Redesign travel norms: social norm interventions to reduce the behaviour of frequent flying among young professionals

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Abstract

The aviation industry is a growing contributor to climate change, yet frequent flying has become a normalized behavior even among environmentally conscious individuals. This paradox, characterized by the attitude–behavior gap, reveals how social norms and cognitive dissonance sustain unsustainable travel practices. This thesis investigates how social norm interventions can be strategically designed to disrupt these dynamics and encourage sustainable alternatives among young professionals.

The research adopts a mixed-methods approach. Study 1 employed qualitative interviews to explore how individuals negotiate social expectations, experience conflicting emotions, and rationalize frequent flying. Findings highlighted the powerful influence of peer validation, the tension between environmental values and travel choices, and coping strategies such as justification and moral licensing. Study 2 tested these insights through a quantitative experiment with a between-subjects design, examining the effects of different social norm framings on emotional responses, perceived environmental impact, purchase intentions, and travel mode selection. Results showed that unsustainable static norm + unsustainable dynamic norm framings increased participants' purchase intentions to choose trains over planes, triggers the negative feelings such as guilty, anxiety, frustration etc.

By integrating qualitative and quantitative evidence, this thesis demonstrates that how social norms can be reframed to shift travel choices. The findings advance understanding of how social norm reinforce the attitude–behavior gap and provide actionable insights for policymakers, organizations, and designers aiming to foster more sustainable mobility practices.

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1. Introduction

The aviation industry is one of the fastest-growing contributors to global greenhouse gas emissions. Although it accounts for a relatively small proportion of total anthropogenic emissions, its impact is disproportionately large due to the altitude at which emissions occur and the complex mix of gases released, including CO_2, NO_x, and contrail-induced cirrus clouds (Lee et al., 2009). As the demand for air travel continues to grow, frequent flying has become a normalized behavior, even among individuals who identify as environmentally conscious. This contradiction reflects a broader behavioral paradox; many environmentally aware consumers continue to engage in frequent air travel despite expressing concern for climate change. Flying is often perceived as a symbol of modernity, success, and freedom, and these social and cultural narratives reinforce its desirability. Consequently, individual environmental beliefs may conflict with behavior, resulting in cognitive dissonance (McDonald et al., 2015). This tension, widely known as the "attitude-behavior gap," reveals the challenge of translating environmental awareness into consistent sustainable actions—particularly when the act of flying is deeply embedded in social norms (Barr et al., 2010).

1.1 Understanding flying as a socially reinforced behaviour

Research on aviation's environmental impact has often been framed from a technological perspective, focusing on improving aircraft efficiency, biofuels, or emissions offsetting. However, these solutions alone are insufficient to mitigate the climate impact of aviation at the necessary scale or urgency (Chapman, 2007). In contrast, the consumer behavior perspective, particularly in the context of frequent flying, remains underexplored. This thesis will examine consumer behavior towards flying through a behavioral lens**.**

Within the consumer behavior domain, this thesis examines consumer behavior towards frequent flying through the theoretical lens of cognitive dissonance and the attitude–behavior gap. These frameworks provide a basis for understanding why environmentally aware individuals continue to justify unsustainable travel despite holding strong pro-environmental values. Despite strong pro-environmental values, many individuals compartmentalize flying as an exception—justifying it as a necessary or deserved indulgence (Barr et al., 2010). The persistent disconnect between what people believe and how they behave in the context of air travel is not just a matter of knowledge but also of social norms.

Social norms theory offers a powerful explanation for this phenomenon. Norms shape behaviors by influencing what is seen as acceptable, expected, or desirable within a group or society (Chung & Rimal, 2016). Flying is not only normalized but often celebrated through social media, marketing, and peer validation. Yet while social norms have been studied extensively in domains such as health, sustainability, and consumption, their role in shaping and maintaining frequent flying behaviors has received limited attention. Existing studies (Zijlstra et al., 2023) suggest that peer behaviors and perceived group expectations are powerful motivators, but few have investigated how these dynamics can be disrupted through design interventions.

Moreover, although behavioral design is increasingly used to nudge pro-environmental actions, its application in the travel sector—particularly in relation to challenging normalized behaviors like flying—is still emerging.

There is a need to explore how design can strategically leverage social norm mechanisms to encourage sustainable alternatives like rail travel, staycations, or digital connection.

Thus, this thesis identifies two interlinked knowledge gaps:

1. The underexplored role of social norms in sustaining frequent flying behavior consumers.
2. The limited application of strategic design interventions and encouraging sustainable travel decisions

1.2 Designing for behaviour change: a strategic approach

This project seeks to address these gaps by exploring how designed social norm interventions can influence frequent flying among young professionals, with a focus on the emotional and behavioral mechanisms involved .Grounded in the theoretical intersection of social norms, and behavioral design, the research investigates how individuals negotiate their travel decisions in the presence of normative cues, and how framing interventions may shape their responses.

The thesis is structured in two parts. Study 1 employs a qualitative approach (in-depth interviews) to explore the lived experiences, perceptions, and internal conflicts, identifying the role of social cues and the emotions that drive justification or discomfort. Study 2 builds on these insights through a quantitative experiment, testing how different social norm framings affect participants' emotional responses, perceived environmental impact, and purchase intentions to select between plane, train, and bus.

By integrating qualitative and quantitative evidence, the thesis aims to generate actionable insights into how social norms operate in the domain of air travel. Its implications extend to the design of interventions and communication strategies that seek to foster reflection, reduce the normalization of unsustainable flying, and support more sustainable travel decisions.

1.3 Methodology

This thesis adopts a mixed-methods design to investigate how social norms influence frequent flying among professionals, and how design interventions may support behavioral change. The research consists of two complementary studies. Study 1 is qualitative research based on in-depth interviews and thematic analysis. Its purpose is to capture how individuals experience, rationalize, and negotiate their frequent flying behavior within the context of social norms, emotional dynamics, and identity considerations. Study 2 is a quantitative experiment conducted through a survey with a between-subjects design. It aims to empirically test the causal effects of different social norm framings on emotional responses, purchase intentions, and perceptions of environmental impact across travel modes. Taken together, the two studies provide both exploratory and confirmatory evidence: the qualitative study uncovers underlying processes and meanings, while the quantitative study evaluates the robustness and generalizability of these mechanisms under controlled conditions.

Research question	**Method**	**Objectives**
RQ1 (Qualitative Research): How do environmentally aware consumers perceive and	Qualitative (Interviews, Thematic Analysis)	- Explore how individuals experience and internalize social expectations

rationalize their frequent flying behavior in the context of social norms and group identities?		around flying. - Identify justification patterns, cognitive dissonance, and value conflicts. - Reveal social norm and emotional drivers that literature may not capture.
RQ2 (Quantitative Research): How do different social norm framing influence individuals' intention to reduce flying?	Quantitative (Qualtrics experiment, SPSS analysis)	- Examine whether different social norm framings influence individuals' **intention to reduce air travel.** - Assess how framing affects the **actual choice between plane, train, and bus.** - Investigate whether framing alters individuals' **perceptions of the environmental impact** associated with different travel modes. - Provide empirical evidence on the effectiveness of norm-based interventions in shaping sustainable travel decisions.

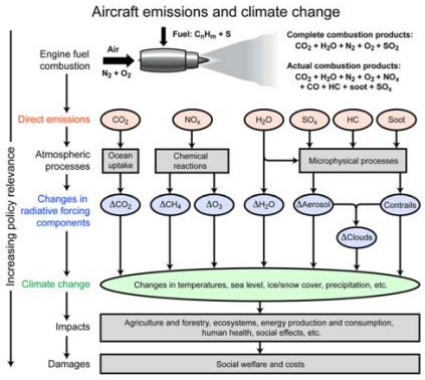
Table 1. Research Questions and Methodological Overview

2. Literature Review

2.1 Environment impact of aviation

Aviation emissions significantly contribute to the radiative forcing (RF) that drives climate change. Key contributors include carbon dioxide (CO2), nitrogen oxides (NOx), aerosols and their precursors such as soot and sulphates, as well as enhanced cloud cover caused by persistent linear contrails and aviation-induced cirrus clouds (Lee et al., 2009).

These emissions (Figure 1.) and cloud effects alter the chemical composition and particle microphysical properties of the upper atmosphere, leading to changes in the radiative forcing (R›F) of Earth's climate system. Such modifications can contribute to climate change impacts, potentially causing damage and losses to ecosystems and human welfare.

1. 

2. *Figure 1.*

The IPCC (1999) report identified aviation as a relatively small yet potentially significant and growing contributor to climate forcing, with considerable uncertainty regarding its overall impact due to non-CO2 effects. In 1992, aviation was estimated to account for 3.5% of total anthropogenic radiative forcing (excluding aviation-induced cloudiness, AIC). This share was projected to rise to 5% by 2050 under a mid-range emission scenario (Lee et al., 2009).

Aviation and motor vehicles are increasingly preferred modes of passenger transport but are also among the most environmentally damaging. A similar trend is evident for freight, as shown in Fig. 3b, where aviation and road freight demonstrate both the highest growth and the largest CO2 emissions (Chapman, 2007).

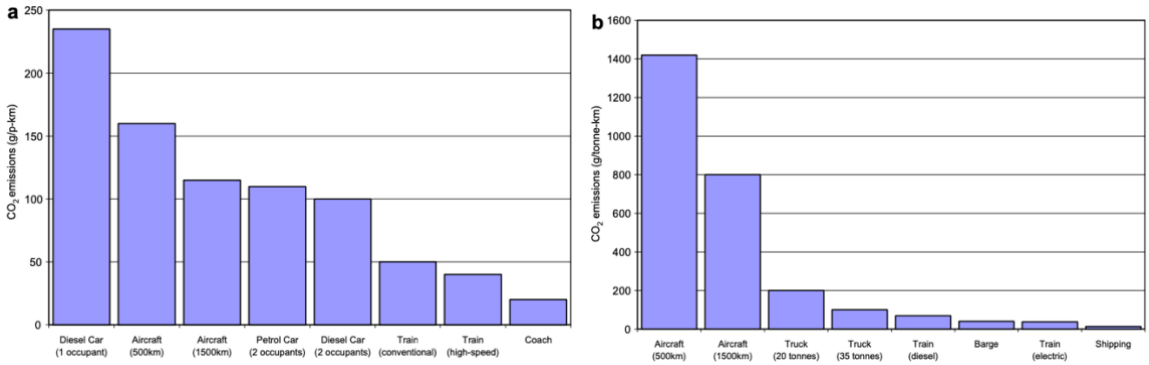


Figure 2. Carbon dioxide emissions for long-distance travel per: (a) passenger kilometre and (b) freight kilometre (Source: Roos et al., 1997 cited in Bonnafous and Raux, 2003).

Technological advancements in aviation are limited and insufficient to address the ongoing problematic expansion in the sector (DfT, 2005b). Although the policy of contraction and convergence with strict emission targets provides the medium to long term solution, immediate action needs to be taken to limit the growth of aviation. Behavioral change is the primary factor needed for the transport sector to contribute its fair share alongside other sectors, although technological advancements can provide some support (Chapman, 2007).

The significant environmental impact of aviation emphasizes the need to understand why individuals, even those who are environmentally conscious, continue to engage in frequent flying behavior. This disconnect between attitudes and actions is best explained through the concept of cognitive dissonance.

2.2 Cognitive dissonance and attitude-behaviour gap

Understanding the psychological and behavioral mechanisms behind frequent flying among consumers involve exploring two interconnected concepts: cognitive dissonance and the attitude-behavior gap. These concepts help explain why pro-environmental attitudes often fail to translate into corresponding sustainable actions in air travel.

2.2.1 Cognitive Dissonance: Conflict Between Beliefs and Actions

Cognitive dissonance, introduced by Festinger (1957), explained as individuals hold two psychologically inconsistent beliefs or behaviors, creating internal discomfort that motivates them to reduce the inconsistency (Aronson, 1969). Festinger (1957) famously illustrated this with the example of a smoker who believes smoking causes cancer but continues to smoke. This contradiction pushes the individual to either change behavior, adjust beliefs, or rationalize the inconsistency through additional information. Cognitive dissonance occurs in aviation domain when individuals experience discomfort due to conflicts between their attitudes (e.g., environmental awareness) and behaviors (e.g., flying). This concept is crucial for social scientists aiming to influence consumer behavior, as cognitive dissonance between an individual's attitudes or self-beliefs and their actions creates a motivation for change (McDonald et al, 2015). These findings emphazise the potential for addressing dissonance through behavioral design strategies, which aim to align attitudes with actions by reshaping decision-making contexts. Cognitive dissonance theory has been applied to domains such as meat consumption. Rothgerber (2020) introduced the concept of Meat-Related Cognitive Dissonance (MRCD), outlining how consumers resolve the conflict between valuing animal welfare and continuing to eat meat, through strategies such as denial, rationalization, and the so-called "4Ns" (normal, natural, necessary, and nice) (Joy, 2010; Piazza et al., 2015). Dowsett et al. (2018) experimentally demonstrated that making the meat-animal connection explicit increased negative emotional responses, particularly among female participants, which in some cases led to reduced attachment to meat.

A similar cognitive dissonance dynamic is observed in air travel behavior (Barr et al., 2010). While social norms undoubtedly influence flying decisions, individuals often justify their own frequent flying through "trade-offs"—for instance, choosing low-cost flights due to a perceived lack of affordable alternatives, or compensating by adopting eco-friendly habits at home (Barr et al., 2010). This reflects the internal conflict between environmental awareness and actual behavior, where rationalization strategies are used to maintain a consistent self-image. It further illustrates how cognitive dissonance contributes to the persistence of the attitude-behavior gap, even among environmentally conscious individuals. What remains less clear is how social and normative cues interact with dissonance in the specific context of frequent flying—a gap this thesis addresses.

This dynamic illustrates how cognitive dissonance operates as a key psychological mechanism underlying the broader attitude–behavior gap, where individuals struggle to align their pro-environmental values with frequent flying practices.

2.2.2 Attitude-Behaviour Gap: Barriers to Sustainable Actions

The attitude-behaviour gap falls within the research category exploring the relationship between attitude and behavior (Zhuo et al, 2022). The general relationship between attitude and behavior primarily focuses on three key aspects: 1. the factors related to the attitude itself, such as the strength of the attitude, the accessibility of the attitude, the ambivalence of the attitude (Glasman & Albarracín, 2006); 2. individual factors, such as positive emotions, personal evaluation needs, and personality traits (Ziegler et al, 2005); 3. the interaction between an individual's subjective experiences and their context (Hampson et al, 2006).

The attitude-behavior gap in sustainability is evident as many individuals committed to environmental practices at home perceive holidays as "exceptions," prioritizing relaxation and enjoyment over sustainable habits (Barr et al, 2010). Skepticism toward green taxes, such as carbon taxes, and carbon offset programs stems from doubts about their actual environmental impact, often fueled by a lack of transparency or understanding of their mechanisms, combined with limited awareness or trust in environmental policies targeting tourism, highlights the attitude-behavior gap in addressing climate change (Barr et al, 2010).

Insights from cognitive dissonance research can support long-term behavior change by addressing both internal conflicts and external barriers. Most studies focus on internal factors, such as individual needs and psychological processes, followed by marketing activities and social norms (Zhuo et al., 2022).

While prior research has outlined multiple drivers of the attitude–behavior gap, much of this work has emphasized individual factors or policy-related mechanisms. Less is known about how social norms specifically reinforce or mitigate this gap in the domain of frequent flying, where strong environmental attitudes coexist with persistent unsustainable behavior. Moreover, existing studies rarely examine how normative cues interact with emotional responses that may explain why individuals continue to fly despite environmental concerns.

2.3 Social norms and flying behaviour

Social norms may not only influence behavior externally but also trigger internal conflict when they clash with personal values. In such cases, they can act as a source of cognitive dissonance, reinforcing the tension between sustainable beliefs and unsustainable travel habits.

2.3.1 Understanding of flying behaviour

Researchers have long acknowledged that social norms—informal rules of behaviour that dictate what is acceptable within a given social context for a long time (Cislaghi & Heise, 2019). Social norms play a key role in shaping individual behaviour by creating strong, though often unnoticed, social expectations. Individuals often conform out of fear of social judgement, even when they are not consciously aware of the norms influencing them (Higgs, 2015; Young, 2015). These norms are so deeply embedded in everyday life that adherence becomes habitual. Remarkably, people tend to follow norms even when they recognize them as arbitrary, highlighting the strength of the psychological pull to conform. Understanding this influence is crucial for developing effective behaviour change strategies (Kim & Seock, 2019).

Social norms are commonly divided into two types: injunctive norms and descriptive norms. Injunctive norms reflect what individuals perceive others believe they *should* do, conveying moral expectations through anticipated social approval or disapproval (Cialdini, 2003, 2007). In contrast, descriptive norms are based on observations of how others actually behave, offering implicit cues about what is considered typical or common within a group (Cialdini, 2007; Rivis & Sheeran, 2003). While injunctive norms influence behavior through the desire to meet social expectations, descriptive norms shape behavior through perceived social information. Research suggests that behavior change is most effective when both types of norms are aligned—when people believe a behavior is both common and socially approved (Cialdini, 2003; Schultz et al., 2008). Another common distinction in social norms is between static and dynamic norms. Static norms represent what is currently perceived as typical or acceptable at a given point in time, while dynamic norms highlight how these perceptions are shifting over time (Sparkman & Walton, 2017). In a field experiment, Sparkman and Walton (2017) tested the effects of dynamic norms on food choices in a real restaurant setting. They compared two messages: one stating that "30% of people have tried to limit their meat consumption" (static norm), and another noting that "30% of people have started to limit their meat consumption, and more and more people are doing so each day" (dynamic norm). The dynamic message significantly increased the likelihood that customers would choose a meatless meal. This effect is attributed to the psychological mechanism of preconformity, where individuals are motivated to align their behavior with what they perceive will soon become the new norm. By signaling social change in progress, dynamic norms not only inform behavior but also make it feel urgent and socially forward-thinking, thereby fostering greater motivation to adapt.

2.3.2 Theory of social norm

Social norms exert their influence through several psychological pathways. According to Reynolds et al. (2015), there are three primary mechanisms through which norms shape behavior. The Information Account suggests that individuals rely on others' actions as heuristics—assuming others have made optimal decisions, a process known as "social proof." The Social Sanction Account emphasizes conformity due to the desire to gain approval or avoid disapproval, often summarized as "going along to get along." Finally, the Self-Categorization and Internalization Account posit that when individuals identify strongly with a social group, they internalize the group's values and norms, which then guide their own behaviors (Turner et al., 2012). When individuals perceive a mismatch between their personal values and the expectations set by their social environment, cognitive dissonance may arise as a result of conflicting norms. For example, environmentally conscious individuals may feel discomfort when surrounded by peers who travel frequently, especially if flying is framed as a status symbol or social norm. This emotional tension can act as a psychological barrier to sustainable behavior and a motivation for rationalisation, such as justifying flights as "necessary" or "deserved." In this way, social norms not only guide behavior but may also induce or intensify dissonance, particularly when aligned with cultural ideals that conflict with environmental goals (McDonald et al., 2015).

These mechanisms lay the foundation for more comprehensive models like the theory of normative social behavior (TNSB) highlights how social norms influence behavior through behavioral intention, and how this process is moderated by a range of factors categorized into behavioral, individual, and contextual attributes (Chung & Rimal, 2016). In this project, the framework is particularly relevant for identifying design leverage points that influence how environmentally aware individuals make travel decisions—especially in relation to flying.

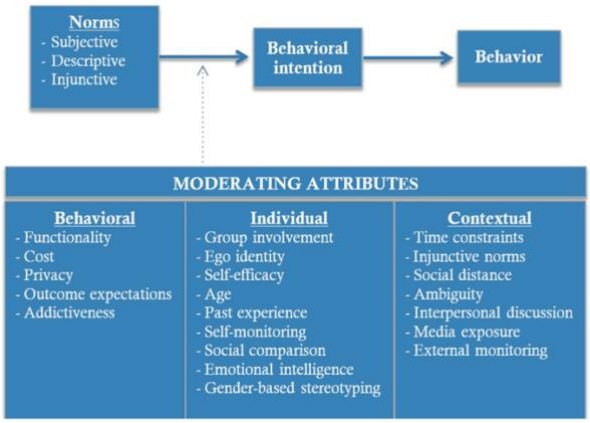


Figure 3. A revised framework of normative influences.(Chung & Rimal, 2016)

From the behavioral dimension, two moderators are especially salient: cost and outcome expectations. Flying is often perceived as cost-efficient in terms of time and money, especially compared to slower alternatives like train travel. At the same time, outcome expectations—such as the belief that individual actions have little effect on global emissions—may reduce motivation to change behavior. These factors have been shown to directly moderate the relationship between descriptive norms and behavioral intention (Rimal et al., 2004). Conversely, attributes such as addictiveness or functionality are less central in the air travel context and may not be prioritized in this study.

