Eesti Maaülikool
Estonian University of Life Sciences

VIRTUAL REALITY IN SUPPORT OF SUSTAINABLE TOURISM: EXPERIENCES FROM EASTERN EUROPE

VIRTUAALREAALSUS TOETAMAS JÄTKUSUUTLIKKU TURISMI: IDA-EUROOPA KOGEMUSED

SERGEY KASK

A Thesis
for applying for the degree of Doctor of Philosophy
in Environmental Sciences

Väitekiri
filosoofiadoktori kraadi taotlemiseks keskkonnateaduste erialal

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Estonian University of Life Sciences**

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CONTENTS

LIST OF ORIGINAL PUBLICATIONS

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II   **Kask, S.**, Kull, T., & Orru, K. (2018). Use of 3D Visualization for Sustainable Tourism Planning. *Journal of Baltic Studies*, 49, 371-385.

III Orru, K., **Kask, S.**, & Nordlund, A. (2018). Satisfaction with virtual nature tour: The roles of the need for emotional arousal and pro-ecological motivations. *Journal of Ecotourism*, DOI: 10.1080/14724049.2018.1526290

The contributions from the authors to the papers are as follows:

Paper	Idea and design	Data collection	Data analysis	Manuscript preparation
I	**SK**	**SK**	**SK**	**SK,** TK, KO
II	**SK,** KO	**SK**	**SK,** TK, KO	**SK,** TK, KO
III	**SK,** KO, TK	**SK**	**SK,** KO, AN	**SK,** KO, AN

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KO – Kati Orru

ABBREVIATIONS

3DV   Three dimensional visualization
RTM   Russian tourism managers
ST   Sustainable tourism
STD   Sustainable tourism development
STP   Sustainable tourism planning
VBN   Value-belief-norm
VR   Virtual reality
VT   Virtual travel
PD   Participatory development

1. INTRODUCTION

Tourism development leads to intensification of infrastructure worldwide. This in turn impacts on the natural environment and along with globalisation is perceived to be increasing in frequency and intensity. Conflict between sustainability and development of a destination is coming into focus globally including in Estonia and Russia. Russian and Estonian stakeholders, for example, tourism managers, ecologists and local authorities wish to understand more about the possible means to explore the experience. Tourists motivations to travel include hedonistic gains, socialisation, need for place change and others. According to WTO (2017) during the last 25 years the number of tourists grew more than two-fold worldwide and tourism pressure on the natural environment could increase even further during the next 25 years. Greenhouse gas emission from tourism related transportation keeps on emitting greenhouse gases in the atmosphere in numbers that require urgent attention according to the concept of sustainability. Stakeholders in Eastern Europe are looking for instruments to decrease the impacts and effects of conventional tourism.

Estonian ecosystems are sensitive to human interference while nature tourism in such areas may negatively affect the environment. In areas subjected to "natural sightseeing", and where carrying capacities are almost exceeded, further tourism development should be especially limited. In order to better understand this problem and elaborate solutions, links between environmental and social research are necessary. This study aimed to establish methodologies for implementing sustainable development within nature-based tourism and to present opportunities for the tourism sector which take into consideration the values expressed in the concept of sustainability and which can reduce negative tourism impacts on the natural environment and local culture. Such solutions may include the development of possible complementarities to conventional tourism such as virtual travel (VT) to show landscapes and to enable tourists to penetrate into the fauna and flora of a region without the need to actually visit the real destination. In this way we may refrain from expanding existing tourism infrastructure, while offering tourists alternative experiences of virtual reality. 3D visualisations (3DV) may also be of benefit to effective sustainable tourism planning (STP).

2. REVIEW OF THE LITERATURE

2.1 Nature-based tourism

Nature-based tourism is often observed with connection to concepts of ecotourism, sustainable, responsible, green and friendly tourism. The definition of ecotourism (Buhalis et al., 1995; Fennell, 1999) was formulated over 20 years ago and further developed in later publications where debates on its sustainability and environmental impacts were also discussed (Buckley, 2004). Subsequently the sustainable tourism development concept was introduced and adopted as a guide for action planning by authorities in Agenda 21 (Rio+20, 1997). Many nature-based tourism researchers study both the means by which it is implemented (Rigall-I-Torrent, 2008; Connell et al., 2009) and policy making (Fennell, 2003; Castellani & Sala, 2010).

Green tourism as a part of the green economy improves human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UN Environment, 2017); it also generates good quality jobs and is vital to the elimination of persistent poverty (Rio+20, 1997). Ecologically sound strategies (Jones, 1987) have much in common with friendly tourism practices (Bramwell, 1990). Guidance in operating green tourism destinations (Hong & Kim, 2003) is similar to the sustainable tourism approach taken in destination marketing. Green tourism also faces criticism (Bendell & Font, 2004) when it has been incorrectly applied to restrict competition within the tourism sector. Other examples of developing integrated community tourism goals were described in responsible tourism scenario research (Mowforth & Goldstein, 1995). Earlier examples of where the importance of demand for new environmentally friendly paths in international tourism stressed, can be found in the literature (Cooper & Ozdil, 1992). It was also found that responsible tourism niches increasingly attract specific customers (Cushnahan, 2001), the appreciation of local aboriginal culture and a lower ecological footprint are common characteristics of such tourists. They generally demonstrate high levels enthusiasm in learning new things about the places they visit and especially about local nature. Responsible tourism has encountered critical issues for conservation and development (Goodwin, 2016) while it is also argued that the sheer volume of ecological standards may remain unsolved issue in responsible tourism.

Nature-based tourism is operationally defined through the type of wilderness surrounding the destination (Scott, 2004). Degree of human use of wilderness areas is measured in conjunction with ethical attitudes towards destinations (Hall & Brown, 2006). Wildlife tourism is defined as tourism undertaken to view or encounter wildlife and may include observation, feeding local species or physical contact (Lu & Stepchenkova, 2012). Importantly nature-based tourism ideally should ensure sustainability through maintaining socio-cultural and environmental resources (Buhalis, 2001). Sustainable tourism should complement the local community rather than displacing existing activities (Tao & Wall, 2009).

Thus, nature conservation seems to be the major concern in nature-based tourism literature, while at the same time tourists expect to receive increasingly sophisticated new experiences within their destinations consequently increasing the use and exploration of nature. The potential for conflict increases in line with human population growth (Hill, 2009) and the impact of tourism on the natural environment steadily accelerates (Kuvan & Akan, 2005; Zhang et al., 2012). In response to societal demand for diversity and sustainability, tourism is seeking new ecologically sound ways to grow (Tribe & Xiao 2011, 7-26).

Research has demonstrated that sustainable tourism practices can be implemented and improved by certification (Black & Crabtree, 2007), and raising environmental awareness (Zhang et al., 2012; Song et al., 2012,), which has a beneficial effect on the environmentally responsible behaviour of tourists (Ballantyne et al., 2011). Sustainable tourism (ST) and sustainable tourism planning (STP) potential may be explored via research into nature-tourist motivation (Torres-Sovero et al., 2012). An approach to the study of sustainable tourist motivations was suggested by Mihalic (2016) through an examination of the social values of responsible travelling as opposed to market driven behaviour. Green consumer behaviour is also characterized by high levels of nature friendliness and awareness of the destination's natural environment (Wagner, 1997). Ecolodges which demonstrate respect for eco-friendliness, are praised for their conservation practices (e.g., dim lights, solar panels, or no a/c), peaceful coexistence with nature, and undisturbed surroundings (Lu & Stepchenkova, 2012). However, links between international conservation concern and effective sustainability solutions are still lacking (Balmford et al., 2009). Recent research (Cole & Razak, 2009; Williams & Shaw, 2009; Mittal, 2012) shows

that virtual travel has considerable potential for development and in some cases may play a positive role in the sustainable development of tourism destinations (Cole & Razak, 2009; Williams & Shaw, 2009; Mittal, 2012). Virtual travel as an application of the broader virtual reality technology, is in the practical sense a visualised real or imaginary destination in the forms of video or a sequence or still images delivered to the observer by means of a screen/hologram projection, virtual reality glasses, monitor etc. (Buhalis & Law, 2008). Virtual travel may enable the effect of increasing the carrying capacity of a destination (Simón et al., 2004) by reducing the real time spent at the natural attraction, which may be interpreted as a preservation outcome of virtual tourism.

2.2 Nature tourist's consumption

2.2.1 Drivers and Constraints

A wide range of factors shape the implementation of sustainable tourism ideas. Such factors include structural conditions such as market demand (e.g. demand for sustainable tourism products and services), state regulations and support schemes (Verbeek, 2010; Golub & Jonathan, 2013).

Tourists' motivations have received considerable attention in tourism research (see e.g. Dann, 1981; Bansal & Eiselt, 2004) and provided useful knowledge for tourism managers to tailor their services to meet tourists' expectations (Lo et al., 2011; Andereck et al., 2012). Consumer motivation comprises physiological needs, safety and health needs, need for love and companionship, social image needs and the need to possess (Kumra, 2007). The travel and tourism choice is one where consumers choose an experience rather than a single-dimension product. The choice modelling approach is well developed to capture the probabilities that consumers will choose one combination of experience/product attributes over another. Estimating attribute prices and consumer's willingness to trade one attribute for another are also very useful results from the choice model method (Kask et al., 2011).

In the literature regarding tourists' motivations, push-pull factors are observed as elements that drive tourists' choices (Crompton & McKay, 1997; Crouch, 2004; Kumra, 2007). For example, the pull factor "cleanliness of a destination" is a broader characteristic than most other factors desired by tourists. Cleanliness may significantly influence the level of

comfort, which is one of the key pull factors for satisfaction with a destination vis-à-vie mass tourism (Bansal & Eiselt, 2004). Other important pull factors observed in the literature are novelty, facilities at the destination, climate and service level (Crompton, 1997; Bansal & Eiselt, 2004). Among push factors, social status has been recognized as a vital driver in tourism research (Mehmetoglu, 2007; Verbeek, 2008; Tribe & Xiao, 2011). According to Crompton (1997) other important push factors are extreme experience, connection to nature, escape from routine, sports etc. In our case, Crompton's (1997) push-pull factor classification was used as the basis to evaluate the variety of motivations and values attributed to practical aspects of sustainable tourism.

The push-pull model (Dann, 1977; Crompton, 1979; Dann, 1981) is extensively employed in classical tourist motivation research. Push factors generally include desire to escape one's daily routine, find excitement or novelty, engage in social interaction. Tourists are also motivated by destination pull factors, such as visiting particular attractions, people or participating in an activity. More recent research into tourist motivations, fundamentally based on push-pull theories, distinguishes other factors influencing tourist`s behaviour (Bansal & Eiselt, 2004) and suggests that nature tourists are motivated by the following destination factors: climate, relaxation, adventure, personal, educational, sites, festivals. Among constraints in travel decision-making Bansal enumerates time, money, distance, conflict of interest, personal and none; personal is listed both in push and pull factors but most importantly he adds "none" providing an opportunity for tourist`s irrational behaviour. Bansal also concludes that knowledge about age specific tourist facilities would enable tourism planners to address specific age groups because of the different preferences expressed by young, middle aged and older tourists. An interesting conclusion of the study states that push factors are in fact hard to distinguish from pull factors as both groups represent subjective motivation of tourist behaviour influenced by cognitive and emotional individualities. Mehmetoglu (2007) categorise tourist`s motivation through identification of clusters based on trip activities such as culture and pleasure activity oriented, nature activity oriented, low-activity oriented. For every selected group he measured six trip motivation items: "physical activities", "novelty/learning", "mundane everyday", "social contact", "nature" and "ego/status". These variables are variations of the classical set of push factors offered by Crompton (1979). Significantly Mehmetoglu identified that culture and pleasure activity-oriented people differ very slightly from the

nature activity-oriented respondents when it comes to trip motivations, demographic and trip characteristics. Another interesting observation of this study is that not everyone who visits a nature-based attraction is interested purely in nature related activities. Kim and co-authors (2003) put income as an important measurement of respondent's characteristics. They explore push factor domains: "family togetherness and study", "appreciating natural resources and health", "escaping from everyday routine" and "adventure and building friendship". These general factor domains may be useful in classifying the minor impact factors of tourist's decision-making behaviour. The author employs pull factors analysis of "key tourist resources", "information and convenience of facilities" and "accessibility and transportation". The study provides push and pull factors analysis for groups of different age, education, income, occupation and gender. Huang (Huang et al., 2013) employs hedonic theory to identify the factors affecting the experience of virtual tourists and their behavioural intentions within a 3D tourism destination. The study explores elements of enjoyment, emotional involvement, positive emotions, and flow experience meaning "total involvement feeling".

Motivation of tourists leads to action, though planned behaviour differs from realized behaviour depending on obstacles (March & Woodside, 2005). A motivation-opportunity-ability model (Huang & Backman, 2010) was used to explain travel intentions in sustainable tourism research. The study shows that such tourists are driven by internal environmental values corresponding to the perceived indirect worth of the destination.

Constraints for tourism activities commonly include lack of money, lack of time, poor health, safety fears, political risk, lack of skills for an activity, and an absence of travel partners (Beh & Bruyere, 2007). The cost, distance and time dimension is significantly more constraining for alumni who have visited more than once (Schofield & Fallon, 2012).

2.2.2 Attitudes

Traditionally, attitude function has been widely used to describe the relationships between values and behavioural intention (Maio & Olson, 1995; March & Woodside, 2005a). Attitude as an expression of sympathy or incomprehension towards a phenomenon is often examined vis-à-vie sustainable tourism (Choi & Sirakaya, 2006). The impact of experiences, level of knowledge, social forces such as the media, education and

socialisation have been widely studied as factors shaping attitudes at the level of the individual in tourism research (McCool & Martin, 1994; Teye et al., 2002). These attitudes and intentions are not necessarily realized through actions.

Group attitude is often referred to as the sum of individual group members' scores (Giffin & Ehrlich, 1963; Danowski, 1980; Choi et al., 2010). When group members do not strongly identify themselves as being in an organized group, they often still have mutual understandings and possess some similar values (Evans & Jarvis, 1986). This collective experience influences the way their own attitudes to a phenomenon are formed. Individual attitudes of group members contribute to group attitude in line with mutually accepted practices or norms, and can help to form a cooperative approach for the sake of public good (Um & Crompton, 1990; Terry & Hogg, 1996). In the sphere of tourism, individual managers may have different subjective values, but all of them pursue the primary business aims of their companies and so their attitude towards sustainable tourism initiatives is affected by profit-conscious behaviour (Shavitt, 1990; Maio & Olson, 2011).

A large body of literature focuses on how attitudes transform into planned and realised behaviour (Thogersen, 1997; Maio, 2011). Attitudes serve as a function for individuals to balance their ideal self-images or values (Bestard, 2007; Maio, 2011). Tourist consumer behaviour theorists have also shown how the process of consumption of tourism products is related to enactment of consumer's internal identities consistent with their ideal self-images (Wood & Solomon, 2009; Barr et al., 2011).

Pro-environmental attitudes as potential motivations for acceptance of virtual travel via feelings of immersion in VR have not yet been comprehensively covered in the tourism literature. Pro-environmental attitudes related to behaviours that support home energy use or recycling, were weakly connected with reducing holiday flying (Diekmann & Preisendörfer, 2003), whereas the literature shows that tourists with pro-environmental orientations travel even more (Whitmarsh & O'Neill, 2010). In related studies, it was found that there is no significant difference in pro-ecological motivations among conventional drivers and those using electric vehicles (Nordlund et al., 2016).

2.2.3 Virtual travel consumption

Virtual travel as a sustainable alternative to real travel has been examined in tourism literature (Guttentag, 2010). Recent studies support the idea of virtual consumption as a substitute for real goods (Lehdonvirta, 2009; Lehdonvirta et al., 2009). However, it is yet questionable whether virtual consumption theory may be applied to virtual tourism. It has been pointed out by Lehdonvirta (2009) that virtual travel is only applicable when the same set of customer needs as those associated with real travel can be sufficiently satisfied. Our literature search did not reveal any literature on virtual travel products designed to identically address the real physiological travel needs of tourists. The value attributed to authenticity of experience has been discussed (see e.g. Halewood & Hannam, 2001; Belhassen et al., 2008; Sedmak & Mihalič, 2008) and it has been proposed by Guttentag (2010) that authenticity is what virtual travel may be lacking most when compared with the real destination. However, tourism research demonstrates that virtual travel may have an authenticity of its own kind, which contains self-value and may possess different characteristics than the real destination (Cho & Fesenmaier, 2000; Govers et al., 2000; Guttentag, 2010). For example, virtual tourism may feature sightseeing in a past or future state or appearance, which is not possible in conventional tourism. Furthermore, some research highlights the instructive (e.g. Buhalis, 2001; Buhalis & Law, 2008) and promotional (Lee & Oh, 2007; Huang et al., 2010) potential of virtual travel in supporting real visits to nature destinations.

Virtual consumption (VC) or digitalization of consumption can potentially have significant implications for the ecological sustainability of consumer culture (Lehdonvirta et al., 2009). Virtual reality (VR) offers the potential to create substitute experiences that may be extremely useful for heritage preservation in certain situations (Guttentag, 2010). Part of VR's possible utility as a preservation tool derives from its potential to create virtual experiences that tourists may accept as substitutes for real visitation to threatened sites. However, the acceptance of such substitutes will be determined by a tourist's attitudes toward authenticity and his or her motivations and constraints (Guttentag 2010, 637-651). The fundamental drivers of virtual consumption are rather found in individual's social and hedonic motivations (Lehdonvirta et al., 2009, 1059-1079). These motivations may include personal push factors, such as the desire to escape one's daily routine, find excitement or novelty, or engage in social interaction.

Although VR applications are capable of satisfying essentially all of one's push factors– this is only to a limited degree. Currently, since there is insufficient knowledge on tourist`s perception of virtual travel, further study of this topic would be useful.

Lee and Oh (2007) found that a virtual tour of a panoramic sequence of photos on a hotel website may offer psychological relief to individuals feeling travel anxiety. Visiting a museum's website can increase one's interest in visiting the real museum (Thomas & Carey, 2005). Findings also demonstrate that sites featured in movies experience increased tourism (Riley et al., 1998). This serves as indirect evidence that visiting tourism destinations in VR may encourage real visitation.

A downside of VR products is a potential isolation from the real world (Basso, 2017) and VT may lead tourists away from the natural experiences. In a worse scenario, VT to an imaginary dark tourism destination may create unpleasant and even negative memorials (e.g. virtual death or disaster sites) as pointed out by McDaniel (2018). Thus, VT may create fictional risks that distract users and undermine real risks demonstrating real destinations in safe VR environment. Another weakness of VT is that it is not fully environmentally friendly as it still consumes electric energy and requires the production of hardware devices (Ge et al, 2017).

Research into the virtual tourism field is particularly lacking in how virtual travelling compares to real world visits and whether this satisfies tourists' needs and expectations. This is an increasingly relevant question, but little research has been devoted to the topic so far.

2.3 Virtual travel features for tourists

The virtual reality market forecast for the year 2022 (Virtual Reality (VR) - Statistics & Facts, 2018) suggests it will be equal to 209bn USD. This market primarily includes gaming, marketing and social application, whereas virtual tourism has about a 12% share, totalling 25.1bn USD and 2.28bn USD is spent on consumer hardware and software worldwide. A number of virtual travel agencies such as Ascape (https://ascape.com/) have appeared during the last three years with the recent development of 3DV devices for the consumer market (3D glasses, helmets and projectors). There is as yet no exact data on the number of virtual tourism agencies operating in the VR market since it is a rapidly developing economic

sector. The global tourism economy by the year 2017 was estimated at 8.27tr USD (Statista. Travel and tourism industry, 2018) and VT remains a comparatively small niche given the relatively small market share forecast by the year 2022. At the present stage of VT development, VR is proven to positively influence tourist decision making processes regarding real travel and thus is also perceived by tourism actors as a strong marketing instrument (Beck et al., 2018). Tourist attitudes to VT authenticity is referred to as somewhat lacking in sensorial and corporal immersion (Mura et al., 2017). This shortcoming of VT may be overcome by the use of 360-degree video visualisation instead of two-dimensional viewing conditions (Wagler et al., 2017). Higher quality of VT shapes a more positive tourists' attitude towards such mediated experience (Tussyadiah et al, 2018).

2.3.1 Travelling convenience

The impact of distance on tourist demand is widely accepted in tourism geography, with a number of studies demonstrating that absolute volumes of tourists decline exponentially with distance (McKercher 2008), virtual travel may offer some resolution for this. Interacting with multimedia-enhanced websites can produce telepresence and allow people to "experience" products and destinations without actually visiting a place. (Buhalis & Law 2008, 609-623).

Based on examples from existing virtual museums in Levorno, Virtual Museum of Sculpture and Pure Form Museum (Carrozzino & Bergamasco, 2010) offers a classification of the virtual travel experience related to the level of penetration into the virtual reality world. The principle of the proposed classification consists of visual, acoustic, haptics and motion factors measured on the scale of immersion level, where non-immersive corresponds mainly to desktop devices, low immersion to wearable devices and high immersion to external devices.

People with disabilities may go for virtual traveling where environmental accessibility of a destination can be limited by the physical abilities of tourists (e.g. mountain hiking). Lee, Agarwal, and Kim (2012, 569-579) state that existence of a direct relationship between travel constraints (people with disabilities) and intention to travel may not always be the case.

2.3.2 Virtual reality enriches travel experiences

Multimedia content in virtual tourism facilitates the creation of a unique memory in two ways. Firstly, it supplements the overall satisfaction of a trip, secondly it may create an independent and important tourist experience which may actually be the only opportunity whereby this product can be consumed through the medium of virtual tourism. Guttentag (2010) shows that virtual presence at football stadium where all tickets sold out may be a case when there is no opportunity to get to the stadium but enjoyment by virtual means gives better view angles than possible from any seated location inside the venue. Other research supports the idea that virtual context may add extra value if not presenting the unique value by itself. Guttentag also points out that the virtual traveling application may offer a significant solution for destinations where sightseeing of local natural attractions incurs the risk of damage through human exploitation. The work of Kang and Gretzel (2012, 440-455) also supports the usefulness of podcast tours as interpretative media. Cho and Fesenmaier (2000) state that interactivity and multimedia are key factors in the creation of the virtual environment and provide virtual experiences. With experiential information, a virtual tourist creates their own unique memory and personal story which in turn enables them to form a more vivid and clear destination image and to reduce the uncertainty about destination. In order to be truly beneficial virtual travel facilities should be designed using cutting edge technology (Carrozzino & Bergamasco, 2010). The benefits of virtual travel identified by researchers may provide further direction for the study of how to implement such technologies in nature-based tourism.

