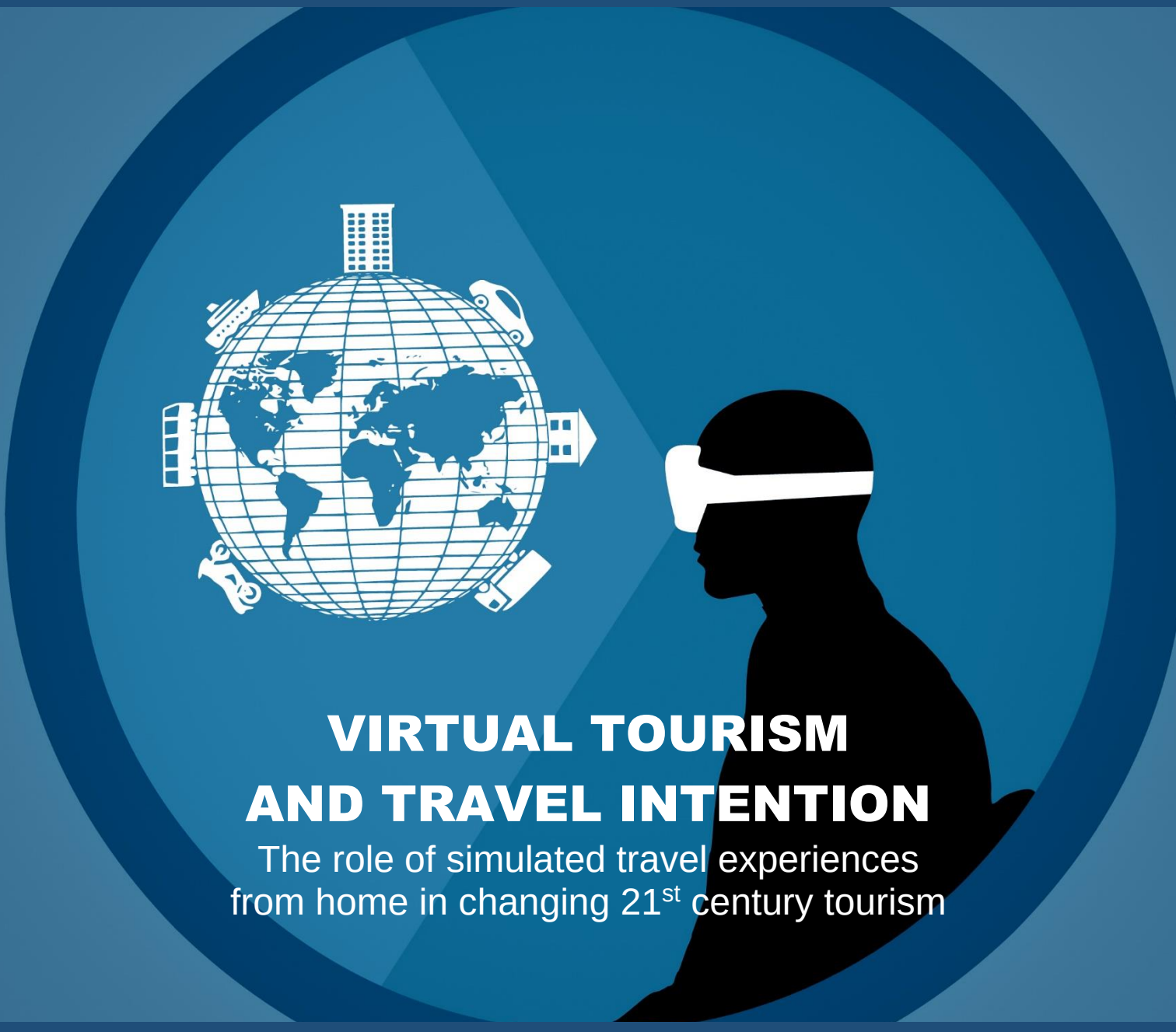
Jochem Lips
Wageningen University and Research
June 18, 2021



VIRTUAL TOURISM AND TRAVEL INTENTION

The role of simulated travel experiences from home in changing 21st century tourism

Supervisor: Edward Huijbens
Examiner: Maarten Jacobs

VIRTUAL TOURISM AND TRAVEL INTENTION
The role of simulated travel experiences from home in changing 21st century tourism

Jochem Lips
900214523130

MSc Tourism, Society, and Environment
Department of Environmental Sciences
Cultural Geography Chair Group
Wageningen University and Research

Supervisor: Edward Huijbens
Examiner: Maarten Jacobs

Submission date: June 18, 2021
Thesis code: GEO-80436

For Alba, as you resolutely stood by my side for eight long years.

Acknowledgements

While my name is on the cover as this thesis' sole author, I could not have written this without the support of the people around me. I am truly grateful and owe this thesis to them.

First and foremost, I cannot gloss over the fact that the first complete draft of this thesis was delivered on the 20th of May 2021, exactly fifteen years after my mother lost her battle to cancer. Her death made an immense impact on my life and prompted me to undertake a three-year journey to the other side of the world. This cultivated my passion for travel and led me to finding the love of my life in New Zealand.

This brings me to mentioning my dear partner Alba. By now, she is probably as informed on the subject of this thesis as I am thanks to her endless patience as I talked about my ideas and struggles during our never-ending conversations. Alba, you inspired me to no end, and thanks to you I was able to complete this thesis and subsequently, my MSc programme. The waiting is over, this is the final step.

Second, I want to thank my supervisor, Edward Huijbens. You kept me on my feet with your prompt and constructive emails. You always motivated me with your positive feedback and drove me to do my best with your suggestions. During all my years of studying, I can honestly say that you were the best supervisor I ever had. Thank you for inspiring and motivating me.

I would also like to thank my study advisor, Lieke van der Zouwen. Without you, I might have abandoned this programme when I hit a low point at the beginning of 2020. Thanks to your unwavering support and astonishing attentiveness I am here today.

Furthermore, I would like to give a special thanks to Jorg Neumann. Jorg, your work on Microsoft Flight Simulator enabled me to carry out this research and your vision of technology's potential inspires me. I also need to give credit to Bart Knuiman and Patrick Machado, who both showed great patience with my doubtlessly elementary questions about virtual experiences and technology.

Finally, this research would have been impossible without the 164 survey respondents and the 30 active forum users who volunteered to participate in the research. While I never saw your faces or do not even know most of your real names, I am indebted to every single one of you.

A wise man once told me that the greatest gift we can give to anyone is our time, and every single one of you gave it to me without a second thought. Thank you, from the bottom of my heart.

Abstract

The concept of virtual tourism, which can be defined as a digital approximation of a tourism experience, has gained renewed attention due to the travel restrictions put in place to prevent the spread of Covid-19. Several studies describe the relation between people's travel intention and their virtual tourism experiences. However, much is still unknown about how this relationship works. This thesis therefore combines Ajzen's Theory of Planned Behaviour and Guttentag's Substitution Acceptance Model to provide insight into the current and future potential of virtual tourism to inspire or substitute real tourism.

In pursuance of empirical evidence to support any assertions on this subject, the latest iteration of *Microsoft Flight Simulator* was used as a surrogate for a virtual tourism experience to investigate the potential of VT from home to complement or substitute real tourism. Its users filled out a survey regarding their experiences with the simulator, attitudes, (social) environment, individual characteristics, and travel intention. In addition, many joined online discussions which yielded qualitative information to complement the survey's quantitative data. Lastly, three industry experts were interviewed to gain a wider perspective on the issue.

The results show that an individual's experience with the specific destination, attitude towards VT, subjective norms, and barriers to real travel are all important in relation to travel intention based on the VT experience. Similarly, the quality of the experience is related to personal context and, in turn, related to the extent to which VT can replace or inspire real tourism. However, the findings also indicate that these two possibilities are not mutually exclusive, and that VT can serve both functions, i.e. replacing and inspiring travel. Lastly, consideration of VT as a travel replacement does not have a significant relation with travel intention, which implies that VT from home can currently serve as travel inspiration and a way to virtually travel while not reducing the desire for real tourism.

Table of Contents

List of Figures

List of Tables

Glossary

HMD ..... Head-Mounted Display, commonly known as a VR headset
MSFS ..... Microsoft Flight Simulator
PBC ..... Perceived Behavioural Control
SA ..... Substitute Acceptance
SAM ..... Substitution Acceptance Model
TI ..... Travel Inspiration
Tourism ..... Spending extended time away from home for pleasure or relaxation
TPB ..... Theory of Planned Behaviour
TR ..... Travel Replacement
Travel ..... Used as synonym for tourism in this thesis
UNWTO ..... World Tourism Organisation
VR ..... Virtual Reality
VT ..... Virtual Tourism

1 Introduction

You hear the grass crush under your feet, still frosty from the cold night. The morning sun rises above the mountains, warming your face. You stop to look around. The Swiss Alps stretch out before you in all their glory. The only sounds you hear are those of cow bells down in the valley below and a gentle breeze whispering in your ears. You sit down on a nearby rock for a moment, taking in the endless view of snowy peaks, rocky cliffs, and one of Europe's largest glaciers.

You look down at your watch. 7:18AM, almost time for your meeting. You take off your headset. The view is replaced by that of your home office: time to start the working day.

1.1 | Contents of this thesis

Virtual tourism (VT) is a term that might sound futuristic or even paradoxical: the word *tourism* implies to *move, tour* or to be away from home. A digital approximation of a touristic experience might never replace the social and (inter)cultural benefits of tourism, but industry experts suggest that it is not entirely implausible that they might be an interesting complement or (partial) alternative for specific touristic attractions, activities, or people. The question is consequently not if, but to what degree and how it could substitute real tourism experiences. What are the mechanisms behind these virtual adventures that make them a viable alternative to real travel? Is VT, as it is available in its current form, able to persuade people to travel less, or will they travel more? What indeed is the relationship between VT and actual travel and tourism?

These are questions that have gained more attention since last year's Covid-19 outbreak and the ensuing worldwide travel restrictions. Whereas most research on VT has been on its application as a (potential) marketing tool, its potential to give a feeling of actual travel and the consequent effect on real travel intentions, has been researched much less, especially in an empirical study. With advancing technologies and newly available software, it is now possible to research how VT and travel intention are correlated when individuals are frequently exposed to a VT-experience. This research provides insight into the preceding questions by learning from individuals who use Microsoft Flight Simulator (MSFS) – a mix between videogame and simulator that presents a highly detailed digital render of landscapes and cities around the globe.

A mixed framework based on Ajzen's Theory of Planned Behaviour and Guttentag's Substitution Acceptance Model was created to uncover the different factors that could contribute or detract from travel intention based on MSFS. The robustness of this model was tested by distributing a survey to MSFS users through online discussion forums. At the same time, MSFS users were asked to submit

their thoughts and opinions on the same forums to gather more qualitative data and consequently explore the topic from a more open-ended perspective. Lastly, three one-on-one interviews were held with IT experts to gain more insight into the present and future potential of MSFS and VT to influence human behaviour.

The rest of the introduction further elaborates on the motive behind the research, poses the research questions, and elaborates on the general research design. Chapter 2 offers the conceptual framework that provides a theoretical basis for the research. Chapter 3, 4, and 5 explore the different research results. Finally, chapter 6 and 7 contain the discussion and conclusion.

1.2 | Motive for research

1.2.1 Tourism in crisis

The challenge of the modern world is perhaps not to continue the growth of economies, but to maintain what has been gained and include those that have so far been left behind. The very essence of the often-deliberated term 'sustainability' implies maintaining something. However, what is often meant with the term is sustainable *development*, which is contrasted from sustainability in that it also entails an alteration or transformation of the current status quo (Murgante et al., 2011). This means that sustainability, or rather sustainable development, does not only incorporate the maintaining or preservation of something, but also a 'change'.

The UNWTO (World Tourism Organisation) defined sustainable tourism specifically as the industry taking responsibility of its "current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities." (UNWTO, 2005) This belief clearly implies that the industry has a responsibility towards the world to offer tourism products that are more environment-friendly, socially responsible, and yet profitable for the provider based on Elkington's Triple Bottom Line (1997). However, it can be unequivocally stated that by and large this ambition has not been met: despite an increased interest in sustainable tourism, there has been very little progress towards achieving it (Sharpley, 2020).

Tourism provides several important social, environmental, and economic benefits, including increased cultural and social exchanges, a motive for environmental protection, and job creation (Dwyer & Forsyth, 1993). However, in the context of social and environmental sustainability, the harmful effects of tourism have also become more obvious over the last decades. Many mass tourism destinations have struggled with 'overtourism' (Koens et al., 2018); an excessively negative impact on local citizens' life

or the quality of visitors' experience (as per the definition of the UNWTO, 2018). Furthermore, tourism has been estimated to comprise about 5% of total worldwide CO_2 emissions and concurrently contributes significantly to global climate change (Scott et al., 2008). Future technological developments in transportation are unlikely to mitigate this effect, thus solutions be of another nature must be found (Peeters, 2017).

In 2020 the environmental effects of reducing transport, and above all aviation, became painstakingly clear due to the Covid-19 pandemic halting a large share of global tourism flows. Based on Google Mobility data, more than 80% of 114 countries' population reduced their travel by more than 50% during the virus outbreak (Le Quéré et al., 2020), resulting in an NO_x and CO_2 emissions reduction of about 30% around mid-April 2020 (Forster et al., 2020). Currently, many people are still deprived of the ability to travel freely due to (renewed) lockdowns or travel restrictions. Consequently, the tourism industry is in a crisis without real precedent (Güliz Uğur & Akbıyık, 2020). In its current form it is not environmentally nor socially sustainable, while the Covid-19 crisis adds economic strain to this as well.

1.2.2 Resilience of other industries

At the same time, other industries are seeing a boom in revenue due to the nature of their business. The popularity of online shopping for example, and particularly online grocery delivery, has grown worldwide as a result of the strict measures that governments have taken to combat Covid-19 (see e.g. CBS, 2020; Melton, 2020; Nesin, 2020). Other activities that can be done safely from home have also seen an increase in users: the popular online video streaming platform Netflix saw twice as many new subscribers as it had expected to gain earlier in 2020 (Rushe & Lee, 2020), although this growth had slowed down by October 2020 (Solsman, 2020). A similar trend can be observed with video game sales: sales in 2020 grew between 20 to 44 percent compared to the previous year, across different markets and different video game platforms worldwide (Epstein, 2020).

While both video streaming platforms and the video game industry have other issues mainly to do with product development due to Covid-19 (Finck, 2020; Whitten, 2020), the tourism industry can only be envious of these other businesses' resilience at times like these. Future pandemics are becoming more likely due to human interventions in what remains of natural habitats for animals, such as deforestation and a reduction of biodiversity (Ardrey, 2020; Gill, 2020). The world can thus assume that the Covid pandemic will likely be followed by others. These concerns also relate back to the aforementioned challenge of environmental and social sustainability.

1.2.3 Tourism from home

The way in which tourism is practiced ultimately needs to change. The tourism industry would benefit from a source of revenue that does not depend on long-distance mobility due to potential future pandemics and growing concerns about tourism's negative social and environmental impacts. Consequently, research into a tourism alternative that can be done at or close to home might be both environmentally, socially, and economically valuable.

Travel is an integral part of what constitutes tourism (Beaver, 2012) which might make the idea of tourism at home seem paradoxical. However, VT is not new. Almost three decades ago the same question was asked in a paper by Musil & Pigel (1994). Their standpoint was very hypothetical as computer technology at that time was not as advanced yet as it is in the present. Computer speeds have increased exponentially over the years (Routley, 2017), which makes Musil & Pigel's imagined *virtual reality trip* technically almost possible. The general concept has not changed, although VT is not universally defined and is often also referred to as *Virtual Reality Tourism* or *Virtual Travel* (Beck et al., 2019; Minucciani & Garnero, 2013).

The continuous technological developments that enable VT experiences have led to research that not only tried to see the current impact of this phenomenon, but often projecting their findings into the future to see where it might lead. Dewailly (1999) foresaw a potential to substitute real travel with VT to mitigate some of the negative social and environmental effects of tourism, but also warned about a concurrent disparity between those who can afford real travel and those who are left behind to travel virtually. Conversely, many contemporary research focuses on the use of VT for travel marketing, (see e.g. Griffin et al., 2017; Kim et al., 2018) thus having the opposite effect of inciting real travel.

The technological advances that make VT possible have also found their way into commercially available software. Google Earth, for example, lets users view the entire planet and has tours available, provides interactive stories, and supports Head-Mounted Displays (HMDs, also known as Virtual Reality Headsets) (Cheng, 2017). This application has been studied as both a tourism planning tool and a VT system on its own (Jensen, 2010; Li & Hao, 2010). Similarly, certain video games can also border the line between game and VT: examples include virtually walking around Paris in *Assassin's Creed Unity* or driving around in San Francisco in *Watch Dogs 2* (Dubois & Gibbs, 2018).

1.2.4 Using Microsoft Flight Simulator as a research instrument

Recently, Microsoft published its latest entry in its Flight Simulator (MSFS) series, which could be considered both a video game and a simulation (Fischer, 2020). Praised for being the most realistic commercially available flight simulator to date (Iwaniuk, 2020), it has also been likened by many to taking a virtual holiday during Corona times (Holmes, 2020; Maessen, 2020; Rahming, 2020). Other media publications seem to agree on this point. The Dutch newspaper *AD* included MSFS as the only video game in an article about VT (Damen, 2020) while d'Anastasio (2020), author for the popular technology magazine WIRED, even uses the name 'tourism game' when referring to the simulator. According to the simulator's developer, French *Asobo Studio*, its reason for getting involved with MSFS was its "fascination with virtual travel" (Stuart, 2020).

Based on this knowledge and the notion of VT being a digital, approximated tourism experience, MSFS fits the definition. This understanding is highly relevant for this research and the effects of VT on global tourism, as MSFS currently represents the most technologically sophisticated (Jensen, 2020) and commercially available VT experience. In this way, it serves as an opportunity to empirically study the relation between VT and real tourism and, most prominently, people's travel intentions.

Whereas previous empirical studies on this subject considered the VT experience as a destination 'preview' rather than an independent product (e.g. Li & Chen, 2019) or considered VT as either a marketing tool *or* substitute (e.g. Yung, Khoo-Lattimore, Prayag, & Surovaya, 2020), this research focuses how intention to travel and frequent VT experiences corelate using MSFS as a research instrument.

1.3 | Research questions and goal

The aim of this research was to assess the potential of VT at home to complement or substitute real tourism by investigating how using MSFS correlates with its users' travel intention. The resulting central research question reads:

"How does the use of Microsoft Flight Simulator correlate with the travel intention of its users?"

To find an answer to the central research question, the following sub-questions were posed:

1. What are the characteristics of MSFS' users?
2. What are the potential factors that might influence travel intention in relation to VT/MSFS?
3. To what extent do these factors correspond with a higher intention to travel?
4. Under what conditions do these factors correspond with a higher intention to travel?
5. To what extent do these factors correspond with a lower intention to travel?
6. Under what conditions do these factors correspond with a lower intention to travel?

1.4 | General research design

This research followed a mixed methods design, also known as a concurrent triangulation design (Boeije, 2009). As the purpose of this research was to both generalise findings while understanding the mechanism behind VT's future potential and relation to travel, this approach fits the aim of the research best. The research was conducted solely online, which came with two distinct advantages: it allowed for a geographically dispersed, varied research sample, and it ensured the feasibility of the research despite the current and ongoing social restrictions employed by governments against the spread of Covid-19. For a schematic overview of the general research design, see Figure 1 on the next page.

An important issue that needs to be emphasised is that this research attempted to provide insight in the *correlation* between MSFS and travel intention without a controlled experimental setting. According to Petty (2013), proving causality (in epidemiological studies) requires meeting eight different criteria which are confirmed by Kenny in Antonakis, Bendahan, Jacquart, & Lalive (2010):

1. Strong relationship between the supposed cause and effect
2. Strong research design
3. Temporal relationship (the cause precedes the effect)
4. Dose-response relationship (i.e., a higher exposure leads to a stronger effect)
5. Reversible association (i.e., removing the cause reduces the effect)
6. Consistency (other studies produce similar effects)
7. Biological plausibility (social and psychological plausibility in social science)
8. Coherence with known facts

While some conditions could be met without an experiment, it is not possible to establish a causal relationship within the limits of this research. More about this can be found in Chapter 6, section 6.5.3.

Four distinct research methods were used to answer the sub-questions and central research question, one of which is the literature review as presented in Chapter 2 and expanded further in Chapter 6. The other three methods; an online survey, online forum discussions review, and in-person interviews took a quantitative (survey) and qualitative (forum and interviews) approach. The strategy for employing these three instruments, including how exactly they contributed to answering the research questions, are expounded in the Chapter 3 to 5, which describe the research results. Additionally, the final section in Chapter 6 elaborates on the limitations of this research.

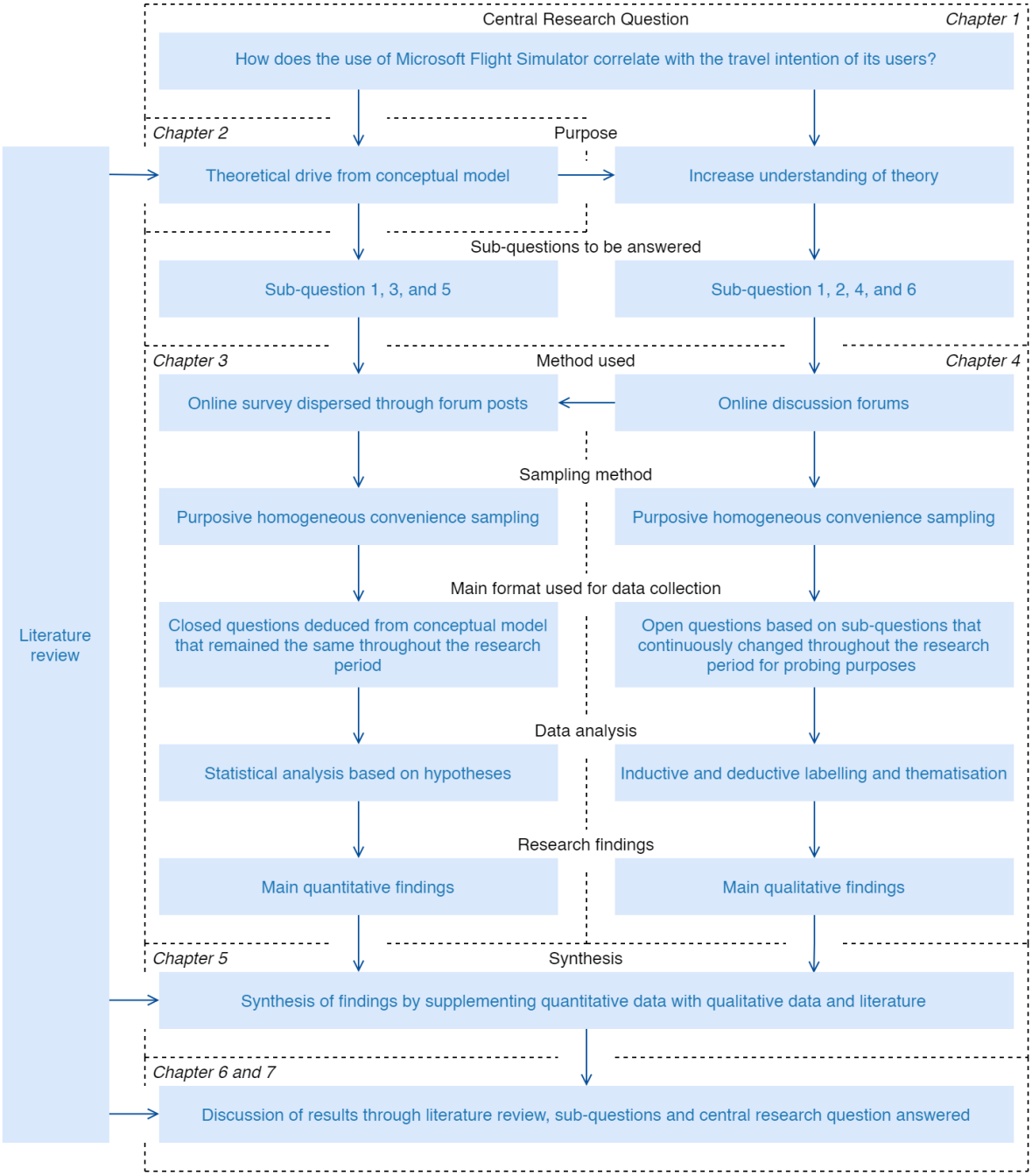


Figure 1: General Research Design, based on the QUAN + qual Mixed Methods Design by Morse (2016).

2 Conceptual framework

2.1 | Substitution Acceptance Model

Studies into VT and travel intention have thus far employed different conceptual models to understand the variables that affect intention, often depending on the VT application examined. The most scrutinised of these applications are also in opposition to each other: whereas VT would increase travel intention in a marketing context, it would decrease travel intention in a substitution context. Although many studies have demonstrated the effect of VT in promoting travel behaviour (see e.g. Griffin et al., 2017; Kim et al., 2018), Li & Chen (2019) were one of the first to consider both ends of this spectrum in an empirical study and found that the expected enjoyment of a destination determines whether travel intentions are increased or decreased.

Guttentag (2020) also noted the irony in these two opposite perspectives of VT applications and hypothesised three underlying factors that determine whether a virtual reality-experience can be accepted as a substitute for real tourism. His model (see Figure 2 below) thus provides a conceptual perspective for understanding the specific role of virtual tourism experiences in shaping travel intention. In essence, this model explains the different characteristics of an experience and individual that lead to a VT experience being accepted as a substitute. However, this acceptance might be mediated by other factors that are covered by the Theory of Planned Behaviour.

