Asian Journal of Information and Communications 2019, Vol. 11, No. 1, 46-58

KISDI
KOREA INFORMATION SOCIETY DEVELOPMENT INSTITUTE

Asian Journal of Information and Communications

Virtual reality application case illustrations: usability in tourism

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Abstract

Virtual and augmented reality are being used both as "low cost" travelling experiences (e.g. the Munich 360° VR app[1)]) and to enhance real visits of monuments[2)] in the field of tourism. These apps can either be created from scratch, or be built on top of tourist guides or other pre-existing documentation. In this paper, we suggest an alternative, potentially lower-effort way to create virtual reality applications to heighten interest in specific areas and promote tourism: since virtual reality is increasingly being used in the professional and academic fields to study a multitude of systems in various domains, we propose repurposing those which could be of interest for tourists/visitors. And analyzing the cases, we classify them by technology use, co-creation and timing of the experience with respect to the actual visit (pre-, during and post-). The results in this paper should be generally applicable to other suitable virtual reality tools in use by other researchers worldwide, and should enable the increased awareness of less-known tourist destinations.

Keywords: virtual reality, tourism management, marketing, ICTs

1. Introduction

The development of information and communication technologies (ICTs) has changed tourism globally (Buhalis, 2003; Buhalis and Law, 2008). For example, nowadays tourists can easily access the information of destinations in the world. To survive in the competitive tourist market, not only domestically, but also globally, the managers in tourist destination must develop distinct tourist experiences to attract tourists in innovative ways. In addition, it is crucial to analyze ICTs for tourism researchers, and one of the important topics in ICTs is virtual reality (VR) in the field of tourism studies (Guttentag, 2010). An early overview of virtual reality applications for tourism was provided by Guttentag (2010), but of course since then, the capabilities and affordability of VR devices have increased greatly, and many new applications in the tourism field have been commercialized.

To discuss VR as the great opportunity in tourist destinations, the impact towards tourism development has

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1) Discover Munich virtually - with the new VR app from muenchen.de. Retrieved September 29, 2018 from http://www.muenchen.de/int/en/meta/iphone-android-app/360degrees.html

2) Augmented reality in action - travel and tourism. Dan Sung. 2011. Retrieved September 29, 2018 from https://www.pocket-lint.com/ar-vr/news/108891-augmented-reality-travel-tourism-apps

been considered. Tourism in general has generated several positive impacts, such as economic, social and environmental (Wall and Mathieson, 2006). However, tourism development has often meant negative impacts in the regions (King et al., 1993; Lepp, 2007). Related to VR in the field of tourism studies, there is a current trend to try to diminish the impact of tourism on the environment, and enhance the tourism-ecology synergies. The maximum number of tourists may be thus limited by fixing the maximum number of available beds (Heslinga et al., 2018). Virtual reality can be used to reduce the impact of tourists on the environment, by virtualizing some of their experiences. On the other hand, virtual reality visits increase the interest of tourists in visiting the real locations (Tussyadiah et al., 2018). In addition, some experiences have a strong component of opportunity (e.g. whale watching, surfing), and so having a satisfying VR experience can reduce disappointment in case the real-life experience is not up to expectations due to weather or other factors.

Using of VR at the destination is also practical because of the high development costs (time and monetary), especially for the infra- and superstructure. For example, building or reconstructing a Edo-era castle in Tokyo, where the shogun and emperor were, versus using VR technology, with lower costs and providing tourists with easy to visualize / imagine scenes. Also using VR in tourist destinations generates social benefits for residents, such as having the opportunity to educate in local histories (Izumi, 2017), and participating in the tourism experience as one of many co-creators (Guttentag, 2010; Neuhofer et al., 2012). Therefore, there is great potential to utilize VR in the area of tourism studies not only from the economic viewpoint, with the approach of reducing tourists, but also increasing the satisfaction degree, ease of management, and social/educational perspectives.