2.3.3 Virtual travel supports real visits decisions

Virtual touring develops consideration and awareness in making choices of potential destinations. 3DV experiences positively impact on people's travel intentions (Huang et al., 2010). The congruity between self-images and effective destination images influences people's travel intentions. The more congruent images are, the more likely people would wish to travel to the destination (Hung & Petrick 2012, 855-867). Hung and Petrick tested self-congruity variables along the scale of pleasant-unpleasant, relaxing-distressing, calming annoying etc. Similarly, the results of a study by Huang and others (2010), demonstrated that the antecedents of flow and flow experiences in 3DV destinations are positively associated with

people's intentions to take an actual trip. By engaging in a virtual tourism destination site and experiencing enhanced flow, customers can develop consideration and awareness in their potential destination choice.

Information Communication Technologies (ICT) empowers consumers to identify, customize and purchase tourism products worldwide (Buhalis, 2000; Buhalis & O'Connor, 2006). The internet has brought about dramatic changes to market conditions for tourism organizations (Buhalis, 2000; Buhalis & Law, 2008). Travel and tourism nowadays is generally considered to be a market with high online potential for e-commerce (Govers et al., 2000) with studies exploring customer drivers to purchase directly through websites (Blasco Lopez et al., 2018). The current research concentrates on virtual travel starting from a particular sightseeing physical location with an originally designed technical installation recreating the object of tourist's interest visually (3D) and audibly. Virtual communities are gradually growing in influence in tourism (Buhalis & Law, 2008) and the link between the intention to participate in a community may subsequently benefit the host firm through tourist loyalty towards the firm's products (Casaló et al., 2010).

2.4 Sustainable tourism planning

Planning is a tool which can be used to help make sustainable tourism more available to tourists. In 1999, WTO published a document entitled „Guide for local authorities in planning for sustainable tourism" followed by „Policies, Strategies and Tools for the Sustainable Development of Tourism" in 2007. These documents became milestones for STP and also provided groups of ST indicators for tourism destinations such as management of natural resources (waste, water, energy, etc.), development control, satisfaction of tourists, satisfaction of host communities, preservation of cultural heritage economic impacts, climate change (Choi et al, 2006).

The literature however shows shortfalls in ST implementation exist due to difference in national policies and priorities (Williams et al, 2009), lack of a mutual platform for discussion (Simpson, 2001), numerous conflicting interests between locals, authorities, business, NGOs etc. (Tsaur et al, 2006), nature and clean air as common goods are hard to measure in budgets or figures (Timur et al. 2009). Differences in national policies and priorities influence the way the Kyoto protocol is being adopted regionally due in part to significant variation in national legislation. Rationality also mat-

ters in terms of country specific biodiversity. Lack of a mutual platform for discussion is, in part, a result of differences in language, country size, resources, budgets, cultural and historical background. 3DV may serve as a potential solution for involvement in interaction between tourism players with different profiles for the wide range of ST indicators (Lange et al., 2006; Hayek et al., 2016). Potential alternatives for STP may also include: eco-labelling of tourism products, participatory development, integration of sustainable tourism demands into the planning of travel business processes (Hoffmann, 2007), the changing of tourists` consumption behaviour and raising awareness (Jamal et al., 2009).

Participatory development as a technique for effective STP can be realised through 3DV (Bryan et al., 2011). Environmental goals for landscape scenario planning may employ object modelling and may positively influence STD in local communities (Tsaur et al., 2006). Wissen et al. (2008) show that 3DV may facilitate PD planning. How to resolve potential conflicts of interests between tourism actors is a common question in tourism research. 3DV may provide a platform for discussion and a solution seeking process in PD. It is especially beneficial to exercise 3DV during the introduction phase, when participants are new to the problem (Aref, 2011; Byrd, 2007).

2.5 Synthesis

Nature-based tourism is limited by the number of incoming tourists and modes of travel due to ecological and sustainability constraints. Nature tourists' consumption theory focuses on the drivers, constraints and attitudes of travellers as well as aspects of VT consumption. However, there is a research gap in understanding tourism manager's perceptions of ST and STP with the help of 3DV. VT advantages and disadvantages for tourists also require further clarification in terms of understanding how individual motivations may form pro-environmental behaviour following the use of VR technology.

More systematic research is needed to investigate the VT experience from the perspective of all tourism actors (managers, planners and tourists). In the literature there is a lack of coherent research connecting tourists' pro-environmental motivations, tourism managers' understanding of ST and ST practises as well as possible efficient practical implementations of ST concepts by means of VT.

3. AIMS OF THE STUDY

The impact of tourism on the natural environment has increased steadily. Discourse surrounding the conflicts between the sustainability and development of a destination is not only becoming more focussed globally but also in Estonia and Russia with the problems spanning both environmental and social sciences research. The current research aims to better understand how ST implementation within nature-based tourism, increase sustainable economic activity and reduce damage to the natural environment and culture. The existing literature gives some useful insights into, and possible explanations for, the poor organization of sustainable tourism practices in Russia. However, these (sometimes rather outdated) studies have a rather shallow spatial coverage or focus on separate narrow issues, with rather limited reflections on the reasons why goodwill derived initiatives often dissolve due to unclear goals and weak organization. The first paper attempts to address this gap in understanding by taking an in–depth look at the role of tourism practitioners in sustainable tourism development and understanding of sustainable tourism concept.

IT-technologies may provide significant solutions to the challenges posed by unsustainable tourism practices and can include development of modern museums using for example; 3DV to show landscapes, video installations showing high quality panoramas and exhibitions of indigenous species to enable tourists to penetrate into the fauna and flora of the region without the need to actually visit vulnerable sites within nature reserves. It is proposed to not only utilise existing tourism infrastructure, but offer a possibly even more satisfying tourist experience than physically visiting the nature reserve could provide.

Stakeholders and decision makers wish to employ the means to implement ST strategy. This study is concerned with the question of how tourism players perceive ST and improvements to STP practices via VR. Furthermore, how efficient and satisfactory a substitute is the virtual experience as an alternative to a real visit to a nature-tourism destination? The research goal set, was to study the drivers which may favour tourists' acceptance of virtual substitutions over the real experience. Travel often means transportation and need for place change, but traveling to a destination gives this sense of place change, and a VR facility in that place could provide tourist's experiences that local nature could give.

It is postulated that when compared to individuals with weaker pro-ecological attitudes, those with stronger pro-ecological attitudes are more likely to accept the VT opportunities, research suggests that there are some VT features which are not accepted and others which are accepted by tourists. The study will focus on the issue of VT advantages and disadvantages and the role of pro-ecological motivations behind the choices between real travel and virtual travel.

The more specific research questions raised in the thesis are:
- How tourism managers' perceptions of sustainable tourism affect sustainable tourism planning? (I,II)
- How 3DV can facilitate sustainable tourism development and sustainable tourism planning? (I,II,III)
- How tourists perceive virtual travel depending on their individual need for emotional arousal from mediated experience, socio-demographic background, travel preferences, and pro-ecological motivations? (III)

Figure 1 illustrates how papers cover the above-described aspects of sustainable tourism and possibilities to substitute real travel by virtual.
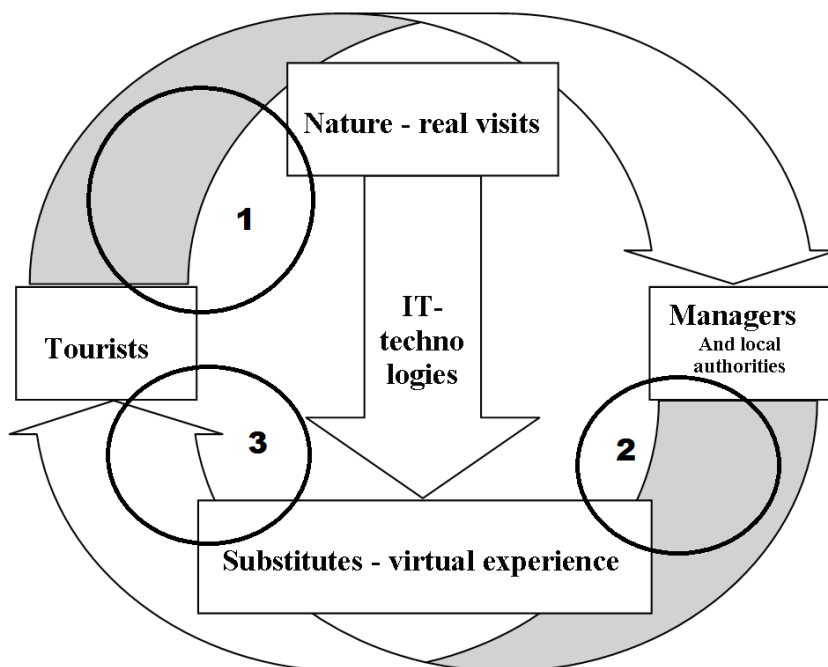

Figure 1. Frame of the research and bonds between three articles.

The upper arrow of Figure 1 shows that tourists have demand for nature-based physical travel the opportunities for which are affected by their social and environmental structures (motivations). Meeting this demand is facilitated by the tourism industry and its managers who operate their businesses in the frames of national and local regulations and planning decisions (e.g. sustainability policy). Tourism planning and product developments may be considered as a process with a certain level of openness and reflexiveness to different stakeholders including authorities, local people and service users (down arrow). Vertical arrows demonstrate how real travel can be substituted with virtual travel, placed within the Tourists-Managers circle they show that the substitution process is being developed by managers for tourists should be based on tourist perceptions of VT advantages and disadvantages.

The first paper (I) focuses on Russian tourism manager's (RTM) understandings of ST, perceptions of nature tourists' motivations and possible ST strategies. The second paper (II) seeks possible solutions based on the prospects from RTM (VT) and ways to improve STP via 3DV in Estonia, which could help spread the experience to other locations worldwide. The third paper (III) provides deeper insights into the role of VT in developing ST practices. It was expected that tourist acceptance of VT could be controversial and its features partly denied by study sub groups.

4. MATERIALS AND METHODS

4.1 Study areas

Major sustainable tourism developments in Estonia include national standards for accommodation, food eco-labelling and the Blue Flag project for small ports. The Estonian Tourist Board and Estonian Ecotourism Association launched ST guidelines for hotels and tourist companies according to Agenda 21 (UN, 1997). Estonian ST regulations include financial aspects and stress the main direction of STP, such as green electricity development (Ehrlich, 2012), with state tourism development programme 2014-2020 (Majandus- ja kommunikatsiooniministeerium, 2013) defining some priorities of ST entrepreneurship.

The state of ST development in Russia is heavily dependent on the current level of state regulations and lacks the recent applications adopted by the UN. The level of understanding by Russian tourism managers of ST varies from region to region due to the vast territory of the country.

Over the last decade a number of projects were conducted to improve ST development in Eastern Europe. Policy initiatives such as UNWTO and UNEP through supported projects and conferences positively influence regional cooperation between businesses and countries (unwto.org). EU directives state that ST is a top priority strategy for tourism sector development in Europe. Financial support instruments are designed to promote responsible and high-quality tourism initiatives (European Parliament, 2017; EU Funding Ecotourism, 2017). Among such projects are those that particularly integrate into other EU priorities, for example Calypso, which help disadvantaged groups (seniors, low-income families, young people with reduced mobility) to travel other European destinations. *(http://www.europarl.europa.eu).*

The Estonian Ministry of Regional Development has developed a Strategy 2030 masterplan, which puts into place a balanced and sustainable development model for settlements, infrastructure and transport. According to the document, tourism development in Estonia should correspond to the best EU practices and standards. The environmental planning system in Estonia is also supported via educational institutions and EU financed cooperation projects. The Comcot project is one such recent example.

The Comcot tool was developed in partnership with Finnish institutions to help communities in both Finland and Estonia to develop their tourism sector at the level of the community. As a result of the project, 3D computer models of particular Finnish and Estonian landscapes were developed. This 3D tool provided an opportunity to visualise areas at the detail of the actual tourism facility, and could show the natural (landscape & wildlife) attributes. These could then be viewed by each of the communities in a special portable 3D visualisation theatre so that they actually saw what the tourism potential of their area was. New ideas and proposals for tourism developments and changes to the landscape could also be modelled and inserted into the 3D presentation so that the communities could see what these changes might actually look like.

Another good example of collaboration between natural sightseeing and VT is in the Piusa Caves nature reserve visitor centre located in the South of Estonia. The reserve consists of a series of sandy caves where bats hibernate winter, apart from being an appealing tourist attraction this also the home for rare species of bats under protection. In order to provide natural surrounding safe for bats this part of caves was visualised in 3D so that visitors could get an impression on the place without disturbing the inhabitants of the caves. It represents a good example of VR use for sustainability purposes in Estonia and for this reason it was chosen for this particular study. Other VT projects in Estonia include the AAHHA science centre *(http://www.ahhaa.ee)* in Tartu, which provides visitors with a virtual tour prior to the actual visit. This eases the planning of real visit and provides incentives into the programme of the activity. Another advanced presentation using VT in Estonia was demonstrated in the recently opened Estonian National Museum *(http://www.erm.ee/en)*, where 3DV was used to illustrate regions inhabited by Finno-Ugric speakers and their language examples on the virtual map.

4.2 Social science in tourism research

4.2.1 Qualitative strategy (I, II)

4.2.2.1 Relation to theory

This paragraph will guide you through the reasons why this doctoral project employed a qualitative research approach with a case study design. A qualitative approach, including in-depth interviews is widely adopted in the social sciences. In tourism and particularly in the study of tourist's attitudes and perceptions of specific phenomena the interaction between researcher and the object being researched is a significant characteristic (Creswell, 1994; Creswell, 1998). The qualitative approach has potential in research fields where numerous subjective realities are being observed. In the current research different tourists and tourism managers may demonstrate a range of different perceptions towards virtual travel compared to real visits to nature-tourism destinations. Tourist's attitudes are considered to be examined in context-bound practice and the data collected is subject to further inductive evaluation. The in-context researcher placement is used to obtain an insider viewpoint of a particular phenomenon. Qualitative research often suits when an object is observed in a natural setting and not constrained by a researcher (Creswell, 1998). The aim was to describe Russian tourism managers' (RTM) attitudes towards sustainable tourism and suggest initiatives for improvement (I). Due to the limited knowledge in this field, an in-depth case study that was exploratory in nature and described the phenomena from the participants' perspective (Marshall et al., 1999; Yin, 2003b) was used. The first step was to explore the current state of sustainable tourism development in Russia through documentary analysis of state and local level tourism strategy policy documents and tourism reports. More specifically, we explored Russian tourism managers' attitudes towards sustainable tourism initiatives. Therefore, semi-structured interviews that are commonly applied in exploring social attitudes in a specific set of circumstances (Yin 2003a) were conducted. In our case, interviews were carried out with RTM to ascertain their attitudes in a context-bound environment, in order to obtain an insider's view of the sustainable tourism phenomenon.

4.2.2.2 Data gathering

We focus on tourism managers as potentially key initiators and conveyors of sustainability ideas and practices. In this case study on the potential of sustainable tourism practices in Russia, we used documentary and interview materials in order to: 1) explain state institutional circumstances that can support sustainable tourism; 2) explore Russian tourism managers' understanding of the motivations of nature travellers; 3) elucidate the characteristics of potentially lucrative sustainable tourism initiatives.

In highly centralised Russia, Moscow is the location of the headquarters for all major tourism operators and actors, who from there, influence the direction of tourism industry development across the whole country. For our case study, 20 well-established large and medium-sized tourist companies based in Moscow were approached. These were the top 20 Russian tourism companies in terms of number of trips sold in the year 2012. It was assumed that the greater the number of trips sold, the higher the level of influence of the player in the Russian tourism market. All organizations had international inbound and outbound operations, a minimum of 10 employees and had worked for over seven years in the Russian tourism market. It was a prerequisite that each respondent could speak on behalf of their company about its operations and possess sufficient information, knowledge and experience to satisfy our requirements. Each informant was interviewed during a personal meeting lasting up to 2.5 hours. The first group of interview questions were formulated about the RTM's awareness regarding the concepts of sustainable tourism and the broadly used definitions of eco-, friendly-, responsible- and green-tourism. The second set of questions aimed to uncover each company's operations and market strategies. The third part was devoted to defining ways of promoting sustainable tourism and finding possible sustainable tourism initiatives. All interviews were audio recorded with the consent of the respondents.

In the case of 3D use in STP (II) the case was selected based on the current availability of project documentation and free access to the actors involved in STP, thus the Comcot project *(http://pk.emu.ee/en/comcot)* was chosen. The aim of the project was to visualise landscape scenarios to facilitate decision-making over possible tourism development options by representatives of a variety of interest groups. The study covers experiences from Setomaa and Maidla areas. Interviews with tourism managers

and practitioners were conducted in 2014 in Tartu, Estonia. This case helped to explore how tourism managers perceive STP and characteristics of 3DV as part of VT that may affect PD planning sessions.

4.2.2 Data analysis and drawing conclusions (I, II)

Open coding techniques can be utilized for qualitative data analysis (I, II), (Strauss& Corbin, 1990). This method is applicable when phenomena are to be described through close observation. In analysis of the documentary and interview material, the authors followed a seven-step process including naming the phenomena, unitizing it, categorizing, naming categories and developing them from the perspective of their properties.

In order to provide a solid methodological base for research, triangulation of information from different sources can be employed (Denzin, 1970). For example, categories developed from coding can be triangulated with information received from relevant literature, questionnaires or in-depth interviews, while repeat data collection may also serve as a triangulation source.

In order to test if RTMs could mutually agree on a rationale for sustainable tourism initiatives (I), a Delphi consensus search (Gokhale, 2001; Bolger & Wright, 2011; Hasson & Keeney, 2011) was carried out following the interview sessions. The Delphi method is used when a consensus of expert opinions is needed (Linstone & Turoff, 2011; Rowe & Wright, 2011). As Choi & Sirakaya (2006) have suggested, the Delphi technique is constructive for measuring attitudes towards sustainable policies and their specific political, social, ecological, economic, technological and cultural dimensions. In our case, since the sample was relatively small, a consensus design with anonymous responses was employed in order to increase internal validity and exclude cross-expert influence.

Two weeks after the interviews when all the answers had been categorised, all RTMs were emailed with a list of all the sustainable tourism attributes, tourist motivations and methods for promoting implementation that were mentioned during the individual interviews. Elements in common from interview material were proposed for a potential mutual agreement search. RTMs were asked which key characteristics of sustainable tourism, tourists` motivations and main support for sustainable tourism initiatives they could agree upon. Based on the RTM's email responses, a consensus list

of sustainable tourism motivations, practices and supportive structures they accepted was compiled. For data analysis (II), the content analysis technique was employed. All answers were audio recorded, typed, divided into categories and sorted according to the main topic.

4.2.3 Survey strategy (III)

4.2.3.1 Relation to theory

Quantitative research design is used to identify differences between classes of objects (Kerlinger, 1979), whereby an independent variable of interest can be managed or changed so as to observe the impact on another dependent variable. "In the tourism field, using surveys is one major method for academics to collect data." (Illum et al. 2010, 340). Questionnaire type research offers standardized answers and relatively low costs are normally involved (Brace, 2008).

4.2.3.2 Data gathering

The specific design of the survey study can be a holistic, explanatory study (Yin, 2003a; Yin, 2003b). Firstly, respondents visited the site of Piusa Cave and then undertook the same visit in virtual representation by means of 3D visual technology, then subsequently they were requested to complete a detailed questionnaire. Data collection took place at Piusa Cave visitor centre in Southern Estonia during three summer months in 2014. Altogether 299 questionnaires were collected from tourists visiting the site by individual transport and in organised groups coming in buses. The assumption was made that there was no significant difference among these groups, and therefore all informants were analysed together in one sample.

In the survey instrument, variables to be measured are formulated in the form of statements expressing the tourist`s attitude to features and the advantages and disadvantages of virtual vs. real travel. Alternatively, the level of tourists expected satisfaction can be measured using a typical five-level Likert scale (Likert, 1932) consisting of respondent's level of agreement (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree) with proposed statements. The typical five-level Likert scale is well suited to measuring tourist's attitudes towards virtual and real travel (Likert, 1932).

4.2.4 Data analysis and drawing conclusions (III)

The convenience sampling technique in social science can be utilized to allow researchers generalize study results. In our research such generalizations from a particular group of tourist's perceptions can be extrapolated to nature tourists visiting other locations.

 Principal component analysis was employed to analyse features characterising VT in Piusa Caves. Finding mutuality and differences between two groups is a common method in social sciences. For example, regression analysis can be utilized in tourist's attitudes research (Bart et al., 1999; Shao, 1999; Govaert, 2010). General linear modelling was employed to explore the effectiveness of predicting satisfaction with VT based on values, beliefs about treating nature, pro-ecological norms, and the need for emotional arousal from virtual experiences. Generalized linear models (GLMs) represent a class of regression models that allow generalisation in the linear regression approach to accommodate many types of response variables including   count, binary, proportions and positive valued continuous distributions. Correspondence and cluster analysis were used for tourists motivations overview.

5. RESULTS

5.1 ST principles and STP implementation (I, II)

This section focuses on how RTMs perceive sustainable tourism and the opportunities they observe for sustainable tourism development in Russia (I). The results covering ST initiatives implementation in Estonia were sourced from the Comcot Project (II). During initial search for study participants it was established that there is a common absence of sustainable tourism practices among major Russian tourism operators. However, interviews revealed that all respondents' companies were working on developing sustainable tourism options as part of their corporate strategies. In terms of sustainable tourism implementation four approaches were offered by the respondents:

- Strengthening and better enforcement of national legislation on sustainable tourism;
- Nature protection and sustainability policy development for maintaining the areas of tourism interest;
- Promotion of environmental education to raise interest in sustainable tourism;
- Virtual travel as a sustainable alternative to nature tourism at locations where physical carrying capacities have been reached or in areas reserved for nature protection.