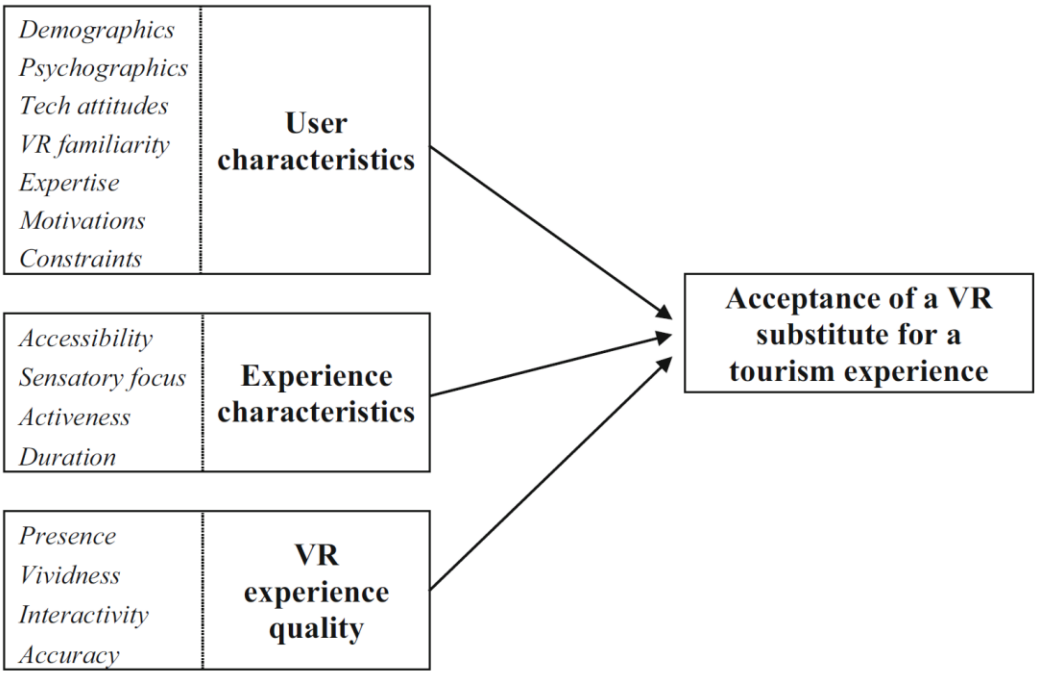


Figure 2: Guttentag's (2020) Substitution Acceptance Model of VR Tourism (SAM)

2.2 | The Theory of Planned Behaviour

A well-known and commonly accepted theory on the factors that determine human behaviour is the *Theory of Planned Behaviour* (TPB, see Figure 3 below) by Icek Ajzen (Ajzen, 1991). In this theory, intention and consequent behaviour depend on three interdependent factors: attitude towards the behaviour, subjective norm surrounding the behaviour, and perceived behavioural control (PBC) over the behaviour. The first two stem from Fishbein & Ajzen's original *Theory of Reasoned Action* (TRA) from 1975, upon which the TPB is based (Madden et al., 1992) and remained unchanged in the newer model; perceived behavioural control was added later.

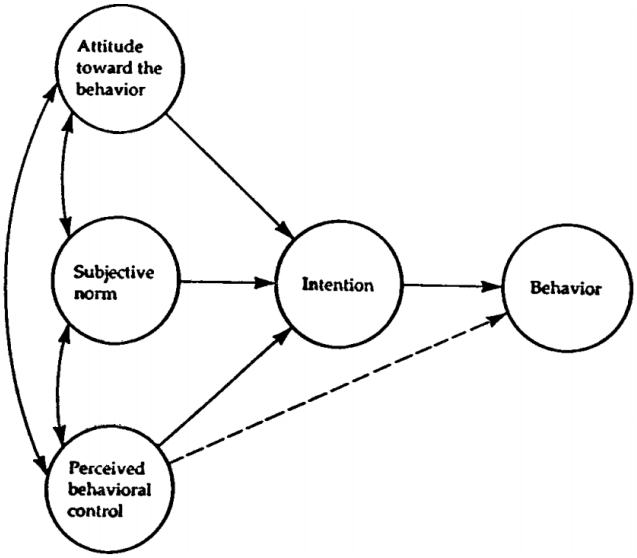


Figure 3: The Theory of Planned Behaviour by Ajzen (1991)

Despite justified criticism, the model has withstood the test of time quite well. Thirty years after its inception, and almost half a century after the foundations were laid with the TRA, it continues to attract attention (Conner, 2020) and has been applied in various empirical studies (see e.g. Hamilton et al., 2020; Lin & Roberts, 2020). While its popularity is perhaps somewhat explained due to its simplicity and applicability in policymaking (Hargreaves, 2011), its empirical validity has also been repeatedly confirmed. While results evidently vary across studies, the TPB has managed to explain a large part of the variance in intention and, to a lesser extent due to the intention-behaviour gap, behaviour (Greaves et al., 2013; Kaiser et al., 2005; McEachan et al., 2011; Sutton, 1998).

2.3 | Conceptual model: VT and travel intention

To gain a better understanding of how virtual tourism might affect people's intention to travel, it is important to know what might affect intention. The model below (Figure 4) integrates the Theory of Planned Behaviour (TPB) and Substitution Acceptance Model (SAM) in explaining the relations between the various factors that might correspond with a person reducing or increasing their travel intention, categorised under factors relating to the specific VT experience, the specific individual, and the individual's environment.

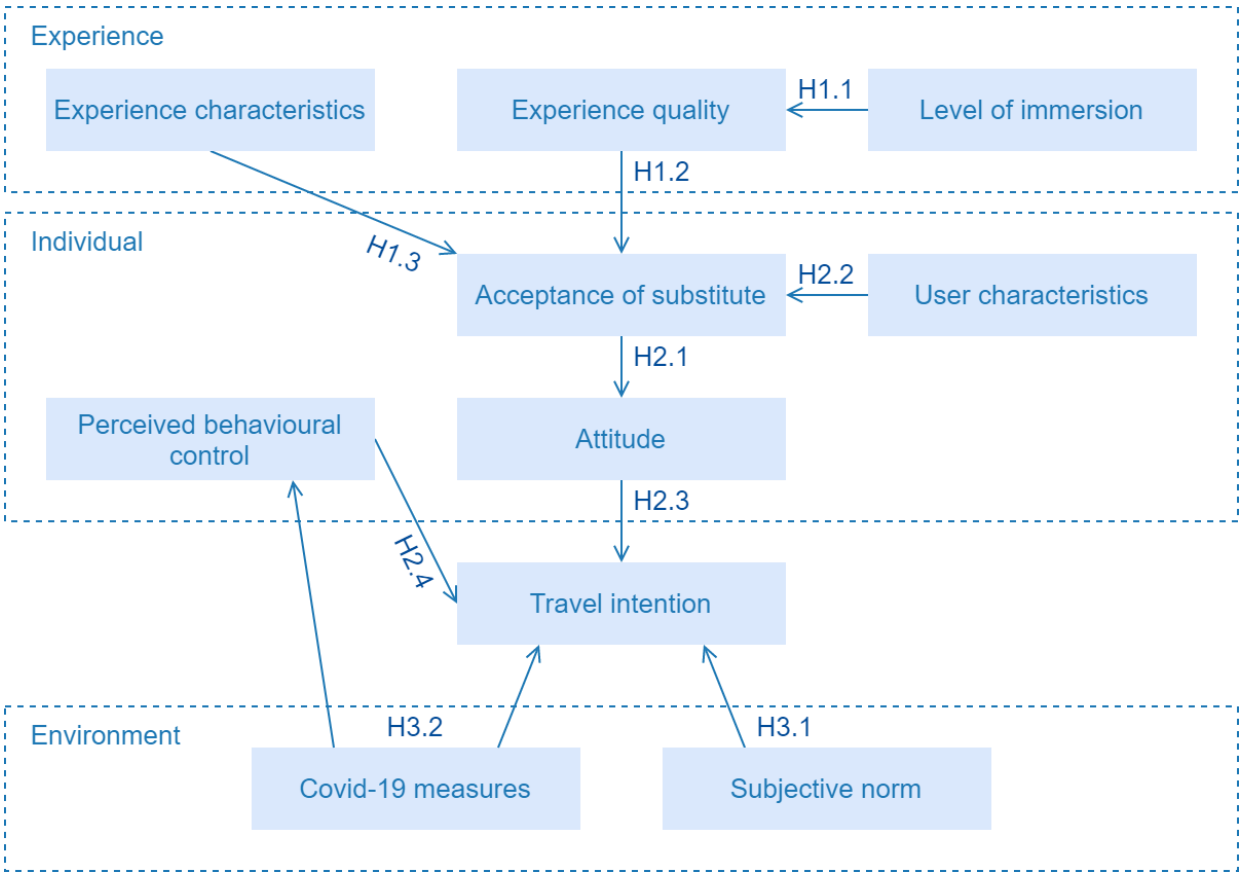


Figure 4: Conceptual model used for research.

The following pages elaborate on the individual components of this model, explaining the theory behind each factor and the hypotheses posed based on the literature.

2.4 | Experience

In its broadest sense, VT can be defined as a technologically enhanced or technologically created tourism experience (Stainton, 2020). In the context of this research, it is further delimited to signify a non-in-situ digital tourism experience: a virtual (approximation of) a tourism experience without the tourist being physically present at the simulated location. The experience itself is a vital component for understanding under what conditions VT might reduce or increase the intention to travel and groups three distinct factors: immersion, experience characteristics, and experience quality.

2.4.1 Immersion

Immersion, the degree to which a user is isolated from the real world, is not a part of Guttentag's (2020) SAM as he applies a stricter definition of VR than this study. However, he does affirm that it greatly affects the experience and consequently, the willingness to substitute real tourism for a VT experience. The higher the level of immersion, the more present a user can feel in a virtual world (Guttentag, 2010). Because this is such a key component to VT, Beck et al. (2019) use it to categorise three systems for showing VR content: *fully immersive*, which necessitates the use of an HMD to completely isolate the user; *semi-immersive*, which involves large screens or projections on a wall and floor, and *non-immersive*, which is accomplished through a simple desktop setup and thus the most common way in which most people can experience virtual environments.

While Beck et al.'s definition focuses only on how the virtual environment is presented to an individual, there is also evidence that the way in which an experience is manipulated contributes to a feeling of immersion (Riva et al., 1998; Schmierbach et al., 2012). Although this relates to the aforementioned factor of experience quality, it constitutes an addition to Beck et al.'s categories based on physical hardware. As such, this study replaces their definition of a semi-immersive experience with one that includes experience-specific input devices such as a yoke or joystick.

Hypothesis 1.1: The higher the level of immersion, the higher the overall experience quality.

2.4.2 Experience Quality

The experience quality describes how the experience is presented to the user and consequently how 'present' the user feels in the experience, aided by how accurately the world is recreated digitally. This element of 'presence' is very closely linked to immersion. Also known as 'telepresence', it communicates the feeling of 'being there' (Cipresso et al., 2018). This occurs when the user forgets about the technology used and experiences a sensation of physical presence in the virtual environment

(Haans & IJsselsteijn, 2012) through vivid and interactive content. The former, which is also referred to as 'sensory depth' relates to the quality of the image presented, whereas the latter encompasses the way (i.e., input methods), the speed (i.e., reactivity), and the range (i.e., interactions available) in which users manipulate the content (Steuer, 1992).

Presence is associated in VT studies with mental imagery, the experience as it is represented in the mind through more inputs than just sensory, such as perception and affect (Richardson, 2013). It is also correlated with attitude changes (Tussyadiah et al., 2017) and consequently, intention change. Furthermore, the more accurately a VT experience resembles a real tourism experience, the more likely it is to be accepted as a substitute (Guttentag, 2020).

Hypothesis 1.2: The higher the overall experience quality, the higher the likelihood of accepting MSFS as a substitute.

2.4.3 Experience characteristics

The third factor represents the content of the VT experience, as certain experiences lend themselves better to substitution than others. This includes the accessibility, sensory focus, activeness, duration, and frequency of the experience.

How accessible an experience is can depend, for example, on the physical, temporal, or financial distance between the content and the user. A visit to the moon would currently be impossible to achieve in real life and might thus be more readily accepted as a substitute than a visit to a museum that is near a user's home. Likewise, fragile destinations such as historic sites may not allow (many) visitors due to their sensitive nature, thus making a virtual visit more appealing or plausible (Guttentag, 2010).

Certain experiences also lend themselves to better substitution than others due to their sensory focus. Currently, sight and sounds are most easily simulated in VT, thus experiences focusing on those two senses could be more readily accepted as substitutes. In contrast, VT experiences that are based on touch, smell, and/or taste, such as culinary tourism experiences, would be much harder to achieve due to the limitations of most VT systems. Although these senses can also be simulated to a certain degree (Ranasinghe et al., 2011), these technologies might not be available for the general public for the foreseeable future.

Technology also currently limits the type of VT experience that one might have with regards to the level of activeness. As many VT experiences, such as virtually flying in MSFS, will be experienced while sitting down, the content presented will have to match the situation of the user. A mismatch

between an individual's senses (e.g., sitting down while virtually running) has been shown to increase a person's discomfort (Chang et al., 2020). Although solutions ranging from room-tracking to 360-degree treadmills do exist, these all come with limitations regarding freedom of movement and/or cost (Anthes et al., 2016).

Lastly, the duration and frequency of the experience are also of importance. Guttentag (2020) argues that it is doubtful that anyone would spend a significant amount of uninterrupted time in a VT environment. Although there are exceptions to this notion (Tangerman, 2019), most people would indeed be more inclined to replace a short museum visit with a virtual equivalent than they would substitute a multi-day hike. Similarly, there is evidence that the more often a person uses a virtual substitute, the higher the intention to repeat this in the future (Han et al., 2014).

Hypothesis 1.3: Due to the characteristics of MSFS[1], a higher frequency of engaging with it will correspond to a higher likelihood of accepting MSFS as a substitute.

2.5 | Individual

Whether or not a person might be inclined to travel based on (the availability of) a VT experience will not only depend on the specifics of that experience, but also on other individual factors such as their general characteristics, their attitude towards travel, and perceived control over the behaviour in question, i.e., travel.

2.5.1 Acceptance of substitute

Whether a VT experience is seen as a substitute is captured by this factor. Sussman & Vanhegan (2000) were the first to do field research on the potential of VT. They asked a small sample of British researchers and the general public whether they thought VT could ever replace tourism. The answer, according to both groups, was that it could not. The potential of VT was considered more as a way for disabled tourists to enjoy experiences that they could not physically participate in and as a method to prepare for an actual visit of a place. Sussman & Venhegan did note that VT might be an option for replacing short holidays, although this suggestion was not investigated further.

[1] I.e., sitting down (non-physically active), flying an airplane in possibly distant places (inaccessible), mostly visually and auditory stimuli (sensory focus).

Besides its potential to be a (partial) substitute to real tourism, VT could also be a complement. Its use in marketing is the most commonly researched application for VT (Guttentag, 2020). It is actively used as an interactive preview of holiday destinations by the travel industry, such as virtual reality videos on destination marketing organisations' websites (Yung & Khoo-Lattimore, 2019), hotels allowing potential guests to walk through their hotel rooms in VR (Barnes, 2016), or to promote destinations inside virtual worlds (Huang et al., 2016).

Ultimately, this factor connects directly to the TPB-concept of *attitude*: whether someone regards a VT experience as a sufficient substitute a real tourism experience can be considered a cognitive attitude towards real travel.

Hypothesis 2.1: Accepting MSFS as a substitute to real travel will negatively correlate with the attitude towards real travel.

2.5.2 User characteristics

In Guttentag's (2020) original SAM, user characteristics include demographic and psychographic factors, but also aspects such as 'expertise' (familiarity with the specific virtual experience) and constraints are considered, with the latter relating to the perceived behavioural control of the TPB. In essence, this factor contains all the elements that relate to the individual in the original SAM. However, as the TPB already contains the behaviour-specific factors such as perceived behavioural control, user characteristics will be applied in this study to signify an individual's demographics, familiarity with the VT content, and motivation for engaging in VT.

Familiarity with the VT content entails the expertise or interest that a person might have towards the VT content in question and relates to the identity of the individual. Guttentag (2020) mentions the example of an Egyptologist being less likely to accept a VT experience of the famous Pyramids of Giza than a person with average knowledge or interest in the subject. This effect, however, might be mediated by the motivation for engaging in VT and, likewise, the perceived behavioural control of the TPB: if said Egyptologist perceives difficulty or lacks confidence in making a real visit, he or she might be more inclined to use a VT experience as a substitute.

Hypothesis 2.2: Familiarity with the content presented in MSFS (either destination-specific or piloting experience) will correspond to a lower acceptance of MSFS as a substitute.

2.5.3 Attitude

The attitude towards a behaviour describes how a person perceives the specific behaviour; whether he or she has a relatively positive or negative attitude towards the behaviour in question would lead to a higher or lower intention to perform that behaviour, respectively. An important distinction can be made between the affective and cognitive (or instrumental) elements of attitudes (Crites Jr et al., 1994; Van den Berg et al., 2006). An affective attitude towards a behaviour describes mostly emotional judgements, such as boring-exciting or happy-sad. In contrast, cognitive elements of attitude encompass the more rational, knowledge-based beliefs about behaviour, i.e., whether the behaviour is perceived as 'desirable' or 'valuable'.

In the aforementioned study by Li & Chen (2019), the term *perceived enjoyment*, which is most closely related to attitude, was found to be the most significant predictor of travel intention. More specifically, the expected enjoyment of a specific destination as experienced virtually was found to increase intentions to travel to that destination. They note that VT could be utilised as a destination marketing tool only if the participant already possesses a positive attitude towards a destination but might conversely decrease the intention to travel to that specific destination if the person enjoys the VT experience as a standalone product.

Hypothesis 2.3: A positive attitude towards VT will correlate with a decrease in general travel intention.

2.5.4 Perceived Behavioural Control

From a psychological perspective, *perceived* behavioural control (PBC) encompasses non-motivational factors such as available time and money, and consequently influences both intention and behaviour directly. It is also important to note that PBC is distinguished from locus of control in that the latter is a measure of perceived control over one's life (Spector et al., 2001), whereas the former relates to very specific behaviour. PBC comprises of two components: self-efficacy (or perceived difficulty), which involves the difficulty and confidence a person perceives in carrying out specific behaviour, and perceived control, which is closer to locus of control in that it measures to what extent a person believes that the behaviour in question is up to them to control (Ajzen, 2002).

Using this knowledge, PBC can be measured by assessing one's perceived control over specific behaviour, and one's confidence and perceived difficulty in performing this behaviour (covering self-efficacy). It might be that someone find it easier to travel to a place nearby, than to find and try a VT experience that simulates the same destination. One thing to consider as well is that perceived difficulty

has been found to overlap with the aforementioned factor of attitude. A person will generally have a more positive attitude towards behaviour that he or she perceives as easy to perform (Leach et al., 2001).

Hypothesis 2.4: A high PBC towards real travel will moderate the effect of H2.3, i.e., the higher the PBC, the higher the general intention to travel.

2.6 | Environment

The last category, environment, combines two factors which find their inspiration both directly from the TPB in the shape of the subjective norm, and indirectly from the SAM by considering the circumstances of an individual in determining travel intention.

2.6.1 Subjective Norm

The subjective norm represents the perceived social pressure around the person to perform or not to perform the behaviour. This factor seems to be best represented when measuring group identification and making comparisons with group prototypes (Hamilton et al., 2020). Critics of the TPB have highlighted the fact that it is too focused on the individual and that, at times, (social) context overrides all other factors (Conner & Armitage, 1998; Stern, 2000). In contrast, the subjective norm has also been called the weakest predictor of behaviour in the TPB and TRA by others (Godin & Kok, 1996; Sheppard et al., 1988). However, Conner (2020) suggests that this contradiction is most likely caused by the way in which norms are measured in different studies: multi-item measure scales were found to be more reliable than single items intended to measure the influence of norms on surveys.

A distinction can be made between what others do, and what others approve of. Cialdini, Kallgren, & Reno (1991) labelled these two as *descriptive* norms and *injunctive* norms. A descriptive norm might describe whether others are, for example, participating in VT, whether an injunctive norm would attach a judgement on whether this is considered ‘good’. At the same time, these norms can take two different forms: an individual’s perception or belief in how others expect the person to behave, and the individual’s motivation to abide by these expectations (Ajzen, 1991). These four distinctions are obviously correlated: it might be that the more others are perceived to do something, the more acceptable the behaviour might become, such as can be seen with the advent of video conferencing as a replacement for face-to-face meetings during the Covid-19 pandemic (Williams-Jones, 2020).

Hypothesis 3.1: The stronger the perceived subjective norm for real travel (i.e., ‘travel is desirable’), the higher the intention to travel.

2.6.2 Covid-19 measures

Guttentag (2020) uses a concept which he describes as 'constraints' to refer to any barriers that might prevent a person from participating in a real tourism experience, thus differing from PBC in that these are actual rather than *perceived* constraints. However, Guttentag does not mention that the opposite might also be true: opportunities might present themselves to prospective (virtual) travellers that might affect their travel intention. For example, a discount offer for flight tickets might reduce the perceived barrier for visiting a real destination. On the other hand, a new VT experience that can be enjoyed from home might suddenly reduce the need to travel.

This concept is illustrated well by the Covid-19 crisis. While these circumstances have mostly presented constraints, they have also brought opportunities for the tourism industry and individual tourists. The tourism sector might be able to change to a more sustainable way of operating (Romagosa, 2020), while tourists who travel now and perhaps in the future, if hygiene and social distancing become new social norms, encounter fewer other tourists which makes overtourism less of an issue (Koh, 2020). However, despite these potentially positive aspects, data clearly shows that when governments take social measures against the spread of Covid-19, people will travel less (Le Quéré et al., 2020). Conversely, the intention to participate in VT might increase based on these measures; making this an important factor to take into consideration.

Hypothesis 3.2: Covid-19 measures moderate the PBC and intention to travel.

2.7 | Travel intention

All factors together affect the *intention* to perform certain behaviour. Intentions "… capture the motivational factors that influence a behaviour; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour" (Ajzen, 1991, p. 191). Consequently, intention is dependent on a person's motivation and indicates a certain likelihood of a person's behaviour. The 'stronger' the intention, the more likely the actual intended behaviour becomes. In this research proposal, *travel intention* is then understood as a general, outspoken desire to partake in tourism activities away from home, irrespective of the destination.

Intention does not directly translate to behaviour. The gap between these two has been confirmed to exist and is often discussed, yet is not generally understood (Hassan et al., 2016). This is not the only weakness of the model: time is also a significant factor. Ajzen & Fishbein (2005) note that the longer the gap in time between the intention and the actual behaviour, the more the behaviour is likely to differ from the original intention, i.e., the intention changes over time. Still, due to constraints in time and resources that would allow for the measurement of actual travel behaviour based on VT experiences, travel intention is most likely the best predictor of behaviour while taking these limitations into account.

2.8 | Summary of hypotheses

This chapter listed several hypotheses that are summarised below.

Experience

- H1.1: The higher the level of immersion, the higher the overall experience quality.
- H1.2: The higher the overall experience quality, the higher the likelihood of accepting MSFS as a substitute.
- H1.3: Due to the characteristics of MSFS, a higher frequency of engaging with it will correspond to a higher likelihood of accepting MSFS as a substitute.

Individual

- H2.1: Accepting MSFS as a substitute to real travel will negatively correlate with the attitude towards real travel.
- H2.2: Familiarity with the content presented in MSFS (either destination-specific or piloting experience) will correspond to a lower acceptance of MSFS as a substitute.
- H2.3: A positive attitude towards VT will correlate with a decrease in general travel intention.
- H2.4: A high PBC towards real travel will moderate the effect of H2.3, i.e., the higher the PBC, the higher the general intention to travel.

Environment

- H3.1: The stronger the perceived subjective norm for real travel (i.e., ‘travel is desirable’), the higher the intention to travel.
- H3.2: Covid-19 measures moderate the PBC and intention to travel.

The next chapter shows the quantitative results informing the hypothesis tests.

3 Quantitative Results

This chapter elaborates on the quantitative results of the research. First, the method used to obtain the results are introduced, followed by the descriptive results and hypothesis tests.

3.1 | Method used to obtain the quantitative results

The quantitative results of this study were generated through an online survey that was distributed through online forums. The full survey can be found in Appendix 1 and was used to answer sub-question 1, 3, and 5:

1. What are the characteristics of MSFS' users?
3. To what extent do these factors correspond with a higher intention to travel?
5. To what extent do these factors correspond with a lower intention to travel?

It was important to test each hypothesis with several distinct (scale) items to increase the reliability of the survey (see Appendix 1). For example, H1.1 was tested by several questions such as "When I use MSFS, I completely forget about my surroundings", rated on a Likert scale from 'completely disagree' to 'completely agree', and a question that asks for the hardware utilised while using MSFS. The hypothesis was then verified by connecting these answers to questions relating to 'experience quality' such as 'When I think back about my experiences in MSFS, I imagine myself as if I were really flying an airplane'. Table 15 in Appendix 2 shows an example of this method of operationalisation from Bogicevic, Seo, Kandampully, Liu, & Rudd (2019) that was used to operationalise the concepts.

The survey used QuestionPro software and was tested by five volunteers before being considered complete and distributed through the forum posts. In total, 238 respondents filled out the survey between February 22 and March 27, 2021. A total of 164 surveys were fully and correctly completed and were thus used for further statistical analysis in SPSS.

3.2 | About the survey sample

The sample's representativeness could be assessed by comparing with data from a recent, larger survey from Navigraph, a flight simulation data supplier (Navigraph, 2020). While the Navigraph survey covers more flight simulators than just MSFS, the raw data has been made publicly accessible which made it possible to filter only for MSFS users. This filter left 9,442 respondents to compare to the research sample of 164 respondents. Table 1 (next page) shows the research sample's nationalities compared to Navigraph's sample - note that the percentages have been rounded. The high number of

respondents from the Netherlands is noticeable and is the most significant difference from the Navigraph survey which only had 3% of its respondents from the Netherlands. This difference can be explained by the fact that Dutch forums were also used to recruit research participants.

Table 1: Top 10 respondents' nationalities from the research sample and Navigraph's survey

Research sample				*Navigraph comparison data*			
Country	**Freq.**	**%**	**Cum.%**	*Country*	*Freq*	*%*	*Cum.%*
United States	33	20%	20%	*United States*	*2549*	*27%*	*27%*
Netherlands	30	18%	38%	*United Kingdom*	*1339*	*14%*	*41%*
United Kingdom	26	16%	54%	*Germany*	*1118*	*12%*	*53%*
Germany	13	8%	62%	*Canada*	*474*	*5%*	*58%*
Finland	9	5%	67%	*Australia*	*441*	*5%*	*63%*
Switzerland	8	5%	73%	*France*	*397*	*4%*	*67%*
Canada	5	3%	76%	*Netherlands*	*327*	*3%*	*70%*
Italy	4	2%	78%	*Switzerland*	*192*	*2%*	*72%*
Norway	4	2%	80%	*Spain*	*191*	*2%*	*74%*
Australia	3	2%	82%	*Italy*	*190*	*2%*	*76%*

The two other demographics that were captured are gender and age. Interestingly, 98.8% of the sample is male, with only one female and one person who preferred not to disclose their gender. While this is a large deviation from an expected 50-50 gender division of the population at large, it is very representative of the research population (MSFS users) as both the Navigraph survey (96.9% male) and Jorg Neumann, head of the Microsoft Flight Simulator team, confirm the same heavy bias towards male users (Jorg Neumann, personal communication, March 2, 2021).