Among individual-level attributes, self-efficacy and group involvement are critical. People who believe they have the power to make meaningful travel choices (high self-efficacy) are more likely to act on their environmental values. Likewise, strong group identification with environmentally conscious communities can enhance the influence of pro-sustainability norms. TNSB literature emphasizes that group involvement and ego identity significantly enhance the impact of injunctive norms on behavior (Chung & Rimal, 2016; Rimal & Real, 2003). Other individual factors such as gender stereotyping or emotional intelligence, while meaningful in other domains, are not directly relevant to this project's focus. In the contextual category, media exposure and injunctive norms are especially pertinent to frequent flying behavior. Social media platforms and advertising often reinforce the desirability of air travel, portraying it as a symbol of freedom, success, and modern identity. Such narratives contribute to both descriptive and injunctive norms—what others do, and what is seen as socially acceptable (Cialdini et al., 1990). As highlighted by Chung & Rimal (2016), the salience of these contextual cues can amplify the pressure to conform, even among those who hold conflicting personal values. This tension becomes particularly evident when individuals internalize pro-environmental values but are constantly exposed to media and peer messages that normalize or even

glamorize frequent flying. Such conflicting cues may create a state of cognitive dissonance, in which personal beliefs are at odds with socially accepted or admired behaviors. The need to resolve this discomfort often leads to rationalizations or trade-offs, rather than actual behavior change.

2.4 Social norms in aviation

These theoretical insights help explain how individual decisions around travel are embedded within broader social structures. The social normalization of air travel is not simply a result of convenience, but also of deeply rooted collective perceptions and group-based identities. For instance, fostering a group identity centered on sustainable travel could counteract the normalization of frequent flying. Social norms around flying have become deeply ingrained in modern life, making it challenging to avoid due to its status as a societal expectation (McDonald et al., 2015). The aspiration to maintain a “world traveler” identity—especially among professionals, digital nomads, or academics—is often intertwined with social validation and peer behavior. In such cases, the influence of group norms and the desire for belonging can outweigh personal environmental concerns (Zijlstra et al., 2023).

By combining theoretical models like TNSB with real-world travel behaviors, this project aims to explore how design interventions based on social norm theory can influence more sustainable choices in travelling behavior The key lies in targeting salient moderators—such as conflicting goals to create higher cognitive dissonance, —to shift behavioral intentions and reshape the meaning of travel within socially conscious communities.

2.5 Behavioural design: leveraging social norm for change

Social norms can play a pivotal role in reshaping the behaviour by redefining the concept of being "well-traveled" by promoting environmentally responsible travel. Encourage a cultural shift to redefine social norms around travel, reducing the association of status with frequent flying (Zijlstra & Uitbeijerse, 2023). Rather than advocating for the complete elimination of flying, these initiatives emphasize meaningful alternatives such as "slow travel" and "staycations," which align personal travel habits with sustainability goals (McDonald et al, 2015).

To enhance user awareness, targeted campaigns can address existing knowledge gaps about aviation's environmental impact. While 40% of respondents recognize that aviation emissions result from burning kerosene, many remain unaware of its exact climate effects. Educational initiatives can bridge this gap by raising public awareness about the true environmental consequences of flying and promoting viable alternatives. By combating misconceptions through targeted information and public engagement, these campaigns can encourage more informed and sustainable travel decisions (Zijlstra & Uitbeijerse, 2023). Long-term strategies should focus on building familiarity and trust to bridge the attitude-action gap (Codagnone $ et al., 2013).

However, the success of behavioral design hinges on its ability to move beyond raising awareness to fostering lasting change. For instance, while campaigns may highlight the environmental benefits of reduced flying,

their impact could be limited if they fail to address deeper psychological and cultural barriers. Moreover, behavioral change is seen as unlikely without systemic interventions (Zijlstra et al., 2023).

3. Study 1 - Qualitative research

3.1 Participant

The method four-point approach to qualitative sampling (Robinson, 2014) was conducted in this research for sampling.

3.1.1 Define the sample universe

The sample universe consisted of individuals who met the following criteria:

- Travel frequency: Participants must have taken flight for at least 2 times per year, with a focus on short-to medium-haul flights within Europe.
- Location: Participants are based in Europe, where alternative modes of travel (e.g., trains, buses) are accessible.
- Young professional-PhD students.

3.1.2 Deciding on sample size

A small sample of five to eight participants was considered sufficient. The interviews were designed to be brief and focused (approximately 30-45 minutes each), aiming to capture deepen insights about social norm and conflicting emotion. This approach supports the goal of generating contextual understanding that can inform the design of the later intervention.

3.1.3 Select a sample strategy

A quota sampling strategy was used to ensure diversity within the targeted population. This approach allowed for a structured flexible participant pool that reflected different manifestations of frequent flying behavior.

3.1.4 Source the sample

All participants were approached with an information sheet outlining the research aims and provided informed consent before the interview.

A summary table presenting anonymized participant characteristics is included below:

	Age	Time of travel per year within europe	Transportation	Purpose	Environmental-concious (total mark)
Participant 1	27	For the past five years, participant 1 travelled 3-4 timer per year: now 1-2 times per year	Mostly by train, prefer to take long train; if the train cannot reach the destination, then will go by plane.	Holiday, visiting family, conference	18

Participant 2	29	4 or 5 times per year	By train, participant has not taken plane since 2018. Only one exception because the body condition is unwell.	Visiting family, holiday	25
Participant 3	27	approximately 3 times per year	Travel with camper van lately; approximately once by plane	Conference, holiday	22
Participant 4	25	Around 4 times on average per year	Travel by plane for most of time; if time is flexible, then take train	VIsiting family, holiday	21
Participant 5	29	Around 2-3 times per year	Mostly take plane when travel within europe	Half for business, half for leisure	9
Participant 6	26	5-6 timer per year	Usually travel by car, sometimes by plane	Holiday, hiking or photography	9
Participant 7	30	Around 2-3 times per year	Depends on the distance, so if it's certain countries that are closer, go by train and then also depending on the price sometimes might choose Plane.	Conference	25
Participant 8	25	1-2 timer per year	Usually by car or rarely train/ plane, usually like car.	Holiday, conference	22

Table 2. Participant Information

3.2 Data collection procedure

Semi-structured interviews were conducted with participants, each lasting approximately 30-45 minutes. A pilot interview was conducted beforehand to refine the questions. All interviews were audio-recorded and transcribed for analysis. Participants were given an informed consent form and briefed on the aims of the study.

3.3 Analysis

The data analysis was done by using thematic analysis (Braun & Clarke, 2006). This approach allowed for the identification of patterns and themes related to social norm influence, conflicting emotions. And coping strategy. Coding was both inductive and theoretically informed, with attention to themes. Firstly, the analysis

of interview data began with the transcription process, where both automated software and manual review were used. Initially, software (Microsoft Word) facilitated the initial transcripts of each interview. This automated step was complemented by a manual review phase, ensuring accuracy and capturing contextual details that automated processes overlooked. Secondly, generating the initial codes was focused on segments of interviews directly addressing the social norm, conflicting emotions and efficient education, maintaining fidelity to the original transcripts to mitigate interpretative bias and enhance result validity.
Then, organizing data into clusters, facilitating a deeper understanding of personal contexts before arranging findings into broader themes during cross-case analysis. Cluster names were crafted to represent RQ answers, promoting clarity and relevance, while their concise and thematic quality enhanced categorization and analysis efficiency. Finally, cross-case analysis involved grouping clusters into overarching themes to identify common patterns across participants, with separate clusters created for data that did not align with identified themes, ensuring a comprehensive exploration for later design interventions.

3.4 Result

The analysis revealed into two main themes: social norm and conflicting emotion. These themes provide insights into how social norms and conflicting emotions could be implemented or reframed through design interventions to change flying behaviour.

3.4.1 Influence of social norms on sustainable travel behaviour

Thematic analysis of the interviews revealed that social norms significantly influence participants' travel behaviors and decision-making processes. Three key thematic categories were identified: (1) Role Modeling and Positive Reinforcement**,** (2) Peer and Group Influence**,** and (3) Social Communication**.** These themes interact to shape attitudes toward sustainable travel and to encourage behavioral change.

1. Role Modeling and Positive Reinforcement

A recurring insight across participant narratives is the significant impact of both observing role models and receiving social approval, which together contribute to shaping and reinforcing sustainable travel behavior. The data suggests they are mutually reinforcing individuals who witness others acting sustainably (role models) are more likely to try similar behaviors themselves, and when these actions are met with positive peer feedback, the behavior becomes more likely to be repeated. This creates a feedback loop where external modeling and internal affirmation reinforce one another.

Participants frequently described observing others engaging in sustainable travel, such as taking long-distance trains instead of flights, as a source of inspiration and proof of feasibility as participant 2 noted "*And by talking to others and inspiring them and say Oh yeah, I made this trip to like Finland, and I didn't fly. And so it's actually possible. And that actually also reinforces your choices,"*. This modeling not only made the concept of sustainable travel seem more accessible but also increased individuals' self-efficacy—the belief that they too could make such choices. For example, one participant noted *"I think colleagues influence me in a way that I am inspired if they take long train trips then I see" (P2)* shared how seeing colleagues travel long distances by train influenced her own sense of what was possible, reinforcing her motivation. However, the

influence of role models was not always immediate. As noted *"I would just add them in my list in the future, but not so soon, but still I think they are like kind of slow long term effects on my destination choice, yeah."* by participant 5, while colleagues inspired long-term awareness and reflection, they did not necessarily cause an instant behavioral shift—highlighting a slow-burn effect of role modeling. This role-modeling effect often intersected with peer exposure to alternative transport options *"I also decided to travel by train back to Spain because of a friend of mine." (P4)*, suggesting that peer environments can shape the mental availability of certain choices (e.g., train travel), even before they become habits.

Crucially, when participants' sustainable choices were met with praise, admiration, or moral validation, the behavior became related to their identity. This aligns with subthemes like positive identity affirmation and praise or admiration. One participant noted *"If their choice It's very much deviated with my choice and there is a clear distinction that I take the most sustainable choices that I will feel good Because compared to my friends, I take the very explicit, sustainable choices"(P1)* expressed moral satisfaction upon realizing their travel choices were more environmentally friendly than those of their peers—this emotional reward strengthened their motivation to continue such behavior. Similarly, receiving external approval from peers was described as a powerful reinforcement*" I want to go there by train and if my peers and my friends support me or even praise my behaviour, that can really encourage me", "I would say because it's I think it's also nice if you get that feedback that people think, oh wow, you did that. That's really cool and that. Also motivates me to continue, so yeah." (P1 & P2)*, encouraging the repetition of sustainable choices.

Thus, the relationship between role modeling and reinforcement can be conceptualized as a two-step process: first, individuals are inspired by what they observe in their social environment; then, they are motivated to continue the behavior through affirmation and social feedback.

Code	Subcode	Quote (raw material)	Note	
Role Model Influence		I know that like many of my friends are, people around me still Many people also take trains. Again, it depends a bit on the starting point and where they want to go to, because if I have friends that come from countries further away, I mean I have many the situation to consider what kind of and what kind of circles you are in. But I also think that I get inspired or I could inspire people to go by train.	Participant acknowledges variance in others' behaviors but believes their own sustainable actions may serve as a source of inspiration to peers.	P2
		I think colleagues influence me in a way that I am inspired if they take long train trips then I see. I mean I for example had one, I mean such a colleague. Technically it was more like a classmate. Yeah she when I was living in Sweden she went from Sweden. which was even longer than the trip that I had to take, and I think it's really inspiring, and she also takes really long train trips.	Participant feels positively influenced by role models among colleagues who pursue long-distance sustainable travel, which reinforces feasibility and personal motivation.	P2

		I would just challenge myself and try to make it and then just Yeah, see it as a personal challenge and if you can make it and you can also talk about. It to others and inspire others, and by talking to others and inspiring them and say Oh yeah, I made this trip to like Finland and I didn't fly. And then people asked Ohh, how did you do it and then you can talk. Yeah. I I took the the train and then I went by ferry. And so it's actually possible. And that actually also reinforces your choices,	Links personal experimentation with storytelling as a motivational and reinforcing tool.	P2
		I only know a friend of Mine, who told me about Going by train and that's how I learned. Also, some tips so only a few people that I know like Travel like me. I also decided to travel by train back to Spain because of a friend of mine. Also did it before. So, in that sense I'm not the pioneer. I really follow a lot of my friends.	Peer influence played a key role in exposing the participant to alternative transport options such as train travel.	P4
		I think they are just they really like doing the outdoor activities like hiking, camping and surfing like these kinds of things. Yeah. And usually the places they go for travelling is somewhere that is not so known to me, like as a European person, but still like if they really suggest somewhere when they show the photo or something, that would also like attract Me, I would just add them in my list in the future, but not so soon, but still I think they are. They have like kind of slow long-term effects on my destination choice, yeah.	Colleagues inspire long-term awareness but not immediate changes.	P5
Positive Reinforcement by Peers	Positive identity affirmation through contrast with peers	if their choice It's very much deviated with my choice and there is a clear distinction that I take the most sustainable choices that I will feel good Because compared to my friends, I take the very explicit, sustainable choices	When individuals recognize their choices as more sustainable than their peers, they experience pride or moral satisfaction.	P1
	Praise or admiration	OK, I want to go there by train and if my peers and my friends support me or even praise my behaviour, that can really encourage me, encourage me to take this behaviour and also seeing yeah, for example, sometimes you will always feel really good that people say: Hey. Hey. Yeah, you will take this behaviour, but we don't because we simply just value the the convenience. But then I think the encouragement from your friends and peers really matters in this situation	Receiving praise or admiration reinforces future similar choices.	P1

		I would say because it's I think it's also nice if you get that feedback that people think, oh wow, you did that. That's really cool and that. Also motivates me to continue, so yeah.		P2

Table 3. Role Modeling and Positive Reinforcement

2. Group and Peer Influence

The influence of social groups and peers emerged as a powerful determinant in shaping participants' travel behaviors. This theme includes a range of sub-mechanisms through which group dynamics, identity, and perceived expectations interact with personal decision-making. Group or peer influence manifests both explicitly through shared plans or conformity and implicitly through emotional alignment, symbolic signaling, and cultural framing.

One of the most direct expressions of group influence lies in conformity to group travel plans. Participants often adopted the travel mode preferred by their peers, particularly when traveling together. As described by P1 *"I will make their planning as my references to adjust my behaviour."*, peers' choices served as a baseline expectation, and the travel mode itself became more than a logistical means, it was framed as a medium to deepen group connection. Participant 1 describe a situation "*for example, within three people, I can still have a say, but if the group is larger than four or five or even 10, then I think I simply just follow their plan then"* conformed to the group's preferences even when it went against their own sustainable ideals, especially in larger groups where the perceived pressure to fit in was higher.

Beyond behavioral conformity, participants were also sensitive to comments within the group. The fear of being judged as irrational or "stupid" as described *"I would take 18 hours on the train rather than one or two hours on the plane. They were simply seeing me as a very stupid choice, because why would you do that? Right? And I think this kind of comments can really influence my choice. And, you do not want to be stupid in front of the others." (P1)*, shaped travel choices in subtle but powerful ways.

In response to group dynamics, participants also engaged in mutual adjustment *"if the deviation is small, Then I might even get influenced by them, or they also get influenced by me" (P1)*, a more negotiated form of conformity. As one participant noted, influence was stronger when the behavioral gap was small, allowing for social calibration and shared decision-making. This mutual influence suggests that even slight peer shifts toward sustainability can open space for others to follow, reinforcing a subtly adaptive norm environment.

These interactions were further shaped by norm transmission through communication. Some participants *"I think a lot of people might not directly kind of say it to me, but like, because I see that other people are a bit more ethically kind of more socially Conscious and they're more conscious about their sustainable like carbon footprint and stuff then they do. Notch me a bit" (P3)* noted being indirectly influenced by visible behaviors, suggesting that visibility and observability of choices play a role in shaping what is considered "normal" or desirable. However, exposure and communication alone were not universally effective; the impact depended on the social group and cultural context *"I think it's becoming aware about our consumption and also the necessity of doing certain trips. Is also valuing like proximity and your own regions" (P2).*

In some cases, group influence operated through social categorization and status signaling. One participant reflected on her identity *"I had a like a roommate when I was living in Sweden and she was from Portugal and she made this observation that like. Many German Girls mostly, but also maybe man. I don't know. She made this observation that whenever she met like a new person, like from Germany, like in my age groups or like younger people. So let's say between 20 and 30 or something. And she said, oh, you're travelling by train and you're a vegetarian" (P2)* within a particular group and how this identity aligned with sustainable stereotypes she embraced. Similarly, sustainable behavior was perceived by others *"a lot of colleagues of mine doing a PhD, maybe that that is inherent to them that they are perhaps more sustainably sustainable or sustainably aware. So it's also a bit of a status thing" (P3)* as a status symbol, particularly within academic or professional environments where environmental consciousness was admired or expected.

Lastly, cultural exposure played a key role in norm activation. Participant 6 noted *"Because I never aware that flying would be unsustainable before I come to Europe, so that really shapes my opinion towards"* that exposure to different social groups and cultural settings shaped their awareness of sustainability. The relatability and social relevance of these exposures were crucial for translating awareness into actual behavior change.

In sum, group and peer influence: it operates through explicit conformity, identity-based alignment, normative communication, and cultural contextualization. These dynamics not only shape short-term travel decisions but also influence long-term perceptions of what is socially acceptable or aspirational within different communities.

Code	**Subcode**	**Quote (raw material)**	**Note**	
Group Influence	Conformity with group travel plans	Definitely because if I travelled with my friends they will also informed me of which travelling plan they have made or transportation Plan. I think that's also will influence me a lot because I will make their planning as my references to adjust my behaviour.	Participant uses peers' travel modes as baseline expectations, especially when traveling together.	P1
		I think if all of them chose to take train, even we need to spend like 18 hours. I will still choose the train because we can spend the time together and also we might Stop at the city in between and have drinks over there so that can make the whole experience more memorable	Travel mode becomes a medium to deepen group connection, not just a means to destination.	P1
		I think that's multiple times as I think because especially If I want to go to travel with my friends, for example, within three people, I can still have a say, but if the group is larger than four or five or even 10, then I think I simply just follow their plan then.	Group Size–Dependent Norm Conformity → The participant tolerates more influence from peers in larger groups, even if it contradicts their own preferences or values.	P1

		So I, I and and colleagues also went by plane. So I was like, I will just travel with them.	Group behavior and social conformity influence individual travel decisions.	P3
		So then even if I said I would like to go by car to Germany and and everyone decided to go by plane to Milan for instance. Yeah. So that's super practical	Travel decisions are often made collectively, and the participant sometimes conforms to the group despite personal preferences.	P3
		If they are going to travel with me, then yes, OK. And how I think if it's, if it's a group of people travelling together then you must consider other people's feelings. So you cannot say they don't like travelling by car, but you insist. I think that's that's not going to make it. So I think it's a bit of a negotiation among All of us.	Travel decisions in group contexts are negotiated; friends do influence choices when traveling together.	P3
	Norm transmission via communication	I think we are aware of sustainable concerns, and I think the most admired behaviour is that if you make a plan, simply share your reasoning with us	The participant values open discussion of travel choices among colleagues rather than judgment or superficial signaling.	P1
		I talked about earlier as well, like taking a train for 10 hours or 12 hours or even more, that's like I think not really normal. It's normal or like gets more normalised among some groups of people. That's my impression, but it's also like really much the bubble. And I mean, as in my tear, I'm I'm kind of reflecting on it a lot. So it's also like a bit biassed because you hear those things more. Or you to listen to them or admit with more attention.	Norms vary by social group and exposure.	P2
		Yeah, I think. Yeah, I think a lot of people might not directly kind of say it to me, but like, because I see that other people are a bit more ethically kind of more socially Conscious and they're more conscious about their sustainable like carbon footprint and stuff then they do. Notch me a bit	Participant is indirectly influenced by others' sustainable behaviors, especially when these are visible.	P3

	Emotional alignment with group	I would take 18 hours on the train rather than one or two hours on the plane. They were simply seeing me as a very stupid choice, because why would you do that? Right? And I think this kind of comments can really influence my choice. And also you do not want to be stupid in front of the others.	Participant alters behavior to avoid being perceived as "stupid" or irrational by others.	P1
			The influence of family judgment highlights the emotional vulnerability associated with deviating from group expectations.	
	Mutual Adjustment	if the deviation is small, Then I might even get influenced by them, or they also get influenced by me because that sort of deviation I I'm not sure if there is an English word, but then it's sort of influenceable. So you can really take this, you can really see the influence over there	Influence becomes stronger when behaviors are perceived to be only slightly different.	P1
	Identity-Based Social Categorization	I had a like a roommate when I was living in Sweden and she was from from Portugal and she made this observation that like. Many German Girls mostly, but also maybe man. I don't know. She made this observation that whenever she met like a new person, like from Germany, like in my age groups or like younger people. So let's say between 20 and 30 or something. And she said, oh, you're travelling by train and you're a vegetarian	The participant reflects on identity via social categorization and embraces the stereotype as congruent with her values and lifestyle.	P1
	Signaling Sustainability for Status Alignment	a lot of colleagues of mine doing a PhD, maybe that that is inherent to them that they are perhaps more sustainably sustainable or sustainably aware. So it's also a bit of a status thing, perhaps that if you not go by plane then you sort of can Show that you behave sustainable and and they will like it and and they will tell you similar stories.	Sustainable behavior is seen as part of social status within professional (PhD) context	P2
	Cultural Exposure as Norm Activation	I think first of all, it's definitely people's opinion. Because I never aware that flying would be unsustainable before I come to Europe, so that really shapes my opinion towards OK, flying can be really let's say on environment friendly. So that will makes me rethink about the way of travelling.	Social norms and cultural exposure influence sustainability awareness; relevance and relatability are key to behavioral change.	P6

Table 4. Group and peer influence

3. Communication for Norm Activation

Communication emerged as a crucial mechanism for transmitting and reinforcing social norms around sustainable travel. Rather than operating through direct persuasion, communicative forms—such as

storytelling, metaphor, social media, and environmental cues—subtly shaped participants' perceptions of what is desirable, aspirational, or socially acceptable.