Derived from research on RTM, VT as a potential strategy for ST was suggested (I). This input was further elaborated in the Comcot case study (II), where VT in form of 3DV tool was employed during an STP process. Thus, the RTM study provided an important insight to be tested in the Comcot project, which revealed that VT may serve in functional optimisation of PD techniques and methods such as providing a mutual platform for discussion, visualisation of landscape planning scenarios, easing of moderating discussion in small and middle-sized groups, instrumental in tracking changes, documentation of decision-making phases and tailoring of final solutions.

5.2 Sustainable tourism planning (II, III)

In this section characteristics of VT that can help making it a feasible strategy for ST and STP are presented. The Piusa Caves survey (III) disclosed that natural areas can be treated as untouched by people (32.0% of respondents), exploited without limitations (32.1%), administered as national parks (23.4%) and developed responsibly as tourism destinations following a process of sustainability research (12.4%). These last two groups can be compared with the group targeted by the STP project Comcot (II) and represent 33.8% of tourists visited Piusa Since tourists visit the area only few times in their lives they are probably rather detached from the local tourism planning process, and could therefore only be indirectly drawn into planning process as stakeholders. The latter two groups represent the percentage of the audience that could potentially respond to STP initiatives in similar planning projects in the future and also who might be taken into account when budget restrictions apply and bulk invitations are being addressed, indicating that roughly each third might have an opinion on the goals of sustainable nature management (III). Nevertheless, it should be assumed by default that all groups of respondents have an equal right to participate in planning initiatives. Tourists who feel morally obliged to use IT solutions for reducing the environmental impact of travelling make up 48.4% of total respondents, and represent a considerable potential target group of tourist stakeholders who might be attracted by using 3DV for STP. A downside of 3DV for tourism planning described by stakeholders (II) was the potentially unrealistic expectations that could be created by a low detalization or an approximate 3D model.

Personal beliefs (III) in the low need of arousal group demonstrated significantly more probable (Bonferroni Sig 0.043) orientation towards scepticism about environmental and social scientific expert guidance being required as a basis for the development of sustainable tourism. Beliefs that sustainable tourism helps to preserve nature, and serves the interests of tourists, local communities, and tourism operators, did not differ significantly between the groups with different levels of need of arousal from VT. There was no significant difference between the groups with different levels of need of arousal from VT in their opinions of whether wildlife areas should stay untouched, be developed responsibly as tourism destinations, or be administered as natural parks. Belief that people may exploit nature and wildlife areas as tourism destinations as they please,

was significantly (p< 0.00) more prevalent among the high satisfaction with VT group compared to the low satisfaction group.

5.3 Perceptions of motivations of tourism actors (I, II, III)

This section presents opinions of RTM on nature tourist motivations (I) when compared to the motivations of Piusa Caves visitors (III). Factors that were brought out from RTM interviews and those motivating factors which were agreed upon in the later consensus rounds regarding nature tourists' motivation from an RTM perspective are presented in Table 1.

Table 1. Russian tourism managers' (RTM) perceptions of nature tourists' motivations (I).

Push factors	Pull factors
Social status	Cleanliness
Extreme experience	Novelty
Connection to nature	Comfort facilities
Escape from routine	Comfort climate
Sports	Good service
	Historical heritage
	Authentic culture

The ranking method was used in creating a hierarchy of Piusa Cave tourists motivations as push/pull factors from more frequently mentioned to the less mentioned by respondents (Table 2).

Table 2. Piusa Cave tourists' motivations (III).

Push factors	Pull factors
Having an impact on people or events	Unity with nature
Respect the Earth and harmony with other species	Equal opportunity for all
Protecting natural resources	Preserving nature
	Historical heritage
	Authentic culture

RTMs perceived cleanliness as closely related to the comfort driver, i.e. the cleanliness of a destination may significantly influence the level of comfort, which is one of the key motivations for tourist satisfaction from

the destination's characteristics. Another important comfort factor was defined as security. More comfortable travel destinations offer higher security standards in the opinion of RTMs. All RTMs highlighted that both weather and climate are important drivers of travel choices. This illustrates how climate factors are connected to geographical locations being pull factors for tourists. (I) Pull factors may also include unity with nature (24.3%) equal opportunities for all (57.1%) and nature preservation (43.3%). Social interaction is a driver for travellers that wishes to enjoy wilderness areas. This finding was confirmed as 24.4% of tourists named socialisation among pull factors . Results show that the need of arousal is linked with socio-demographic factors as well as with pro-environmental motivations (III); it also significantly correlated with acceptance of VT (ANOVA Sig 0.000). Both need-level groups have no significant differences according to demographics, travel budget and time spent on nature travel. The most frequent travel types were nature tourism, day-trips, trips to enjoy sea and sun, as well as culture, and travelling for business. Bonferroni showed significant differences between the low need and high need of arousal groups in case of trips for visiting friends (Sig 0.001) and for adventure (Sig 0.020).

As for nature tourist motivations from the Piusa Caves case, moral obligation to reduce car travel was significantly (Bonferroni Sig 0.047) lower among the group with the low level of need of arousal. Other personal norms did not differ significantly between the groups with varying need of arousal. Pro-environmental intentions (initiating discussions regarding environmental protection over the internet, using IT solutions to decrease their environmental impact, or discussing with family how to decrease their environmental load) did not differ significantly between the groups.

STP using 3DV faces an obstacle in terms of the constructive involvement in active dialogue of all parties affected by a particular development (II). As reflected in respondent feedback there are different degrees of participant engagement in discourse resulting from their differing internal motivations. According to stakeholders` responses the following motivations of participating in 3DV planning sessions were observed: personal interest in the subject, planning goals, expression of own opinion, communication with others, use of advanced 3DV tools, opportunity of future vision, socialisation, need for change, strive to live better and group identity.

5.4 Acceptance of virtual travel and substitute for real travel (I)

This chapter answers the question of tourist perceptions of VT from RT perspective. Virtual travel emerged from the interviews as a possible methodology for implementing sustainable tourism (I) and as an alternative to real visits into the natural environment which in some cases could provide a solution for sustainable tourism development. According to interviews with RTMs, virtual travel was suggested as a particularly valuable tourism option in areas where visitors are likely to exceed the carrying capacity of sensitive ecosystems. Virtual tourism also appeared to be a realistic solution at locations where the local population suffers from the negative impacts of tourism, thus virtual travel opportunities could potentially replace real visits to nature sightseeing areas in order to protect them. The consensus search however revealed a set of interesting statements regarding virtual travel as compared to real travel. Even though it was proposed as an alternative to travelling to real destinations, virtual travel was largely criticized by the interviewees. RTMs agreed on the fact that with the current state of information technology, it is possible to design a virtual trip, avoiding at least partially, some of disadvantages encountered (such as lack of connection to real nature, fewer impressions and less experience, unnaturalness, less memorable), however according to RTMs, most tourists would prefer real visits to virtual ones. It was suggested that a major reason for rejecting virtual travel is that people prefer actual visits because these let them "feel" true experiences. It was noted in all cases that RTMs evaluated tourists´ virtual visits as "not satisfying visits" or even "bad visits". They perceived real visits as normal, while "virtual visits" were treated as "non-visits", real visits were appreciated for their "naturalness", "originality" and "authenticity".

5.5 Satisfaction with virtual travel and substitute for real travel (III)

Study(III) demonstrates that 58.8% of the sample find the virtual Piusa Caves tour satisfactory and agree (31.6%) or strongly agree (27.2%) that virtual tourism is an opportunity to escape from every day routine. In other words, these tourists were satisfied with the Piusa virtual tour. As the p-value (p-value = 0.001) is lower than the .05 significance level, thus we reject the null hypothesis that Virtual Piusa tour satisfaction is independent of tourists` attitude to VT as to an opportunity to escape from every day routine. Tourists find Virtual Piusa as an opportunity to escape

from every day routine. Correspondence analysis was used as graphic method of exploring the relationship between variables in a contingency table. Links between VT characteristics were examined. The results show that over 89% (sum of 1 and 2 eigenvalues) of the association between Piusa virtual tour satisfaction and attitude to VT as an opportunity to escape from every day routine accounted for in 2 dimensions and almost 100% in 3.

Cluster analysis shows (III) a weak positive correlation between "I found Piusa Caves sightseeing completely satisfactory" and "I would visit a similar nature sight again" with $\varrho=0.335$. A weak positive correlation was also found between "Opportunity to escape from every day routine" and a judgement "No connection to real nature", $\varrho=0.248$. Median negative correlation between "I would take a similar virtual tour again" and "No connection to real nature", $\varrho=0.618$. Weak negative correlation between "Opportunity to escape from every day routine" and "No connection to real nature", $\varrho=0.271$. Almost no significant correlation ($\varrho=0.028$) between "I spend 0 hours a week outdoors in nature for recreation" and "VT has no connection to real nature", $\varrho=0.0317$ and "I spend 0 hours a week in virtual environments (playing games, sightseeing) for recreation", $\varrho=0.025$; "I prefer nature as a type of travel" and "sustainable tourism preserves nature", $\varrho=0.076$.

The first principal component distinguishes between the variables (opportunity to escape from every day routine, ability to experience life in the past or future and no risk of accidents, delays, crime, bad weather, etc.) along an agree-disagree attitude scale. The second principal component largely distinguishes between characteristics of VT "ability to adopt a virtual body/identity", "opportunity to re-live experiences", "preserves the natural environment" along an agree-disagree attitude scale. The first principal component has a standard deviation of around 1.88 and accounts for almost 21% of the variance in the data. Loadings show that the first principle component describes 61,8% of variable.

5.6 Comparing virtual and real travel (III)

Among tourists surveyed at Piusa Caves were those who evaluated their experience as satisfactory and wish to visit similar sightseeing again and those who found the 3DV of Piusa Caves satisfactory. Data for these two groups is presented in the Table 3.

Table 3. Support for Virtual Tourism.

Age groups	Support for the VT (strongly agree and agree), %	Disagree strongly disagree, %
15–25	7.69	6.35
26–35	9.69	9.36
36–50	18.39	16.05
51–70	14.71	9.03
Over 70	0.66	6.35
Sex		
Women	30.10	22.74
Men	22.07	24.75

Table 3. shows that the general number of those who support VT is higher than those who do not with the exception of the over 70 years old age group. The Chi-square test of age groups in terms of the share of people with low and high satisfaction with VT returned significant (Sig 0.00) differences. In the age group 51-70 years, there are significantly more people with high satisfaction with VT (60%), compared to the proportions in other age groups. There are also gender differences: among women there are somewhat (Sig 0.06) more satisfied people (57%) compared to the share of satisfied people among men (46%). Significantly there are more women who support VT comparing to those who do not, whereas men are vice versa. Among the people that enjoy trips for visiting friends (Sig 0.00), daytrips (Sig 0.04), and adventure (Sig 0.00), there were significantly more people that were not satisfied with VT, compared to the number of satisfied ones. Among people enjoying culinary trips (Sig 0.003) and education trips (Sig 0.018), there were significantly more people with a high satisfaction with VT, compared to low satisfaction.

Acceptance of VT was tested through value-belief-norm (VBN) model to find out how it is affected by the need for arousal, pro-environmental values, beliefs, norms and intentions. Multiple regression analysis was employed to predict the satisfaction with VT. Such social values as protecting natural resources (biospheric); having an impact on people or events (egocentric); a world free of war and conflict (altruistic); hardworking and striving were tested to clarify the satisfaction with VT. Further, the

beliefs on ST that were added proved significant in ANOVA: sustainable tourism should be based on research; people should be allowed to exploit nature as they please. Personal norms that were included: feeling morally obliged to reduce car travel. Pro-environmental intentions - choice of bus or train over air travel. All the predictors within this model were below the level of significance except the need of arousal. An average score index was formulated based on respondents' agreement with these statements (internal consistency index Cronbach's alpha 0.803) and named 'Need of arousal'. For further analysis, the 299 respondents were categorised into three relatively equally numbered groups: a low need of arousal and a high need of arousal.

The results show that there was a significant difference in correlation between values, beliefs, norms, intentions, and socio-demographic variables and satisfaction with VT depending on different needs for arousal from VT. In the group with a low need for arousal an egoistic value orientation (hard-working and striving) and the need of arousal itself had statistically significant negative associations with satisfaction with VT. Satisfaction with VT was found in the group with respondents with the personal norm to reduce car travel. Among the group with a high need of arousal these variables were found not significant as predictors.

The need of arousal and satisfaction with VT was tested to be predicted by pro-environmental values, beliefs regarding sustainable tourism, personal norms, and intentions. Satisfaction with VT varied significantly between low and high need of arousal groups (ANOVA Sig 0.000). The willingness to take such a tour again differed significantly between the low and high need of arousal groups (Bonferroni Sig 0.000) and the high and low need of arousal groups (Bonferroni Sig 0.000). The interaction between the need of arousal and valuing material possessions was statistically significant (Sig 0.04), and somewhat significant were interactions with valuing having an impact on people and events (Sig 0.06) and valuing world's freedom from war and conflict (Sig 0.06). In the group with low need of arousal, an increase in valuing having an impact on people and events by one unit increases the satisfaction with VT significantly (Sig 0.02) less compared to high need of arousal group.

6. DISCUSSION

The study is focused on advantages and disadvantages of VT and the role of value, norms and pro-ecological motivations behind the choices between real travel and VT. Specifically research questions raised in the thesis were designed to elicit tourism managers' perceptions of ST, characteristics of VT as a feasible strategy for STP and tourists' satisfaction with VT.

6.1 Tourism managers' perceptions of ST and STP

Strengthening of national legislation was suggested by interviewees as probably the most important state level strategy to support sustainable tourism development. (I) Respondents stressed that proper enforcement of nature protection was a significant precondition for sustainable tourism. The tourism literature shows that improvements to environmental legislation may positively affect sustainable tourism development and even have side effects on tourism actor's social responsibility (Rigall-I-Torrent, 2008), formulation of new ethical approaches to nature treatment by local communities (Hall & Brown, 2006), which in turn provide maintenance of higher environmental standards (Rio+20, 1997; Ballantyne et al., 2009; Hill, 2009). Perspectives suggested by RTMs may influence legislation changes in the long-term. However, Russian interviewees were sceptical regarding political capability to process such shift and were reluctant to get more deeply involved in policy making. In the current situation RTMs admit that they are obliged to follow the existing legislation and tailor their business strategies accordingly. (II) From environmental policy perspectives, the Comcot Project demonstrated that tourism actors in Estonia take responsibility for STP and develop new innovative approaches to fulfil the requirements of EU directives regulating sustainability standards for tourism industry. Nature protection policy enforcement and promotion of environmental education as second and third tier approaches are already broadly used in today's practice of sustainable tourism planning by local authorities and stakeholders in European Union (Tao & Wall, 2009; Castellani & Sala, 2010; Lozano-Oyola et al., 2012). (I) It was strongly signalled in interviews that nature protection policy in Russia requires promotion to receive support from stakeholders. General environmental education was referred to as a means of promoting nature tourism and increasing interest in sustainable tourism, as well as a way of raising public pressure for improved sustainable tourism policies. In Estonia, ecological education is given as a priority for realisation at state

level in the strategy planning document entitled "Estonia 2030". RTMs have demonstrated a rather limited understanding of sustainable tourism principles and therefore education on sustainable tourism could be of great value to tourism practitioners. There is also a moderate demand for comprehensive professional training among RTMs in order for sustainable tourism implementation to benefit in Russia. In interviews it was especially stressed by most of the respondents that sustainable tourism itself could provide an educational function and thus contribute towards a better understanding of environmental processes, including ecosystem services such as recreation at locations of natural sightseeing.

The interviews revealed that in the opinion of RTMs, spending time in nature is a way of expressing ones' social status. Social status has also been recognized as a push factor by a number of tourism researchers (Mehmetoglu, 2007; Verbeek, 2008; Tribe & Xiao, 2011). Research shows that push factors make-up 52.1% of tourist motivations for travelling. As results from individual interviews were sent to the other respondents for a consensus round (I), the main motivation of tourists in the opinion of RTMs demonstrate links to existing push-pull factors presented in the literature (Crompton & McKay, 1997; Crouch, 2004). The factors mentioned in this research, such as climate, social status and comfort correspond to those highlighted in the literature (Mehmetoglu, 2007; Tribe & Xiao, 2011). There are some other push and pull factors described in the literature, but these were not considered worthwhile aspects by RTMs. For example, the rush for escape from everyday life (push factor) and a desire for social interaction (pull factor) were not covered in RTM interviews but suggested in tourism research (Kumra, 2007; Verbeek, 2008).

6.2 3DV support for STP

Klein et al. (2013) writes that it is not realistically possible to involve everyone in STP and this should not be a task of PD and as respondents said, some people were really not willing to come. The goal of PD should be set to involve the majority of interested parties. In Comcot it required a lot of publicity and information events especially when dealing with rural communities, where people live quite far from each other and word of a mouth dissemination can be very slow. Good practice according to interviewees was to go and visit these people well in advance and to ensure that invitations reach everyone. The timing and depth of involvement of groups in STP varied, some became involved from the start, others much

later. This task was quite difficult to handle with this project because there were several groups. Those groups had different views on the questions arising during discussion sessions, however all major parties were included in the discussions.

Respondents agreed that in 3DV sessions motivation was a very important factor in the success of STP. Literature reports (Bouwen et al., 2004; Byrd, 2007) show similar results, demonstrating that motivations in PD may significantly influence the flow of STP and especially the quality of outcomes. Motivation to take part in PD according to the literature may be caused by such social structures as interest, desire, challenge or curiosity (Kapoor, 2002; Holden 2003). This was also confirmed by interviewees when planning for 3DV.

The motivation of community representatives to take part in STP was their wish to make their place better (II). A significant driver was a desire to be involved in and/or influence their own community's development arising out of concerns over what might be being done within their own community and curiosity over their place in the community landscape. Importantly respondents in the case of Comcot mentioned that they felt that they had something to say and could bring their ideas to the media, express their will and observe how the landscape changes, which made them feel connected. Individual motivations in PD sum up to group motivations and reflect in group interest (Botes et al., 2000). Group motivations are bounded to the context and locality; they do not appear to be universal but defined by a cross section of interest groups for cooperation in areas of such mutual interest. In our case during 3DV planning, group motivations were expressed in forms of group interests.

In Comcot it was noted by one respondent that it was tricky to come to concord with opposing interest groups. Even one single person interested in a particular development represented an interest group from the PD perspective since opposing opinions create the potential for a conflict of interest (Bjorgvinsson, 2010; Byrd, 2007). A key task of the organisers was to distinguish who the different pressure groups were since they would tend to divert the conversation towards their own interests, whereas the goal of PD is to discuss such interests openly. As shown by Okazaki, (2008) and Timur et al. (2008), interest groups have the potential to enter into conflicts of interest. The variety of group interests in Comcot 3DV sessions is demonstrated in the example where two interest groups that

didn't communicate in one region were fisherman and entrepreneurs. They were not working together, rather being in opposition and as such the main challenge was to sit them around the table for the 3D presentation.

One of anticipated result was understanding the drivers for virtual travellers when compared to those visiting the real destinations. This knowledge could help to elaborate practical strategies for problem solving at natural destinations which are close to reaching their tourist's carrying capacity. Managers perceive a conflict from the profit point of view, trying to increase number of visits rather than attempting to make the visits more qualitatively interesting. They should be assisted in creating sustainable tourism business plans through the provision of free consultations. Authorities could also regulate legislation and include benefits for those developing sustainable attitudes. In Russia ecological education should be included in the curricula of educational institutions at all levels, as was demonstrated by RTMs.

6.3 Tourists perceptions of VT

The focus in (III) was on tourist's satisfaction with VT compared with nature-based tourism and the results showed there were psychological differences between respondents. Cultural and hedonistic motivations of real travel (e.g. Bansal & Eiselt, 2004; Crouch, 2004; Kumra, 2007), as well a tendency towards exhilaration and social interaction were identified as tourist drivers of VT (Lehdonvirta et al., 2009). In this study, nature tourists were positive regarding nature and culture, single day trips and travel to the seaside. Nonetheless, the group that was accepting of low levels of arousal from VT was less eager for socialisation and adventure. The low need of arousal group was more directed towards hedonistic pleasures and appreciated self-enhancement (being striving or hard-working) less than the high need of arousal group. The difference in bio-spheric values between the groups with different needs for arousal from VT was not found. This finding suggests that egoistic values predict less and pro-environmental values predict more nature tourist orientations (Hedlund et al., 2011; Hedlund, 2012). The mismatch of pro-environmental orientations of tourists and acceptance of VT may be a sign of value-action spread that was previously shown in studies where respondents demonstrated low responsibility for the environment in line with their pro-environmental concerns (Cohen et al., 2013). Due to the rather indefinable environmental effects of tourist's behaviour, they may show greater concern regarding a

particular local nature destination rather than consider the environmental contribution of large-scale tourism impacts such as climate change. When comparing virtual travel to real travel, environmental impacts can be difficult to measure since the abstract ecological benefits may hardly overweigh the low hedonistic satisfaction from VT. As a result, value-action spread is hard to overcome by travellers.

Among the motivational and socio-demographic factors that may influence the acceptance of virtual travel it was found that the need for arousal plays an important role. Different personal motivations and social status play a less important role in the prediction of tourist satisfaction with VT in the low and medium need of arousal groups. In high need arousal groups these factors did not describe the variance in the sample. The need for excitement, explained through the need for arousal, in our study was the major variable illustrating the satisfaction with VT. Importantly this finding may help in furthering the implementation of sustainable initiatives in Eastern Europe. VT may reduce real travel costs in business since virtual meetings can be a substitute for business travel (Gustafson, 2012). There is a shift from business travel to virtual meetings (Arnfalk & Kogg, 2003) and virtual mobility will progressively be instrumental in decreasing the weight of physical business trips (Jauneikaite & Misiunas, 2007). There is a shift from business travel to virtual meetings (Arnfalk & Kogg, 2003). Apart from cost, time and comfort benefits that tourists might experience during sustainable travelling, they are more likely to be positive to this type of tourism if they can also satisfy their hedonistic needs as well (Gatersleben & Steg, 2012).