The average age of respondents is 47 years old, with a vast majority of respondents (N=158) being over 18. Figure 5 below shows all ages, sorted into 10-year age brackets, together with a Navigraph comparison (N=9,426). There are some significant differences to be seen when comparing the two. While the Navigraph mean (44 years old) does not differ greatly, the graph shows clearly that the measure of dispersion is higher than within the research sample. Another irregularity with the research sample's age distribution is its high number of 30–39-year-olds and 50–59-year-olds, with a lower number of 40–49-year-olds in the middle.

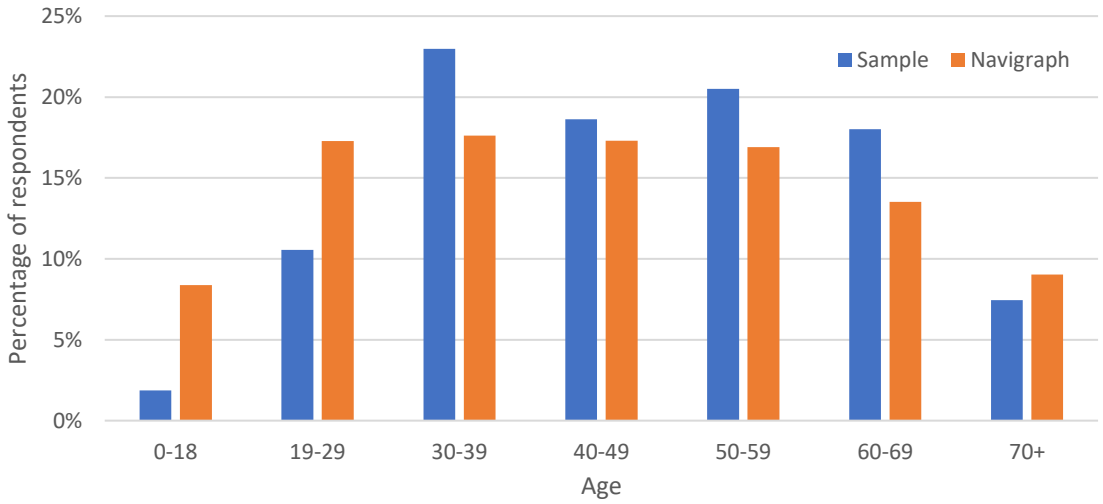


Figure 5: Graph showing the age brackets of respondents next to a comparison with the Navigraph research sample

A last item that helps to determine the sample's representativeness is the sample's affiliation with real-world aviation. While the survey question's main goal is to assess the research concept of 'expertise', the Navigraph survey also asked respondents whether they are real (student) pilots. Combining and comparing data shows that 27.53% of Navigraph respondents are real (student) pilots, whereas this is true for 17.7% of the research sample. One plausible explanation for this difference could be that Navigraph and its affiliated networks are used more by professional pilots than the forums that were used to recruit this study's survey participants, or that more non-pilots were prepared to fill out the survey.

Overall, the population the survey is meant to sample seems demographically similar in terms of gender and average age based on the available information, albeit with some deviations regarding nationality, age distribution, and users' familiarity with real-world aviation. This must be taken into account when drawing conclusions based on the survey results.

3.3 | Survey answers

The survey posed a total of 10 agree/disagree questions arranged on a 7-point Likert scale containing several questions per concept, and five further questions that could not be measured on a Likert scale. All these were used to test hypotheses 1.1 to 3.2. This section shows all survey questions including which were used to test which hypotheses, and each question's mean, mode, and standard deviation.

Table 3 on page 22 shows all the survey questions and the corresponding hypotheses, the mode, mean, and median. To help with interpreting the results, Table 2 on the same page shows the coding of the agree/disagree questions. For example, question 1.1.1 has a mode value of 5. This means that the most chosen answer on this particular question is 'Tend to agree'. All questions had a valid N of 164 except

for question 4.1 (“I prefer really traveling instead of traveling in MSFS”) and 12 (MSFS setup used), which each had one missing response.

Table 2: Answer coding for agree/disagree questions.

Answer	Code
Completely disagree	1
Disagree	2
Tend to disagree	3
Neither agree nor disagree	4
Tend to agree	5
Agree	6
Completely agree	7

Note that some items were shortened in this chapter to fit into the tables: the full items as presented to respondents can be found in Appendix 1. Also note that item 1 measures two different concepts (experience quality and attitude towards MSFS), thus it is the only item that has a three-level number (question.concept-number.item-number). Questions 1 to 10 were measured on a Likert scale, whereas question 11 to 15 were multiple-choice (see Table 4 to Table 8 further in this chapter, page 24 and 25).

Table 3: Corresponding hypothesis, mean, median, mode, and standard deviation per survey item.

Question.item number - item name	Hypothesis	Mean	Median	Mode	Std. Deviation
1.1.1 When I use MSFS, I forget about my present surroundings	1.1 1.2	4.99	5.00	5[a]	1.375
1.1.2 My experiences in MSFS are like flying somewhere		5.46	6.00	6	1.255
1.1.3 My experiences in MSFS are like traveling somewhere		4.82	5.00	6	1.479
1.1.4 The way in which the world is presented in MSFS looks real		5.57	6.00	6	.928
1.1.5 The way in which the world is presented in MSFS feels real		4.88	5.00	5	1.284
1.2.1 I think that MSFS is exciting	2.3	5.87	6.00	6	1.016
1.2.2 Whenever I use MSFS, I feel satisfied		5.31	5.00	6	1.226
1.2.3 I consider MSFS a fun activity		6.14	6.00	7	.984
1.2.4 I consider MSFS a relaxing activity		6.05	6.00	7	1.115
1.2.5 I learn something about the world from MSFS		6.08	6.00	7	1.062
1.2.6 I think that MSFS is a valuable activity		6.02	6.00	7	1.088
2.1 I think that my family and/or friends find MSFS interesting	3.1	3.82	4.00	4	1.570
2.2 My friends and/or family members also use MSFS		2.33	2.00	1	1.590
2.3 My family and/or friends enjoy hearing about MSFS experiences		3.64	4.00	4	1.570
2.4 I care what my family and/or friends think of MSFS		3.15	3.00	2	1.770
2.5 I care what my family and/or friends think of MSFS experiences		3.14	3.00	2	1.690
3.1 MSFS is easy for me to use	2.4	5.69	6.00	6	1.138
3.2 It is mostly up to me when I want to use MSFS		5.98	6.00	7	1.331

3.3 It is mostly up to me how I want to use MSFS		6.34	7.00	7	1.011
3.4 I could use MSFS more often if I wanted to		5.52	6.00	6	1.596
3.5 To increase the duration of my MSFS sessions is easy for me		4.86	5.00	6	1.719
4.1 I prefer really traveling instead of traveling in MSFS	1.2 2.1 2.2	5.60	6.00	7	1.538
4.2 MSFS makes me interested in visiting certain places		5.68	6.00	6[a]	1.360
4.3 I feel inspired by MSFS to visit places that I have seen in the sim		5.52	6.00	7	1.500
4.4 MSFS gives me a travel feeling		4.93	5.00	5	1.547
4.5 MSFS provides me with a 'real enough' travel experience		3.70	4.00	5	1.591
4.6 MSFS allows me to see parts of the world that I'd otherwise not		6.30	7.00	7	1.132
5.1 Covid-19 makes me want to use MSFS more	3.2	5.12	5.00	7	1.670
5.2 Covid-19 makes it easier for me to use MSFS		4.76	5.00	4[a]	1.695
5.3 If Covid-19 changes, I will also change how often I use MSFS		3.71	4.00	4	1.616
5.4 If Covid-19 changes, I will change the duration of MSFS sessions		3.55	3.50	2	1.652
6.1 I think that travel is exciting	2.1	6.18	7.00	7	1.064
6.2 Whenever I travel, I feel satisfied		5.81	6.00	7	1.071
6.3 I consider travel a fun activity		5.99	6.00	7	1.135
6.4 I consider travel a relaxing activity		5.27	5.00	7	1.516
6.5 I learn something about the world from travel		6.35	7.00	7	.863
6.6 I think that traveling is a valuable activity		6.21	7.00	7	1.067
7.1 It is easy for me to travel	2.4	4.69	5.00	6	1.604
7.2 It is mostly up to me when I want to travel		4.54	5.00	6	1.801
7.3 It is mostly up to me how I want to travel		5.01	5.50	6	1.596
7.4 I could travel more often if I wanted to		4.37	5.00	6	1.811
7.5 To increase the duration my trips would be easy for me		3.69	3.00	3	1.682
8.1 My family and/or friends find travel interesting	3.1	5.88	6.00	6	.916
8.2 My family and/or friends travel often		4.87	5.00	6	1.411
8.3 My family and/or friends like hearing about my travel experiences		5.07	5.00	6	1.201
8.4 I care what family and/or friends think of my travel		4.15	4.00	4	1.626
9.1 Covid-19 makes me not want to travel	3.2	5.24	6.00	7	1.922
9.2 Covid-19 makes it harder to travel		6.60	7.00	7	.724
9.3 If Covid-19 changes, I will change my travel plans		5.54	6.00	7	1.556
10.1 I want to travel more than I usually do this year	2.3 2.4 3.1	4.24	4.00	4[a]	1.883
10.2 I intend to travel more than I usually do this year		3.30	3.00	2	1.742
10.3 I am planning to travel more than I usually do this year		3.14	3.00	2	1.708
11 In approximately the last 30 days, I used MFS about … times [b]	1.3	5.21	6.00	6	1.201
12 I use the following setup for MSFS [b]	1.1	3.08	3.00	3	.458
13 I use the following approximate graphical settings for MSFS [b]	1.1 1.2	3.39	3.00	3	.651
14 The resolution I use for MSFS comes closest to [b]		3.08	3.00	3	1.080
15 Experience flying real airplanes [b]	2.2	3.20	2.50	2	1.511

a. Multiple modes exist. The smallest value is shown

b. Not measured on a 7-point Likert scale, see tables below

The last five multiple-choice questions related to the hypotheses measured items on a different scale, asking for users' MSFS settings, resolution, setup, frequency of use, and familiarity with aviation. The results are shown in more detail in Table 4 to Table 8.

Table 4: Question 11 - Frequency of use (times used MSFS in approximately last 30 days).

	Frequency	Percent	Valid Percent	Cumulative Percent
Not at all	1	.6	.6	.6
Once or twice	6	3.7	3.7	4.3
3-5 times	10	6.1	6.1	10.4
6-10 times	28	17.1	17.1	27.4
11-15 times	15	9.1	9.1	36.6
More than 15 times	104	63.4	63.4	100.0
Total	164	100.0	100.0	

Table 5: Question 12 - MSFS setup used.

	Frequency	Percent	Valid Percent	Cumulative Percent
Screen and mouse/keyboard	2	1.2	1.2	1.2
Screen and gamepad	5	3.0	3.1	4.3
Screen and peripherals	134	81.7	82.2	86.5
Virtual Reality Headset	22	13.4	13.5	100.0
Total	163	99.4	100.0	
Missing	1	.6		
Total	164	100.0		

Table 6: Question 13 - Approximate graphics settings used for MSFS.

	Frequency	Percent	Valid Percent	Cumulative Percent
Low	1	.6	.6	.6
Medium	9	5.5	5.5	6.1
High	82	50.0	50.0	56.1
Ultra	69	42.1	42.1	98.2
Other	3	1.8	1.8	100.0
Total	164	100.0	100.0	

Table 7: Question 14 - Approximate resolution used for MSFS.

	Frequency	Percent	Valid Percent	Cumulative Percent
Lower than 1080p	3	1.8	1.8	1.8
1080p	48	29.3	29.3	31.1
(W)QHD	68	41.5	41.5	72.6
4K	33	20.1	20.1	92.7
Not sure	2	1.2	1.2	93.9
Other	10	6.1	6.1	100.0
Total	164	100.0	100.0	

Table 8: Question 15 - Experience with flying real airplanes.

	Frequency	Percent	Valid Percent	Cumulative Percent
Never flown in a real airplane	8	4.9	4.9	4.9
As a passenger in large airplanes	74	45.1	45.1	50.0
As a passenger in GA planes	11	6.7	6.7	56.7
Piloting of a real airplane under supervision	42	25.6	25.6	82.3
Student pilot/taking lessons	6	3.7	3.7	86.0
Licensed pilot	23	14.0	14.0	100.0
Total	164	100.0	100.0	

While question 12 to 15 do not show anything very notable on their own and are thus mostly useful for hypothesis testing, question 11 demonstrates an unfortunate oversight in its measurement scale. Almost two thirds (63.4%) of respondents indicated that they used MSFS '15 times or more' in approximately the last 30 days, which means that potentially useful data (i.e., scales above 15 times per 30 days) was lost due to the formatting of the question. The result is that H1.3 ('Due to the characteristics of MSFS, a higher frequency of engaging with it will correspond to a higher likelihood of accepting MSFS as a substitute'), which depends on this question, cannot be tested accurately.

3.4 | Reliability analysis

The conceptual model used for answering the research questions includes nine distinct hypotheses that link the different concepts used in this study, which were all represented in the survey by using at least three question-items per concept. In order to process these questions back into the concepts that they should represent, a reliability test was performed for each to confirm whether the individual items measure the concepts that they should measure.

Cronbach's alpha (α) represents the consistency within a certain scale, expressed in a number between 0 (no internal consistency between items) and 1 (items are the same). It can therefore be used to measure the extent to which specific items in a questionnaire measure the same concept (Tavakol & Dennick,

2011). At a minimum α value of 0.7, the measuring scale can be considered as reliable (Christmann & Van Aelst, 2006). Lastly, the conceptual meaning of the items need to be similar: the same latent trait needs to be measured by each item (Tavakol & Dennick, 2011).

Table 9 below shows the α value per survey question, including the items that were meant to represent the concepts that the questions intended to measure.

Table 9: Cronbach's alpha per survey question, where α denotes the adjusted value after item omission (crossed out) to meet the minimum cut-off criterion of 0.7. Insufficient α values that thus show insufficient internal consistency have been underlined.*

Concept	Items	α	α*
1.1 Experience quality	1.1.1 When I use MSFS, I forget about my present surroundings	<u>0.680</u>	<u>0.680</u>
	1.1.2 my experiences in MSFS are like flying somewhere		
	1.1.3 my experiences in MSFS are like traveling somewhere		
	1.1.4 the way in which the world is presented in MSFS looks real		
	1.1.5 the way in which the world is presented in MSFS feels real		
	13 I use the following approximate graphical settings for MSFS		
	14 The resolution I use for MSFS comes closest to		
1.2 MSFS Attitude	1.2.1 I think that MSFS is exciting	0.817	0.817
	1.2.2 Whenever I use MSFS, I feel satisfied		
	1.2.3 I consider MSFS a fun activity		
	1.2.4 I consider MSFS a relaxing activity		
	1.2.5 I learn something about the world from MSFS		
	1.2.6 I think that MSFS is a valuable activity		
2 MSFS Subjective Norm	2.1 I think that my family and/or friends find MSFS interesting	0.825	0.825
	2.2 My friends and/or family members also use MSFS		
	2.3 family and/or friends enjoy hearing about my MSFS experiences		
	2.4 I care what my family and/or friends think of MSFS		
	2.5 I care what family and/or friends think about MSFS experiences		
	~~3.1 MSFS is easy for me to use~~	<u>0.691</u>	0.755
	3.2 It is mostly up to me when I want to use MSFS		
	3.3 It is mostly up to me how I want to use MSFS		
	3.4 I could use MSFS more often if I wanted to		
	3.5 increase the duration of my MSFS sessions easy for me		
4 Substitute Acceptance	~~4.1 I prefer really traveling instead of traveling in MSFS~~	<u>0.696</u>	0.819
	4.2 MSFS makes me interested in visiting certain places		
	4.3 inspired by MSFS to visit places that I have seen in the sim		
	4.4 MSFS gives me a travel feeling		
	4.5 MSFS provides me with a 'real enough' travel experience		
	4.6 MSFS allows me to see parts of the world that I'd otherwise not		
5 Covid-19 Impact on MSFS use	5.1 Covid-19 makes me want to use MSFS more	0.822	0.822
	5.2 Covid-19 makes it easier for me to use MSFS		
	5.3 If Covid-19 changes, I will also change how often I use MSFS		
	5.4 If Covid-19 changes, I'll change the duration of MSFS sessions		

6 Travel Attitude	6.1 I think that travel is exciting	0.903	0.903
	6.2 Whenever I travel, I feel satisfied		
	6.3 I consider travel a fun activity		
	6.4 I consider travel a relaxing activity		
	6.5 I learn something about the world from travel		
	6.6 I think that traveling is a valuable activity		
7 Travel Perceived Behavioural Control	7.1 It is easy for me to travel	0.801	0.801
	7.2 It is mostly up to me when I want to travel		
	7.3 It is mostly up to me how I want to travel		
	7.4 I could travel more often if I wanted to		
	7.5 increase the duration my trips would be easy for me		
8 Travel Subjective Norm	8.1 my family and/or friends find travel interesting	0.670	0.670
	8.2 my family and/or friends travel often		
	8.3 family and/or friends like hearing about my travel experiences		
	8.4 I care what family and/or friends think of my travel		
9 Covid-19 Impact on travel	9.1 Covid-19 makes me not want to travel	0.326	0.326
	9.2 Covid-19 makes it harder to travel		
	9.3 If Covid-19 changes, I will change my travel plans		
10 Travel intention	10.1 I want to travel more than I usually do this year	0.865	0.865
	10.2 I intend to travel more than I usually do this year		
	10.3 I am planning to travel more than I usually do this year		

As can be deduced from this table, there were several concepts that cannot be considered reliable based on a cut-off value of $\alpha > 0.7$. Specifically, experience quality, MSFS perceived behavioural control, substitute acceptance, and travel subjective norm are just below the required values. Interestingly, question 9, 'Covid-19 Impact on travel', has an extremely low α value and can undoubtedly be considered an unreliable measure based on this test. Deleting any single item from the list lowers this value even further, which means that the concept cannot be reliably used in further testing. As the impact of Covid-19 on MSFS usage is reliable and uses almost identical items, this might be explained by the mixed effects of Covid-19 measures around the world as mentioned in Chapter 2, page 17 (Covid-19 measures).

Question 2 (MSFS Subjective Norm) and 3 (MSFS Perceived Behavioural Control) also did not meet the criterion of $\alpha > 0.7$ but could be recalculated by omitting item 3.1 ('MSFS is easy for me to use') and item 4.1 ('I prefer really traveling instead of traveling in MSFS') from each question respectively. The resulting α for question 3 turned into 0.755, whereas for question 4 this was recalculated at 0.819. Evidently, the two omitted items did not measure the concept as well as the others did.

Lastly, the concept of experience quality could only be raised to just below the cut-off value by deleting item 14. However, because an α of 0.680 is already very close to the cut-off value and item 14 is only

one of two items covering objective 'sensory depth' as per the concept of Experience Quality, it was not removed in favour of conceptual integrity.

Similarly, question 8 (travel subjective norm) is just below the cut-off value but deleting any of the items that represent this concept does not raise the α value. While 0.670 is thus strictly speaking also considered too low to be considered reliable, Goforth (2015) mentions that it is acceptable to use 0.650 as the minimum value for Cronbach's alpha. Eisinga, Grotenhuis, & Pelzer (2013) add that the measure always underestimates the true reliability of a scale. The concept will consequently still be used for further analysis, with the small caveat that it might be represented by slightly less consistent items than the other concepts.

3.5 | Hypothesis tests

A total of nine hypotheses were posed at the end of Chapter 2 (see page 18). However, the reliability analysis and survey results have demonstrated that answering two of these hypotheses is unattainable. H1.3 (frequency of use and substitute acceptance) cannot be tested due to the limitations in the measurement scale used for frequency of use. H3.2 (Covid-19 and PBC/intention to travel) can also not be included as the reliability test showed the measurement items to be unreliable. More about this can be found in Chapter 5 and 6, but for now, these two hypotheses were not included in the hypothesis testing.

The remaining hypotheses could still be tested. To achieve this, new variables were computed in SPSS by taking the average of the items that were assessed to measure the same concepts in the reliability tests. This resulted in variables that explicitly represent the concepts used in the hypotheses, rather than the individual questions.

Table 10 on the next page shows the computation of the new variables based on the reliability test in the last section. Note that the first concept, immersion, is based on survey question 12, which did not need reliability testing as it concerns one item. However, it did require recoding to fit this research's definition of three levels of technical immersion: using a screen as non-immersive, using peripherals as semi-immersive, and using VR as immersive. Similarly, the concept of 'expertise' was only measured with question 15, 'aviation experience'.

Table 10: Recalculation of variables based on reliability.

Formula used to calculate new variable in SPSS	New variable represents concept
Q12 A 1&2 = 1, A3 = 2, A4 = 3	Immersion
1.1.1 + 1.1.2 + 1.1.3 + 1.1.4 + 1.1.5 + 13 + 14 / 7	Experience quality
1.2.1 + 1.2.2 + 1.2.3 + 1.2.4 + 1.2.5 + 1.2.6 / 6	MSFS Attitude
2.1 + 2.2 + 2.3 + 2.4 + 2.5 / 5	MSFS Subjective Norm
3.2 + 3.3 + 3.4 + 3.5 / 4	MSFS Perceived Behavioural Control
4.2 + 4.3 + 4.4 + 4.5 + 4.6 / 5	Substitute Acceptance
5.1 + 5.2 + 5.3 + 5.4 / 4	Covid-19 Impact on MSFS use
Q15 [no recoding]	Expertise
6.1 + 6.2 + 6.3 + 6.5 + 6.6 / 5	Travel Attitude
8.1 + 8.2 + 8.3 + 8.4 / 4	Travel Subjective Norm
7.2 + 7.3 + 7.4 + 7.5 / 4	Travel Perceived Behavioural Control
10.1 + 10.2 + 10.3 / 3	Travel intention

Once the new variables were computed, a regression analysis between different concepts became possible. The correlations between the separate research concepts were analysed per hypothesis, e.g., variable 'Experience Quality' and 'Substitute Acceptance' were added in a linear regression equation in SPSS to test H1.2 ('The higher the overall experience quality, the higher the likelihood of accepting MSFS as a substitute rather than a complement to real travel').

Table 11 below shows Pearson's R value and the p-value per individual hypothesis. Note that significant values ($p < 0.05$) are in bold.

Table 11: Hypotheses, Pearson's R, and significance (p-values).

	Hypothesis	Pearson's R	Significance
1.1	The higher the level of immersion, the higher the overall experience quality	-0.033	0.678
	Correlation 'Immersion' and 'Experience Quality'		
1.2	The **higher** the overall experience quality, the higher the likelihood of accepting MSFS as a **substitute**	**0.550**	**0.000**
	Correlation 'Experience Quality' and 'Substitute Acceptance'		
2.1	Accepting MSFS as a **substitute** to real travel will **negatively** correlate with the attitude towards real travel	**0.378**	**0.000**
	Correlation 'Substitute Acceptance' and 'Travel Attitude'		
2.2	**Familiarity** with the content presented in MSFS will correspond to a **lower** acceptance of MSFS as a substitute	-0.047	0.551
	Correlation 'Expertise' and 'Substitute Acceptance'		
2.3	A **positive** attitude towards VT will corelate with a **decrease** in general travel intention	-0.011	0.893
	Correlation 'MSFS Attitude' and 'Travel intention'		
2.4	A **high PBC towards real travel** will **moderate** the effect of H2.3, i.e., the **higher the PBC**, the **higher the general intention to travel**	0.107	0.173
	Correlation 'Travel PBC' and 'Travel intention'		
3.1	The **stronger the perceived subjective norm for real travel** (i.e., 'travel is desirable'), the **higher the intention to travel**	0.109	0.166
	Correlation 'Travel subjective norm' and 'Travel intention'		

As can be seen from the table above, H1.1 and H2.2 to H3.1 are rejected. Only H1.2 and H2.1 show statistically significant relations. However, the latter does show a *positive* relation, whereas for the hypothesis to be accepted, it should have shown a *negative* correlation. The fact that this still shows a significant correlation but in the wrong direction requires further investigation.

To know for certain that experience quality and travel attitude are mediated through substitute acceptance, and substitute acceptance and travel intention through travel attitude, the correlations between all the concepts used for the hypotheses were examined as well. This test showed that experience quality and travel attitude are also directly correlated ($p = 0.028$, $R = .172$) but less so than either concept correlates with substitute acceptance ($p = 0.000$, $R = .550/.378$). No correlation was found between substitute acceptance and travel intention ($p = 0.118$, $R = .123$), revealing that the mediation of travel attitude is indispensable.

Ultimately this signifies that only a part of the conceptual model (see Figure 6) remains intact. This shows the same conceptual model as Figure 4 on page 10, but adds this chapter's findings with regards to the hypothesis tests. The centre of the model is relatively unchanged: experience quality has been shown to relate to substitute acceptance, and substitute acceptance in turn relates to attitude. However, most hypotheses are proven wrong.

While the conceptual model might thus also partially disintegrate because of measurement limitations, the rejected hypotheses that were measured with reliable scales require further analysis to discover what might cause this discrepancy between the theory and practice. Chapter 5 and Chapter 6 will further elaborate on these results. However, prior to that, the next chapter first examines the qualitative results that were collected using the online forums and personal interviews.

