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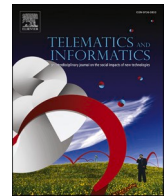
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Virus tinged? Exploring the facets of virtual reality use in tourism as a result of the COVID-19 pandemic

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ABSTRACT

Several studies have investigated the use of virtual reality (VR) in tourism, but none has taken an epidemiological outlook. This research examined the use of VR in tourism through the lenses of an extended TAM model in times of COVID-19 pandemic. The premise was that, in this context, people would prefer less risky experiences and would see VR as a substitute for traditional travel. The data used was collected through a within-subjects experiment, which proved that intention to use VR in tourism increased under the COVID-19 effect. This study tested a conceptual model that showed this intention was influenced by the perceived ease of use, perceived usefulness, and perceived substitutability of VR, all mediated by people's interest in VR use in tourism. The perceived authenticity of VR experience determined the perceived substitutability of VR. This paper has theoretical and practical implications. In the long term, promoting tourism-related VR activities might reduce the risk of virus spreading, lessen the pressure imposed on this sector by such epidemic episodes, and increase its sustainability.

1. Introduction

A new and highly infectious coronavirus (COVID-19) appeared in mid-December 2019 and swept away the entire world. The outbreak grew into a pandemic, which brought about unprecedented challenges for the tourism sector. Increasingly, there are views of a “new normal” (WTTC, 2020a, 2020b; Serra and Leong, 2020; Winston, 2020). The term was coined by WTTC to refer to the necessary routine starting as lockdowns are ending, and restrictions are eased. The new normal will include new standards and protocols such as improved hygiene, contactless payment, safe distancing, among others (WTTC, 2020a). The ideas of integrated digital identity solutions and touchless travel are gaining ground (Serra and Leong, 2020).

World Travel and Tourism Council (WTTC, 2020b) works on developing a vision of the Future of Travel and Tourism taking into account what the new normal will be. Among the key issues for the industry, WTTC (2020b) mentions sustainability, technology, and health and security. We argue that VR use in tourism relates to these topics and will become a contributor to the transformation of the sector. We believe that VR tourism related activities might mitigate the effect of the COVID-19 crisis and, more importantly, help the tourism industry transform itself into a more resilient form. These activities might not only help operators cope with this crisis, but also could contribute to creating a safer and more secure environment in the coming months and years.

Gössling et al. (2020) argue that the global volume growth model should be reconsidered. Now success is seen as growth in arrivals; it only increases the risks incurred at the global level and deepens the contribution to climate change. Thus, the COVID-19 crisis should

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be seen as an opportunity to question the logic of growth in tourism numbers implying greater benefits (Gössling et al., 2020). OECD (2020) also recommends a green and inclusive recovery from COVID-19; it means not only providing revenues and jobs, but also integrating strong climate and biodiversity action, and building resilience. We believe that VR use in tourism contributes to the creation of a new, more resilient tourism model. The current tourism model involves large numbers of people moving from one destination to another. VR could reduce the incidence of these movements and allow consumers to experience tourism destinations without physically visiting the place (Correia Loureiro et al., 2020). Even though the cost of using the VR technology affect its adoption (Vishwakarma et al., 2020) and the “tourist experience may never be fully replicable in VR” (Guttentag, 2010, p. 644), the new technological developments allow immersive interactions, improving VR experiences in terms of memorability and authenticity. The VR tourism related activities can substitute corporeal tourism, reducing the necessity to travel in a physical place; as a result, they create lower CO2 emissions, degradation, or destruction of cultural icons. Through substitutability, VR tourism related activities represent a more sustainable way of traveling (Cheong, 1995; Guttentag, 2010; Beck et al., 2019; Yung and Khoo-Lattimore, 2019; Dewailly, 1999; Hobson and Williams, 1995; Sussmann and Vanhegan, 2000; Wiltshier and Clarke, 2016). But, are people ready to embrace such activities?

The premise of the present study was that, in the new pandemic context, people would prefer less risky experiences and would see virtual reality (VR) as a substitute for conventional travel. Accordingly, we started to test this hypothesis in mid-March, right after restrictions were imposed in our country. In May, UNWTO Secretary-General recognized virtual reality among solutions for accelerating the recovery of tourism from COVID-19. “We now have an opportunity to rethink tourism and do things better. Virtual reality, artificial intelligence, and big data will all have a part to play in our joint response to COVID-19, and in building resilience for the future” (UNWTO, 2020a). Even though several studies have investigated the VR use in tourism (Cho et al., 2002; Guttentag, 2010; Huang et al., 2016; Kim et al., 2020b, 2020a; Kim and Hall, 2019; Tussyadiah et al., 2018), none has taken an epidemiological outlook. Given the recognition of virtual reality as a response to COVID-19 (UNWTO, 2020a) and the lack of papers on this subject, the present study fills a noticeable research gap.

This study explores the facets of VR use in tourism, trying to do pioneer work regarding its usage and driving factors under the pandemic influence. Specifically, the use of VR in tourism is seen through the TAM model lenses in the COVID-19 context. The specific objectives were:

- (1) To empirically investigate the influence of COVID-19 outbreak on the intention to use VR in tourism, along with its factors.
- (2) To examine the relationships among interest in VR, perceived ease of use, perceived usefulness, perceived substitutability and authenticity of VR, and the intention to use VR in tourism as a result of COVID-19 influence.

2. Literature review

2.1. Pandemics and tourism

Over the centuries and, more recently, decades, human kind has faced a series of pandemics and epidemics that have seriously shaken both societies and economies on multiple levels and with long spans over the upcoming years. From the ‘Spanish Flu’ pandemic of influenza in 1918, through the 2003 ‘Severe Acute Respiratory Syndrome epidemic (SARS-CoV-1)’ (Lee et al., 2012), the ‘Middle East respiratory syndrome-related coronavirus (MERS-CoV)’ epidemic (Memish et al., 2020), the new strain of Influenza A H1N1 in 2009, rapidly declared a high phase six level pandemic by the World Health Organisation (WHO, 2010), to the today situation of the ‘Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)’ pandemic, all the epidemiological outbreaks carry along a series of measures that are taken around the affected areas to restrain the spread of the virus, to limit their impact. According to the study of Kuo et al. (2008), the measures inadvertently limit the number of fatalities, but those not only restrain the virus, but also the economies, with serious disservice in the travel and tourism domain (Fan et al., 2019).

Regardless of the type of epidemic (WHO, 2003), the tourism sector has undergone great changes because of the measures that in all cases created havoc, with unprecedented negative effects, with millions of people, employed by the industry losing their jobs (Kuo et al., 2008), and billion dollars lost in terms of GDP contribution. As stated by McKercher and Chon (2004), the losses were not caused by the viruses and the risk they posed, but more by the reaction of the governments, through the measures that aimed at limiting the spread. For instance, WHO (2009) issued a series of travel recommendations to and from specific geographical areas that led to the closure of many borders, governments imposed on tourists coming from the affected areas to wear masks for the entire duration of their visit, countries and cities instituted a 14-day quarantine for tourists arriving from the affected areas (Breda, 2004), while Mainland Chinese tourists were denied visas to specific countries or access to shows, accommodation units or cruise ships (Wilder-Smith et al., 2020). Important travel agencies and airline companies have canceled trips to and from the affected areas; special airport restrictions and control procedures were implemented for foreigners. Moreover, on-site measures included closure of archeological sites, museums, cancellation of fairs and festivals, restaurants and bars, all of which, combined with the growing distrust of the tourists, led to catastrophic effects on the travel and tourism industry worldwide, with average occupancy rates ranging from 3% to 15% in accommodation units, which was also the most affected sector (Monterrubio, 2010).

2.2. COVID-19 and tourism

At the end of 2019, WHO was informed about the occurrence of cases of pneumonia of unknown origin in the city of Wuhan, Hubei Province in China, later called Coronavirus 2019 or COVID-19 (WHO, 2020). The Severe Acute Respiratory Syndrome Coronavirus-2

(SARS-CoV-2) is the name given to the 2019 novel coronavirus and COVID-19 is the name given to the disease associated with the virus (ECDC, 2020). As a result of the dramatic evolution of the infection, on January 30, the WHO declares the outbreak a Public Health Emergency of International Concern; later, on March 11, it declares it a pandemic (WHO, 2020). The major concerns about the new coronavirus came from the fact that there was yet no specific vaccine or treatment, it was more transmissible than the seasonal flu, it had an exponential growth, and the entire population of the globe was susceptible to getting sick because immunity had not been acquired (ECDC, 2020). In addition, it was estimated that this virus would push half a billion people into poverty (McCarthy, 2020), causing an economic disaster.

In the event of epidemics, the tools at hand to stop the transmission of the disease are isolation, quarantine, social distancing (Conti, 2017; Wilder-Smith and Freedman, 2020), and Community Containment (Wilder-Smith and Freedman, 2020). Many states have taken steps ranging from social distancing, isolation, and quarantine to restrictions on large communities (Deloitte, 2020; ECDC, 2020); some countries such as Armenia, Estonia, Georgia, Latvia, Moldova, and Romania have even requested derogations from the European Convention on Human Rights, invoking the ongoing Coronavirus pandemic which constitute unprecedented situations in human history (Maksimov, 2020).

Some of the strict government measures imposed (Haleem et al., 2020) violate constitutional rights (Meier et al., 2020) but are medically justified (Cohen and Kupferschmidt, 2020). Those should be accompanied by research that analyzes the economic impact (Barro et al., 2020; Ivanov, 2020; Haleem et al., 2020; Snooks, 2020) and proposes recovery solutions (Ruiz Estrada, 2020). Economically, the shock created by COVID-19 to the global economy has been more severe than the 2008 global financial crisis and even than the Great Depression (Roubini, 2020). Though, there is a scenario according to which global production could return to positive growth in the fourth quarter of this year (Di Salvo, 2020). At the European Union level, there is a discussion of a financial plan for the next seven years (Kelly and Zubascu, 2020).

Over time, tourism has experienced very strongly all the economic “shocks” generated by the outbreak of epidemics and pandemics, in all sectors (Bhati et al., 2016), whether we are talking about Food and Beverage, Travel, Lodging or Recreation. Significant financial losses have been recorded as a result of SARS in 2003 (Joppe, 2020), the bird-flu pandemic in 2007 (the World Bank cited by Tew et al., 2008) or Ebola (Novelli et al., 2018).

Tourism is one of the sectors most affected by travel restrictions as a result of the COVID-19 epidemic. It is estimated that global world tourism traffic could fall by 20–30%, which means losses of US\$ 30 to 50 billion in international tourism receipts (UNWTO, 2020b). According to The Statistics Portal for Market Data (STATISTA, cited by Lock, 2020), global revenue from the travel and tourism industry would decrease by over 20%. Spain has faced massive cancellations of bookings, Paris experienced an occupancy rate decrease from 84% in January 2020 to 1.8% in March 2020, and Italy could lose over 7.7 billion Euros in tourism this year (Lock, 2020). Bans imposed by the US generate a strong impact on European markets such as Italy, Germany, France, and UK (Barua, 2020; Bremner, 2020). The International Air Transport Association (IATA, 2020) assesses global revenue losses in 2020 for the passenger business of between \$63 billion and \$113 billion. The World Travel Agents Associations Alliance (WTAAA, 2020) has called on global governments for financial support, as has IATA for consumers, travel agencies, and the air travel channel as a whole, noting the catastrophic impact. The European Tourism Manifesto alliance, the voice of the European travel and tourism sector, calls for urgent action (The European Tourism Manifesto, 2020). The International Hotels and Restaurants Association (IHRA) also reacted, stating that we are facing an unprecedented crisis, with social distancing measures, travel restrictions and quarantine at the same time as the closure of restaurants leading to a real financial disaster (Freifer, 2020; Ozili and Arun, 2020). The impact on cruises is also dramatic (Gosling et al., 2020) as it is on MICE, many of the events being canceled, including ITB in Berlin and Salon Mondial du Tourisme in Paris. More than 500 trade shows have been annulled, costing up to \$26 billion in lost orders for exhibitors, according to UFI, The Global Association of the Exhibition Industry (Campos, 2020).

Given that the outbreak of the COVID-19 pandemic has reduced certain negative effects of tourism such as congestion, destruction of cultural icons, and ecosystem degradation, the question arises whether the current crisis could generate innovative, sustainable solutions. Among the many alternatives, slow tourism and virtual tourism bring reasons for optimism. In the medium term, the digital world is expected to meet these requirements and even become “the engine of this industry” (Oguz et al., 2020) as long as tourism stakeholders are prepared to improve their resilience (Cetin, 2020).

2.3. VR use in tourism

Rapid technological progresses, especially advances in information and communications technologies (ICTs), have been acknowledged to exert a strong influence on the tourism industry (Guttentag, 2010). Virtual reality, a salient sector of ICT, integrates “a set of technologies that enable people to immersively experience a world beyond reality” (Berg and Vance, 2017, p.1), and is already used in varied areas including tourism. Kim et al. (2020b) suggested that tourists’ experiences have been enriched by the deployment of VR in tourism-related activities. In the context of this paper, the concept of tourism-related VR activities denotes the usage of VR devices for “playing, enjoying, experiencing, traveling, exploring information, looking at pictures, gaming, watching 3D 360 degree videos, watching drone videos, looking at holographic images, and participating in other tourism-related activities” (Kim et al., 2020a; p.2).

As the COVID-19 pandemic progressed, in an attempt to protect the public health, many governments imposed limits on some constitutional rights such as freedom of movement. We hypothesized that in this context, under national quarantine, with limited options to move around and travel, people intention to use VR for tourism purposes would increase. Up to now, many papers, researchers, and practitioners assessed that VR could not replace conventional tourism. Though, given the limited mobility imposed in so many countries, VR might become a substitute for traditional travel. Our premise was that the COVID-19 pandemic would determine a

stronger behavioral intention to use VR in tourism and change perceptions of VR use in tourism. Herein, we discuss the concepts related to this assumption.

