"QR-RHODES: FROM THE TIME MACHINE TO THE QR CODE. Play Rooms for Non-Captive Audiences in the Age of Mobile Telephony. The Approach of the SEE TCP SAGITTARIUS 2011-2014"

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ABSTRACT

"**QR-RHODES**", subtitled "*Rhodes building Europe: Knights at Work*", is a mobile telephony application under the umbrella of SAGITTARIUS, an ongoing Project within the SOUTH EAST EUROPE TRANSNATIONAL COOPERATION PROGRAMME 2007-2013, Priority 4.3 "Use of Cultural Values for Development". The aim of **QR-RHODES** is to effectively communicate the CH values of the Unesco enlisted Medieval Town of Rhodes, Greece to non-captives audiences in an entertaining and participatory way. A Significance Assessment Tool (SAT) was developed and tested in situ to facilitate the selection of assets with interpretive potential in the Medieval Town. Information architecture presupposes a limited working memory capacity to deal with visual and auditory material and an almost unlimited long-term memory, able to hold mental representations that vary in their degree of automation. Selected information is analyzed from a Human Cognitive Architecture point of view, considering working memory constraints, element interactivity continua and types of cognitive loads. Asset-related information is re-structured so as to free working memory from irrelevant cognitive loads, facilitating attention and information retention

an within a scarce time-budget. Interpretive narratives reinforce the association chain enabling new cognitive content to relate to prior knowledge.

Keywords: Cultural Heritage (CH), Quick-Response-Codes (QRC); Non-Captive Audiences, Human Cognitive Architecture (HCA); Long-Term-Memory (LTM); Working Memory (WM);

1. INTRODUCTION

H. G. Wells' science fiction novella, TIME MACHINE, 1895, is credited with the popularization of the concept of time travel by using a vehicle that allows an operator to travel purposefully and selectively. In the 21st century a variety of more effective ICT means are used to bridge the spatiotemporal gap. An exemplary application is the mobile application **QR-RHODES** *"Rhodes Building Europe: Knights at Work"*, in the Unesco enlisted Medieval town of Rhodes, Greece. The innovation of **QR-RHODES** lies in that **a-** instead of attracting CH consumers by merely exposing asset visibility, it links the tangible object with its intangible dimension, the hidden meanings and the stories in a cognitive-emotional way; and **b-** is projecting every-day-life basic knowlegde into the remote past utilizing heritage assets onsite and an ICT-intense experience environment. The application is designed to offer a participatory CH service with cognitive-emotional affinity, through a process of negotiation with creative crowds and prosumers, where validated expert knowledge matches the creative skills of experience seekers and cultural consumers.

2. THEORETICAL BACKGROUND

With the advent of pervasive technology locational restrictions are lifted, experiences dematerialized, the dynamism in data production-consumption increases, our knowledge and communication pattern is transforming (Mangold and Faulds, 2010:361-365; Kaplan and Haenlein, 2010:63-68; Kietzman et al., 2011:245 and 251). Pervasive media and smart specialization have changed the way people interact, work, deliver services, and create products and values (EU DG Regional Policy, 2011:7; European Commission 2012:4). Driven by the digital shift and globalization, the new race of skilled workers, handle mobile businesses with highly customized services, that traditional distribution channels cannot offer, where supply and demand merge into a successful unity (Rausell, 2011:54-55; Egdeman and Eskildsen 2012:9).

The major economic and technological shifts have impacted the profile of the CH consumer: skilled individuals enter **en masse** the phase of **self-designing** collaborative consumption at heritage places. Scholars document that CH consumption is stratified by education and not by class, as consumers explicitly seek for authenticity and use Social Media to broadcast their experiences and emotions to family and friends in real time (Harvey and Lorenzen, 2006:13; Chan and Goldthorpe 2007:379; Lizardo and Skiles, 2008:10). Tapping the power of distributed networks they share ideas and expertise quickly and effectively, create and share information and knowledge with richer patterns of participation and engagement through Social Media and wired communities. In regards to both first hand and mediated cultural heritage experiences, Social Media are transforming the learning panorama by providing unprecedented opportunities for co-creation, self –directed learning, collaborative learning and lifelong learning. However the understanding of the Learning 2.0 phenomenon and its implications for CH learning and CH consumption is an under-researched topic.