The results from the current study revealed that international and high-income groups of tourists were willing to pay much higher fees than those proposed by communities. According to (Reynisdottir et al., 2008,) the introduction of fees would not significantly decrease the demand for nature-based attractions. These findings may be useful for drawing up an investment plan for virtual travel facility installation at nature sightseeing destinations. This finding is especially important as virtual reality equipment such as professional 3D projector and multi-channel sound speakers are expensive assets and proper return on investment plans need to be elaborated beforehand.

Virtual travel may be a more sustainable version for real travel (Cole & Razak, 2009; Mittal, 2012; Williams, 2009) and could potentially decrease

some of the negative environmental impacts of tourism. For further VT development however, it would be helpful to understand more about its characteristics, opportunities and threats. This study has illustrated that the demand for arousal is negatively correlated with the satisfaction obtained through VT. This was previously described in the literature as low feelings of authenticity and shallow penetration into virtual travel experience (Guttentag, 2010;). Repeated virtual sightseeing visits were perceived as less interesting than recurring visits to real nature destinations, such weaknesses of virtual travel according to RTMs, resulted from an absence of a "connection" to nature. Thus, acceptable virtual tourist products should have their own value and a "naturalness" of a unique kind in order to make people feel connected. Effective virtual travel applications may represent destinations where visits are restricted or locations out of physical reach (e.g. under the ocean, Antarctica, the Moon, jungles, the past or the future) (Carrozzino, 2010; Costa, 2012).

Individual socio-demographic background, social, and pro-environmental motivations were tested for a deeper understanding of the need of arousal from VT. It was found that level of need of arousal from VT was not correlated with social background. This was correspondent with other literature (Montero-Lopez et al., 2015), which showed that women are generally more engaging in VT than men. Additionally, our results confirm that older people are more accepting of VT compared with real travel (Paccagnella, 2016).

This study explored how individual background could influence feelings of presence in VR, as has been reported in the literature (e.g. Mühlberger et al., 2012; Peperkorn & Mühlberger, 2013). Our results demonstrate that personal pro-environmental orientation, beliefs and norms do not inevitably lead to acceptance of VT. Controversially, respondents with higher pro-environmental standards of sustainable tourism had stronger requirements for arousal from VT. The "low need of arousal" group had lower sustainability ideals regarding tourism when compared with the "higher need of arousal" group. They were also more questioning of the narration of sustainable tourism and tended to make uncontrolled use of wildlife areas. The "low need of arousal" group had lower individual pro-environmental norms compared to the higher need of arousal group.

Our findings show that how low need of arousal groups accept VT varies according to their social background, this was also illustrated in earlier research of real travel motivations (Mehmetoglu, 2007; Tribe & Xiao,

2011; Verbeek, 2008). Consumer behaviour theories state that consumers have different preferences for particular goods and services that are available in the market. Each consumer has a budget constraint and is moved by rational behaviour meaning that they wish to pay less money for maximum satisfaction provided by goods or services (Crouch 2004). According to our findings, tourists with more advanced education showed a lower acceptance of VT, although this finding contradicts earlier statements in the tourism literature (Paccagnella, 2016). In this research VT was less accepted by people with a higher education in the low arousal need group. Lower need of arousal groups had lower satisfaction with VT according to factors of self-enhancement (hardworking, striving) and egoism (impact on other people). This finding confirms earlier studies which showed egoistic values being influential on lower pro-environmental tourism behaviour (Hedlund et al., 2011; Hedlund, 2012) and that nature tourists with a high need of arousal prefer real over VT.

Tourism actors perceived that education and improvements to information and communications technology will bring about a new generation of customers more loyal to virtual substitutes for real travel. ICT may be instrumental in developing virtual travel products derived from real destinations, where carrying capacities are exceeded and forms of virtual are used as substitutes for the purpose of destination protection. This sets a place for further discussion about the remaining variance characteristics. Such further research could compare how immersion and interactivity attributes of other 3DV equipment may be related to the need for arousal. For example, the quality of 3DV (Gilbert, 2016) may influence the experience of VT.

6.4 Limitations and implications

This research has its limitations. The first assumption is that all sites at a chosen sightseeing location are accepted to be equally influenced by human penetration, whereas some research suggests that this is not the case. Lyon et al., (2011) studied spatial distribution of visitor use within the park. Their results indicated that important habitats for endangered species were often located nearby or on the edge of high visitor use zones leaving them vulnerable to human impacts. When comparing real with virtual travel there is a need to be aware of such effects, though it may be hard to conduct a comparative study.

Digital tourism consumption is a fast-growing niche in e-tourism. This topic attributes some similar characteristics to the proposed (III) but here the focus is on those tourism products consisting of both a real change place component and a virtual travel component (e.g. a visit to wetlands in the Tartu area combined with a 3D panoramic show at the sightseeing location's facility). Purely digital consumption has the potential for booming growth in the future and thus needs to be continually monitored to establish if correlations with the current study are found. However, in the current proposal an examination of the entire digital consumption was out of scope of the research, which was the delimitation of the research.

Earlier studies (Concu & Atzeni, 2012) indicate that increasing environmental protection has positive effects only on the welfare of residents who do not earn their income from tourism. In this paper it is assumed that the entire local society gains from sustainable initiatives developed with VR and that this is the overall goal of proposed research.

Another limitation of this research is that it is focused on nature travellers. Prospective research may be directed towards a study of virtual travel acceptance in other tourism market niches e.g. the senior age travellers' group is steadily expanding. It would be worth exploring if VT facilities embedded into third party services could improve the average consumer profile characteristic of loyalty towards pro-environmental standards. Industries that could potentially integrate VT into services may include applications for public transportation, road traffic management systems and event management.

7. CONCLUSIONS

This study indicated that there is a lack of comprehensive sustainable tourism practices in Russia. Russian tourism managers' attitudes towards sustainable tourism are mostly influenced by their personal background in the industry and less by internationally adopted concepts. Even though RTMs personal attitudes varied significantly and our findings demonstrated contradictory understandings of sustainable tourism phenomena among them, the consensus search rounds showed that the managers do recognise the possible negative impact of tourism on nature, and see sustainable tourism as part of their future business development strategies. The observed lack of understanding about sustainable tourism principles and the perceived low demand for such initiatives in state regulations and among potential clients, are the key reasons for RTM's low motivation towards creating their own sustainable tourism initiatives. RTM came up with the idea that VT may be a feasible strategy for destination management where carrying capacities are exceeded or require nature conservation (I)

An individual's motivation to take part in sustainable tourism planning using 3DV may be derived from such social structures as interest, desire, challenge or curiosity. While interest groups in 3DV planning may significantly influence the flow and the value of sustainable tourism planning results, the same also happens when using the 3DV tool. Integration of 3DV into sustainable tourism planning from initialization of the participatory development process provides more opportunities for comprehensive planning outcomes (II). Several alternative landscape change 3DV scenarios provide for better sustainable tourism planning results. VT has a positive role to play as a sustainable tourism planning facilitator in participatory development. Precise selection of objects for 3DV, detalization level and intuitive user interface are factors in maintaining a qualitative sustainable tourism planning. A neutral moderator in 3DV planning is especially important when dealing with the problem of conflicting interests in STP.

This study revealed that tourists accepting of a low level of arousal from VT had lower socio-economic security, they are also less motivated by social interaction and adventure. Tourists most accepting of VT are less striving, and less interested in the societal impact of their lives. It was proposed that VT may serve as a substitute to nature-based travel. The study shows that at the current state of 3DV technologies, VT is capable

of satisfying sophisticated hedonic needs of tourists. Those who like active outdoors, are unsurprisingly, less satisfied with VT. VT could also be instrumental in nature experiences for tourists with lower travel budgets.

Sustainable tourism development within nature-based tourism may reduce damage to the natural environment and local culture by minimising damage from construction of physical tourism infrastructure (roads, path, buildings) in cases where tourists can be offered the alternative experiences of virtual travel as complementarities to conventional tourism. VT may show landscapes and enable tourists to get impression of natural sightseeing without physical visit to real destination. This in turn may increase opportunities for virtual tourism activity and benefit local communities. A weakness encountered with VT is that tourists may perceive such travel experiences as less satisfactory when compared to real trips.

This study revealed potential key strategies for overcoming obstacles for sustainable tourism development in Eastern Europe. Firstly, significant cooperation is required among stakeholders (local authorities, tourism managers, tourists, local population) to tailor more effective international and local legislation in the field of sustainable tourism, and for ensuring proper enforcement of this legislation. Secondly, the promotion of environmental education, including sustainability training among Russian tourism players, is highly recommended. Thirdly, virtual travel even though not an equal substitute for real visits, is a potential solution for implementing sustainable tourism strategies. Thus, further research could aim to find if virtual travel derived from real destinations where carrying capacities are exceeded may benefit nature preservation, and could be a means to raising tourists' awareness of tourism's environmental and social impacts.

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SUMMARY IN ESTONIAN

Virtuaalreaalsus toetamas jätkusuutlikku turismi: Ida-Euroopa kogemused

Kokkuvõte

Käesolev uurimus otsib vastust küsimusele: kuidas turismi huvirühmad tajuvad säästvat turismi ja säästva turismi planeerimispraktikate parendamist virtuaalse reisimise abiga. Lisaks uuritakse kui tõhusalt ja rahuldavalt asendab virtuaalne kogemus loodusliku sihtkoha tegelikku külastamist. Uurimuse eesmärgiks seati uurida ajendeid, mis soodustavad seda, et turistid eelistavad reaalsetele kogemustele nende virtuaalset asendust. Reisimine tähendab sageli transporti ja asukoha muutust, ning reisimine sihtkohta annab muutuse toimumise tunde ja virtuaalne külastus annab turistile võimaluse kogeda, mida kohalik loodus suudaks pakkuda. Töös postuleeritakse, et tugevama ökoloogilise hoiakuga isikud on suurema tõenäosusega avatud virtuaalse reisimise võimaluste kasutamisele võrreldes isikutega, kel ökoloogiline hoiak on nõrgem. Uuringud on näidanud, et turistid aktsepteerivad mõningaid virtuaalse reisimise viise, kuid eitavad teisi. Uurimus keskendub virtuaalse reisimise eeliste ja puuduste uurimisele ja ökoloogiliste motiivide rollile, mis mõjutavad reaalse ja virtuaalse reisimise valikuid. Töö väljendab kolmes artiklis kajastatud uurimusi ja nende tulemusi, need on tähistatud vastavalt I, II ja III.

Uurimisküsimused:

- Kuidas turismi korraldajate säästva turismi tajumine mõjutab säästva turismi pakkumist ja säästva turismi planeerimist? (I, II)
- Kuidas kolmemõõtmeline visualiseerimine (3D) soodustab säästva turismi arendamist ja säästva turismi planeerimist? (I, II, III)
- Kuidas turistid tajuvad virtuaalset reisimist olenevalt nende elamusvajadusest, sotsiaal-demograafilisest taustast, reisimiseelistustest ja ökoloogilistest hoiakutest? (III)

Metoodika

Uurimisandmed koguti dokumendianalüüsist (I), süvaintervjuudes ja küsitlusest. Töö jaoks uuriti Venemaal praktiseeritavat säästva turismi korraldamist dokumentide (ametlikud turismitegevust suunavad dokumendid, arengustrateegiad, õigusaktid jt) analüüsi abil. Kasutati ka kontentanalüüsi (II).

Intervjuud (I, II) turismiga seonduvate huvirühmade ja kohaliku kogu-konna esindajatega lindistati, transkribeeriti, kodeeriti ja kategoriseeriti. Intervjueeriti Moskva (Venemaa) turismiettevõtjaid ja Eesti ettevõtjaid ja kogukonnaliikmeid.

Lõuna-Eestis Piusa koobaste külastuskeskuses külastajate seas läbiviidud 299 küsitluse tulemusi analüüsiti üldistatud lineaarse mudeli abil (III). Virtuaalse reisimise vastuvõetavust kontrolliti rakendades väärtuste-uskumuste-normi teooria (Stern *et al.*, 1995) edasiarendust, tuvastamaks, kuidas vastuvõetavust mõjutavad elamusvajadus, ökoloogilised väärtused, uskumused, normid ja kavatsused.

Tulemused

Uuring tõi välja, et Venemaal puuduvad komplekssed säästva turismi prak-tikad. Venemaa turismikorraldajate hoiakuid säästva turismi suhtes mõjutab peamiselt nende enda taust selles sektoris ja mitte nii palju rahvusvaheliselt omaksvõetud kontseptsioonid. Kuigi Venemaa turismikorraldajate isikli-kud hoiakud varieerusid märgatavalt ja saadud tulemused demonstreerisid vastuolulisi arusaamu säästva turismi fenomeni olemusest, näitas Delphi meetodi rakendamine, et korraldajad tunnevad ära turismi võimaliku negatiivse mõju loodusele ja näevad säästvat turismi ühe osana oma tulev-astest äri arendamise strateegiatest. Üksmeele puudumine säästva turismi põhimõtete suhtes ja tunnetatud vähene nõudlus selliste algatuste suhtes riiklikes õigusaktides ja võimalike klientide seas on peamised põhjused, miks vene turismikorraldajatel on madal motivatsioon ise säästva turismi algatustega välja tulla. Nad esitasid seisukoha, et virtuaalne reisimine on sihtkoha juhtimise puhul otstarbekas strateegia, kui piirkonna taluvusvõime on ületatud või vajaks looduskaitse alla võtmist (I).

Üksikisiku motivatsioon säästva turismi planeerimises osalemiseks kui kasutatakse kolmemõõtmelist visualiseerimist tuleneb sellistest sotsiaal-setest motivatsiooni allikatest nagu osalussoov, väljakutse või uudishimu. Ehkki kolmemõõtmelise visualiseerimise planeerimise juures osalevad huvigrupid võivad märkimisväärselt mõjutada säästva turismi planeerimise kulgu ja väärtust, toimub sama ka siis, kui kasutatakse kolmemõõtmelise visualiseerimise tööriista. Kolmemõõtmelise visualiseerimise integreeri-mine säästva turismi planeerimisse kaasava arendamise protsessi algusest peale annab rohkem võimalusi paremate planeerimistulemuste saamiseks (II). Mitme alternatiivse maastiku muutmise 3D-stsenaariumi kasutamine annab samuti paremad säästva turismi planeerimise tulemused. Virtuaalne

reisimine soodustab kaasava arendamise protsessis säästva turismi planeerimist. Objektide täpne valimine kolmemõõtmelise visualiseerimise jaoks, detailsuse aste ja intuitiivne kasutajaliides on tegurid, mis teenivad kvaliteetse säästva turismi planeerimise eesmärki. Neutraalne moderaator on kolmemõõtmelise visualiseerimise planeerimise protsessi juures hädavajalik, eriti tähtis on ta siis, kui on tegu huvide konfliktiga säästva turismi planeerimises.

See uuring näitas, et virtuaalne reisimine on enam aktsepteeritav inimestele, kel on madal elamusvajadus, ja kes ei hooli sellest, et virtuaalne reisimine pakub vähem elavaid muljeid, koha vahetuse tunnet, ja kokkupuudet loodusega. Virtuaalne reisimine on aktsepteeritavam turistidele, kelle reisivalikute ajendite seas on sotsiaalne suhtlemine ja seikluslikkus vähem olulised. Virtuaalsest reisimisest enam huvitatud turistid väärtustavad vähem edasipüüdlikkust ja sotsiaalset mõjukust. Pakuti välja, et virtuaalne reisimine võiks olla looduspõhise reisimise asenduseks. Uurimus näitas, et kolmemõõtmeliste visualiseerimistehnoloogiate praeguses seisus on virtuaalne reisimine võimeline rahuldama hedonistlikumate, suurema mugavusvajadusega turistide vajadusi. Need, kellele meeldib aktiivne tegevus looduses, on vähem rahul virtuaalse reisimisega.

Säästva turismi areng loodusturismi raames võib vähendada looduskeskkonnale ja kohalikule kultuurile tehtavat kahju, minimeerides kahju, mis tekib turismi füüsilise infrastruktuuri rajamisest (teed, rajad, hooned) neil juhtudel, kui turistidele saab pakkuda alternatiivseid kogemusi virtuaalsest reisimisest tavaturismi täiendusena. Virtuaalne reisimine saab näidata maastikke ja võimaldab turistidel koguda muljeid ilma reaalset sihtkohta füüsiliselt külastamata. See omakorda suurendab võimalusi virtuaalse turismi tegevusteks ja on soodne kohalikule kogukonnale. Virtuaalne reisimine on aktsepteeritav alternatiiv suurema mugavusvajadusega ja vanemaealistele inimestele.

Uurimus tõi välja võimalikud peamised strateegiad, kuidas tulla toime takistustega säästva turismi arengus Ida-Euroopas. Esiteks on vaja märkimisväärset koostööd huvigruppide (kohalikud omavalitsused, turismikorraldajad, turistid, kohalikud elanikud) vahel, et luua tõhusamaid rahvusvahelisi ja kohalikke õigusakte säästva turismi valdkonnas ning tagada nende õigusaktide asjakohane ellurakendamine. Teiseks on äärmiselt vajalik edendada keskkonnaharidust, sh säästlikkuse koolituse pakkumist Venemaa turismitegijate seas. Kolmandaks, ehkki virtuaalne reisimine ei

ole ehtsa reisimise samaväärne asendaja, on see ikkagi võimalik lahendus, et ellu viia säästva turismi strateegiaid. Seega võiks edaspidine uurimistöö püüda välja selgitada, kas virtuaalne reisimine, mis põhineb reaalsetel sihtkohtadel, kus taluvusvõime on ületatud, võiks tuua kasu loodushoiule ja olla vahend, millega tõsta turistide teadlikkust turismi keskkonna- ja sotsiaalsetest mõjudest.

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I

ORIGINAL PUBLICATIONS

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Understanding of sustainable tourism among Russian tourism managers

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Abstract

An examination of the understanding of sustainable tourism among Russian tourism managers (RTM) offers insights into methods for designing acceptable sustainable tourism development strategies. Documentary analysis of tourism legislation revealed inconsistency in policies at both local and federal levels while five semi-structured interviews with RTMs revealed low levels of awareness of key aspects of sustainable tourism concepts. Delphi consensus search disclosed RTMs' associations of sustainable tourism such as nature travel, green tourism, ecological and outdoor, sports and friendly tourism. Achieving a comprehensive understanding of sustainable tourism by RTMs requires raising their awareness on the subject through training and facilitation in the elaboration of sustainable tourism strategies.

Introduction

The goal of this paper is to shed light on the understanding of sustainable tourism by Russian tourism managers (RTM). The subject is poorly covered in literature, yet worth exploring in order to elaborate initiatives for sustainable tourism development acceptable to RTMs. Sustainable tourism may benefit from collective actions by bringing together stake-holders (local authorities, tourism managers, tourists and local population) to develop mutually agreed initiatives and strategies (Bramwell, 2011). The role of the state however, previously considered as the sustainable policy initiator, faces serious challenges when considering the performance of such policies (Hall, 2011). One of the reasons Choi & Murray (2010) suggest, is the reluctance of key state actors to admit their failures when sustainability goals are not reached. Potential for overcoming this issue may exist in broadening the representation of sustainable tourism policy makers, including for example self-organized community groups and

private enterprises, i.e. tourism practitioners (Choi & Murray, 2010). Careful consideration of stakeholders` views and attitudes is as critically important for policy design as it is for the effective implementation of sustainable tourism initiatives in the longer term (Brandon et al., 2010).

This paper adopts the concepts for sustainable tourism as defined in the United Nations (Rio+20, 1997) guide for sustainable strategy building. Sustainable tourism is understood to be 'tourism that respects local people and travellers, cultural heritage and the environment'. In order to develop a feasible strategy for sustainable tourism planning it is vital to take into account the following key components: nature preservation (Ballantyne et al., 2009), cultural diversity and social contract (Hall & Brown, 2006; Rigall-I-Torrent, 2008). Achieving only a low level of mutual agreement among RTMs on nature-based tourism phenomena has been shown (Vespestad, 2010) to result in a failure to form the backbone policy that could help to coordinate consistent sustainable tourism practices (Kuskov, 2006) and indicates a shallow understanding of sustainable tourism requirements by RTMs (Karmalskaya, 2013).

An important point addressed in the literature concerns the problematic implementation of sustainable tourism principles in areas where tourism strategies are designed regionally (e.g. in the Baikal case analysed by Maksakova, 2005). Strategies are difficult to put into effect without proper action guidelines, e.g. when service standards remain underdeveloped (Zeletdinova, 2005). Problems also stem from the poor correlation between the tourism and economic development plans of a region (Maksakova, 2005).

Methodology
Because of limited knowledge in the field, an exploratory case study design was selected to describe the phenomena from the participants' perspective (Marshall et al., 1999; Yin, 2003b). The current state of sustainable tourism development in Russia was explored through documentary analysis of tourism federal law, two federal programs and five local tourism development strategy documents. Secondly,

semi-structured interviews that are commonly applied in exploring social attitudes in a specific set of circumstances (Yin 2003a) were conducted. Russia is a highly centralized economy with headquarters of major tourism operators based in Moscow. Thus, top 20 tourism sales companies from Moscow were approached in December 2012. After a short briefing on the current research objectives with managers involved in business development, five companies confirmed their commitment to participate in the research. Each informant was interviewed during a personal meeting lasting 1 to 2.5 hours at their company office. In order to present RTMs consensus understanding of sustainable tourism a Delphi consensus search (Gokhale, 2001; Linstone & Turoff, 2011) was employed. Two weeks after the interview sessions the results were tabulated and sent by e-mail to all participants asking for feedback.