Although current VR devices concentrate only on the visual and auditory senses, there has been an interest since the early days in developing devices supporting the other senses (touch, smell, and taste) in order to increase the feeling of presence and provide stronger emotional impact. Despite this, the state of the art in VR supporting these senses is still in its infancy, due to the difficulty of the problem. Issues of complexity and cost (both for recording the experience and for reproduction) exist. Smell and taste are especially difficult due to the high dimensionality of chemical detection.

Nevertheless, a theoretical study of a multisensory VR experience for tourism, dealing with the Port wine region, shows how the use of state of the art devices capturing and delivering smell, meteorologic stations, high-end air-conditioning, fans, treadmills and the addition of operator-assisted mixed-reality (e.g. providing real wine to the user at the appropriate time) could produce a realistic immersive experience (Martins et al., 2017). While the devised system would currently require large and expensive equipment, we expect that in the next decades, future developments in multimodal VR will allow commodity hardware to implement such experiences.

2. ICT in tourism

The next section provides an overview on the studies of ICT in the field of tourism (with emphasis on virtual reality), while section 2.2 concentrates on the Japanese situation.

2.1 Theoretical background about ICT in tourism

The development of tourism in regions is seen as an effective means of achieving not only the regeneration of rural areas but also a variety of tourism objectives, including the ability to attract more diverse, higher-spending markets (Sharpley, 2002). However, in recent years, tourism has increasingly been considered as an effective catalyst of social and economic development and regeneration in rural areas. This is mainly due to

the growing number of tourists. With the development of transportation and infrastructure, tourists can easily reach their destinations, and the number of repeat visitors has increased. This increase in repeat visits has changed the needs of tourists; marketers have therefore turned their attention to providing not only "Old Tourism" (i.e. mass, package-type tourism, "Sun, Sea and Sand Tourism", shopping tourism, etc.) but also "New Tourism," which includes independent tours, eco tourism, green tourism, and experiential tourism (Poon, 1993).

Secondly, the tourism business has been widely promoted and relied upon to generate job opportunities. World Travel & Tourism Council has estimated that the travel and tourism sector is shown to account for 10.4 % of global GDP and 313 million jobs, or 9.9 % of total employment, in 2017 (WTTC, 2018). On the other hand, tourism development has caused negative impact in regions, such as increases in the cost of living (Liu and Var, 1986), or over-dependence upon tourism revenue (Mathieson and Wall, 1982). Furthermore, there is a possibility that tourism development has led to drastic changes in traditional culture (Akis et al., 1996), negative environmental impact, such as traffic congestion, restricting the entrance to public spaces due to increasing visitors (King et al., 1993; Johnson et al., 1994).

In these circumstances, information and communication technologies are one of the biggest possibilities to mitigate the issues listed above, and the study on ICTs has been paid attention in the field of tourism. The book "*eTourism: Information Technology for Strategic Tourism Management*" was published by Buhalis (2003), mentioning that the development of ICTs has changed tourism globally. For example, tourists can easily access the information of possible destinations in the world. To survive in the competitive tourist market, not only domestically, but also globally, the managers in tourist destination must develop distinct tourist experiences to attract tourists in innovative ways.

Furthermore, the framework of destination experience co-creation has emerged in the field of tourism study, as a driver to revitalize the regions (Neuhofer et al., 2012). The development of social media (e.g., Blogs, Twitter, etc.) and open data platforms (like Wikipedia or OpenStreetMap) has made it easier to use co-creation for tourism experiences in the regions. There is a possibility not only to revitalize the regions economically, but also to rethink the regional history, and the interaction between tourists and residents through the process of co-creation for tourism experience (i.e. social and cultural impacts).

In addition, it is crucial to analyze ICTs for tourism researchers, and one of the important topics in ICTs is virtual reality (VR) in the field of tourism studies (Guttentag, 2010). And in this situation, as the articles concerning VR and AR have been published in journals (e.g., Tourism Management and Journal of Travel Research, etc.) since the middle of the 2010s, much academic attention has been paid to understand the process about the development of regions as tourist destinations utilizing VR and AR.