3. RESEARCH OBJECTIVES

QR-RHODES is addressing multinational, multigenerational non captive audiences, i.e., the average healthy adult with sufficient knowledge of English as a foreign language. Prior and expert knowledge about the Medieval Town of Rhodes are set to zero. Two objectives are set: to reduce

extraneous cognitive loads and exploit universal concepts to redirect attention as familiarity allows the human brain to expend less effort to concentrate on personal and meaningful content.

3.1 Reducing Cognitive Loads

QR-RHODES aims to capture the essence of 20 assets and effectively communicate it in a cognitive-emotional way to non-captive audiences in real time through the use of QRCs. Brain literacy is the *conditio sine qua non* for a cognitive design that facilitates perception of novel information and raises meta-cognitive awareness (Berninger and Corinna 1998:352, Rushton and Larkin, 2001:25, O'Donell et al., 2002:75-78). Humans acquire, store, recall, code and decode information about the relative locations and attributes of phenomena in their everyday spatial environment using perception and memory to create cognitive maps. Genetically intrinsic only to humans, memory is the collective function of the human ability to perceive, learn and cognize. Memory is not only the information storage place, but also the information processor, with memory functions distributed in the cortex and sub cortex (Waxman, 1996:281). The Human Memory Processor consists of Sensory-(SM), Short-Term (STM), Working-(WM) and Long-Term Memory (LTM), (Robinson, 1998:306). Human Cognitive Architecture (HCA) offers an unlimited LTM able to hold mental representations of varied automaticity degrees, but a limited capacity WM with independent subcomponents to deal with auditory and visual material.

THE HUMAN MEMORY PROCESSOR

DESCRIPTION	CAPACITY	OPERATIONS
SENSORY MEMORY	**Finite Storage Capacity**	**-retains impressions of sensory information**
	Time Frame: less than 1 sec	**-operates outside of conscious control**
WORKING MEMORY	**Finite Storage-Retrieval Capacity**	**- manipulates visual and auditory data**
	Specific Processing Capacity	**- organizes and integrates data with existing knowledge**
	Time Frame less than 30 sec	**- governs and directs attention**
SHORT TERM MEMORY	**Finite Storage-Retrieval Capacity**	**- comprises the storage structures of WM**
	Time Frame less than 15 sec	**- enhances its performance by chunking and rehearsal**
LONG TERM MEMORY	**Unlimited Storage-Retrieval Capacity**	**- the human' brains permanent knowledge repository**
	Time Frame: from 30 sec up to a lifetime	

Table 1: The Human Memory Processor

Prime goal of **QR-RHODES** is to facilitate information processed in WM. The use of procedures able reduce CLs should not be though at the expense of understanding. Mental representations, i.e., schemas are stored and organized in LTM but information that constructs them is processed in the WM (Paas et al., 2004:2, Gerjets et al., 2004:39). Schema construction and automation are useful of solving problems of interest, to reduce CLs, and capture attention in the long run. Therefore all asset-related information has been analyzed from the perspective of WM limitations, element interactivity continua and 3 CL types:

A. The Intrinsic Cognitive Load (ICL) is affected by the intrinsic nature of information and cannot be altered by instructional interventions, rather it depends on the interactivity of the elements, on the nature of the material to be learnt, as well as on the expertise of recipients.

B. The extraneous Cognitive Load (ECL) is generated by the manner in which information is presented rather than by the intrinsic characteristics of information and required activities. It can be determined by instructional interventions.
C. The germane CL (GCL) reflects the effort that constitutes schema construction and may be increased by instructional interventions.

WM is used to process all conscious information, but is very limited with respect to the number of elements it can handle.The constraints inherent in the WM are the determinants for the design of heritage narratives.

3.2 Re-directing Attention

Non-captive audiences at heritage places are multinational, multicultural, and multigenerational groups, exploring novel information potentially connected with their own pre-understandings and prior knowledge. The main difference between learners in formal settings and non-captive audiences is the possibility to rehearse material. As WM is limited in capacity with respect to the number of elements it can handle simultaneously, rehearsal is necessary to prevent information loss (Cowan, 1998:77-78, Kolk et al, 2003:26-29). This condition cannot be met with time-scarce non-captive audiences at heritage places. In order to create a mental bridge to selected phenomena, and make the novel seem familiar by relating it to prior knowledge and/or universal concepts in a much shorter time period and more entertaining way, **QR-RHODES** presupposes a limited WM capacity to deal with visual, auditory and verbal materiala nd an almost unlimited LTM, able to retain schemas i.e., mental representations that vary in their degree of automation (Waxman, 1996:281, Oberauer et. al., 2003:167-193, Baddeley, 1981; 2003).