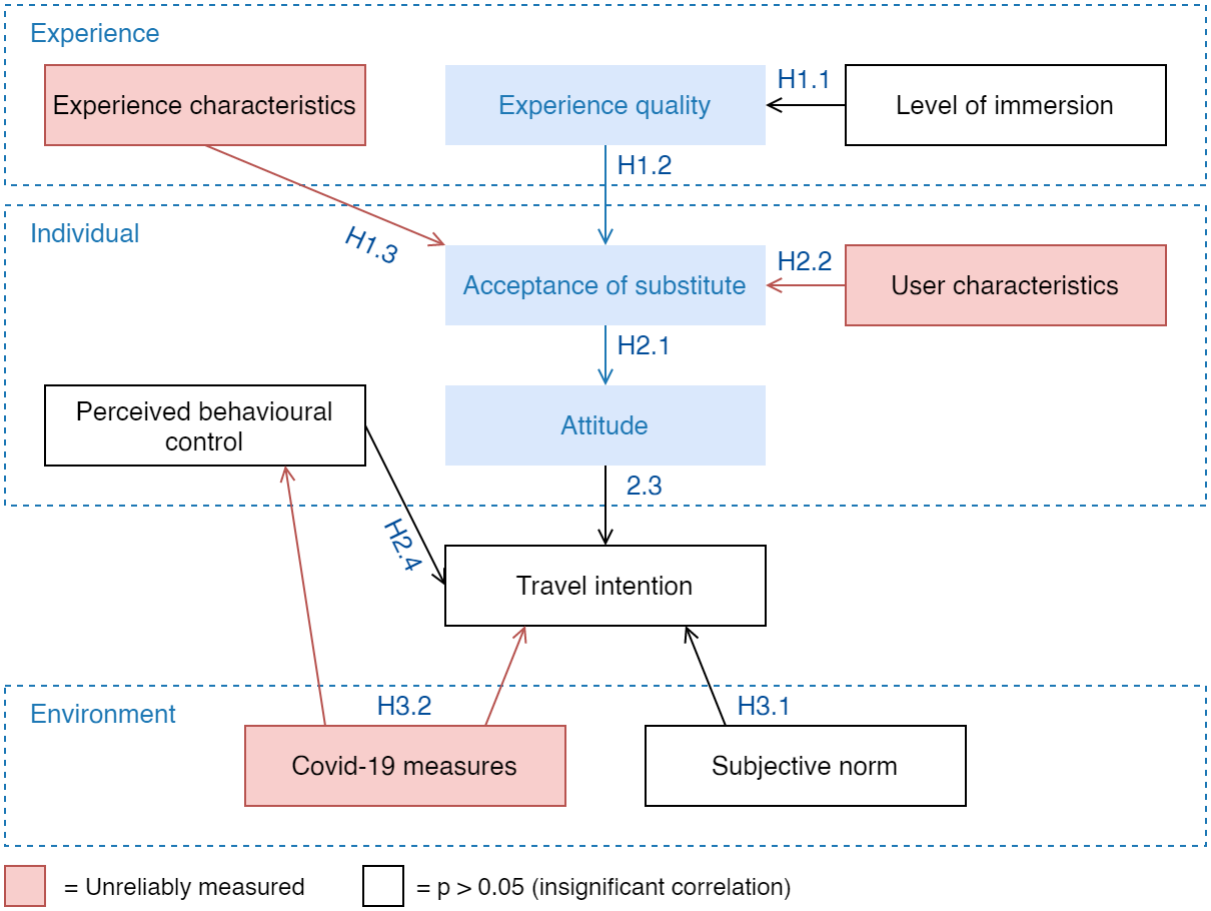


Figure 6: Conceptual model and (dis)proven hypotheses.

4 Qualitative results

This chapter describes the results from the qualitative results of the research, consisting of written forum replies and three interviews. The results were combined into several themes which follow the introductions to each of the two methods used to collect the data.

4.1 | Methods used to obtain the qualitative results

4.1.1 Interviews

The one-on-one interviews were held with three different people: Bart Knuiman, programmer for the WUR visualisation team (original interview in Dutch); Patrick Machado, developer of the MSFS-app Bushtalk Radio; and Jorg Neumann, head of the MSFS development team. The purpose of these interviews was to gain a deeper understanding of the current and potential impact of MSFS and/or virtual tourism, and the interviewees were deliberately selected based on their familiarity/expertise with this field.

Each interview was held through online Microsoft Teams with the support of an interview topic guide (see Appendix 3). The audio was recorded separately and subsequently transcribed by using the online transcription software *oTranscribe*, after which each resulting text was labelled based on themes from the research questions (deductively) and that emerged from the data (inductively).

4.1.2 Forum replies

The online forum discussions were used to answer sub-question 1 (‘What are the characteristics of MSFS’ users?’) and sub-questions 4 and 6 (‘Under what conditions do these factors correspond with a higher/lower intention to travel?’. This method was used for several reasons: it provided access to the research population (MSFS users), it allowed for simultaneous recruitment of survey respondents and discussion participants, it provides a place where participants can discuss amongst themselves as well as with the researcher (akin to a group interview), and it allows for a geographically dispersed sample to be tapped into within limited research time. While this research method is uncommon, it can be an accurate way of collecting data that equals semi-structured interviews: while it does not allow for direct communication and is more anonymous, this method facilitates longer conversations that allow for more involved participation over time (Jamison et al., 2018).

Despite these advantages, there are several drawbacks of this method that needed to be addressed to increase the reliability and validity of the research. Im & Chee (2006) assessed this method critically,

and came to the following issues that needed to be taken into account when applying online forum discussions:

1. Credibility: Qualitative analysis software cannot (easily) be used and non-verbal cues only exist in the form of e.g., smileys, pictures, and language use.
2. Dependability: Participants need to have some level of computer skills to successfully participate in the discussion.
3. Confirmability: Achieving theoretical saturation is more difficult due to the asynchronous nature of online forums and use of internet jargon, such as smileys being used to express emotions.
4. Transferability: Highly individualised forum messages might make the data less generalisable.
5. Security/confidentiality: Forum posts, although anonymous, will be publicly accessible and confidentiality can thus not be guaranteed to participants.

These practical issues were mostly mitigated by taking them into consideration during the field work (the researcher took an active role as a moderator of each discussion) and analysis. The last section in Chapter 6 delves deeper into the limitations of this method.

The forum replies were posted in threads on seven different forums. The opening post of these threads contained an appeal to fill out the survey and a request for anyone reading it to share their thoughts on the topic of MSFS, virtual tourism, and real tourism. To make this more specific, five direct questions were included as well, but forum users were also invited to share any other relevant opinions and ideas that did not fit these questions. Appendix 4 shows the English opening post, with Appendix 5 showing the Dutch translation that was posted on the Dutch forums.

Table 12 on the next page shows a list of forums, users, and the words written per user. In total, 30 users (one user posting on two different forums) made actual contributions to the research, i.e., posting more than just a few words. On average, each user contributed 585 words each for a total of 17,557 words written. Note that usernames are written with the original capitalisation. All forum replies were copied to Microsoft Word, after which they were labelled (thematised) based on the content as with the interviews.

Table 12: Forums, participating users, and words written.

	Forum name	Username	Words
English-speaking forums	Official MSFS Forum	Steeler2340	143
		StewyMacaroon80	373
		EvidencePlz	257
		somethingbrite	532
		RogueN6482T	879
		HerkDvr	1,824
	AVSim	Guenseli	1,094
		bobcat999	927
		hjsmuc	319
		sal9000	958
		KJANRBeard	245
	AVSim/FlightSim.com	Hansb57	510
	FlightSim.com	Chicagorandy	316
		Tiger1962	437
		Neilends	502
		Kapitan	693
		Mallcott	169
	Mutley's Hangar	Brett	556
		Tim_A	151
	Steam Forum	Svennoj	2,720
		Macman	401
		Twelvefield	537
		TargetLost	569
Dutch-speaking	Tweakers.net	Ircghost	262
		Strider1007	170
		Pretpik	344
		Cracking cloud	451
		JohnnieWbl	572
	Dutchfs.nl	Greencan	425
		FsTheo	221
Total		**33**	**17,557**

4.1.3 Qualitative themes

After labelling all the data, the content was sorted per theme. This facilitated analysis of the different opinions or ideas on the different topics. Eight different themes were identified, many of which were predefined based on the research questions. The previous chapter has shown results that attempted to answer sub-question 1 ("What are the characteristics of MSFS' users?") by looking at demographics and shared the findings related to sub-question 3 and 5, where the extent of certain factors related to

higher and lower intention to travel were explored. The qualitative data provides a more open-ended perspective on these questions: contemplating non-demographic data about the users, regarding all potential factors related to VT and travel intention, and looking for the conditions that need to be met to either raise or lower travel intention (sub-question 1, 2, 4, and 6). Thus, while certain themes (1, 5, 6, and 7, specifically; see the list below) relate to the topics in Chapter 3, the perspective is different. The other themes were uncovered inductively based on information that emerged from the data itself.

The list below shows each theme in the order in which they appear in the rest of this chapter.

1. MSFS user characteristics
2. Reasons for using MSFS
3. MSFS compared to other media
4. Post-tourism experiences
5. MSFS and travel inspiration
6. MSFS as a travel substitute
7. Experience quality and immersion
8. The future of VT

The themes ‘MSFS and travel inspiration’ and ‘MSFS as a travel substitute’ are a combination of deduction and induction, as they both originate from the concept of substitute acceptance, which was split in two due to the overwhelming evidence found in the qualitative data to the conceptual divide between these two. Also note that Dutch forum replies were translated to English (indicated by ‘[translated from Dutch]’ after the quote).

4.1 | MSFS user characteristics

It is important to explore the shared traits of MSFS users. Where the survey largely uncovered demographics such as gender, age, and nationality, the written replies divulge more about the psychographics of users. Two interests that were mentioned very often are travel and aviation. While not every user mentioned both, most did mention at least one or the other, and often indeed the two together. Many users seem to be very-well travelled, as user *HerkDvr* exemplifies in this quote:

“I’m a guy who’s been interested in aviation since a kid. […] When I wasn’t flying for work, I’d travel as often as possible. Day trips, weekend trips, longer trips. I’ve visited over 60 countries.” - HerkDvr

Some users that indicated to be of an older generation added that even though they love travel, they feel tired or dissociated from real travel as they find it less attractive nowadays, regardless of the global

Covid-19 restrictions. The reasons mentioned for this are the perception of destinations' increasing lack of authenticity and aggravation caused by the large volume and behaviour of other tourists. However, the interest in either aviation and/or travel is reflected in their shared interest in using MSFS.

The word 'simmer' is mentioned quite a few times, referring to people who use flight simulators in general. Instead of a video game or entertainment, many users consider using MSFS more of a hobby. Jorg Neumann confirms that this is indeed the most important target group for MSFS:

"We're making a sim for simmers. And they have clear priorities. They let us know what the priorities are. […] it's about people that have this as a hobby and hobbyists know what they want, more than anybody." – Jorg Neumann

Most of the participants indeed have a lot of previous experience with other flight simulators. Often, this goes back even decades, as *RogueN6482T* explains here:

"Been using flight simulator since MSFS 3.0 in the late 80's. I have always been into flying and I have many family members with their PPL [Private Pilot's Licence] *and have enjoyed Oshkosh many times. I use MSFS because I want to simulate flights and also explore places without the cost/time penalty."* – RogueN6482T

At the same time, there are many newcomers or people that have not used a flight simulator for a long time. The next theme delves deeper into why these and other users might start using MSFS in the first place.

4.2 | Reasons for using MSFS

As the quote above already indicates, many users connect their interests with reasons for using MSFS. This is an interesting topic to explore, as it reveals more about the purpose of this flight simulator in users' lives. As it is primarily positioned as a videogame, the simple answer might be 'entertainment', as one user indeed affirms. However, with the many video games and other entertainment options available to people, this still does not answer the question fully.

One of the most mentioned, and admittedly perhaps also the most obvious of reasons is that MSFS appeals to people interested in aviation, but that for money, time, or career reasons are not able to really fly airplanes. However, as the survey data indicated, licenced pilots also use MSFS, which means that they must have another reason to use the sim. While not many that fall into this category participated on the forum, some of them did elaborate somewhat on why they chose to fly virtually.

"I use the sim (P3D) to prepare for local overseas travel, plan routes and alternatives, and to advise others in my flying club." – Mallcott

User *RogueN6482T* has family members with a Private Pilot's Licence. This means that, while real general aviation might be more accessible to him, he also uses MSFS because of the time and costs associated with flying real planes while still providing the opportunity to "explore places". This is also associated to a second reason for using MSFS, which is a form of travel: virtual tourism. Users are generally impressed with how the world is visually presented to them, which inspires them to explore this digital representation of the globe.

"I fly the flightsimulator today mainly because it shows me new places on the earth. For me the new FlightSimulator with the Bing Maps […] is a wet dream that came true ever since TileProxy [a program that downloads online map data for a previous version of MSFS]." – TargetLost

According to Jorg Neumann, MSFS distinguishes itself here by the way in which it uses data. Rather than packing this on DVDs or CDs, scenery data is downloaded (streamed) while virtually flying – this means that the total data storage of MSFS is equal to "millions of CDs" and is thus able to present a much more accurate picture of the globe than other/previous flight simulators. Users confirm that the new visual aspects such as the scenery, the illumination, and the weather effects brought flight simulators into a "new era of default scenery", as user *Brett* notes. There is some indication that the virtual tourism aspect of MSFS might be a reason to purchase the simulator for some people that are less interested in aviation, like Patrick Machado:

"I don't consider myself a hardcore flight simmer […] I bought it more for sightseeing and exploring the world, rather than actually learning the fly the planes." - Patrick Machado

The connection between MSFS and virtual tourism is no coincidence: the developer's reason for getting involved with MSFS was its fascination with virtual travel, as detailed in Chapter 1 on page 5 (*Using Microsoft Flight Simulator as a research instrument).* Despite the earlier statement that MSFS' main target group is hobbyists, its main unique selling point is very closely related to virtual tourism, as Jorg Neumann discloses here:

"We had not made a Flight Simulator in quite a long time, 14 years or something. When you come back you need to have truly something to say. And what are you going to say? You can always make the planes a little bit better, but frankly there are pretty good flight simulators out there that are sophisticated. What they're not good at is the world itself." - Jorg Neumann

4.3 | MSFS compared to other media

When users talk about the reason for using MSFS, a comparison with other media seemed inevitable. This is highly relevant to this research, as it aids in understanding the specific relation that VT can create with real tourism in contrast with other media forms. One such difference seems to lie in its ability to communicate the landscapes and a sense of scale better than anything else.

"I especially like MSFS to get a sense of scale (time and space). […] I started flying with one plane (a little Cessna) around my own home region to get a good idea of how long it takes to fly in a certain area, to cover certain distances. If you fly over an unfamiliar area after that, you get a good impression of how big or how small the place that you're exploring really is." – JohnnieWbl [translated from Dutch]

At the same time, MSFS might provide a sense of virtual presence, i.e., the sense of having an avatar in the digital world. Several users mention feeling this way. For example, saying that MSFS provides them with a 'grounded' feeling in the virtual environment. The extent of this kind of presence might highly depend on the individual and his/her personal frame of reference. For example, users that are accustomed to flying often mention that MSFS provides them with a way to explore the earth in a way that they are used to, compared to Google Earth, for instance.

However, besides replacing other potential virtual-tourism media, MSFS can also complement or be complemented by certain media. Google is mentioned quite often for its Streetview, Maps, and Earth-products.

"What I do often to have or reinforce the feeling that I have 'been' there, is combining MSFS with Google Streetview. Once I've landed somewhere, I will look around that place with Streetview. Then I can see what it really looks like (or at least, recently looked like)." - Strider1007 [translated from Dutch]

Some users also make their own applications that contribute to a VT experience. Patrick Machado created *Bushtalk Radio,* a publicly available program that connects directly to MSFS and provides a location-based audio tour based on Wikipedia content. According to him, this fills the period between take-off and landing with points of interest to visit. *Bushtalk Radio* has found a lot of interest amongst MSFS users, which shows that combining MSFS with what could be considered VT-experience enrichments is rather widespread.

The complementing of MSFS thus seems to be a common theme with MSFS users that use it for its virtual tourism potential. As MSFS provides something akin to a sightseeing flight, many users seem

to crave more information and situational context to complete their tourism experience and get sense of 'being there'. Flying over an area in MSFS can provide some users with the spark to wonder about a place and its people, leading to a subsequent consumption of other media such as YouTube, Wikipedia, or Google Streetview. The reverse also occurs when users see or hear about a place in the world where they have never been, triggering a curiosity and inciting a virtual visit in MSFS.

"I read books and then fly there in MSFS to see what the author saw. For example, Mark Twain makes a lot more sense if you're flying over Hannibal Missouri, but also Hartford Connecticut." – Twelvefield

4.4 | Post-tourism experiences

While the quotes above relate to reasons why users spent time visiting new places in MSFS, there were many more that indicated that they enjoyed virtually visiting places where they had been before. Jorg Neumann confirms that this a normal first introduction to MSFS: his data shows that new users fly over their own houses first, followed by visiting other known areas such as homes of friends and relatives or previous vacation spots. It seems that this introduction establishes a sense of authenticity to the world, as Jorg explains:

"You need to get confidence in the things you know and then with that confidence you will also get confidence that other places you explore actually are also accurate. so it's actually very important that when people do their first test, "Let me check out my house", that that actually looks quite close to their house because that formulates the framework under which they look at the entire experience." – Jorg Neumann

The forum users confirm that this is an important theme as many users mentioned that they did this, such as *Guenseli*:

"So, for now it is more that I check places I have been already as I then can compare how good or bad the sim is compared to reality. All in all it is about how authentic it is, what I see in the sim." – Guenseli

Some users explain that virtually revisiting places enhances their real memories - this nostalgic sentiment is something that comes back to many users when talking about this topic and explaining their motivation. The idea of 'reliving past holidays', as *bobcat999* calls it, seems to evoke strong emotional responses which users thus consciously look for. Many mention the memories that the landscapes recall, being generally impressed with how close the digital world matches their experience in-person.

"The first thing I did in FS2020 after locating my house was trace my most popular cycling routes in the ICON A5. When I flew over the area I grew up in it evoked all the good memories from my childhood, location based. Flying over the Loosdrechtse plassen where my grandfather always took us sailing, not only evoked all the good memories, but also 'sorted' them to match the scale of the actual place. Memory changes over time, FS2020 provides an anchor to plant them down, adding a different perspective. […] Bringing back the good feelings." – Svennoj

This indicates that some users do this because of the feelings or emotions that they attach to certain places, which they can reinvigorate with MSFS. However, it seems to serve another function as well, which is related to *Svennoj*'s last comment: using memories as an anchor and reinforcing a sense of realness to the digital world. *Svennoj* adds to this that his extensive travel experience greatly adds to the feeling of presence in the simulator. As users explore a certain area in MSFS that they are familiar with, it helps them to get a sense of scale for new, unvisited places as well.

4.5 | MSFS and travel inspiration

There seems to be a divide in opinion when users were asked directly whether MSFS inspired them to really travel to places. Many commented on how it helped with selecting destinations while others did not recognise this at all. Starting with this latter attitude, users that shared this sentiment seemed to either use different media such as YouTube for travel inspiration or did not find the scenery in MSFS convincing enough to inspire travel. Many other users did, however, see MSFS as a way to get inspiration for their real travels. For these people, it is mostly used as another method to get a feeling for a destination, as *bobcat999* exemplifies here:

"I have spent time flying around Utah in MSFS […] Utah is certainly one of the most beautiful states in the US, and I didn't realise it before. Me and the wife now have it on the radar to fly/drive some of the routes through the Utah when things return to some level of normality." - bobcat999

Interest in travelling to a destination certainly does not depend solely on seeing it in MSFS, however. Some users explained that they usually have some interest already in a certain place, and MSFS either heightens or suppresses an interest to travel there. This initial interest seems to come from an infinite variety of sources such as previous travel experiences, books, TV, and social media. Sometimes, such interest can lead to other destinations accidentally being 'discovered'. The opposite, travel inspiration being reduced, can happen as well. This is exemplified by the quote below from *HerkDvr*, which also shows how important MSFS can become for a person's travel destination selection:

"I've heard great reviews about São Tomé and Príncipe and looked into traveling there. I booted up MSFS, and both islands didn't do it for me. I've been to many islands that have done "it" for me, but São Tomé and Príncipe didn't share the same characteristics. [...] I've now started a list. If I come across something cool in MSFS, it goes on the list. When deciding where to travel domestically or internationally, that list will factor in very heavily on where I go once COVID lets up." - HerkDvr

Interestingly, available time and money are not only a reason for using MSFS instead of really travelling; they also affect destination choice in MSFS itself. Some users purposefully decide to virtually fly to places that they might be able to visit sometime soon, instead of places farther away.

Based on what users write on the forum, it seems that for certain people, MSFS is a tool to preview potential travel destinations. Whether this is the case varies greatly from person to person, however, and perhaps depends on the reason why they use MSFS in the first place. As the following quote indicates, whether a destination is considered 'inspiring' could greatly depend on the specific user's previous experience with that destination:

"Florida can look very flat and boring from MSFS, but we know it isn't, and we will keep going back as we love it, so the negative effects don't really take much precedence, only the positive. It might have more effect for a place we have not yet visited, but we always back this up with other information anyway, such as YouTube reviews of the area." – bobcat999

Microsoft itself seems to count on the idea that MSFS can indeed be a tool for travel inspiration. Jorg Neumann disclosed that tourism organisations seem to start to understand the potential impact that MSFS and its underlying technology might have.

"There were a lot of large travel organisations asking me if they can preview for people what it looks like. And I think they totally can. you can look outside the window, you can do that fully in real time, but what's really important is to see you can pre-vis pretty much anything." – Jorg Neumann

Jorg described a concept here that has not yet been mentioned: pre-vising, or previsualisation. This term is usually used in professional filmmaking or photography, and is used to indicate testing or 'pre-visualising' scenes before shooting them in order to reduce costs or communicate ideas with others (Ferster, 1998). When translated to a tourism context, this could provide prospective visitors of a destination an accurate preview of a destination in any season or weather situation – while simultaneously supplying usage data to the industry.

"It's expensive to pre-vis and you're dependent on, again, weather. A lot of things don't look good on a rainy day, for example. So, if you want to make your destination attractive it's very useful to have a tool where you control the weather. So right now I'm talking to a few hundred governments, or governmental organisations around the world about data […]. I started talking with scientific organisations and I end up with tourism organisations, which is telling." – Jorg Neumann

The proposition that Jorg establishes here seems to connect with the replies from forum users about travel inspiration, granted that this seems to depend on an individual's connection with a destination. The ability to previsualise a place at any time and season might be a function that, when coupled with accurate, realistic landscapes, makes MSFS a VT experience that helps users, depending on their personal context, to get travel inspiration.

4.6 | MSFS as a travel replacement

Besides travel inspiration, many users also reflected on the idea of how MSFS could, in some way, substitute real travel. The initial opinion from most users was that it could not, in any way, ever replace tourism. Many also added to this that they could not see a way for future virtual tourism options, no matter how realistic or immersive, to achieve this. *Steeler2340* summarised his thoughts on this as follows:

"[MSFS] does not replace real travel, as you have no real interaction with people and the scenery. […]. A flight simulator let's me switch off my brain for a couple of hours (and yes, whenever I like, agreed), but that's not a real substitute for "real holidays aka travel." - Steeler2340

Many others agreed with this point of view: the social, cultural, gastronomic, and relaxation aspects of travel were often mentioned as key elements that could not possibly be replaced. And as the quote above shows, the duration of the experience also lowers its potential for substitution. Another reason that is mentioned as a limiting factor for substitution is related specifically to MSFS: for many users, the 'ground perspective' that a tourist would usually have is missing, as the simulator's perspective is mostly from the air.

However, despite this overwhelming agreement, there are also indications that MSFS provides a travel sensation at certain times. Many users that delve deeper into the question acknowledge that they immerse themselves in the experience at times, recognising that it "halfway the real thing" as user *TargetLost* notes. Other users mention that, as with the reason to use MSFS, the potential costs and time saved by virtually traveling are significant, on top of which they recognise that it is unlikely that they will be able to see all the places that they would like to see within their lifetimes.

This demonstrates that the people that consider the potential of MSFS for substitution of travel recognise that there are limitations to travelling the entire globe. Furthermore, Covid-19 is often mentioned as a factor that affects users' willingness to accept MSFS as a substitute. Or, as *somethingbrite* commented, the familiar sight and sounds of airports and airplanes can be unexpectedly comforting during these times.

Interestingly, the users that elaborate on the travel feeling that MSFS provides are the same ones that agree that it does not replace travel. In other words, for them, MSFS is a partial *substitute* as it was defined in the literature, but not a *replacement* for real tourism. This seems contradictory at first, but *Guenseli* and *KJANRBeard* provide insight into what might be occurring:

"Sim or not: I'd like to visit so much many new places in the world ... probably if I could do that, I wouldn't have the time to play with the sim. 😉 *So, my wanderlust (Fernweh) is here, with or without the sim. The sim does compensate this a bit. A little bit."* - Guenseli

"I also don't have a ton of vacation time […], which make international travel challenging, but doable. But, I can do it in the sim! […] So yes, [MSFS] eases my wishes a bit to go virtually .... BUT it is so worth it to go in reality. To see my family is priceless. Even if it is harder to do right now." – KJANRBeard

As can be seen from these two quotes, the sentiment that MSFS provides a travel feeling but does not replace travel can be understood by considering personal circumstances and desires. In other words, if MSFS conveys a travel feeling or experience in some way, it does not lead to a reduced wish to travel. Many other users confirm this assessment, calling MSFS an 'addition to travel', or mentioning how it fills the need to go to places, but is not considered a substitute. *JohnnieWbl* below elaborates on this difference below.

"Travel is many things in one, amongst which, I think, seeing new things, meeting new people, getting to know yourself, relaxing, different customs, trying new foods, killing time. MSFS can only approximate a small part of this in a limited way, which is 'seeing' a new area (and a different way of relaxing)." – JohnnieWbl [translated from Dutch]

In other words, 'travel' as a concept is too broad to completely replace or substitute; perhaps only small elements that make up the idea of a vacation could be replaced in some limited way. This small element, according to *JohnnieWbl*, is seeing new places: indeed, this seems to be the only function MSFS could partially replace in a travel context. But how is this limiting the travel experience, exactly? Experience quality as described by Guttentag (2020) and its related factor, immersion, are discussed in the next section.

4.7 | Immersion and Experience Quality

Immersion and experience quality are two related concepts that are both connected to substitute acceptance in the conceptual model on page 10. While the survey tested *whether* participants feel immersed or present in the digital environment that MSFS displays, the qualitative data can explain *why* some users have this experience. The survey thus measures for a preconceived notion of immersion and the interviews and forum replies add a qualitative dimension to this.