However, there is a need for more comprehensive studies in this field, considering previous research about ICTs and VR in tourism. Usually, the approach of a tourism study is based on analyzing various groups (e.g., tourists, tourism related businesses, the government of the host community or area, and the host community) (Goeldner and Ritchie, 2009) or the interdisciplinary perspective (Jafari and Ritchie, 1981). Commonly, though, there is only one-perspective analysis, such as "visitor" or "government in the host area."

With respect to the VR devices themselves, there is a wide range of virtual reality devices, from low-cost devices such as Google Cardboard (approx. €10), to computer-based systems such as Oculus Rift and HTC Vive (approx. €1,000) to high-end installations such as CAVE-like[3)] devices (multi-million euro installations). When using virtual reality in the tourism field, the middle ground (PC-based solutions) is preferred in shops, while phone-based experiences can be offered for large groups or to enable clients to test the experience at home.

3) CAVE™ is a trademark of the University of Illinois Board of Trustees. We use the term CAVE to denote both the original system at Illinois and the multitude of variants developed by multiple organizations.

However, CAVE-like installations are sometimes available and can be rented in order to provide a collaborative, immersive experience. Figure 1 showcases typical devices.

Figure 1. Google Cardboard (left), HTC Vive (center), and CAVE-like system at the Leibniz Supercomputing Centre (LRZ) of the Bavarian Academy of Sciences (right)

2.2 Situation about VR for tourism contents in Japan

Nowadays, there are a lot of regions which are facing social and economic issues, such as decline in working-age population due to the rapidly declining birthrate and aging population, lack of productivity growth and lack of new demand creation. There has been increasing recognition that the effective utilization of VR/AR will contribute to mitigate these issues, and has grown rapidly in recent years as a fusion of the real world and cyberspace (Mitsubishi Research Institute, 2018). In Japan, Internet of Things (IoT) and VR have been paid attention to at a national level. For example, the Ministry of Internal Affairs and Communications is working to create and deploy IoT services, and the Ministry of Economy, Trade and Industry is preparing budgets for making contents and promotion for revitalization of the regions.

In the tourism field, VR is beginning to be used in some areas, as a key tool to communicate a unique characteristic about culture and history of the regions to inbound tourists to Japan, because tourism contents utilizing VR/AR are excellent in their high information-carrying capacity and reproducibility. In collaboration with the Agency for Cultural Affairs since 2018, the Japan Tourism Agency is implementing some model projects using VR contents, such as promotion in foreign countries (pre-visit), offering tourism experience (during and post-visit) (Prime Minister's Office of Japan, 2018). And some excellent precedents or cases using VR have been introduced in the report of Japan Tourism Agency, such as "Virtual's Nagoya Castle (Saga Prefecture)" and "VR experience of Hakata-Gion-Yamakasa (Fukuoka Prefecture)" (Japan Tourism Agency, 2019).

However, there are some issues to utilize VR/AR for the excellence in tourism contents. One of them is about the collaboration between companies. Although there are industry groups of companies using VR/AR in the world such as the Augmented Reality for Enterprise Alliance, there are few Japanese companies participating in this alliance. Furthermore, in Japan, as the VR consortium ended its membership system in the end of February, 2018, there are few places to collaborate among companies dealing with VR/AR businesses (Mitsubishi Research Institute, 2018).

The other reason is about cost. As mentioned above, some regions try to introduce VR/AR as a new tourism experience and marketing tool, but cost is quite high (42 million yen for "Virtual's Nagoya Castle"; 5.6 million yen for "VR experience of Hakata-Gion-Yamakasa") (Japan Tourism Agency, 2019). So it is difficult to introduce VR/AR as a tool of marketing and tourism experience for the regions which have a small budget. Furthermore, looking at the situation in Japan, there are huge potentials in the field of tourism marketing. However, the cases in Japan seem to place an emphasis on one side in which theoretical framework in the field of tourism has emerged.

3. Specific examples

We show here some examples from the fields of art, history, archeology, and geography which can be easily used to provide an immersive experience showcasing various aspects of tourist attractions. Our focus here is typical destinations of Japanese tourists, but the results should transfer to other countries. Typical destinations are Japan itself, China and South Korea (in Asia), Hawaii and Guam in the US and France, Spain and Germany in Europe.[4] The following sections are structured in two parts: a) a description of the software and the scientific research being performed; b) an overview of the changes required to adapt it for tourism use.