As the Medieval Town is a Unesco enlisted monument, tourism signposting is prohibited. At major entry gates i.e. moat, gates, monuments there exists directional signage and/or labels in expert language. A hypothesis is formulated in regards to the reading time-information volume correlation:

- 45 sec for each interpretive exhibit;
- 60 secs for each interpretive unit;
- 180 minutes for the Game in the Medieval Town,

meaning that information units are chunked with max. 3 novel concepts per unit, below the limit proposed by Miller (1957) Baddeley and Hitch (1981) and Badldely (2003). Graphic design is aligned with the eye-scan-path movement, information layering follows international standards for the interpretation of heritage (Moscardo; Lehnes and Zanyi, 2001; Lehnes, 2006). In order to decongest WM, redirect attention and allow visitors to connect with prior knowledge from the everyday life, metaphors and associations have been extensively utilized. Meanings communicated through the use of associations and metaphors are based on universal concepts, and differ substantially from transmitting formal knowledge (Papathanasiou-Zuhrt, 2012:36).

4. METHODOLOGY

4.1 Heritage Assessment

The National Heritage Register declares 281 assets within the wall of the Medieval Town of Rhodes (1948). 20 assets have been selected, following the Significance Assessment Process (SAP) adopted by SAGITTARIUS. The SAP documents exactly why assets are significant using a multivariate analysis (Papathanasiou-Zuhrt, 2008:18-21). A Statement of Significance produced for each asset on the basis of the historic-archaeological information, 6 intrinsic qualities, inherent values, visibility in the landscape, spatial importance, social recognition, physical accessibility and interpretive potential, builds the spinal cord for the asset primary value and concludes with the interpretive message.

TANGIBLE DIMENSION	*INTANGIBLE DIMENSION*	*LEGACY*
Rhodes is the only European walled town with its landscape maintained intact in 1522.	The innovation the Knights have performed in medicine is that instead of following the typical monastic infirmary pattern to prepare the soul for death and provide for basic medical interventions only, they delivered medical care and rehabilitation in the modern sense	The fruits of that commitment are to be found in the substantial and effective work they undertake throughout the world.
It shows the transition between the classical medieval fortification and the modern ones.	instead return their soldiers to health to continue their religious vocation and thus the aim is to cure the patient	In 150 countries 50.000 members and 400.000 regular volunteers and hands-on supporters, backed by millions of individual donors, run ambulance corps;
The Great Hospital is evaluated a the veritable jewel of Gothic Art in Rhodes	instead of abandoning the sick to their fate organized their care independently of creed, sex and class and origin	relief services, hospitals, hospices, clinics and medical programmes;
The Great Hospital of the Knights is the most important monument from the Knights' legacy.	the ability to care for large numbers of patients with a logistics system worthy of today's standards	care for the elderly, the disabled, children and the homeless;
The Great Hospital is two-storey, furbished like modern Hospitals with Water facilities, Surgery, Patient Wards, Toilets, Garden, Kitchen, Pharmacy, commercial store, administration units	the promotion of medical studies and the certification of higher and lower skills in the medical profession	engage in first aid training and disaster and humanitarian relief.
Bed and Bed Linen for Patients is a world innovation	the standards of hygiene and disinfection for the first time in collective establishments of Western Europe	No other order claiming to use the title of St. John of Jerusalem can be described in these terms.
All utensils and kitchenware are silver to ensure disinfection	Medical staff is under oath and earns approximately as doctors today	

Table 2: STATEMENT OF SIGNIFICANCE: Great Hospital of The Knights in Rhodes

4.2 The Planning Concept

QR-RHODES entails 20 geolocations, accessed by the use of QRCs. Given the multiethnic character of the Knights Hospitallers and the visibility of monuments in the landscape, 5 interpretive spheres have been introduced comparing the sovereignty of Rhodes (1306-1522) with the European Union:

QR-RHODES: INTERPRETIVE SHPERES		
	STATE OF THE ORDER OF ST JOHN IN RHODES 1306-15522	EUROPEAN UNION
	MULTIETHNIC GOVERNANCE	
1	STREET OF THE KNIGHTS	BRUSSELS STRASBOURG
	Inn of England	
	Inn of France	
	Inn of Auvergne	
	Inn of Provence	
	Inn of Germany (not discovered yet)	
	Inn of Spain	
	Inn of Italy	
	CITIZEN SERVICES	
2	HEALTH FREE OF CHARGE	CITIZEN PAID HEALTH
	Public Hospitals and Pharmacies	Public and Private Hospital
	Old Hospital of the Knights in Rhodes	
	Great Hospital of the Knights in Rhodes	
	PAID DEFENCE Taxes, Donations, GM Contributions, Labour, Military Service, Piracy	PAID DEFENSE Taxes. Military Service
	1 Moat	National Army National Air force National Navy UN Army NATO Army
	11 Gates	
	8 Battle Areas entrusted to each National Language	
	3 Bastions	
	Gundpwoder Magazine	
	Arsenal	
	Military Harbour Mandraki	
	8 Towers (St. Nicholas, Naillac, Pagnac, of Spain, of England, of Italy)	
	JUSTICE	JUSTICE
	Merchants' Court Castellania	National Courts Hagues
	COMMERCE AND ECONOMY	
3	Market Place (Magna et Communis Platea)	European Single Market
	Commecial Harbour	
	International Banks (Florence, Venice)	
	FAITH, SOCIAL LIFE AND THE ARTS	
4	24 Churches	Polycentric Urban Spaces Rural and Marine Heritage
	1 Hotel, St. Catherine's Hospice	117.000 (tripadvisor)
	PRIVATE LIFE	
5	232 Private Houses of the Knights (no children)	17 million single housholds undet 65 year in the EY 25 (Eurostat 2010)
	10 VIP Houses of Higher Dignitaries (no children)	

TABLE 3: QR-RHODES: The Five Interpretive Spheres

A Game involving 10 geolocations, titled" *GRAND MASTER CHALLENGE. THE GAME*" is played at 10 selected geolocations, each one is connected to a special meaning and a task. Main goal is to entertain cultural consumers of all types and inspire them to:

- Co-create contents
- Have fun
- Get to know and valorize local heritage
- Experience heritage in a playful way without alienating the socio-historical context
- Realize clear benefits

The Games tell a story at each play unit. Depth and complexity depend directly on the location-task correlation, which affects the time required to play at each location, perform the tasks, the ease of accessing and processing information. The Game is linked to Social Media Channels. By mastering all relevant tasks the winner is awarded the title of the Grand Master. Promoting the Game's ludic character, winners receive a diploma and a free meal/drink and his/her photograph is uploaded in the GM-Gallery, Generation II.

Fig. 1: QR-RHODES. Depicting the Game's ludic character: The GM Diploma

4.2 The Field Research

The Field Research includes the investigation of the Demand and Supply Side with emphasis on the inclusion of young audiences. It is extends in the time period November 2012-June 2013. A sample of 26 adolescents from the 1st High School of Rhodes has been engaged and a Study Visit in the Mediaeval Town of Rhodes organized in November 2012. A Teacher Book for the Interpretation of Heritage and an Onsite Template has been delivered to participants beforehand. 24 adults and 26 young individuals participated the Study Visit co-producing 19 videos, 605 photographs, 3 interviews, 1 Heritage Plan and 1 Facebook Timeline Page.

In March 2013 the methodology, specifications and standards for qualitative interviews have been prepared. Public, private and third sector local actors and project stakeholders form the supply side. The demand side is represented by 13 small groups from Russia (3), the UK (2) and US (1), Italy (2), Germany (1), France (3) and Thechoslovakia (1). In April 2013 the **QR-RHODES** draft application has presented to a sample of 53 individuals (supply and demand) utilizing busing mobile devices. A remedial evaluation, undertaken in June 2013, has led to reorganize application contents and enhance the final result.