"I was actually supposed to visit [my parents in Germany] last year. Then the pandemic hit and I couldn't go. And at some point I got really homesick – they're older, my dad is 92 or something like that, so […] you feel very restricted. I actually flew to my parents' house in Flight Sim in real time, landed right on the lake where they live, gave them a call, and I said I am as close to you as I can get right now. That was a substitute a certain way." – Jorg Neumann

This quote shows how Jorg's own personal frame of references shapes his experience. Without his connection to the place – his parents' home – he would not have had an experience that was so engaging. There are more MSFS users that also corroborate the assertion that travel experience affects immersion, where familiarity of the location combined with audio-visual quality creates moments of 'being there'. This relationship, which is also measured in the survey, comes out strongly in the forum replies. Many users comment on moments where they felt 'there' due to the quality, or realism, of the experience as it was presented to them:

"Yes I had a "real as it gets" moment on approach into Frankfurt at sunset, following two other aircraft on finals. The buildings and street lights were switching on, even the car headlights were switching on." – Tiger1962

In contrast, one user indicated that MSFS was not realistic enough for him due to the quality of the scenery, *especially* when flying over familiar terrain: *StewyMacaron80* commented that he felt less immersed in familiar places as he was able to recognise the inaccuracies. Similarly, there were other users that agreed with the point that what is defined as experience quality in this research could also have the effect of reducing the feeling of presence:

"Low poly models, poor AI/control systems, clunky animations, things being just plain wrong etc, are all immersion killers. And that's in the best parts of the sim. Go to some of the automatically generated places and it really looks dire (although less dire than it looked in older sims)." – Tim_A

The difference between users shows that even though they use the same simulator, they experience it very differently. Personal interests seem to play a role: Patrick Machado, for example, mentions how

his love of photography might be related to the satisfaction and immersion he gets from visiting places in MSFS. Another user, *RogueN6482T*, relates it more to where exactly in the simulator he flies. This indicates that perhaps besides personal differences, there are also large differences within the same simulator depending on where in the virtual world the user travels to:

"This [nostalgia from revisiting places] is especially true for the cities that have photogrammetry and look true to life. I would compare the feelings to looking through a photo album of a trip or reminiscing with travel companions."- RogueN6482T

The experienced difference between the more detailed photogrammetric landscapes – using photographs of a location to construct and texture the 3D models in the simulator (Shashi & Jain, 2007) - and other areas makes sense from a theoretical point of view and fits the measurement of experience quality in the survey, which besides 'presence', is also measured by graphics settings and resolution as per the Substitute Acceptance Model. Bart Knuiman comments on this relationship:

"Your brain really thinks that the better the graphics and the better the experience, the more real it is. The brain does distinguish this much. Yes, you probably know, but you still experience the same fears [as in reality]." – Bart Knuiman [translated from Dutch]

Some users also also describe the large impact of using an HMD (Head-Mounted Display; also known as VR device) on their level of immersion. Using such a peripheral gives the impression of being in a cramped cockpit or being there. It is notable that the earlier hypothesis tests do not show a relation between experience quality and using a Head-Mounted Display for VR. Bart Knuiman clarifies why MSFS might not be more immersive through VR: except for the virtual cockpit, the scenery is usually too far away (i.e., seen up high from the air) to get a 3D stereo effect, as our eyes are too close together to perceive depth beyond 50 metres. This suspicion is confirmed by one MSFS user:

"The difference between 'pancake' gaming and VR, I think, is the level of immersion, but then specifically in the role of pilot. You can much better submerse yourself in the role of being responsible for controlling an airplane, something that in real life costs years of training, experience, and money. However, I don' think this has much to do with your research question: because of how MSFS works, it's not as if VR increases that 'travel feeling' that much." – JohnnieWbl [translated from Dutch]

A last possible explanation comes from Patrick Machado, who explains that the technology behind HMDs is perhaps not fully mature or suitable for the nature of MSFS, as it can cause discomfort during extended use. However, this might not yet explain fully why many users state that they experience more immersion when using an HMD, while this does not relate to presence according to the hypothesis tests. This divergence between the qualitative and quantitative data is further explored in Chapter 6.

4.8 | The future of virtual travel

While most of the data collected was specifically about MSFS and its relation to tourism, the qualitative data also revealed more about the potential future for VT in general. The technology behind MSFS, where satellite data is downloaded continuously to present a more detailed copy of Earth, is an example of how 'the cloud' can be used nowadays. The potential application of this technology is in a "fundamental upheaval", according to Jorg Neumann.

The impact that this will have on tourism, specifically, can only be considered based on current developments, but Jorg believes the eventual use will be that of a previsualisation tool based on the concept of 'digital twinning'. Different than some of the other media mentioned, such as Google Maps, it would enable users to interact with the environment at a chosen time and season:

"I think there will be a tool, whether it's Flight Sim or something else, that will allow people to virtually travel to the degree that they want to. Like they can walk around as a character, they can take a car, drive up a road... the digital twin is happening. It's just a question of time. Tourism is certainly one of the aspects of digital twins that are new, therefore I have zero doubt that there will be, that before you go and book a room, somewhere, you will check out what that looks like." - Jorg Neumann

This technological change is still in its infancy, according to both Jorg and Bart. Products such as MSFS could thus possibly be seen as testbeds for future developments. However, both interviewees believe strongly that augmented reality (AR), where virtual projections are blended with the real world, has even more potential to change the world. Where HMDs might be immersive because they isolate users from the real world, this might also be considered a disadvantage *because* it isolates users. Jorg and Bart both mention that technology such as HoloLens, an HMD with cameras for AR applications, could be analogous to the first cell phones: big, unwieldy, and expensive, but potentially just as disruptive in the long term.

Another aspect of VT's future that has so far not been mentioned often is the concurrent cost. Products such as MSFS or HoloLens require relatively specialised and expensive hardware, which means that their consumer appeal is reduced to enthusiasts with spare time and income. However, once such tools are more widely available through, for example, smartphone applications, they will be a lot more accessible. Bart Knuiman adds that another way in which immersive VR, and consequently VT, might gain faster adoption:

"It would also be smart if not everyone needs to have [an HMD-device] to make use of it. For example, that I'd have one and that it would work in combination with people that do not have one. That would

also make some difference, instead of ten people [in a Teams meeting] all needing to have it. […] It all needs to be good and easy to put on […], like headphones, that it is all just super simple. I think that it would really add extra value then." – Bart Knuiman [translated from Dutch]

Accessibility in the sense that Bart mentions here does not mean that the cost for VT experiences is low, but also that the experience needs to be easy to use and usable. This last aspect could entail that a social aspect is added even when there are differences between the hardware used to create the experiences, and that it works correctly, which could possibly relate back to experience quality. Furthermore, Jorg explain below that it would need to be useful, which he thinks it is:

"If something becomes a useful tool, like a phone. remember the time that it was a dial tones and you had to have a land line and you had to put coins into one? Yeah, it's useful to be able to make calls from anywhere. And yeah, it's useful to be able to access the internet from anywhere. and it's useful to be able to pre-vis the planet under pretty much any conditions." – Jorg Neumann

While Jorg's vision goes beyond that of VT only, he makes a clear statement on the potential impact of this technology here. Following his analogy, perhaps MSFS can be seen as one of the early, bulky portable phones: useful, but not accessible to many people. The concept behind this simulator is what is truly interesting, however: a digital twin of the world that is commercially accessible. While Jorg made no statements on Microsoft's plans with this technology, he obviously sees a lot of future potential from a personal perspective. While Bart and Jorg are both industry experts who work with this technology on a daily basis, MSFS users could be seen as early adopters of this new concept. Some forum users also had something to say about how they saw the future for VT and what it would mean for them. For example, *Tiger1962* comments below on the potential advantages he would see if VT would become more accessible.

"I know many people who have queued for hours to see the Mona Lisa, and couldn't see it because of the crowds. Same story for the Acropolis in Athens, the Trevi Fountain in Rome, and countless others. A VR tour would also lessen the environmental impact of pollution and land erosion at sites such as Machu Picchu." – Tiger1962

Other users agree with this point but do add some caveats. For some, such as *Hansb57*, VT would only be able to preview a part of a real travel experience: a point that was resonates with the earlier notion of MSFS's place as a travel replacement, where it became clear that 'a part' of a travel experience for MSFS means seeing a new place only. From this perspective, VT would evolve to a technology that enables potential tourists to make travel choices based on the virtual experience.

Users also seem to agree that while VT does have a future where it could play a more significant role, there are simply elements to reality that are irreplaceable. MSFS, and by extension VT in general, comes out much stronger as a previsualisation tool instead of a full travel replacement again. For some users, potential futuristic developments would not change this either:

"There's never any doubt that I'm sitting in my room looking at a PC. I think even VR with a full on haptic suit and motion platform would still have trouble." – Tim_A

However, as this chapter has made clear, there are always differences in opinion between these users: personal frame of reference is a key component here that cannot be ignored. One user, *EvidencePlz*, even made a slightly more philosophical comparison with reality and simulation:

"What is 'real', and 'unreal'? What are the differences between the two? Who decides what is real and unreal? We homo sapiens have five senses: touch, smell, hearing, vision and taste. If we flew from UK to USA yesterday on an airliner such as the Boeing 747, we can use some or all of these senses to get the feeling that we have travelled." – EvidencePlz

In conclusion of this this chapter, the qualitative data indicates that the future for virtual travel seems to lie in the direction of previewing rather than replacing travel. However, based on an individual's background and expectations, VT in the form of MSFS does partially replace the exploration of familiar and unfamiliar destinations. Whether this can be seen then as a 'replacement' or an 'addition', and what those terms would mean in this context, is a question that is examined in Chapter 6.

However, before going into an elaborate discussion of these results, the information that was gathered through the forums and interviews requires a re-examination of the quantitative results in the next chapter.

5 Synthesis: Post Hoc Exploratory Data Analysis

As indicated by the research design proposed in Chapter 1 (page 7), the meaning of the results presented in Chapters 3 and 4 can be best interpreted when juxtaposed. This chapter thus considers the main findings and re-evaluates them based on the most significant discrepancies between the qualitative - and quantitative data, revisiting the latter based on the knowledge gained through the former.

5.1 | Qualitative data insights

As Chapter 3 indicated, many of the previously established hypotheses must be rejected based on the quantitative results. While a part of the conceptual model still holds up, it does call into question its eventual usefulness now that many of its elements do not have statistically significant relations and one relation (substitute acceptance and travel attitude) is in the opposite direction of what was hypothesised. The possible reasons for these findings are discussed in the next chapter, but to fully understand the results it is necessary to revisit the quantitative data and explore relations that are hinted at throughout the qualitative results.

The interview data and forum replies provide four direct insights that could be used to re-examine the quantitative survey data that did not match the original hypotheses. The statements below can be tested with the existing quantitative data and thus might lead to a better understanding of the relation between VT and real tourism.

1. Personal context seem to be a strong determinant for how MSFS is seen in a travel context (i.e., replacement, inspiration, or neither).
2. Covid-19 seems to affect the willingness of users to accept MSFS as a (partial) travel replacement.
3. The potential for MSFS as a tool for travel inspiration seems to be much higher than its potential in travel replacement.
4. Acceptance of MSFS as a travel replacement does not reduce the intention to travel.

These points all relate back to what the different elements or concepts within the conceptual model entail, and how they relate to each other. For example, the concept of ‘personal characteristics’ was originally measured only based on ‘aviation familiarity’ or subject expertise, as explained in the theoretical framework. However, while not a single user has expressed a lack of immersion based on their piloting experience, many others mentioned how their familiarity with a destination affects their experience. While the survey did not include any destination-specific questions, it did include several questions based on the Theory of Planned Behaviour and MSFS, which means the correlation between these concepts can be tested.

5.2 | A division of Substitute Acceptance

At the same time, the knowledge gained from the interviews and forum replies requires an assessment of what is meant with 'substitute acceptance'. While the implicit assumption in the hypotheses was that this comprised a single concept based on Guttentag's Substitution Acceptance Model, the qualitative data splits this into two seemingly opposite segments: MSFS as travel inspiration, and MSFS as a travel replacement. This fits the theoretical framework as well, where the opposition between substitution and marketing effects of VT was discussed (see Chapter 2, section 2.5.1 *Acceptance of substitute*).

Re-examining the survey items that represented substitute acceptance, the conceptual divergence can indeed be determined by dividing the original concept into two on an analytical level. Table 13 below shows the outcome of the reliability analysis when taking this approach. Removing item 4.1 increased the reliability of 'Travel Inspiration' above an α of 0.7. As this leaves only two items to measure 'Travel inspiration' with, the reliability of this concept is measured with the Spearman-Brown coefficient (ρ) instead of Cronbach's alpha as per Eisinga et al.'s recommendations (2013).

Table 13: Cronbach's alpha for each segment of 'Substitute Acceptance', where α and ρ denote the adjusted values after item omission (crossed out) to meet the minimum cut-off criterion of 0.7. The insufficient α value that shows insufficient internal consistency has been underlined.*

Concept	Items	α	α*	ρ
4-1 Travel Inspiration	~~4.1 I prefer really traveling instead of traveling in MSFS~~	.683	N/A	.923
	4.2 MSFS makes me interested in visiting certain places			
	4.3 I am inspired by MSFS to visit places that I have seen in the sim			
4-2 Travel Replacement	4.4 MSFS gives me a travel feeling	.724	.724	N/A
	4.5 MSFS provides me with a 'real enough' travel experience			
	4.6 MSFS allows me to see parts of the world that I'd otherwise not			

This result shows that substitute acceptance can be reliably divided. Note that for purposes of clarity, these two elements will be referred to as Travel Inspiration (TI) and Travel Replacement (TR), while the overarching concept (i.e., original combination of the two) will continue to be referred to as Substitute Acceptance (SA). Furthermore, this concept is still internally consistent on its own when item 4.1 is omitted (see Chapter 3) and a correlation test between TI and TR reveals a Pearson's R of .509 at p = 0.000. Chapter 6 explores how and why these two are related; the next section examines whether the division is theoretically useful, i.e., shows significant differences in the relations with other concepts.

5.3 | Hypotheses based on qualitative data

Based on the assertions above, the correlations between concepts were tested again for several relations that were not included in the original hypotheses. This process, called THARKing (Transparently Hypothesising After Results are Known) by Hollenbeck & Wright (2016), results in maximum utilisation of the gathered data and, while the findings are placed in a literature context in Chapter 6, this method helps to explore the data further. The following list shows the new quantitative hypotheses that could be tested with the existing data and correspond with the qualitative findings.

1. Substitute acceptance: The concepts 'Travel Inspiration' and 'Travel Replacement' will each have significantly different relations with the other concepts (i.e., the two have unique properties so that splitting substitute acceptance results in new insights for the research).
2. Personal context: MSFS attitude, subjective norm, and perceived behavioural control affect the extent to which MSFS is considered a travel replacement or tool for travel inspiration.
3. Covid-19 affects the extent to which MSFS is considered a travel substitute or tool for travel inspiration.
4. Acceptance of MSFS as a travel replacement does not reduce travel attitude and, consequently, the intention to travel.

The results of these correlation tests can be seen in Table 14 below.

Table 14: Newly tested conceptual relations based on qualitative data. Statistically insignificant relations ($p<0.05$) are underlined.

Relationship		Pearson's R	Significance
1a	Experience Quality – Travel Inspiration	.363	.000
1b	Experience Quality – Travel Replacement	.589	.000
2-1a	MSFS Attitude – Travel Inspiration	.465	.000
2-1b	MSFS Attitude – Travel Replacement	.436	.000
2-2a	MSFS Subjective Norm – Travel Inspiration	.281	.000
2-2b	MSFS Subjective Norm – Travel Replacement	.339	.000
2-3a	MSFS PBC – Travel Inspiration	-.032	.688
2-3b	MSFS PBC – Travel Replacement	.141	.072
3a	Covid-19 – Travel Inspiration	.397	.000
3b	Covid-19 – Travel Replacement	.179	.021
4a	Travel Inspiration – Travel Attitude	.518	.000
4b	Travel Replacement – Travel Attitude	.144	.066

There are several interesting outcomes from these tests. First of all, while attitude and subjective norm seem to have a moderate, statistically significant relation with travel inspiration and – replacement, perceived behavioural control does not. In other words, it seems that this is the only personal aspect from the Theory of Planned Behaviour that does not affect whether a person would use MSFS to get inspiration for real tourism, or as a partial substitute. However, there is a large difference between *how* insignificant the relation between MSFS PBC and travel inspiration/replacement is, which is an interesting point for discussion in Chapter 6.

Furthermore, while splitting the original concept of substitute acceptance in two separate elements does not make much of a difference for the personal context (MSFS attitude and subjective norm), it does make a significant difference[2] for experience quality, travel attitude, and Covid-19. While further discussion of the meaning of these outcomes is absolutely required, these results indicate that aspects such as immersion and presence (i.e., experience quality) are more strongly correlated to travel substitution than travel inspiration, and that, conversely, seeing MSFS as travel inspiration relates much more strongly to travel attitude than seeing the simulator as a partial travel substitute.

As the qualitative data already suggested, there is a positive relation with travel replacement and travel attitude, but the statistical analysis shows that this relationship is not statistically significant. This calls into question the relationship between the different concepts again and requires further discussion. Lastly, the impact of Covid-19 on participants' MSFS use relates significantly stronger with Travel Inspiration than with Travel Replacement. This is noteworthy as the qualitative data shows that more users relate the travel restrictions connected to the pandemic to the ability of MSFS to substitute travel, rather than its ability to inspire travel.

The next chapter revisits all previous results and divulges if or why they matter and places them in a wider scientific context.

[2] Based on Diedenhofen & Musch's (2015) correlation comparison method.

6 Discussion

This chapter examines the results of the previous three chapters, discussing the findings in the context of existing literature in the next four sections. The last part, section 6.5, also considers the limitations of this research.

6.1 | Immersion and Experience Quality

"Your brain really thinks that the better the graphics are and the better the experience is, the more real." – Bart Knuiman [translated from Dutch]

6.1.1 Immersion

This research defined immersion on three different levels based on the work by Beck et al. (2019), in which the hardware used (ranging from a screen to a Head-Mounted Display) determines the level of immersion. The term 'immersion' was subsequently used to indicate the degree to which a user is isolated from the real world: a more systematic definition of the term. In contrast, 'presence', a main component of experience quality, signifies a feeling of 'being there', which is a more cognitive approach and consequently highly related to the particular user (Slater, 1999).

Lombard & Ditton (1997) list 'presence as immersion' as one of the conceptualisations of 'presence', detailing that it entails the feeling of being submerged in a virtual environment and confirming the presumed correlation between the two concepts. Klippel et al. (2021) add that this also means that this can cause confusion. The results of the survey data demonstrate that the objective, technical measurement of immersion and the more personal, cognitive state of mind representing experience quality did not relate, rejecting hypothesis 1.1 (a higher level of immersion leads to a higher experience quality). An explanation for this rejected hypothesis is thus required.

One factor that might explain the lack of a connection between the literature and the research findings is that 'experience quality' entails more than just a feeling of presence. It also includes vividness, resolution, interactivity, and accuracy of the virtual environment's representation of the real world. While these were measured through resolution and visual quality, this might not make a significant impact on the accuracy: the quality of the satellite data MSFS uses could, for example, be more impactful to the experience quality.

However, as presence is still such a large component of experience quality, this explanation might not be the only reason for the discrepancy. A final explanation can be found in the literature when the

overall research design is considered. Other studies that did not expose research participants to two or more different experiences (i.e., an between-subjects design) (see e.g. de Kort et al., 2006; Dillon et al., 2002) also failed to find a statistically significant correlation. Apparently, the ability to compare two different experiences (as would be the case with a within-subjects research design) makes people more consciously aware of their virtual presence.

The fact that participating MSFS users were asked specifically for their personal experience and setup signifies that they were only aware of their own specific MSFS configuration and experience. Self-reporting on single experiences might therefore be an insufficient measure of presence (de Kort et al., 2006), whereas immersion might have to be measured by more than just the technical aspects (i.e., HMD-peripherals-screen) (Steuer, 1992).

6.1.2 Experience Quality

Section 6.1.1 already mentioned the tenuous relation between immersion and experience quality. A more detailed discussion about the latter is in order, however, as it is an important aspect of the original Substitution Acceptance Model by Guttentag (2020) and plays an essential part in answering the research questions. While the survey measured the extent to which experience quality relates with substitute acceptance, the forum replies have provided more insight into why and how this relation is created.

One finding that was perhaps surprising is the role that personal context seems to play in increasing the experience quality, as exhibited by the different opinions on this aspect by the forum participants. IJsselsteijn (2004, p. 146) confirms that the level of 'presence', a vital part of experience quality, as a "product of the individual's brain", indeed varies highly based on individuals' needs, preferences, and experiences, as well as their expectations towards the technology used. Relating back to section 6.1.1, this perhaps also explains why 'technical immersion' alone as a measurement for immersion and as a basis for a relation with presence is insufficient.

A second aspect that came out of the qualitative data is the quality and accuracy of the virtual world. While opinions varied on whether MSFS was realistic or accurate enough, there are indications from users that this is indeed directly related to the quality of the experience, and that a perception of quality is linked to a perception of presence. According to existing research into VR, visual quality and content accuracy, together with the number of senses that are being addressed, are indeed highly correlated to presence and, subsequently, travel intention (Lee, Lee, Jeong, & Oh, 2020). This confirms the findings of the quantitative results, where perceived and technical visual quality, and presence are combined and affirms the usefulness of merging these factors into the concept of experience quality. Section 6.2 elaborates on the role of Substitute Acceptance as a mediator between these factors.

6.2 | Substitute Acceptance

"The sim [is] giving me the opportunity to see places that I just won't be able to get to in my lifetime." – RogueNT6482T

The concept of SA turned out to be a central part of this research, as it connects the two different theoretical frameworks (TPB and SAM) that were used. The qualitative findings and subsequent synthesis with the quantitative results led to a subdivision into 'travel inspiration' and 'travel replacement', which provided more insight into the relation of SA with the other concepts.

Travel inspiration (TI) signifies that a user feels inspired to visit new places by using MSFS. Agreement on this factor thus signifies that seeing and exploring destinations in the simulator invokes a feeling of wanting to travel to (these) locations in real life. Travel replacement (TR) is used to convey a seemingly opposite relation with MSFS, where virtually seeing and exploring places is deemed as sufficient substitution for real travel.

The word 'seemingly' in this sentence is important, however, as the results show that these two concepts are moderately ($R = .509$, $p = 0.000$) correlated. In other words, consideration of MSFS as either TI or TR is clearly related and cannot be completely separated from each other. This contrasts with previous studies into VT, where the focus was either only on TI (i.e., VT as a marketing tool, see e.g. Griffin et al., 2017 or Kim, Lee, & Jung, 2018) or the two concepts as diametrical opposites (see e.g. Li & Chen, 2019. There are several possible causes for this connection. One explanation might lie in the methods used to obtain the data; perhaps the question items that were used in the survey did not sufficiently distinguish between the two concepts (see section 6.4).

Another possible reason is that there is simply a conceptual overlap between providing a travel feeling (i.e., MSFS as TR) and getting inspired to travel (MSFS as TI). While literature on VT mostly covers the difference between the two, this explanation finds some theoretical support in the travel motivation literature: according to the Travel Career Ladder/Patterns (TCL/TCP) frameworks, people's travel motivation changes based on their (past) travel experiences (Hsu & Huang, 2008). Similarly, Boto-García (2020) demonstrated that travel can become a habit. This would indicate that a relation between the two could indeed be expected, as having a 'travel feeling' in MSFS might affect an individual's travel motivation, thus simultaneously satisfying a need for travel and serving to inspire travel.

This relation between the two sub-concepts means that the use of the overarching concept of SA is thus still justified when there are no significant differences in correlations with other factors. The following paragraphs examine the usefulness of either using SA or TI/TR to explain these correlations.

6.2.1 Experience and Substitute Acceptance

The correlation tests in Chapter 5 (see page 51) showed a significantly stronger correlation between experience quality and travel replacement (R = .589 at p = 0.000), than it did with experience quality and travel inspiration (R = .363 at p = 0.000). This seems to signify that the perception of presence, accuracy, and visual quality of the world in MSFS corresponds with a higher likelihood of accepting MSFS as a substitute. However, at the same time, it *also* increases the likelihood of being inspired to travel, albeit less so.

It is possible that this latter relation exists solely because of the strong relation between TI and TR, but this does not explain the difference in the strength of the relationship. The qualitative results provide a first way of shedding light on this, as one user (*Hjsmuc*) commented on how he could use other media to get inspired but used MSFS to relive moments of places he visited and liked. Considering this perspective would signify that experience quality is a key component in creating a travel feeling that stands on its own, rather than connected to real travel (i.e., serving as inspiration).

This assertion seems to find support in the literature. Deng, Unnava, & Lee (2019, p. 568) found that VR-styled websites that 'approximate reality' will weaken the desire to "engage in the experience promoted". Similarly, research by Li & Chen (2019) showed that a 'better' VR experience reduced people's travel intention. Both of these statements correspond to this study's finding that a higher experience quality positvely affects the willingness to accept MSFS as a travel replacement, although the results of this study do not replicate the finding that travel intention will be reduced as a consequence.

Lastly, the experience characteristics of MSFS should be taken into consideration here as well when generalising to VT in general. As detailed in Chapter 2 secton 2.4.3 (*Experience characteristics*), certain experiences lend themselves better to substitution than others. While this relation could not be tested statistically due to the aformentioned measurement error in the question pertaining to frequency of use, it makes sense to expect these results to be only valid for similar VT experiences where sitting down, seeing, and hearing are the main activity and senses used.

6.2.2 Personal Context and Substitute Acceptance

The words ‘personal context’ were used multiple times in Chapter 4 to indicate that a similar MSFS experience will have a different effect on users depending on their personal frame of reference. For example, while this study’s focus is on VT’s relation with a general desire to travel, the qualitative data shows that the particular destination that is ‘visited’ in MSFS matters in this context.

Specifically, a user’s existing familiarity with the destination might partially determine whether MSFS contributes to TI or TR. Based on the forum replies, it seems that familiarity with the destination reduces any negative effects that MSFS might have in a TI-context, i.e., when someone using MSFS knows the location that they are flying over from personal experience, the impression they get will not negatively affect any future travel intention to that destination.

While this phenomenon has not been observed in other VT studies, it corresponds with existing research in destination branding, which confirms that destination familiarity makes a significant impact on travel intention (see e.g. Chi et al., 2020; Murphy et al., 2007). In contrast, virtually flying over familiar locations does appear to serve two other functions: it provides users with the opportunity to revisit a destination digitally (i.e., enjoy a form of ‘nostalgia-tourism’) and it provides an anchor to the rest of the virtual world; giving a sense of scale and accuracy.

Although the survey did not include any items about destinations, the three TPB-concepts of attitude, subjective norm, and perceived behavioural control (PBC) were used as a surrogate for personal context in Chapter 5. The former two both indeed correlated with SA, with attitude showing the strongest relation. This somewhat corresponds with the findings of Rauscher (2021), who also identified a connection between enjoyment and VR-technology acceptance. Intuitively, this seems to make sense as well: whereas using MSFS for travel inspiration turns the simulator into a tool, or a means towards the goal of real travel, using it as a travel replacement requires the product to be (more) enjoyable on its own. MSFS, in that regard, needs to *be* the goal, instead of the instrument.

Furthermore, while there was no significant difference in correlation size for the connection between attitude and TI/TR, the research by Li & Chen (2019) stated that enjoyment directly correlates with travel intention, although this effect was mitigated when the expected enjoyment of a destination was low. Using SA as an intermediate step between attitude and travel intention shows that not only travel intention increases through TI, but that a positive attitude towards VT might simultaneously be linked with an increase in considering the VT content as a travel replacement.