2.3.1. Technological Acceptance Model (TAM) and behavioral intention

The behavioral intention was defined by [Warshaw and Davis \(1985\)](#) as the extent that people express conscious plans to perform or not a particular future behavior. It might influence real action of usage of a particular technology ([Bagozzi et al., 1992](#); [Morris and Dillon, 1997](#); [Thompson et al., 2006](#); [Venkatesh et al., 2003](#)) and it exerts a positive effect on usage ([Davis, 1989](#)). Technological Acceptance Model (TAM) was suggested by [Davis \(1989\)](#) to explain what determines the people's acceptance of information technology and their behavioral intentions, theorizing two salient determinants: perceived usefulness and perceived ease of use. Perceived usefulness regards the extent that users believe a specific information technology will support them obtain enhanced job performances. Perceived ease of use explains whether a particular information system is facile to use, meaning that is effort-free. Some scholars examined the connections between perceived ease of use, perceived usefulness and the adoption of new information technologies ([Adams et al., 1992](#); [Hsu and Lu, 2004](#); [Mathieson, 1991](#); [Pavlou, 2003](#); [Saeed et al., 2009](#); [Szajna, 1996](#)). Their studies reinforced the TAM suggested by [Davis \(1989\)](#), which postulates that perceived ease of use and perceived usefulness can predict the adaptation and usage of technology. Applying TAM to investigate the determinants of tourists' adoption of mobile devices, [Kim et al. \(2008\)](#) indicated that perceived usefulness and perceived ease of use positively influenced the users' behavioral intentions to use mobile devices within the tourism context. [Kaplanidou and Vogt \(2006\)](#) developed and tested a structural model based on TAM to determine the effects of perceived tourism web site usefulness in planning a trip on behavioral intentions of tourists to visit a destination, reporting that intentions were positively influenced by destination web site usefulness.

Additionally, travel and tourism researchers focused on the integration of TAM toward deeper understandings of consumer behavior concerning user experiences of virtual reality technology within the context of travel and tourism. [Huang et al. \(2013\)](#) investigated the influence of perceived ease of use and perceived usefulness on people's interests to travel to a destination when experiencing the virtual tourism site, concluding that people's behavioral intentions in visiting the tourism destination were related to the perceived usefulness of the virtual site.

2.3.2. Behavioral intention to use VR tourism-related activities

Over the past years, behavioral intention has also received considerable attention from researchers in virtual reality in tourism. In an attempt to elaborate an integrated model of travel consumption behavior in the VR realm, [Kim et al. \(2020b\)](#) found that behavioral intention of people who experienced VR tourism activity refers to the intention to re-experience, recommend to others, and visit the place portrayed in the tourism-related VR activity. Examining the behavioral intentions of people who used Google Street View application system and virtually visited a potential holiday destination, [Disztinger et al. \(2017\)](#) indicated intentions to buy, use and recommend the application system by the users. [Huang et al. \(2013\)](#) and [Huang et al. \(2016\)](#) reported that behavioral intention is composed of willingness to obtain more information about the place, gaining an interest in visiting the place, and desire to recommend the place experienced in VR. [Marasco et al. \(2018\)](#), based on the virtual depiction of a real cultural tourism heritage site, investigated the role of VR experiences in shaping intentions toward the promoted site, concluding that users were motivated to visit, recommend, and find out more information about the actual site. [Jung et al. \(2017\)](#) captured tourists' behavioral intentions to visit a destination based on a VR application experience, pointing out that participants intended to repeat the same experience and recommend it to others as a form of relaxation and a way to better understand the destination's attractions. More findings confirm the adoption of VR and positive effects on the travel decision-making process and optimistic attitudes towards the destinations ([Griffin et al., 2017](#); [Rainoldi et al., 2018](#); [Tussyadiah et al., 2017, 2018](#)). Therefore, we regard behavioral intention as a target construct that encompasses intentions to use VR in tourism, to recommend the VR tourism experience, and to pay for the use of VR applications related to tourism.

In a study that developed a conceptual framework on the influence of people who experienced a VR tourism activity's hedonic behaviors on continued use, [Kim and Hall \(2019\)](#) indicated that the perceived usefulness has a strong indirect influence on the visitors' behavioral intentions for continued use of tourism-related VR activities in the future. Similarly, a study examining motivation for consumption behavior in travel planning by [Disztinger et al. \(2017\)](#) pointed out that TAM is a useful framework to understand consumer' motivations and acceptance of using VR technology after virtually traveling to a selected destination, asserting that perceived usefulness and perceived ease of use showed strong effects on the behavioral intention to use VR technology for travel planning. Therefore, we believe that the perceived ease of use and the perceived usefulness are factors that influence the behavioral intention to use VR in tourism; they might also be affected by the COVID-19 pandemic. This pandemic pressed governments and societies to use digital technologies to respond to the crisis, solve some of its consequences, and reinvent their tools for long-term solutions ([UN, 2020a, 2020b](#)). The extensive use of technology by consumers during COVID-19 to stay informed and to safeguard their health may become an "unforeseen catalyst to assert broader, longer term adoption of technology platforms and solutions" ([Nielsen, 2020](#)). Not only that the pandemic made many individuals shift their work and social lives online ([Wiederhold, 2020](#)), but also the interest in e-services has grown during this period, leading to increased informational awareness ([Gutowska and Klos-Adamkiewicz, 2020](#)). The COVID-19 pandemic, with its restricted environment and health threat, might push people to reevaluate technological solutions such as VR and make people see them more useful and ease to use. Hence, we propose the following hypotheses:

- H1a.** In the COVID-19 pandemic context, people change their perception of VR ease of use
- H2a.** In the COVID-19 pandemic context, people change their perception of VR usefulness
- H1b.** The VR perceived ease of use has a positive effect on behavioral intention to use VR in tourism
- H2b.** The VR perceived usefulness has a positive effect on behavioral intention to use VR in tourism

2.3.3. Authentic experience and behavioral intention to use VR tourism-related activities

Rooted in the sociological literature, the systematic study of authenticity began in the '70, when [McCannell \(1973\)](#) introduced it as a construct of Staged Authenticity Theory to understand tourists' travel experiences at cultural sites. Authenticity has been defined as the concept that summarizes what is authentic, genuine, real, and/or true ([Cateran and Roederer, 2013](#); [Chhabra, 2005](#); [Cohen, 1988a](#); [Goldman and Papson, 1996](#); [Pine and Gilmore, 2013](#); [Wang, 1999](#)). Recent literature in the tourism-related context has indicated that the construct of authentic experience may be used as an antecedent of behavioral intention to revisit the slow-life-related event ([Chung et al., 2018](#)), to use mobile social media and network sites for tourism-related activities ([Kim et al., 2017, 2019](#)). Based on extensive research on VR use in tourism, [Kim et al. \(2020a\)](#) examined the determinants that motivate individuals engaging in VR tourism, unveiling the substantial influence of consumers' authentic experience in predicting potential behavioral intentions to use tourism-related VR activities. Similarly, [Kim et al. \(2020b\)](#) argued that authentic experience positively correlated with the intentions of travel consumers in using VR programs. [Cohen \(1988a\)](#) showed that authenticity is a context-based, relative, subjective and negotiable construct. Moreover, [Guttentag \(2010\)](#) appreciated that, even though a VR experience "would not be authentic in the strictest sense" (p. 645), some users might perceive it as authentic. Therefore, we believe that the restrictions imposed by the COVID-19 pandemic influence the perception of authenticity of the VR experience, the context making people more open to VR use and less demanding on the authenticity of the experience:

H3a. In the COVID-19 pandemic context, people change their perception of the authenticity of the VR experience

2.3.4. Substitutability

[Hendee and Burdge \(1974\)](#) proposed that leisure activity substitutability involves the interchangeability of activities to satisfy participant needs, motivations, and preferences. From a leisure participant perspective, substitution indicates that the initially proposed behavior is no longer viable and must be interchanged by an alternative behavior if leisure activity is to be initiated or continued ([Brunson and Shelby, 1993](#)). In his Theory of Substitutability, [Iso-Ahola \(1986, p.374\)](#) posits that "if the reasons for substitution are understandable, justifiable, or fair, one's willingness and tendencies to substitute is greater than if the reasons are not perceived as understandable, justifiable or fair". If, in the COVID-19 pandemic context, the attached risks and the limitation of tourists' freedom of movement force them to cancel their traditional travel arrangements, the reasons are understandable. Besides being understandable, these reasons suggest a need for only a temporary substitution. Therefore, such constraints to traditional travel behaviors are perceived as unavoidable. [Bulman and Wortman \(1977\)](#) argued that individuals are better able to cope with the results of circumstances that they see as unavoidable than those they see as avoidable.

2.3.4.1. Perceived substitutability and behavioral intention to use VR tourism-related activities. The concept of perceived substitutability has received considerable attention in studies attempting to understand consumer behavior. A study conducted by [Lin \(2004\)](#) found that internet users' perceived substitutability of offline with online media content partially predicts the webcasting adoption interest. [Cha \(2013\)](#) studied users' preference to use video platforms as Internet and television, indicating that perceived substitutability of television with online video platforms is related to consumers' intention to watch the content of old and new video platforms. [Cha \(2014\)](#) suggested that the most frequent users of video-sharing sites are men who perceive video sharing sites to have greater substitutability for offline video media. In addition, [Cha and Chan-Olmsted \(2012\)](#) observed that the degree of perceived substitutability of online platforms for television is higher for non-users than for users of online video platforms.

[Lu et al. \(2019\)](#) investigated the determinants that influence the acceptance of the smart product-service systems, pointing out that the perceived substitutability of the smart shared products for owned products has a positive indirect effect on the consumers' intention to use the smart product-service systems. Similarly, when examining the behavior in the context of sharing economy, it is found that consumers are more inclined to adopt shared products, if they perceive that shared products can substitute their own products ([Hennig-Thurau et al., 2007](#); [Lamberton and Rose, 2012](#)). In the context of VR consumer behavior, [Ernst et al. \(2016\)](#) examined the predictors of augmented reality smart glasses usage, indicating that consumers' use intentions are positively exerted by perceived substitutability of virtual objects for real physical objects.

In this article, we evaluate the potential influence of perceived substitutability on the usage of VR tourism-related activities. We postulate that perceived substitutability — which we describe as the extent to which a person believes that VR tourism-related activities are able to substitute his/her traditional travel activities — might be a predictor of behavior intention to use VR tourism-related activities. We predict that people will create a coping mechanism or a greater willingness to substitute traditional tourism activities that are eliminated because of unavoidable causes with tourism-related VR activities, especially in the COVID-19 context. Their willingness to substitute traditional tourism activities will eventually influence their intention to use VR in tourism, hence:

H4a. In the COVID-19 pandemic context, people change their perception of VR substitutability

H5a. In the COVID-19 pandemic context, people show stronger behavioral intention to use VR in tourism

H3b. The VR perceived substitutability has a positive effect on behavioral intention to use VR in tourism

2.3.4.2. Authentic VR experience and perceived substitutability. The users' perceived authenticity of VR experience represents one factor in their acceptance of VR as a substitute for the traditional tourism experiences ([Guttentag 2010](#)). Investigating the perceptions of the authentic experience of virtual tourism, [Mura et al. \(2017\)](#) found that the perceived substitutability of VR tourism-related activities for actual trips is influenced by the users' sensory participation as a salient component of the perceived VR authentic experience. Based on a systematic review of virtual reality in tourism research studies, [Yung and Khoo-Lattimore \(2019\)](#) found that a high level of perceived authentic experience of VR platforms content might increase the perceived substitutability of corporeal with virtual tourism.

Authenticity of VR experiences is a positive determinant of intention to use VR technologies in the tourism context (Kim et al., 2020a, 2020b), greater perceived authenticity of VR experience determining higher perceived substitutability of virtual tourism experiences for real ones. Therefore, we expect that VR perceived authentic experience would positively associate with the perceived substitutability of tourism-related VR activities:

H4b. Perceived authenticity of VR experience has a positive effect on perceived substitutability of VR

2.3.5. Interest in technology and behavioral intention to use VR in tourism-related activities

Past studies have indicated that user general interest in technology is a salient predictor that positively influence the behavioral intention for adopting new electronic banking applications (Röcker and Kaulen, 2014), using mobile TV services (Leung and Chen, 2017), accepting computerized product and services (Umemuro, 2004).

Moreover, scholars have suggested that interest in technology may be used as an antecedent of behavioral intentions in acceptance of virtual reality. Sanchez-Cabrero et al. (2019) studied the use of virtual reality in formal education, reporting the positive effect of interest in technology on users' behavioral intentions to adopt virtual reality as a learning tool. Exploring the acceptance of virtual reality as a travel planning tool, Disztinger et al. (2017) found a binary relationship between interest in VR technology and tourists behavioral intention to use it. Based on a structured review of the literature to understand VR research in the tourism context, Beck et al. (2019) reported that interest in VR is a significant predictor of behavioral intention to use VR tourism-related activities.

Studies in tourism indicated that the mediating role of interest in relation to consumers' behavioral intention is extremely important. Exploring Thai students behavioral intention to travel by proposing travel interest as a mediator, Mohsin et al. (2017) found out that the more Thai students perceived travel motivations (experiencing new culture, scenic values, and adventure) as attractions to travel to a destination, the greater their travel interest subsequently manifested in higher behavioral intention to visit the destination. The study conducted by Lim et al. (2019), suggesting involvement – interest for product information (Zaichkowsky, 1986; Richins and Bloch, 1986) – as a mediator in understanding the tourists' behavioral intention towards ethnic food, found that the more tourists like reading online reviews of ethnic food gastronomy and perceive relevant outcomes, the more they will manifest interest in exploring ethnic food gastronomy online reviews; consequently, when interest in ethnic food information increases as an effect of reading online reviews, the tourists' behavioral intention towards ethnic food is heightened. In this research, we propose interest in VR use in tourism as a mediator between VR perceived ease of use, perceived usefulness, perceived substitutability, and behavioral intention to use VR in tourism:

H5b. The interest in VR use in tourism mediates the relationship between perceived ease of use and behavioral intention to use VR in tourism

H6b. The interest in VR use in tourism mediates the relationship between perceived usefulness and behavioral intention to use VR in tourism

H7b. The interest in VR use in tourism mediates the relationship between perceived substitutability and behavioral intention to use VR in tourism

3. Method

This research adopted an experimental approach to test the enunciated hypotheses. The study was conducted in mid March 2020, right after the outbreak of the COVID-19 pandemic and the lockdown imposed in Romania. People were obliged to stay at home and had restricted moving freedom. We opted for a within-subject experiment with one intervention to test the influence of these restrictions on tourists' behavior. This design makes all participants go through the same steps, each subject acting as his or her own control. The within-subject option was chosen because it allowed identifying the effect of the treatment with less concern about individual differences impairing the results (Gravetter and Forzano, 2012). In general, it has more statistical power (Lambdin and Shaffer, 2009; Thompson and Campbell, 2004; Viglia and Dolnicar, 2020) and smaller sample (Gravetter and Forzano, 2012; Thompson and Campbell, 2004). By exposing all subjects to more interventions, the disadvantage might be the risk of learning and order effects (Viglia and Dolnicar, 2020) or time-related and environmental effects (Gravetter and Forzano, 2012). But with only one intervention, we tough we limited these risks.