Except for Legends of Girona, the authors were not involved in the development of the scientific projects described in the next sections (acknowledgements are provided in section 5). However, the software has been used for publicity and public relations in multiple events with the presence of the authors.

We follow the two-axis classification proposed by Neuhofer et al. (2014): technology use (low, medium, high) vs co-creation (staged, company-customer, customer-to-customer). We also add a third axis dealing with the timing of the experience with respect to the actual visit (pre-, during and post-). Virtual and augmented reality currently stand in the high-end of technology use, so our use-cases can fill the gap mentioned in the discussed paper (Neuhofer et al., 2014).

3.1 Low co-creation (staged experience)

We describe in the following sections some examples of staged experiences. These prove to be the most common, because they are relatively easier to create.

3.1.1 Art exhibition: simulated voyages

Nishimura et al. (2012) created an art installation using a container to simulate a train. Immersive virtual reality techniques were used to simulate the views and sounds of different train voyages. Views of Japan (Yamanote train line in Tokyo), Korea, France, and Hong Kong were shown in the virtual train's windows. A user study confirmed that the users found the system immersive, and they enjoyed the foreign landscapes.

The system could be used in a tourism setting to introduce the different countries, perhaps as a preliminary overview of possible destinations, before leading users to more specific information and other relevant virtual reality experiences of their chosen destination (pre-visit).

For tourists interested in Tokyo, various places are reached directly from the Yamanote line, such as Ueno zoo, Meiji Jingu (Shinto shrine), Tokyo Station, Omotesandō street, or the National Museum of Western Art.

Virtual-reality based on airplane voyages has also been created for scientific purposes. In particular, Wiederhold et al. (2002) studied VR treatments of fear of flying. The developed software could be used in the tourism industries to introduce relevant destinations, in a similar way to the train trips mentioned above.

This application is obviously intended for the pre-visit stage.

3.1.2 Terracotta army (China)

Ancient burial sites often provide a plethora of information regarding the life and customs of cultures. Difficulty of access and the need for conservation usually mean that visiting the sites is often severely restricted. Virtual reality reconstructions are sometimes created to help historians and archaeologists understand the find. Artists also benefit from the tools to help the eventual restoration process.

4) Japanese Overseas Travelers by Destination [Visitor Arrivals from Japan] from 2013 to 2017, Retrieved January 18, 2019 from https://www.jnto.go.jp/jpn/statistics/201810266.pdf

These tools can be adapted and simplified to enable tourists visiting the region to experience a walk-through of the site. The state of the site across the millenia can also be showcased by selecting either original scans of the site or the reconstructed models.

Figure 2. Details of the Terracotta army at the Great Hall

The Terracotta army in Xi'an (Figure 2) consists of more than 8 000 statues, including warriors, horses, musicians, etc. They belong to the mausuleum of the first Chinese emperor, in the third century BCE. This is a UNESCO heritage site, and archeological works continue since 1974, when the complex was discovered. As part of the effort to recover the original colouring of the statues (Langhals and Bathelt, 2003), a virtual reality visualization was created at the LRZ (Horn and Zhongyuan, 2006).

The site is also a large tourist attraction, so reusing the VR tool to assist tourists can be a beneficial increase to understand of the site, avoid overcrowding, and reach tourists which cannot visit the site physically. The application is intended mainly for the pre-visit stage.

3.1.3 Historical buildings

Virtual reality tours centered around historical buildings provide a good opportunity to understand the evolution of the building, and are often of interest to tourists. One such example is the Medieval Notre Dame de Paris Cathedral VR Tour[5] in France.

Historical buildings are sometimes modelled in 3D to aid in the process of restoration. The produced tools provide a high-quality overview of the state of the frescos, statues, walls and ceilings. Additional information regarding materials, painting techniques and highlights of deteriorated areas are provided in an integrated environment.