Lastly, PBC showed no correlation with SA. This means that whether a user feels in control over his or her MSFS experience bears no relation with whether he or she is likely to use MSFS for travel inspiration or as a travel replacement. As other VT studies (e.g. Han et al., 2014) did find a relationship between PBC and intentions, this could mean that PBC is not a sufficient substitute for personal context and only relates to intention to use the VT-alternative, which was not measured.

6.2.3 Covid-19 and Substitute Acceptance

Lastly, the results showed that Covid-19 has a significantly greater correlation with TI than with TR, while users mostly mention that they often see MSFS as a partial substitute due to the current travel restrictions. While these two findings are seemingly in opposition to one another, perhaps they show that MSFS users who are more frequent travellers are more likely find travel inspiration in MSFS at a time when real travel is made very difficult.

Schiopu, Hornoiu, Padurean, & Nica's (2021) recent findings on the effects of Covid-19 on VT confirm the qualitative findings of this study that the pandemic does increase the perception of VT as a travel replacement. However, while they argue that this might mean that future travel might be replaced more frequently by VT, the findings of this research clearly oppose that statement due to the strong relation between TR and TI, and the lack of a connection from TR to travel attitude.

6.3 | Subjective Norm, PBC, and Travel Attitude

"I do not see simming as a "substitute", but it does fill the need many times of going places." - Kapitan

Travel attitude is the only element of the TPB model related to travel that shows a significant relation with travel intention and, at the same time, with travel inspiration (TI). On the other hand, subjective norm and perceived behavioural control did not correlate with travel intention. This section explores why this might be the case and how this is relevant for the final conclusions.

6.3.1 Subjective Norm and Perceived Behavioural Control

While the TPB model predicts that all three of its constituent factors predict an intention to perform certain behaviour, the survey results found no such correlation for subjective norm and perceived behavioural control in relation to travel intention. While measurement errors are certainly a possible explanation for this discrepancy, the foundation upon which the survey questions were built makes this improbable and the assumption that the methods applied were adequate calls for a more profound explanation.

Starting with subjective norm, the results indicate that social pressure is not a contributor to MSFS users' travel intention. This contrasts with many other studies using this model (Hsiao & Yang, 2010; McEachan et al., 2011) that found a small to moderate, direct correlation between subjective norms and intention. However, Yeh, Guan, Chiang, Ho, & Huan (2021) observed a lack of evidence to support the subjective norm-travel intention connection, and instead found that an individual's perception of social influence relates much more strongly to that person's attitude, rather than directly to the behaviour itself. This corresponds to a study by Han et al. (2014) where golfers' intention to play screen golf was also found to be mediated by attitude.

Where Yeh et al. (2021) did find a correlation between PBC and travel intention, no such relation was found in this study's quantitative results either. Other studies that used the TPB framework strongly contrast this, as PBC was found to be the strongest TPB-factor that predicted (travel) intention (Nguyen & Coca-Stefaniak, 2020; Sánchez-Cañizares et al., 2020; Wang et al., 2021). It must be concluded that this is an anomaly that is specific to this research and its research sample. Lastly, the usefulness of subjective norm and perceived behavioural control as predictors for travel intention were also recently called into question by Sarkady, Neuburger, & Egger (2021). They inferred that the global travel restrictions due to Covid-19 make these factors too uncontrollable and thus perhaps ineffective in constructing a model for travel intention during these times.

6.3.2 Substitute Acceptance and Travel Attitude

As mentioned above, travel attitude is the only factor that correlated with travel intention. Furthermore, SA also correlates positively with travel attitude, forming a bridge between the two conceptual models (SAM and TPB) that were applied. The cross-correlation test mentioned on page 30 shows that the relation between these variables is indeed stronger by including substitute acceptance, which corresponds to the theory by Tussyadiah et al. (2017) (see Chapter 2 page 13, *Experience Quality*) that presence and attitude changes are related. However, the rejected hypothesis that accepting MSFS as a travel substitute would negatively correlate with travel attitude led to the finding that only TI is related to travel attitude. This introduces the question of what effect MSFS, and by extension VT, has on travel intention: should consideration of MSFS as TR mean that a user will travel less?

First and foremost, both the qualitative and quantitative data confirm that MSFS is capable of evoking a strong travel feeling for certain users, providing a sense of 'being there'. Whether or not this means that it could be considered a replacement for specific travel experiences (i.e., 'exploring new areas' for MSFS) might not be as relevant as previously thought when contemplating future travel intentions. Clearly, MSFS users do not change their travel plans based on whether they consider the simulator as

such. If anything, the relation between TI and TR signifies an increase in travel intention, but certainly not a reduction.

If the findings for MSFS are representative for VT in general, it would place previous research into context where the relation between substitution and travel intention (see e.g. Dewailly, 1999; Guttentag, 2010, 2020) was postulated. The 'double edged sword' as described by Li & Chen (2019), might be a lot blunter than thought: they foresaw a certain risk in using VT for destination marketing due to its potential to replace travel. However, the results from this study show that people might just make different travel choices based on VT but will not travel less.

Iswahyudi, Azlan, & Azlan's (2021) research on VT's potential use post-pandemic indeed confirms that VT provides an additional channel through which people might find out travel information. VT might therefore only 'replace' travel that might be otherwise unattainable due to certain restraints (e.g., money, time, or pandemics) as per Sung, Lee, Kim, Kwon, & Jang's (2000) suggestion with regards to the potential benefits of VT.

6.4 | The potential of virtual tourism from home

"As a tool to learn a lot more about the places that you're going to go to I think [MSFS] is amazing. It's one of those really unique games that comes around once every 20 years. The technology behind it to fully recreate the world to almost perfect detail... There are a lot of cool things that you can do with it that we even haven't thought of yet." – Patrick Machado

The results discussed so far provide insight into the relation between MSFS and travel intention, where the flight simulator has been used as a surrogate for virtual tourism in general. However, to what extent can these findings truly be generalised, and what do they mean for the potential future role of VT?

6.4.1 Demographic deliberation

While section 6.5 delves deeper into the bias and statistical significance of the research sample, it is also important to consider the unique characteristics of MSFS and its users. Starting with the latter, the research sample and coinciding comparison with Navigraph's survey showed that an overwhelming percentage (98.8% - 96.9% respectively) of users is male. While this shows a clear gender imbalance, it coincides with the many studies that report a preponderance of males playing video games (Rehbein et al., 2016), overall more positive attitude towards technology (Cai et al., 2017), and preference for careers in aviation (Turney, 2000).

The age and nationality of respondents also reveal more about MSFS users. The average age is reported to be around 47 – 44 years old based on research sample and the Navigraph survey. While respondents were not asked directly for their income level, median income is at its highest between 40 and 50 years old (Boshara et al., 2015). Respondents are also largely located in developed, wealthy countries: all nationalities in Table 1 (page 20) either North American or European. This finding leads to the assertion that using MSFS requires an certain disposable income, especially considering the associated high costs for the hardware (personal computer and peripherals) required to run the flight simulator (Grubb, 2020).

These findings thus show that MSFS is a very niche product in more ways than just being a hobby facilitator as established in the qualitative results. Dewailly (1999) warned about a potential future where only wealthier individuals could afford real travel while the rest would have to be content with virtual tourism experiences. Ironically, then, the opposite is currently (also) true: virtual travel from home in the form of MSFS is only accessible to those who can afford it. Similarly, MSFS does not seem to appeal to females, i.e., generally half of the world's population. While other VT products might lay the focus on something else besides aviation, the technological, immersive, and interactive nature of VT in general might lead to a difference in appeal between genders.

6.4.2 MSFS as a virtually embodied digital twin and the future of virtual tourism

The research findings have also shown that this interactive and immersive nature of VT is represented in MSFS by providing a perspective from the pilot, interacting with the airplane to navigate through the virtual world. As the results show, this conveys a sense of scale and a 'grounded' feeling unlike other media forms (see Chapter 4 section 4.3) and might contribute to a sensation of virtual embodiment: extending the mental self to a non-physical body, also known as an avatar (Bailey et al., 2016). This perspective leads to a more embodied cognition, a mental processing of information through interaction of the mind and the body (*Ibid.*).

MSFS also enables users to interactively preview any destination on the planet. By using satellite data, photogrammetry, live airplane visualisation, and live weather information, it displays characteristics of a digital twin: an aspect of MSFS that has only briefly been mentioned by Jorg Neumann in the qualitative results. A digital twin is a "high-fidelity model or a digital equivalent of physical object" (Jiang et al., 2021, p. 37), mirroring or 'twinning' these physical entities and thus becoming a virtual counterpart (Barricelli et al., 2019).

This entails that MSFS could be considered one of the first virtually embodied digital twins of the earth that is accessible and desirable to (certain) consumers. Embodied digital twins are still a young discipline, but have been shown to facilitate learning through an immersive visualisation of the

connection between the physical and virtual world (Klippel et al., 2021). Users might be able to perceive themselves as subjects inside the virtual world, leading to a higher sense of presence and immersion (Schultze, 2010).

If MSFS is seen as a precursor of future VT experiences, this might mean that physical and virtual worlds might become more connected with a higher sense of presence in VT applications. Based on the interviews with Jorg Neumann and Bart Knuiman, technological development seems to be headed in a direction where VT could become more accessible through HMDs and augmented reality (AR). VT might thus become more common while projecting one's presence while the body stays in place (i.e., telepresence) has already become more commonplace; a development that started before the pandemic and has only accelerated because of it (Weibel, 2020).

The research findings show that MSFS users will not want to travel less because of their virtual experiences but consider it a 'second best' option either as an addition to real travel or when the real alternative is out of reach. The glimpse of VT's potential might also make a combination possible: for example, experiencing the real journeys of friends or family members from home through a digital twin. This would enable the sharing of experiences in a more direct, embodied way than any current media could emulate. While it might be some time before this imagined application might become accessible to the general public, tests of the reverse have already been done by Leuze & Leuze (2021), where MSFS planes were projected live into the real world through AR.

6.5 | Methodological reflections

This thesis used a combination of qualitative and quantitative methods, which each provide a slightly different perspective thus aiding in triangulation. At the same time, there are limitations to the research that need to be addressed for full disclosure. Each method is discussed separately below.

6.5.1 Using online discussion forums for data collection

The argument for using online discussion forums for data collection was primarily to gather a varied (representative) research sample of a very specific group: MSFS users. In that sense, the method has proven very effective as there were enough users that voluntarily became research participants without any other incentive but to contribute to the research. The fact that all interaction with participants was mostly anonymous and in written form made the conversations very direct with very little small talk or deviations from the topic, meaning that many forum replies were very dense in information. However, there were also some disadvantages of this method that might have skewed the results.

First and foremost, the voluntary nature of the method combined with the research focus probably means that there is a certain bias in the research sample. MSFS users that are interested in travel and tourism are more likely to have participated than those that are mainly using MSFS for the aviation aspect of the simulator. A similar assessment can be made with the more general choice to use an online text-based method, which by definition relies on participants' computer skills and available time as per the aforementioned issues addressed by Im & Chee (2006). However, as MSFS is installed on a personal computer and needs a fast internet connection to work, meaning that the research population needs to possess certain computer skills and hardware, this might not have created a particularly strong bias in this specific research.

Probing participants for more information proved to be challenging, as non-response or partial response to probing questions was quite common. This means that participants are mostly in control of the quality and depth of the information that they are willing to share. This also relates to the next point: there is no non-verbal insight into the characteristics of participants, which means that age, nationality, gender, experience, and other features that might give cues to participants' thinking were obscured. Lastly, despite some level of anonymity in the form of usernames, users are aware that they write on publicly accessible forums, which affects confidentiality. While the research usually did not lead to any highly personal information being disclosed, two users did feel more comfortable to continue a conversation in private messages when they wrote about their personal history with travel and MSFS.

6.5.2 Survey construction and sampling

As the forums were used to distribute the survey, the latter might have been affected by the former's bias, meaning a bias towards users that are interested in travel probably exists within the survey sample as well. The sample is also biased in other ways, as described in Chapter 3 (page 19). A nonprobability sample was used, i.e., by convenience, to increase the sample size in a short amount of time. The use of Dutch forums had a specific advantage in the sense that the researcher's native language was utilised to further increase the size of the research sample in both the qualitative and quantitative data collection. However, it also caused a bias in the sample. While the exact effect of nationality on the survey answers is unknown, it is still important to take into account when generalising the results.

Moreover, and despite increasing the size of the research sample by the inclusion of Dutch forums, the sample (N = 164) can still be considered small for statistical purposes. This might mean that the effect sizes that were measured might be overestimated, and the results might be less reproducible (Button et al., 2013). However, Bacchetti (2013) argues that an overemphasis on sample size and a p-value lower than 0.05 can occlude other research issues and recommends distinguishing between the different p-values (e.g. $p = 0.049$ and $p = 0.001$) instead of considering '$p<0.05$' as sufficient. While this does not

fully negate the effect of a small sample size, this recommendation should be taken into consideration as well.

While the issue of bias and sample size might simply be inherent to the nature of doing research with limited budget and time, the survey had several faults that, in hindsight, might have been avoided. The measurement of the main concepts such as experience quality, attitude, and travel intention was all done correctly. However, the operationalisation of 'user characteristics' and 'expertise' to answer H2.2. ('Familiarity with the content presented in MSFS (either destination-specific or piloting experience) will correspond to a lower acceptance of MSFS as a substitute to real travel, and vice-versa') was flawed. While participants were only asked for their familiarity with aviation, they should have also been asked for their familiarity with tourism, for example by asking for their travel habits and/or frequency. Although the inclusion of other personal characteristics (elements from the Theory of Planned Behaviour and demographics) slightly negated this issue, some valuable insights might have been lost by this oversight.

The measurement and subsequent division of Substitute Acceptance into Travel Inspiration and Travel Replacement might also affect some of the results. The overall concept was measured with six items, one of which ('4.1 I prefer really traveling instead of traveling in MSFS') was omitted, while the separation into two concepts after the results were known left only two items for TI and three for TR. Considering the moderate (R = .509) correlation between the two, it remains unknown whether the question items captured each concept sufficiently.

Lastly, question 11 (representing the concept 'experience characteristics') asked how often participants used MSFS but used a measurement scale that did not cover the full range of possible responses. Almost two-thirds of respondents answered that they used MSFS "15 times or more" in the last thirty days, which makes it impossible to know whether that means once a day, twice a day, or more. Despite testing the survey before publication, how often MSFS users use the simulator was vastly underestimated. If the question would have asked for frequency of use per week instead of per thirty days, this error might have been avoided.

6.5.3 Direction of relations

The direction of the different conceptual relations also needs to be discussed. The Theory of Planned Behaviour and the Substitute Acceptance Model both have arrows connecting the different concepts, indicating a certain direction in the relationship. This signifies causality, or one factor causing the other to change. However, as indicated previously, it cannot be overemphasised that no causal claims can be made based on the research findings.

For example, it might very well be that an individual's travel attitude is among the reasons why that individual seeks travel inspiration or, in certain cases, travel replacement in VT. Using Collins' (2004) reflections on counterfactual thinking as inspiration, if experience quality transitively (through changing substitute acceptance and travel attitude) causes travel intention to change, then the travel intention would not be as high for participants that do not see MSFS as travel inspiration. It is certainly *possible* that MSFS contributes towards an individual's travel attitude, of course, but it cannot be concluded solely based on the research evidence that was gathered.

All that can be stated with certainty is that the hypothesis tests show that certain concepts are associated with each other, not that one specific concept precedes the other and thus causes change. The directional arrows in the revised conceptual model in the next chapter (Figure 7 on page 68) are thus based on those depicted in the TPB and SAM, whereas the relations are confirmed by this thesis' research data.

7 Conclusion

7.1 | Sub-questions answered

The six sub-questions that were presented in the introduction were as follows:

1. What are the characteristics of MSFS' users?
2. What are the potential factors that might influence travel intention in relation to VT/MSFS?
3. To what extent do these factors correspond with a higher intention to travel?
4. Under what conditions do these factors correspond with a higher intention to travel?
5. To what extent do these factors correspond with a lower intention to travel?
6. Under what conditions do these factors correspond with a lower intention to travel?

The research findings revealed that many MSFS users consider their activity a hobby based on an interest in aviation and travel. For some, it enables a dream of becoming a pilot without the associated costs and time investment, while others use it to digitally explore the world for the same reasons. Unlike many other media, it enables a feeling of presence through the perspective of a pilot in an airplane. However, many users complement their MSFS sessions with other media to create a richer experience.

MSFS users are overwhelmingly male, middle-aged, and located in wealthy countries. The gender asymmetry can partially be explained by the fact that, at its core, MSFS can be considered a videogame focused on aviation, thus attracting a male audience. However, the average age and prevailing nationalities also indicate that MSFS is not accessible to just anyone. It requires a certain dedication and ability to invest time and money; something which might only be reachable by those who possess the means.

This leads to the factors that affect travel intention in relation to MSFS as a VT experience. While the VT experience quality became central to this research due to the continuous improvements in technology over the last decades, the research findings show that personal context plays a very substantial role as well. In fact, the findings seem to indicate that the specific activity and destination, combined with attitude towards the VT experience, subjective norm surrounding the VT experience, and barriers to real travel such as the recent Covid-19 travel restrictions have an equal if not greater effect than experience quality.

The subsequent relation with travel intention also leads to some interesting findings. This research has found no relation, positive or negative, with seeing MSFS as a travel substitution and (real) travel intention. This calls into question what 'substitution' actually means in a VT-context: does it mean only

that a virtual experience approximates a real experience, or does it mean that this can consequently replace that real experience as well? While the findings show that MSFS can perform the former when it comes to seeing places (i.e., a small part of the full travel experience), it does not lead users to desire real travel any less.

However, there are indications that while desire for travel does not decrease based on the VT experiences, it does replace real tourism when users do not see real travel as a desirable or viable option. Revisiting destinations (i.e., 'post-tourism experiences') in MSFS might satisfy a certain desire for nostalgia. Similarly, while the measurement of Covid-19 impacts on real travel did not result in a reliable measure for the survey, the forum replies indicate that some users do see MSFS as a way to alleviate the desire for travel when considering barriers such as the Covid-19 pandemic, costs, or time. This confirms the earlier assertion that personal context is highly influential when considering VT and travel intention.

The capability of MSFS to inspire travel is also made clear throughout the research findings, though equally dependent on the individual user. While some get their travel inspiration from other sources, others use the simulator as a tool to inspect or gain ideas for potential future travel destinations. Some of these users consciously select places to virtually explore based on their ability to travel there, showing that the aforementioned barriers also work virtually: not only can MSFS simulate the exploration of new places when certain barriers for real travel exist, these same barriers can also affect virtual destination choice.

7.2 | Central research question answered

The central research question of this thesis reads:

"How does the use of Microsoft Flight Simulator correlate with the travel intention of its users?"

The quantitative and qualitative findings indicate that MSFS is connected to travel intention through travel attitude, travel inspiration, and experience quality. However, this varies strongly between individuals which means that personal context such as the specific destination, subjective norm, and attitude towards MSFS, are strong factors affecting this correlation. Those users that use MSFS to determine new destinations to travel to exhibit a higher intention to travel, while the opposite effect has not been observed: considering MSFS as a partial travel replacement does not affect travel intention.

However, this finding requires some elaboration. Despite this study's initial premise, seeing MSFS as either travel inspiration or a travel replacement is not mutually exclusive. This means that there is a

certain degree of overlap between the two considerations, as captured by the concept of substitute acceptance. Furthermore, MSFS can convey a travel feeling and a perception of presence in the virtual world and in that sense replaces a small part of what constitutes travel. With all results indicating that this will not decrease users' interest in real travel, MSFS thus enables users open to this experience (i.e., based on personal context) to travel more than they usually could, instead of considering the simulator as 'good enough'.

The use of a quantitative survey with closed questions, open online forum discussions, and three semi-structured interviews yielded results that enabled triangulation and required a reassessment of the original hypotheses and, consequently, the conceptual model proposed in Chapter 2 (page 10). The expected relations between VT and travel intention are different than what was expected based on existing literature. This provides an opportunity to propose a new conceptual model based on the research findings in Figure 7 below.

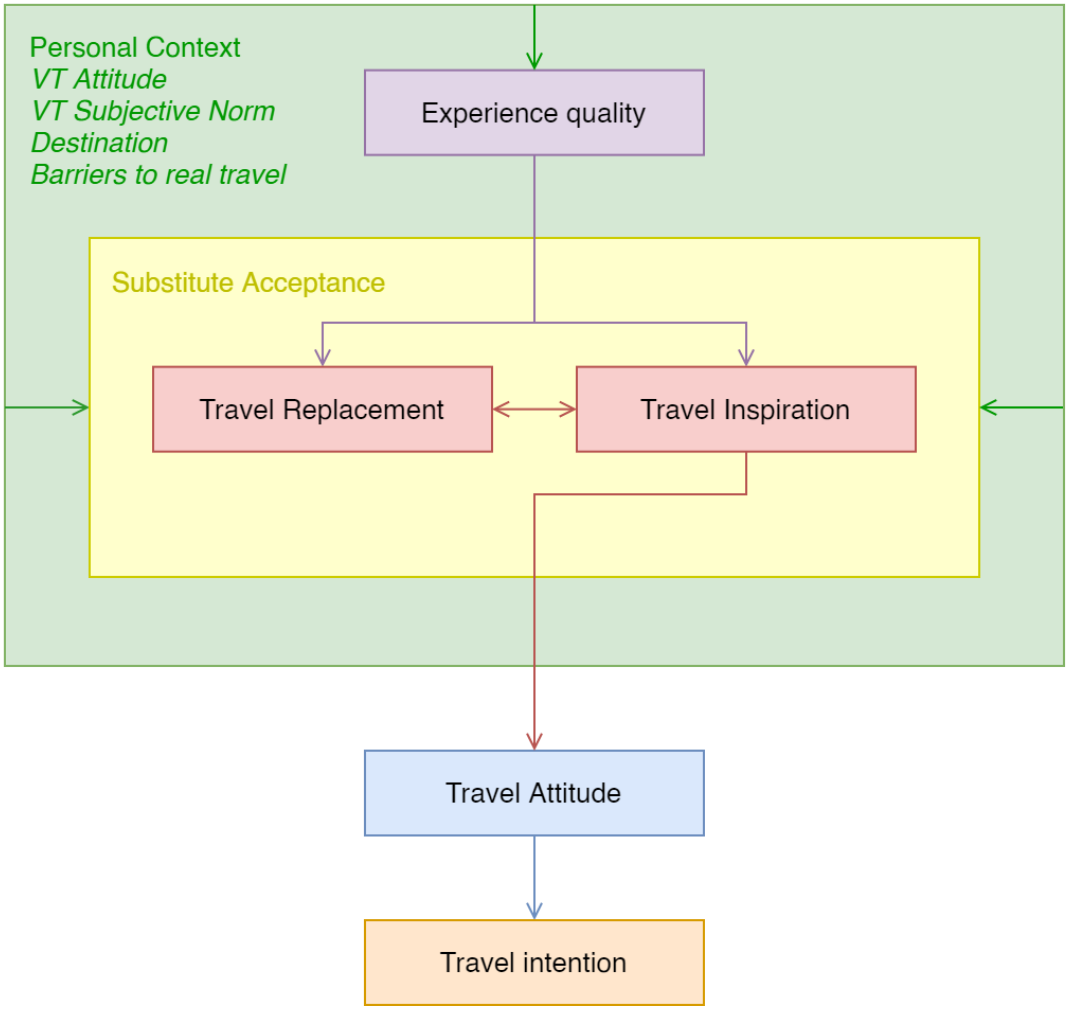


Figure 7: Newly proposed conceptual model based on research findings.

The foundation of this model is still based on Guttentag's (2020) Substitution Acceptance Model and Ajzen's (1991) Theory of Planned Behaviour but differs from the original on page 10 in several ways. First, it omits the factors that were either not measured correctly or showed insignificant results, such as experience characteristics, level of immersion, and perceived behavioural control. Furthermore, it combines the individual elements that were found to contribute significantly to substitute acceptance from the quantitative and qualitative data into 'personal context' and shows the significant influence of this factor. Lastly, it shows how substitute acceptance comprises two different factors that are connected, yet different in their connection with travel attitude and travel intention.

While Guttentag's (2020) SAM and Ajzen's (1991) TPB explain VT substitute acceptance and behaviour intention, respectively, combining the two provides a useful basis to elucidate the relation between virtual - and real tourism. To understand this relation is important. Despite the finding that VT is unlikely to replace real tourism, VT still has a function in tourism's transformation towards a more sustainable modus operandi. For many people around the world, leisure travel has become a recent(ly accessible) desire in the last decades; a newly acquired freedom that, once it becomes more habitual (Boto-García, 2020), might be harder to reduce again (McKercher et al., 2010).

VT cannot replace travel and might thus not reduce the negative impacts of tourism; however, it could satiate this travel appetite by providing a travel feeling of far-away (carbon-intensive) or sensitive destinations, substituting real travel to these places. This will not lessen the desire to travel altogether but could reduce the need to undertake environmentally or socially undesirable travel. Conversely, VT might be capable of encouraging people to travel to nearby and resilient locations – depending on personal context.

The social, environmental, and economic benefits of tourism mentioned in Chapter 1 (section 1.2.1) should be sustained and made accessible to the multitudes around the world that still lack the means to enjoy leisure travel. However, to avert an 'end of tourism' (Burns & Bibbings, 2009), more radical ideas such as VT could be explored to aid in solving tourism's 21st century issues. As this thesis has demonstrated, virtual tourism can inspire travel: perhaps then, it could inspire to travel differently.

7.3 | Practical implications

This thesis aimed to assess the potential of virtual tourism from home to complement or substitute real tourism. The research shows that MSFS could be considered an embodied digital twin of the earth that is accessible and desirable to consumers. As a proxy for VT from home, MSFS demonstrates that VT is related to an increased intention to travel and can function as a tool to preview or digitally explore potential destinations. This appears to be a positive finding for the tourism industry as a whole, as the idea that VT might replace real travel (Cheong, 1995) seems to be dismissed. Similarly, there might be

a future potential for the industry to use this data for a wide range of applications, ranging from visitor forecasts to destination design.

However, MSFS users also indicate that they select destinations based on their virtual experiences. While this does not affect their general travel intention, it might affect destinations that are not represented (accurately) in the simulator based on the finding that experience quality correlates with using MSFS as travel inspiration. Extending this finding to VT in general, wealthier destinations with available resources such as accurate satellite data, photogrammetry, and connections to VT experience providers might be more capable of tapping into this new form of media than less resourceful destinations. The quality and subsequent marketing effect of VT's supply side might thus become biased towards wealthier places and countries.