Birnbaum (1999) demonstrates that the between-subject experiments can lead to doubtful conclusions when the dependent variable is a judgment. By the between-subject procedure, the stimuli and the context vary between conditions, hampering the results (Birnbaum, 1999). Given the main dependent variable in our study was the behavioral intention to use VR in tourism, the within-subject design was, once again, the right choice. Within-subject options avoid stimulus and contexts confounding (Birnbaum, 1999; Lambdin and Shaffer, 2009).

3.1. Participants, sample size justification and manipulation

The participants were selected from a renowned higher education institution undergraduate and master program in tourism. In total, 162 students were invited to take part. Some of the invited students chose not to participate, and others did not meet the requirements imposed by the experimental treatment. In the end, 89 responses could be used for analysis. Table 2 presents information about participants' profile.

The sample may be considered relatively small (N = 89) but is satisfactory. First, in a review of experiments in tourism and hospitality, Viglia and Dolnicar (2020) appreciate "there is no single optimal sample size for experiments" (p.8). Many times experimental design involves small samples. Smith and Little (2018) argue that some of the most robust and valuable results in psychology

were achieved using small N designs for experiments. Moreover, recent studies dealing with VR use in tourism are developed using small samples such as Surovaya et al. (2020) with 80 participants, Kang (2020) with 89, Marchiori et al. (2017) with 23, Huang et al. (2012) with 42, Lee and Oh (2007) with 51.

Viglia and Dolnicar (2020) point out that using the standard approach ($\alpha = 0.05$ and a power of 0.80 , $\beta = 0.20$), 15.68 observations for each group would be needed to detect a one-standard deviation change and 141 observations for each group assuming a $1/3$ standard deviation change. For $1/2$ standard deviation change, a $N = 2(1.96 + 0.84)^2(2)^2 \sim 63$ participants would be needed.

Moreover, the chosen within-subject approach has a positive impact on the size of the sample. The within-subject designs involve smaller samples with fewer participants than the between-subject versions (Judd et al., 2001).

Last but not least, we employed the G*Power software version 3.1.9.7 to determine the sample size using a significance level of 0.05 ($\alpha = 0.05$), an effect size of 0.35 or large effect (Cohen, 1988b), a power level of 0.8 as suggested by Cohen (1988b) and 5 predictors. Given these parameters, the minimum sample size is 43. With a higher power of 0.95 , the minimum sample size would be 63. Our sample size of 89 exceeds all these thresholds. Based on these considerations, the sample size is adequate to validly analyze the data.

The treatment was applied through the university platform used for online classes in a seminar in which the topic related to VR use in tourism. This platform allowed checking if the students respected the sequence of steps, time allocated to each task, and the general instructions of the study. First, the participants were given a questionnaire to test their perception of VR use in tourism (Q1). This represented the control phase. Second, they went through the treatment which involved introducing the idea of COVID-19 influence on tourism sector. Specifically, students viewed a video (FRANCE 24 video 'Losing €1billion a month': Coronavirus hits European tourism) in which the dramatic Coronavirus effect on tourism was presented and a 15 min video which involved the use of a VR technique (Bright Side video 'Travel without Leaving Home | 360 VR'). Then, they filled in a second questionnaire in which there were studied the same variables as in the previous stage (Q2). As part of the manipulation, all questions were rephrased to include the influence of COVID-19 pandemic. All VR variables were scored again by students, but having in mind the context of the COVID-19 pandemic, the risks attached to it, and the imposed restriction on freedom of movement included in the phrasing of the questions. The questionnaires were developed in Romanian and discussed with three experts in tourism and technology to verify the content validity. Apart from suggestions for refining a few items, the experts appreciated the questionnaire was consistent in relation to the content, clear, and free of errors or grammatical mistakes.

3.2. Measurement constructs and measurement model

The constructs were derived from prior studies. The perceived ease of use, perceived usefulness, and behavioral intention were grounded in the work of Davis (1989), Davis, Bagozzi, and Warshaw (1989), Venkatesh and Davis (2000), Van der Heijden (2003), Huang et al. (2013), Chung et al. (2015), Chen and Tsai (2019), Kim et al. (2020b). Items were adapted to measure VR perceptions, attitudes and intention to use VR in the chosen paradigm. Authentic experience was measured with items used by Kim et al. (2020b). The interest in VR item was adapted from Huang et al. (2012). For behavioral intention to use VR in tourism we adapted two items from Huang et al. (2013) and Kim et al. (2020b) and added one item to measure people's willingness to pay for VR activities in tourism. Given the new condition, it is important to know if tourists would be ready to pay for VR use in tourism. Since perceived substitutability has not yet been studied, we proposed our own measure to evaluate the extent to which a person believes that VR tourism related activities are able to substitute his/her traditional travel activities (Table 1).

Even though the conventional approach in research measurement is the use of multi-item instruments, some authors draw attention on the fact that researchers may utilize shortened versions of existing multi-item scales (Fuchs and Diamantopoulos, 2009, p.196) or

Table 1
Constructs and items..

Construct	Abbreviation	Items	Cronbach's alpha
Perceived ease of use	CLEAR	Interacting with VR (virtual reality) is clear and easy to understand	0.840
	MEMO	Seeing a tourist attraction through virtual reality (VR) offers a memorable experience	
Perceived usefulness	LIKE	I like to use VR (virtual reality)	0.773
	UTI	Using VR (virtual reality) applications in tourism is a good idea	
Perceived authenticity	BENEF	Virtual reality is beneficial in tourism	0.860
	AUTH	VR (virtual reality) applications offer an authentic experience	
Perceived substitutability	UNIQ	VR (virtual reality) applications offer a unique experience	0.861
	SUBST	VR (virtual reality) applications substitute the tourist experience in a suitable way	
Interest in VR	INTER	I am very interested in virtual reality use in tourism	
Behavioral intention VR in tourism	INTE	I intend to use VR applications in the future for tourism purposes	0.861
	REC	I want to recommend to others the use of VR applications for tourism purposes	
	DISP	I am willing to pay to use VR applications in tourism (for example, a 360 degree virtual tour of a famous tourist destination)	

even single-item constructs. The shorter measures are already advocated in psychology by [Wanous et al. \(1997\)](#), [Nagy \(2002\)](#), [Russell et al. \(2004\)](#), [Marsh et al. \(2005\)](#), or [Schweizer \(2011\)](#). These measurements can be characterized by sufficient reliability and accuracy on the condition the items allow for more than two answers ([Schweizer, 2011](#)). We opted for a shorter, more flexible instrument given the constraint environment in which we undertook the experiment (Covid-19 lockdown). The intention was to test some variables during the quarantine period, opting for a more efficient approach in developing the questionnaire. Therefore, some of the constructs have two items instead of three or four. We measured all items on a 7-point Likert scale ranging from strongly disagree (1) to strongly agree (7), respecting the reliability condition suggested by [Schweizer \(2011\)](#).

This is not a new approach; other researchers have used selectively TAM's variables adapted from [Davis \(1989\)](#) and [Venkatesh and Davis \(2000\)](#) and included a smaller number of items from the original model. [Fernandes and Oliveira \(2021\)](#) used only two items for both perceived ease of use and perceived usefulness in a very recent study on consumers' adoption of intelligent digital voice assistants in service encounters. Both previous constructs showed Cronbach's alpha, Composite Reliabilities (CR), and Average Variances Extracted (AVE) above the minimum thresholds, indicating the scales were reliable and valid, as in our case. Some authors included three items for perceived ease of use and/or perceived usefulness in their studies such as [Lee et al. \(2019\)](#) of the adoption of virtual reality devices, [Pando-Garcia et al. \(2016\)](#) of training simulators, [Perry \(2016\)](#) of acceptance of smart virtual closets, [Moták et al. \(2017\)](#) of intention to use autonomous shuttles, [Vishwakarma et al. \(2020\)](#) of intention to adopt virtual reality to evaluate tourist destinations, and [Raes et al. \(2020\)](#) of attitude towards quizzes across different learning environments. The shorter versions of the scales are arguably reducing the respondents' fatigue ([Fernandes and Oliveira, 2021](#)), having at the same time the potential for good reliability and validity.

As per the use of single-item constructs, several authors have demonstrated that researchers that are faced with construct measurement decisions can use single-item designs as feasible alternatives for multi-items designs ([Wanous et al., 1997](#), [Bergkvist and Rossiter, 2007](#); [Fuchs and Diamantopoulos, 2009](#); [Diamantopoulos et al., 2012](#)). [Wanous et al. \(1997, p.250–251\)](#) note "the use of single-item measures should not be considered fatal flaws in the review process. Rather, their appropriateness for a particular piece of research should be evaluated". Single-item measures can be both reliable and valid ([Fuchs and Diamantopoulos, 2009](#)). Two single-item constructs are utilized in the present study: perceived substitutability and interest in VR use in tourism. The latter is deemed acceptable since it is used as a mediating variable in the research model.

The perceived substitutability is considered suitable as a single-item based on several reasons. First, a global item was most appropriate for the ad-hoc research context in which the study was developed. [Wanous et al. \(1997\)](#) indicate the existence of practical limitations or cost considerations leading researchers to favor single-item measures. Though it is a new idea under study, the substitutability of corporeal tourism for VR, it was considered concrete, real, perceptible by respondents. As suggested by [Rossiter \(2002\)](#) and [Diamantopoulos et al. \(2012\)](#), when the construct is judged concrete, there is no need to use multiple-items constructs. Lastly, single-item measures could be considered when dealing with small samples ([Fuchs and Diamantopoulos, 2009](#)).

The measurement instrument has good reliability and validity, as described by the following Cronbach's alpha and CFA analyses. To evaluate the inner consistency of these constructs, the Cronbach's alpha was calculated (as shown in [Table 1](#)). All results demonstrated a strong internal reliability of the constructs. The values were 0.840, 0.773, 0.860, and 0.861 for perceived ease of use, perceived usefulness, perceived authenticity, and behavioral intention to use VR in tourism, respectively. The high level of Cronbach's alpha values indicated an acceptable reliability for these measurements.

We employed confirmatory factor analysis (CFA) with IBM SPSS AMOS software version 26 to test the measurement model. First, because it is a sensitive issue, we discuss here the inclusion of single item constructs in the measurement model in CFA. It is noted in the literature that the single item indicators can and should be included in SEM and CFA ([Burt, 1975](#); [Hayduk et al., 1997](#); [Onyskiw and Hayduk, 2001](#); [Hayduk and Littvay, 2012](#); [Oberski and Satorra, 2013](#); [Petrescu, 2013](#); [Sagan and Pawelek, 2014](#)). [Hayduk and Littvay \(2012\)](#) assert the single indicators have an "encouraging precision in latent theory" (p. 7), a fixed loading of one and a fixed measurement error variance being sufficient to identify the latent.

In the CFA analysis in AMOS, for the single item factors, we fixed the factor loading to one and the error variance to zero as instructed in the literature ([Blunch, 2012](#); [Sagan and Pawelek, 2014](#); [Kenny, 2016](#); [Raykov and Marcoulides, 2000](#); [IBM, 2018](#)). It is one of the methods used to model single item factors in SEM and CFA and has been utilized by other authors. For example, [Burnkrant and Page \(1982\)](#) fixed the factor loading to one and error to zero for single item constructs in a model of behavioral intention. Another good example is a highly cited article by [MacKenzie et al. \(1986\)](#). The construct with one indicator has to meet either of two conditions, and one is this: the "error variance is fixed to zero or some other a priori value" ([Kenny, 2016](#)). We chose to fix it to zero since it is the common recommendation in many papers discussing this subject. We pondered assigning a small error variance to the single item indicators to account for occasional error. Eventually, we considered the error associated with our single item constructs (perceived substitutability and interest in VR use) was minimized by the questions wording and automatic registration of answers. Our single item constructs are concrete, and such constructs presume a lower error risk ([Petrescu, 2013](#)). More, the non-zero error variance allows only for small improvements. For example, [Sagan and Pawelek \(2014\)](#) compared two models, one with error variances estimated for fixed parameters and one with zero error variance for indicators; they noted only a small improvement of 1% in the fit of the model when fixing the error variance to a fixed measure. Therefore, we considered the zero error variance for single item factors a satisfactory method. In the end, we did not correlate the error variance with anything, as suggested by [Kenny \(2016\)](#) and [IBM \(2018\)](#).

The relevant indices of CFA showed that the model fit is adequate: chi-square = 76.882 with 40 degrees of freedom $p < 0.001$, chi-square /d.f. = 1.922, NFI = 0.910; TLI = 0.923; CFI = 0.953; IFI = 0.955; RMSEA = 0.102; SRMR = 0.0686. The RMSEA of 0.102 is higher than the 0.08 criteria ([Hair et al., 2010](#)), but is still reasonable. Moreover, as suggested by [Hair et al. \(2010\)](#) and [Hu and Bentler \(1999\)](#), we can use either RMSEA or SRMR along with an absolute index. The SRMR index of 0.0686, less than the guideline of 0.08, along with a CFI of 0.953, higher than the suggested 0.95 ([Hair et al., 2010](#)), supports a good fit of the measurement model. Moreover,

the normed chi-square or the chi-square value divided by the degrees of freedom is 1.922. By being smaller than 2.0, the normed chi-square suggests a very good fit of the CFA model (Hair et al., 2010).

Almost all items have factors loadings greater than 0.7, which is regarded as very good (Hair et al., 2010). There are two exceptions with loadings between 0.5 and 0.7, which is considered acceptable (Hair et al., 2010). Hence, all the items used in this study are significant. The value of average variance extracted (AVE) ranges from 0.53 to 0.78, exceeding the 50 percent criterion (Hair et al., 2010). Construct reliabilities (CR) range from 0.80 for behavioral intention to use VR in tourism to 0.76 for perceived ease of use, 0.72 for authenticity, and 0.66 for perceived usefulness. Since the Cronbach's alpha is above 0.7 (Nunnally and Bernstein, 1994) for perceived usefulness, we can conclude that even though the CR is less than the recommended 0.7 (Hair et al., 2010), this construct also has good reliability. All other constructs CRs exceed 0.7, implying adequate reliability.

The CFA analysis confirms the validity of measurement. It indicates the model offers a good fit to the data and shows that all relevant constructs (Table 1) can be successfully used to explain the dependent variable, which is people's behavioral intention to use VR in tourism after COVID-19.

3.3. Data analysis

The analysis of this study is presented in two parts. First, the summative measures of VR perceived ease of use, perceived usefulness, perceived authenticity, perceived substitutability potential, and behavioral intention to use VR are analyzed in descriptive terms and compared based on their means. Since we had a within-subject experimental design, with one treatment, the paired T-test was used to validate Hypotheses 1a-5a. The T-test is a traditional way of verifying the changes and is appropriate when the research question tackles differences (Mara and Cribbie, 2012). The objective was to see if the intention to use VR in tourism would change as a result of the Coronavirus outbreak along with its associated factors. This test permits comparing the means of the research variables from each phase of the experiment, concluding if there was a significant difference as a result of the intervention or change in the conditions.