Narratives played a central role: participants reported that hearing alternative travel stories from peers (e.g., enjoyable train journeys) encouraged them to consider non-flight options *"Yeah, I think when other people tell me that they were able to have a nice holiday also without flying. So especially in nature holidays" (P3).* The reframing of the journey itself—from a tedious necessity to an enriching part of the holiday—also made individuals more receptive to slow travel *"you will be seeing along the way to that sort of the travelling itself is already the holiday," "Train is fine because I think the travel is part of my holiday like I'm going to enjoy my train ride" (P2, P8)*. Other participants also noted that social media further amplified these influences by shaping destination aspirations and nudging undecided travelers : *"social media can influence you in what places you Visit in this place like in this region so But I can also maybe if you just have in mind to go some kind of trip and then it can inspire you to visit if you don't have a destination", "because social media shows the glamorised version of things, it probably makes people want to go to places that they wouldn't otherwise know about." (P2, P7).* Meanwhile, reflective messaging that challenged the prestige of distant holidays, and design-based cues (e.g. airport atmospheres) influenced how participants emotionally interpreted their choices *"sense some business elements in the airport that makes you feel a bit like a like a successful person or manager." & "I remember I fly to great Canaria once in January this January and then everyone is on vacation. So that gives us a little bit mood of relaxing." (P5, P6).*

Importantly, communication did not always lead to behavioral change. In some cases, such as supervisor comments or professional discourse, participants became more aware of environmental concerns but did not necessarily act on them *"I don't think it's happened to me personally. No, actually. I was going to take holidays to the US. And my supervisor made a comment about make sure you're there for, you know, more. Don't make it just a quick trip because it's a pretty environmentally expensive trip" (P7).*

Code	Subcode	Quote (raw material)	Note	
Communication	Alternative Travel Narratives	I think it's becoming aware about our consumption and also the necessity of doing certain trips. Is also valuing like proximity and your own regions, so you don't have to for example, I mean you see many people travelling to, I don't know beaches somewhere else, but I think for me it's also value that you can appreciate what is in your surrounding or in your closer surrounding or vicinity. Vicinity so it's not always that like you are.	Participant expresses an ideological value of "local sufficiency," preferring slow, nearby travel and culturally immersive experiences over mass tourism.	P2
		Yeah, I think when other people tell me that they were able to have a nice holiday also without flying. So especially in nature holidays, when people indeed go for hiking, so they just go by car to yeah, 1 mountain area in Austria for example, and they will	Stories from peers about enjoyable non-flight travel motivate participant to	P3

		just have a super amazing holiday just by walking and then taking car back.	consider alternative travel modes	
	Social media as a Decisional Nudge	But then, of course, if you have already destination in mind, social media can influence you in what places you Visit in this place like in this region so But I can also maybe if you just have in mind to go on on some kind of trip and then it can inspire you to yeah, visit if you don't have a destination, you just know that you want to go on a trip. Then it could inspire you to to visit that place. And then for me it would be mostly things that are close and in in my reach. But I think for other people who maybe. It can be more influenced by social media and like remote.	Social media can shape destination selection, especially when people are undecided	P2
		I'm sure people get access to places that they're not familiar with through social media and then Especially because social media shows the glamorised version of things, it probably makes people want to go to places that they wouldn't otherwise know about.	Social media contributes to aspirational travel and destination choices.	P7
	Reflective Messaging on Travel Necessity	"I think I would really try to promote reflecting on the destination, so make people reflect on the destination if it's really necessary to go there and also maybe make people reflect on because it's also kind of effect.	participant 2 emphasizes designing reflective interventions to challenge the perceived prestige of distant holiday destinations	P2
	Reframing Transit as Explorative Opportunity	I mean, I'm not only planning to go to city a whatever city, but I see, OK, maybe I have to stop along the way and then I see, OK, where can I stop and what is there so I can also discover the area there and I see this as something nice, but I Imagine that maybe not everyone sees that at night.	Reframes the journey as an enriching part of travel, not just a means to an end	P2
	Narrative Framing of the Journey as Part of the Holiday	you will be seeing along the way to that sort of the travelling itself is already the holiday, not necessarily a means to go to a place where you'll have the holiday if it's sort of nicer and often experience during travelling as well. And they make that clear That would also help, perhaps.	Participant is more receptive to non-flying options if the journey itself is framed as enjoyable and valuable.	P3
		last summer I went by train and it was like 2 days of train and people would think that's not comfortable. Yeah, but I thought it	The participant challenges	P4

		was actually quite nice and I could stop different places so I could, like, relax. And of course the train rides were long. But I found it quite comfortable, Think these like Fun component. Yeah. And comfort are important to me. Like I find aeroplane or airport.	conventional perceptions of comfort, finding long train travel surprisingly enjoyable	
		Train is fine because I think the travel is part of my holiday like I'm going to enjoy my train ride. Probably if I'm going to that far I would stop somewhere along the way to have a visit at a different city for a few Days so that Would become more of a trip.	train is part of holiday can be a potential of norm	P8
	Discouragement in certain bubble	I think professional circle, everyone is quite negative about flying, always apologises when they do and sometimes sort of try to suddenly ask about hey, how did you travel? And then it's and then it's either by car, yes, or it is. Whole explanation and yeah, so yeah, that's sort of what I experienced, OK.	Flying is socially discouraged in professional context; people feel compelled to justify their actions, indicating strong group norms.	P3
		I don't think it's happened to me personally. No. I was going to take holidays to the US. And my supervisor made a comment about make sure you're there for, you know, more. Don't make it just a quick trip because it's a pretty. Environmentally expensive trip is what he said. OK, I was making a short trip for a graduation in my family.	A supervisor's comment raised awareness about the environmental cost of flying, though it did not change behavior.	P7
	Uses metaphor to describe flying as mechanical, and emotionally unengaging	How would I say it is kind of quick and convenient in a way that is kind of like as you are going to a supermarket and grabbing like The pre made food.		P4
	Views train travel as symbolic of European unity and sustainability	And we have maybe like a more unified railway system. Mm-hmm. So with sustainability should be the same that we could, like, have a more unified. We do know, but maybe, like, sustainable and be sustainability goals and Objective There's. So I think it would be nice that if like also like different European countries were like all very aligned in this, it's Difficult, but		P4

		there's a bit of A value or ambition that I have in mind. Yeah, and train represents of it.		
	Affective Framing of Flying through Airport Design	Actually the design elements in the Airport is really Important because I noticed that the Yeah, because I think Like they are, sometimes they are trying to build some kind of like you said, identity in airport especially for example if you're travelling for business then there's a lot of Like I sense some business elements in the airport that makes you feel a bit like a like a successful person or manager.	Airport design can reinforce aspirational or status-based identities, making air travel feel prestigious and desirable.	P5
		Everyone's around you is like when you are boarding on like this kind of contacts. When everyone wants you is dressing like vacation. Then it gives you a bit happy sense like the contacts. So I remember I fly to great Canaria once in January this January and then everyone is on vacation. So that gives us a little bit mood of relaxing.	Social context and atmosphere at the airport (vacation vibe) affect emotional experience and perception of flying.	P6

Table 5. Communication

3.4.2 Conflicting emotion

1. The Process of Emotion–Behavior Mismatch

A recurring pattern in the interviews was that participants chose to fly without much reflection. Although they described the experience as stressful and inconvenient, flying was often treated as a routine option. As P2 explained, *"they could do other things if they just reflected. But I think, yeah, they just see it as so normal."* This lack of reflection prevented them from reconsidering alternatives, creating a gap between their discomfort and their actual behavior.

As a result, once the behavior had been completed, participants experienced an internal dissonance—a growing awareness that their actions contradicted their values. This emotion–behavior mismatch created a feeling of discomfort, often expressed as mild guilt or internal unease *"It make it twofold. So it makes me feel worse about flying if a lot of people don't fly, and I still do. But then again it's because flying is so normalised." (P3)*. Notably, this discomfort did not occur from external pressure, but from self-comparison to internal ideals. To resolve this tension and preserve a coherent moral identity, participants turned to justification strategies. Some reframed their unsustainable choices as occasional deviations offset by consistent good behavior (e.g., cycling to work), while others emphasized practical constraints or invoked higher moral priorities (e.g., family obligations) to legitimize their actions. As previous discussion, using daily eco-friendly habits to "make up for" unsustainable travel allowed them to maintain a sense of being environmentally responsible overall.

Code	Subcode	Quote (raw material)	Note	

Emotion-Behavior Mismatch	Emotional discomfort	I mean also we're travelling abroad or like far away to holiday destinations and also stressful with the luggage and like taking a lot of luggage and going to the airport and queuing and waiting and these things. So like getting checked to check up and security check and so on. But I don't know I think. Yeah. And then also people complain about it, which they sometimes find weird because they actively decide to do that. So I mean, they they could do other things if they just reflected. But I think, yeah, they just see it as so normal that.	Highlights a dissonance between the discomfort people express and their chosen behavior	P2
	Lack of Reflexivity		Suggests that the behavior is driven by lack of reflection, not necessity — implies a missed opportunity for behavior change.	

Table 6. The Process of Emotion–Behavior Mismatch

2. Socially Triggered Guilt

Emotions around unsustainable behaviors were often socially activated—particularly through comparative self-evaluation within one's peer group. This dynamic reflects by participant 3 describe how social norms not only inform behavior but also shape the emotional responses to one's own actions.

Upward Social Comparison and Guilt

One key emotional trigger was upward social comparison: when participants evaluated their behavior against more sustainable peers, they often experienced guilt or self-doubt. These moments of comparison made the environmental impact of their own choices feel more salient, particularly when sustainability was perceived as a social expectation within their group. This phenomenon underscores how peer norms can amplify moral dissonance, even when no direct judgment is expressed.

Downward Comparison and Emotional Relief

To manage this guilt, some participants engaged in downward comparison—measuring themselves against individuals or norms perceived as less environmentally responsible. By doing so, they found emotional relief and constructed a narrative of relative virtue: "at least I'm better than others." This comparison served as a form of justification, allowing participants to restore their self-concept without having to modify behavior. This oscillation between upward-induced guilt and downward-anchored reassurance reflects a subtle psychological negotiation. It demonstrates that participants' sustainability identities were relationally constructed, not just based on internal beliefs but also continuously calibrated through social interaction.

Code	**Subcode**	**Quote (raw material)**	**Note**	
Socially Triggered Guilt		It make it twofold. So it makes me feel worse about flying if a lot of people don't fly, and I still do. But then again it's because flying is so normalised. It also makes me feel less worse about taking a plane every Two or three holidays because then I would still be behaving better than the average. So it also sort of, yeah,	Upward social comparison with more sustainable peers evokes guilt	P3

Downward Comparison Relief	Justification to reduce guilty by downward comparison	yeah, it makes it easier to fly for if a lot of people do it more often.	Downward social comparison provides emotional relief — comparison to less sustainable norm serves as justification.	

Table 7. The Process of Emotion–Behavior Mismatch

3. Awareness-Driven Regret and Retrospective Guilt

In addition to real-time emotional responses, some participants expressed a retrospective form of guilt—a regret that only emerged after gaining new ecological awareness. This emotional response, termed here as awareness-driven regret, highlights the temporal dynamics of moral emotion: participants reinterpreted past behaviors through the lens of new values they acquired later.

For instance, participant P8 described feeling regret over a previous flight decision, which at the time seemed acceptable, but was later seen as environmentally irresponsible after gaining deeper insight into sustainability issues. This form of guilt differs from immediate cognitive dissonance; instead, it reflects a delayed moral awakening and a sense of personal failure due to prior ignorance.

Awareness-driven regret thus represents a unique category of emotion that emerges after belief systems shift, suggesting that environmental education and normative shifts can recast one's moral self-evaluation even after the behavior has passed.

Code	Subcode	Quote （raw material)	Note	
Guilty	Sense of personal moral failure due to previous ignorance	Yeah, i feel it's weird because I was not into eco topics and because quite eco awareness of my own research and my work, I'm not really aware of it back then. But now I feel like, yeah. It's quite stupid that I've done that. It's such a waste to do that by plane, especially because it's only.	Expresses regret over previous flight due to later-acquired eco awareness.	P8
Awareness-Driven Regret	Past actions now viewed through a new lens of awareness			

Table 8. Awareness-Driven Regret and Retrospective Guilt

4. Lack of emotional rewarding for sustainable actions

While much of the emotional tension in participants' narratives stemmed from guilt or dissonance, a subtler but equally important dynamic emerged: the absence of emotional reward following sustainable actions. In these cases, participants did the "right" thing, such as choosing a lower-impact travel mode but reported a lack of validation, satisfaction, or reinforcement.

This emotional vacuum left individuals feeling uncertain about the value of their efforts, particularly in contexts where the environmental benefit was abstract or invisible. Without external affirmation or internal gratification, the motivational foundation for repeating sustainable behaviors becomes fragile.
This insight suggesting that sustainable behaviors may require not only rational justification but also affective feedback loops to become habitual.

Code	Subcode	Quote (raw material)	Note	
Missing Emotional Reward	Struggle about whether to continue sustainable behavior	For me, I also don't get. I also always get a headache when I'm on a plane. Yeah, you don't get that on the train. Uh feels more relaxed. And also in some sense it feels like I'm doing better for the environment, but I don't get this really rewarding feeling whenever I do something for the environment because I just have the idea it should be normal to do it, so it's it's. I try to do it in in most of everything that I that I do so	The participant lacks emotional reinforcement after doing the "right" thing	P8

Table 9. Missing emotional reward

Based on the thematic analysis of the interview data, several key mechanisms influencing sustainable travel decisions were identified, including the impact of social norms - role modeling & positive reinforcement, the emotional dynamics of guilt and regret, the use of coping strategies (rationalization & justification), and the importance of emotional rewards. These qualitative findings provide in-depth insights into individual experiences and motivations regarding environmentally conscious travel behavior.

3.4.3 Coping strategy for conflicting emotion

Despite participants' general awareness of the environmental consequences of flying, many described experiencing conflicting emotions (e.g. guilty, regret) when their actions failed to align with their values. These tensions frequently gave rise to a range of coping mechanisms aimed at reducing cognitive guilt, or discomfort. The analysis reveals two primary dimensions: (1) emotional reactions to misaligned behavior, including guilt, regret (2) rationalization and justification strategies employed to resolve or suppress this discomfort.

1. ***External Rationalization***

A common form of dissonance management involved convenience-based rationalization. Participants acknowledged their environmental awareness *"So I think once the environmental concerns are aligned with the convenience, that's the time that I will definitely make this choice. But then sometimes you will mostly see the tensions over there." (P1)* but admitted to taking action only when it aligned with their convenience. Flights were often framed as practically necessary *"Because there's no other way I can make it on time. I mean, I could, but the yeah, the. It's two days of travel. So yeah, time that I can." (P4)* due to the impracticality of alternatives such as long or unavailable train journeys. This framing provided individuals with a way to reduce guilt by shifting responsibility to external systems. Similarly, participants used efficiency- and sense-based rationales to defend their choices *"For example, let's say 3 or 400 kilometres, you*

were still thinking about this environmental things, but then if the distance exceeded, for example 400 kilometres, then I will have this sense of fatigue because you feel like, OK anyway. I just want to take the plane because I want to arrive at the destination quickly so." (P1). For instance, the trade-off between time, cost, and fatigue was cited as justification for choosing flights over more sustainable options. These forms of rationalization allowed participants to maintain a positive self-image while engaging in environmentally harmful behavior.

Code	Subcode	Quote (raw material)	Note	
Coping Strategy	Convenience-based rationalization	Yeah. So I think once the environmental concerns are aligned with the convenience, that's the time that I will definitely make this choice. But then sometimes you will mostly see the tensions over there.	Participant 1 expressed a sense of ambivalence: environmental awareness is present, but action is only taken when it aligns with convenience	P1
	Guilt relief by rationalization through objective barrier	since this comes to the objective barrier, so I think that's one can well leads to sort of excuse or makes me a little bit relieved about my Choice because I simply I can't take the train. That's why I think. Yeah, I think my burden of causing environmental issues.	The participant uses the lack of viable alternatives to rationalize environmentally harmful choices, reducing personal guilt	P1
		if I'm going to Spain, to my hometown for like 5-4 days and then I'm going for four days only, then I kind of need to go by plane. Because there's no other way I can make it on time. I mean, I could, but the yeah, the. It's two days of travel. So yeah, time that I can.	The participant rationalize choosing flights for short trips due to the impracticality of long train	P4
	Efficiency & sense-based Rationalization	For example, let's say 3 or 400 kilometres, you were still thinking about this environmental things, but then if the distance exceeded, for example 400 kilometres, then I will have this sense of fatigue because you feel like, OK anyway. I just want to take the plane because I want to arrive at the destination quickly so.	Final behavior is rationliazed by valuing time and sense of fatigue over environmental concern	P1

Table 10. Participant Information

2. Internal Justifications

Beyond external barriers, participants also relied on internal justifications to restore coherence between their values and behavior. One participant *"life is A bit short so it's. Like you might as well enjoy time with your family, so it is a bit of a complicated Issue." (P4)* reframed unsustainable travel as justified through existential values, arguing that meaningful experiences were more important than strict environmental adherence. Another participant "*Than having to make this decision to take a plane and seeing that I'm failing in a way not*

to Like go along my values or with my values also didn't make it better but I think for I could justify it for myself."(P2) justified flying due to mental health needs, highlighting the complex role of personal well-being in sustainability-related decisions.

Relatedly, moral hierarchy justification was employed when family obligations took precedence over environmental ideals. For example, participant P4 noted "I justify it with the reason that I'm because I'm going to this like family appointment." their flying behavior as morally acceptable given the social or emotional necessity of visiting family.

a. Mechanisms of Reframing and Dissonance Reduction

Participant P3 described actively altering the way they perceived their own role in decision-making to lessen dissonance "So I try to. Yeah, to destroy the link between or destroy the inconsistency by looking differently at my behaviour and my possibilities.", signaling a deeper reflective process rather than mere excuse-making. Others resorted to more defensive strategies such as ignoring the contradiction entirely, or using generic rationalizations without introspection. These approaches may be less sustainable over time, but provide immediate relief from emotional discomfort.

b. Compensation and Value Balancing

Lastly, a notable coping mechanism was offset planning—wherein participants attempted to compensate for unsustainable behavior through future sustainable actions. For instance, frequent flyers reported engaging in occasional eco-friendly travel, or described a mental balancing act where environmental concern was only activated when the trade-off became visibly significant as participant 3 describe *"So I was like, OK, at least I'm going to try to compensate the once for once and this year I'm planning to do the same in at the end of July to go by train so at Least. There's a try to offset or like to reduce a bit my carbon footprint. So it's something that I consider."*. While not eliminating the dissonance, such strategies provided a sense of redemption and allowed individuals to preserve their environmental identity.

Code	Subcode	Quote (raw material)	Note	
Coping Strategy	Meaning-First Justification	life is A bit short so it's. Like you might as well enjoy time with your family, so it is a bit of a complicated Issue.	Participant resolves internal tension by appealing to existential values, prioritizing meaningful experiences	P4
	Internal Justification: Reflects internal self-justification process to reduce own guilt.	I was talking about previously when I had to take the plane to go to my yeah, my home at that time. Yeah. And it was just like, in general, it was like a really stressful period for myself. And I didn't feel good at all. And also, of course. Then having to make this decision to take a plane and seeing that I'm failing in a way not to Like go along my values or with my values also didn't make it better but I think for I could justify it for myself.	Participant recalls a rare instance of flying that caused conflicting emotion due to value misalignment, but justifies the behavior due to mental health circumstances	P2

	Moral Hierarchy Justification (Family over Environment)	I justify it with the reason that I'm because I'm going to this like family appointment.	Participant copes with the inconsistency by justifies the decision as morally justified due to family obligations	P4
	Perception shift Justification	Ignore uh. Also try to rationalise it a bit, or new ones hit a bit. So yeah, just as I also did a bit now like I then try to feel it's like I just do whatever I can and some things it's just Too complicated or too difficult to do. So then you tend to feel like it's out outside of your control, even though you could opt for not going on the on the travel for instance. So I try to. Yeah, to destroy the link between or destroy the inconsistency by looking differently at my behaviour and my possibilities.	describes coping mechanisms like just ignore and rationalization to reduce dissonance	P3
			Dissonance reduction by reinterpretation — changing the way sees their own agency to restore coherence	P3
	Future Offset Planning (compensation)	When I go, for example, when I go to the plane then I want to sort of compensate for this later, so I would be more prone to look into other options.	where environmentally damaging behavior is offset by later (potential) sustainable action	P3
		It was also like I was also flying a lot. So I was like, OK, at least I'm going to try to compensate the once for once and this year I'm planning to do the same in at the end of July to go by train so at Least. There's a Try to offset or like to reduce a bit my carbon footprint. So it's something that I consider.	Participant feels guilt from frequent flying and attempts to compensate through occasional sustainable trips	P4

Table 11. Participant Information

3.5 Discussion for study 1

The qualitative analysis revealed that young professional individuals is shaped by a complex interplay of social norms, emotional tensions, and coping mechanisms. Social influence emerged as a powerful driver: observing role models, receiving peer reinforcement, and navigating group expectations all played a role in legitimizing or discouraging certain travel decisions. At the same time, participants described a persistent mismatch between their environmental values and actual behaviors, often accompanied by discomfort, guilt, or regret. To manage these tensions, individuals employed various coping strategies, such as rationalization, moral justification, or offsetting unsustainable choices with later sustainable actions. Importantly, even when participants engaged in sustainable travel, they reported a lack of emotional reward or reinforcement, which weakened their motivation to maintain these behaviors.