In order to re-purpose these tools for tourists, the datasets need to be simplified and the information layer related to restoration procedures can be disabled, in order to produce a simple-to-use viewer. These viewers can be then used to advertise palaces, buildings, related museums and the city in general.

The software can be used un-modified to showcase the locations to tourists; although if desired, some more

5) Medieval Notre Dame de Paris Cathedral Virtual Reality Tour. Retrieved September 29, 2018 from https://www.getyourguide.com/paris-l16/medieval-notre-dame-de-paris-cathedral-virtual-reality-tour-t164343/

information about the sites could be easily added. The examples in this section can cover both pre- and post-visit experiences.

3.1.3.1 Kikusuiyu/bath house (Tokyo, Japan)

Iwasaki et al. (2017) used a kikusuiyu (one of the most famous Japanese public bathhouses) located near the University of Tokyo as a model to test their improved method for 3D reconstruction and texturing of buildings. They report high-quality reconstruction for free-exploration purposes.

Since the building was closed in 2015[6] and can no longer be visited, Iwasaki's system could be used either unmodified or with minor changes to let tourists explore the building and learn about the Japanese bath culture. In combination with other similar systems, a virtual reality introduction to Tokyo for foreign nationals could be prepared.

3.1.3.2 Baroque ceiling painting (Schließheim, Germany)

The digital model of the electress chapel in the New Castle in Schleißheim was produced by students of the Ludwig Maximilian University Munich (LMU) in the context of two parallel courses during the winter semester in 2015/2016[7]. The 3D modeling of the Emperor's hall in the New Residence in Bamberg, Germany was developed by Bernhard Strackenbrock from the company *illustrated architecture*[8] using photogrammetry, and reconstructed from over 2,000 photos. Unrestricted movement allows scientists to study any perspective (e.g. the artist's view).

The developed software can run on the LRZ CAVE-like system or on the HTC Vive. The software was used by experts to study the painting techniques. Artists also studied how people experience the room in which the artworks reside, and highlighted the usefulness of having a new perspective/medium instead of the normal 2D images, exploring what documentation method is best. Having more approaches was deemed beneficial.

The software can be used un-modified to showcase the locations to tourists; although if desired, some more information about the sites could be easily added.

Figure 3. Emperor's hall at the Bamberg Residence (left), electress chapel in the New Castle in Schleißheim (center), and Munich Arsenal at Lothstraße 17 in Munich (right).

6) さようなら、菊水湯。長く暮らしを彩り、惜しまれながら閉業した銭湯の話 (Goodbye, Kikusui hot water. A story about a cherished public bath that regretfully has long been closed.) Retrieved September 29, 2018 from http://todai-umeet.co m/article/4283/

7) 3-D-Modelle barocker Innenräume in der CAVE des LRZ am 27.06.2016. Retrieved September 29, 2018 from https://deckenmalereI .badw.de/projektgeschichte/3-d-modelle-cave-2016.html

8) Illustrated architecture. Retrieved September 29, 2018 from http://illustrated-architecture.de/

3.1.3.3 Munich Arsenal (Germany)

One of Munich Arsenals was built in the historicist archway style between 1861–1865 at Lothstraße 17 in Munich. After its decommission, it was used as a museum. The building was lately used by the Technical University of Munich and the Munich University of Applied Sciences.

This building was modelled in 3D to test VR-assisted CAD tools used in architectural design for design optimization of digital building models. Structural design, planning of technical building services, energy analysis and various simulations were performed. The CAVE visualization proved to be practical, goal-oriented and promising. Schneider (2016) added crowd simulation to the system. A simplified version of the software, allowing free exploration of the premises, would be ideally suited for tourist use.

3.2 Middle co-creation (Company-consumer)

We consider complex video games as an intermediate level in the co-creation axis, because the multiple decisions the player makes can affect the final experience significantly. Our use case is single player, so it does not reach the highest level of co-creation. The video game can be used at the pre-, during and post-visit stages.