Second, the validation of the proposed research model (Fig. 1) is taken into account. Therefore, apart from T-tests and simple descriptive statistics used to understand how the variables evolved in the experiment, regression analyses were employed for measuring causality among interest variables, as mentioned in the formulated hypotheses. These associations were studied based on the data collected through the second questionnaire used in the experiment. This instrument was applied in the COVID-19 crisis framework and measured the variables under this influence, allowing testing the relationships involved by the proposed research model under the COVID-19 paradigm.

The associations implied by Hypotheses 1b-4b were tested through linear regression. Regression is usually used when the researcher's objective is to predict the changes in the dependent variable (Hair et al., 2010). Since the study is involved in understanding the behavioral intention to use VR in tourism in relation to other independent variables, we thought the predictive character of the regression brings value to the analysis. Moreover, regression was chosen over structural equation modeling (SEM) since SEM is usually recommended for larger samples. Using simulation studies, Yung and Bentler (1994) suggest a minimum sample size of 200 to obtain satisfactory results in SEM. Hair et al. (2010) propose the same size in less than ideal conditions and advance a minimum sample size of 100 as a guideline when using SEM. The regression is widely used in tourism research (see, for example, Karl et al., 2020 or Birch and Memery, 2020) and in VR use in tourism (see, for example, Lee and Oh, 2007, Huang et al., 2012 or Wei et al., 2019). It is also utilized in recent studies of behavioral intentions such as travel intention (Li and Chen, 2019; Giusti and Raya, 2019), intention to slow travel to a heritage city (Lin et al., 2020), or intention to use autonomous cars (Hohenberger et al., 2016; Nodjomian and Kockelman, 2019). We consider the behavioral intention to use VR in tourism similar to the intention to use autonomous cars, in terms of their novelty, both implying accepting technology as the new way of doing things.

In order to test Hypotheses 5b-7b, regression was employed to measure the mediation effect of subjects' interest in VR in the relationship between each element – perceived ease of use, perceived usefulness, and perceived substitutability – and behavioral intention to use VR. Then, Sobel tests (Sobel, 1982) were applied to verify the indirect effects. This test implies computing the ratio of regression coefficient to its estimated standard error (Preacher and Hayes, 2008; Preacher and Kelley, 2011; Sobel, 1982) and helps testing hypotheses which involve mediation. The regression analysis and Sobel tests are the classical approach to mediation studies, or the common practice (Iacobucci, Saldanha and Deng, 2007; MacKinnon et al., 2012), even though SEM outperforms them in certain

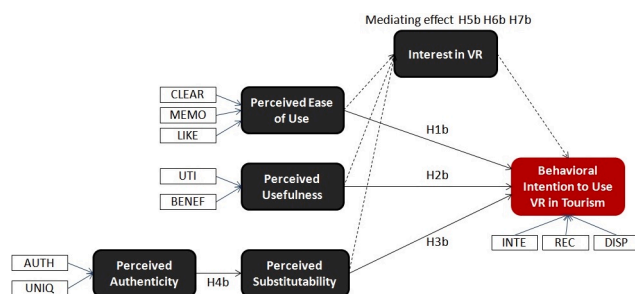


Fig. 1. Proposed research model. Black lines – Hypotheses, Blue lines – Items, Dotted lines – Mediating effect. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

situations.

IBM SPSS software was used to calculate the statistics necessary to check the hypotheses. The significance level was set at 0.05 for this study.

4. Results

4.1. Descriptive data

All participants were students, but more than half of them were also employed (52.8%). This is explained by the fact that around half of them are master students. 69.7% of the participants were female and 30.3% were male (Table 2). The age of the respondents ranged from 20 to 29 years, with an average age of 22.3 years. Additional information showed that the most important reasons for traveling were culture (57.3%), nightlife and entertainment (20.2%), and nature (18%). Moreover, the average number per person of foreign leisure trips in 2019 was two, the average number per person of national leisure trips in 2019 was four, and the average amount spent on travel in 2019 was 1,778 Euro per individual.

VR use is often associated with some devices (i.e. headset). Therefore, the technology usage profile of the sample was outlined. Most participants use daily their smartphones and laptops. Only slightly above half of them own a tablet or a PC. This is not surprising given the new features of modern devices such as smartphones and laptops. Slightly below 35% of participants own and use a games console. The assumption was that the present use would influence the future use of technology such as VR. This supposition is confirmed by the industry. For example, people with smartwatches are 66% more likely to have an interest in using VR, and 1 in 2 gamers are eager to use VR technology (Global Web Index, 2016).

Boland (2017) notes that VR affinity correlates to young ages, due to natural technology interest among those seen as digital natives. This relationship between age and interest in VR is noticed in other industry reports and scientific articles (Boland, 2017; Global Web Index, 2016; Leung et al., 2019; Tussyadiah et al., 2018). The age group 25–34 is more willing to spend on VR technology than younger 18–24 (Boland, 2017; Leung et al., 2019). Millennials are twice more likely to buy a VR headset than other age groups (Rogers, 2018).

Since age and technology usage are important factors explaining VR consumption, this group represents a reasonable sample of VR users in tourism.

Table 2
Participants' profile (N = 89).

Characteristic	n	%	Characteristic	n	%
Gender			Devices owned and used on a regular basis		
Female	62	69.7	Smartphone		
Male	27	30.3	used daily	61	68.5
Status			used frequently	25	28.1
Student	42	47.2	used sometimes	1	1.1
Employed student	47	52.8	used occasionally	1	1.1
Age			used rarely	1	1.1
20	3	3.4	Tablet		
21	15	16.9	used daily	2	2.2
22	39	43.8	used frequently	7	7.9
23	22	24.7	used sometimes	9	10.1
24	7	7.8	used occasionally	12	13.5
25 and over	3	3.4	used rarely	17	19.1
Main reasons for travel			do not own	42	47.2
experiences in nature	16	18	Laptop		
cultural experiences	51	57.3	used daily	41	46.1
visiting friends / relatives	4	4.5	used frequently	34	38.2
nightlife	18	20.2	used sometimes	9	10.1
religious reasons	0	0	used occasionally	1	1.1
other reason	0	0	used rarely	2	2.2
Average number of hours spent online			do not own	2	2.2
0 hours	0	0	PC		
1-3 hours	18	20.2	used daily	9	10.1
4-6 hours	37	41.6	used frequently	4	4.5
6-7 hours	15	16.9	used sometimes	13	14.6
Over 7 hours	19	21.3	used occasionally	8	9
			used rarely	12	13.5
			do not own	43	48.3
			Games console		
			used daily	3	3.4
			used frequently	6	6.7
			used sometimes	11	12.4
			used occasionally	5	5.6
			used rarely	5	5.6
			do not own	59	66.3

4.2. Hypotheses testing

4.2.1. The experiment

The experiment was the first took into account in terms of statistical analysis. The general hypothesis was that, under limited moving and traveling liberty within the COVID-19 outbreak, people intention to use virtual reality for tourism purposes would increase. Therefore, it was compared what happened with the mean of the behavioral intention to use VR, along with some of its drivers, before and after the treatment imposed by the experiment (the COVID-19 influence). First, an analysis of the means was performed (Fig. 2). Then, hypotheses H1a-H5a were tested based on paired T-test (Table 3 and 4). These tests were performed traditionally (Table 3) and under a bootstrapping procedure (Table 4) with a resample size of 5,000 to ensure quality of results. Simulation studies proved that these methods increase the power of T-test under non-normality (Konietschke and Pauly, 2013). The results did not change after the bootstrapping re-sampling proving the data is accurate.

The comparative analysis of means (Fig. 2) showed higher values in the post-treatment phase for perceived ease of use, perceived usefulness, perceived substitutability of VR, and behavioral intention to use VR in tourism. The only variable that had a lower mean after the manipulation was the perceived authenticity of VR experience. Thus, the experiment had an effect. But, this analysis does not allow checking if these differences are significant or not. The T-test analyses permit comparing the means from each stage of the experiment, enabling identifying if a significant difference appeared as a result of the intervention.

As shown in Table 3, H2a, H4a and H5a were supported; the relationships were statistically significant at a 0.05 significance level. H1a and H3a were not validated; the data did not support the change of people's perception of ease of use and authenticity of VR experience when exposed to the Coronavirus crisis information and the limitation of the freedom of movement. Apart from this, the experiment manipulation had a significant effect on all variables. H2a was supported because the perceived usefulness of VR changed from pre-treatment to post-treatment ($t(88) = -2.962$, $p < 0.05$, that is with 88 degrees of freedom and an associated p-value of $0.007 < 0.05$). The same holds true for H4a, the perceived substitutability of VR increased as a result of the COVID-19 intervention ($t(88) = -2.675$, $p = 0.009 < 0.05$). Finally, the behavioral intention to use VR was significantly affected by the experiment, providing support for H5a. The mean changed notably, the Coronavirus crisis making people more prone to use VR in tourism ($t(88) = -2.933$, $p = 0.004 < 0.05$).

Overall, the experiment showed that the COVID-19 outbreak and the imposed moving limitations determined a statistically significant improvement in the appreciation of perceived usefulness of VR, perceived substitutability of VR, and a stronger behavioral intention to use VR in tourism.

4.2.2. Testing the conceptual model

Results regarding Hypotheses 1b-7b are presented in this section. As shown in Table 6, Table 7, and Table 8, linear regression and Sobel tests were used. Sobel tests entail computing the ratio of regression coefficient to its estimated standard error (Preacher and Hayes, 2008; Preacher and Kelley, 2011; Sobel, 1982) and enable evaluation of hypotheses which comprise mediation. Another regression analysis was used for perceived authenticity (Table 9). The relationships among the variables were studied based on the data collected after the experimental treatment. This allowed testing the research model and the associations implied by it under the COVID-19 influence. It was already proven that this crisis had a significant effect on the research variables, as discussed in the previous section. Therefore, the next step was to validate the propose model based on post-treatment responses. This implied a series of relationship between VR perceived ease of use, perceived usefulness, perceived substitutability, and behavioral intention to use VR in tourism as a dependent variable.

Since regression analyses were performed, variance inflation factors (VIF) were examined to investigate the impact of

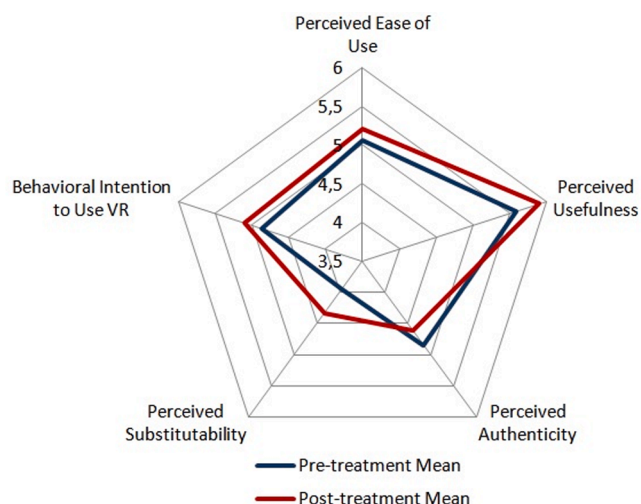


Fig. 2. Analysis of means.

Table 3
Paired sample T-test statistics based on the two stages of the experiment for VR variables (N = 89).

Pair	Variables	Mean	95% CI		t	df	Sig. (2-tailed)	H	Supported
			Lower	Upper					
1	Ease of use 1 – Ease of use 2	-0.1500	-0.3165	0.0165	-1.790	88	0.077	H1a	No
2	Usefulness 1 – Usefulness 2	-0.3090	-0.5163	-0.1017	-2.962	88	0.004	H2a	Yes
3	Authenticity1 – Authenticity 2	0.2247	-0.0197	0.4692	1.827	88	0.071	H3a	No
4	Substitutability 1 – Substitutability 2	-0.3933	-0.6854	-0.1011	-2.675	88	0.009	H4a	Yes
5	Behavioral intention 1 – Behavioral intention 2	-0.2328	-0.3906	-0.0750	-2.933	88	0.004	H5a	Yes

Legend: 1 = Pre-treatment, 2 = Post-treatment.

Table 4
Paired sample T-test statistics based on the two stages of the experiment for VR variables with bootstrapping.

Pair	Variables	Mean	Bias	SE	Sig. (2-tailed)	95% CI		H	Supported
						Lower	Upper		
1	Ease of use 1 – Ease of use 2	-0.1500	0.0007	0.0826	0.077	-0.3144	0.0153	H1a	No
2	Usefulness 1 – Usefulness 2	-0.3090	-0.0003	0.1045	0.006	-0.5169	-0.1124	H2a	Yes
3	Authenticity1 – Authenticity 2	0.2247	-0.0019	0.1217	0.071	-0.0223	0.4551	H3a	No
4	Substitutability 1 – Substitutability 2	-0.3933	-0.0011	0.1474	0.009	-0.6854	-0.1011	H4a	Yes
5	Behavioral intention 1 – Behavioral intention 2	-0.2328	0.0014	0.0791	0.006	-0.3900	-0.0827	H5a	Yes

Legend: 1 = Pre-treatment, 2 = Post-treatment.

multicollinearity (Table 5). VIF scores pointed out those results were not considerably affected by such a problem. All the variance inflation factors were under 2, which coincide with the thresholds mentioned in the literature. Different limits are suggested by different authors. A considerable collinearity problem arises if the VIF exceeds 2.5 (Adeboye et al., 2014; Johnston et al., 2018), 5 (Hair et al., 2014; Kim, 2019) or even 10 or greater (Allison, 1999). According to the statistics presented in Table 5, collinearity was not a concern regarding this study. All the VIF values were under the minimum threshold mentioned in the literature.