Together, these findings underscore the centrality of both social and emotional dynamics in shaping travel behavior. They highlight the potential for interventions that leverage social norms, strengthen positive reinforcement, and address conflicting emotions.

However, while qualitative research allows for rich and nuanced understanding of these processes, it does not enable the assessment of their relative strength, prevalence, or causal influence on behavior intentions in a broader population. Furthermore, qualitative data alone cannot statistically test whether social norm framings effectively shift individuals' behavioral intentions toward reducing air travel.

To address these limitations and further validate the mechanisms identified, a follow-up quantitative study was designed. This experimental study aims to test the effects of social norm framings on individuals' purchase intention, perceived environmental impact, transportation selection and their emotional responses. By systematically manipulating social norm framings and measuring subsequent changes in behavioral intention, the study seeks to provide empirical evidence on the potential efficacy of these levers as levers as interventions for promoting sustainable travel behaviors.

4. Study 2 - Quantitative research

4.1 Participant and design

A total of 202 Participants were recruited online via Prolific and completed the survey hosted on Qualtrics. Participants were required to be Dutch residents with fluent English proficiency, as the hypothetical trip scenario involved travel from Utrecht to Berlin. While the study aimed to reflect general European travel behavior, demographic inclusion was limited to ensure consistency and comprehension of the materials.

The participants were invited to simulate planning a trip from Utrecht to Berlin and to evaluate different travelling options. To deeply immerse participants in the travelling scenario, they were first asked to read some pieces of news about travelling behaviour among European consumers. The news interventions were designed into between-subjects experimental design with two framing conditions and a control group: condition 1 includes unsustainable static and unsustainable dynamic norm framing (fully matching negative framing); condition 2 combines unsustainable static norm framing and a sustainable dynamic norm framing (mixed framing), and condition 3 serves as a control condition without explicit normative framing. Participants are randomly assigned to one of the experimental conditions or the control condition. Informed consent will be obtained prior to participation, and responses will be anonymous.

4.2 Stimuli material

The new interventions were systematically designed to manipulate participants' perception of social norms related to travel behavior. As illustrated in Table 12, each condition presented participants with both textual and visual stimuli, varying by norm type (static vs. dynamic) and sustainability framing (unsustainable vs. sustainable).

In **c**ondition 1 (Unsustainable static norm + unsustainable dynamic norm)**,** participants were first presented with a static descriptive norm text that emphasized the current widespread unsustainable behavior (i.e., short-

distance flights being the norm across Europe), accompanied by an image showing people boarding an EasyJet airplane. This was followed by a dynamic unsustainable norm text suggesting that this unsustainable behavior is expected to increase further in the future, paired with an image of a busy airport boarding scene. Together, this condition was designed to reinforce the perception that frequent flying is both common now and likely to become even more normalized.

Condition 2 (Unsustainable static norm+ sustainable dynamic norm) began with the same unsustainable static norm framing as Condition 1, reinforcing the current prevalence of unsustainable travel behaviors. However, the second half of the intervention introduced a dynamic sustainable norm text, emphasizing a positive shift: consumers are increasingly flying less and choosing more sustainable alternatives such as trains or buses. This was accompanied by a hopeful image of travelers boarding a train. This condition aimed to evoke dissonance or emotional conflict by presenting a contrast between current norms and an emerging sustainable shift.

Condition 3 (Control) used neutral texts and images to avoid influencing participants' normative perceptions. The texts focused on general holiday planning behaviors, such as booking in advance and considering different travel factors. The accompanying images depicted people planning trips or using laptops, with no visual reference to transportation modes. This condition served as a baseline for comparison, controlling for general information exposure without normative influence.

To ensure experimental control, the textual content across the static and dynamic norm messages in Conditions 1 and 2 was carefully matched in structure, tone, and length. Both static texts described the same travel behavior (frequent short-distance flying under 500 km) using similar sentence constructions and statistical framing.

Condition 1 Unsustainable static + unsustainable dynamic	**Unsustainable static norm**	**Unsustainable dynamic norm**
	Recent statistics indicates that most European consumers engage in frequent, short-distance air travel: nearly 1.1 billion passengers travel by plane for short-distance trips within Europe (under 500 kilometres) instead of by train or bus. Travelling by plane is an accepted and standard trend in today's European society, where frequent short-distance flying is the norm.	Travelling behaviour in Europe is becoming even less sustainable: travellers take more flights than before and an increasing number of consumers are choosing to fly even more frequently, for short-distance trips within Europe, rather than opting for more sustainable alternatives such as trains or buses. Frequent short-distance flying is expected to become the norm by 2030, when flying excessively will become more common among travellers.
	Image static norm	**Image dynamic norm**
		
Condition 2	**Unsustainable static norm**	**Sustainable dynamic norm**

Unsustainable static + sustainable dynamic	Recent statistics indicates that most European consumers engage in frequent, short-distance air travel: nearly 1.1 billion passengers travel by plane for short-distance trips within Europe under 500 kilometres) instead of by train or bus. Travelling by plane is an accepted and standard trend in today's European society, where frequent short-distance flying is the norm.	Travelling behaviour in Europe is becoming more sustainable: travellers take less flights than before and an increasing number of consumers are choosing to fly less frequently, and to opt for more sustainable alternatives such as trains or buses, for short-distance trips within Europe. Sustainable train travel is expected to become the norm by 2030, when flying parsimoniously will become more common among travellers.
	Image static norm	**Image dynamic norm**
		
Condition 3 Control condition	**Neutral text 1**	**Neutral text 2**
	Recent statistics indicates that most European consumers plan their holidays in advance, opting for different travelling alternatives based on factors like the destination, time, budget, environment impact and personal preferences.	Travelling behaviour in Europe is changing, as an increasing number of consumers are organizing their holiday in advance, booking their accommodation and organizing activities in advance to make the overall travel experience smoother and more enjoyable.
	Neutral Image 1	**Neutral Image 2**
		

Table 12. Full intervention table

To present normative messages in a realistic and engaging format, the final intervention was designed into three digital news article mockups titled "News Today," simulating a typical media report (Figure 4. & Figure 5. & Figure 6.). Each experimental condition included two sections ("Present" and "Future") to illustrate current travel norms and anticipated future trends, supported by both textual information and accompanying images. Notably, Conditions 1 and 2 shared an identical headline: "Present and future of travelling behaviour," reinforcing structural consistency across treatments. In contrast, the control condition used a slightly different title: "Trends in travelling behaviour," to signal a more neutral informational tone. Additionally, all conditions included a dateline ("Thursday, 17th July 2025") to enhance the realism of the news framing and help participants mentally situate the message within a near-future context. Each news frame also featured color-coded subheadings beneath the PRESENT and FUTURE labels to highlight the

normative framing: either "Unsustainable Trend" or "Sustainable Trend" depending on the experimental condition. These visual cues were intended to strengthen the salience of the normative direction (e.g., rising vs. declining air travel), while maintaining textual consistency across groups. The control condition did not include trend-related subheadings, reinforcing its neutral framing.

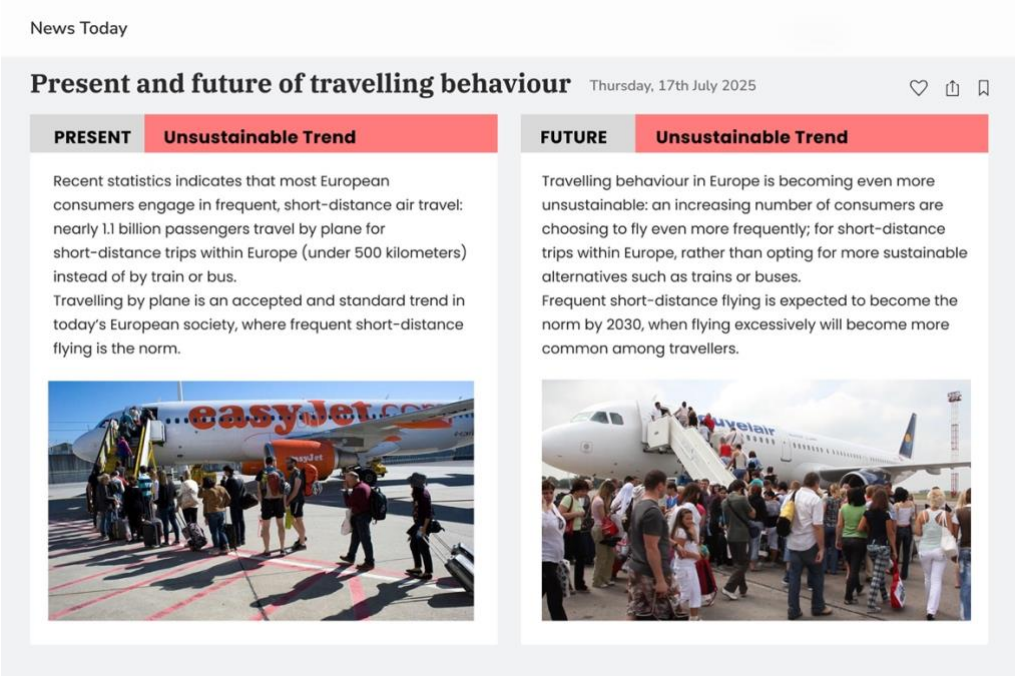


Figure 4. Condition 1 Unsustainable static + unsustainable dynamic

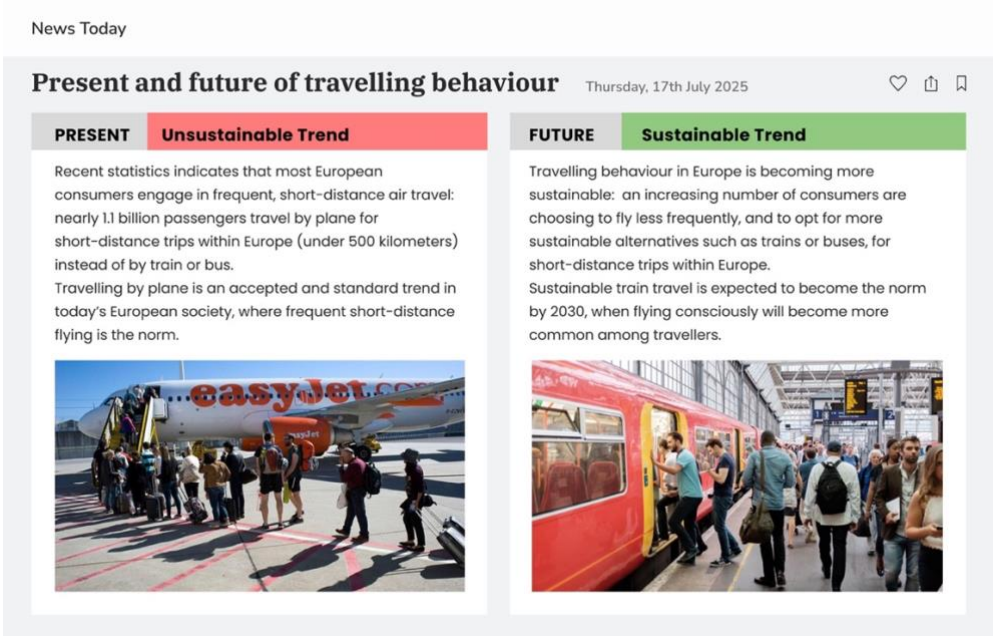


Figure 5. Condition 2 Unsustainable static + sustainable dynamic

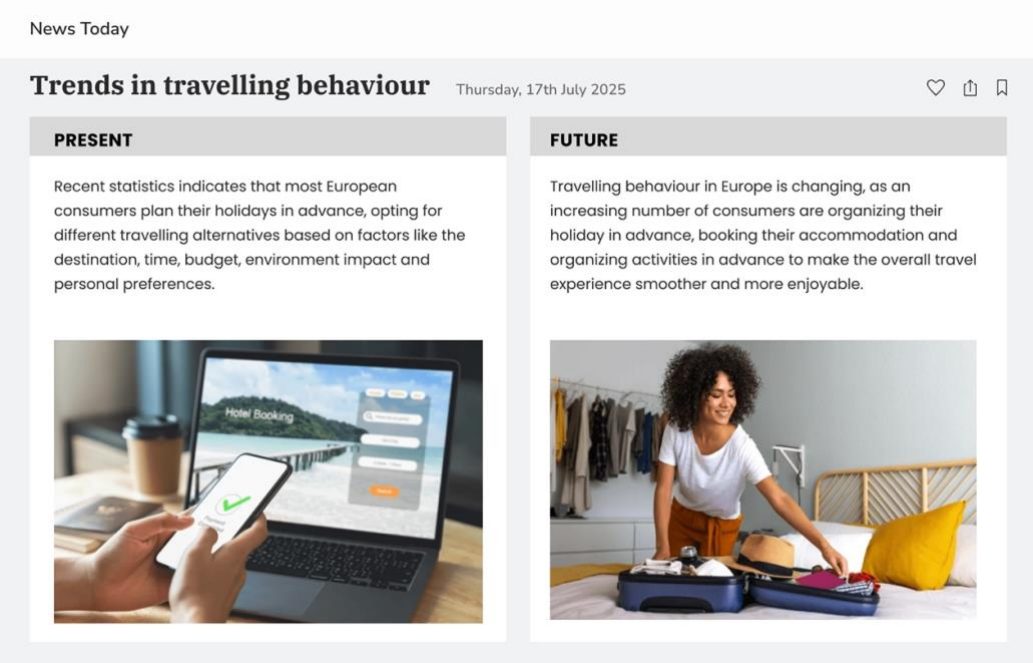


Figure 6. Condition 3 Control: neutral

4.3 Procedure and measures

The study entirely took place through a Qualtrics questionnaire. Before starting with the study, participants were required to read and agree to the informed consent incorporated into the Qualtrics questionnaire. Afterwards, the participants were randomly assigned to one of the three conditions. In each condition, participants were first asked to read some pieces of news about travelling behaviour among European consumers that belonged to their randomised condition. The news has been extrapolated from popular newspapers and recent research.

Following the news intervention exposure, participants were asked to complete a manipulation check and emotion-related measures to assess the perceived content of the news and their corresponding emotion responses. The manipulation check was implemented only for the two experimental conditions (Condition 1: Unsustainable Static + Unsustainable Dynamic; Condition 2: Unsustainable Static + Sustainable Dynamic). Participants in the control condition were not presented with these items, as their news article did not contain specific sustainability framing.

Two manipulation check items were presented:

The first question assessed participants' perception of current travelling behaviour：“The news state that, currently, travelling behaviour is…” Participants responded on two 7-point semantic differential scales:

- (1) centered on flights – (7) centered on trains
- (1) unsustainable – (7) sustainable

The second question assessed perceived future travelling behaviour, using a similar scale：“*The news state that, in the future, travelling behaviour is becoming…”*

- Participants responded on two 7-point semantic differential scales:

- (1) less sustainable – (7) more sustainable
- (1) centered on more flights – (7) centered on more trains

In addition to the manipulation check, participants completed two validated subscales to capture social moral responses to the news: "*In the news, you read about other's people behavior: how most people currently behave and how their behavior is changing. Please state the extent to which you disagree or agree on the following statements."*

The responses including:

- Social Moral Cleansing (4 items): This subscale measured the extent to which participants felt an increased urgency, responsibility, and pressure to act more sustainably after reading about others' behaviour. Items included statements such as "I feel more pressure to act urgently, after reading about what other people are doing."
- Social Moral Licensing (3 items): This subscale captured the extent to which participants felt a sense of reduced personal obligation to act, because others were already made an effort. Example item: "I feel less urgency to act immediately, because I believe others are already contributing enough."

Lastly, to assess participants' emotional responses to the news intervention *"To what extent do you feel the following emotions after reading the above news?"*, a 10-item emotion checklist was administered. Participants rated the extent to which each emotion described their feelings after reading the news article, using a 7-point scale from (1) "Does not describe my feelings" to (7) "Clearly describes my feelings." Emotions included both negative (e.g., anxious, guilty, frustrated) and positive (e.g., motivated, excited, proud) affective states. The complete set of items is provided in Appendix B.

Next, participants were asked to imagine planning a leisure trip from Utrecht Central Station to the Brandenburg Gate in Berlin, traveling alone with a budget of €200 for transport and a single bag. They were presented with three transportation options (airplane, bus, and train) (see Appendix C.), each clearly outlining the total price, total travel time (including waiting and transfers), and carbon emissions (in kg CO_2). Participants were first asked to indicate their purchase intention: "*How likely you are to choose this travel option?*" for each travel option on a 7-point Likert scale (1 = extremely unlikely, 7 = extremely likely), followed by selecting their preferred travel option (categorical variable): *"Select the journey you wish to book for your trip from Utrecht to Berlin by clicking on your preferred option."*, and finally evaluating the perceived environmental impact of each option: *"How little or big do you think the environmental impact of the three options is?*" (0 = very little environmental impact, 7 = very high environmental impact). The complete set of items is provided in Appendix D.

Following the main dependent variable measures, participants proceeded to the covariate section of the survey, which aimed to capture individual differences in travel behavior and environmental attitudes. Two primary covariates were included: travel frequency and environmental concern.

Participants were first asked to report the frequency of their short-distance flights within Europe over the past year, using a categorical item with five options ranging from *"I never fly", "1 flight a year or less in*

Europe", "2–3 flights a year in Europe", "4–5 flights a year in Europe", "6 flights a year or more in Europe."

To assess general pro-environmental orientation, participants completed a brief environmental concern scale. They were presented with three items adapted from previous literature (e.g., Stern et al.) and asked to indicate their level of agreement on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree): Now we would like to ask you some personal information. Please indicate how much you agree or disagree with each of the following statements. Items included statements such as *"I normally make a conscious effort to limit my use of products or services that are made of scarce resources,"* and "*When I have a choice between two equal products or services, I always purchase the one that is less harmful to other people and the environment.*"

For participants who indicated that they "never fly" within Europe, a follow-up item prompted them to report their primary reason(s) for not flying. They could select from multiple options including work, holiday, family, or specify their own reason.

For those who reported flying 4 or more times per year, additional questions were displayed to better understand their behavior and psychological responses. First, participants indicated the main *purpose of their flights (*e.g., work, holiday, family). Then, they were asked to rate t*he extent to which they considered environmental consequences (e.g., emissions, climate change) when flying*, with separate ratings for work, pleasure, and family-related flights.

Next, participants evaluated the emotions they typically experience during their own flights within Europe. Using a 7-point Likert scale, they rated how well a range of feelings (e.g., guilty, satisfied, free, regretful, shameful) described their experience. Finally, two items assessed participants' perceived efficacy of reducing air travel: (1) perceived difficulty of reducing their annual air travel by 50%, and (2) perceived impact of this reduction on global warming. These questions were conditional and only presented to participants who reported frequent flying behavior.

Following this, the participants were asked to fill in some demographic information, including age, gender, nationality, urban characters of place of residence, total annual income.

4.4 Analysis plan

Prior to conducting the main analyses, several preliminary checks were performed to ensure that the assumptions required for parametric and regression-based methods were met. For the continuous dependent variables: purchase intention and perceived sustainability, normality and homogeneity of variances were assessed using Shapiro-Wilk tests and Levene's tests respectively. In the case of repeated-measures factors (i.e., different transportation modes within-subject), the assumption of sphericity was examined via Mauchly's test; if violated, appropriate corrections such as the Greenhouse-Geisser adjustment were applied. When covariates (e.g., environmental concern, travel frequency) were included in the model, the assumptions of linearity between covariates and dependent variables, as well as homogeneity of regression slopes across experimental conditions, were also tested using General Linear Model procedures.

For the categorical dependent variable—transportation selection, assumptions specific to multinomial logistic regression were considered. These included checking for sufficient cell counts across condition-category combinations and testing for multicollinearity among predictors using variance inflation factors (VIF). Finally, internal consistency of multi-item constructs such as emotional responses and environmental concern was evaluated through Cronbach's alpha, ensuring that composite scores reflected reliable underlying dimensions. Only after confirming these assumptions were met, the main inferential analyses were conducted.