Discussion of findings
The documentary analysis revealed that local and federal legislation only partially cover sustainable tourism principles, such as nature conservation, environmental ethics and social responsibility. Local tourism strategies in three of the five regions that were examined, repeat general provisions of federal tourism policy but lack mechanisms for the implementation of some sustainable tourism principles. For example, in Murmansk region, the tourism development strategy does not comprehensively cover the estimated social impact of incoming tourism growth. Additionally, for the preservation of traditional occupations of local minorities in this area, a more specific approach is required, taking into account declining national minorities. This issue was discussed by Zeletdinova (2005), who pointed out that sustainable tourism practices have previously been described as sporadic and largely unregulated in terms of local cultural background. Maksakova (2005) highlighted that sustainable tourism development in Russia often needs a more consistent and systematic approach.

The ad hoc nature of the sustainable tourism industry in Russia was also supported by our interviews. For example, interviewee (*IS*) explained: "*I am not familiar with any other companies practicing sustainable tourism.*"

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Table 1. *Russian tourism managers' consensus understanding of sustainable tourism*

Terms	Attributes
Nature travel	Cognitive, national parks, wildlife, countryside
Green tourism	Cognitive, friendly, nature protection
Ecological	Ecotourism
Outdoor	Fishing & hunting
Sports	Rafting, alpinism, ecotourism
Friendly tourism	Green, togetherness, emotional unity

Recent analysis (Kagan, 2013) showed that in practice most Russian sustainable tourism initiatives are realized intuitively and stem from the goodwill of tourism planners rather than from a scientifically supported knowledge base or learning from international tourism practices.

Interviews demonstrated little mutual understanding regarding the attributes of sustainable tourism from the perspective of RTMs. Data from the interviews illustrated that respondents associated a variety of terms with the phenomena of sustainable tourism.

In Table 1, terms that respondents used to refer to sustainable tourism are given along with attributes associated with them. Several types of tourism domain were mentioned, such as nature tourism, green and ecological tourism, outdoor and sports activities, and friendly tourism. Furthermore, nature protection and local cultural heritage preservation were brought out in individual interviews as elements of sustainable tourism. These attributes were mentioned by different informants, but were included in the table only after the consensus round ended in mutual agreement by all informants. As presented in Table 1 the connection between terms and attributes may seem subjective and even doubtful, for example, "friendly tourism" was referred to as togetherness and emotional unity whereas the literature points rather more towards ecologically sound tourism. Earlier analysis by Zeletdinova, (2005) suggested that out-of-date professional education of tourism practitioners hinders further development of sustainable tourism practices in Russia. Low knowledge levels of modern sustainable tourism standards among RTMs is partly driven by a gap between current tourism education in Russia and sustainable tourism concepts developed by the global scientific community (Kokorev, 2010).

Individual interviews demonstrated a rather limited understanding of sustainable tourism among RTMs, which can make elaboration of efficient tourism policies difficult (Castellani et al., 2010).

None of the respondents demonstrated a broad understanding of the sustainable tourism concept as defined by the United Nations (Rio+20, 1997). Their focus was set on types of tourism activities, rather than the application of sustainable principles, nature conservation requirements or local socio-cultural protection issues. However, after the individual interviews were conducted, a later consensus round ended with a set of commonly agreed attributes of sustainable tourism closely resembling the United Nations' definition. This demonstrates that discussion panels may benefit the RTMs understanding of sustainable tourism even though respondents may have a quite fragmented knowledge of the topic. A mutual understanding of real sustainable tourism objectives may provide a solid ground for sustainable tourism planning (Ateljevic, 2010) providing a higher quality of sustainable initiatives. For example, one interviewee (DM) contrasted sharply, sustainability endeavours and tourism activities:

"*Sustainability versus tourism. These two things are contradictory. More tourism means less sustainability and vice versa.*"

As (IS) explained "*From my point of view, cultural heritage should be defended along with nature when we talk about sustainable tourism.*"

Interviews brought out that sustainable or green tourism are means of nature protection from the RTM perspective. Informants often

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equated the meaning of sustainable tourism with environmental purity and ecological balance. The term "green tourism" contains a nature protection element, which is an important component of the sustainable tourism concept (Ballantyne et al., 2009). During the initial interviews, two respondents referred to green tourism as connected with the activities of Greenpeace. For example, one manager (*TP*) explained green tourism as follows: *"Green tourism is something that Greenpeace does*."

All respondents referred to a nature-based element as crucial for sustainable tourism, though this is not inevitably a prerequisite according to internationally recognized definitions (Rio+20, 1997). In fact, the term "nature tourism" was commonly used as a synonym for sustainable tourism by RTMs. The following comment from an RTM is an example in this regard: "*Sustainable tourism is when tourists visit nature for sightseeing and wildlife* [interview with *ON*]." Importantly, nature-based tourism was not related to sustainable tourism by RTMs (Vespestad, 2010).

RTMs tended to classify sustainable tourism by the types of physical activities involved (e.g. fishing, rafting and wildlife watching). As one interviewee (*VS*) put it: *"Sustainable tourism is for example alpinism or other sport events that may need a good command of training in the fresh air outdoors.*" The interviewed managers did not distinguish sustainable tourism from outdoor activities. This may indicate that, being generally unfamiliar with sustainable tourism concepts, RTMs still pursue a healthy and nature-based image of it. This could be interesting to verify through further research.

Another common perception of sustainable tourism was its exclusiveness and the untouched nature of the travel destinations. The interviewees demonstrated an understanding that green tours take travellers to places difficult to reach and that have been rarely visited in the past. As one interviewee (*IS*) explained it: *"Sustainable tourism is when people choose unique places for their travel. Such places are located in isolated from well-known routes*." The interviewed RTM understood sustainable tourism as a somewhat

rare type of travel, more like an extraordinary experience affordable only by a limited group of people with a higher than average income. This demonstrates how far from reality RTMs` perception can reach in contrast, which may become a barrier for the improvement of communication between stakeholders (Bramwell, 2011).

Interestingly, a consensus was reached among RTMs that virtual travel using 3D visualization could potentially be included in strategies for the sustainable tourism development of areas where carrying capacities have been reached. They also agreed upon the necessity for more intense cooperation between tourism stakeholders in the development of sustainable tourism in Russia and pointed out that training may raise awareness of sustainable tourism. RTMs agreed that public discussion may also positively impact on the improvement of tourism legislation.

Conclusion
A limitation of the current study is that only 5 from more than 80 Russian regions were observed in the study, whereas RTMs` understanding of sustainable tourism may still significantly differ. The paper highlights the shallowness of RTMs` understanding of sustainable tourism concepts. The attitudes towards sustainable tourism amongst RTMs were largely influenced by their personal background in the industry rather than by internationally adopted concepts. RTMs described sustainable tourism in terms of 'outdoors activities', 'visits to unique places', 'nature-based tourism', 'friendly tourism' and 'green tourism'. This observed lack of understanding of sustainable tourism principles by RTMs is an obstacle to the elaboration of feasible strategies for sustainable tourism development. Greater cooperation between tourism stakeholders and training are required to initiate public discussion and raise awareness of sustainable tourism in Russia. This in turn may facilitate an improvement in tourism legislation.

An interesting and unexpected outcome was that virtual travel, derived from real destinations where carrying capacities are overexploited, was perceived by RTMs as a tool capable of

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benefitting nature conservation. However, further research into the prospect of virtual travel is required. This knowledge could be useful for effective local and international environmental policy planning and implementation.

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ARTICLE

The use of 3D visualization for sustainable tourism planning

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ABSTRACT

This paper describes the results of using 3D visualization (3DV) in sustainable tourism planning (STP) during the Comcot project in Estonia. Organizers were interviewed on the characteristics of 3DV for STP and on how participants were involved in discourse using 3DV. The study describes experiences from the Setu, Maidla, and Võrtsjärv lake regions of Estonia. The content analysis of the interviews suggested that the precise selection of visualization objects, detalization levels, and user interface characteristics may significantly influence the quality of STP sessions and help to optimize time, financial, and human resources allocated for a project. The coherent design of the 3DV tool and the neutral moderator positively affect the level of participant involvement in STP and support a trusted platform for community decision making.

Sustainable tourism development involves bringing together all major stakeholders to create a mutually approved strategy. The process of such planning ideally connects the interests, needs, desires, and future visions of all major social groups in the area. It also reflects shared responsibilities for local social, cultural, and environmental capital. In practice, this often occurs when a social group appears to be passive toward tourism planning; it does not perceive a need for change, whereas others strongly do (Aref 2011). Whether people have no opinion on the issues discussed or are too busy, frustrated, reluctant, or simply not interested in anything new, all these factors may contribute to a weaker basis for the legitimacy of sustainable tourism planning (STP). Conversely, Cole (2006) suggests that not everyone can and should participate in STP because not everyone has the capacity, skills, or competence to participate in the decision-making process. In addition, such groups are most likely to be passive regarding the enforcement of these decisions, strategies, and so on.

Certain STP stages can be visualized in 3D to facilitate the decision-making process for local stakeholders (Wissen et al. 2008; Shojaei et al. 2013; Lovett et al. 2015). Additionally, the visualization tool may serve as common ground and provide a method to bring less interested parties together to engage in dialog. The focus of this research is to establish how 3D visualization (3DV) can be used for STP by

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facilitating the comprehensive representation of local society in the participatory development process, especially those social groups most likely to be affected by the planning process.

The research questions posed are as follows:

- What are the characteristics of 3DV in the STP process from a participants' perspective?
- How are STP participants involved in the discourse when using 3DV?

Literature review

Sustainable development prioritizes 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland 1985; Ryan 2002). In tourism planning and community resource usage, various social groups face each other in a competitive environment (Hassan 2000; Blackstock 2005; Saarinen 2006). The groups struggle to maintain and promote their lifestyles while seeking better approaches to utilizing local resources (Hardy and Beeton 2001; Dinica 2009; Perdue 2003). In the process of participatory development, social groups united by an external characteristic transform into interest groups united on the basis of their internal characteristic (motivation). It can be problematic, however, to correctly identify stakeholders involved in a particular case at any definite point of time (Hardy, Beeton, and Pearson 2002; Ayuso 2006; Jamal and Stronza 2009; D'Angella and Go 2009). This situation creates a potential conflict of interest in STP (Okazaki 2008; Timur and Getz 2008).

Low interest in participatory development also risks the failure of future strategy discussions. A 'silent' group, for example, may introduce an unexpected problem (Choi and Sirakaya 2006; Timur and Getz 2009) up until the final planning phase or may later provide negative feedback (Chok, Macbeth, and Warren 2007; Dwyer 2005). Silent social groups remain a serious concern in participatory development for STP.

An important objective in sustainable tourism development is revealing hidden stakeholders and enabling their voices to be heard (Liu 2003; Bouwen and Taillieu 2004; Williams and Ponsford 2009). One of the least explored areas is the approach to social groups with little or no interest in participatory development discourse. Existing practices dealing with reluctant groups in participatory development utilize techniques of communication enhancement (Björgvinsson et al. 2010; Presenza et al. 2014). The latest findings suggest that even marginalized participants could be legitimized for public discussion, although they can still present communication challenges. Björgvinsson (2010) suggests that complex cases usually address significant controversy and antagonistic perspectives of stakeholders; they may require an original design in every particular case. In general, a comprehensive approach should provide democratization as a central component for solving dilemmas in participatory development. The basis for this approach includes the continuous monitoring of new techniques and the attraction of a wider range and number of participants. Currently, a gap exists in the scientific literature defining the means of communication improvement in cases where the list of participants cannot be fully categorized or remains largely unknown.

Bryan et al. (2011) indicate that 3DV may be a useful instrument for effective participatory development in STP. Environmental targets for landscaping future

scenario planning using software modeling is a winning strategy in terms of long-term income increases in local communities and in terms of maintaining the sustainability of a region (Tsaur, Lin, and Lin 2006). The impacts of every future scenario can be calculated across a set of economic, ecological, and social indicators. Policy options and other external factors may influence the costs of a new development and can be presented for review by engaged stakeholders through 3DV modeling.

Wissen et al. (2008) demonstrate how 3DV may positively influence the participatory development planning process. This visualization method provides a common ground for discussions with stakeholders by homogenizing the knowledge bases of different parties that otherwise have very different knowledge and perspectives. STP through 3DV may be effectively applied for the development of regionally specific indicators (landscape, seasons, and habitats). It may be particularly beneficial to use 3DV during the introduction phase, when stakeholders are unfamiliar with each other, and during the initial assessment of a problem (Aref 2011; Byrd 2007). By facilitating communication between professionals and the public, 3DV can help to improve participatory development practices.

Hayek et al. (2016) suggest that 3DV interfaces should be customizable for different user groups (age, background, education). Otherwise, the planning process can become problematic because each subgroup would require a different time and lexicon for introduction. Such user group-oriented interfaces may significantly improve the quality outcomes of the participatory development process. A degree of realism is also important and should match the topic requirements (Holden 2003). However, it is not possible to satisfy all stakeholders in a planning session because participants may differ in their cultural and technical backgrounds, interests, and motivations. A study of Estonian participatory environmental planning (Palang et al. 2011) shows that participant perceptions of the phenomenon being discussed may also change during the planning process, thus influencing their level of involvement.

Methodology

Sustainable tourism planning used case study methodology (Yin 2003a, 2003b) to describe the context in which 3DV was employed. The following case selection criteria were established: the availability of initial documents and opportunities for desk research into official STP initiatives, an ongoing project in STP, and the accessibility of stakeholders and organizers for interviews during the STP. A sustainable development strategy until 2030 was adopted in Estonia at the parliamentary level. As a result, a number of sustainable tourism initiatives were put into place. Soomaa, one of the first projects, was located in the Pärnu region in southwest Estonia. The enterprise established a goal to provide guided trips in Soomaa National Park, offering canoeing as a way to explore the wilderness, and day-trips with bog walking on wooden paths. Another example was in southeast Estonia. Seto is a unique culture that has preserved its own language, outlook, and habits. Today, Seto's song festival, traditional food, and handicrafts attract tourists from all over Europe. On the basis of the selection criteria, the Comcot project was chosen.[1] The goal of the project was to visualize protected areas and zoning plans. The study describes experiences from the Setu, Maidla, and Võrtsjärv lake regions of Estonia. The Comcot project had joint private and state investors. Public discussions were held on local TV and radio, in newspapers, and on

the Internet to attract public attention regarding the planning process and to increase the interest of potential participants. At the initial stage, organizers identified a list of social groups affected by the project's development, and local stakeholders were invited to participate in planning sessions.

Zoning decisions had already been prepared and written in regional master planning documents, and 3D maps were designed using local photos and videos. Next, a strategy was developed to present the content in 3D visual format. Organizers prioritized the project targets and reached an agreement on how the project would be visualized. Several approaches were integrated in the project. An audit of local resources was conducted from the beginning of planning and then visualized in the 3D planning tool. The diagrams helped to make decisions regarding priorities, goals, and strategies. Some auditing results, such as tourist attractions and accommodations, were visualized.

Using a qualitative approach, the perceptions of the participants involved in STP were explored. Open-ended interviews were used to collect material for the case study. A descriptive design and a snowball method were used for data saturation measurement. Interviews were conducted in 2014 in Tartu, Estonia, when the Comcot project was in the reporting phase.

The content analysis technique, a strategy for interview-based research recommended by Berg and Lune (2004) was used for data analysis. Derived from posed research questions, the interview answers were audio recorded, written, verified in English, split into categories (domains of information), and then sorted by research questions and topics. An analysis of the characteristics of 3DV for the STP process from the participants' perspective was performed via a description of objects sufficient for 3DV, a detalization level for STP, requirements for user interface, and types of future scenarios. The use of 3DV for STP was analyzed via participatory development techniques employed to engage participants in 3DV discussion and via methods of involvement for interested parties in 3DV sessions.

Results and discussion

Characteristics of 3DV for the STP process from participants' perspective

Objects for 3DV in STP

Comprehensive STP requires the tailored selection of objects for 3DV based on participants' needs. The respondents demonstrated that elements of tourism infrastructure suited for 3DV included buildings, roads, water objects, coastal lines, and small architectural forms. In the Comcot project, no strong opinions were recorded against the visualization of certain types of objects such as parks, paths, embankments, and benches, as well as public recreational areas along the shores of the lake where people are able to relax near water.

Respondent LS: 　 "For example, a bird-watching platform was designed in 3D format as located in the sea among rock stones."

　　　　MVP: 　 "Virtually, we can visualize via the 3D tool future landscape scenarios, housing development, bird-watching towers, marinas, and sea docks."

The use of these types of visualized objects has also been justified in previous research. The notion of visualized objects is quite broad in the literature and includes tourism infrastructure, landscape, and inhabitants (Lange and Hehl-Lange 2006; Lovett et al. 2015). Wissen et al. (2008) note that the selection of visualized objects should be linked with the aims of practicability and expediency in 3D modeling for STP purposes.

The respondents suggested that 3DV provides opportunities for larger tourism planning tasks, which could extend beyond typical physical object modeling to include integrated landscape planning and vegetation. Complex design solutions for tourism destinations can make STP a more realistic experience and build trust in participants. Interviewee (IZ) said that the technically advanced 3DV provides the impression of motion through virtual space, increasing the impressiveness of the experience. The demonstration of an object under different lighting, viewing angles, and weather conditions positively influences the dynamics of STP. Wissen et al. (2008) suggest that it is essential for the 3DV elements of objects to be precisely selected in a model at the initial stage of the planning process to ensure a smooth bridge to the following stages of STP. Importantly, the type of 3DV and technological settings must correspond to the specific requirements of the audience (Hayek et al. 2016). In our case, one of the main requirements articulated by participants was an opportunity to view visualized objects from various angles. The effect of dynamic motion through virtual space provided such an opportunity.

MT: "Dynamic motion 3DV is definitely more efficient in terms of STP rather than still images or drawings."

The advantages of motion in 3DV provide a better understanding among participants of any changes suggested during STP. This advantage positively affects the quality of decisions made during participatory development sessions. Accurate preparation via STP helps planning sessions to fit the time frame of the project and to keep up with resource limitations and budget allocations, thus providing efficiency in the entire planning progress with meaningful outcomes. This idea aligns with the findings of Hayek et al. (2016), who suggest that the proper selection of objects and objectives prior to the planning session is the key to sustainable planning. One potential conflict in STP is between what the community wants and what can be practically realized. Setting clear goals for STP using 3DV can ensure consistent development process results.

MT: "When you start using the 3D visualization planning tool, you don't necessarily know beforehand what is going to be the challenge. So I think that objective is to find out what are the community needs from the very beginning."

Ultimately, the interviewees suggest that sustainability can be realized when the initial strategic vision planning coincides with the systematic process revision at all phases, which coincides with earlier findings (Simpson 2001).

Level of 3DV detalization for STP
There was confusion among the participants in STP when objects were not visualized properly or did not look exactly like real ones.

LS: "In 3D visualization it is important that people could recognize the places they know."

It was difficult, however, to determine from the respondents' interviews whether some of the objects were presented in a technically insufficient way or whether the participants simply did not like how the objects would look in the future. Some respondents suggested that the objects should be better designed or that the proposed changes did not meet their priorities.

MT: "I can't definitely say that I would like the 3D visualized object appearance more if the quality of the image was better."

Literature suggests that technical presentation (physical appeal) may shape the overall attitude of presentation participants with regard to STP (Wissen et al. 2008). A completely realistic representation of the landscape and objects in 3DV is, however, technically complicated and practically never achieved. As one of the organizers (JK) of the planning process commented: 'Technically, it was difficult to visualize all the details we wanted in the software we used. Sometimes people didn't recognize places that we showed them around the lake.' In earlier studies, the requirement that the viewers of 3DV recognize the objects being presented was considered sufficient for general participatory planning purposes (Lam et al. 2012). The interviews in this study, however, suggest that the capability to recognize the objects may vary among participants due to their individual characteristics.

Respondent LS stressed that participants might perceive 3DV as a marketing tool if images in 3DV look better than reality. Wissen et al. (2008) indicate that there should be no image exaggeration or artificial enhancement in 3DV as it may cause participants to become suspicious towards STP and doubtful about the credibility of the planning process. The lowest level of detail in 3DV generally should be set at the smallest level the human eye can detect; however, such improvement may lead to significantly increased time and financial resources (Hayek et al. 2016). The optimal detalization level of visualization should meet the users' demand for every specific task. The higher the level of required detalization, the longer the time required for creating 3DV and the entire planning process itself. Any significant enhancements to increase user satisfaction and to improve STP almost inevitably lead to a greater investment of time and a possible budget over-run. An interviewee with project management background confirmed this particular scenario:

RE: "Key features can be created to a greater detail as necessary and can if needed be made to look almost lifelike. There is a cost balance to be considered between time (salary cost) taken to create the virtual model landscape and the visual appearance of the features within the model."

Some respondents indicated that their expectations were not met during the planning sessions, noting that they would like 3DV to be comparable to what they can see with their own eyes.

MK: "These objects were seen as from an airplane height. I expected a more detailed view in this 3D visualization. This was the first time we used this 3D visualization tool and it was a little disappointing as it was not close to the real situation. I expected video [of the] real situation but it was a quite general picture."

Such an idealistic approach, however, cannot be realized in practice because of hardware and software limitations. In addition, there is a subjective perception of

3DV as 'not real', which is a common criticism of visualization technologies reported in the literature (Wissen et al. 2008; Munar and Jacobsen 2013).

The detalization level in visualization (Hayek et al. 2016) should meet users' requirements, significantly affecting the length and flow of the planning process and the outcomes justification by participants. Gaining an understanding of audience drivers may help organizers identify the required level of 3DV while also remaining practical. Managing the expectations established by the 3DV is also significant. Nevertheless, it could be expected that representatives of the local community might be interested in concrete objects that are relevant to their daily lives rather than in the more general development principles of a larger tourism region.

MVP: "So when you design 3DV it is important to understand that you have to be realistic in what to let people expect."

Participants' attention during 3DV sessions became diverted from STP objectives toward their own personal interests in the project. For this reason, the moderator decided to use a low to middle level of detail in which all the houses were presented as gray blocks unless they represented very specific objects such as churches. In certain examples, a higher resolution of visualization did not necessarily provide improvement for participants.

MVP: "If you want to go into too much detail you can never reach 100% but when you are getting closer to it, people tend to focus more on the outlook of the houses rather than the future scenarios that you are trying to discuss."