	QR-RHODES AAAET INVENTORY	INTERPRETIVE MESSAGE
1	**Moat** *(Tongue of France, Auvergne, Germany, Spain, England, Provence, Italy);* (Moat Walk - Wall Walk - Park Walk)	always dry and mortal lethal to the enemies
2	**Gates** *(Liberty, Amboise, Cannon, St. Antonius, St. Athanasios, St. John, Acandia, St. Catherine, Virgin, Marine, Arnaldo, Arsenal, St. Paul)*	The military structures of the Order in Rhdes have entered history as impregnable fortress: in 1522 the island has been negotiated to the Ottoman forces.
3	**Bastions** (*St. George (Auvergne), of Spain (Spain), St. Athanasios (England) St. John (Provence), del Caretto (Italy))*	
4	**Towers** *(Naillac, St. Peter, Pagnac, Tower of Spain, Tower of St. Athanasios, Tower of St. John, St Nicholas, Tower of France or of the Angels)*	
5	**GMP**	Collective Multiethnic Administration
6	**St. John** *(Evangelismos)*	Seat of the Knights
7	**Knight Street** *Spain, Provence, Italy, France, England, Auvergne)*	The 8 of Europe
8	**Private Houses** (*Prince Cem, Constanzo Operti, Guy de Melais)*	VIP Gothic Houses
9	**New Hospital of The Knights**	1st Modern Hospital of Europe
10	**Lady of the Castle**	Orthodox Church
11	**Old Hospital of The Knights**	1st Organized Hospital of Europe
12	**Gunpowder Magazine**	Close to the Harbor Chain
13	**Armory de Milly**	
14	**Medieval Market** (Socratous)	Commerce Center of the Med
15	**Castellania**	1st Merchant Court
16	**Admiralty**	Bishop's Seat
17	**Hospice St. Catherine**	1st Hotel in Europe
18	**Jewish Synagogue**	Oldest Synagogue in Europe
19	**Lady of the Burgo**	Catholic Church
20	**Windmills**	Highest Concentration of Windmills in the Med

Table 4: QR-RHODES. Selected Geolocations

5. IMPLEMENTATION

QR-RHODES belongs to the Roving Museum and the App of the Transnational Cooperation SEE TCP SAGITTARIUS. It implements 20 QRCs by directly guiding audiences to asset information, without any other media intervention in between. The Quick Response Code (QRC) is a specific matrix bar code (or two-dimensional code) that is readable by smartphones. QRCs do not require typing URL addresses of tiring web searches. QRCs came onto the scene as a way to bridge mobile and traditional media across various mediums including print publications, product packaging, outdoor kiosks and more. They result in client offers, event information and location-based mobile check-in services to name but a few examples (Verclas and Linnhof-Poppien, 2012).

Field research has assisted planners to understand how users are engaging QRCs and how these codes create connections point with consumers in the Medieval Town combined with the Transnational Project App. Research results have demonstrated that information, which requires recipients to engage in complex reasoning and involve combinations of unfamiliar elements, is rejected. The deployment of a **QRC-Inventory** in the Medieval Town enables an unlimited user number to retrieve key media information and customize it according to the personal preferences and the own points of enthusiasm, building simultaneously a truly effective heritage marketing tool. **QR-RHODES** has demonstrated a fundamental ability to engage users in the co-creation of meaningful heritage contexts, and reveals emerging trends in mobile telephony and has identified how consumer time is shifting across interpreted monument, but also across app categories and operating systems. More specifically results from the onsite research in the Medieval Town of Rhodes in 2013 has demonstrated that the intrinsic motivated sample (78%) has freely selected to attend or ignore communication content, whilst the minor part of the sample (22%) has stated explicitly that learning outcomes are paramount to recreational objectives. By incorporating educational elements in real time, **QR-RHODES** is meeting the audience's demand, which prefers educational interactive entertainment to passive observation.

Fig. 2: The Roving Museum. Application for the iOs.