To examine the effects of normative framing on travel-related decisions, separate analyses were conducted for each of the three dependent variables. First, two mixed-design ANOVAs were performed for the continuous outcomes: (1) purchase intention and (2) perceived sustainability of each transport mode. In these models, transportation mode (train, bus, plane) was included as a within-subject factor experimental condition (Condition 1: unsustainable static + unsustainable dynamic framing; Condition 2: unsustainable static + sustainable dynamic framing; Condition 3: control) was treated as a between-subject factor**.** These analyses aimed to assess both the main effects of condition and transportation mode, as well as the interaction effect between the two factors on participants' evaluations of transport options.
For the third dependent variable, (3) transportation selection, which is categorical in nature (i.e., participants chose one transport mode), a multinomial logistic regression was conducted. This analysis assessed whether the experimental condition significantly predicted the likelihood of choosing a specific travel mode (bus, train, or plane), while controlling for relevant covariates such as environmental concern **and** travel frequency**.**
All analyses were conducted in SPSS, and statistical significance was determined using a threshold of $p < .05$. Where appropriate, effect sizes (η^2 for ANOVAs and odds ratios for logistic regression) and post-hoc comparisons (e.g., LSD or bonferroni) were reported to interpret the direction and strength of observed effects.

To account for individual differences that might influence the dependent variables beyond the framing condition, covariate analyses were conducted. For the continuous dependent variables (purchase intention and perceived sustainability), ANCOVA models were used to examine the effect of framing condition while controlling for relevant covariates such as environmental concern and travel frequency. These covariates were entered as continuous predictors to determine whether they had significant independent effects on the outcome variables, and whether controlling for them altered the main effects of condition.
For the categorical dependent variable (transportation selection), multinomial logistic regression was used to test the influence of framing condition on participants' transport selections while accounting for covariates. This method allowed for the inclusion of both continuous and categorical predictors and provided odds ratios to interpret how covariates such as high travel frequency or low environmental concern might increase or decrease the likelihood of choosing specific transport modes (e.g., plane vs. train).
The significance of covariates was evaluated using p-values (< .05 threshold) and effect size indicators such as partial η^2 (for ANCOVA) or odds ratios and Wald χ^2 (for logistic regression).

4.5 Result

A total of 202 participants were included in the analysis. The average age of the sample was 32.6 years (SD = 9.76), indicating a relatively young population. In terms of gender distribution, the sample was fairly balanced, with 55% identifying as male and 44.6% as female, while only 0.5% identified as another gender. With respect to nationality, most participants were Dutch (72.2%), although about one-fifth (20.8%) represented other nationalities, reflecting a certain degree of cultural diversity in the sample. Regarding place of residence, most respondents reported living in cities with more than 50,000 inhabitants (63.9%), while about a quarter lived in medium-sized towns (27.2%) and a smaller proportion (8.9%) in rural areas. This distribution suggests that the sample leaned towards an urban population, which might be relevant in relation to their travel and consumption patterns. The reported annual household income varied, with the largest proportion falling in the €31,000–60,000 range (33.7%), followed by €61,000–90,000 (19.3%) and €91,000–120,000 (14.9%). A smaller group reported higher income levels above €120,000 (8.5% combined), while 11.4% reported low income (below €30,000). Additionally, 12.4% of participants chose not to disclose their income. This distribution reflects a relatively broad socioeconomic spectrum, though concentrated in the middle-income range. In terms of travel behaviour, air travel within Europe was relatively common among respondents. About one-third reported flying once a year or less (32.7%), and another third reported flying 2–3 times a year (31.2%). A smaller share reported more frequent flying, with 13.9% taking 4–5 flights per year and 9.9% taking six or more flights. The majority of the sample engages in at least occasional air travel. Participants' environmental concern was measured with three items on a 7-point Likert scale ($\alpha = .82$). On average, respondents reported a moderate level of concern ($M = 4.47$, $SD = 1.33$).

4.5.1 The effect of social norm interventions on purchase intention for plane, train and bus

A 3 (transportation mode: plane, bus, train; within-subject) × 3 (social norm interventions; between-subject) mixed repeated ANOVA was conducted to examine the effects of on purchase intention. Mauchly's test indicated that the assumption of sphericity was met (W = .983, p =.183).

The analysis (Table 13.) revealed a statistically significant main effect of social norm intervention on purchase intention (*F value*= 3.182, $p = .044$, $\eta^2_p = .031$). A significant main effect of transportation mode was also observed (*F* value = 48.223, $p < .001$, $\eta^2_p = .328$), indicating a large effect size. Participants expressed substantially different levels of purchase intention depending on the mode of transportation**,** regardless of the framing condition.

Although the interaction between social norm intervention and transportation mode on purchase intention was not statistically significant (F value = 0.224, $p = .913$, $\eta^2_p = .002$) exploratory pairwise comparisons were conducted to further examine potential differences in purchase intention across framing conditions within each transportation modes, and across transportation modes within each framing condition.

Main effects on Purchase intention			
	F value	**P value**	**Part eta square**
Social norm intervention	3.182	.044	.031

Transportation	48.223	< 0.01	.328
Interaction effects	0.2244	.913	.002

Table 13. Main effects of social norm intervention, transportation and interaction effect on purchase intention

Pairwise comparison - Condition × Transportation

For plane travel, participants' purchase intentions did not differ significantly across conditions, this suggests that framing interventions may have had limited impact in discouraging air travel, possibly due to deeply entrenched preferences or perceptions of necessity associated with flying. For bus travel, participants exposed to Unsustainable static norm + Sustainable dynamic norm reported the lowest purchase intentions.

For train travel, a marginally significant effect was observed between Condition 1 (M = 5.279, SD=1.524) and Condition 2 (M = 4.746, SD =1.752), p = .064. Descriptively, participants in Condition 1 reported higher train purchase intention compared to those in Condition 2, indicating that exposure to repeated unsustainable framings may have heightened awareness of environmental harm and encouraged stronger intention to sustainable travel choice.

Although these differences were not statistically significant, the pattern may indicate that participants who were repeated exposure to unsustainable framings (as in Condition 1) may heighten awareness of environmental harm and consequently motivate stronger intention to choose train travel. Interestingly, participants in Condition 2, who saw both negative and positive framings, expressed the lowest train purchase intention, possibly due to a psychological balancing effect ("moral licensing") or a dampening of guilt after the second message.

Consumers' purchase intention across framing conditions within plane, bus, train	**Condition 1** Unsustainable static norm + Unsustainable dynamic norm **N= 68**	**Condition 2** Unsustainable static norm + Sustainable dynamic norm **N= 67**	**Condition 3 N= 67**	**Significant test**	**P values**
Plane	M = 4.25 SD = 2.076	M = 4.209 SD =1.895	M = 4.149 SD =1.956	Condition 1v2 Condition 1v3 Condition 2v3	P = .904 P = .768 P = **.867**
Bus	M = 3.176 SD =1.895	M = 2.955 SD = 1.762	M = 3.090 SD =1.764	Condition 1v2 Condition 1v3 Condition 2v3	P = .493 P = .787 P = .678
Train	M = 5.279 SD = 1.524	M = 4.746 SD =1.752	M = 5.015 SD = 1.710	Condition 1v2 Condition 1v3 Condition 2v3	P = .064 P = .357 P = .351

Table 14. Results of Pairwise comparisons across framing conditions for transportation-plane, bus, train

Pairwise comparison – Transportation * Condition

Across all three framing conditions, participants consistently showed a significantly high willingness to purchase train compared to both plane and bus**.**

In Condition 1 (Unsustainable Static norm+ Unsustainable Dynamic norm), participants were significantly more willing to choose train (M = 5.28, SD = 1.96) over both plane (M = 4.25, SD = 2.08; $p = .007$) and bus (M = 3.18, SD = 1.90; $p < .001$). This suggests that being exposed to repeated negative messaging about unsustainable behaviors may have heightened participants' awareness of environmental harm and consequently choose a more sustainable train travel**.**

In Condition 2 (Unsustainable Static norm + Sustainable Dynamic norm), there is not significant different to choose train (M = 4.209, SD =1.895) over plane (M = 4.21, SD = 1.90; $p = .156$). This may suggest that pairing an unsustainable message with a positive sustainable frame can somewhat reduce air travel intention. The gap between train and plane narrows in this condition, possibly due to a moral licensing effect, where the positive framing tempers the urgency of behavioral change. In the Control condition, participants still showed a significant preference for train (M = 5.02, SD = 1.71) over plane (M = 4.15, SD = 1.96; $p = .023$) and bus (M = 3.09, SD = 1.76; $p < .001$).

Consumer's Purchase Intention across plane, bus, train within each framing condition	**Plane**	**Bus**	**Train**	**Significant test P values**
Condition 1 Unsustainable static norm + Unsustainable dynamic norm N= 68	M = 4.250 SD = 2.076	M = 3.176 SD =1.895	M = 5.279 SD =1.956	Plane vs. Bus P = .005 Plane vs. Train P = .007 Train vs. Bus. P < **.001**
Condition 2 Unsustainable static norm + Sustainable dynamic norm N= 67	M = 4.209 SD =1.895	M = 2.955 SD = 1.762	M = 4.746 SD =1.764	Plane vs. Bus P = .001 Plane vs. Train P = .156 Train vs. Bus. P < **.001**
Condition 3 Control N= 67	M = 4.149 SD =1.524	M = 4.746 SD =1.752	M = 5.015 SD = 1.710	Plane vs. Bus P = .006 Plane vs. Train P = .023 Train vs. Bus. P < **.001**

Table 15. Results of Pairwise comparisons within each framing condition for transportation-plane, bus, train

Figure 16 displays the mean levels of purchase intention for plane and train travel under three framing conditions: (1) unsustainable static norm + unsustainable dynamic norm, (2) unsustainable static norm + sustainable dynamic norm, and (3) control. Across all conditions, train travel consistently elicited higher purchase intention than plane travel, with the largest gap observed in Condition 1. A statistically significant difference (denoted by *) was identified between plane and train purchase intention under Condition 1, where participants exposed to repeated unsustainable norm messages reported significantly greater willingness to choose train travel (M = 5.279) compared to plane travel (M = 4.25).

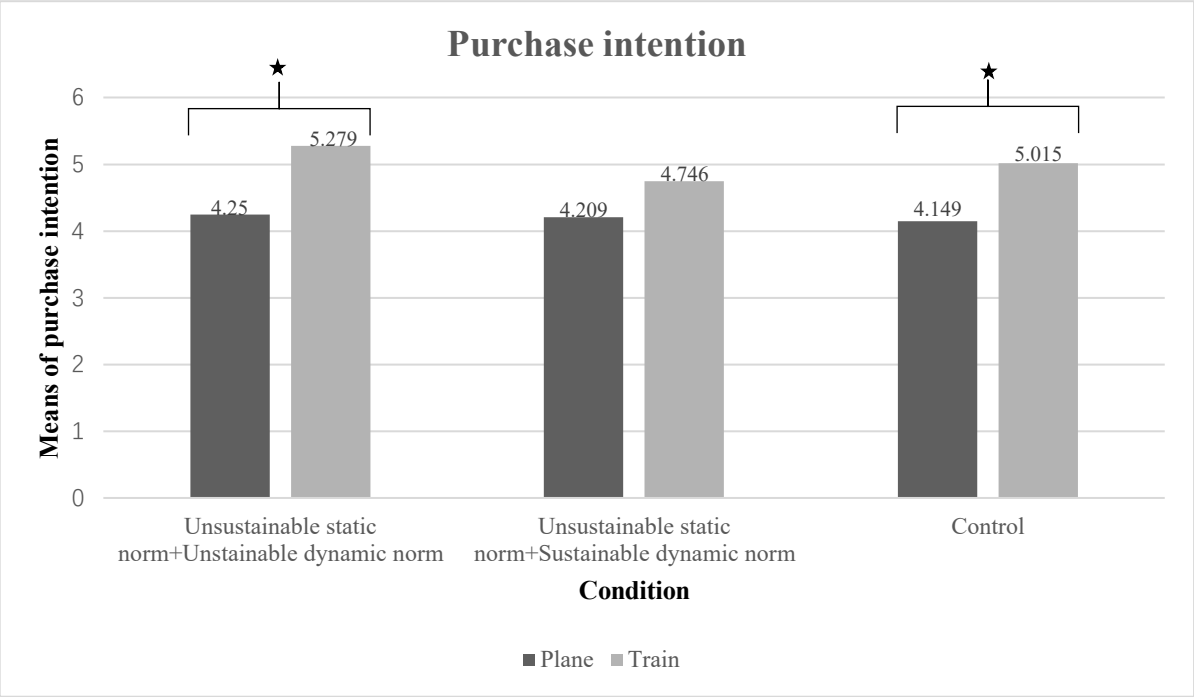


Figure 16. Mean of purchase intention for plane and train travel across framing conditions

Across all three framing conditions, participants consistently demonstrated a higher willingness to purchase train over plane or bus travel. Notably, participants in Condition 1, who were exposed to Unsustainable Static norm+ Unsustainable Dynamic norm social norm messages, showed the highest intention to choose train travel (M = 5.28), significantly exceeding their willingness to choose plane (M = 4.25; p = .007). This suggests that repeated exposure to negatively framed social norms may heighten environmental awareness and promote pro-environmental behavioral intentions.

Effect of Covariate - Environmental concern

To account for potential individual differences in environmental attitudes, a covariate analysis was conducted with environmental concern included as a predictor. However, environmental concern did not significantly influence purchase intention ($F(1,195) = 0.365$, $p = .546$, $\eta^2_p = .002$), and was therefore not considered further in the analysis.

4.5.2 The effect of social norm interventions on perceived environmental impact for plane, train and bus

A 3 (transportation mode: plane, bus, train; within-subject) × 3 (social norm intervention; between-subject) mixed repeated ANOVA was conducted to examine the effects of on perceived environmental impact. Mauchly's Test of Sphericity was performed to assess whether the assumption of sphericity had been met for the within-subject factor (transportation mode). The test was significant, $W = .718$, $\chi^2 (2) = 65.658$, $p < .001$, indicating that the assumption of sphericity was violated. Therefore, degrees of freedom were adjusted using the Greenhouse–Geisser correction ($\varepsilon = .780$) in all subsequent analyses involving the within-subject factor. This correction ensures more conservative and statistically valid results.

The results revealed that there was a significant main effect of transportation mode on perceived environmental impact, $F = 669.799$, $p < .001$, $\eta^2_p = .771$, indicating a large effect size. Under the inverted interpretation of the response scale where higher values represent greater perceived environmental impact. This result confirms that participants reliably distinguished between travel modes in terms of sustainability. In contrast, the main effect of social norm intervention on perceived environmental impact was not statistically significant, $F = 1.336$, $p = .265$, $\eta^2_p = .013$. Furthermore, no significant interaction effect between transportation mode and social norm condition was found, $F = 0.666$, $p = .515$, $\eta^2_p = .007$, indicating that social norm interventions did not amplify or reduce the perceived sustainability between transport options. These results suggest that while social norm interventions may influence behavioral intentions as observed in previous analyses of purchase intention, but they appear no effective in shaping consumers' perceptions of environmental concern.

Environmental impact perception			
Main effects	**F value**	**P value**	**Part eta square**
Social norm intervention	1.336	.265	.013
Transportation	669.799	<0.01	.771
Interaction effects	.666	.515	.007

Table 17. Main effects of social norm intervention, transportation and interaction effect on environmental impact perception.

Pairwise comparison - Condition × Transportation

Pairwise comparisons were conducted both across framing conditions for each transportation mode (Table 18.) and within each framing condition across transportation modes (Table 19.). As shown in Table 18., comparisons across framing conditions within each transportation mode revealed no significant differences (all $p > .05$), indicating that exposure to different social norm interventions did not alter participants' assessments of how environmentally impact for each mode of transport was perceived to be. This supports the conclusion that social norm interventions as implemented in this study did not significantly influence

participants' willingness to choose one mode over another. These results align with the non-significant main effect of framing condition and interaction effect.

Consumers' Environmental impact perception across framing conditions within plane, bus, train	**Condition 1** Unsustainable static norm + Unsustainable dynamic norm **N= 68**	**Condition 2** Unsustainable static norm + Sustainable dynamic norm **N= 67**	**Condition 3** Control **N= 67**	**Significant test**	**P values**
Plane	M = 6.191 SD = 1.458	M = 6.074 SD = 1.159	M = 5.791 SD = 1.600	Condition 1v2 Condition 1v3 Condition 2v3	P = 1.000 P = .308 P = .745
Bus	M = 2.721 SD = 1.244	M = 2.836 SD = 1.163	M = 2.672 SD = 1.248	Condition 1v2 Condition 1v3 Condition 2v3	P = 1.000 P = 1.000 P = 1.000
Train	M = 1.794 SD = 1.322	M = 1.970 SD = 1.279	M = 1.746 SD = 1.235	Condition 1v2 Condition 1v3 Condition 2v3	P = 1.000 P = 1.000 P = .937

Table 18. Results of Pairwise comparisons across framing conditions for transportation-plane, bus, train

Pairwise comparison - Transportation × Condition

Importantly, while these within-condition comparisons yielded significant results (all $p < .001$), these differences should not be interpreted as evidence for the effectiveness of the framing manipulation. Instead, they are a direct reflection of the robust main effect of transportation mode on perceived environmental impact. The observed pattern: train consistently perceived as the most sustainable option and remained unchanged regardless of which social norm message participants received. This suggests that participants' environmental evaluations of different travel options are stable and likely driven by pre-existing knowledge or visual emission data rather than short-term exposure to normative messages.

Consumers' Environmental impact perception across plane, bus, train within each framing condition	**Plane**	**Bus**	**Train**	**Significant test**	**P values**
Condition 1 Unsustainable static norm + Unsustainable dynamic norm N= 68	M = 6.192 SD = 1.458	M = 2.721 SD = 1.244	M = 1.794 SD = 1.322	Plane vs. Bus Plane vs. Train Train vs. Bus.	P < .001 P < .001 P < .001
Condition 2	M = 6.074	M = 2.836	M = 1.970	Plane vs. Bus	P < .001

Unsustainable static norm + Sustainable dynamic norm N= 67	SD = 1.159	SD = 1.163	SD = 1.279	Plane vs. Train P < .001 Train vs. Bus. P < .001
Condition 3 Control N= 67	M = 5.791 SD = 1.600	M = 2.672 SD = 1.248	M = 1.746 SD = 1.235	Plane vs. Bus P < .001 Plane vs. Train P < .001 Train vs. Bus. P < .001

Table 19. Results of Pairwise comparisons within each framing condition for transportation-plane, bus, train

This suggests that while social norm framings influence purchase intention, they were not effectively influence in perceived environmental impact across transportation mode.

Effect of Covariate - Environmental concern

To account for potential individual differences in environmental attitudes, environmental concern was included as a covariate in a follow-up model. The analysis revealed a statistically significant effect of environmental concern ($F(1,195) = 9.724$, $p = .002$, $\eta^2_p = .047$). This indicates that participants with higher levels of environmental concern tended to assign higher environmental impact scores across transportation modes. In other words, they perceived all travel options, particularly plane travel as more environmentally harmful. This pattern suggests that individuals with stronger pro-environmental attitudes may be more sensitive to sustainability related information and more likely to recognize or emphasize the negative environmental consequences of transportation.

4.5.3 The effect of social norm interventions on selection for plane, train and bus

To assess the effect of the three social norm interventions on participants' actual transportation selection (plane, bus, or train), a multinomial logistic regression was conducted. The overall model was not statistically significant, $\chi^2(4) = 1.647$, $p = .800$, indicating that social norm intervention did not have influence on consumers' transportation selection. The pseudo-R-squared values (Nagelkerke = .009) also indicated a small explanatory power. Moreover, as presented in Table 21, no pairwise contrasts between the social norm intervention conditions produced statistically significant effects on the likelihood of selecting plane or bus rather than train (all $p > .05$).

This pattern highlights the robustness of participants' pre-existing preferences: while they clearly distinguished between transportation modes, these distinctions were not shifted by social norm cues. Overall, the results indicate that short-term exposure to normative framing was insufficient to alter entrenched behavioral tendencies in actual transportation selection.

Test	χ^2	df	p-value	Nagelkerke R^2	Conclusion
Model fitting (Final vs. Intercept only)	1.647	4	.800	.009	Not significant

Condition effect (Likelihood Ratio Test)	1.647	4	.800	–	Not significant

Table 20. Model Fit Statistics and Overall Effects for Multinomial Logistic Regression Predicting Transportation Mode Selection (Reference Category: Train)

Comparison (Choice)	Predictor	B	SE	Wald	df	p	OR (Exp(B))	95% CI for OR
Plane vs. Train	Intercept	0.588	0.279	4.442	1	.035	–	–
	Condition 1	0.322	0.393	0.671	1	.413	1.380	[0.639, 2.982]
	Condition 2	-0.023	0.399	0.003	1	.954	0.977	[0.447, 2.135]
Bus vs. Train	Intercept	1.186	0.345	11.844	1	<.001	–	–
	Condition 1	0.492	0.468	1.109	1	.292	1.636	[0.654, 4.092]
	Condition 2	0.195	0.473	0.170	1	.680	1.216	[0.481, 3.075]

Table 21. Parameter Estimates for the Effect of Social Norm Interventions on Transportation Mode Selection (Reference Category: Train)

Effect of Covariate - Environmental concern

A multinomial logistic regression was conducted to examine the effect of social norm intervention and environmental concern on participants' selection of transportation mode (plane, bus, train).

The overall model was statistically significant compared to the intercept-only model, χ^2 (6) = 36.63, $p < .001$, with a Nagelkerke R^2 of .193, indicating a modest improvement in explanatory power relative to the model without covariates. Likelihood ratio tests revealed that the consumers with higher environmental concern have higher willingness to purchase train, χ^2 (2) = 34.67, $p < .001$, whereas social norm intervention do not have significant effect on transportation selection, χ^2 (4) = 2.55, $p = .636$.