Although organizers were keen to keep participants focused on the aim of STP and to discuss future scenarios, there was a lack of data describing the characteristics of certain objects. This data shortage was encountered as a seriously limiting factor for 3DV planning in other research (Wissen et al. 2008; Hayek et al. 2016) because the model must at least correspond to minimum user interface requirements.

Requirements for 3DV user interface

The interface used for 3DV during the Comcot project was designed to look as simple as possible. Participants had moderate expertise in mapping and GIU software. Technical skill requirements were low and assumed to not depend on the level of education or background of the participants. According to Hayek et al. (2016), the visualization interface should closely match the characteristics of users.

MVP: "It was basically like a video game, you could easily navigate those landscapes and switch from one scenario to another. So no high technical knowledge was required."

This experience suggests that it is important to understand the IT background of the audience when developing 3DV tools for tourism planning. Technical complexity of the user interface is required to be relevant to the skills of system operators. Otherwise, the efficiency of STP may be challenged.

MVP: "Useful to make people in the community understand better what the future landscape is going to look like. The thing is that most people do not usually manage well with MAX or Autocad plans."

During a planning session, respondent IZ noted that the 3DV experience was some-what limited because the technical requirements exceeded some audience members' capability. The models were prebuilt, and there was no facility for overlaying different scenarios onto a basic landscape so that users could see the impact of different developments simultaneously on their landscape. This issue was described as a short-coming of the 3DV model by interviewees.

Tourism future scenario development by means of the 3DV planning tool

Tourism future scenario visualization is a common practice in STP. As revealed in the case study, the outlook of Võrtsjärv shore is important for the local community, especially in terms of new construction, buildings, and landscape development throughout the area. These objects can be modeled in the 3DV tool by targeting the plans to look more realistic, thus facilitating the decision-making process by the local community. The 3DV tool can demonstrate possible future scenarios to partici-pants in their neighborhood or even next to where they live in terms of environ-mental, social, and economic indicators (Bryan et al. 2011). Interviewees suggested that the proper visualization of future scenarios should start with a precise develop-ment of tourism strategy with the local community and harmonization with existing master plans for the region. In the example below, a respondent comments on the preparation of 3DV sessions.

MK: "These important changes presented in 3DV start from detailed planning on paper."

As respondents have noted, the development of future tourism scenarios in 3DV should ideally begin with normal detailed planning, including the preparation of a destination tourism master plan prior to transferring those plans into the 3DV model for community discussions.

MT: "Firstly a local architect had made the plan and we put it into 3DV scenario."
RE: "Strategic and action plans for a community, it's territorial and business devel-opment are to be ready prior to visualization of future scenarios."

Our findings generally confirm previous literature suggesting that thoroughly addres-sing data input provides consistency in 3DV models for STP (Bryan et al. 2011). The inclusion of major external factors such as climate change or commodity prices would ensure the creation of a sustainable model, whereas the achievement of environmen-tal targets may also benefit the economy.

MVP: "Different future scenarios according to various environmental management strategies benefit environmental sustainability. So you could see the results of environmental protection in the time scale… and calculating the economic gain or loss."

The respondents suggested that STP is dependent on the purpose of the object or landscape visualization being shown. Although there are numerous ways in which landscapes can be visualized, the analysis of these visualizations will vary according to what types of indicators are being tested or demonstrated (Choi and Sirakaya 2006). According to interviews, the tool would be extremely useful in several scenarios: when

planning changes to the landscape and tourism routes, exploring how tourism businesses within a particular area might cooperate, investigating how to develop an area to obtain an overview of its tourism potential, and planning environmental management of protected natural areas. Interviewees suggested that 3DV future scenarios for local communities might have a number of informational uses, including providing future construction overviews, raising community awareness, and helping a community become used to the idea that something will be done. Importantly, respondents confirmed earlier research (Lange and Hehl-Lange 2006; Lam et al. 2012) that 3DV facilitates the decision-making process in local communities.

LS: "The good thing is that when the visualization has been presented, a community starts speaking in a way that everybody takes it for granted that this construction will be there one day although they are not sure when and what will happen in that place. So, it served as a kind of psychological prompt. When people see the plan visualized they can see it through their eyes and they start thinking that this is going to be there sometime, perhaps not today or tomorrow but one day in the future they will have it."

This finding specifically supports the study of Wissen et al. (2008), who showed that 3DV is especially effective in bringing stakeholders to potential mutual agreement. For consensus finding, participants can employ 3DV for informed decision making, as also shown in a study by Lange and Hehl-Lange (2006). The use of 3DV in STP also influences audiences as a marketing function and stimulates participants to initiate discussion in reaction to the presentation.

From the experiences learned through the project, using 3DV in future scenarios could assist in participatory development as a means of bringing people together for discussion and involving a range of different groups including tourists, investors, and the local population. Overall, 3DV assists in bringing stakeholders together in a mutual platform for collective decision making.

LS: "There always used to be a problem in making people initiate the dialogue. Thanks to our 3D visualization tool, we managed to create a platform where people could discuss decisions affecting the community at large. Now we can observe the process of decision making, which involves and is being prepared by more than a single group."

Responders noted that it is also important to provide several alternative future scenarios to offer flexibility and to find one that best matches the interests of the local community.

LS: "We visualized 3 scenarios of a bird-watching platform so that local people could compare and choose."

Organizers visualized the current situation plus three future scenarios so that audience members could choose among the proposed alternatives.

LS: "Whereas only seeing the future scenario without the current one makes them feel like a decision is already taken."

Wissen et al. (2008) and Bryan et al. (2011) also demonstrated the requirement for several alternative scenarios in 3DV for STP.

Involvement of STP participants in the discourse using 3DV

To understand STP participants' involvement when using 3DV, an analysis of techniques was employed to engage people in participatory development. In our case, organizers were attempting to engage people in 3DV discussions in the initial phase of the project when the audience was unfamiliar with the project and organizers.

MK: "Frankly I expected more interest from ordinary people; it was quite hard in my municipality to get people involved."

Literature on participatory development describes many challenges in gaining the initial involvement of stakeholders in planning (Aref 2011; Cole 2006; Hassan 2000). People might have been reluctant because they were insufficiently informed about details of the project, lack correct information, or had low levels of trust in the 3DV tool (Wissen et al. 2008).

LS: "The problem was that local people were not aware of these zoning decisions that were put into 3DV and because of that they were not motivated."

Participants in circumstances with a low degree of certainty tend to feel frustrated. Blackstock (2005) suggests that a 'shortage of information lowers participant interest in interacting and can disrupt the beginning of the planning process'. When local community representatives are not aware of current planning projects, lack information, or have low levels of trust in 3DV, their motivation to participate in development will be significantly lower or absent in comparison to a more informed audience. As a solution, in our case, five local meetings and seven information dates were conducted to increase information levels and to motivate local residents to participate.

MT: "We had a good network so we sent out invitation emails."
JK: "We invited people also via articles in local newspapers. We sent invitations addressing the local community and provided them with information on the project so that they could invite others who were interested in planning meetings."

Several groups were invited to 3DV sessions: pupils from schools, municipality representatives, council members, and employed and unemployed local residents. Each group required different messages and approaches to activate interest in public discussion (Wissen et al. 2008). D'Angella and Go (2009) suggest that when each social group receives a personalized message, group members' interest in speaking out becomes proactive. The following interviewee explained another culturally specific reason:

MK: "People in Estonia are not very social. If something concerns them personally they are more ready to speak about their opinion; however, public issues face lower interest when they are not obviously bound with their personal interests."

Personal motivation may form the key driving force to make the participatory development process move forward toward open debates (Getz and Timur 2004; Timur and Getz 2008). One issue, however, was maintaining participant interest during the entire process of intensive and time-consuming planning sessions. This challenge was addressed by encouraging participant involvement in table discussions, questionnaires, workshops, and feedback.

LS: "We used the community to find whether participants prefer to have more or less tourists in various zones around the lake."

Keeping participants interested by asking questions was positively referred to in earlier studies (Perdue 2003; Timur and Getz 2009). Another revealing result regarding participatory development was the benefit of enthusiasm among the participants. They inspired the rest of the group, provided a future vision based on examples, and drove others to provide more input in mutual discussions.

MT: "We had one or two active persons… they contributed by introducing local community members to the project and facilitation of discussions."

In the project, an element of entertainment was employed to attract participants' attention during 3DV planning sessions.

MVP: "We had some funny ideas [about] how to attract people's attention. Once we were dressed up like airline pilots because this session was performed like a flight over the land using 3DV."
MT: "We took 3DV presentations as flights. When we wore airline uniforms, this was quite interesting for participants. We got a lot of publicity in local newspapers."

This entertainment element also helped to engage children. At the entrance to the 3DV session, they were given plane tickets, and the entire planning session was organized like a game. Children were invited to discuss their special needs and requirements for the planning area. On other occasions, sessions for entrepreneurs and municipality leaders were arranged. After every 'flight', roundtable discussions were held, and participants drew up an action plan. As a result, local community representatives reached an agreement on a scheme sharing the tasks and responsibilities. Aref (2011) and Caffyn and Jobbins (2003) show that in order to attract attention and to stimulate interaction during STP meetings, the approach to participatory development must be original in some way.

   Another important factor in maintaining participant interest in discussions is determined by the role of facilitator, as described by participant feedback:

MK: "The role of facilitator is definitely one of the most important in participatory development. He must be a very dynamic person, he cannot just stand at the back of the rows saying nothing, he must really drive the public."
LS: "There are people who are afraid of changes and try to avoid initiatives. In our presentations, we used show elements to attract people's attention; this seems a way out. This is interesting for people and can make them participate more actively."

MVP: "The role of facilitator is a key factor in participatory development. People are not usually willing to get together and start a discussion from scratch. You need a very dynamic person, capable of pushing people to talk, to constantly ask questions regarding future scenarios, source their opinions and gathering people's preferences."

A moderator who is neutral to the interests involved in the discussion is an essential factor in effective planning sessions (Voss et al. 2004; Hoffmann 2007). Third-party independent discourse moderators may help to bring together different interest groups within a project and solve conflicts of interest. 3DV participants also articulated this view:

MT: "We explained that we as organizers had nothing to gain, that this was a pilot project, we were trying to create a tool and said that if they were not interested and just carried on arguing then we will not lose anything but that they will. On the other hand, we said they could gain something out of the project and in the end this was one of the most successful pilots that we had."

Respondents agreed that an outside/independent moderator was required from the very beginning of STP planning sessions. Such a person would have no personal interest in the development and would not be involved in any conflicts of interest among participants. For participants, it was important to clearly see that the process was transparent (with no hidden arrangements), to note that all Comcot 3D visualization planning was conducted openly, and to understand that everyone in the local community could participate in these sessions. The role of moderation and facilitation in participatory development has been demonstrated to be broadly and positively associated with good discussion outcomes by a number of researchers (Björgvinsson et al. 2010; Getz and Timur 2004). These experiences suggest that in terms of activating people and getting them involved, the same issues regarding the role of organizers and planners are present when organizing a planning session with or without the 3DV platform.

Conclusions

Nearly all types of physical objects of tourism infrastructure and landscapes are suitable subjects for 3D visualization in STP. Motion pictures and 'fly over' effects improve the outcomes of planning in comparison to still 2D imagery. The integration of 3DV into STP during the initial planning phases provides more opportunities for comprehensive participatory development results.

Incorporating a high level of detalization requires significant time and financial resources and can be misinterpreted by STP participants as a marketing rather than planning tool. A low level of detalization, however, creates the risk that STP is not taken seriously by participants because the images are not sufficiently realistic. Thus, the correct balance in the detalization level of 3DV should be derived from particular tasks, the objectives of STP, and the IT literacy skills of participants. The user interface of the 3DV tool must be kept simple and user-friendly given that the level of participant IT literacy is largely unknown.

Tourism future scenario development utilizing 3DV should begin with detailed STP documents and, ideally, tourism master plans for the region. Effective STP includes the

development of several alternative future scenarios, thus raising the possibility of meeting the major interests of the local community. In addition to providing an information function, visualized 3D future scenarios may also be used as a marketing tool to popularize changes being proposed to the public. Using 3DV creates a platform that brings people together to initiate public discussion.

A lack of information, low personal interest, and a lack of trust in 3DV technology (risk of being misunderstood) are all factors that may slow the progress of STP sessions and increase participants' reluctance to express their opinions or collaborate proactively, especially during the initial phases of a project. This obstacle can be overcome by a dynamic moderator who is clearly neutral in conflicts of interest, who is capable of moving discussion further via entertainment elements, who possesses an original approach and who can delegate to enthusiasts from within the group of participants. Although 3DV provides an extra attraction value, offers a common platform for discussion, and helps to engage all affected parties in STP, not all participants will be able to meaningfully contribute, a common challenge found in all participatory planning tasks.

The results of this study can potentially improve sustainable tourism planning sessions via the 3D visualization tool and can positively influence existing sustainable tourism planning practices, benefit local stakeholders, and advance participatory development knowledge.

Note

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III

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Satisfaction with virtual nature tour: the roles of the need for emotional arousal and pro-ecological motivations

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ABSTRACT

Interactive multimedia enables a mediated nature experience in ecologically vulnerable areas. The aim of this study is to clarify the social and individual motivational factors governing satisfaction with virtual nature tours. After visiting the Piusa Caves Nature Reserve in Estonia, and participating in its virtual tourism (VT), 299 tourists responded to a questionnaire regarding their natural and VT experiences. We use a general linear model to explore the effectiveness of predicting satisfaction with VT based on values, beliefs about treating nature, pro-ecological norms, and need for emotional arousal from virtual experiences. Compared to people with a high need for arousal, people with a low need are more easily satisfied with VT, regardless of its weak emotional triggers, e.g. lack of lively impressions, feeling of place change, and connection to real nature. Pro-ecological beliefs augment satisfaction with VT in people with a high need for arousal. Mediated nature experiences offer ways of engaging with nature more conveniently to hedonistic travellers and would likely be rejected by people who seek social interaction and physical challenges when travelling. As VT is better received among women, lower educated people, and 50–70-year-olds, these may be ideal target groups for promotion of mediated nature experiences.

1. Introduction

Virtual tourism (VT) offers mediated nature experiences in places with physically restricted accessibility or where heritage and/or threatened ecosystems need protection (Dewailly, 1999; Guttentag, 2010; Novelli, 2005). However, the exploration of the possible incentives to substitute physical travel by virtual is crucial in the context of growing demand for and environmental impacts of physical travel (Tussyadiah, Wang, Jung, & tom Dieck, 2018). Virtual reality (VR) technology developers are searching for ways to deliver comprehensive experiences to VR users and this arises questions on customer satisfaction with quality of VR products (Kourouthanassis, Boletsis, Bardaki, & Chasanidou, 2015). A better understanding of the factors that promote acceptance of these virtual experiences is necessary to stimulate their wider use. Acceptance of virtual substitutes

has been associated with tourists' attitudes towards authenticity, their motivations (e.g. engaging in social interaction), and the constraints of travelling (Guttentag, 2010). However, the impact of pro-ecological motivations that have been validated as significant drivers of sustainable travel behaviour (e.g. De Groot & Steg, 2008; Donald, Cooper, & Conchie, 2014; Nordlund & Garvill, 2003; Şimşekoğlu, Nordfjærn, & Rundmo, 2015), have received scarce attention in the context of virtual tourism.

This article focuses on whether people who enjoy environmentally friendly tourism might accept VT as an alternative way to experience nature. The aim of the research is to clarify the motives and barriers to satisfaction with VT. The specific research questions were as follows:

(1) What are the qualities of VT that may contribute to emotional responses and a feeling of arousal from the mediated nature experience?
(2) How do the individual need for emotional arousal from mediated experience, socio-demographic background, travel preferences, and pro-ecological motivations differ among people with varied levels of satisfaction with VT and nature tour?
(3) Which other factors beyond the need for arousal, e.g. individual pro-ecological motivations and socio-demographic factors, predict the satisfaction with virtual tour?

We tested individual-centred theories of travel behaviour (e.g. the value-belief-norm theory of Stern [2000]) that have been well-established in predicting pro-ecological travel choices, in combination with theories on emotional reactions triggered by virtual reality (Diemer, Alpers, Peperkorn, Shiban, & Mühlberger, 2015; Seth, Suzuki, & Critchley, 2012). This allowed us to explore both explicit motives (e.g. the need of relaxation and emotional arousal) and potential implicit motives (e.g. eco-centric values) that may underlie the use of a VT application.

1.1. Rationale for virtual tourism

The impact of tourism on ecosystems is permanently increasing and accelerating with population growth (Kuvan & Akan, 2005; Zhang, Xiang, & Li, 2012). To meet the societal demand for diversity and sustainability, the tourism industry is seeking new ecologically sustainable ways to grow (Tribe & Xiao, 2011). VT delivers travelling experience by means of visualisation technologies, media and internet. Virtual travel has the potential to be developed to provide an alternative to real tourism, and in some cases may play a positive role in making tourist destinations more sustainable (Cole & Razak, 2009; Mittal, 2012; Williams & Shaw, 2009). Virtual travel may also become an effective solution at destinations where local natural sightseeing entails the risk of damaging the biodiversity in vulnerable ecosystems (Guttentag, 2010; Simón, Narangajavana, & Marqués, 2004). Multimedia-enhanced interactions facilitate telepresence, thereby reducing the financial and environmental costs associated with travelling (Gustafson, 2012; Poom, Orru, & Ahas, 2017). However, VT may also facilitate further interest in visiting actual sites or, as an additional feature of a tourism site, promote overall satisfaction with a trip, thus stimulating real travel (Huang, Backman, Backman, & Moore, 2013; Jung, tom Dieck, Lee, & Chung, 2016; Lee & Oh, 2007).

The desires to escape one's daily routine, indulge oneself in comfort, and engage in social interaction have been demonstrated as important incentives to travel (Bansal & Eiselt, 2004; Crouch, Perdue, & Timmermans, 2004; Kumra, 2007). In the literature on virtual consumption, similar social and hedonic motivations, including excitement and social engagement, have been highlighted to contribute to emotional experience and as incentives to engage in virtual worlds (Lehdonvirta, Wilska, & Johnson, 2009). Furthermore, high importance has been attributed to the authenticity of tourism experiences as an incentive to participate (see e.g. Belhassen, Caton, & Stewart, 2008; Sedmak & Mihalic, 2008). The literature on VT describes how low levels of authenticity, including the lack of spontaneity, limited feeling of novelty and place change act as a barrier to producing the emotional reactions that real destinations offer (Funk, Alexandris, & Ping, 2009; Guttentag, 2010). However, virtual travel is suggested to have a kind of authenticity of its own, which contains self-value, and may possess different characteristics than real travel (Cho & Fesenmaier, 2000; Govers, Jansen-Verbeke, & Go, 2000; Guttentag, 2010).

1.2. Virtual reality as a trigger of emotional reactions

Psychological research (see e.g. Diemer et al., 2015; Peperkorn & Mühlberger, 2013) has focused on virtual reality as a medium that relies on perceptual stimulation via particular visual cues, sounds, and sometimes tactile and olfactory triggers of emotional reactions. This research defines the feeling of presence as a necessary mediator to allow real emotions to be activated by a virtual environment (Parsons & Rizzo, 2008; Price, Mehta, Tone, & Anderson, 2011). According to Circumplex Model of Affect (Russell, 1980), a provoked emotion is represented by arousal (degree of intensity) and valence (degree of positivity or negativity), that are likely perceived as mutually inclusive. Individual differences appear in how virtual environments are experienced; for example, men generally report more perceived realism and higher levels of a sense of actually being in an environment than women (Felnhofer, Kothgassner, Beutl, Hlavacs, & Kryspin-Exner, 2012; Montero-López et al., 2016).

More sophisticated simulations (providing higher immersion) result in increased presence, especially in virtual environments not designed to induce particular emotions (Banos et al., 2012). The stronger the feeling the greater the likelihood of finding a significant correlation between presence and emotion. As Freeman and colleagues (2005) suggest, the correlation of presence and emotion might be limited to arousing stimuli. Their arousal theory of presence argues that arousal leads to alertness, which in turn leads to higher presence ratings. Perception elicits emotional reactions, and arousal is a basic dimension of emotional experience.

More recent studies (Gorini, Capideville, De Leo, Mantovani, & Riva, 2011; Mühlberger, Neumann, Lozo, Müller, & Hettinger, 2012; Peperkorn & Mühlberger, 2013) have highlighted the need to consider not only the above-described bottom-up processes of perception, but also top-down effects when it comes to understanding how virtual reality can be emotionally engaging; for example, a background narrative to a virtual reality scenario may enhance the emotional experience. Gorini and colleagues (2011) reported that emotionally relevant background information enhances presence, indicating a causal relationship between emotions and presence. Thus, to understand the reception of virtual reality, it is necessary to distinguish between immersion (the technological features

of a given VR system) and arousal (as a dimension of emotion) as well as cognitive presence (presence as a subjective judgment) and emotional presence (see e.g. Diemer et al., 2015; Seth et al., 2012). The current paper explores pro-ecological attitudes as potential subjective narratives that could augment cognitive presence and thus facilitate emotional arousal and feelings of satisfaction from a nature tour.

1.3. Pro-environmental motivations behind virtual tourists' choices

Eco-friendly values, beliefs, and personal norms have been associated with sustainable behaviour in tests using individual-centred models of travel behaviour such as the value-belief-norm theory (VBN) of Stern (2000). In this study, we apply the VBN to explore how pro-ecological motivations, including the idea of recreation without causing harm to environment by physical travelling, could enhance emotional responses and thus satisfaction with VT.

Values, as deeply held beliefs about desirable end states or behaviours, underpin individuals' moral choices (Schwartz & Bilsky, 1987) and are thus considered key to understanding motivation for eco-friendly travel choices. According to Stern (2000), three different value orientations may affect people's beliefs related to environmentally significant behaviour: egoistic, social-altruistic, and biospheric. Egoistic values capture orientation towards self-enhancement and hedonic gains; social-altruistic values indicate orientation to self-transcendence and concern for collective interests; and biospheric values are characterised by assigning importance to the intrinsic value of the ecosystem. Applications of VBN in studies of tourist behaviour (e.g. Hedlund, 2011; Hedlund, Marell, & Gärling, 2012) have shown that unlike egoistic value orientations, social-altruistic values are positively related to environmental concern, which in turn is positively related to purchasing intentions of environmentally sustainable tourism alternatives.