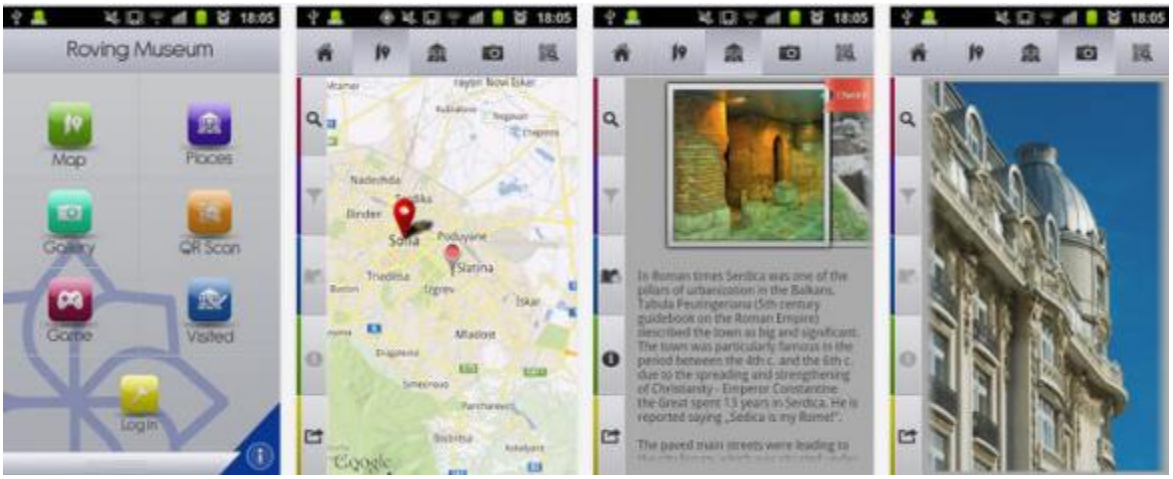

Fig. 3: The Roving Museum. Information Architecture

Fig. 2: THE ROVING MUSEUM. Extract from the Great Hospital of the Knights in Rhodes

6. CONCLUSIONS

The field research revealed that the new race of connected consumers is looking for authentic experiences at heritage places, exploiting all possibilities for the co-creation of context. While most cultural and tourism-oriented services include exceptional scenic or heritage assets to attract consumer flows, **QR-RHODES** generates customized experiences and points of enthusiasm, broadened and deepened by the stories and their interpretation. By highlighting cultural experiences in the Medieval Town, win-win scenarios for the host community and its visitors are offered. A series of outcomes describe the desired impacts of the application, i.e., what visitors do, think, or feel as the result their encounter with **QR-RHODES.** The remedial evaluation in May 2013 has revealed a series of factors that require future research:

Cognitive engagements described how visitors engaged mentally with the asset content – actively and passively, how they reflected on suggested topics, and how they made connections between ideas. Visitors deployed **QR-RHODES** onsite allocating an approximate 20-50 seconds for each exhibit, 1-3 minutes for an interpretive, such as the Great Hospital of the Knights, Shadow and sitting opportunities prolonged the reading time substantially. A maximum of 1-3 hours is given onsite, with the Great Hospital of the Knights, which serves as Archaeological Museum since 1912, to be declared as the long race winner. **QR-RHODES** wins a very specific significance onsite: the heritage narratives were gladly rehearsed by the sample more than 3 times in average. Embedded in a longer narrative, as indicated by the application's subtitle, they have been re-visited, contextual information is assessed among groups, comparisons are drawn in the proximity of authentic assets, geolocations and new meanings are created and shared via the through apps and Social Media Tools as literature denotes (Hargittai and Walejko, 2008; Fotis, Buhalis and Rossidis, 2011; Neuhofer, Buhalis and Ladkin, 2012; 2013a and b; Leung and et. 2013). Different types of built heritage in the Medieval City, have been compared (Classic, Gothic, and Ottoman era). Similarities and differences in the hospital care of today and in the Middle Ages in Rhodes and Europe have been discussed. Income differences of skilled workers today and in the Middle Ages i.e., doctors, engineers, but also carpenters, sailors, artisans, construction workers and farmers provoked curiosity and further discussion.

Social engagements described how visitors engaged with each other and when and how they interact with others in their social group. Visitors have discussed how the experienced heritage assets relate to their own lives, most notably the Great Hospital of the Knights, the Grand Master's Palace, St. Catherine's Hospice and the Moat. Visitors have called others in their group over to try the suggested activity offered by **QR-RHODES**.

Emotional engagements described how visitors have felt after having acquired "expertise" about the Medieval Town, perception, understanding, and new knowledge lead to excitement, passion, awe, inspiration, but also to familiarity and security. The dress rehearsal of **QR-RHODES** in 2013 has revealed that positive emotional engagements are connected to familiarity and the security of freely moving at a spatial scale. Familiarity is a result of prior knowledge: previous onsite-virtual experiences, experiences of others, by means of visual, verbal and sensory stimuli and last but not least by information acquisition through ongoing quests e.g. *"how can I find the GM Palace"*. Landscape familiarity has impacted length of stay within the Medieval Town for different consumption purposes. Observed behavior of the sample has proved to be congruent with the risk-reduction strategy theory formulated by scholars (Walmsley and Jenkins, 1994, Ankomah et al., 1996, Ryan, 2000, Gursoy and McCleary, 2004, Kerstetter and Cho, 2004, Yovcheva et al. 2013), however as mobile technologies impact the knowledge pattern, further inquiries are needed to shed more light into the correlation heritage knowledge – cultural consumption.

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