Test / Statistic	χ^2	df	p	Notes
Model fitting (Final vs. Intercept only)	36.628	6	<.001	Model significantly better than intercept-only
Likelihood ratio – Environmental concern	34.670	2	<.001	Significant predictor
Likelihood ratio – Condition	2.548	4	.636	Not significant

Table 22. Model fit statistics for multinomial logistic regression predicting transportation choice

Parameter estimates indicated that the consumer with higher levels of environmental concern were less likely to choose plane over train, (B = -0.769, SE = 0.148, Wald = 26.86, $p < .001$, Exp(B) = 0.464, 95% CI [0.347, 0.620]). Specifically, each one-point increase in environmental concern was associated with a 53.6% reduction in the odds of selecting a plane rather than a train, indicating a clear behavioral shift away from the highest-emission option toward the lowest-emission alternative. This relationship was not observed in the bus

vs. train comparison, where environmental concern did not significantly influence choice where p value=.387>0.05.

Comparison	Predictor	B	SE	Wald	p	Exp(B)	95% CI for Exp(B)
Plane vs. Train	Environmental concern	-0.769	0.148	26.861	<.001	0.464	[0.347, 0.620]
	Condition 1	0.482	0.432	1.247	.264	1.619	[0.695, 3.774]
	Condition 2	0.042	0.444	0.009	.924	0.959	[0.402, 2.287]
Bus vs. Train	Environmental concern	-0.146	0.169	0.747	.387	0.864	[0.621, 1.203]
	Condition 1	0.540	0.484	1.244	.265	1.715	[0.665, 4.427]
	Condition 2	0.302	0.484	0.390	.532	1.353	[0.524, 3.494]

Table 23. Multinomial logistic regression predicting transportation choice from social norm intervention and environmental concern (reference category = Train)

Across both comparisons, social norm interventions were non-significant, suggesting that the normative message manipulation did not meaningfully alter transportation selection when controlling for environmental concern. These results indicate that environmental concern rather than social norm intervention, was the primary driver of variance in participants' transportation choices, particularly in the context of high-emission (plane) versus low-emission mode (train).

4.5.4 Manipulation check

To verify the effectiveness of the experimental manipulation, an independent-samples t-test (Table 24.) was conducted comparing manipulation check scores between the *Condition 1: unsustainable static norm+ unsustainable* dynamic norm and Condition 2: *unsustainable static norm +sustainable dynamic norm.*

For manipulation check 1, *"Currently, travelling behaviour is…"*, participants in the unsustainable static norm + unsustainable dynamic norm condition rated the present travel culture as much more **f**light-centred and unsustainable (M = 1.49, SD = 0.63) compared to those in the unsustainable static norm + sustainable dynamic norm condition (M = 4.03, SD = 0.36), $t(106.56) = -28.96$, $p < .001$. This substantial mean gap (-2.54, 95% CI [-2.72, -2.37]) indicates that the static norm framing successfully shifted perceptions of the *current* state of travel towards the direction emphasised in the message either negatively framed (unsustainable) or more positively framed (sustainable).

For manipulation check 2, *"In the future, travelling behaviour is becoming…"*, those exposed to *unsustainable static norm+ unsustainable* dynamic norm condition anticipated the future to be less sustainable and more flight-centred (M = 1.59, SD = 0.81), whereas those in the *unsustainable static norm +sustainable dynamic norm* condition expected it to be more sustainable and more train-centred (M = 4.04, SD = 0.47), $t(105.70) = -21.56$, $p < .001$. The large difference (-2.46, 95% CI [-2.68, -2.23]) suggests that the dynamic norm framing strongly influenced participants' expectations about future travel behaviour.

In both cases, the very large effect sizes (Cohen's d =4.966 for current behaviour, =3.726 for future behaviour) confirm that the manipulations were clearly perceived in line with their intended framing.

Measure	Condition	Mean (SD)	t(df)	p-value	95% CI	Mean Difference	Cohen' d
Manipulation Check 1	Condition 1	1.49 (0.63)	-28.96 (106.56)	<.001	[-2.72, -2.37]	-2.56	4.966
	Condition 2	4.03 (0.36)					
Manipulation Check 2	Condition 1	1.59 (0.63)	-21.56 (105.70)	<.001	[-2.68, -2.23]	-2.46	3.726
	Condition 2	4.04 (0.47)					

Table 24. Independent samples t-tests comparing manipulation check responses between the two experimental framing conditions

4.5.5 Effect of social norm interventions on social moral and cleansing and licensing

To assess the internal consistency of the scales, reliability analyses were conducted for both the *Social Moral Cleansing* and *Social Moral Licensing* measures. The overall results highlight that while both constructs were measured reliably.

As shown in Table 25, the Social Moral Cleansing scale, consisting of four items, demonstrated excellent internal consistency (Cronbach's α = .94). The mean scores of the individual items ranged between 3.58 and 4.08, with relatively high standard deviations (SDs ≈ 1.70–1.77), suggesting that while participants generally agreed with the cleansing statements, there was also substantial variation in their responses. This indicates that reading about others' behaviours tends to elicit a strong sense of urgency and responsibility among participants, but the intensity of this effect differs across individuals.

Item (social moral cleansing)	Mean (SD)	Cronbach's α
After reading about other's behaviour, I feel the need to act quickly to travel more sustainably	3.73 (1.71)	.942
Knowing what others are doing, makes me realize that immediate action is critical for climate protection	4.08 (1.77)	
I feel more pressure to act urgently, after reading about what other people are doing	3.58 (1.71)	
I feel a greater responsibility to change my own behavior, after reading about other actions	3.81 (1.70)	

Table 25. Descriptive statistics and reliability for Social Moral Cleansing scale

The Social Moral Licensing scale, displayed in Table 26**,** showed acceptable reliability (Cronbach's α = .82). The mean values of the three items were somewhat lower (M = 2.60–3.07), reflecting that participants were less inclined to agree with statements that justified reducing their own efforts after observing others' actions. The smaller standard deviations (SDs ≈ 1.14–1.34) further indicate that responses were more concentrated, taken together, these results imply that participants maintained a personal sense of responsibility for sustainable behaviour, rather than relying on others' contributions as a justification for inaction.

Item (social moral licensing)	Mean (SD)	Cronbach's α
Reading about other's behaviour makes me feel I can relax a bit my own efforts	3.07 (1.29)	.819
I feel less urgency to act immediately, because I believe others are already contributing enough	2.60 (1.14)	
Since others are making an effort for the environment, I don't feel as pressured to change my behavior right now	2.65 (1.34)	

Table 26. Descriptive statistics and reliability for Social Moral Licensing scale

4.5.6 Effect of social moral cleansing across conditions

For social moral cleansing, the assumption of homogeneity of variances was met, F (2, 199) = 1.59, p = .206, indicating that the variability of responses was comparable across groups. The subsequent one-way ANOVA demonstrated a strong overall effect of condition on cleansing scores, F (2, 199) = 13.44, p < .001.
As shown in Table 27, participants exposed in the *unsustainable static norm + unsustainable dynamic norm* condition reported the highest levels of cleansing (M = 4.37, SD = 1.60, ; followed by the *unsustainable static norm + sustainable dynamic norm* condition (M = 3.95, SD = 1.54), while participants in the control group expressed the lowest inclination (M = 3.06, SD = 1.35, P = .002). Also, statistical comparisons confirmed that both experimental conditions elicited significantly higher cleansing tendencies compared to the control group (p < .001 and p = .002, respectively), no significant difference was found between the two experimental conditions (p = .316).

Social moral cleansing		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	4.37 (1.60)	Condition 1v2 P = .316 Condition 1v3 P < 0.001 Condition 2v3 P = .002
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	3.95 (1.54)	
Control N=67	3.06 (1.35)	

Table 27. One-way ANOVA Results of social moral cleansing between conditions

4.5.7 Effect of social moral licensing across conditions

For social moral licensing, Levene's test confirmed that the assumption of homogeneity of variances was met, F (2, 197) = 0.83, p = .439, indicating that the variability of responses was comparable across groups. The subsequent one-way ANOVA (Appendix 5) revealed no significant overall effect of condition on licensing scores, F (2, 197) = 2.75, p = .066, suggesting that exposure to different framing did not reliably influence participants' tendency to relax their own efforts after reading about others' behaviour.

Social moral licensing		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68	2.53 (0.98)	Condition 1v2 P = .353

Unsustainable static norm + Unsustainable dynamic norm		Condition 1v3 P = .069
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	2.82 (1.09)	Condition 2v3 P = 1.00
Control N=67	2.96 (1.12)	

Table 28. One-way ANOVA Results of social moral licensing between conditions

Taken together, the findings indicate that social norm intervention predominantly elicited cleansing rather than licensing responses. While participants who read about others' bad behaviours (Unsustainable static norm + Unsustainable dynamic norm) reported significantly greater pressure and responsibility to act sustainably (cleansing), there was no reliable evidence that participants relaxed their own efforts on the basis of others' contributions (licensing).

4.5.8 Emotion experienced

To better understand how social norm framings influence behavioral intentions, this section examines the emotional responses elicited across conditions.

Levene's test indicated that the assumption of homogeneity of variances was met, $F(2,199) = 0.95$, $p = .388$. A one-way ANOVA revealed a significant effect of condition on relaxation levels, $F(2,199) = 11.34$, $p < .001$. As shown in Table 29, participants in the control condition reported feeling most relaxed after reading the news ($M = 4.54$, $SD = 1.37$), followed by those exposed to the unsustainable static norm with a sustainable dynamic norm ($M = 3.84$, $SD = 1.55$), whereas those in the unsustainable static combined with unsustainable dynamic norm condition felt the least relaxed ($M = 3.29$, $SD = 1.62$). Post hoc comparisons further showed that the control group experienced significantly greater relaxation compared to both experimental conditions (Condition 1 vs. Control: $p < .001$; Condition 2 vs. Control: $p = .025$), while no significant difference was observed between the two norm manipulation conditions ($p = .119$). This pattern suggests that exposure to unsustainable norm information, particularly when reinforced by dynamic cues, diminished participants' sense of relaxation compared to the control condition.

Relaxed		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	3.29 (1.62)	Condition 1v2 P = .119 Condition 1v3 P < .001
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	3.84 (1.55)	Condition 2v3 P = .025
Control N=67	4.54 (1.37)	

Table 29. Comparisons of relaxed across conditions

For the emotion *Relieved*, the assumption of homogeneity of variances was violated, $F(2,199) = 16.30$, $p < .001$. Therefore, Welch's ANOVA was conducted, which revealed a significant effect of condition on relief scores, $F(2,123.17) = 34.11$, $p < .001$.

As shown in Table 30, participants in the unsustainable static + unsustainable dynamic norm condition reported the lowest level of relief (M = 2.07, SD = 0.88). In contrast, both the sustainable dynamic norm condition (M = 3.43, SD = 1.41) and the control condition (M = 3.49, SD = 1.58) were associated with substantially higher relief, suggesting that exposure to unsustainable cues strongly diminished feelings of relief. Post hoc Games-Howell comparisons confirmed that participants in Condition 1 felt significantly less relieved compared to both Condition 2 ($p < .001$) and the control group ($p < .001$), whereas no difference was found between Condition 2 and the control condition ($p = .971$).

Relieved		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	2.07 (0.88)	Condition 1v2 P < .001 Condition 1v3 P < .001 Condition 2v3 P = .971
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	3.43 (1.41)	
Control N=67	3.49 (1.58)	

Table 30. Comparisons of relieved across conditions

For the emotion *Anxious*, the assumption of homogeneity of variances was met, $F(2,199) = 0.77$, $p = .466$. The one-way ANOVA revealed a significant effect of condition on anxiety levels, $F(2,199) = 9.87$, $p < .001$. As shown in Table 31, participants in the unsustainable static + unsustainable dynamic norm condition reported the highest anxiety (M = 3.91, SD = 1.75). This was followed by those exposed to the sustainable dynamic norm (M = 3.13, SD = 1.58), while participants in the control condition experienced the lowest anxiety levels (M = 2.68, SD = 1.53). Post hoc Tukey comparisons indicated that participants in Condition 1 felt significantly more anxious compared to both Condition 2 ($p = .018$) and the control group ($p < .001$), whereas no significant difference was found between Condition 2 and the control condition ($p = .335$). These findings suggest that repeated exposure to unsustainable cues intensified participants' anxiety, whereas sustainable or neutral information did not elevate anxiety to the same extent.

Anxious		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	3.91 (1.75)	Condition 1v2 P = .018 Condition 1v3 P < .001 Condition 2v3 P = .335
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	3.13 (1.58)	
Control N=67	2.68 (1.53)	

Table 31. Comparisons of anxious across conditions

For the emotion *Frustrated*, the assumption of homogeneity of variances was met, $F(2,199) = 1.23$, $p = .296$. The one-way ANOVA revealed a significant effect of condition on frustration scores, $F(2,199) = 20.46$, $p < .001$.

As displayed in Table 32, participants in the unsustainable static + unsustainable dynamic norm condition reported the highest frustration (M = 4.23, SD = 1.83), followed by those in the sustainable dynamic norm condition (M = 3.55, SD = 1.79). By contrast, participants in the control condition felt considerably less frustrated (M = 2.34, SD = 1.58). Bonferroni comparisons confirmed that both participants exposed to experimental conditions elicited significantly greater frustration than the control condition (Condition 1 vs. Control: $p < .001$; Condition 2 vs. Control: $p < .001$). However, the difference between the two norm conditions did not reach significance ($p = .071$). Overall, these findings suggest that exposure to norm manipulations, especially when emphasizing unsustainable cues, heightened participants' frustration compared to the control condition.

Frustrated		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	4.23 (1.83)	Condition 1v2 P = .071 Condition 1v3 P < .001 Condition 2v3 P < .001
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	3.55 (1.79)	
Control N=67	2.34 (1.58)	

Table 32. Comparisons of frustrated across conditions

For the emotion *Excited*, the assumption of homogeneity of variances was violated, $F(2,199) = 4.69$, $p = .010$. Therefore, Welch's ANOVA was used, which showed a significant effect of condition on excitement levels, $F(2,131.31) = 19.62$, $p < .001$.

As illustrated in Table 33, participants exposed in the unsustainable static + unsustainable dynamic norm condition reported the lowest excitement (M = 2.03, SD = 1.17). By contrast, both the unsustainable static norm + sustainable dynamic norm condition (M = 3.16, SD = 1.42) and the control group (M = 3.24, SD = 1.39) elicited substantially higher levels of excitement. Post hoc Games-Howell tests confirmed that participants in Condition 1 were significantly less excited compared to both Condition 2 ($p < .001$) and the control condition ($p < .001$), whereas no significant difference was observed between Condition 2 and the control group ($p = .949$). These results suggest that exposure to unsustainable norm messages markedly dampened participants' excitement, while sustainable or neutral contexts sustained a more positive emotional response.

Excited		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	2.03 (1.17)	Condition 1v2 P < .001 Condition 1v3 P < .001 Condition 2v3 P = .949
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	3.16 (1.42)	
Control N=67	3.24 (1.39)	

Table 33. Comparisons of excited across conditions

For the emotion *Motivated*, Levene's test indicated a violation of homogeneity of variances, F (2,199) = 6.38, p = .002. Also, Welch's ANOVA showed no significant differences across conditions, F (2,131.46) = 1.82, p = .167. This suggests that participants' motivation did not vary meaningfully between the experimental and control groups.

Motivated		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	3.62 (1.80)	Condition 1v2 P = .161 Condition 1v3 P = .274 Condition 2v3 P = .929
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	4.13 (1.44)	
Control N=67	4.04 (1.39)	

Table 34. Comparisons of motivated across conditions

For the emotion *Indifferent*, the assumption of homogeneity of variances was met, F (2,199) = 0.26, p = .770. A one-way ANOVA revealed a significant effect of condition, F (2,199) = 5.71, p = .004.

As shown in Table 35, participants in the control condition reported the highest indifference (M = 4.24, SD = 1.74), followed by those in the sustainable dynamic norm condition (M = 3.82, SD = 1.77), whereas participants in the unsustainable static + unsustainable dynamic norm condition reported the lowest indifference (M = 3.21, SD = 1.84). Bonferroni comparisons indicated that Condition 1 reported significantly lower indifference compared to the control condition (p = .003), while no significant differences were found between the two experimental conditions (p = .141) or between Condition 2 and the control condition (p = .532). This suggests that exposure to unsustainable cues reduced participants' sense of indifference, whereas sustainable or neutral information may not influence participants' attention of sustainable behaviour.

Indifferent		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	3.21 (1.84)	Condition 1v2 P = .141 Condition 1v3 P = .003 Condition 2v3 P = .532
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	3.82 (1.77)	
Control N=67	4.24 (1.74)	

Table 35. Comparisons of indifferent across conditions

For the emotion *Discouraged*, the assumption of homogeneity of variances was violated, F(2,199) = 5.12, p = .007. Therefore, Welch's ANOVA was used, which revealed a significant effect of condition on discouragement scores, F (2,129.52) = 13.93, p < .001.

As presented in Table 36, participants in the unsustainable static + unsustainable dynamic norm condition reported the highest discouragement (M = 3.81, SD = 1.74). This was followed by those in the sustainable dynamic norm condition (M = 2.90, SD = 1.64), while participants in the control condition reported the lowest

discouragement (M = 2.43, SD = 1.23). Post hoc Games-Howell comparisons indicated that Condition 1 elicited significantly higher discouragement than both Condition 2 ($p = .006$) and the control group ($p < .001$). No significant difference was found between Condition 2 and the control condition ($p = .160$). These findings suggest that repeated exposure to unsustainable cues increased participants' feelings of discouragement, whereas sustainable and neutral contexts helped buffer against such negative emotions.

Discouraged		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	3.81 (1.74)	Condition 1v2 P = .006 Condition 1v3 P < .001 Condition 2v3 P = .160
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	2.90 (1.64)	
Control N=67	2.43 (1.23)	

Table 36. Comparisons of Discouraged across conditions

For the emotion *Proud*, the assumption of homogeneity of variances was violated, $F(2,199) = 3.47$, $p = .033$. Consequently, Welch's ANOVA was conducted and revealed a significant effect of condition on pride scores, $F(2,131.14) = 20.68$, $p < .001$.

As shown in Table 37, participants in the unsustainable static + unsustainable dynamic norm condition reported the lowest levels of pride (M = 1.82, SD = 1.27). In contrast, both the sustainable dynamic norm condition (M = 3.07, SD = 1.50) and the control group (M = 3.19, SD = 1.58) reported substantially higher pride. Post hoc Games-Howell comparisons confirmed that participants in Condition 1 felt significantly less proud than those in both Condition 2 ($p < .001$) and the control group ($p < .001$), whereas no significant difference was found between Condition 2 and the control condition ($p = .895$). These findings suggest that unsustainable norm cues undermined participants' sense of pride, while sustainable and neutral contexts maintained higher levels of this positive emotion.

Proud		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	1.82 (1.27)	Condition 1v2 P < .001 Condition 1v3 P < .001 Condition 2v3 P =.895
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	3.07 (1.50)	
Control N=67	3.19 (1.58)	

Table 37. Comparisons of proud emotion across conditions

For the emotion *Guilty*, the assumption of homogeneity of variances was violated, $F(2,199) = 4.49$, $p = .012$. Accordingly, Welch's ANOVA was applied and revealed a significant effect of condition on guilt scores, $F(2,131.22) = 6.95$, $p = .001$.

As shown in Table 38, participants in the unsustainable static + unsustainable dynamic norm condition reported the highest guilt (M = 3.29, SD = 1.70). This was followed by the sustainable dynamic norm condition (M = 2.75, SD = 1.47), whereas the control group reported the lowest guilt (M = 2.33, SD = 1.28). Post hoc Games-Howell tests indicated that participants in Condition 1 experienced significantly more guilt than those in the control group ($p < .001$). However, differences between Condition 1 and Condition 2 ($p = .116$), as well as between Condition 2 and the control group ($p = .190$), were not statistically significant. These findings suggest that persistent exposure to unsustainable norms primarily heightened participants' feelings of guilt compared to a neutral context, whereas sustainable cues did not differ meaningfully from the other conditions.

Guilty		
Condition	**Mean (SD)**	**Comparison p-value**
Condition 1: N=68 Unsustainable static norm + Unsustainable dynamic norm	3.29 (1.70)	Condition 1v2 P = .116 Condition 1v3 P < .001 Condition 2v3 P = .190
Condition 2: N=67 Unsustainable static norm + Sustainable dynamic norm	2.75 (1.47)	
Control N=67	2.33 (1.28)	

Table 38. Comparisons of guilty across conditions

4.6 Discussion of study 2

The quantitative study provided mixed evidence for the effectiveness of social norm framings in shaping travel-related decisions. Consistent with expectations, participants expressed markedly different purchase intentions depending on transportation mode within each condition. Notably, Participants exposed in Condition 1 (unsustainable static + unsustainable dynamic) showed greater purchase intention to choose train travel compared to both plane ($p = .007$) and bus ($p < .001$). This pattern suggests that repeated exposure to unsustainable norm messages heightened awareness of environmental harm and reinforced pro-environmental travel intentions. In contrast, social norm framing did not significantly influence participants' perceptions of the relative environmental impact of different modes. Instead, perceptions followed a stable hierarchy (plane > bus > train), indicating that participants relied primarily on pre-existing knowledge or visible emission cues rather than short-term normative information. Environmental concern emerged as a consistent predictor, with higher concern associated with greater sensitivity to the environmental cost of air travel. Also, social norm framings did not significantly alter participants' transportation selection choices. Instead, selection patterns reflected strong pre-existing preferences, with environmental concern rather than short-term normative cues. Finally, participants who exposure to Unsustainable static norm + Unsustainable dynamic norm condition consistently heightened negative emotions such as guilt, anxiety, and frustration, while simultaneously lowering positive affect such as pride, relief, and relaxation. In contrast, participants who exposure to Unsustainable static norm + Sustainable dynamic norm and control condition were associated with the maintenance of more positive emotions, including pride, relief, and excitement.