Next, behavioral intention to use VR was used as the dependent variable and the perceived ease of use of VR as an independent variable (Table 6, Step 1). The perceived ease of use of VR had a positive effect on the behavioral intention to use VR in tourism ($\beta = 0.686$; $t = 8.797$, $p < 0.001$). Therefore, H1b was supported. The behavioral intention to use VR in tourism increased when people perceive VR as easy to use. For Hypothesis 5b, the perceived ease of use was the independent variable, people’s interest in VR the mediator, and behavioral intention to use VR in tourism the dependent variable. The mediating effect of interest in VR was investigated through regressions and the Sobel Test (Table 6, Step 2, 3 and 4). First, the relationship between perceived ease of use and interest in VR was tested (Step2), which proved to be significant and positive ($\beta = 0.703$; $t = 9.214$, $p < 0.001$). Then, the relationships among perceived ease of use, interest in VR, and behavioral intention to use VR in tourism were examined (Step 3). These associations also proved to be significant and positive ($\beta_1 = 0.150$, $\beta_2 = 0.763$; $t_1 = 2.039$, $t_2 = 10.405$, $p < 0.001$). The Sobel Test statistics (Table 6, Step 4) showed the mediator had a significant indirect effect ($b = 6.8822$; $p < 0.001$). This result indicated that people’s interest in VR had a meaningful mediating effect in the relationship between the VR perceived ease of use and the behavioral intention to use VR in tourism. As a result, H5b was also supported.

Similarly, behavioral intention to use VR was used as the dependent variable and the perceived usefulness of VR as an independent variable (Table 7, Step 1). The perceived usefulness of VR had a significant positive relationship with the behavioral intention to use VR in tourism ($\beta = 0.673$; $t = 8.497$, $p < 0.001$), and Hypothesis 2b was supported. A higher perceived usefulness of VR determined a stronger behavioral intention to use VR in tourism. For the associated Hypothesis 6b, the perceived usefulness of VR was the independent variable, people’s interest in VR the mediator, and behavioral intention to use VR in tourism the dependent variable. As shown

Table 5
Collinearity statistics (variance inflation factors - VIF).

	Step 1 (X → Y)	VIF	Step 2 (X → M)	VIF	Step 3 (MX → Y)	VIF
<i>Perceived ease of use (X) vs. behavioral intention (Y)</i>						
Perceived ease of use ease (X)		1		1		1.976
Interest in VR (M)						1.976
<i>Perceived usefulness (X) vs. behavioral intention (Y)</i>						
Perceived usefulness (X)		1		1		1.913
Interest in VR (M)						1.913
<i>Perceived substitutability (X) vs. behavioral intention (Y)</i>						
Perceived substitutability (X)		1		1		1.437
Interest in VR (M)						1.437

Table 6
Effect of perceived ease of use on behavioral intention to use VR in tourism.

	Step 1 (X → Y)	t	Step 2 (X → M)	t	Step 3 (MX → Y)	t	Step 4 (Sobel Test)	Sign.
Perceived ease of use (X)	0.686	8.797**	0.703	9.214**	0.150	2.039	6.8822	0.000
Interest in VR (M)					0.763	10.405**		
F	77.392**		84.905**		140.530**			
R ² for each step	0.471		0.494		0.766			
ΔR ²			0.023		0.272			
Adj R ² for each step	0.465		0.488		0.760			
Δ Adj R ²			0.023		0.272			

Obs. Significant at **p < 0.001.

in Table 7 (Step 2), the relationship between perceived usefulness of VR and interest in VR resulted to be significant and positive ($\beta = 0.695$; $t = 9.005$, $p < 0.001$). The same holds true for the relationships among perceived usefulness of VR, interest in VR, and behavioral intention to use VR in tourism (Step 3, $\beta_1 = 0.136$, $\beta_2 = 0.774$; $t_1 = 1.861$, $t_2 = 10.632$, $p < 0.001$). As shown in Step 4 (Table 7), people's interest in VR represents a significant mediator on the relationship between perceived usefulness of VR and behavioral intention to use VR in tourism ($b = 7.059$; $p < 0.001$). Therefore, Hypothesis 6b was supported.

Hypotheses 3b and 7b were tested by the same procedure (Table 8). The dependent variable was the intention to use VR in tourism and tested against perceived substitutability as the independent variable (Step 1). The perceived substitutability of VR and the behavioral intention to use VR in tourism had a positive significant relationship ($\beta = 0.524$; $t = 5.746$, $p < 0.001$). Hypothesis 3b was supported. People that see virtual reality as having a high potential to substitute traditional travel express a stronger intention to use VR in tourism. For Hypothesis 7b, the perceived substitutability of VR was the independent variable, people's interest in VR the mediator, and behavioral intention to use VR in tourism the dependent variable. Once again, the interest in VR was found to significantly mediate the relationship between the predictor and the dependent variable. As shown in Table 8 (Step 2), the relationship between perceived substitutability of VR and interest in VR was significant and positive ($\beta = 0.551$; $t = 6.165$, $p < 0.001$). Moreover, the relationships among perceived substitutability, interest in VR, and behavioral intention to use VR in tourism were tested (Step 3). These associations also showed to be significant and positive ($\beta_1 = 0.065$, $\beta_2 = 0.832$; $t_1 = 1.028$, $t_2 = 13.074$, $p < 0.001$). The Sobel Test statistics (Table 8, Step 4) showed that the mediator had a significant effect on the tested relationship ($b = 5.5817$; $p < 0.001$). Consequently, H7b was supported. The interest people have in VR had a noteworthy mediating effect between the perceived substitutability and the behavioral intention to use VR in tourism.

The results demonstrated that interest in VR acts as a mediator in the relationships between VR perceived ease of use, perceived usefulness, and perceived substitutability and behavioral intention to use VR in tourism.

The perceived authenticity proved to be a driver of perceived substitutability (Table 9). The regression analysis for the effect of perceived authenticity on perceived substitutability of VR in tourism determined an R² of 0.491, an adjusted R² of 0.485, R of 0.701, F of 42.035, and $p < 0.001$ (Table 9). The regression model explained 48.5 percent variance of dependent variable. As a result, H4b was supported. Perceived authenticity of VR experience had a positive effect on the perceived substitutability of VR, explaining almost half of its variance.

5. Discussion and insights

5.1. Theoretical implications

During the current period, the so-called "age of acceleration" era (Xiang, 2018, p. 147 citing Negroponte, 2016 and Friedman, 1995), understanding how travelers respond to new technologies such as virtual reality or augmented reality, among others, is of much interest to researchers. This era is characterized by an incredible growth of user-generated content on the Internet and by an extensive diffusion of technologies and devices in all physical environments in which people live and work, causing an exponential rate of data and information accumulation (Xiang, 2018). All these developments in technology changed tourism in a fast, profound, and extensive

Table 7
Effect of perceived usefulness on behavioral intention to use VR in tourism.

	Step 1 (X → Y)	t	Step 2 (X → M)	t	Step 3 (MX → Y)	t	Step 4 (Sobel Test)	Sign.
Perceived usefulness (X)	0.673	8.497**	0.695	9.005**	0.136	1.861	7.059	0.000
Interest in VR (M)					0.774	10.632**		
F	72.195**		81.094**		139.113**			
R ² for each step	0.453		0.482		0.764			
ΔR ²			0.029		0.282			
Adj R ² for each step	0.447		0.476		0.758			
Δ Adj R ²			0.029		0.282			

Obs. Significant at **p < 0.001.

Table 8
Effect of perceived substitutability on behavioral intention to use VR in tourism.

	Step 1 (X → Y)	t	Step 2 (X → M)	t	Step 3 (MX → Y)	t	Step 4 (Sobel Test)	Sign.
Perceived substitutability (X)	0.524	5.746**	0.551	6.165**	0.065	1.028	5.5817	0.000
Interest in VR (M)					0.832	13.074**		
F	33.011**		38.003**		134.216**			
R ² for each step	0.275		0.304		0.757			
ΔR ²			0.029		0.453			
Adj R ² for each step	0.267		0.296		0.752			
Δ Adj R ²			0.029		0.456			

Obs. Significant at **p < 0.001.

Table 9
Regression analysis of VR perceived authenticity on perceived substitutability of VR.

Independent variables	DF	β	t-value	p-value	VIF	R	R ²	Adjusted R ²	F	Sign.
Perceived authenticity	1	0.701	9.164	0.000	1	0.701	0.491	0.485	83.979**	0.000

Obs. Significant at **p < 0.001; DF – degrees of freedom.

manner. VR is revolutionizing the way people experience travel and tourism-related products (Correia Loureiro et al., 2020). Additionally, now a prevalent disruptive force, the COVID-19 pandemic, and all its long-run consequences alter the form of the tourism sector. Within this rather kaleidoscopic context, we contribute to prior ideas mentioned in the literature regarding several topics.

First, the present paper brings an important theoretical contribution being the first study of this type in the literature. As far as we know, we are the first studying the VR substitutability potential in times of a health crisis of this nature. We hypothesized and demonstrated that VR perceived substitutability – which we describe as the extent to which a person believes that VR tourism related activities are able to substitute his/her traditional travel activities – increased as a result of the COVID-19 pandemic. People became more inclined to see VR as a potential substitute for traditional travel. VR was treated as a substitute for real travel by Cheong (1995) and Guttentag (2010). Herein, VR was seen as having a rather low potential to replace corporeal travel as tourism experiences could not be fully replicated in a virtual environment. But, in order to become an acceptable tourism replacement, “VR experience simply must be perceived as a satisfactory substitute in the mind of the user” (Guttentag, 2010, p. 644). The present study shows that the perceived substitutability of VR increased as a result of the COVID-19 effect. We believe that this has to do not only with the reduced mobility imposed by lockdowns but also with the changing “mind” of the tourists. The pandemic is perceived as risky and makes people reconsider some of their earlier choices. Even though VR was not seen previously as a threat to the current tourism industry (Li and Chen, 2019), we think that the COVID-19 pandemic might be a turning point for the VR use in tourism.

Second, this study develops a model to explain people’s behavioral intention to use VR in tourism under the COVID-19 effect. Some research has been done on the behavioral intention to use VR in tourism (Disztinger et al., 2017; Jung et al., 2017; Kim et al., 2020a,b) and use of the TAM model from this angle (Huang et al., 2013; Li and Chen, 2019). We extended the literature by including a new, relevant variable in the framework. Since, in the first phase of our study, the perceived substitutability of VR proved to increase after COVID-19, we deemed necessary to test if it represents a driver of behavioral intention. We hypothesized and confirmed that perceived substitutability of VR is a predictor of behavioral intention to use VR in tourism alongside perceived ease of use and perceived usefulness of VR as proposed by the TAM model. Our findings attest that tourists that regard VR as having a high replacement potential express a stronger intention to use VR in tourism. Another contribution of our study resides in identifying a determinant of the perceived substitutability of VR, namely the perceived authenticity of it, which explains almost half of its variance. The more authentic a person perceived VR experience in tourism, the more inclined they would be to use it.

Last but not least, this research demonstrates that interest in VR mediates the relationship between VR perceived ease of use, perceived usefulness, and perceived substitutability and behavioral intention to use VR in tourism. High interest in VR use in tourism would increase the positive effect of perceived ease of use, perceived usefulness, and perceived substitutability of VR on behavioral intention to use VR in tourism. Using the virtual world of Second Life, Huang et al. (2012) demonstrated that flow experience mediated the relationship between involvement and behavioral intention. Li and Chen (2019) found that perceived enjoyment of VR plays the role of a mediator in the relationship between perceived ease of use, perceived usefulness of VR, and travel intention. Kim et al. (2020a) identified the mediating role of cognitive and affective responses in forecasting attachment to VR and visit intention to visit a destination in VR. The present study is the first paper in which interest in VR is studied as a mediator of the behavioral intention to use VR in tourism.

5.2. Practical implications

What is the utility of our study to managerial practice? First, behavioral intention is a major determinant of usage behavior (Davis et al., 1989). Our model helps understanding user acceptance of VR in tourism and assists operators in finding short-term solutions for a pandemic context. Practitioners should be interested in understanding the behavioral intention determinants to increase acceptance

and usage of VR in tourism. It is a time of perceived risks and emotions when tourists might look for safer solutions in terms of health issues. Managers might influence future behavior through improving the perceived ease of use, perceived usefulness, and perceived substitutability of VR solutions in tourism. Our findings indicate that the perceived ease of use and the perceived usefulness are quite similar as regards to their impact on behavioral intention, followed closely by the perceived substitutability of VR. For an efficient strategy to improve acceptance, these determinants should be taken into account in a balanced manner. One could not generate consumption of VR tourism with a solution that lacks one of these features. Practitioners have to explain why a certain VR application is easy to use, useful, and able to substitute corporeal travel. By doing so, they will have a positive impact on people's behavioral intention to use VR in tourism.

In addition, through improved perceived authenticity of VR solutions, managers can increase the perceived substitutability, and eventually, the behavioral intention to use VR in tourism. Also, our study showed that interest in VR mediates the relationship between behavioral intention to use VR and its determinants. This might help managers identify communities interested in VR and trigger them into using it for tourism purposes. It would be easier to first convince those interested in VR to consume tourism products of this sort, and then share their experience and create a behavioral change within more general customer segments. The measures included in our model help practitioners identify ways to improve the awareness of VR solutions for tourism among potential users.

All of the above are micro-level implications. Though, we believe that our work could influence the tourism sector in a more profound way. The use of VR in tourism could improve the strategic flexibility of a tourism destination, which is defined as its ability to respond more willingly to unstable environments (Dwyer et al., 2014). VR could be used as a strategic flexibility facilitator to promote sustainable development of tourism and a responsive mechanism to provide attractive experiences during a health crisis situation. Many practitioners already started to use VR solutions to cope with the lockdown effect and keep people involved in their practice.

Therefore, the present paper is not only about mitigating the COVID-19 effect but also about contributing to creating a new, more resilient tourism model. This crisis opened a window of opportunity. If we improve the tourists' perception of VR substitutability and increase the acceptance of this solution, in time, we will increase the sustainability of the sector. Through switching from traditional travel to VR, we can lessen the pressure put on all resources. Is tourism bounded by corporeality? We think not. The developments seen in terms of improved VR solutions could be used to support this argument. The technology is expanding at a very high rate in this area, the headsets having the potential to become consumer products in a very short time. Through immersive interactions, the experiences improve in terms of memorability and authenticity, and as predicted by our model, authenticity increases the perceived substitutability.

Decision makers could use the VR substitutability avenue as a vector of change to improve tourism sustainability. Many admit that sustainability is a contemporary requirement (UN, 2020a, 2020b; UNWTO, 2018), and virtual tourism is a more sustainable solution. Through promoting VR use in tourism, authorities can support the United Nations' Sustainable Development Goal 13 on Climate Action (UN 2020a, 2020b), given virtual tourism related activities create lower CO₂ emissions than corporeal tourism.

The present study demonstrated that people could change their perception of the substitutability of tourism activities. As our model proposes, the behavioral intention to use VR in tourism can be boosted through perceived ease of use, perceived usefulness, and perceived substitutability of VR; the perceived substitutability of VR can be influenced through increased authenticity of VR solutions. VR could become a driving force in the new tourism paradigm. Through VR, we could soften the current exponential growth of tourism, which creates many climate problems. Moreover, disease and climate change have been linked (Winston, 2020). Consequently, if we use more VR in tourism, we might reverse some of the climate problems, and ultimately we might reduce the incidence of diseases such as COVID-19.