In a similar manner, the demand side, i.e., the virtual tourist, is also currently biased towards those who can spend time and money on the materials needed to experience VT at home. Ironically, while individual barriers such as available time and money might make VT a viable alternative or 'second best' option to real travel, this means that MSFS as a VT experience is not accessible by those who lack the funds and time to invest in the hardware and experience. Future technological developments such as an increased usage of cloud computing and cheaper hardware might make VT more accessible.

This raises Dewailly's (1999) question of whether real travel could reduce negative environmental effects of travel, or simultaneously become an exclusive activity for the wealthier individuals in society while others are left behind to experience travel virtually. Based on the research results, the former is only likely to occur if the perceived barriers for real travel become too great, as was the case during the Covid-19 pandemic. However, VT alone does not seem to satisfy a desire to travel, thus might only function as a replacement while these barriers are in place. In other words, VT only contributes to the aim of sustainable tourism development as a way to alleviate people's travel desire when real travel is not an option, but cannot persuade people to choose a digital alternative when the real option is available and within an individual's reach.

The second prediction relating to real travel being accessible only for the wealthy seems only applicable to certain destinations or activities. Individuals that perceive barriers to travelling to faraway destinations or participating in costly activities might be more willing to accept a virtual substitute. These people will not be 'left behind'; incapable of traveling in reality, as they will simply choose to travel to places that suit their means and needs. Instead, they can travel more by using VT technology, perhaps following a relative or acquaintance on a journey through digital twinning.

Lastly, at the time of writing (June 2021), some countries are cautiously reopening their borders again after strict travel bans due to the Covid-19 crisis (Leicester, 2021),. This might make this thesis look

less relevant than during the height of the pandemic. However, regardless of whether the world is about to close this chapter of history, future pandemics are becoming more likely (Ardrey, 2020; Gill, 2020). If the tourism industry is looking for an opportunity to increase its resilience against such calamities, VT could be a way to generate income and/or public interest without requiring tourists' physical presence.

7.4 | Suggestions for future research

The findings are relevant for the study of virtual tourism, as personal context was found to be such an important factor in how VT is experienced and influences intentions. While experience quality might change in the future due to continuous technological development, individuals' personal context can be expected to be more stable, especially in terms of destination experience. As this finding is based on qualitative data, subsequent studies interested in researching the effects of VT could add this element separately to uncover the strength of this relationship. Similarly, accepting VT as a replacement and/or as travel inspiration might relate to other personal characteristics, such as travel experience, that were not measured in the survey either.

Furthermore, this research can only empirically confirm the existence of correlations between the different factors in the (revised) conceptual model. Future research could set up experiments with MSFS and a control group to assess causality. Such research would be costly due to the required hardware, but it would aid greatly in further understanding the effects of VT and could also examine the effects of small differences in the immersion level, experience quality, and personal context on travel intentions.

An unexpected finding concerned the mixed use of MSFS and other media such as video, Google Streetview, and Google Maps to create a richer VT experience. How this combined experience adds to the total experience and relates to travel inspiration and replacement might be an interesting topic for future research. In addition, the relations between travel intention, experience quality, and personal context presented in Figure 7 (page 68) could prove interesting for marketing researchers. MSFS users already use their VT experiences to discover and determine places to travel to. If VT becomes more widely accessible in the coming decade, its impact on destination choice – and similarly, how VT experiences fit into the consumer decision-making process as an alternative to real travel – should be relevant for tourism organisations.

Finally, this thesis considered the potential of VT from home, which has the unique property of allowing frequent and relatively unhindered access to VT experiences. As examining the effect of use frequency was impeded due to measurement errors, researching its effects on substitution acceptance and travel intention would still be highly relevant as technological developments also promises VT at home becoming more accessible.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review*, *6*(2), 107–122.

Ajzen, I., & Fishbein, M. (2005). *The influence of attitudes on behavior.*

Anthes, C., García-Hernández, R. J., Wiedemann, M., & Kranzlmüller, D. (2016). State of the art of virtual reality technology. *2016 IEEE Aerospace Conference*, 1–19.

Antonakis, J., Bendahan, S., Jacquart, P., & Lalive, R. (2010). On making causal claims: A review and recommendations. *The Leadership Quarterly*, *21*(6), 1086–1120. https://doi.org/https://doi.org/10.1016/j.leaqua.2010.10.010

Ardrey, T. (2020, March 25). *Epidemiologists have been warning of a coronavirus outbreak for years and say that another pandemic will happen again*. Bussiness Insider. https://www.businessinsider.nl/epidemiologists-on-chances-of-future-coronavirus-outbreak-2020-3?international=true&r=US

Bacchetti, P. (2013). Small sample size is not the real problem. *Nature Reviews Neuroscience*, *14*(8), 585. https://doi.org/10.1038/nrn3475-c3

Bailey, J. O., Bailenson, J. N., & Casasanto, D. (2016). When Does Virtual Embodiment Change Our Minds? *Presence*, *25*(3), 222–233. https://doi.org/10.1162/PRES_a_00263

Barnes, S. (2016). Understanding virtual reality in marketing: Nature, implications and potential. *Implications and Potential (November 3, 2016)*.

Barricelli, B. R., Casiraghi, E., & Fogli, D. (2019). A survey on digital twin: Definitions, characteristics, applications, and design implications. *IEEE Access*, *7*, 167653–167671.

Beaver, A. (2012). *A dictionary of travel and tourism LK* (1st ed. NV). Oxford University Press. http://www.oxfordreference.com/view/10.1093/acref/9780191733987.001.0001/acref-9780191733987

Beck, J., Rainoldi, M., & Egger, R. (2019). Virtual reality in tourism: a state-of-the-art review. *Tourism Review*.

Boeije, H. R. (2009). *Analysis in Qualitative Research*. SAGE.

Bogicevic, V., Seo, S., Kandampully, J. A., Liu, S. Q., & Rudd, N. A. (2019). Virtual reality presence as a preamble of tourism experience: The role of mental imagery. *Tourism Management*, *74*, 55–64. https://doi.org/https://doi.org/10.1016/j.tourman.2019.02.009

Boshara, R., Emmons, W. R., & Noeth, B. J. (2015). *The Demographics of Wealth*. https://www.stlouisfed.org/~/media/files/pdfs/hfs/essays/hfs-essay-3-2015-age-birth-year-wealth.pdf

Boto-García, D. (2020). Habit Formation in Tourism Traveling. *Journal of Travel Research*, 0047287520964597.

Burns, P., & Bibbings, L. (2009). The end of tourism? Climate change and societal challenges. *Twenty-First Century Society*, *4*(1), 31–51.

Button, K. S., Ioannidis, J. P. A., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S. J., & Munafò, M. R. (2013). Power failure: why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, *14*(5), 365–376.

Cai, Z., Fan, X., & Du, J. (2017). Gender and attitudes toward technology use: A meta-analysis. *Computers & Education*, *105*, 1–13.

CBS. (2020). *Coronacrisis jaagt online winkelen aan in het tweede kwartaal*. https://www.cbs.nl/nl-nl/nieuws/2020/32/coronacrisis-jaagt-online-winkelen-aan-in-het-tweede-kwartaal

Chang, E., Kim, H. T., & Yoo, B. (2020). Virtual reality sickness: a review of causes and measurements. *International Journal of Human–Computer Interaction*, *36*(17), 1658–1682.

Cheng, S. (2017, April 19). *Google Earth now offers tours of the world's most obscure and interesting corners in new design*. Quartz. https://qz.com/962793/google-earth-now-offers-tours-of-the-worlds-most-obscure-and-interesting-corners-in-new-design/

Cheong, R. (1995). The virtual threat to travel and tourism. *Tourism Management*, *16*(6), 417–422. https://doi.org/https://doi.org/10.1016/0261-5177(95)00049-T

Chi, H.-K., Huang, K.-C., & Nguyen, H. M. (2020). Elements of destination brand equity and destination familiarity regarding travel intention. *Journal of Retailing and Consumer Services*, *52*.

Christmann, A., & Van Aelst, S. (2006). Robust estimation of Cronbach's alpha. *Journal of Multivariate Analysis*, *97*(7), 1660–1674.

Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. In *Advances in experimental social psychology* (Vol. 24, pp. 201–234). Elsevier.

Cipresso, P., Giglioli, I. A. C., Raya, M. A., & Riva, G. (2018). The Past, Present, and Future of Virtual and Augmented Reality Research: A Network and Cluster Analysis of the Literature. *Frontiers in Psychology*, *9*, 2086. https://doi.org/10.3389/fpsyg.2018.02086

Collins, J. (2004). *Ned Hall and LA Paul (Eds)(2004). Causation and Counterfactuals*. Cambridge: MIT Press.

Conner, M. (2020). Theory of planned behavior. *Handbook of Sport Psychology*, 3.

Crites Jr, S. L., Fabrigar, L. R., & Petty, R. E. (1994). Measuring the affective and cognitive properties of attitudes: Conceptual and methodological issues. *Personality and Social Psychology Bulletin*, *20*(6), 619–634.

d'Anastasio, C. (2020, August 21). *The Uncanny Escapism of "Flight Simulator 2020."* WIRED. https://www.wired.com/story/flight-simulator-2020-uncanny-escapism/

Damen, A. (2020, August 9). *Reizen in virtual reality: op vakantie vanuit je luie stoel* . AD. https://www.ad.nl/nlthuis/reizen-in-virtual-reality-op-vakantie-vanuit-je-luie-stoel~a195a00e/

de Kort, Y. A. W., Meijnders, A. L., Sponselee, A. A. G., & IJsselsteijn, W. A. (2006). What's wrong with virtual trees? Restoring from stress in a mediated environment. *Journal of Environmental Psychology*, *26*(4), 309–320. https://doi.org/https://doi.org/10.1016/j.jenvp.2006.09.001

Deng, X., Unnava, H. R., & Lee, H. (2019). "Too true to be good?" when virtual reality decreases interest in actual reality. *Journal of Business Research*, *100*, 561–570.

Dewailly, J. (1999). Sustainable tourist space: From reality to virtual reality? *Tourism Geographies*, *1*(1), 41–55. https://doi.org/10.1080/14616689908721293

Diedenhofen, B., & Musch, J. (2015). cocor: A Comprehensive Solution for the Statistical Comparison of Correlations. *PLOS ONE*, *10*(4), e0121945. https://doi.org/10.1371/journal.pone.0121945

Dillon, C., Keogh, E., & Freeman, J. (2002). It's been emotional': Affect, physiology, and presence. *Proceedings of the Fifth Annual International Workshop on Presence, Porto, Portugal*.

Dubois, L.-E., & Gibbs, C. (2018). Video game–induced tourism: a new frontier for destination marketers. *Tourism Review*.

Dwyer, L., & Forsyth, P. (1993). Assessing the benefits and costs of inbound tourism. *Annals of Tourism Research*, *20*(4), 751–768.

Eisinga, R., Grotenhuis, M., & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health*, *58*, 637–642. https://doi.org/10.1007/s00038-012-0416-3

Elkington, J. (1997). The triple bottom line. *Environmental Management: Readings and Cases*, *2*.

Epstein, A. (2020, September 28). *Just how popular were video games were during COVID-19?* . https://www.weforum.org/agenda/2020/09/covid19-coronavirus-pandemic-video-games-entertainment-media/

Ferster, B. (1998, April). *Previsualization for Feature Films*. POST Magazine. http://www.stagetools.com/previs.htm

Finck, B. (2020, August 11). *How COVID-19 is Changing the Global Video Game Business*. Medium. https://medium.com/super-jump/how-covid-19-is-changing-the-global-video-game-business-e485411f1a5f

Fischer, M. (2020, September 22). *Review: Microsoft Flight Simulator 2020 reinvents itself for a new decade of technological possibility*. GameCrate. https://gamecrate.com/reviews/review-microsoft-flight-simulator-2020-reinvents-itself-new-decade-technological-possibility

Forster, P. M., Forster, H. I., Evans, M. J., Gidden, M. J., Jones, C. D., Keller, C. A., Lamboll, R. D., Le Quéré, C., Rogelj, J., & Rosen, D. (2020). Current and future global climate impacts resulting from COVID-19. *Nature Climate Change*, *10*(10), 913–919.

Gill, V. (2020, June 6). *Coronavirus: This is not the last pandemic*. BBC News. https://www.bbc.com/news/science-environment-52775386

Godin, G., & Kok, G. (1996). The theory of planned behavior: a review of its applications to health-related behaviors. *American Journal of Health Promotion*, *11*(2), 87–98.

Goforth, C. (2015, November 16). *Using and Interpreting Cronbach's Alpha*. University of Virginia. https://data.library.virginia.edu/using-and-interpreting-cronbachs-alpha/

Greaves, M., Zibarras, L. D., & Stride, C. (2013). Using the theory of planned behavior to explore environmental behavioral intentions in the workplace. *Journal of Environmental Psychology*, *34*, 109–120. https://doi.org/https://doi.org/10.1016/j.jenvp.2013.02.003

Griffin, T., Giberson, J., Lee, S. H. M., Guttentag, D., Kandaurova, M., Sergueeva, K., & Dimanche, F. (2017). *Virtual reality and implications for destination marketing*.

Grubb, J. (2020, August 20). *Microsoft Flight Simulator could push PC-hardware spending to $2.6 billion*. VentureBeat. https://venturebeat.com/2020/08/20/how-microsoft-flight-simulator-could-help-stimulate-2-6-billion-spending-on-pc-hardware/

Güliz Uğur, N., & Akbıyık, A. (2020). *Impacts of COVID-19 on global tourism industry: A cross-regional comparison*. https://doi.org/10.1016/j.tmp.2020.100744

Guttentag, D. A. (2010). Virtual reality: Applications and implications for tourism. *Tourism Management*, *31*(5), 637–651.

Guttentag, D. A. (2020). *Virtual Reality and the End of Tourism? A Substitution Acceptance Model BT - Handbook of e-Tourism* (Z. Xiang, M. Fuchs, U. Gretzel, & W. Höpken (eds.); pp. 1–19). Springer International Publishing. https://doi.org/10.1007/978-3-030-05324-6_113-1

Haans, A., & IJsselsteijn, W. A. (2012). Embodiment and telepresence: Toward a comprehensive theoretical framework. *Interacting with Computers*, *24*(4), 211–218. https://doi.org/https://doi.org/10.1016/j.intcom.2012.04.010

Hamilton, K., van Dongen, A., & Hagger, M. S. (2020). An extended theory of planned behavior for parent-for-child health behaviors: A meta-analysis. *Health Psychology*, *39*(10), 863.

Han, H., Hwang, J., & Woods, D. P. (2014). Choosing Virtual – Rather than Real – Leisure Activities: An Examination of the Decision–making Process in Screen-Golf Participants. *Asia Pacific Journal of Tourism Research*, *19*(4), 428–450. https://doi.org/10.1080/10941665.2013.764333

Hargreaves, T. (2011). Practice-ing behaviour change: Applying social practice theory to pro-environmental behaviour change. *Journal of Consumer Culture*, *11*(1), 79–99.

Hassan, L. M., Shiu, E., & Shaw, D. (2016). Who Says There is an Intention–Behaviour Gap? Assessing the Empirical Evidence of an Intention–Behaviour Gap in Ethical Consumption. *Journal of Business Ethics*, *136*(2), 219–236. https://doi.org/10.1007/s10551-014-2440-0

Hollenbeck, J. R., & Wright, P. M. (2016). Harking, Sharking, and Tharking: Making the Case for Post Hoc Analysis of Scientific Data. *Journal of Management*, *43*(1), 5–18. https://doi.org/10.1177/0149206316679487

Holmes, O. (2020, August 21). *Take it from me, Microsoft Flight Simulator captures the joy of real flying* . The Guardian. https://www.theguardian.com/games/2020/aug/21/microsoft-flight-simulator-real-flying

Hsiao, C.-H., & Yang, C. (2010). Predicting the travel intention to take High Speed Rail among college students. *Transportation Research Part F: Traffic Psychology and Behaviour*, *13*(4), 277–287.

Hsu, C. H. C., & Huang, S. (2008). Travel motivation: A critical review of the concept's development. *Tourism Management: Analysis, Behaviour and Strategy*, 14–27.

Huang, Y. C., Backman, K. F., Backman, S. J., & Chang, L. L. (2016). Exploring the implications of virtual reality technology in tourism marketing: An integrated research framework. *International Journal of Tourism Research*, *18*(2), 116–128.

IJsselsteijn, W. A. (2004). *Presence in depth*. Technische Universiteit Eindhoven Eindhoven, The Netherlands.

Im, E.-O., & Chee, W. (2006). An online forum as a qualitative research method: practical issues. *Nursing Research*, *55*(4), 267–273. https://doi.org/10.1097/00006199-200607000-00007

Iswahyudi, I., Azlan, I., & Azlan, H. (2021). *Virtual Tourism In New Normal: Are People Going To Change Their Style Of Travel Temporarily Or Permanently?*

Iwaniuk, P. (2020, August 20). *Microsoft Flight Simulator review*. PC Gamer. https://www.pcgamer.com/microsoft-flight-simulator-review/

Jamison, J., Sutton, S., Mant, J., & De Simoni, A. (2018). Online stroke forum as source of data for qualitative research: insights from a comparison with patients' interviews. *BMJ Open*, *8*(3).

Jensen, J. L. (2010). Online tourism: just like being there. *Re-Investing Authenticity: Tourism, Place and Emotions*, 213–225.

Jensen, K. T. (2020, August 18). *Why Microsoft Flight Simulator 2020 Is This Year's Most Ambitious Game*. PCMag. https://www.pcmag.com/news/why-microsoft-flight-simulator-2020-is-this-years-most-ambitious-game

Jiang, H., Qin, S., Fu, J., Zhang, J., & Ding, G. (2021). How to model and implement connections between physical and virtual models for digital twin application. *Journal of Manufacturing Systems*, *58*, 36–51.

Kaiser, F. G., Hübner, G., & Bogner, F. X. (2005). Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior 1. *Journal of Applied Social Psychology*, *35*(10), 2150–2170.

Kim, M. J., Lee, C.-K., & Jung, T. (2018). Exploring Consumer Behavior in Virtual Reality Tourism Using an Extended Stimulus-Organism-Response Model. *Journal of Travel Research*, *59*(1), 69–89. https://doi.org/10.1177/0047287518818915

Klippel, A., Sajjadi, P., Zhao, J., Wallgrün, J. O., Huang, J., & Bagher, M. M. (2021). *Embodied digital twins for environmental applications*. Unpublished manuscript.

Koens, K., Postma, A., & Papp, B. (2018). Is overtourism overused? Understanding the impact of tourism in a city context. *Sustainability*, *10*(12), 4384.

Koh, E. (2020). The end of over-tourism? Opportunities in a post-Covid-19 world. *International Journal of Tourism Cities*.

Le Quéré, C., Jackson, R. B., Jones, M. W., Smith, A. J., Abernethy, S., Andrew, R. M., De-Gol, A. J., Willis, D. R., Shan, Y., & Canadell, J. G. (2020). *Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. Nat Clim Chang*.

Leach, M., Hennessy, M., & Fishbein, M. (2001). Perception of easy–difficult: Attitude or self-efficacy? *Journal of Applied Social Psychology*, *31*(1), 1–20.

Lee, M., Lee, S. A., Jeong, M., & Oh, H. (2020). Quality of virtual reality and its impacts on behavioral intention. *International Journal of Hospitality Management*, *90*, 102595.

Leicester, J. (2021, June 9). *France is back: Borders reopen to American tourists, others*. Associated Press. https://apnews.com/article/france-europe-coronavirus-vaccine-coronavirus-pandemic-lifestyle-5a3e32a35f13c90ba0b8b75967216c80

Leuze, C., & Leuze, M. (2021). Shared Augmented Reality Experience Between a Microsoft Flight Simulator User and a User in the Real World. *2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, 757–758. https://doi.org/10.1109/VRW52623.2021.00261

Li, J., & Hao, Z. G. (2010). Tourism planning based on Google Earth virtual earth platform. *Remote Sensing for Land & Resources*, *1*, 130–133.

Li, T., & Chen, Y. (2019). Will virtual reality be a double-edged sword? Exploring the moderation effects of the expected enjoyment of a destination on travel intention. *Journal of Destination Marketing & Management*, *12*, 15–26. https://doi.org/https://doi.org/10.1016/j.jdmm.2019.02.003

Lin, N., & Roberts, K. R. (2020). Using the theory of planned behavior to predict food safety behavioral intention: A systematic review and meta-analysis. *International Journal of Hospitality Management*, *90*, 102612.

Lombard, M., & Ditton, T. (1997). At the Heart of It All: The Concept of Presence. *Journal of Computer-Mediated Communication*, *3*(2). https://doi.org/10.1111/j.1083-6101.1997.tb00072.x

Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin*, *18*(1), 3–9.

Maessen, L. (2020, August 25). Microsoft Flight Simulator 2020 is overweldigend gedetailleerd. *NRC*. https://www.nrc.nl/nieuws/2020/08/24/scheer-dicht-over-de-alpen-bij-zonsondergang-a4009611

McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychology Review*, *5*(2), 97–144.

McKercher, B., Prideaux, B., Cheung, C., & Law, R. (2010). Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism*, *18*(3), 297–317.

https://doi.org/10.1080/09669580903395022

Melton, J. (2020, July 20). *The coronavirus pandemic lifts global online grocery sales*. https://www.digitalcommerce360.com/2020/07/20/the-coronavirus-pandemic-lifts-global-online-grocery-sales/

Minucciani, V., & Garnero, G. (2013). Available and implementable technologies for virtual tourism: a prototypal station project. *International Conference on Computational Science and Its Applications*, 193–204.

Morse, J. M. (2016). *Mixed method design: Principles and procedures* (Vol. 4). Routledge.

Murgante, B., Borruso, G., & Lapucci, A. (2011). Sustainable Development: Concepts and Methods for Its Application in Urban and Environmental Planning. In *Studies in Computational Intelligence* (Vol. 348, pp. 1–15). https://doi.org/10.1007/978-3-642-19733-8_1

Murphy, L., Benckendorff, P., & Moscardo, G. (2007). Destination brand personality: Visitor perceptions of a regional tourism destination. *Tourism Analysis*, *12*(5–6), 419–432.

Musil, S., & Pigel, G. (1994). Can tourism be replaced by virtual reality technology? In *Information and Communications Technologies in Tourism* (pp. 87–94). Springer.

Navigraph. (2020). *FlightSim Community Survey 2020 Final Report*.

Nesin, B. (2020, June). *Will Consumers Stick With Online Grocery? The Post-Covid World of US Online Grocery Growth*. https://research.rabobank.com/far/en/sectors/beverages/will-consumers-stick-with-online-grocery.html

Nguyen, T. H. H., & Coca-Stefaniak, J. A. (2020). Coronavirus impacts on post-pandemic planned travel behaviours. *Annals of Tourism Research*.

Peeters, P. (2017). Tourism's impact on climate change and its mitigation challenges. *How Can Tourism Become 'climatically Sustainable*.

Petty, N. (2013, October 21). *Proving causation*. Creative Maths. https://creativemaths.net/blog/proving-causation/

Rahming, A. K. (2020, September 9). *Microsoft Flight Simulator has let me go on vacation again*. PCInvasion. https://www.pcinvasion.com/microsoft-flight-simulator-vacation/

Ranasinghe, N., Karunanayaka, K., Cheok, A. D., Fernando, O. N. N., Nii, H., & Gopalakrishnakone, P. (2011). Digital taste and smell communication. *Proceedings of the 6th International Conference on Body Area Networks*, 78–84.

Rauscher, M. (2021). Virtual Reality in Tourism: Is it 'Real'Enough? *Academica Turistica-Tourism and Innovation Journal*, *13*(2).

Rehbein, F., Staudt, A., Hanslmaier, M., & Kliem, S. (2016). Video game playing in the general adult population of Germany: Can higher gaming time of males be explained by gender specific genre preferences? *Computers in Human Behavior*, *55*, 729–735.

Richardson, A. (2013). *Mental imagery*. Springer.

Riva, G., Wiederhold, B., & Molinari, E. (1998). An investigation into factors influencing immersion in interactive virtual reality environments. In *Virtual environments in clinical psychology and neuroscience* (pp. 43–51). IOS.

Romagosa, F. (2020). The COVID-19 crisis: Opportunities for sustainable and proximity tourism. *Tourism Geographies*, *22*(3), 690–694.

Routley, N. (2017, November 4). *Visualizing the Trillion-Fold Increase in Computing Power*. Visual Capitalist. https://www.visualcapitalist.com/visualizing-trillion-fold-increase-computing-power/

Rushe, D., & Lee, B. (2020, April 21). *Netflix doubles expected tally of new subscribers amid Covid-19 lockdown*. https://www.theguardian.com/media/2020/apr/21/netflix-new-subscribers-covid-19-lockdown

Sánchez-Cañizares, S. M., Cabeza-Ramírez, L. J., Muñoz-Fernández, G., & Fuentes-García, F. J. (2020). Impact of the perceived risk from Covid-19 on intention to travel. *Current Issues in Tourism*, 1–15.

Sarkady, D., Neuburger, L., & Egger, R. (2021). *Virtual Reality as a Travel Substitution Tool During COVID-19 BT - Information and Communication Technologies in Tourism 2021* (W. Wörndl, C. Koo, & J. L. Stienmetz (eds.); pp. 452–463). Springer International Publishing.

Schiopu, A. F., Hornoiu, R. I., Padurean, M. A., & Nica, A.-M. (2021). Virus tinged? Exploring the facets of virtual reality use in tourism as a result of the COVID-19 pandemic. *Telematics and Informatics*, *60*, 101575. https://doi.org/https://doi.org/10.1016/j.tele.2021.101575

Schmierbach, M., Limperos, A. M., & Woolley, J. K. (2012). Feeling the need for (personalized) speed: How natural controls and customization contribute to enjoyment of a racing game through enhanced immersion. *Cyberpsychology, Behavior, and Social Networking*, *15*(7), 364–369.

Schultze, U. (2010). Embodiment and presence in virtual worlds: a review. *Journal of Information Technology*, *25*(4), 434–449.

Scott, D., Amelung, B., Ceron, J.-P., Dubois, G., Gössling, S., Peeters, P., & Simpson, M. C. (2008). *Climate change and tourism: Responding to global challenges*.

Sharpley, R. (2020). Tourism, sustainable development and the theoretical divide: 20 years on. *Journal of Sustainable Tourism*, *28*(11), 1932–1946. https://doi.org/10.1080/09669582.2020.1779732

Shashi, M., & Jain, K. (2007). Use of photogrammetry in 3D modeling and visualization of buildings. *ARPN Journal of Engineering and Applied Sciences*, *2*(2), 37–40.

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*, *15*(3), 325–343.

Slater, M. (1999). Measuring presence: A response to the Witmer and Singer presence questionnaire. *Presence*, *8*(5), 560–565.