These findings highlight the psychological mechanism through which social norms influence sustainable behavior. This heightened emotional discomfort appears to have motivated compensatory processes, as reflected in higher scores on moral cleansing. Importantly, this emotional and moral response was accompanied by a significantly stronger consumer's purchase intention to choose train travel over plane travel.

Together, these results suggest that negative emotions can translate social norm pressure into sustainable behavior, with moral cleansing serving as an intermediate step that strengthens the behavioral shift.

5. General discussion

The aim of this thesis was to explore how social norms intervention and conflicting emotions shape the travel behavior. Across two complementary studies: qualitative interview-based analysis and a quantitative experiment, this research has highlighted the interplay of cognitive dissonance, social influence, and emotional processes in understanding the persistent attitude–behavior gap in sustainable travel.

Study 1 revealed the nuanced psychological and social mechanisms underlying frequent flying despite environmental concern. Participants described their travel choice as embedded in a web of peer expectations, role-modeling, and social positive reinforcement. Importantly, they reported recurring experiences of guilt, regret, and discomfort when their behavior clashed with their ecological values, as well as the rationalization strategies they employed to cope with such tensions. These findings provided a detailed account of the everyday dilemmas faced, underscoring that decisions are not made in isolation but within social contexts that legitimize or constrain sustainable choices.

Study 2 extended these insights by testing the causal influence of social norm framings on consumer's' purchase intentions, perceived environment impact, transportation selection and emotional responses in a controlled setting. The results demonstrated that repeated exposure to unsustainable norms heightened emotional discomfort, which in turn strengthened intentions to select the more sustainable train option over flying. Moreover, this process appeared to operate through moral cleansing, suggesting that negative emotions triggered by norm violations can act as catalysts for compensatory pro-environmental behavior. At the same time, the study highlighted the limitations of social norm interventions: while they affected intentions, they did not alter participants' underlying environmental impact perceptions or actual transport mode selection, which remained driven by pre-existing preferences and structural considerations.

Taken together, the two studies together provide a more complete understanding of how social norms and emotions influence sustainable travel behavior. The qualitative findings emphasized the depth and persistence of internal conflicts and social pressures, while the quantitative results showed how social norm framings can trigger emotional mechanisms that nudge individuals toward more sustainable intentions. Importantly, the thesis shows that conflicting emotions are not merely barriers to sustainable behavior but can also function as levers when appropriately activated.

Overall, this thesis contributes to a growing understanding of the psychological and social dynamics underpinning the attitude–behavior gap in sustainable travel. By bridging qualitative and quantitative

evidence, it highlights both the constraints and opportunities for designing interventions that address not only knowledge and structural barriers but also the emotional and normative dimensions of frequent flying.

5.1 Theoretical implication

This thesis offers several theoretical contributions to the study of sustainable travel behavior, particularly within the frameworks of cognitive dissonance, the attitude–behavior gap, and social norms theory.

First, the findings extend cognitive dissonance theory (Festinger, 1957; Thøgersen, 2004) by showing how dissonance in the context of frequent flying is not merely an individual conflict between values and actions but is socially mediated. The qualitative study demonstrated that guilt, regret, and justification strategies were often activated by **s**ocial comparison processes (Festinger, 1954), such as observing peers who travel more sustainably or receiving judgment from others. This suggests that dissonance is relational rather than purely intrapsychic, highlighting the need for future research to account for the social embedding of emotional discomfort in sustainability-related decisions.

Second, the research contributes to the literature on the attitude–behavior gap (Barr et al., 2010; Carrington et al., 2010; Zhuo et al., 2022) by illustrating the role of emotional dynamics as both barriers and levers for behavior change. While most prior studies emphasize structural barriers (e.g., cost, convenience) or psychological mechanisms (e.g., low attitude accessibility), the present work shows that conflicting emotions particularly guilt and frustration can catalyze compensatory mechanisms such as moral cleansing (Merritt et al., 2010), which in turn strengthen pro-environmental intentions. This points to the dual nature of emotions in sustaining and potentially bridging the attitude–behavior gap.

Third, the thesis advances social norms theory (Cialdini et al., 1991; Chung & Rimal, 2016) by demonstrating how different types of norms—static, dynamic interact with emotional responses. While existing research has shown that dynamic norms can promote sustainable behavior in domains such as food choice (Sparkman & Walton, 2017; Aldoh et al., 2024), the quantitative findings here suggest that repeated exposure to unsustainable norms can also motivate sustainable intentions through negative affect.

Finally, this research contributes to the field of behavioral design (Zijlstra & Uitbeijerse, 2023) by integrating emotional mechanisms into the strategic use of social norms. Prior work has often emphasized cognitive routes such as information provision or rational persuasion. The present findings highlight that interventions can be more effective when they also engage affective pathways by combining dissonance-inducing cues with mechanisms for positive reinforcement. This opens theoretical opportunities for expanding behavioral design frameworks to include not only rational but also emotional leverage points in shifting entrenched unsustainable practices.

5.2 Practical implication

The findings of this thesis also provide important implications for practice, particularly for policymakers, transport providers, and sustainability-oriented designers.

First, the results suggest that communication strategies should not only emphasize encouragement but also carefully employ negative normative cues to evoke moral urgency. The quantitative study demonstrated that

exposure to unsustainable static norm + unsustainable dynamic norm messages heightened feelings of guilt, anxiety etc. which in turn motivated stronger intentions to choose more sustainable options such as trains. This highlights the potential of designing campaigns that deliberately confront individuals with the persistence of unsustainable practices, thereby activating cognitive dissonance and triggering compensatory pro-environmental behavior (McDonald et al., 2015; Merritt et al., 2010). At the same time, interventions should balance negative affect with opportunities for positive reinforcement (e.g., pride or moral satisfaction) once sustainable choices are made, ensuring that behavior change is not only initiated but also maintained (Deci & Ryan, 2000).

Second, the results emphasize that policy and infrastructure measures need to complement psychological interventions**.** While normative framings influenced behavioral intentions, they did not significantly shift actual transport mode selection, which remained strongly tied to structural constraints such as convenience, cost, and availability. This implies that normative interventions alone are insufficient without systemic support. Policies such as higher aviation taxes, restrictions on short-haul flights, and investment in affordable and accessible rail alternatives are necessary to create enabling conditions for sustainable decisions (Chapman, 2007; Zijlstra & Uitbeijerse, 2023). In this sense, interventions that combine individual-level nudges with systemic reforms are likely to achieve greater long-term impact.

Finally, the findings suggest practical opportunities for behavioral design interventions in digital environments. Travel booking platforms, for example, could integrate social norm framings and emotional feedback into their user interfaces—such as displaying how many peers recently chose trains over planes, or highlighting the collective emissions saved by similar travelers. These design strategies could embed normative and affective cues directly into decision-making contexts, making sustainable travel options more salient and socially desirable at the point of choice (Cialdini et al., 1991; Sparkman & Walton, 2017).

5.3 Limitation and avenues for further research

A further limitation of this study lies in its focus on individual level's behaviour while not accounting for systemic interventions, such as policies and structural changes. Broader systemic measures including higher flight taxes, restrictions on airport capacity, or the development of affordable international rail alternatives play a critical role in shaping travel behaviors at scale (Zijlstra et al., 2023). However, skepticism about the effectiveness of such policies, particularly green taxes and offsetting schemes, remains widespread due to limited transparency and public trust (Barr et al., 2010). By concentrating primarily on social norm framings and emotional responses, this research does not capture how these larger structural interventions might interact with individual attitudes and emotions to influence sustainable travel intentions. Future studies could therefore explore the interplay between systemic policy measures and psychological drivers, ensuring that interventions balance regulatory mechanisms with supportive incentives to avoid resistance or unintended consequences.

In addition, the thesis employed a mixed-methods design, with Study 1 limited to young professionals in European context also a small qualitative sample and Study 2 relying on a quantitative scenario. While the

qualitative study provided rich insights into social dynamics and emotional tensions, the small sample size limits generalizability. This limits the applicability of findings to other socio-cultural contexts where infrastructure is less developed, or where air travel carries different symbolic meanings. Future research could extend the analysis to cross-cultural settings, exploring how social norms around flying are constructed and contested in regions with diverse mobility infrastructures and cultural narratives of modernity and success (McDonald et al., 2015). Similarly, although the quantitative study demonstrated causal effects of normative framings, participants' decisions were hypothetical and did not involve real economic or time costs. Future research should therefore employ field experiments or longitudinal designs to capture real-world travel behaviors and assess whether normative interventions lead to sustained behavior change over time.

6. Conclusion

These insights highlight the potential of strategic design interventions that do not rely solely on either negative or positive emotions but instead seek to combine them in a complementary way. On the one hand, negative emotions such as guilt, frustration, or anxiety can be powerful in creating a sense of moral urgency and responsibility pushing individuals to reflect on the environmental consequences of their choices and consider alternatives to flying. On the other hand, positive emotions such as pride, relief, and moral satisfaction are essential for reinforcing sustainable decisions once they are made, providing a motivational reward that encourages repetition and long-term adoption. Designing interventions that carefully balance these two dimensions: using negative affect to disrupt the normalization of unsustainable behavior, while embedding positive reinforcement to sustain pro-environmental motivation which offers a comprehensive strategy to challenge the social desirability of frequent flying and promote lasting change.

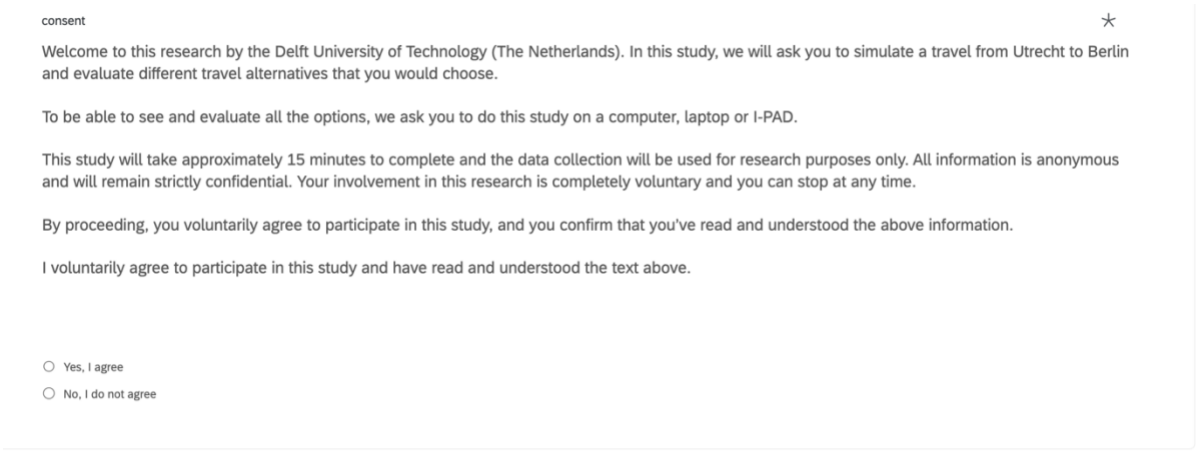
7. Appendix

Appendix A. Descriptive data

Characteristics of the study sample					
	Possible range	M or %	SD	Item no.	alpha
Age		32.60	9.76	1	
Gender (%)					
Male		55			
Female		44.6			
Other		0.5			
Nationality (%)					
Dutch		72.2			
Other		20.8			
Urban Character of place of residence (%)					
City (equal or more than 50.000 inhabitants)		63.9			
Town (5000 - 50.000 inhabitants)		27.2			
Rural area (less than 5000 inhabitants)		8.9			
Total household annual income in euro (%)					
0 - 30 000		11.4			
31 000 - 60 000		33.7			
61 000 - 90 000		19.3			
91 000 - 120 000		14.9			
121 000 - 150 000		4.0			
151 000 - 180 000		3.0			
Above 180 000		1.5			
Prefer not to say		12.4			
Environmental concern	1-7	4.472	1.330	3	.816
Flying frequency					
I never fly		12.4			
1 flight a year or less in Europe		32.7			
2–3 flights a year in Europe		31.2			
4–5 flights a year in Europe		13.9			
6 flights a year or more in Europe		9.9			

Appendix B

Introduction (Qualtrics)


consent

Welcome to this research by the Delft University of Technology (The Netherlands). In this study, we will ask you to simulate a travel from Utrecht to Berlin and evaluate different travel alternatives that you would choose.

To be able to see and evaluate all the options, we ask you to do this study on a computer, laptop or I-PAD.

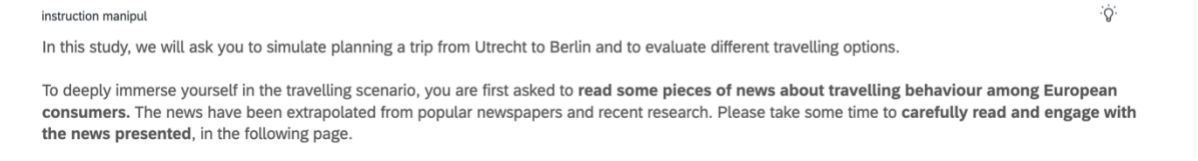
This study will take approximately 15 minutes to complete and the data collection will be used for research purposes only. All information is anonymous and will remain strictly confidential. Your involvement in this research is completely voluntary and you can stop at any time.

By proceeding, you voluntarily agree to participate in this study, and you confirm that you've read and understood the above information.

I voluntarily agree to participate in this study and have read and understood the text above.

- Yes, I agree
- No, I do not agree

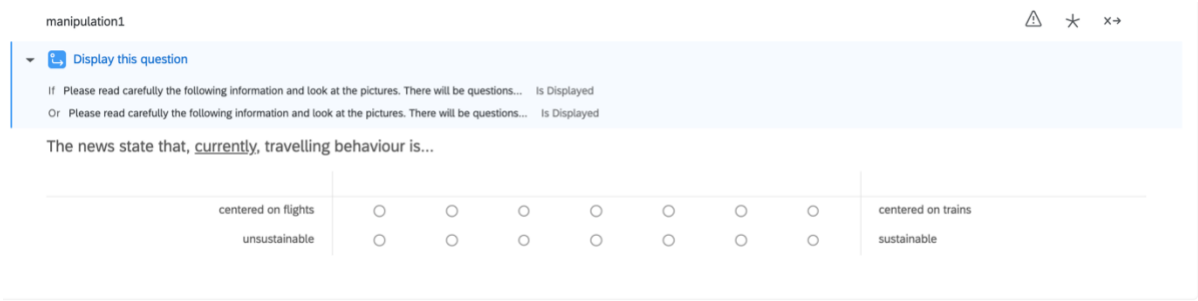
Page Break


instruction manipul

In this study, we will ask you to simulate planning a trip from Utrecht to Berlin and to evaluate different travelling options.

To deeply immerse yourself in the travelling scenario, you are first asked to **read some pieces of news about travelling behaviour among European consumers.** The news have been extrapolated from popular newspapers and recent research. Please take some time to **carefully read and engage with the news presented**, in the following page.

Manipulation check, social moral cleansing and licensing and emotions (Qualtrics)


manipulation1

Display this question

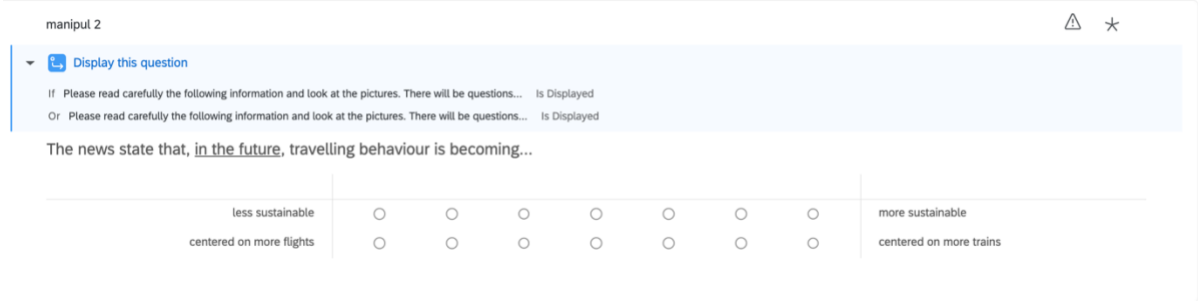
If Please read carefully the following information and look at the pictures. There will be questions... Is Displayed

Or Please read carefully the following information and look at the pictures. There will be questions... Is Displayed

The news state that, currently, travelling behaviour is...

centered on flights	○	○	○	○	○	○	○	centered on trains
unsustainable	○	○	○	○	○	○	○	sustainable

Page Break


manipul 2

Display this question

If Please read carefully the following information and look at the pictures. There will be questions... Is Displayed

Or Please read carefully the following information and look at the pictures. There will be questions... Is Displayed

The news state that, in the future, travelling behaviour is becoming...

less sustainable	○	○	○	○	○	○	○	more sustainable
centered on more flights	○	○	○	○	○	○	○	centered on more trains

social moral clean

In the news, you read about other's people behavior: how most people currently behave and how their behavior is changing. Please state the extent to which you disagree or agree on the following statements.

	Strongly disagree						Strongly agree
After reading about other's behaviour, I feel the need to act quickly to travel more sustainably	○	○	○	○	○	○	○
Knowing what others are doing, makes me realize that immediate action is critical for climate protection	○	○	○	○	○	○	○
I feel more pressure to act urgently, after reading about what other people are doing	○	○	○	○	○	○	○
I feel a greater responsibility to change my own behavior, after reading about other actions	○	○	○	○	○	○	○

social moral licensi

	Strongly disagree						Strongly agree
Reading about other's behaviour makes me feel I can relax a bit my own efforts	○	○	○	○	○	○	○
I feel less urgency to act immediately, because I believe others are already contributing enough	○	○	○	○	○	○	○
Since others are making an effort for the environment, I don't feel as pressured to change my behavior right now	○	○	○	○	○	○	○

To what extent do you feel the following emotions after reading the above news?

	Does not describe my feelings						Clearly describes my feelings
Relaxed	○	○	○	○	○	○	○
Relieved	○	○	○	○	○	○	○
Anxious	○	○	○	○	○	○	○
Frustrated	○	○	○	○	○	○	○
Excited	○	○	○	○	○	○	○
Motivated	○	○	○	○	○	○	○
Indifferent	○	○	○	○	○	○	○
Discouraged	○	○	○	○	○	○	○
Proud	○	○	○	○	○	○	○
Guilty	○	○	○	○	○	○	○

Appendix C

Travel instruction (Qualtrics)

Now, imagine you are traveling alone to Berlin, with your destination being the Brandenburg Gate in the city center.
Your journey begins at Utrecht Central Station.

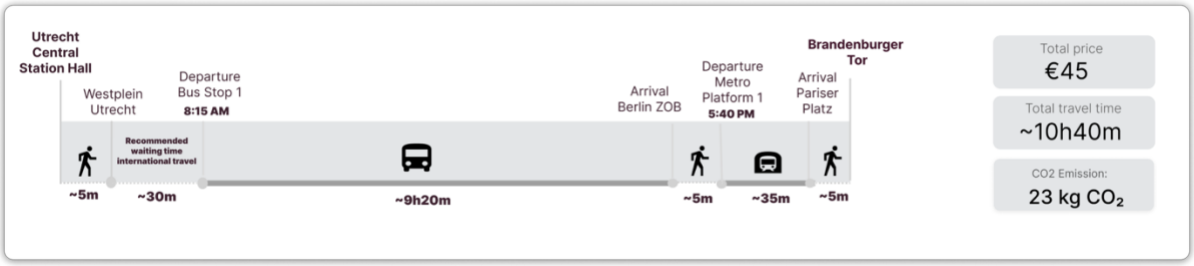
DEPARTURE: Utrecht Central Station
ARRIVAL: Berlin, City Center

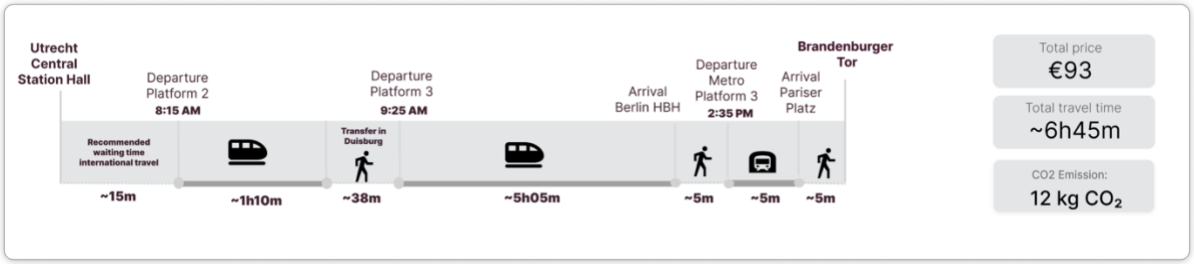
DEATAILS: It is a leisure trip, you travel with a bag only (or one luggage only) and you stay in Berlin for 3 nights, with an accommodation near the "Brandenburg Gate". We will ask you to book the OUTBOUND JOURNEY only (only the way-going).
You have a budget of €200 for transports.