5.3. Limitations and future research

Our study has many contributions, but as part of our post-positivism stance, we recognize it has several limitations. First, in choosing the experiment, we tried to disrupt the predictability of classical quantitative methods. But, we acknowledge the necessity of triangulation of data. Future studies on the topic, using different research methods such as in-depth interviews or surveys will help in terms of triangulating the data obtained through our experimental approach. We have only initiated the understanding of the VR substitutability in tourism in the new context after the COVID-19 outbreak. Second, our sample is from only one country (Romania), selected using convenience sampling. The participants were drawn from students enrolled in business and tourism courses of a renowned higher education institution in economic studies. Third, the study was framed in a constraints context, being undertaken during the lockdown period imposed after the outbreak of COVID-19. This timeframe might have an indirect effect on the behavioral intention to use VR in tourism. A future test would be recommendable after the relaxation measures to see if the perceptions change again and people become less inclined to use VR, when the crisis is not that serious anymore, and when solutions to deal with the virus are imposed. Fourth, our main dependent variable was the behavioral intention to use VR in tourism. There are studies that concluded that intentions have a rather low predictive validity (Viglia and Dolnicar, 2020). In experimental research, the best option of an outcome Y is to assess actual behavior (Viglia and Dolnicar, 2020). Therefore, future research is needed to understand the actual use of VR in tourism. Additional research is also needed to understand the value and impact of external interventions on the perceived ease of use, perceived usefulness, perceived authenticity, and perceived substitutability of VR. Future studies should consider identifying techniques to improve the acceptance of VR solutions in tourism.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Adams, D.A., Nelson, R.R., Todd, P.A., 1992. Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS Quart.* 16 (2), 227–250.
- Adeboye, N.O., Fagoyinbo, I.S., Olatayo, T.O., 2014. Estimation of the Effect of Multicollinearity on the Standard Error for Regression Coefficients. *IOSR J. Math.* 10 (4), 16–20. Retrieved from <http://www.iosrjournals.org/iosr-jm/papers/Vol10-issue4/Version-1/D010411620.pdf>, accessed April 1, 2020.
- Allison, P., 1999. *Multiple Regression: A Primer*. Thousand Oaks: Pine Forge Press.
- Bagozzi, R.P., Davis, F.D., Warshaw, P.R., 1992. Development and test of a theory of technological learning and usage. *Human Relat.* 45 (7), 659–686.
- Barro, R.J., Ursua, J.F., Weng, J., 2020. The Coronavirus and the Great Influenza Epidemic Lessons from the “Spanish Flu” for the Coronavirus’s Potential Effects on Mortality and Economic Activity. In CESifo Working Papers, March 2020, Retrieved from https://www.cesifo.org/DocDL/cesifo1_wp8166.pdf, accessed April 22, 2020.
- Barua, S., 2020. Understanding Coronanomics: The Economic Implications of the Coronavirus (COVID-19) Pandemic. SSRN. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3566477, accessed April 18, 2020.
- Beck, J., Rainoldi, M., Egger, R., 2019. Virtual reality in tourism: a state-of-the-art review. *Tour. Rev.* 74 (3), 586–612.
- Berg, L.P., Vance, J.M., 2017. Industry use of virtual reality in product design and manufacturing: a survey. *Virtual Reality* 21 (1), 1–17.
- Bergkvist, L., Rossiter, J.R., 2007. The predictive validity of multiple-item versus single-item measures of the same constructs. *J. Mark. Res.* 44 (2), 175–184.
- Bhati, A., Upadhyaya, A., Sharma, A., 2016. National disaster management in the ASEAN-5: an analysis of tourism resilience. *Tour. Rev.* 71 (2), 1660–5373.
- Birch, D., Memery, J., 2020. Tourists, local food and the intention-behaviour gap. *J. Hospit. Tour. Manag.* 43, 53–61.
- Birnbaum, M.H., 1999. How to show that $9 > 221$: collect judgments in a between-subjects design. *Psychol. Methods* 4, 243–249.
- Blunch, N. J., 2012. *Introduction to Structural Equation Modeling Using IBM SPSS Statistics and Amos*. SAGE Publications Ltd., Second Edition.
- Boland, M., 2017. How do consumers really feel about VR? ARTILLY Insights. Retrieved from <https://www.thevrara.com/blog/2017/8/28/how-do-consumers-really-feel-about-vr-new-report>, accessed April 25, 2020.
- Breda, Z., 2004. The impact of severe acute respiratory syndrome (SARS) on China’s tourism sector. *Tour. Res. J.* 1 (2), 5–14.
- Bremner, C., 2020. Italy in Crisis as Tourism Demand Collapses Amid Coronavirus Pandemic. EUROMONITOR INTERNATIONAL. Retrieved from <https://blog.euromonitor.com/italy-in-crisis-as-tourism-demand-collapses-amid-coronavirus-pandemic/>, accessed April 2, 2020.
- Brunson, M., Shelby, B., 1993. Recreation substitutability: a research agenda. *Leisure Sci.* 15, 67–74.
- Bulman, R.A., Wortman, C.B., 1977. Attributes of blame and coping in the real world: severe accident victim react to their lot. *J. Pers. Soc. Psychol.* 35, 351–363.
- Burnkrant, R.E., Page Jr., T.J., 1982. An examination of the convergent, discriminant, and predictive validity of Fishbein’s behavioral intention model. *J. Marketing Res.* 19 (6), 550–561.
- Burt, R.S., 1973. Confirmatory factor-analytic structures and the theory construction process. *Sociol. Methods Res.* 2 (2), 131–190. <https://doi.org/10.1177/004912417300200201>.
- Campos, G., 2020. Five hundred trade shows cancelled, costing \$26bn, in Business, Covid-19, Live Events, March 12, 2020. Retrieved from <https://www.avinteractive.com/news/business/ufi-releases-first-global-assessment-of-the-economic-impact-that-covid-19-is-having-on-trade-shows-and-exhibitions-12-03-2020/>, accessed March 29, 2020.
- Cateran, H., Roederer, C., 2013. Does authenticity really affect behaviour? The case of the Strasbourg Christmas market. *Tourism Management* 36, 153–163.
- Cetin, G., 2020. Impact of Covid-19 on Tourism Industry. *J. Tourismol.* April 2020.
- Cha, J., 2013. Predictors of television and online video platform use: a coexistence model of old and new video platforms. *Telemat. Inform.* 30, 296–310.
- Cha, J., 2014. Usage of video sharing websites: drivers and barriers. *Telemat. Inform.* 31, 16–26.
- Cha, J., Chan-Olmsted, S.M., 2012. Substitutability between online video platforms and television. *J. Mass Commun. Quart.* 89 (2), 261–278.
- Chen, C.C., Tsai, J.L., 2019. Determinants of behavioral intention to use the personalized location-based mobile tourism application: an empirical study by integrating TAM with ISSM. *Future Gen. Comput. Syst.* 96, 628–638.
- Cheong, R., 1995. The virtual threat to travel and tourism. *Tour. Manag.* 16 (6), 417–422.
- Chhabra, D., 2005. Defining authenticity and its determinants: toward an authenticity flow model. *J. Travel Res.* 44, 64–73.
- Cho, Y.H., Wang, Y., Fesenmaier, D.R., 2002. Searching for experiences: the web-based virtual tour in tourism marketing. *J. Travel Tour. Market.* 12 (4), 1–17.
- Chung, J.Y., Kim, J.S., Lee, C.K., Kim, M.J., 2018. Slow-food-seeking behavior, authentic experience, and perceived slow value of a slow-life festival. *Curr. Issues in Tour.* 21 (2), 123–127.
- Chung, N., Han, H., Joun, Y., 2015. Tourists’ intention to visit a destination: The role of augmented reality (AR) application for a heritage site. *Comput. Hum. Behav.* 50, 588–599.
- Cohen, E., 1988a. Authenticity and Commoditization in Tourism. *Annals of Tourism Research.* 15 (3), 371–386.
- Cohen, E., 1988. *Statistical power analysis for the behavioral sciences* (2nd ed.). New York, NY: Academic Press.
- Cohen, J., Kupferschmidt, K., 2020. Strategies shift as coronavirus pandemic looms. *Science* 367 (6481), 962–963.
- Conti, A., 2017. Quarantine through history. *Int. Encycl. Public Health.* (Second Edition) 229–235, 2020. <https://doi.org/10.1016/B978-0-12-803678-5.00369-6>, accessed March 25.
- Correia Loureiro, S.M., Guerreiro, J., Ali, F., 2020. 20 years of research on virtual reality and augmented reality in tourism context: a text-mining approach. *Tourism Management.* 77, 104–128.
- Davis, F.D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quart.* 13 (3), 319–340.
- Davis, F.D., Bagozzi, R.P., Warshaw, P.R., 1989. User acceptance of computer technology: a comparison of two theoretical models. *Manage. Sci.* 35, 982–1002.
- Deloitte, 2020. COVID-19 Global Mobility update 23-24 March 2020. Retrieved from <https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/tax/deloitte-ch-tax-covid-19-global-mobility-update%20-23-24-march-2020.pdf>, accessed May 15, 2020.
- Dewailly, J.M., 1999. Sustainable tourist space: from reality to virtual reality? *Tour. Geograp.* 1 (1), 41–55.
- Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., Kaiser, S., 2012. Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective. *J. Acad. Mark. Sci.* 40 (3), 434–449.
- Di Salvo, M., 2020. The economic crises of the third millennium. Project: Economic effects of covid-19, April 2020, Retrieved from https://www.researchgate.net/publication/340363042_The_economic_crisis_of_the_third_millennium, accessed May 28, 2020.
- Disztinger, P., Schlogl, S., Groth, A., 2017. Technology acceptance of virtual reality for travel planning, in Schegg, R. and Stangl, B. (Eds), *Information and Communication Technologies in Tourism 2017 Proceedings of the International Conference in Rome, Italy, 24-26 January*, Springer, Cham, 255–268.
- Dwyer, L.M., Cvelbar, L.K., Edwards, D.J., Mihalic, T.A., 2014. Tourism firms’ strategic flexibility: the case of Slovenia. *Int. J. Tour. Res.* 16, 377–387.
- Ernst, C.P.H., Stock, B., dos Santos Ferreira, T., 2016. The Usage of Augmented Reality Smartglasses: The Role of Perceived Substitutability. In *Twenty-second Americas Conference on Information Systems* (pp. 1–9). San Diego, CA, USA: Association for Information Systems.
- European Centre for Disease Prevention and Control, 2020. Q and A on COVID-19, Retrieved from <https://www.ecdc.europa.eu/en/covid-19/questions-answers>, accessed April 30, 2020.
- Fan, Y., Zhao, K., Shi, Z.L., Zhou, P., 2019. Bat Coronaviruses in China. *Viruses.* 11 (3).