3.2.1 Legends of Girona (Spain)

This serious game lets the user learn about the history and legends of the city of Girona. In particular, the siege of Girona in 1285 is given a thorough overview, the legend of the St. Narcis flies plays a fundamental role in the game, and the user is asked to view and investigate the church of St. Felix. An overview of the game, including the virtual reality port, was described by Garcia et al. (2015).

St. Feliu is only 99 km away from the Sagrada Familia in Barcelona (one of the best known destinations for Japanese tourists in Spain), so this software could be very useful for agencies preparing larger packages featuring it.

Figure 4. St. Felix church in Girona. Left: Photograph. Center: Legends of Girona game, view of the main street with the Felix church in the distance, within a spherical dome virtual reality setup. Right: External view of the dome.

3.3 High co-creation (consumer to consumer)

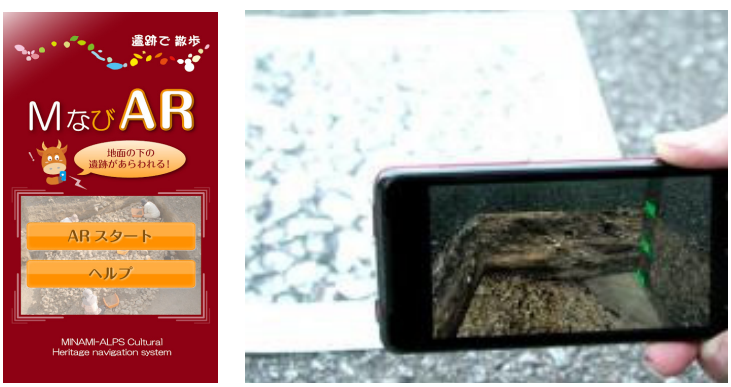
We present here an augmented reality application where tourists and locals can add their own content, reaching higher levels of co-creation. This application corresponds to the “during the visit” stage.

3.3.1 Geography application: Yamanashi Region (Japan)

Even in Japan, there is an increasing number of cases applying VR and AR from tourism development, regional promotion, and educational perspective (Izumi, 2017; Nakano et al., 2017). One of the examples is the application of the Minami Alps City, Yamanashi Prefecture, which is called M-Navi. M-Navi is a cultural heritage navigation system, which is available to acquire information such as sightseeing information, natural resources, historical cultural information, climbing routes, etc., by reading the QR code (two-dimensional bar code) stuck on the guide board, and by using the smart phone's camera function. In Minami Alps City, the distribution of archeological remains is small because there are many floodplains and water-intensive river areas (Izumi, 2017). Furthermore, the area was landfilled, so the ruins can't be seen in this area. However, by reading the code using the application, it became possible to see the ruins with materials photographed before construction. Thus, in the city of Southern Alps, it became possible to see unusual tourism experience looking at past ruins which cannot be seen at the moment, by using AR.

Furthermore, users of M-Navi can download and listen to an explanation of the history of ruins, while looking at its image. Such kind of contents are made by local children. Also local children and residents can understand the history and the city's surroundings, by looking at past ruins which are currently underground (Izumi, 2017). So, M-Navi with AR not only contributes to maximize tourist satisfaction and loyalty as a tool, but also leads residents to co-create the tourist experience, and to rethink of local situations and histories (i.e. social/educational impacts). In this case, the tourism application did not require any changes in the software of the app; content was added by final users in a collaborative manner.

Figure 5. "Underground tour" using application "M-Navi"[9)]



4. Discussion

Concerning the tourism domain, virtual reality provides not only new applications for historical and educational perspectives, but also a new scenario characterised by new implications for tourism (Guttentag, 2010). As our cases of ancient burial sites, and legends of Girona have shown, virtual reality could be a very useful marketing tool, if potential tourists are able to experience new and exotic locations without leaving their houses (Dexeus, 2019; Travel + Leisure, 2016). The cases of the New Castle in Schleißheim and the Munich

9) Mなび AR とは (About AR of M-Navi) Retrieved October 1, 2018 from http://103.route11.jp/?ms=2&mc=54

Arsenal indicate a combination of historical point of view and also tourism perspective. Virtual reality can offer an enriched tourism experience, because it provides mobile apps that could add virtual elements to real-life situations while tourists are travelling (Fayos-Solà and Cooper, 2019).