Solsman, J. (2020, October 20). *Netflix subscriber growth screeches to crawl, slowing more than expected* . https://www.cnet.com/news/netflix-subscriber-growth-slows-to-crawl-misses-expectations/

Spector, P. E., Cooper, C. L., Sanchez, J. I., O'Driscoll, M., Sparks, K., Bernin, P., Büssing, A., Dewe, P., Hart, P., & Lu, L. (2001). Do national levels of individualism and internal locus of control relate to well-being: an ecological level international study. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, *22*(8), 815–832.

Stainton, H. (2020, October 19). *Virtual tourism explained: What, why and where*. Tourism Teacher. https://tourismteacher.com/virtual-tourism/

Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication*, *42*(4), 73–93.

Stuart, K. (2020, July 30). *Microsoft's Flight Simulator is a ticket to explore the world again*. The Guardian. https://www.theguardian.com/games/2020/jul/30/microsoft-flight-simulator-game

Sung, P., Lee, Y., Kim, Y., Kwon, Y., & Jang, B. (2000). Development of virtual cyber-tour in the virtual reality system. *Asia Pacific Journal of Tourism Research*, *5*(2), 45–49.

Sussmann, S., & Vanhegan, H. (2000). *Virtual reality and the tourism product substitution or complement?*

Sutton, S. (1998). Predicting and Explaining Intentions and Behavior: How Well Are We Doing? *Journal of Applied Social Psychology*, *28*(15), 1317–1338. https://doi.org/https://doi.org/10.1111/j.1559-1816.1998.tb01679.x

Tangerman, V. (2019, March 15). *This Guy Spent a Whole Week In a VR Headset*. Futurism. https://futurism.com/guy-week-vr-headset

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Turney, M. A. (2000). Attracting women to aviation careers: What recent studies reveal. *The Collegiate Aviation Review International*, *18*(1).

Tussyadiah, I. P., Wang, D., & Jia, C. (Helen). (2017). *Virtual Reality and Attitudes Toward Tourism Destinations BT - Information and Communication Technologies in Tourism 2017* (R. Schegg & B. Stangl (eds.); pp. 229–239). Springer International Publishing.

UNWTO. (2005). *Making tourism more sustainable: A guide for policy makers*. World Tourism Organization Publications.

UNWTO. (2018). 'Overtourism'? Understanding and Managing Urban Tourism Growth beyond Perceptions Volume 2: Case Studies. In *'Overtourism'? Understanding and Managing Urban Tourism Growth beyond Perceptions Volume 2: Case Studies*. https://doi.org/10.18111/9789284420643

Van den Berg, H., Manstead, A. S. R., van der Pligt, J., & Wigboldus, D. H. J. (2006). The impact of affective and cognitive focus on attitude formation. *Journal of Experimental Social Psychology*, *42*(3), 373–379.

Wang, L., Wong, P. P. W., & Zhang, Q. (2021). Travellers' destination choice among university students in China amid COVID-19: extending the theory of planned behaviour. *Tourism Review*.

Weibel, P. (2020, March 20). *Virus, Viralität, Virtualität: Wie gerade die erste Ferngesellschaft der Menschheitsgeschichte entsteht | NZZ*. Neue Zürcher Zeitung. https://www.nzz.ch/feuilleton/virus-viralitaet-virtualitaet-peter-weibel-ueber-die-erste-ferngesellschaft-in-der-menschheitsgeschichte-ld.1547579

Whitten, S. (2020, July 16). *Netflix eager to restart production, has enough new content for 2020*. CNBC. https://www.cnbc.com/2020/07/16/netflix-eager-to-restart-production-has-enough-new-content-for-2020.html

Williams-Jones, P. B. (2020). *Zoom Meetings and the Need for Evolving Social Norms*. Observatoire International Sur Les Impacts Sociétaux de l'IA et Du Numérique. https://observatoire-ia.ulaval.ca/zoom-meetings-and-the-need-for-evolving-social-norms/

Yeh, S.-S., Guan, X., Chiang, T.-Y., Ho, J.-L., & Huan, T.-C. T. C. (2021). Reinterpreting the theory of planned behavior and its application to green hotel consumption intention. *International Journal of Hospitality Management*, *94*, 102827. https://doi.org/https://doi.org/10.1016/j.ijhm.2020.102827

Yung, R., & Khoo-Lattimore, C. (2019). New realities: a systematic literature review on virtual reality and augmented reality in tourism research. *Current Issues in Tourism*, *22*(17), 2056–2081.

Yung, R., Khoo-Lattimore, C., Prayag, G., & Surovaya, E. (2020). Around the world in less than a day: virtual reality, destination image and perceived destination choice risk in family tourism. *Tourism Recreation Research*, 1–16. https://doi.org/10.1080/02508281.2020.1788351

Appendices

1. Online survey

| Introduction

Welcome, thank you for participating!

This survey is about virtual tourism and travel intentions. By answering the following questions, you are contributing to scientific knowledge on virtual tourism experiences, enabling more people to enjoy the great feeling of traveling.

Please note: the survey is meant for anyone who has used the latest iteration of Microsoft Flight Simulator (hereafter abbreviated as 'MFS').

All questions are organised into four different sections representing four different topics. The instructions with each question should help you to understand the questions and answer options. Answering all questions should only take between 5 and 10 minutes.

Thank you so much for taking the time to fill out the survey,

Jochem Lips
Wageningen University & Research
The Netherlands

Only people who have used MFS at least once are able to participate. Have you used this simulator before?

- □ I have used MFS

Participants were required to check this item to continue as a way to ensure that they have read the introduction.

| Your MFS experiences

The following questions are about how you experience Microsoft Flight Simulator.
All agree/disagree items were measured on a 7-point Likert scale with the following options to choose from: Completely disagree (1), Disagree, Tend to disagree, Neither agree nor disagree, Tend to agree, Agree, Completely agree (7). All options were coded on a scale from 1 to 7 (Completely disagree – Completely agree).

1. Please indicate to what extent you (dis)agree with the following statements about your experience of MFS. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TT D 3	N 4	TT A 5	A 6	CA 7
When I am using MFS, I tend to forget about my present surroundings	*Measure experience quality*						
I think about my experiences in MFS as flying somewhere, instead of sitting at home							
I think about my experiences in MFS as traveling somewhere, instead of sitting at home							
I think the way in which the world is presented in MFS looks real							
I think the way in which the world is presented in MFS feels real							
I think that MFS is exciting	*Measure MFS attitude (affective and cognitive)*						
Whenever I use MFS, I feel satisfied							
I consider MFS a fun activity							
I consider MFS a relaxing activity							
I learn something about the world from MFS							
I think that MFS is a valuable activity							

2. Please indicate to what extent you (dis)agree with the following statements about your family and/or friends and MFS. To make it easier to answer this question, it helps to think of 'family and/or friends' as the people that are close(st) to you. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TT D 3	N 4	TT A 5	A 6	CA 7
I think that my family and/or friends find MFS interesting	*Measure social norm on MFS*						
My friends and/or family members also use MFS							
I think that my family and/or friends enjoy hearing about my experiences in MFS							
I care what my family and/or friends think of MFS							
I care what my family and/or friends think about my MFS experiences							

3. Please indicate to what extent you (dis)agree with the following statements about how you use MFS. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TT D 3	N 4	TT A 5	A 6	CA 7
MFS is easy for me to use	*Measure PBC*						
It is mostly up to me when I want to use MFS							
It is mostly up to me how I want to use MFS							
I could use MFS more often if I wanted to							
To increase the duration of my MFS sessions would be easy for me							

4. Please indicate to what extent you (dis)agree with the following statements about your opinion of MFS in relation to travel, which means travel for leisure or vacation. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TT D 3	N 4	TT A 5	A 6	CA 7
I would prefer really traveling instead of having a feeling of traveling in MFS	*Measure substitute acceptance*						
MFS makes me more interested in visiting certain places in the real world							
I feel inspired by MFS to really visit places that I have seen in the simulator							
MFS gives me a travel feeling							
I think that MFS provides me with a ‘real enough’ travel experience							
MFS allows me to see parts of the world that I would otherwise not see							

5. Please indicate to what extent you (dis)agree with the following statements about your use of MFS and the Covid-19 pandemic. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TT D 3	N 4	TT A 5	A 6	CA 7
I think that the current situation surrounding Covid-19 makes me want to use MFS more	*Measure perceived impact of Covid-19 on MFS usage*						
I think that the current situation surrounding Covid-19 makes it easier for me to use MFS							
If the current situation surrounding Covid-19 changes, I will also change how often I use MFS							
If the current situation surrounding Covid-19 changes, I will also change the duration of my MFS sessions							

| Your travel experience

The following questions are about travel for leisure, which you can interpret as anything from short breaks (for example, a day or weekend away for pleasure) to longer vacations.

6. Please indicate to what extent you (dis)agree with the following statements about your opinions on travel. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TTD 3	N 4	TTA 5	A 6	CA 7
I think that travel is exciting	*Measure travel attitude (affective and cognitive)*						
Whenever I travel, I feel satisfied							
I consider travel a fun activity							
I consider travel a relaxing activity							
I learn something about the world from travel							
I think that traveling is a valuable activity							

7. Please indicate to what extent you (dis)agree with the following statements about how you manage your travels. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TTD 3	N 4	TTA 5	A 6	CA 7
It is easy for me to travel	*Measure PBC for travel*						
It is mostly up to me when I want to travel							
It is mostly up to me how I want to travel							
I could travel more often if I wanted to							
To increase the duration my travel (trips) would be easy for me							

8. Please indicate to what extent you (dis)agree with the following statements about your family and/or friends and travel. To make it easier to answer this question, it helps to think of 'family and/or friends' as the people that are close(st) to you. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TTD 3	N 4	TTA 5	A 6	CA 7
I think that my family and/or friends find travel interesting	*Measure social norm on travel*						
I think that my family and/or friends travel often							
I think that my family and/or friends enjoy hearing about my travel experiences							
I care what my family and/or friends think of my travel experiences							

9. Please indicate to what extent you (dis)agree with the following statements about your travel and the Covid-19 pandemic. *For each item, you can mark the option that most closely corresponds to your opinion.*

	CD 1	D 2	TTD 3	N 4	TTA 5	A 6	CA 7
I think that the current situation surrounding Covid-19 makes me not want to travel	*Measure impact of Covid-19 on travel intention*						
I think the current situation surrounding Covid-19 makes it harder to travel							
If the current situation surrounding Covid-19 changes, I will also change the ideas I have for future travel plans							

10. Please indicate to what extent you (dis)agree with the following statements about your travel ideas for this year. *For each item, you can mark the option that most closely corresponds to your opinion*
.

	CD 1	D 2	TTD 3	N 4	TTA 5	A 6	CA 7
I want to travel more than I usually do this year.	*Measure travel intention*						
I intend to travel more than I usually do this year							
I am planning to travel more than I usually do this year							

| Your MFS setup

The following questions are about how you use Microsoft Flight Simulator.

11. In approximately the last 30 days, I used MFS about … times (please tick the answer that best applies)
    - ☐ Not at all
    - ☐ 1-2
    - ☐ 3-5
    - ☐ 6-10
    - ☐ 11-15
    - ☐ More than 15

    Measure frequency of use (experience characteristic). Ordinal scale coded from 0 to 5.

12. I use the following for MFS (please tick whichever applies best to you):
    - ☐ Screen and mouse/keyboard
    - ☐ Screen and gamepad (such as an Xbox controller)
    - ☐ Screen and peripherals such as a joystick, yoke, or throttle.
    - ☐ Virtual Reality Head-Mounted Display such as Oculus Rift, HTC Vive, or other.
    - ☐ Other, namely… *open response*

    Measure immersion level. Ordinal scale ranging from 1 to 3, with item 1 and 2 coded as 1 (i.e., non-immersive). 'Other' is a blank/missing value or was entered into one of the four other categories depending on the response.

13. I use the following approximate graphical settings for MFS: *Please mark the option that comes closest to your average graphical settings.*
    - ☐ Low
    - ☐ Medium
    - ☐ High
    - ☐ Ultra
    - ☐ Other, namely … *open response*

    Measure technical experience quality on ordinal scale, coded from 1 to 4. 'Other' is a blank/missing value or was added to one of the four other categories depending on the response.

14. The resolution I use comes closest to… *Please mark the option that comes closest to your screen resolution. If you use VR or multiple screens, please try to provide an indication of the resolution of the combined screens.*
    - ☐ Lower than 1920x1080
    - ☐ 1920x1080 (also known as 1080p)
    - ☐ 2560x1440 (also known as (W)QHD)
    - ☐ 3840x2160 (also known as 4K)
    - ☐ Not sure
    - ☐ Other…

    Measure technical experience quality on ordinal scale, coded from 1 to 4. 'Not sure' will be a blank/missing value. 'Other' is a blank/missing value or was added to one of the four other categories depending on the response.

| About you

The following questions are about you and who you are.

15. How much experience do you have with flying in real airplanes? *Please tick the option that best fits your situation.*
    - ☐ I have never flown in a real airplane
    - ☐ As a passenger in larger airplanes
    - ☐ As a passenger in small (general aviation) airplanes
    - ☐ I have experienced flying a real airplane under supervision
    - ☐ I am taking flying lessons (student)
    - ☐ I am a licensed pilot (professional and/or recreational)
    - ☐ Other, namely … *open response*

    Measures expertise (user characteristic) on an ordinal scale from 1 to 6. The 'other' option is coded as a blank/missing value or was entered into one of the other six options depending on the answer.

    The following questions are meant to measure representativeness:

16. What is your gender?
    - ☐ Male
    - ☐ Female
    - ☐ Other
    - ☐ Prefer not to say

17. What is your age in years?
    - ☐ ____ years old
    - ☐ Prefer not to say

18. What is your nationality?

    _____

2. Operationalisation example

Table 15: Example operationalisation from Bogicevic, Seo, Kandampully, Liu, & Rudd (2019), which was used as inspiration for the survey for this research.

Construct		Scale Items
Mental imagery	Elaboration, α = .887	The mental images that came to mind formed a series of events in my mind in which I was a part of.
		The mental images that came to mind made me feel as though I was actually experiencing the hotel suite featured in this service preview.
		•
		This preview made me fantasize about having the opportunity to experience the featured hotel suite.
		I could easily construct a story about myself and the featured hotel experience based on the mental images that came to mind.
		It was easy for me to imagine being at this hotel suite.
		Whilst reviewing this service preview I found myself daydreaming about the featured hotel suite.
		Whilst reviewing this service preview many images came to mind.
		The images that came to mind acted as a source of information about the featured hotel suite.
		I could actually see myself in this scenario.
	Quality, α = .828	Overall the images that came to mind while I examined the virtual tour were:
		1 = Dull, 7 = Sharp
		1 = Weak, 7 = Intense
		1 = Unclear, 7 = Clear
		1 = Vague, 7 = Vivid
Sense of presence		When I finished the hotel preview, I felt like I came back to the "real world" after a journey.
		The hotel preview created a new world for me, and the world suddenly disappeared when I finished the preview.
		The world generated by Aevum Hotels seemed to me like “somewhere I visited” rather than "something I saw."
		While I was previewing the hotel suite, I felt I was in the world of Aevum Hotels.
		While I was previewing the hotel suite, I sometimes forgot that I was in the middle of an experiment.
		While I was previewing the hotel suite, my body was in the room, but my mind was inside the world created by Aevum Hotels.
		While I was previewing the hotel suite, the world generated by Aevum Hotels was more real or present for me compared to the "real world."

3. Interview topic guides

Interview guide Bart Knuiman

Structure of interview (guide): Semi-structured: some fixed questions with room for probing/follow-up questions based on responses.

Duration of interview: Approximately 45 minutes.

Goal of this interview: To learn about concurrent/future techniques to make virtual environments more immersive and affect users emotionally.

About Bart Knuiman: Current programmer for the WUR visualisation team

1. Introduction **10:00**

Goal: Introduce myself and my research

1. **Thank Bart** for taking the time for this interview.
2. **Introduce myself**: name, university, MTO, background (travel and MFS)
3. Briefly explain the **purpose of the research**
4. Ask for permission to make an **audio recording** of the interview.
5. **Elaborate on structure** of the interview

2. Opening questions **10:05**

Goal: create rapport, warm up for real questions.

1. Could you please **introduce yourself**?
   Name, profession, role at WUR
2. Do you (used to/outside of Covid) **travel much yourself**?
   Destinations, activity, duration, future plans/ideas

The following questions are about the immersive virtual environments.

3. Immersive virtual environments **10:10**

1. How do you think a **virtual world** can **immerse users**?
   Quality, realism, hardware (VR, screen, peripherals), why
2. What sort of situations/characteristics/experiences **lend themselves best to "virtualisation"?**
   Types of experiences, why those, future changes, substitution/complements, techniques, why
3. How do you think virtual environments can **affect people's emotions/travel desires**?
   Stories, creating an "I", ….?

The last questions are about your vision on the future of virtual immersion

4. Future of virtual immersion **10:30**

1. How do you see the **future for virtual environments with regards to virtual travel/people's daily lives**?
   VR, impact on world, Covid, training, substitute/complement experiences?

Time to wrap up the interview

2. Conclusion **10:40**

1. Do you have any **last remarks or questions**? Anything that needs extra emphasis?
2. **Thank Bart** again for his time and ask whether he would like me to **send him the final research report** if interested.

Interview guide Jorg Neumann

Structure of interview (guide): Semi-structured: some fixed questions with room for probing/follow-up questions based on responses.

Duration of interview: Approximately 30 minutes.

Goal of this interview: To understand Microsoft's vision on creating a realistic travel experience in MFS and if/how they think this might affect users' travel intentions.

About Jorg Neumann: Current head of Microsoft Flight Simulator, 14+ years at Microsoft as lead game designer

5. Introduction **15:00**

Goal: Introduce myself and my research

6. **Thank Jorg** for taking the time for this interview.
7. **Introduce myself**: name, university, MTO, background (travel and MFS)
8. Briefly explain the **purpose of the research**
9. Ask for permission to make an **audio recording** of the interview.
10. **Elaborate on structure** of the interview

6. Opening questions **15:02**

Goal: create rapport, warm up for real questions.

3. Could you please **introduce yourself**?
   Name, profession, role at Microsoft/Flight Simulator team
4. Do you (used to/outside of Covid) **travel much yourself**?
   Destinations, activity, duration, future plans/ideas

The following questions are about the MFS and travel.

7. Microsoft Flight Simulator and travel **15:05**

4. How do you think MFS **compares to real travel**/?
   Complement/substitute, dependents (e.g., VR/peripherals), situations, social aspects
5. How do you try to **enhance the feeling of 'being there'** in MFS, immersing users in the experience?
   Graphics, map data, feedback from sim, AI, live data
6. How do you think MFS **affects people's travel desires**?
   Substitute during Covid, user-specific characteristics, destination marketing (world updates?), replacing scenic flights or more

The last question is about your or Microsoft's vision on the future of virtual travel

8. Future of virtual travel **15:22**

1. How do you see the **future for MFS with regards to virtual travel**?
   Development updates, additions, experience (e.g. Bushtalk), flight recording/sharing
2. How do you see the **future for virtual travel in general**?
   Microsoft's ambitions/plans, relation of virtual travel with real travel

Time to wrap up the interview

9. Conclusion **15:27**

3. Do you have any **last remarks or questions**? Anything that needs extra emphasis?
4. **Thank Jorg** again for his time and ask whether he would like to **collaborate further** (increase respondents by e.g., publishing a post on the MFS website/other publicity, **other contacts**) and to **send him the final research report** if interested.

Interview guide Patrick Machado

Structure of interview (guide): Semi-structured: some fixed questions with room for probing/follow-up questions based on responses.

Duration of interview: Approximately 30 minutes.

Goal of this interview: To understand the concept behind Bushtalk Radio and what it adds to the MFS experience

About Patrick Machado: Developer of Bushtalk Radio: an audio tour mod for MFS

10. Introduction **20:00**

Goal: Introduce myself and my research

11. **Thank Patrcik** for taking the time for this interview.
12. **Introduce myself**: name, university, MTO, background (travel and MFS)
13. Briefly explain the **purpose of the research**
14. Ask for permission to make an **audio recording** of the interview.
15. **Elaborate on structure** of the interview

11. Opening questions **20:02**

Goal: create rapport, warm up for real questions.

5. Could you please **introduce yourself**?
   Name, profession, background, role in developing Bushtalk Radio
6. Do you (used to/outside of Covid) **travel much yourself**?
   Destinations, activity, duration, future plans/ideas

The following questions are about Bushtalk Radio

12. Bushtalk Radio (BTR) **20:05**

7. Could you please explain **what BTR is and how it works**?
   MFS, mod, Wikipedia,
8. What inspired you to develop **BTR**?
   Sim or real-life experience? Feedback/demand from community?
9. What do you think BTR ***adds* to the MFS-experience**?
   Immersion, tourism, travel-feeling, supplement, …
10. Who or what **kind of people** (do you think) use BTR?
    Hardcore simmers vs newcomers; experience sought after
11. What **features** in BTR would you still love to implement, or where do you see the mod going?
    Video, content, voice, extras…

The last questions are about MFS and travel in general.

13. MFS and travel **20:20**

1. How do you think MFS **compares to real travel**/?
   Complement/substitute, dependents (e.g., VR/peripherals), situations, social aspects
2. How do you think MFS **affects people's travel desires**?
   Substitute during Covid, user-specific characteristics, destination marketing (world updates?), replacing scenic flights or more

Time to wrap up the interview

14. Conclusion **20:27**

5. Do you have any **last remarks or questions**? Anything that needs extra emphasis?
6. **Thank Patrick** again for his time

4. Opening post for English-speaking forums

Hi everyone!

Do you use the latest Microsoft Flight Simulator? Then please keep on reading! Contribute to scientific research by filling out a short 10 min. survey and sharing your experiences in this forum.

MSFS 2020 can easily be considered a new form of virtual tourism: travel without 'real' travel. But could this *substitute* a vacation-feeling to some degree? And why/how? My master's thesis on Virtual Tourism and Travel will try to answer these questions.

From a personal perspective, this topic really fascinates me: I am both an avid traveller (at least, in 'normal' times!) and a MSFS-user myself. My girlfriend and I are both loving this sim since we started using it to fly around both familiar and unfamiliar places around the world… which got me to the point at which I am now with my thesis.

Your thoughts, opinions and experiences can contribute so much to my research and make a difference in a cutting-edge research topic.

Please fill out the survey by clicking on this link. It should only take about 10 minutes of your time, thank you so much in advance!

All done? Time to discuss the topic! Share your experience, opinion, and/or comments about how Microsoft Flight Simulator (2020) simulates (or stimulates?) your travel appetite. And of course, discussion about the topic and with each other is not only allowed, but also actively stimulated!

Thanks again and looking forward to hearing your thoughts!

Jochem Lips
MSc Tourism, Society, and Environment
Wageningen University & Research, The Netherlands

PS: Wondering what to write about? You can use (but you do not have to restrict yourself to) these questions to get started:

1. Do you ever have moments when your MSFS experiences make you **feel as if you are 'there'**, where you are flying? What were you doing? What do you think contributed to this feeling?
2. Have you visited any place in MSFS that you would **consider really traveling to**?
3. … or are there any places you visited in MSFS that you feel **less inclined to travel to** now?
4. **Why** do you use MSFS? Is this the first time you are using a flight sim?
5. **Who are *you***? Do you think that MSFS users are a very specific group of people, or do you think anyone could enjoy this sim?

***Note**: by participating in this discussion, you consent to your answers being used for the purposes of this research. This means that what you write might be published or used in e.g., presentations or other material that might be publicly accessible. Anonymity of your answers cannot be guaranteed, although you can request to have your (user)name omitted in the research report and other data resulting from this study. Please explicitly mention this in you answer(s).*

5. Opening post for Dutch-speaking forums

Hoi allemaal!

Gebruik jij de nieuwste Microsoft Flight Simulator? Lees dan even verder! Draag bij aan wetenschappelijk onderzoek door een korte (10 minuten) enquête in te vullen en je ervaringen te delen op dit forum.

Ik ben (in 'normale' tijden) gek op reizen en een MSFS-gebruiker. Mijn vriendin en ik genieten er allebei van om in deze sim bekende en nieuwe regio's te zien over de hele wereld…. Wat mij tot deze master scriptie leidde.

MSFS2020 kan beschouwd worden als een nieuwe vorm van virtueel toerisme: reizen zonder 'echt' te reizen. Maar kan dit ook echt een vakantiegevoel (deels) nabootsen? En hoe/waarom? Mijn scriptie over Virtueel Toerisme en Reizen tracht deze vragen te beantwoorden.

Hiervoor heb ik uiteraard wel inzicht nodig van de mensen die ook deze sim gebruiken. Jouw meningen en ervaringen kunnen heel veel bijdragen aan dit onderzoek.

Vul de enquête in door op deze link te klikken (in het Engels), deze kost maar ongeveer 10 minuten. Alvast gigantisch bedankt!

Enquête afgerond? Tijd om dit onderwerp te bespreken! Deel je ervaringen, meningen, en commentaar over hoe MSFS2020 je reislust lest of juist opwekt. En uiteraard is hierover discussiëren met elkaar hartstikke welkom!

Nogmaals bedankt en ik kijk er naar uit om jullie ervaringen te horen!

Jochem Lips
MSc Tourism, Society, and Environment
Wageningen University & Research, The Netherlands

PS: Weet je niet helemaal zeker waar je over zou kunnen schrijven? Je kunt de onderstaande vragen gebruiken ter inspiratie:

1. Heb je ooit momenten wanneer je je tijdens een MSFS-sessie voelt alsof je **'echt' bent waar je op dat moment vliegt**? Wat was je aan het doen? Wat zorgde ervoor dat je dit gevoel kreeg?
2. Heb je plekken bezocht in MSFS waar je graag eens **in het echt** naartoe zou willen reizen?
3. … Of zijn er plekken die je in MSFS gezien hebt waar je nu **minder graag naartoe wilt/hoeft te reizen**?
4. **Waarom** gebruik je MSFS? Is dit de eerste keer dat je een flight sim gebruikt?
5. **Wie ben jij?** Denk je dat MSFS-gebruikers een specifieke groep mensen zijn, of denk je dat iedereen van deze sim zou kunnen genieten?

Let op: *door deel te nemen in deze discussie ga je ermee akkoord dat je antwoorden voor onderzoek gebruikt kunnen worden. Dit betekent dat je antwoorden wellicht gepubliceerd kunnen worden of bijv. in presentaties kunnen voorkomen. Anonimiteit kan niet gegarandeerd worden, maar je mag wel verzoeken om je (gebruikers)naam weg te laten: vernoem dit alsjeblieft expliciet in je antwoord(en).*