- Fernandes, T., Oliveira, E., 2021. Understanding consumers' acceptance of automated technologies in service encounters: drivers of digital voice assistants adoption. *J. Bus. Res.* 122, 180–191.
- Freifer, R., 2020. International Hotels and Restaurants Association (IHRA) takes special measures to face COVID-19. Retrieved from <https://www.hospitalitynewsmag.com/en/event/international-hotels-and-restaurants-association-ihra-takes-special-measures-to-face-covid-19/>, accessed April 26, 2020.
- Fuchs, C., Diamantopoulos, A., 2009. Using single-item measures for construct measurement in management research. *Bus. Admin. Rev.* 69 (2), 195–210.
- Giusti, G., Raya, J.M., 2019. The effect of crime perception and information format on tourists' willingness/intention to travel. *J. Destin. Market. Manag.* 11, 101–107. Global Web Index, 2016. 4 in 10 16-34s interested in VR. Retrieved from <http://www.globalwebindex.net/blog/4-in-10-16-34s-interested-in-vr>, accessed April 17, 2020.
- Goldman, R., Papson, S., 1996. *Sign Wars The Cluttered Landscape of Advertising*. New York: Guildford.
- Gössling, S., Scott, D., Hall, M., 2020. Pandemics, tourism and global change: a rapid assessment of COVID-19. *Journal of Sustainable Tourism*. Retrieved from <https://www.tandfonline.com/doi/full/10.1080/09669582.2020.1758708>, accessed May 15, 2020.
- Gravetter, F.J., Forzano, L.B., 2012. *Research Methods for the Behavioral Sciences*. (4th edition). Belmont, CA: Wadsworth.
- Griffin, T., Giberson, J., Lee, S.H.M., Guttentag, D., Kandaurova, M., Sergueeva, K., Dimanche, F., 2017. Virtual reality and implications for destination marketing. In TTRA International Conference on Travel and Tourism Research Association: Advancing Tourism Research Globally. Québec, 20-22 June, paper 29.
- Gutowska, P., Klos-Adamkiewicz, Z., 2020. Development of e-service virtual museum tours in Poland during the SARS-CoV-2 pandemic, 24th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems. *Proc. Comput.Sci.* 176, 2375–2383.
- Guttentag, D.A., 2010. Virtual reality: applications and implications for tourism. *Tour. Manag.* 31, 637–651.
- Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R.L., 2010. *Multivariate data analysis* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Hair, J., Hult, T., Ringle, C., Sarstedt, M., 2014. *A primer on partial least squares structural equation modelling (PLS-SEM)*. Thousand Oaks, CA: Sage Publications.
- Haleem, A., Javaid, M., Vaishya, R., 2020. Effects of COVID-19 pandemic in daily life. *Curr. Med. Res. Pract.* 10 (2), 78–79.
- Hayduk, L.A., Littvay, L., 2012. Should researchers use single indicators, best indicators, or multiple indicators. *BMC Med. Res. Method.* 12 (159), 1–17. <https://doi.org/10.1186/1471-2288-12-159>.
- Hayduk, L.A., Stratkotter, R.F., Rovers, M.W., 1997. Sexual orientation and the willingness of catholic seminary students to conform to church teachings. *J. Sci.Study Religion.* 36 (3), 455–467.
- Hendee, J., Burdge, R., 1974. The substitutability concept: Implications for recreation research and management. *J. Leis.* 6, 157–162.
- Hennig-Thurau, T., Henning, V., Sattler, H., 2007. Consumer file sharing of motion pictures. *J. Market.* 71, 1–18.
- Hobson, J.S.P., Williams, A.P., 1995. Virtual reality: a new horizon for the tourism industry. *J. Vacat. Market.* 1 (2), 125–135.
- Hohenberger, C., Spörrle, M., Welp, I.M., 2016. How and why do men and women differ in their willingness to use automated cars? The influence of emotions across different age groups. *Trans. Res. Part A Policy Pract.* 94 (C), 374–385.
- Hsu, C.L., Lu, H.P., 2004. Why do people play on-line games? An extended TAM with social influences and flow experience. *Inform. Manag.* 41 (7), 853–868.
- Hu, L.-T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model.* 6 (1), 1–55.
- Huang, Y.-C., Backman, S.J., Backman, K.J., 2012. Exploring the impacts of involvement and flow experiences in second life on people's travel intentions. *J. Hospital. Tour. Technol.* 3 (1), 4–23.
- Huang, Y.-C., Backman, S.J., Backman, K.J., Moore, DeW., 2013. Exploring user acceptance of 3D virtual worlds in travel and tourism marketing. *Tour. Manag.* 36, 490–501.
- Huang, Y.C., Backman, K.F., Backman, S., Chang, L.L., 2016. Exploring the implications of virtual reality technology in tourism marketing: an integrated research framework. *Int. J. Tourism Res.* 18 (2), 116–128.
- Iacobucci, D., Saldanha, N., Deng, X., 2007. A meditation on mediation: evidence that structural equations models perform better than regressions. *J. Consum. Psychol.* 17 (2), 139–153.
- IATA, 2020. IATA Updates COVID-19 Financial Impacts - Relief Measures Needed - Press Release No: 12, 5 March 2020, Retrieved from <https://www.iata.org/en/pressroom/pr/2020-03-05-01/>, accessed March 27, 2020.
- IBM, 2018. Should single-indicator latent variables be used in AMOS? Retrieved from <https://www.ibm.com/support/pages/should-single-indicator-latent-variables-be-used-amos>, accessed September 5, 2020.
- Iso-Ahola, S.E., 1986. A theory of substitutability of leisure behavior. *Leisure Sci.* 8 (4), 367–389.
- Ivanov, D., 2020. Predicting the impacts of epidemic outbreaks on global supply chains: a simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. *Trans. Res. Part E Logist. Trans. Rev.* 136.
- Johnston, R., Jones, K., Manley, D., 2018. Confounding and collinearity in regression analysis: a cautionary tale and an alternative procedure, illustrated by studies of British voting behavior. *Qual. Quant.* 52 (4), 1957–1976. <https://doi.org/10.1007/s11135-017-0584-6>. Published online 2017 Nov 13.
- Joppe, M., 2020. Trapped tourists: how is the coronavirus affecting travel? World Economic Forum, 05 February 2020. Retrieved from <https://www.weforum.org/agenda/2020/02/the-coronavirus-will-hit-the-tourism-and-travel-sector-hard>, accessed April 2, 2020.
- Judd, C.M., Kenny, D.A., McClelland, G.H., 2001. Estimating and testing mediation and moderation in within-subject designs. *Psychol. Methods* 6 (2), 115–134.
- Jung, T., tom Dieck, M.C., Moorhouse, N., tom Dieck, D., 2017. Tourists' experience of virtual reality applications. In IEEE International Conference on Consumer Electronics (ICEE), Las Vegas, NV, USA, 8-10 January, IEEE, 208-210.
- Kang, H., 2020. Impact of VR on impulsive desire for a destination. *J. Hospital. Tour. Manag.* 42, 244–255.
- Kaplanidou, K., Vogt, C., 2006. A structural analysis of destination travel intentions as a function of web site features. *J. Travel Res.* 45 (2), 204–216.
- Karl, M., Bauer, A., Ritchie, W.B., Passauer, M., 2020. The impact of travel constraints on travel decision-making: a comparative approach of travel frequencies and intended travel participation. *J. Destin. Market. Manag.* 18, 100471.
- Kelly, E., Zubascu, F., 2020. COVID-19 crisis forces EU to prepare Plan B (and Plan C) for seven-year budget. 31 Mar 2020, Retrieved from <https://sciencebusiness.net/covid-19/news/covid-19-crisis-forces-eu-prepare-plan-b-and-plan-c-seven-year-budget>, accessed April 20, 2020.
- Kenny, D.A., 2016. Multiple Latent Variable Models: Confirmatory Factor Analysis, Retrieved from <http://davidakenny.net/cm/mfactor.htm>, accessed May 15, 2020.
- Kim, D.Y., Park, J., Morrison, A.M., 2008. A model of traveler acceptance of mobile technology. *Int. J. Tour. Res.* 10 (5), 393–407.
- Kim, J.H., 2019. Multicollinearity and misleading statistical results. *Korean J. Anesthesiol.* 72(6), 558-569, DOI: 10.4097/kja.19087 , accessed April 10, 2020.
- Kim, M.J., Bonn, M., Lee, C.K., 2017. Seniors' dual route of persuasive communications in mobile social media and the moderating role of discretionary time. *Asia Pacific J. Tour. Res.* 22 (8), 1799–1781.
- Kim, M.J., Hall, C.M., 2019. A hedonic motivation model in virtual reality tourism: comparing visitors and non-visitors. *Int. J. Inf. Manag.* 46, 236–249.
- Kim, M.J., Lee, C.K., Contractor, N.S., 2019. Seniors' usage of mobile social network sites: Applying theories of innovation diffusion and uses and gratifications. *Comput. Hum. Behav.* 90, 60–73.
- Kim, M.J., Lee, C.K., Jung, T., 2020a. Exploring consumer behavior in virtual reality tourism using an extended stimulus-organism-response model. *J. Travel Res.* 59 (1), 69–89.
- Kim, M.J., Lee, C.K., Preis, M.W., 2020b. The impact of innovation and gratification on authentic experience, subjective well-being, and behavioral intention in tourism virtual reality: the moderating role of technology readiness. *Telematics Inform.* 49, 1–16.
- Konietschke, F., Pauly, M., 2013. Bootstrapping and permuting paired t-test type statistics. *Stat. Comput.* 24 (3) <https://doi.org/10.1007/s11222-012-9370-4>.
- Kuo, H., Chen, C.C., Tseng, W.C., Ju, L.F., Huang, B.W., 2008. Assessing impacts of SARS and Avian Flu on international tourism demand to Asia. *Tour. Manag.* 29 (1), 917–928.
- Lambdin, C., Shaffer, V.A., 2009. Are within-subjects designs transparent? *Judge. Dec. Making.* 4(7), 554–566, Retrieved from <http://journal.sjdm.org/9921/jdm9921.pdf> , accessed April 1, 2020.
- Lamberton, C.P., Rose, R.L., 2012. When is ours better than mine? A framework for understanding and altering participation in commercial sharing systems. *J. Market.* 76 (4), 109–125.

- Lee, C.-K., Song, H.-J., Bendle, L.J., Kim, M.-J., Han, H., 2012. The impact of non-pharmaceutical interventions for 2009 H1N1 influenza on travel intentions: a model of goal-directed behavior. *Tour. Manag.* 33, 89–99.
- Lee, J., Kim, J., Choi, J.Y., 2019. The adoption of virtual reality devices: The technology acceptance model integrating enjoyment, social interaction, and strength of the social ties. *Telemat. Inform.* 39, 37–48.
- Lee, O., Oh, J.E., 2007. The impact of virtual reality functions of a hotel website on travel anxiety. *CyberPsychol. Behav.* 10 (4), 584–586.
- Leung, L., Chen, C., 2017. Extending the theory of planned behavior: a study of lifestyles, contextual factors, mobile viewing habits, TV content interest, and intention to adopt mobile TV. *Telemat. Inform.* 34, 1638–1649.
- Leung, X.Y., Lyu, J., Bai, B., 2019. A fad or the future? Examining the effectiveness of virtual reality advertising in the hotel industry. *Int. J. Hospital. Manag.* <https://doi.org/10.1016/j.ijhm.2019.102391> (in press).
- 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. *J. Destin. Market. Manag.* 12, 15–26.
- Lim, X.J., Ng, S.I., Chuah, F., Cham, T.H., Rozali, A., 2019. I see, and I hunt: The link between gastronomy online reviews, involvement and behavioral intention towards ethnic food. *Br. Food J.* 1–24. Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/BFJ-07-2018-0459>.
- Lin, C.A., 2004. Webcasting adoption: technology fluidity, user innovativeness, and media substitution. *J. Broadcast. Electron. Media.* 48 (3), 446–465.
- Lin, L.-P., Huang, S.-C., Ho, Y.-C., 2020. Could virtual reality effectively market slow travel in a heritage destination? *Tour. Manag.* 78, 104027.
- Lock S., 2020. Coronavirus: impact on the tourism industry worldwide - Statistics and Facts. STATISTA, Apr. 9, 2020. Retrieved from <https://www.statista.com/topics/6224/covid-19-impact-on-the-tourism-industry/>, accessed April 28, 2020.
- Lu, D., Lai, I.K.W., Liu, Y., 2019. The consumer acceptance of smart product-service systems in sharing economy: the effects of perceived interactivity and particularity. *Sustainability.* 928 (11), 1–22.
- MacKenzie, S.B., Lutz, R.J., Belch, G.E., 1986. The role of attitude toward the ad as a mediator of advertising effectiveness: a test of competing explanations. *J. Mark. Res.* 23 (1), 130–143.
- MacKinnon, D.P., Cox, S., Baraldi, A.N., 2012. Guidelines for the investigation of mediating variables in business. *Res. J. Bus. Psychol.* 27 (1), 1–14. <https://doi.org/10.1007/s10869-011-9248-z>.
- Makshimov, V., 2020. Coronavirus derogations from human rights send wrong signal, say MEPs, March 24, 2020. Retrieved from <https://www.euractiv.com/section/justice-home-affairs/news/coronavirus-derogations-from-human-rights-send-wrong-signal-say-meps/>, accessed April 7, 2020.
- Mara, C.A., Cribbie, R.A., 2012. Paired-Samples Tests of Equivalence. *Commun. Stat. Simul. Comput.* 41, 1928–1943. Copyright Taylor and Francis Group, LLC.
- Marasco, A., Buonincontri, P., van Niekerk, M., Orłowski, M., Okumus, F., 2018. Exploring the role of next-generation virtual technologies in destination marketing. *J. Destin. Market. Manag.* 9, 138–148.
- Marchiori, E., Niforatos, E., Preto, L., 2017. Measuring the media effects of a Tourism-Related virtual reality experience using biophysical data, in Schegg, R. and Stangl, B. (Eds), *Information and Communication Technologies in Tourism 2017 Proceedings of the International Conference in Rome, Italy, 24-26 January*, Springer, Cham, 203–215.
- Marsh, H.W., Ellis, L.A., Parada, R.H., Richards, G., Heubeck, B.G., 2005. A short version of the self description questionnaire II: operationalizing criteria for short-form evaluation with new applications of confirmatory factor analyses. *Psychol. Assess.* 17 (1), 81–102.
- Mathieson, K., 1991. Predicting user intentions: comparing the technology acceptance model with theory planned behavior. *Inform. Syst. Res.* 2 (3), 192–222.
- McCannell, D., 1973. Staged authenticity: arrangements of social space in tourist settings. *Am. J. Sociol.* 79 (3), 589–603.
- McCarthy, N., 2020. The coronavirus pandemic could push half a billion people into poverty. *The World Economic Forum.* 12 Apr. 2020. Retrieved from <https://www.weforum.org/agenda/2020/04/coronavirus-pandemic-half-a-billion-people-into-poverty/>, accessed April 30, 2020.
- McKercher, B., Chon, K., 2004. The over-reaction to SARS and the collapse of Asian tourism. *Ann. Tour. Res.* 31 (3), 716–719. <https://doi.org/10.1016/j.annals.2003.11.002>.
- Meier, M.B., Habibi, R., Yang, Y.T., 2020. Travel restrictions violate international law. *Science.* 367(6485), 1436. Retrieved from <https://science.sciencemag.org/content/367/6485/1436.2>, accessed April 30, 2020.
- Memish, Z., Perlman, S., Van Kerkhove, M., Zumla, A., 2020. Middle East respiratory syndrome. *Lancet.* 395 (10229), 1063–1077.
- Mohsin, A., Lengler, J., Chaiya, P., 2017. Does travel interest mediate between motives and intention to travel? A case of young Asian travellers. *J. Hospit. Tour. Manag.* 31, 36–44.
- Monterrubio, C., 2010. Short-term economic impacts of influenza A (H1N1) and government reaction on the Mexican tourism industry: an analysis of the media. *Int. J. Tour. Policy.* 3 (1).
- Morris, M.G., Dillon, A., 1997. How user perceptions influence software use. *Decis. Support Syst.* 58–65.
- Moták, L., Neuville, E., Chambres, P., Marmoiton, F., Monéger, F., Coutarel, F., Izaute, M., 2017. Antecedent variables of intentions to use an autonomous shuttle: Moving beyond TAM and TPB? *Revue européenne de psychologie appliquée.* 67, 269–278.
- Mura, P., Tavakoli, R., Sharif, S.P., 2017. Authentic but not too much: exploring perceptions of authenticity of virtual tourism. *Inf. Technol. Tour.* 17 (2), 1–15.
- Nagy, M.S., 2002. Using a single-item approach to measure facet job satisfaction. *J. Occup. Organ. Psychol.* 75, 77–86.
- Nielsen, 2020. COVID-19: The Unexpected Catalyst for Tech Adoption, CPG, FMCG & RETAIL 16-03-2020, Retrieved from <https://www.nielsen.com/eu/en/insights/article/2020/covid-19-the-unexpected-catalyst-for-tech-adoption/>, accessed August 30, 2020.
- Nodjoman, A.T., Kockelman, K., 2019. How does the built environment affect interest in the ownership and use of self-driving vehicles? *J. Transp. Geogr.* 78, 115–134.
- Novelli, M., Gussing, Burgess L., Jones, A., Ritchie, B.W., 2018. No Ebola...still doomed - The Ebola-induced tourism crisis. *Ann. Tour. Res.* 70, 76–87.
- Nunnally, J., Bernstein, L., 1994. *Psychometric theory*. New York: McGraw-Hill Higher, INC.
- Oberski, D.L., Satorra, A., 2013. Measurement error models with uncertainty about the error variance. *Struct. Eq. Model. A Multidis. J.* 20 (3), 409–428. <https://doi.org/10.1080/10705511.2013.797820>.
- OECD, 2020. An inclusive, green recovery is possible: The time to act is now, 22/04. Retrieved from <https://www.oecd.org/coronavirus/en/>, accessed May 8, 2020.
- Oguz B., Gordon, G., Cruz, H.H., 2020. Global tourism and the COVID-19 pandemic. Retrieved from <https://www.dailysabah.com/opinion/op-ed/global-tourism-and-the-covid-19-pandemic>, accessed April 30, 2020.
- Onyskiw, J.E., Hayduk, L.A., 2001. Processes underlying children's adjustment in families characterized by physical aggression. *Fam. Relat.* 50 (4), 376–385. <https://doi.org/10.1111/j.1741-3729.2001.00376.x>.
- Ozili P., K., Arun, T., 2020. Spillover of COVID-19: impact on the Global Economy. SSRN Electron. J. Retrieved from https://www.researchgate.net/publication/340236487_Spillover_of_COVID-19_impact_on_the_Global_Economy, accessed April 30, 2020.
- Pando-García, J., Periañez-Cañadillas, I., Charterina, J., 2016. Business simulation games with and without supervision: an analysis based on the TAM model. *J. Bus. Res.* 69, 1731–1736.
- Pavlou, P., 2003. Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model. *Int. J. Electron. Comm.* 7 (3), 69–103.
- Perry, A., 2016. Consumers' acceptance of smart virtual closets. *J. Retail. Consum. Serv.* 33, 171–177.
- Petrescu, M., 2013. Marketing research using single-item indicators in structural equation models. *J. Market. Anal.* 1, 99–117. <https://doi.org/10.1057/jma.2013.7>.
- Pine II, B., Gilmore, J.H., 2013. The experience economy: past, present and future. In book: *Handbook on the Experience Economy*. Edward Elgar, Editors: Sundbo, Jon and Sørensen, Flemmin. 0.4337/9781781004227.0000.
- Preacher, K.J., Hayes, A.F., 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavi. Res. Methods.* 40, 879–891. Retrieved from http://quantpsy.org/pubs/preacher_hayes_2008b.pdf, accessed April 12, 2020.
- Preacher, K.J., Kelley, K., 2011. Effect size measures for mediation models: quantitative strategies for communicating indirect effects. *Psychol. methods.* 16(2), 93. Retrieved from http://quantpsy.org/pubs/preacher_kelley_2011.pdf, accessed April 12, 2020.

