally, using self-reported data can cause a "social desirability effect" (Bryman, 2012, p. 271), because of "flight shame"(Gössling et al., 2020), possibly leading to underestimation of air travel, making results less reliable. Using objective data is recommended for future research to prevent this bias.

Furthermore, car use was treated as a continuous variable, despite unequal distances between answer options. Future research should use a continuous variable for dependent variables to prevent possible analysis distortion.

Also, due to the nature of secondary data analysis in this study, there was little control over the included covariates. Future research should include more covariates, to see which increases the variance and play a role.

Additionally, the cross-sectional design makes it impossible to draw causal conclusions, meaning the examined relationships could work differently. To draw conclusions about the association's direction, longitudinal and experimental research is recommended.

Besides recommendations following from limitations, the study's results call for further research, described below.

Firstly, the mediation mechanism of personal norms needs further research regarding the variation in norm strength in the three distinct internalization pathways (Legros & Cislaghi, 2020), to gain more insight into how the different internalization processes influence behavior.

Moreover, travel behavior other than air travel and car use, such as cycling and walking should be examined, to gain knowledge of a broader scope of travel behaviors to possibly target with interventions.

Lastly, to effectively use this study's results to design interventions, future studies should investigate how normative messages should be worded to make them most effective, to maximize the intervention's efficacy.

Implications for practice

This study's findings showed that social norms are related to travel behavior and that personal norms mediate this relationship. Both social and personal norms are important in influencing behavior, but since social norms influence behavior directly and via internalization, recommendations to target these are presented.

Three sources can influence norms: other's behavior, information about a group's opinions and behavior, and institutional signals (Tankard & Paluck, 2016). Firstly, social referents (e.g. family, friends, fictional characters) exhibiting certain behavior can incentivize others to engage in that behavior (Abrahamse & Steg, 2013; Wormbs & Söderberg, 2021). Secondly, explicitly communicating a group's opinions and behaviors will show social approval for certain behaviors (Kormos et al., 2015), resulting in attempts to behave in line with these norms (Bergquist et al., 2023; Kormos et al., 2015). Thirdly, institutional signals from governments and educational institutions show which behavior is desired and accepted (Tankard & Paluck, 2016). Using this, environmental organizations and governments can influence the social norm. Communicated norms do not need to be true, solely credible. It is important to specify the messages and role models for the target audience to identify with (Tankard & Paluck, 2016).

Via moralizing (playing into one's moral duty and responsibility) and persuasion (presenting avoiding air travel as something positive for the individual), the campaign "We Stay on the Ground" managed to destabilize the social norm for flying (Ullström et al., 2021). Such campaigns can be used elsewhere to create a similar effect.

Policy efforts are recommended to consist of multi-stakeholder action, to amplify each other (Gössling & Dolnicar, 2023), for example simultaneously implementing a flight tax, and launching campaigns targeting social norms regarding air travel.

Conclusion

As consumer travel behavior contributes to climate change, this study examined the relationship between social norms and travel behavior, specifically air travel and car use, and the mediating role of personal norms. Both behaviors showed a significant relationship with social norms and a partial mediation of personal norms.

This means that the more people in one's surroundings fly for vacations of 400-700 km or use the car for short drives, the higher one's flight intention and car use, partly explained via the importance people ascribe to reducing air travel and car use.

To reduce consumers' impact on climate change, governments and environmental organizations can target social norms to reduce travel behavior, with interventions using others' behavior, information about a group's opinions and behavior, and institutional signals (Tankard & Paluck, 2016).

Future research should examine various norms (descriptive, injunctive, introjected, internalized), the mediation mechanism, other travel behaviors, and specific norm messages in more detail, to improve knowledge of their relations with behavior, and of targeting them. This can reduce people's impact on climate change, combating the threat to many communities and species (UNGA, 2015).

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Appendix A. Survey Questions

Onderzoeksspecificaties:

- Doelgroep/steekproef: representatief NL 18-80
- Steekproefgrootte: n=1000 (800 per blok)
- Aantal te coderen open vragen: 0

Uitsplitsingen voor analyse:

- Leeftijd (3 niveaus)
- Geslacht (2 niveaus)
- Opleidingsniveau (3 niveaus)
- Inkomen (3 niveaus + wil niet zeggen)
- Mentality (structuurzoekers + de rest)

Vragenlijst

Gedragingen:

- Met trein op vakantie in plaats van vliegtuig (=als je naar een bestemming van 400-700km afstand gaat (Midden-Frankrijk, Zuid-Duitsland, Engeland), met de trein te gaan in plaats van het vliegtuig)
- Fiets in plaats van auto op korte ritten (= vooral de fiets te gebruiken voor korte ritten (onder de 7,5km), in plaats van de auto

Algemene vragen

(soc.norm) De meeste mensen in mijn omgeving (familie, vrienden) ONGEWENST GEDRAG