Imagine that you need to book your travel ticket through a website that offers options for airplane, bus and train travel.
Each option shows the total price from the start to the end of the trip, the total travel time (including the waiting time and the transfers) and the environmental impact by carbon emissions in kilograms (Kg Co2).

Click 'Next' to explore the available travel alternatives, by plane, bus and train.

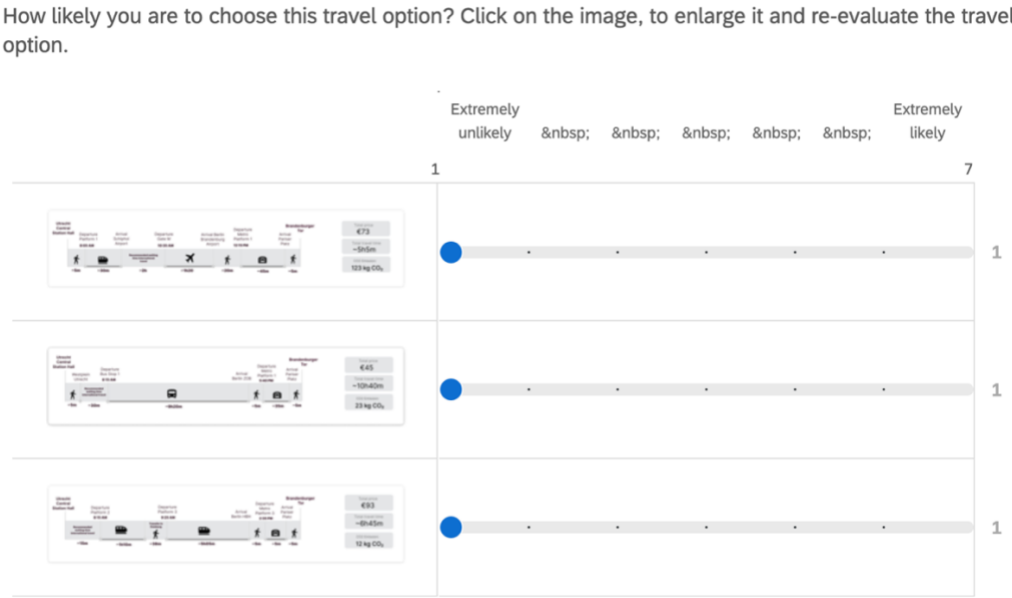
Transportation images (Qualtrics)





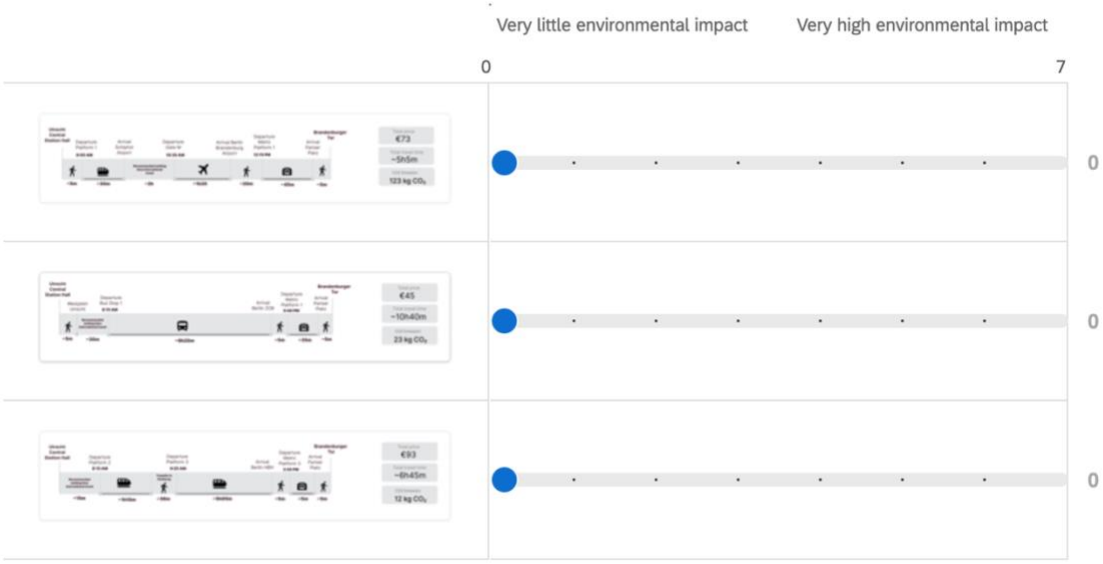
Appendix D

Purchase intention (Qualtrics)



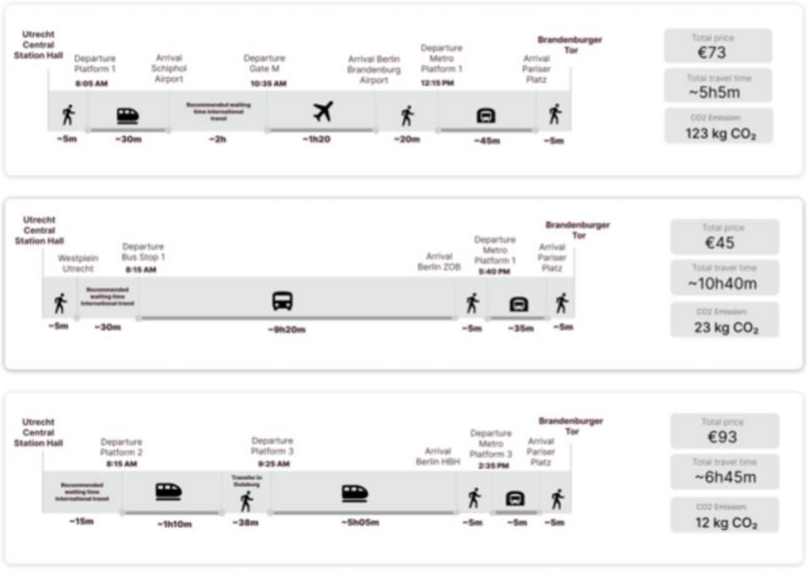
Perceived environmental impact (Qualtrics)

How little or big do you think the environmental impact of the three options is?
Click on the image, to enlarge it and re-evaluate the travel option.

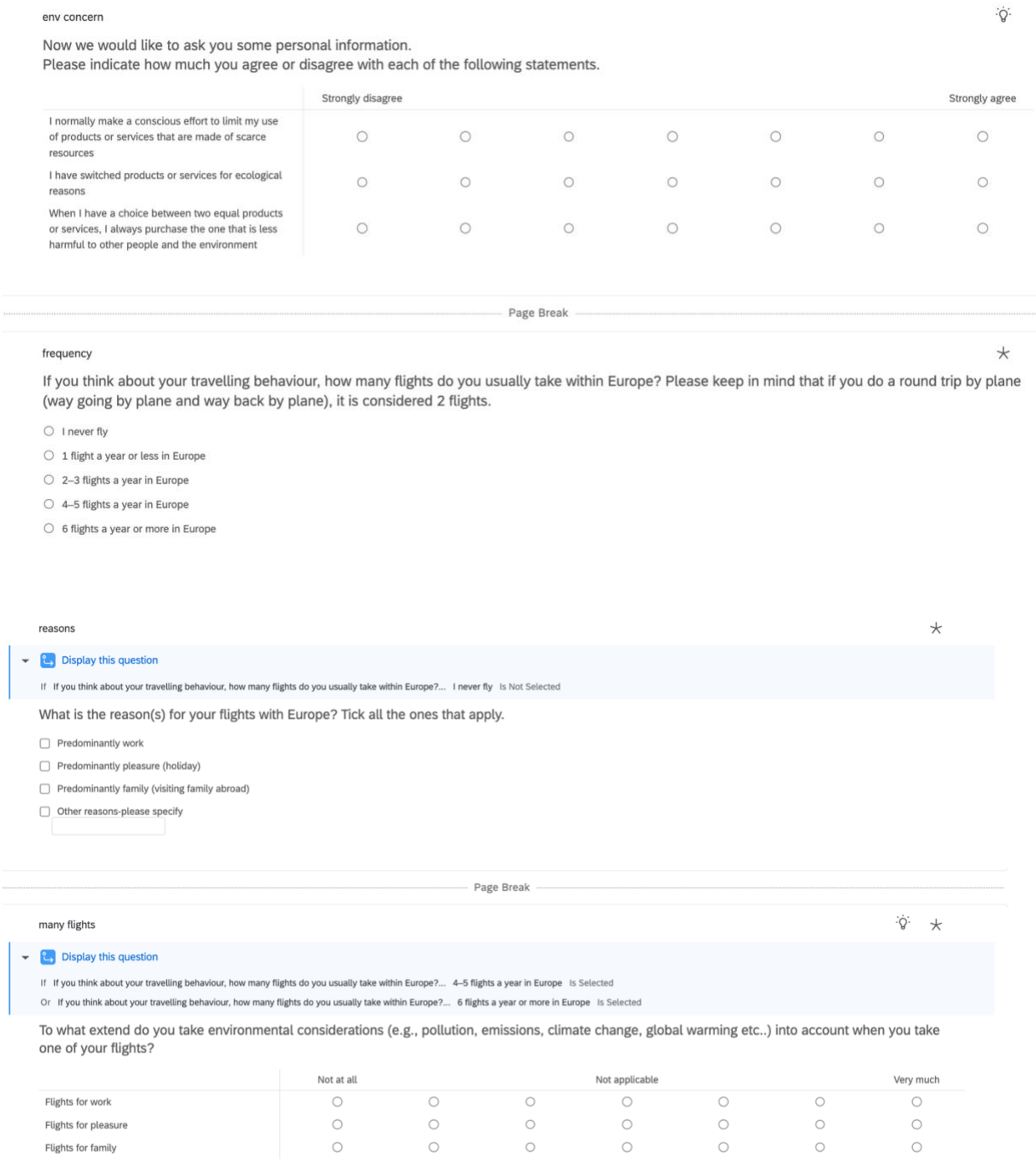


Selection (Qualtrics)

Select the journey you wish to book for your trip from Utrecht to Berlin by clicking on your preferred option.
If you want to re-evaluate the option, click on the image to open it and see it bigger.



Appendix E (Qualtrics)



env concern

Now we would like to ask you some personal information.
Please indicate how much you agree or disagree with each of the following statements.

	Strongly disagree						Strongly agree
I normally make a conscious effort to limit my use of products or services that are made of scarce resources	○	○	○	○	○	○	○
I have switched products or services for ecological reasons	○	○	○	○	○	○	○
When I have a choice between two equal products or services, I always purchase the one that is less harmful to other people and the environment	○	○	○	○	○	○	○

Page Break

frequency

If you think about your travelling behaviour, how many flights do you usually take within Europe? Please keep in mind that if you do a round trip by plane (way going by plane and way back by plane), it is considered 2 flights.

- ○ I never fly
- ○ 1 flight a year or less in Europe
- ○ 2–3 flights a year in Europe
- ○ 4–5 flights a year in Europe
- ○ 6 flights a year or more in Europe

reasons

Display this question

If If you think about your travelling behaviour, how many flights do you usually take within Europe?... I never fly Is Not Selected

What is the reason(s) for your flights with Europe? Tick all the ones that apply.

- ☐ Predominantly work
- ☐ Predominantly pleasure (holiday)
- ☐ Predominantly family (visiting family abroad)
- ☐ Other reasons-please specify

Page Break

many flights

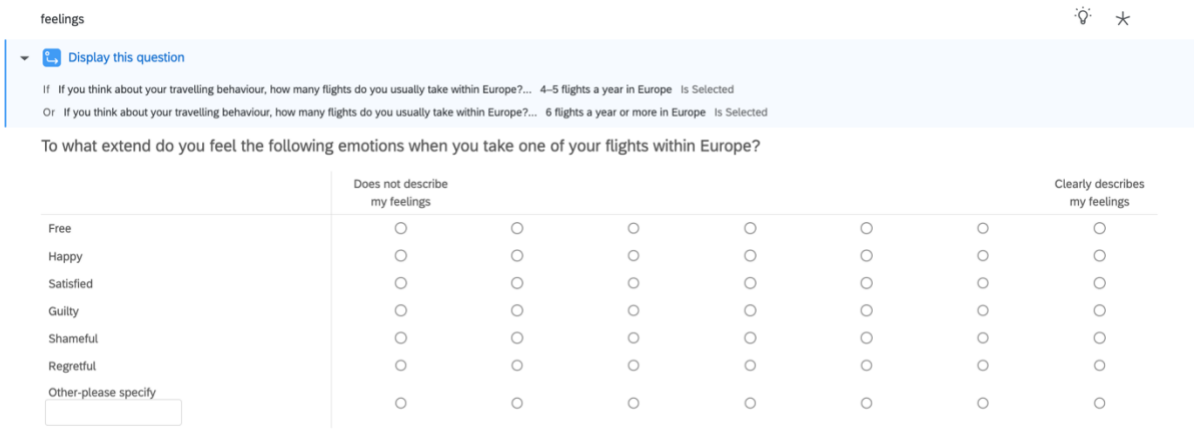
Display this question

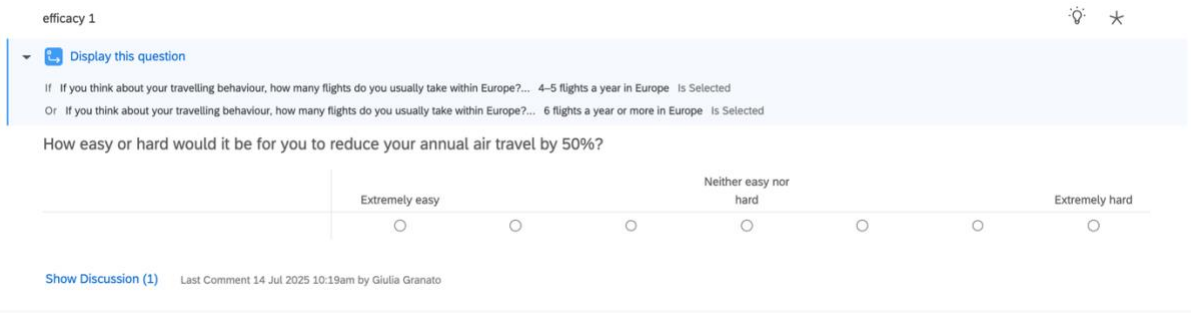
If If you think about your travelling behaviour, how many flights do you usually take within Europe?... 4–5 flights a year in Europe Is Selected

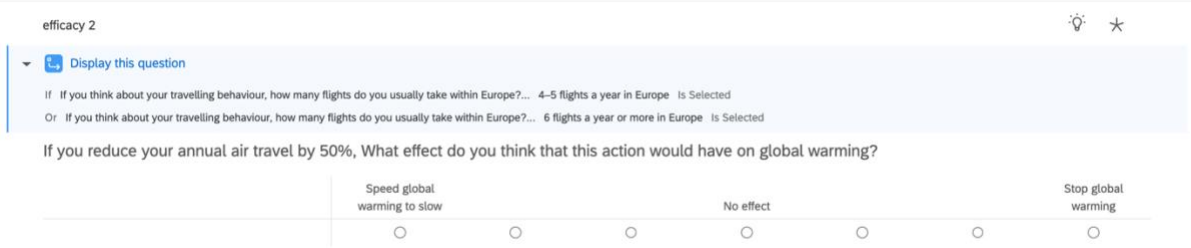
Or If you think about your travelling behaviour, how many flights do you usually take within Europe?... 6 flights a year or more in Europe Is Selected

To what extend do you take environmental considerations (e.g., pollution, emissions, climate change, global warming etc..) into account when you take one of your flights?

	Not at all			Not applicable			Very much
Flights for work	○	○	○	○	○	○	○
Flights for pleasure	○	○	○	○	○	○	○
Flights for family	○	○	○	○	○	○	○







Demographic question

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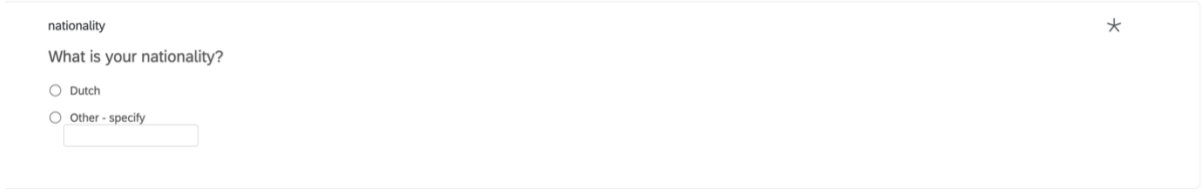

age

How old are you? (number of years)

Page Break

residence

Please indicate the urban character of your place of residence.

- City (equal or more than 50.000 inhabitants)
- Town (5000 - 50.000 inhabitants)
- Rural area (less than 5000 inhabitants)

Page Break

income

What is your total household annual income in euro?

- 0 - 30 000
- 31 000 - 60 000
- 61 000 - 90 000
- 91 000 - 120 000
- 121 000 - 150 000
- 151 000 - 180 000
- Above 180 000
- Prefer not to say

Appendix F - Original project brief

DESIGN FOR our future

TU Delft

Personal Project Brief – IDE Master Graduation Project

Name student _____ **Student number** _____

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT
Complete all fields, keep information clear, specific and concise

Project title Redesign travel norms: social norm interventions to reduce the behavior of frequent flying among environmentally aware consumers

Please state the title of your graduation project (above). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

The aviation sector accounts for 13.9% of transport emissions, ranking it as the second-biggest contributor to greenhouse gas emissions within the transport sector (ICAO, 2024). However, frequent flying remains socially normalized even among environmentally aware consumers due to the attitude-behavior gap and limited awareness of climate impact.
This project aims to investigate the relationship between social norms and frequent flying behavior. By understanding how travel choices are socially constructed, the study will explore design interventions that challenge the normalization of air travel. Specifically, it will focus on strategies that reshape perceptions of sustainable alternatives and encourage behavioral shifts towards low-carbon transport options. Building on existing research on social norms and environmental decision-making, this study will identify key factors influencing frequent flying, assess consumer attitudes, and propose interventions that facilitate sustainable travel choices.

→ *space available for images / figures on next page*

Personal Project Brief – IDE Master Graduation Project

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

This project addresses the issue of frequent flying's environmental impact, driven by entrenched social norms of flying and a lack of awareness. Despite expressing environmental concerns, many individuals continue to choose flying as the default mode of travel, influenced by its convenience, cost, and social norms. The attitude-behavior gap highlights a cognitive dissonance where travelers justify their actions despite knowing the environmental consequences.
Additionally, limited awareness of aviation's contribution to climate change and ineffective communication formed the problem, leaving a gap in shifting behavior toward sustainable travel choices.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Redesigning Travel Norms: social norm interventions to reduce the behavior of frequent flying among environmentally aware consumers

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

To achieve this, I will first research the factors that influence social norms, focusing on key drivers and barriers related to frequent flying. Then, I will gather behavioral insights through qualitative methods such as interview to gather in-depth behavioral insights. Based on these findings, I will identify potential design opportunities to create social norm intervention.
Using the insights from this research, I will develop strategic design interventions aimed at addressing these pain points and reshaping social norms around sustainable travel. User testing, incorporating quantitative methods, will be conducted to evaluate the effectiveness of the proposed designs.

Project planning and key moments

*To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting, mid-term evaluation meeting, green light meeting** and **graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	Feb 13rd, 2025
Mid-term evaluation	April 10,2025
Green light meeting	June 5rd, 2025
Graduation ceremony	September 23rd, 202

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	
For how many project weeks	
Number of project days per week	

Comments:

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

My motivation for this project stems from a strong interest in sustainable consumer behavior and the role of design in shaping social norms. Air travel's environmental impact is well-documented, yet frequent flying remains socially accepted even among environmentally conscious individuals. I aim to explore how social norm interventions can be leveraged to challenge the normalization of air travel and encourage more sustainable choices. This project aligns with my broader academic and professional interests in behavioral design, sustainability, and strategic interventions.

Through this research, I seek to deepen my understanding of social norm theory and behavioral insights, particularly in the context of environmental decision-making. I aim to develop competencies in qualitative research methodologies such as interviews and ethnographic studies, while also strengthening my ability to translate research findings into actionable design strategies. Additionally, I am eager to experiment with intervention design, testing how behavioral nudges and social influence mechanisms can drive meaningful change.

Beyond the project's core objectives, I have personal learning ambitions: (1) refining my ability to synthesize complex behavioral research into design solutions, (2) exploring persuasive design techniques, (3) enhancing my data interpretation skills, and (4) gaining practical experience in user testing and evaluation. This project offers an opportunity to apply my MSc learnings in a real-world context while contributing to sustainability-driven design innovation.

8. Reference

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