- Raes, A., Vanneste, P., Pieters, M., Windey, I. Van, Den Noortgate, W., Depaep, F., 2020. Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes. *Comput. Educ.* 143, 103682.
- Rainoldi, M., Driescher, V., Lisnevskaya, A., Zvereva, D., Stavinska, A., Relota, J., Egger, R., 2018. Virtual reality: an innovative tool in destinations' marketing. *Gaze J. Tour. Hospital.* 9 (1), 53–68.
- Raykov, T., Marcoulides, G. A. 2000. *A First Course in Structural Equation Modeling*, Lawrence Erlbaum Associates Inc.
- Richins, M.L., Bloch, P.H., 1986. After the new wears off: the temporal context of product involvement. *J. Consum. Res.* 13, 280–285.
- Röcker, C., Kaulen, D., 2014. Smart banking: user characteristics and their effects on the usage of emerging banking applications. *Int. J. Virtual Worlds Human Comput.* 2, 1–9.
- Rogers, S., 2018. Why Millennials Need VR. *Forbes*, Oct 23, Retrieved from <https://www.forbes.com/sites/solrogers/2018/10/23/why-millennials-need-vr/#1ad173026260>, accessed April 29, 2020.
- Rossiter, J.R., 2002. The C-OAR-SE procedure for scale development in marketing. *Int. J. Res. Mark.* 19 (4), 305–335.
- Roubini, N., 2020. This is what the economic fallout from coronavirus could look like. *World Economic Forum*, 06 April 2020. Retrieved from <https://www.weforum.org/agenda/2020/04/depression-global-economy-coronavirus/>, accessed April 30, 2020.
- Ruiz Estrada, M., 2020. A Post-Wuhan-COVID-19 Economic Recovery Proposal: The National Domestic Economic Auto-Sustainability Model (NDEAS-Model). DOI: 10.13140/RG.2.2.23882.93128/1, accessed April 30, 2020.
- Russell, S.S., Spitzmüller, C., Lin, L.F., Stanton, J.M., Smith, P.C., Ironson, G.H., 2004. Shorter can also be better: the abridged job in general scale. *Educ. Psychol. Measur.* 64, 878–893.
- Saeed, N., Yang, Y., Sinnappan, S., 2009. Emerging web technologies in higher education: a case of incorporating blogs, podcasts and social bookmarks in a web programming course based on students' learning styles and technology preferences. *Edu. Technol. Soc.* 12 (4), 98–109.
- Sagan, A., Pawelek, B. 2014. Single-indicator sem with measurement error: Case of Klein I model. In M. Carpita, E. Brentari, & E. E. Qannari (Eds.), *Advances in Latent Variables*, pp. 171–183, Cham, Switzerland: Springer.
- Sanchez-Cabrero, R., Costa-Roman, O., Pericacho-Gomez, F.R., Novillo-Lopez, M.A., Arigita-García, A., Barrientos-Fernandez, A., 2019. Early virtual reality adopters in Spain: sociodemographic profile and interest in the use of virtual reality as a learning tool. *Heliyon.* 5 (1–28), e01338 <https://doi.org/10.1016/j.heliyon.2019.e01338>.
- Schweizer, K., 2011. Some thoughts concerning the recent shift from measures with many items to measures with few items. *Eur. J. Psychol. Assess.* 27 (2), 71–72. <https://doi.org/10.1027/1015-5759/a000056>.
- Serra, A., Leong, C., 2020. Here's what travelling could be like after COVID-19. *World Economic Forum, Global Agenda*. Retrieved from <https://www.weforum.org/agenda/2020/05/this-is-what-travelling-will-be-like-after-covid-19/>, accessed May 20, 2020.
- Smith, P.L., Little, D.R., 2018. Small is beautiful: In defense of the small-N design. *Psychon. Bull. Rev.* 25, 2083–2101.
- Snooks, G., 2020. Fight the Virus (COVID-19), Not the Economy! How to Avoid the "Interventionist Storm". March 2020, Retrieved from https://www.researchgate.net/publication/340260891_Fight_the_Virus_COVID-19_Not_the_Economy_How_to_Avoid_the_Interventionist_Storm, accessed April 27, 2020.
- Sobel, M.E., 1982. Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociological methodology 1982* (pp. 290–312). Washington, DC: American Sociological Association.
- Sussmann, S., Vanhegan, H.J., 2000. Virtual reality and the tourism product: substitution or complement. In *Proceedings of the European conference on information systems (ECIS)*. Vienna, 1077–1083.
- Surovaya, E., Prayag, G., Yung, R., Khoo-Lattimore, C., 2020. Telepresence or not? Virtual reality, service perceptions, emotions and post-consumption behaviors. *Anatolia.* <https://doi.org/10.1080/13032917.2020.1808431>.
- Szajna, B., 1996. Empirical evaluation of the revised technology acceptance model. *Manage. Sci.* 42 (1), 85–92.
- Tew P., J., Lu Z., Tolomiczenko G., Gellatli J., 2008. SARS: Lessons in strategic planning for hoteliers and destination marketers. *International J. Contem. Hospital. Manag.* 20(3), 332–346.
- The European Tourism Manifesto, 2020. European tourism sector demands urgent supportive measures to reduce devastating impact of COVID-19, March 17, 2020, *Coronavirus, Presentations, Press Releases*. Retrieved from <https://tourismmanifesto.eu/european-tourism-sector-demands-urgent-supportive-measures-to-reduce-devastating-impact-of-covid-19/>, accessed April 15, 2020.
- Thompson, V., Compeau, D., Higgins, C., 2006. Intentions to use information technologies: an integrative model. *J. Organ. End User Comput.* 18 (3), 25–46.
- Thompson, V.A., Campbell, I.D., 2004. A power struggle: between- vs. within-subjects designs in deductive reasoning research. *Psychologia.* 47, 277–296.
- Tussyadiah, I.P., Wang, D., Jia, C.H., 2017. Virtual reality and attitudes toward tourism destinations, in Schegg, R. and Stangl, B. (Eds.), *Information and Communication Technologies in Tourism 2017 Proceedings of the International Conference in Rome, Italy, 24–26 January*, Springer, Cham, 229–239.39.
- Tussyadiah, I.P., Wang, D., Jung, T.H., tom Dieck, M.C., 2018. Virtual reality, presence, and attitude change: Empirical evidence from tourism. *Tour. Manag.* 66, 140–154.
- Umehuro, H., 2004. Computer attitude, cognitive abilities, and technology use among older Japanese adults. *Gerontechnology.* 3, 64–76.
- UN (United Nations), 2020. About the Sustainable Development Goals, 24 January. Retrieved from <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>, accessed May 20, 2020.
- UN (United Nations), 2020. COVID-19: Embracing digital government during the pandemic and beyond, Division for Public Institutions and Digital Government, United Nations Department of Economic and Social Affairs, Policy Brief 61. Retrieved from <https://www.un.org/development/desa/dpad/publication/un-desapolicy-brief-61-covid-19-embracing-digital-government-during-the-pandemic-and-beyond/>, accessed September 20, 2020.
- UNWTO, 2018. Tourism and the sustainable development goals – Journey to 2030, All regions, 25 JAN 18. Retrieved from <https://www.unwto.org/global/publication/tourism-and-sustainable-development-goals-journey-2030>, accessed May 20, 2020.
- UNWTO, 2020a. The future is now! UNWTO recognizes world's best innovators facing up to COVID-19. Retrieved from <https://www.unwto.org/news/the-future-is-now-unwto-recognizes-world%E2%80%99s-best-innovators-facing-up-to-covid-19>, accessed May 8, 2020.
- UNWTO, 2020b. Tourism and COVID-19, 13 March 2020. Retrieved from https://webunwto.s3.eu-west-1.amazonaws.com/s3fs-public/2020-04/COVID19_NewDS_.pdf, accessed April 17, 2020.
- Van der Heijden, H., 2003. Factors influencing the usage of websites: the case of a generic portal in The Netherlands. *Inform. Manag.* 40 (6), 541–549.
- Venkatesh, V., Davis, F.D., 2000. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Manage. Sci.* 46 (2), 186–204.
- Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D., 2003. User acceptance of information technology: Toward a unified view. *MIS Quart.* 27 (3), 425–478.
- Viglia, G., Dolnicar, F., 2020. A review of experiments in tourism and hospitality. *Ann. Tour. Res.* 80 <https://doi.org/10.1016/j.annals.2020.102858>.
- Vishwakarma, P., Mukherjee, S., Datta, B., 2020. Travelers' intention to adopt virtual reality: a consumer value perspective. *J. Destin. Market. Manag.* 17, 100456.
- Wang, N., 1999. Rethinking authenticity in tourism experience. *Ann. Tour. Res.* 26 (2), 349–370.
- Wanous, J.P., Reichers, A.E., Hudy, M.J., 1997. Overall job satisfaction: how good are single-item measures? *J. Appl. Psychol.* 82, 247–252.
- Warshaw, P.R., Davis, F., 1985. Disentangling behavioral intention and behavioral expectation. *J. Exp. Soc. Psychol.* 21 (3), 213–228.
- Wei, W., Qi, R., Zhang, L., 2019. Effects of virtual reality on theme park visitors' experience and behaviors: a presence perspective. *Tour. Manag.* 71, 282–293.
- Wiederhold, B.K., 2020. Connecting through technology during the coronavirus disease 2019 pandemic: avoiding "Zoom Fatigue". *Cyberpsychol. Behav. Soc. Netw.* 23, 437–438.
- Wilden-Smith, A., Freedman, D.O., 2020. Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak. *Journal of Travel Medicine.* 27(2). Retrieved from <https://doi.org/10.1093/jtm/taaa020>, accessed April 26, 2020.
- Wilden-Smith, A., Chiew, C., Lee, V., 2020. Can we contain the COVID-19 outbreak with the same measures as for SARS? *Lancet.* 20 (5), 102–107.
- Wiltshier, P., Clarke, A., 2016. Virtual cultural tourism: six pillars of VCT using co-creation, value exchange and exchange value. *Tour. Hospital. Res.* 17 (4), 372–383.
- Winston, A., 2020. Is the COVID-19 Outbreak a Black Swan or the New Normal? *MIT Sloan Management Review*. March 16. Retrieved from <https://sloanreview.mit.edu/article/is-the-covid-19-outbreak-a-black-swan-or-the-new-normal/>, accessed May 10, 2020.

- World Health Organization, 2003. Summary of WHO Measures Related to International Travel. World Health Organization. Retrieved from <http://www.who.int/csr/sars/travelupdate/en/>, accessed April 20, 2020.
- World Health Organization, 2009. No rationale for travel restrictions, 1 May 2009. Retrieved from www.who.int/csr/disease/swineflu/guidance/public_health/travel_advice/en/index.html, accessed April 20, 2020.
- World Health Organization, 2010. H1N1 in post-pandemic period. Retrieved from https://www.who.int/mediacentre/news/statements/2010/h1n1_vpc_20100810/en/, accessed April 15, 2020.
- World Health Organisation, 2020. Coronavirus disease (COVID-19) pandemic. Retrieved from <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>, accessed April 30, 2020.
- World Travel and Tourism Council (WTTC), 2020a. WTTC outlines what “the new normal” will look like as we start to travel, 30/04. Retrieved from <https://wttc.org/News-Article/WTTC-outlines-what-the-new-normal-will-look-like-as-we-start-to-travel>, accessed May 10, 2020.
- World Travel and Tourism Council (WTTC), 2020b. WTTC Vision and Recommendations for Travel and Tourism Recovery Post COVID-19. Retrieved from <https://wttc.org/en-gb/COVID-19/Recovery-Post-COVID-19>, accessed May 10, 2020.
- World Travel Agents Associations Alliance (WTAAA), 2020. WTAAA statement on the effects of COVID-19 on the travel industry, 13 April 2020. Retrieved from <https://www.ectaa.org/Uploads/statements/WTAAA-Statement-on-the-Effects-of-COVID-19-041020-FINAL.pdf>, accessed April 29, 2020.
- Xiang, Z., 2018. From digitization to the age of acceleration: On information technology and tourism. *Tour. Manag. Perspect.* 25, 147–150.
- Yung, R., Khoo-Lattimore, C., 2019. New realities: a systematic literature review on virtual reality and augmented reality in tourism research. *Curr. Iss. Tour.* 22 (17), 2056–2081.
- Yung, Y.F., Bentler, P.M., 1994. Bootstrap-corrected ADF test statistics in co-variance structure analysis. *Br. J. Math. Stat. Psychol.* 47 (1), 63–84. <https://doi.org/10.1111/j.2044-8317.1994.tb01025.x>.
- Zaichkowsky, J.L., 1986. Conceptualizing involvement. *J. Advert.* 15, 4–34.