(pers.norm) Ik vind het belangrijk dat mensen … veralgemeniseerd GEWENST gedrag

Selectievragen

- In hoeverre ben jij van plan de komende circa 2 jaar het vliegtuig te nemen (voor bijvoorbeeld vakantie, weekendje weg, familiebezoek of werk)?
    - Zeker niet
    - Waarschijnlijk niet
    - Misschien
    - Waarschijnlijk wel
    - Zeker wel
- Gebruik jij wel eens een auto voor korte ritjes (minder dan 7,5km), bijvoorbeeld voor boodschappen, naar sport, naar je werk in dezelfde stad, naar vrienden, het brengen/halen van de kinderen etc.? *Dit hoeft niet je eigen auto te zijn, ook als je auto leent, huurt of met iemand meerijdt telt het mee.*

- Ja, meer dan 10 korte ritten per week
- Ja, 5-10 korte ritten per week
- Ja, 2-5 korte ritten per week
- Ja, 1-2 korte ritten per week
- Ja, 2-3 korte ritten per maand
- Ja, 1 korte rit per maand of minder
- Nee, nooit

Blok: Vliegtuig

- De meeste mensen in mijn omgeving (familie, vrienden) nemen het vliegtuig naar bestemmingen op 400-700km afstand (soc.norm)
- Ik vind het belangrijk dat mensen minder gaan vliegen (pers.norm)

Blok: Auto

- De meeste mensen in mijn omgeving (familie, vrienden) pakken de auto voor korte ritten (soc.norm)
- Ik vind het belangrijk dat mensen minder met de auto gaan (pers.norm)

Appendix B. SPSS Syntax

```
DATASET ACTIVATE DataSet1.
RECODE Auto1 (1=7) (2=6) (3=5) (4=4) (5=3) (6=2) (7=1).
EXECUTE.

RECODE VliegPer AutoPers (5=1) (4=2) (3=3) (2=4) (1=5).
EXECUTE.
```

```
RECODE nOplCat (3=1) (2=2) (1=3).
EXECUTE.

RECODE nGslcht (1=0) (2=1).
EXECUTE.

WEIGHT OFF.

FREQUENCIES VARIABLES=xlft nGslcht nOplCat nInkCat Vlieg1 VliegSoc VliegPer Auto1
AutoSoc AutoPers
  /STATISTICS=STDDEV MINIMUM MAXIMUM SEMEAN MEAN
  /ORDER=ANALYSIS.

DESCRIPTIVES VARIABLES=Vlieg1 Auto1 VliegSoc VliegPer AutoSoc AutoPers xlft nGscht
nOplCat nInkCat
  /STATISTICS=MEAN STDDEV MIN MAX.

CORRELATIONS
  /VARIABLES=Vlieg1 Auto1 VliegSoc VliegPer AutoSoc AutoPers xlft nGslcht nOplCat
nInkCat
  /PRINT=TWOTAIL NOSIG FULL
  /MISSING=PAIRWISE.
```

```
REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA COLLIN TOL
  /CRITERIA=PIN(.05) POUT(.10) TOLERANCE(.0001)
  /NOORIGIN
  /DEPENDENT Vlieg1
  /METHOD=ENTER VliegSoc VliegPer xlft nGslcht nOplCat nInkCat.

REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA COLLIN TOL
  /CRITERIA=PIN(.05) POUT(.10) TOLERANCE(.0001)
  /NOORIGIN
  /DEPENDENT Auto1
  /METHOD=ENTER xlft nGslcht nOplCat nInkCat AutoSoc AutoPers.

PPLOT
  /VARIABLES=Vlieg1 Auto1 VliegSoc VliegPers AutoSoc AutoPers
  /NOLOG
  /NOSTANDARDIZE
  /TYPE=P-P
  /FRACTION=BLOM
  /TIES=MEAN
  /DIST=NORMAL.
```

```
FREQUENCIES VARIABLES=Vlieg1 Auto1 VliegSoc VliegPers AutoSoc AutoPers xlft
nGslcht nOplCat nInkCat
  /FORMAT=NOTABLE
  /STATISTICS=SKEWNESS SESKEW KURTOSIS SEKURT
  /ORDER=ANALYSIS.

GRAPH
  /SCATTERPLOT(MATRIX)=Vlieg1 VliegSoc VliegPers
  /MISSING=LISTWISE.

GRAPH
  /SCATTERPLOT(MATRIX)=Auto1 AutoSoc AutoPers
  /MISSING=LISTWISE.

REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA
  /CRITERIA=PIN(.05) POUT(.10) TOLERANCE(.0001)
  /NOORIGIN
  /DEPENDENT Vlieg1
  /METHOD=ENTER VliegSoc.

REGRESSION
```

```
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA
  /CRITERIA=PIN(.05) POUT(.10) TOLERANCE(.0001)
  /NOORIGIN
  /DEPENDENT Vlieg1
  /METHOD=ENTER VliegSoc xlft nGslcht nOplCat nInkCat.

REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA
  /CRITERIA=PIN(.05) POUT(.10) TOLERANCE(.0001)
  /NOORIGIN
  /DEPENDENT Auto1
  /METHOD=ENTER AutoSoc.

REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA
  /CRITERIA=PIN(.05) POUT(.10) TOLERANCE(.0001)
  /NOORIGIN
  /DEPENDENT Auto1
  /METHOD=ENTER AutoSoc xlft nGslcht nOplCat nInkCat.
```