There are mixed results on how concern for the environment affects travel choices (Nordlund, Jansson, & Westin, 2016). Some evidence suggests that pro-ecological attitudes predict maintaining everyday environmentally friendly behaviour while on vacation (Miller, Merrilees, & Coghlan, 2015), while some research indicates that compared to other pro-environmental behaviours, such as home energy use or recycling, reducing holiday flying is weakly related to pro-ecological attitudes (Diekmann & Preisendorfer, 2003, p. 460). Some studies even indicate that people with pro-ecological values travel more (Whitmarsh, 2010).

Stern and colleagues (1999) linked VBN to the Norm-Activation theory of altruism (NAM) (Schwartz, 1977), which proposes that awareness of consequences (both pro-social and self-interested) mediates relationships between value orientation and environmental concerns. Tests of Norm-Activation theory show that people who are aware of the ecological and social problems caused by their behaviour are more likely to feel moral obligation and responsibility for limiting their travelling (Lind, Nordfjærn, Jørgensen, & Rundmo, 2015; Mehmetoglu, 2007; Nordlund & Garvill, 2003; Nordlund, Eriksson, & Garvill, 2010; Steg, Perlaviciute, Van der Werff, & Lurvink, 2014). Responsible tourists demonstrate a range of priorities, including moral obligation to show respect for local communities, to share the economic benefits of tourism directly with local people, and to mitigate the ecological impact of their holidays (Fennell, 2008; Miller et al., 2015; Weeden, 2011). Ecotourism's perceived usefulness for these purposes encourages

making environmentally friendly travel choices (Doran & Larsen, 2016; Lee & Jan, 2018). Nevertheless, there is also evidence of people continuing unsustainable travel behaviours, e.g. non-essential air travel, despite having environmental concerns regarding climate change (Büchs, 2017; Cohen, Higham, & Reis, 2013).

Arousal, or affect, is part of the attitude–behaviour relation and originates with the theory on cognitive dissonance: attitudes do not always translate into behaviour (Lavergne & Pelletier, 2016). Furthermore, more modern theoretical frameworks, such as the goal framing theory (Lindenberg & Steg, 2007), have come to include a hedonic goal frame alongside the more traditional gain and normative goal frame as a facilitator of or barrier to pro-environmental behaviour. Studies have shown that fostering positive affect alongside pro-ecological attitudes may lead to pro-environmental behaviour (Bissing-Olson, Iyer, Fielding, & Zacher, 2013). Therefore, in addition to pro-ecological values, beliefs, and norms, the role of arousal (or affect) is important in shaping the reception of eco-friendly tourism, including virtual experiences.

1.4. Synthesis

In this study, based on the case of the Piusa caves, we first explore the qualities of virtual tours that may contribute to emotional responses and feeling of arousal. We explore satisfaction with virtual tour as a reflection of emotions (mutually inclusive of perceived valence and arousal, Russell, 1980) provoked by the experience. Feelings of authenticity and immersion in an experience are key triggers of emotional response in real tourism. In the virtual environment, where visual cues, touch, and/or smell are technologically mediated, emotional reactions and feeling of presence may be hindered. We assume that some qualities of virtual tours, e.g. lack of spontaneity or feeling of place change are particularly important barriers to producing the emotional reactions and thus hinder satisfaction with virtual tours.

Second we explore how the need for emotional arousal from mediated experience, socio-demographic background, travel preferences, and pro-ecological motivations vary in case of different degrees of satisfaction with VT and nature tour. We assume that the subjective judgments over virtual travel experiences differ across socio-demographic traits and travel preferences: e.g. male and younger individuals may exhibit more positive emotional reactions and individuals who enjoy active recreation would more likely reject the virtual travel opportunity. Alongside the immersiveness of virtual reality, background information and related subjective judgments may enhance the hedonic gain of the feeling of presence (e.g. Mühlberger et al., 2012; Peperkorn & Mühlberger, 2013). In this study, we explore how a pro-ecological narrative, the idea of recreation without causing harm to the environment by physically travelling predict the reception of VT and nature tour. We may expect that strong eco-centric and social-altruistic values as well as pro-ecological personal norms and intentions favour satisfaction with VT. We may also expect that people with strong beliefs in the rationale for sustainable tourism are more accepting of VT due to their adherence to pro-environmental ideals. Following this, the current research explores the conceptual model presented in Figure 1, in which the immersiveness of the virtual tour experience leads to emotional arousal and presence judgment and this relationship may be augmented by the favourable subjective narrative (pro-ecological values, beliefs, and intentions) behind a VT experience.
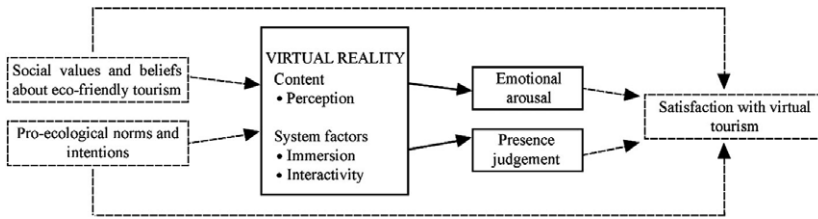
Figure 1. Relationships between perception of virtual reality, emotional arousal (in solid line adopted from Diemer et al., 2015), effect of individual pro-environmental motivations, and satisfaction with virtual tourism.

2. Method

Using the above conceptual model, this study aimed to clarify the attributes of virtual tours that contribute to emotional responses to virtual nature tours, how satisfaction with VT differs based on individual socio-demographic background and pro-ecological motivations, and how the need for emotional arousal in relation to individual motivations shapes satisfaction with VT.

2.1. Study area

This paper focuses on visitors to the Piusa sandstone caves in Southern Estonia. The caves were formed as a result of hand-mining sand for glassmaking between 1922 and 1966. Tourist access is restricted, due to the caves hosting the largest wintering colony of bats (Brandt's bat Myotis brandtii, Daubenton's bat Myotis daubentonii) in Eastern Europe and the threat of cave-ins. In addition to sightseeing in the caves, a virtual tour equipped with an originally designed technical setup recreating the Piusa caves and its habitat is offered to visitors. Visitors can follow a virtual tour based on a pre-planned navigation scenario on the curved projection screen providing 3D effects. The selection of case study area was motivated by presence of both, the natural sightseeing possibility and a VT facility, which enabled to compare judgments over real visits with VT.

2.2. Sample and procedure

Data collection was completed in the summer of 2014 at the Piusa tourism centre. Individuals who had taken the nature and virtual tours of the Piusa sand caves and were 18 + years of age were invited to participate in the study. A questionnaire was distributed to tourists, with 85% responding (N = 299; 83% international, 17% domestic). 33% of participants were in the age group 18–35 years, 35% were 36–50 years old, and 32% were older. 53% of study participants were female.

2.3. Questionnaire

Besides collecting socio-demographic information, the four-page questionnaire (offered in English or Estonian) inquired about individual motivations for visiting. Respondents rated their satisfaction with the experience of the nature tour and virtual Piusa caves tours using

a 5-point Likert Scale with the options 'strongly disagree' (1), 'disagree' (2), 'neither agree nor disagree' (3), 'agree' (4), and 'strongly agree' (5). For descriptive overview, respondents who answered from (1) to (3) were categorised as the 'low satisfaction group', which contained 144 individuals, and respondents who answered (4) or (5) were categorised as the 'high satisfaction group', which included 155. Groups were similarly categorised with regard to the nature tour: a 'low satisfaction group' with 101 individuals and a 'high satisfaction group' with 198.

Second, a push-pull factor classification (Crompton, 1979) was used to evaluate the variety of motivations and values attributed to VT. Respondents were asked to rate, using the same 5-point scale, the extent to which they agree about the goodness of the following features of virtual travel: opportunity to escape from one's everyday routine; ability to experience life in the past or future; opportunity to visit isolated areas (e.g. Antarctica or space); opportunity to visit closed areas (nature reserves); absence of risk of accidents, crime, and bad weather; ease of access; ability to adopt a virtual body or identity; opportunity to re-live experiences; preservation of the natural environment; saving travelling time; and opportunities for the disabled; and poor features of virtual travel including no connection to real nature; less lively impressions; lack of spontaneity; less opportunity for socialisation; no feeling of place change; cut revenues for tourism-dependent communities.

Participants also assessed their number of recreational hours spent in virtual and real nature in general. Furthermore, based on Horner and Swarbrooke's (2016) and Pearce's (2013) categorisations of travel preferences, respondents could choose their five main purposes of travel (in no particular order) from among the following categories: nature; sea and sun; extreme sports; festivals; business and conferences; visiting friends and relatives; special events; culture; education; fishing, hunting and safari; religious; medical; adventure; sex; cycling, walking & hiking; virtual; rural; cruises; day-trips; gay and lesbian; culinary; historical; excursions; wine; booze tourism; dark tourism; discount tourism; war tourism; and music tourism.

We measured visitors' attitudes towards sustainable tourism indicators according to the main functions classified by the World Tourism Organisation (WTO, 2004), which have been applied in earlier research on attitudes towards sustainable tourism (Lee & Jan, 2018; Marzo-Navarro, Pedraja-Inglesias, & Vinzon, 2015; Sharpley, 2009; Torres-Delgado & Saarinen, 2014). Respondents were asked to use the same Likert scale to indicate how strongly they agree with the following statements: sustainable tourism preserves nature; preserves local culture and identity; raises environmental awareness; benefits local communities through revenue, jobs, and taxes; and sustainable tourism is based on environmental and social expert guidance.

The respondents' attitudes towards ways of treating wildlife areas were studied following a categorisation that has been tested in existing studies (Watson, Cordell, Manning, & Martin, 2016). Respondents could agree (1) or disagree (2) with the statements that wildlife areas (a) should be administered as National Parks or reserves, (b) can be developed responsibly as tourism destinations with prior sustainability research, (c) should be untouched by people, and (d) may be exploited as tourism destinations as people please.

In order to test the relevance of more abstract value orientations, we used an instrument developed by De Groot and Steg (2007, 2008) to measure how much importance people attach to egoistic values (social power, wealth, authority, influence, and ambition),

altruistic values (equality, world peace, social justice, and being helpful), biospheric values (preventing pollution, respecting the earth, unity with nature, and protecting the environment), and self-improvement (being hardworking and striving). As recommended by De Groot and Steg (2008), participants rated the importance of each value as a guiding principle in their lives (-1 = opposed to their values; 0 = not important; 7 = extremely important).

Furthermore, following the value-belief-norm theory, individuals were also asked about their personal pro-ecological norms, e.g. reducing car travel, avoiding harming local biota as a result of travelling, and avoiding long flights, rating their agreement with these norms on a scale ranging from 'strongly disagree' (1) to 'strongly agree' (5). In addition, respondents used the same scale to rate their agreement with aspects of their pro-ecological intentions: I often choose bus or train travel over air travel to reduce carbon emissions; discuss household waste reduction options with family, and initiate discussions regarding environmental protection over the internet.

3. Results

3.1. Qualities of virtual tours and tourist satisfaction

We first clarified the qualities of virtual tours that may contribute to emotional responses and thus affect satisfaction with VT. We used principal component analysis to clarify which push and pull factors in Crompton's categorisation of travel incentives could form a compound variable in analysis of emotional responses and satisfaction with VT. From the first bipolar principal component (described variance of satisfaction with VT is 21%), we chose one pole (with internal consistency index Cronbach's alpha 0.80; the other pole had Cronbach alfa 0.59; and the whole block had Cronbach alfa 0.05). The chosen pole included statements that virtual tours offer 'less lively impressions', 'lack of spontaneity', 'no feeling of place change', 'less socialisation', and 'no connection to real nature'. A score index was formulated by averaging respondents' agreement with these statements and named 'need for emotional arousal'. For further analysis, the 299 respondents were categorised into three relatively equally numbered groups: low need for arousal (n = 109; classification boundary value ≤ 2.4), medium need for arousal (n = 87; 2.4–3.4), and high need for arousal (n = 103; ≥ 3.4).

3.2. Associations between satisfaction with virtual tours and socio-demographic factors and pro-environmental motivations

Next, we explored how individual socio-demographic background, travel preferences, and need for emotional arousal from virtual travel (as a continuous variable), and pro-ecological motivations differ among people with varied levels of satisfaction with VT and nature tour. The McNemar's test with the continuity correction showed that there is a statistically significant difference (Chi square 11.24; $p < .001$) in satisfaction with VT and nature tour. This encouraged us to explore what factors could predict the differences between groups with high and low satisfaction with VT and the differences between high and low satisfaction with nature tour. Groups of high and low satisfaction with VT and nature tour are described in Table 1 with respect to demographics, personal travel budgets, and time

spent on recreation in nature and in virtual environments. Comparison of age groups in terms of the share of people with low and high satisfaction with VT returned significant (Sig 0.00) differences. In age groups of 51–70 years, there are significantly more people with high satisfaction with VT (60%) than in other groups. There are also gender differences: Among women, there are somewhat (Sig 0.06) more satisfied people (57%) than among men (46%). Furthermore, education plays a role: There are considerably (Sig 0.08) more satisfied people among those with elementary education than among those with higher education. The groups of low and high satisfaction with nature tourism did not differ statistically (Sig > 0.05) with regard to these socio-demographic factors and recreation habits.

Next we explored how the individuals' travel preferences differ in groups of high and low satisfaction with virtual tour (and nature tour). Table 2 presents the ten most preferred travel types of the groups and the division of people with high and low levels of satisfaction with VT and nature tours among the supporters of these travel types. Based on Chi^2 test we compare the low and high satisfaction groups regarding their support for particular travel types. Among the people who enjoy trips for visiting friends (Sig 0.00), day-trips (Sig 0.04), and adventure (Sig 0.00), significantly more were not satisfied with VT than were. Among people enjoying culinary trips (Sig 0.003) and education trips (Sig 0.018),

Table 1. Sample size and percentage of people with low and high satisfaction with virtual and nature tourism and results of group comparison based on demographics and recreation habits.

	N	Satisfaction with virtual tour				Satisfaction with nature tour			
		Low	High	Chi^2	Sig	Low	High	Chi^2	Sig
Women	158	43.0	57.0	3.52	0.06	34.2	65.8	0.02	0.88
Men	141	53.9	46.1			33.3	66.7		
Age (years)				19.07	0.00			3.19	0.53
18–25	42	45.2	54.8			23.8	76.2		
26–35	57	49.1	50.9			38.6	61.4		
36–50	105	46.7	53.3			37.1	62.9		
51–70	76	39.5	60.5			31.6	68.4		
>70	19	94.7	5.3			31.6	68.4		
Highest level of education				5.10	0.08			4.89	0.09
Elementary	55	34.5	65.5			43.6	56.4		
Vocational	146	52.1	47.9			28.1	71.9		
University	98	50.0	50.0			36.7	63.3		
Personal travel budget per year (Euros)				3.84	0.57			0.29	0.99
≤100	55	47.3	52.7			30.9	69.1		
501–1000	51	52.9	47.1			35.3	64.7		
1001–5000	118	45.8	54.2			33.9	66.1		
≥5000	69	52.0	47.8			34.8	65.2		
Time spent in nature for recreation (hours weekly)				6.88	0.14			0.70	0.95
0	48	56.3	43.8			33.3	66.7		
1–5	59	44.1	55.9			37.3	62.7		
6–20	62	50.0	50.0			35.5	64.5		
21–50	70	37.1	62.9			31.4	68.6		
≥50	60	56.7	43.3			31.7	68.3		
Time spent in virtual environments for recreation (hours weekly)				4.91	0.29			0.89	0.93
0	202	48.5	51.5			33.2	66.8		
1–5	29	62.1	37.9			31.0	69.0		
6–20	36	47.2	52.8			33.3	66.7		
21–50	30	33.3	66.7			40.0	60.0		
≥50	2								

Table 2. Share of people with high and low satisfaction with virtual tours and nature tours in terms of the 10 most frequently mentioned reasons to travel.

	N	Satisfaction with virtual tour				Satisfaction with nature tour			
		Low	High	Chi^2	Sig	Low	High	Chi^2	Sig
Visit friends	157	57.3	42.7	11.12	0.00	35.7	64.3	0.53	0.54
Nature	146	47.3	52.7	0.09	0.42	36.3	63.7	0.81	0.39
Daytrip	135	54.1	45.9	0.08	0.04	32.6	67.4	0.15	0.71
Adventure	126	61.1	38.9	14.63	0.00	36.5	63.5	0.73	0.23
Sea and sun	108	53.7	46.3	2.08	0.09	35.2	64.8	0.15	0.70
Culinary	54	29.6	70.4	9.06	0.00	37	63	0.31	0.63
Culture	52	55.8	44.2	1.46	0.15	34.6	65.4	0.02	0.80
Education	48	33.3	66.7	5.03	0.02	25.0	75.0	1.97	0.18
Business	44	54.5	45.5	0.84	0.42	27.3	72.7	0.98	0.39
Extreme	43	39.5	60.5	1.50	0.14	27.9	72.1	0.77	0.47

significantly more had high satisfaction with VT than low. Although sex tourism, gay and lesbian tourism, and booze tourism were selected less frequently, among people who chose them, significantly more had high satisfaction with VT than low. Among people that had mentioned these travel types, there were no significant differences between low and high satisfaction with nature tours.

We further clarified the predictors of satisfaction with virtual tours (and nature tours) from among views on emotional arousal, values, beliefs regarding sustainable tourism, pro-ecological norms, and intentions. Full results of the dispersion analysis are presented in Appendix 1. To enable a comparison between the question categories, answer scales were standardised to values from 0 to 1 (1 standing for high agreement) for Figure 2. Figure 2(A) indicates that views on the arousal offered by VT differ significantly between low and high satisfaction among the virtual tour groups (Sig 0.00).

Selection of predictors from value dimensions (altruism, egoism, bio-centrism) inside these dimension groups was based on correlation analysis: From among the highly correlated factors, we included one as a potential predictor of satisfaction. Finally, we included the value items with the highest individual predictive power (R Square). The value of being hardworking and striving was significantly (Sig 0.06) lower, and valuing material possessions significantly (Sig 0.01) higher, in the group with high satisfaction with VT.

Compared to the low satisfaction group, members of the high satisfaction group were more likely to believe that sustainable tourism raises environmental awareness (Sig 0.07) and preserves local identity (Sig 0.07) and less likely (Sig 0.06) to believe that sustainable tourism is based on research. Beliefs that sustainable tourism helps preserve nature and supports local communities did not differ significantly between the groups. Regarding beliefs about how wildlife areas should be treated, the belief that people may exploit nature and wildlife areas as tourism destinations as they please was significantly (Sig 0.00) more prevalent among the high satisfaction VT group than the low satisfaction group. There was no significant difference between groups with different levels of need for arousal from VT in their opinions on whether wildlife areas should stay untouched, be developed responsibly as tourism destinations, or be administered as natural parks.

In terms of personal norms regarding pro-ecological behaviour, the moral obligation to reduce car travel was significantly (Sig 0.00) lower among the group with high satisfaction with VT than the low satisfaction group. Other personal norms and pro-ecological intentions did not differ significantly between the groups.

A

B
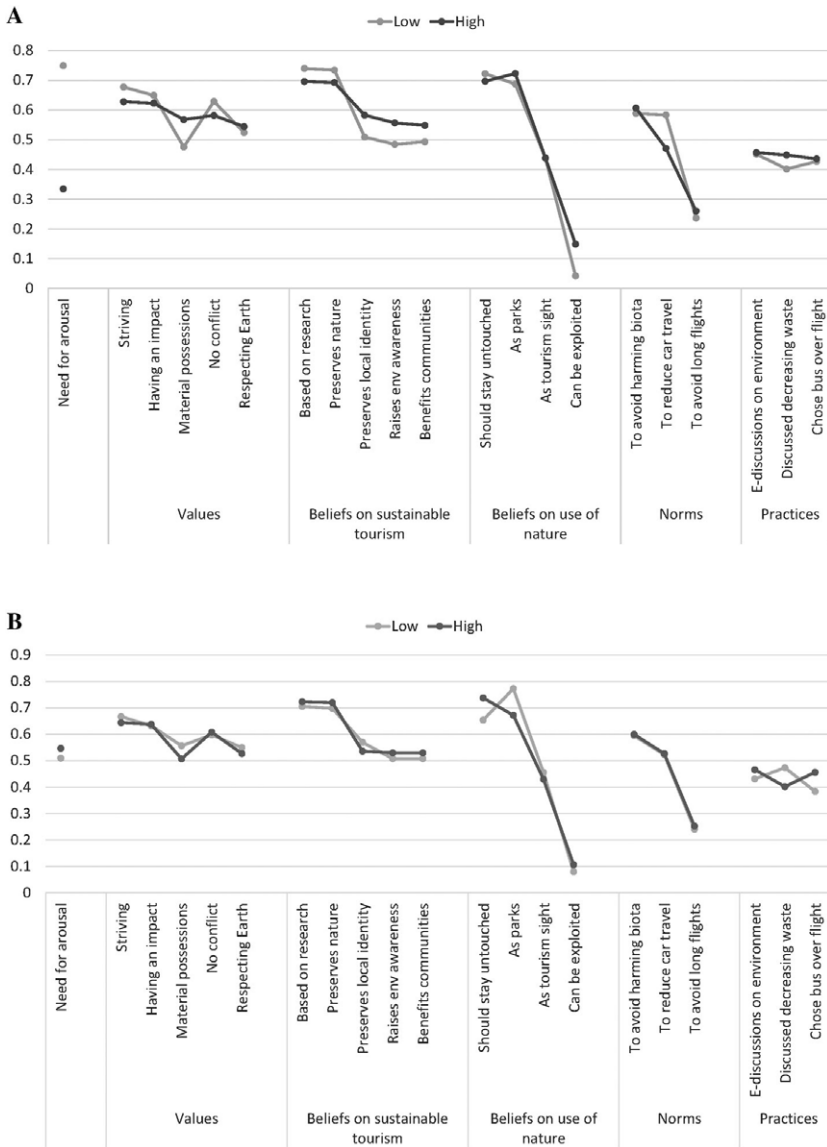
Figure 2. Mean need for emotional arousal, values, beliefs, norms, and intentions in groups with high and low satisfaction with (A) virtual tours and (B) nature tours.