Regarding management implications, cost is crucial for managing destinations. As tourism has become global, more complex, and extremely diversified, virtual reality has great potential for tourism (Guttentag, 2010; Neuhofer et al., 2012). So, destinations will be able to invest in technologies connecting current and future tourists through digital networks and virtual reality (Fayos-Solà and Cooper, 2019). As shown previously, there is a wide range of virtual reality devices, from low-cost devices to computer-based systems, and there is a possibility to utilize such kind of technology in destinations where the budget for tourism policies is limited, and also in the case of Japan, local governments and companies have faced cost problems in introducing VR/AR as a potential tool of tourism marketing.

Furthermore, the understanding of host communities' perceptions of tourism development has been an important theme among managers for destinations, because the success and sustainability of tourist destination depends upon the goodwill of local residents (Garau-Vadell et al., 2019). So, as the case of Yamanashi region indicates, the use of virtual reality, in the context of tourism, contributes not only to tourists' satisfaction, but also to positive perceptions and education for residents.

In addition, as we mentioned previously that the cases in Japan seem to have placed an emphasis on economic impacts or tourism marketing, there will be good opportunities to consider various impacts through tourism developments (e.g., economic and social impacts), utilizing the arguing typology (or categories) of VR applications usage to tourism which we proposed.

5. Conclusions

The previous sections provide an overview of various case studies; the scientific research and the software have been described, followed by some observations of possible changes to optimize the applications for tourism use. Generally, the applications can be easily used (possibly with minor modifications) for the intended tourism use.

The implications for tourism studies include the possibility to integrate the framework from various perspectives: information technology, geography, historical science, fine art, education, sociology and management. Also an understanding of how VR is implemented for tourism development and sustainability will allow destination managers to develop strategies, such as marketing opportunities, cost reduction, increases in user satisfaction and personalization and better understanding of the communities' perceptions.

The main limitation of the approach presented here is that the VR research community will normally model sites located near them (famous places may also be modelled in specific instances). Therefore this approach can only be used opportunistically. We however consider that as time passes and VR becomes a commodity, the number of sites available in VR will increase considerably. For instance, centenaries and other round anniversaries are often used as tourist attraction. In parallel, the VR community can use these anniversaries to inspire their studies. A case in point is the centennial of the Russian revolution, used in the VR field by Slater et al. (2018) to study presence and engagement. It would be advantageous to use these VR studies to strengthen the tourist interest in the celebrations.

For future research, we would like to explore in more depth the VR research and identify further work which could be applied to tourism, and to investigate how some of the solutions presented here are received by tourists.

6. Acknowledgements

The VR systems described in section 2.3.2 were developed within the *Baroque Ceiling Painting and 3D* project, and at the seminars *Baroque Palaces in the Munich area***.** *Possibilities of Visualization with the New Media***,** taught by PD Dr. med. Ute Engel, Institute of Art History and Corpus Ceiling Painting, and *the 3D Software in Creative Processes* by Dr. Ing. Karin Guminski, Art and Multimedia, Department of Art Education. Bernhard Strackenbrock was guest scientist at the German Aerospace Center in the team of Prof. Gerd Hirzinger.

The digitalization and modelling work on the Munich Arsenal was performed by August Pries and Robert Schmid (Staatliches Bauamt München 2)[10] with the support of Erika Krimmer and David Braune (LRZ). The photographs in Figure 3 were licensed using CC BY-SA 3.0[11] by Flying Pharmacist (left), by Rufus46 (center), and by O DM (right). The photograph in Figure 4 was licensed using CC BY-SA 4.0[12] by Zossolino. The photograph in Figure 5 was licensed using CC BY-SA 3.0 by Artico2.

This work was in part funded by the Bavarian Ministry of the Environment and Consumer Protection under the ClimEx project grant. This work has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 671564 (ComPat project).

We would also like to thank the anonymous reviewers for their valuable insights.

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