Figure 2B indicates that there were no significant differences in value orientations, conceptions of sustainable tourism, and beliefs about treatment of wildlife areas between groups with high and low satisfaction with nature tour. As for personal actions, compared to unsatisfied people, the satisfied were significantly more likely to choose buses or trains over flights (Sig 0.03) and less likely to discuss the reduction of waste with family (0.06).

3.2. Predicting satisfaction with virtual tourism

As the need for emotional arousal appeared to be a strong predictor of satisfaction with virtual tour, we used generalised linear models to test the extent to which other factors beyond the need of arousal predict the satisfaction with virtual tour. We predicted the satisfaction with VT (dependent variable) by factors including values, beliefs about sustainable tourism and beliefs about how nature should be treated, and personal pro-ecological norms and intentions. When predicting satisfaction with VT, in each individual model we used the need for arousal as a categorical variable (with ranks of low, medium, and high need) and a specific factor from among values, beliefs, norms, and intentions. We explored the significance of the main effects of the need for arousal and the particular predictor (e.g. value orientation) on satisfaction with VT. We also explored the interaction term with the need for arousal group and the predictor in shaping satisfaction with VT (results of calculations are presented in Appendix 2).

In addition to the statistically significant main effects, significant interactions occurred between the need for emotional arousal and valuing material possessions (Sig 0.04), valuing having an impact on people and events (Sig 0.06) and valuing the world's freedom from war and conflict (Sig 0.06). More specifically, in the group with medium need for arousal, an increase in valuing material possessions by one-unit decreases satisfaction with VT significantly (Sig 0.01) less than in the group with high need for arousal. In the group with low need for arousal, a one-unit increase in valuing having an impact on people and events increases satisfaction with VT significantly (Sig 0.02) less than in the high need for arousal group.

As for the effect of beliefs about sustainable tourism, there were significant interactions between need for emotional arousal and beliefs that sustainable tourism preserves nature (Sig 0.04), local identity (Sig 0.00), and beliefs about financial benefits (Sig 0.08). More specifically, in the group with medium need for arousal, a one-unit increase in the belief that sustainable tourism preserves nature increases satisfaction with VT significantly (Sig 0.01) less than in the reference group. In the low need for arousal group, a one-unit increase in agreement with the belief that sustainable tourism preserves local identity (Sig 0.08) and that sustainable tourism benefits local community financially (Sig 0.05) increases satisfaction with VT less than in the high need for arousal group.

As for the effects of personal norms, the interactions between the need for emotional arousal and personal norms to avoid harming biota by travelling (Sig 0.00), avoid long flights (Sig 0.03), and reduce car use (Sig 0.05) were also significant. To be exact, in the group with medium need for arousal, a one-unit increase in support for the norm of avoiding harming biota by travelling decreases satisfaction with VT significantly (Sig 0.00) less and in support for norm to reduce car travel increases less (Sig 0.02) than in the high need for arousal group. Opinions on how nature may be treated, actual intentions to decrease environmental impact, socio-demographic background, and recreation habits did not prove significant predictors of satisfaction with VT when their particular regression models were adjusted to the need for arousal.

4. Discussion

As a more eco-friendly alternative to physical travel, virtual tourism (Cole & Razak, 2009; Mittal, 2012; Williams & Shaw, 2009) may help curb the environmental impacts of

tourism. In order to better understand what the barriers and motives to acceptance of VT are, this study first identified the qualities of virtual tours that may contribute to emotional responses and the feeling of arousal and thus may enhance satisfaction with mediated nature experiences. Analysis results suggest that a lack of lively impressions, spontaneity, feeling of place change, opportunities for socialisation, and connection to real nature is a key attribute hindering satisfaction with mediated experiences.

Second, we explored how the socio-demographic background, travel preferences and need for emotional arousal from virtual travel, and pro-ecological motivations differ in case of varying degrees of satisfaction with VT (and virtual tour). Thus, the study sheds light on the profile of people more likely to accept VT, who could form the target group for further promotion of mediated nature experiences. Compared to other age groups, 51–70-year-olds had the largest share of people satisfied with VT. Our findings do not fully confirm the notion that older people are less tolerant of digital environments (Paccagnella, 2016). Older people may appreciate the convenience of mediated nature experience. Our analysis has shown that people with higher education are less likely to accept mediated nature experiences. This result contrasts with earlier findings that higher educational attainment is related to higher ICT use (OECD, 2016). Furthermore, the result that men are less likely to be satisfied with VT is surprising considering earlier findings (Felnhofer et al., 2012; Montero-López et al., 2016) that men generally are more easily satisfied with virtual experiences (reporting more emotional arousal) than women when engaging in virtual environments.

Existing research has shown the low feeling of authenticity and immersion in an experience to be the key impediment to emotional responses and feelings of presence while on a virtual tour (Guttentag, 2010; Price et al., 2011; Seth et al., 2012). However, our analysis has demonstrated that not all people seek strong emotions while on virtual tours. People with low need for emotional arousal exhibit positive responses despite weak emotional triggers and are thus more easily satisfied with the virtually mediated nature experience. For these people, the virtual reality experience may indeed create an independent and self-important tourist experience as defined by Buhalis and Law (2008).

We explored how the relevant background narrative and related judgments could enhance satisfaction with virtual environments, as suggested in presence studies (e.g. Mühlberger et al., 2012; Peperkorn & Mühlberger, 2013). We inferred that pro-ecological values, norms, and intentions and beliefs about positive social and environmental effects of sustainable tourism could support the subjective positive judgment that VT has a smaller environmental impact than physical nature tourism. This favourable background narrative may in turn augment the emotional responses, thus leading to greater satisfaction with VT.

Third, analysis clarified which factors beyond the need for arousal contribute to satisfaction with VT. The results indicate that pro-ecological values, beliefs about sustainable tourism, and eco-friendly norms play a less significant role in acceptance of VT in the group with a low need for arousal than in the high need group. Thus, as also suggested in research on pro-ecological behaviours (Bissing-Olson et al., 2013; Lindenberg & Steg, 2007), alongside the more traditional gain and normative goal frame, the hedonic goal of increased emotional arousal is crucial for the uptake of virtual nature tourism alternatives. However, among the low need for arousal group, the pro-ecological narrative is a less significant predictor of satisfaction with VT, a more ecological alternative to physical travel.

As for the effect of values, in the group with low need for emotional arousal, the desire to be impactful does not increase satisfaction, and materialism and biospheric values do not decrease satisfaction with VT as much as in case of people with high need for arousal. Existing studies (Hedlund, 2011; Hedlund et al., 2012; Nayum & Klöckner, 2014) show that egoistic values predict less, and biospheric values stronger, preference for environmentally considerate tourism choices. Our analysis on satisfaction with VT partly supports the above, as among the groups with lower need for arousal, valuing having an impact on people and events, an egoistic value, increases satisfaction with VT less than among people with high need for arousal. However, among the groups with lower need for arousal, another expression of egoism, appreciating material possessions, decreases satisfaction less than in the high need for arousal group. As for the effects of biospheric values, in general more environmentally centred people are less satisfied with VT. Among people with low need for arousal, biospheric values such as valuing Earth and harmony with other species decrease satisfaction with VT less than among those with high need for arousal.

Perceived usefulness of ecotourism for local communities and in mitigating environmental impacts of travel is shown to support the intention to take environmentally friendly travel choices (Lee & Jan, 2018). Our analysis shows that beliefs in the positive effects of sustainable tourism predict higher satisfaction with VT. However, compared to the high need for emotional arousal group, among those who need less arousal, the belief that sustainable tourism benefits nature, local identity, and local community financially are less likely to increase satisfaction with VT.

The concept of tourist social responsibility has been associated with tourists taking responsibility for their environmental behaviour and continuing to be vigilant about the ecological impact of their behaviour while on vacation (Fennell, 2008; Miller et al., 2015; Weeden, 2011). Our analysis has indicated that personal norms to avoid more general impacts of travel on biota or longer flights may indeed predict stronger acceptance of VT, but the personal norm to decrease everyday car use may work against satisfaction with VT. However, among the people with low need for arousal specifically, the norm to avoid the broader effects of travelling does not decrease satisfaction, and avoiding car use does not increase satisfaction as much as it does in the group with high need for arousal.

Thus, this study shows that among people with low need for arousal, social values, beliefs about sustainable tourism, and pro-ecological norms play a less significant role in acceptance of VT. People with low need for arousal do not require further incentives such as orientation to materialism (and not eco-friendliness), beliefs in positive effects of sustainable tourism, and personal norms to decrease the environmental impact of everyday practices to support satisfaction with VT. However, these incentives favour acceptance of VT among people with high need for arousal. This result has important implications for the design and conduct of interventions to promote behavioural change in the tourism domain. Exploiting the notion of VT as an eco-friendly travel option could be particularly fruitful among people with high need for arousal. Providing information on the benefits of ecotourism and VT in particular for mitigating environmental impacts of tourism may motivate people with high need for arousal to take these travel options. Such claims may be less effective among people with low need for emotional arousal.

Our study results have significant implications regarding the wider participation in VT opportunities. In existing research, similarly to the social and hedonic motivations of

physical travel (e.g. Bansal & Eiselt, 2004; Crouch et al., 2004; Kumra, 2007), the desire for excitement and/or social engagement is highlighted as an incentive of VT (Lehdonvirta et al., 2009). Our study has indicated that among incentives to travel, seeking social interaction and adventure while travelling was clearly less important to people with high satisfaction with VT than to those less satisfied. Hedonic, bodily (e.g. culinary) pleasures were more important drivers of travelling for those satisfied with VT. This suggests that VT could be promoted in combination with tourism aimed at hedonic and bodily pleasures as opposed to tours that offer social interaction and physical challenge.

The current study was based on only one virtual tour in Piusa, with its particular technological setup and qualities. However, further studies could explore how physio-psychological and personality traits affect how perception of the instrumental attributes of the VT device, which are related to its functionality and include immersion and interactivity attributes, contribute to emotional experience and arousal. For example, higher quality 3D video resolution (Gilbert, 2016) and meaningful avatars (Chung, Han, & Joun, 2015) may provide a stronger feeling of presence while engaging with VT, and this may satisfy people with high need for emotional arousal. This study also has implications in terms of promotion of environment and pro-environmental choices. For active traveller types with high need for arousal, the pro-ecological motivations may be an important trigger for taking up virtual tools in travelling and even transport planning.

The above analysis has demonstrated the significance of the need for emotional arousal as a basis for acceptance of virtual tourism. However, the available data can only provide indications of what the external triggers of arousal (e.g. socialisation and feeling of place change) and internal motivations (e.g. pro-ecological values and beliefs) might be. Therefore, future research might explore what the role of individual bio-psychological triggers (e.g. brain functioning in response to virtually mediated nature experiences) is. For example, researchers could examine whether lower functioning dopaminergic systems that have been associated with higher sensation-seeking (Chester et al., 2016) could translate to high need for arousal and thus low satisfaction with VT experiences.

Furthermore, the low described variance offered by predictors other than the need for emotional arousal invites discussion about what the remaining variance could be. The symbolic attributes connected to an individual's social identity as a consumer of ICT and travel products or leisure products may play important roles in the acceptance of VT. People are more likely to adopt eco-innovations when consumers evaluate their symbolic aspects, i.e. the extent to which new products signal something positive about the owner or user to others and themselves (Noppers, Keizer, Bolderdijk, & Steg, 2014). Future studies could look into the effect of symbolic attributes in acceptance of VT.

As the questionnaire was administered at the nature site of Piusa in Estonia, we assume that in general, people interested in nature tourism answered the questionnaire. Therefore, it is not surprising that respondents had rather homogenous views on nature tours: The visitors' socio-demographics, travel preferences, and pro-environmental motivations do not differ based on their satisfaction with nature tours. VT provokes more diverse views among these generally nature-focused travellers. We may speculate that acceptance of VT is more prevalent among the general population than among active nature tourists with specific interests and motivations to visit such peripheral nature tourism destinations. Further research could explore the VT acceptance among broader mass tourism market or a particular niche of it e.g. senior age group which steadily expands.

5. Concluding remarks

This paper has conceptualised the satisfaction of mediated nature experiences through the need for emotional arousal from virtual experiences. Emotional responses to mediated nature experiences are hindered by the lack of lively impressions, spontaneity, feeling of place change, opportunities for socialisation, and connection to real nature. However, people with low need for arousal are more easily satisfied with VT regardless of these weak emotional triggers.

This study confirms that a favourable background narrative (pro-ecological norms and intentions and beliefs about positive social and ecological effects of tourism) may augment emotional responses, thus leading to greater satisfaction with VT. However, the pro-ecological narrative and self-ideal is less effective in motivating acceptance of VT among the low need for arousal group than among people with high need for arousal.

Our results suggest that mediated nature experiences may offer ways of engaging with nature in a more convenient way to hedonistic travellers. Virtual tours as an alternative to travel or a promotional tool may not appeal to people looking for social interaction or physical or mental challenge while travelling. As VT was better received among women, less educated people, and 50–70-year-olds, these may be ideal target groups for promotion of mediated nature experiences.

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Appendices

Appendix 1. Mean scores of factors potentially related to satisfaction with virtual tours and nature tours in high and low satisfaction groups and results of group comparisons.

| | Virtual tour | | | | | | Nature tour | | | | | |
| | Mean | | | | ANOVA | | Mean | | | | ANOVA | |
	Low	StD	High	StD	F	Sig	Low	StD	High	StD	F	Sig
Need for arousal	0.75	0.19	0.33	0.14	453.99	0	0.51	0.28	0.55	0.26	1.29	0.26
Values												
Value striving	0.68	0.21	0.63	0.23	3.55	0.06	0.67	0.21	0.64	0.23	0.68	0.41
Value having an impact	0.65	0.21	0.62	0.24	1.05	0.31	0.63	0.21	0.64	0.22	0.04	0.85
Value material possessions	0.48	0.33	0.57	0.30	6.21	0.01	0.56	0.32	0.51	0.32	1.58	0.21
Value no conflict	0.63	0.25	0.58	0.25	2.65	0.12	0.60	0.25	0.61	0.25	0.12	0.73
Value respecting Earth	0.52	0.23	0.54	0.23	0.53	0.47	0.55	0.23	0.53	0.23	0.62	0.43
Beliefs about sustainable tourism												
ST preserves nature	0.73	0.24	0.69	0.28	1.61	0.21	0.70	0.29	0.72	0.28	0.38	0.54
ST based on research	0.74	0.19	0.69	0.19	3.54	0.06	0.71	0.21	0.72	0.19	0.56	0.46
ST benefits communities	0.49	0.37	0.55	0.31	1.95	0.16	0.51	0.35	0.53	0.33	0.27	0.61
ST local identity	0.51	0.37	0.58	0.35	3.11	0.08	0.57	0.37	0.54	0.35	0.59	0.44
ST raises env. awareness	0.48	0.35	0.56	0.33	3.35	0.07	0.51	0.35	0.53	0.34	0.27	0.60
Beliefs about treating nature												
Nature should stay untouched	0.72	0.45	0.70	0.46	0.23	0.63	0.65	0.47	0.74	0.44	2.29	0.13
Nature preserved as national parks	0.69	0.47	0.72	0.45	0.44	0.51	0.77	0.42	0.67	0.47	3.27	0.07
Nature as tourism sight	0.44	0.50	0.44	0.49	0.00	0.98	0.46	0.50	0.43	0.49	0.19	0.67
May exploit nature	0.04	0.20	0.15	0.36	9.97	0.01	0.08	0.27	0.11	0.30	0.55	0.46
Personal norms												
Norm to avoid harming biota	0.59	0.27	0.61	0.27	0.33	0.57	0.59	0.27	0.60	0.27	0.03	0.86
Norm to reduce car travel	0.58	0.34	0.47	0.36	7.70	0.01	0.52	0.36	0.53	0.35	0.01	0.92
Norm to avoid long flights	0.24	0.25	0.26	0.21	0.78	0.38	0.24	0.22	0.25	0.23	0.20	0.66
Intentions												
Initiated e-discussions on environment	0.45	0.28	0.46	0.30	0.02	0.88	0.43	0.29	0.47	0.29	0.97	0.33
Chose bus over flight	0.43	0.27	0.44	0.28	0.07	0.80	0.38	0.28	0.46	0.27	4.57	0.03
Discussed decreasing waste	0.40	0.29	0.45	0.32	1.76	0.19	0.47	0.32	0.40	0.30	3.59	0.06

Appendix 2. Values, beliefs, norms, and intentions predicting as main effects on satisfaction with VT and in interaction with the level of need for emotional arousal in shaping satisfaction with VT.

| | Main effect | | Interaction with need for arousal in groups (reference group: high need for arousal) | | | | Interaction with need for arousal | | R2 |
| | | | Low need for arousal | | Medium need for arousal | | | | |
	B	Sig	B	Sig	B	Sig	F	Sig	
Values									
Value striving	0.00	1	−0.11	0.13	−0.02	0.75	1.27	0.28	0.77
Value having an impact	0.01	0.81	−0.17	0.02	−0.06	0.38	2.88	0.06	0.78
Value material possessions	−0.03	0.36	0.04	0.46	0.12	0.01	3.39	0.04	0.78
Value no conflict	−0.02	0.60	0.11	0.08	−0.03	0.65	2.74	0.06	0.77
Value respecting Earth	−0.05	0.27	0.11	0.09	0.14	0.06	2.23	0.11	0.77
Beliefs about sustainable tourism									
ST preserves nature	0.09	0.20	−0.12	0.17	−0.23	0.01	3.14	0.04*	0.78
ST based on research	0.06	0.51	0.08	0.51	0.03	0.78	0.22	0.80	0.77

Appendix 2. Continued.

| | Main effect | | Interaction with need for arousal in groups (reference group: high need for arousal) | | | | Interaction with need for arousal | | R2 |
| | | | Low need for arousal | | Medium need for arousal | | | | |
	B	Sig	B	Sig	B	Sig	F	Sig	
ST benefits communities	0.04	0.29	−0.14	0.05	0.01	0.90	2.55	0.08	0.77
ST local identity	0.02	0.59	−0.11	0.09	0.12	0.08	5.88	0.00*	0.78
ST raises env. awareness	−0.04	0.44	0.04	0.61	0.073	0.33	0.47	0.63	0.77
Beliefs about the use of nature									
Nature should stay untouched	0.06	0.71	0.12	0.55	−0.04	0.84	0.33	0.72	0.77
Nature preserved as national parks	0.08	0.57	−0.33	0.12	0.31	0.14	4.52	0.012	0.78
Nature as tourism sight	0.16	0.23	−0.03	0.86	−0.26	0.19	0.96	0.38	0.77
May exploit nature	0.01	0.98	0.01	0.98	0.03	0.94	0.00	0.99	0.77
Personal norms									
Norm to avoid harming biota	−0.49	0.06	0.24	0.54	1.21	0.00	6.39	0.00	0.78
Norm to reduce car use	0.232	0.26	−0.24	0.38	−0.69	0.02	2.99	0.05	0.77
Norm to avoid long flights	−0.21	0.50	0.76	0.09	−0.32	0.44	3.43	0.03	0.77
Practices									
Initiated e-discussions over env. protection	0.01	0.96	−0.32	0.32	−0.34	0.34	0.64	0.53	0.77
Chose bus over flight	0.02	0.72	−0.05	0.52	−0.15	0.11	1.27	0.28	0.77
Discussed decreasing waste	−0.13	0.58	−0.09	0.77	0.15	0.66	0.27	0.76	0.77
Gender									
Female (reference: male)	−0.01	0.95	0.01	0.95	0.04	0.86	0.02	0.98	0.77
Education									
Primary (reference: higher)	−0.1	0.76	0.31	0.41	0.13	0.64	0.51	0.73	0.77
Vocational (reference: higher)	0.15	0.33	0.17	0.47	0.25	0.28			
Age	0.00	0.95	−0.02	0.79	−0.02	0.82	0.04	0.96	0.77
Travel budget	0.00	0.95	−0.07	0.43	−0.12	0.16	0.99	0.37	

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2015	10th International Conference on Ecosystems and Sustainable Development, Valencia. Oral presentation: Use of participatory development for sustainable tourism planning.
2014	Sustainable Tourism 2014, Rijeka. Oral presentation: Use of 3D visualization for sustainable tourism planning.
2013	ENTER 2013, Insbruck. Oral presentation: The role of virtual travelling as a component in sustainable nature tourism.

Publications

Kask, Sergey (2013). The role of virtual travelling as a component in sustainable nature tourism: experiences from Baltic region. ENTER 2013.

Kask, Sergey (2014). Use of 3D visualization for sustainable tourism planning. 6: Sustainable Tourism 2014. WIT Press, 372.

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1994-1999	Murmanski Tehnikaülikool, turundus ja majandus, MA

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2009-2012	ISPA Engineering, brändihaldur
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2002-2005	A&T trade, VIP-klientide suhtehaldur
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2015	10th International Conference on Ecosystems and Sustainable Development, Valencia. Use of participatory development for sustainable tourism planning.
2014	Sustainable Tourism 2014, Rijeka. Use of 3D visualization for sustainable tourism planning.
2013	ENTER 2013, Insbruck. The role of virtual travelling as a component in sustainable nature tourism.

Publikatsioonid

Kask, Sergey (2013). The role of virtual travelling as a component in sustainable nature tourism: experiences from Baltic region. ENTER 2013.

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ANDRES JÄÄRATS
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METSA UUENDAMISELE
Emeriitdotsent Heino Seemen, dotsent Ivar Sibul, Arvo Tullus (Tartu Ülikool)
1. juuni 2018

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12. detsember 2018

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Dotsent Eve Veromann, *prof. emeritus* Anne Luik
12. detsember 2018