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Cognitive processing of information with visitor value in cultural heritage environments. The case of the SEE TCP SAGITTARIUS 2011-2014

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Abstract

The South East Europe Transnational Cooperation Project SAGITTARIUS is a research and developmental project aiming to effectively communicate values of cultural heritage to non-captives audiences in an entertaining and participatory way. A significance assessment facilitates the selection of assets with interpretive potential. Information architecture presupposes a limited working memory capacity to deal with visual and auditory material and a long-term memory able to hold mental representations that vary in their degree of automation. A communication pattern has been developed and adapted to the conditions regulating the recreational learning environment. It facilitates attention and information retention, reinforces the association chain enabling new cognitive content to relate to prior knowledge. A Roving Museum offers a scarce time-budget audience access to interpretive narratives via a portable infrastructure, a mobile telephony application and a social media driven platform.

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Keywords: Human Cognitive Architecture (HCA); Significance Assessment Tool (SAT); Heritage Interpretation, Cultural Heritage (CH); RM (RM); Quick Response Code (QRC); Hashtag, South East Europe (SEE); Working Memory (WM); Long-Term Memory (LTM).

1. Introduction

Cultural consumption is a knowledge based activity, liaised to the experience economy. Thus cultural products and services are viable only if they possess widely recognized values. SAGITTARIUS builds a first attempt in South East Europe to exemplify, how heritage is communicated to locals and visitors, protected, and

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marketed with ecological, economic and social profit. SAGITTARIUS considers culture a principal development driver and is committed to effectively communicate values of cultural heritage assets to non-captives audiences in an entertaining and participatory way and thus contribute to advancing cultural heritage consumption in everyday life. 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. A multi-sensory communication pattern has been developed in accordance to the principles of Human Cognitive Architecture (HCA) and adapted to the conditions regulating the recreational learning environment. Asset related information is re-structured to free working memory from irrelevant cognitive loads and facilitate attention and information retention addressing both located and dislocated audiences in real time.

2. Research Objectives

Experiences, e.g. interactions with time-space, people, and products and services, constitute the quintessence of Cultural Heritage (CH), empowering personal and collective identities, self-reflection, critical thinking, protection and sustainability of cultural legacy. 77% of the EU citizens declare CH as important for everyday life (EUROSTAT, 2011). However cognitive-emotional accessibility to CH assets is alarmingly low. Especially the youth, innate to the digital world, acquires lesser CH quality information with lesser opportunities for meta-cognition and critical thinking (EACEA, 2008, EUROSTAT 2011). As access to culture is a universal right, a new knowledge and consumption pattern at heritage settings, connected to the rise of skilled consumption, is a challenging opportunity for the Union's future (Lundvall and Johnson 1994; Florida, 2006; Jenkins, 2006). Cognitive-emotional experiences build the prerequisite for the final heritage product, as users attach personal meanings to heritage assets, fostering active mental processes, combined observations and shared practices: skilled individuals enter en masse the phase of self-designing collaborative consumption at heritage places. Scholars document that cultural consumption is stratified by education and not by class (Chan and Goldthorpe 2007:379; Lizardo and Skiles, 2008:10), and that consumers explicitly seek for authenticity and use Social Media to broadcast their experiences and emotions to family and friends in real time (Mangold and Faulds, 2010:361-365; Kaplan and Haenlein, 2010:67-68; Kietzman et al., 2011:251). Exploiting 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 (Harvey and Lorenzen, 2006:13).

In regards to mediated cultural heritage experiences, Social Media are transforming the learning panorama by providing unprecedented opportunities for contextual co-creation, self-directed, collaborative and lifelong learning. The main research objective is to research the conditions regulating learning in heritage environments and propose the most suitable media to bridge the existing spatiotemporal gap between the object and the visitor. The research aims to demonstrate the value of making Human Cognitive Architecture (HCA) educationally relevant, provide for fully accessible, industry-related, experienced-based products and services and contribute to the transformation of heritage places into collaborative and participatory learning spaces. The innovation of the Roving Museum lies in that instead of attracting visitors by merely exposing asset visibility, it links the tangible object with its intangible dimension, the hidden meanings and the stories in a cognitiveemotional way; and it is utilizing every-day-life basic knowledge to describe the past and connect to the visitor's horizons. It is designed to offer a participatory cultural heritage 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 (Papathanasiou-Zuhrt, Esperante and Weiss-Ibáñez, 2013). It is addressing multi-national and multi-generational non-captive audiences, i.e., adults with sufficient knowledge of English as a foreign language. Prior and expert knowledge about heritage assets in the Project Area are set to zero. Two sub-objectives are set:

• to reduce extraneous cognitive loads through standardizing information layering;

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

5.1 Reducing Cognitive Loads

The Roving Museum aims to capture the essence of 110 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 Corina 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 life 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 Memory (SM), Short-Term Memory (STM), Working Memory (WM) and Long-Term Memory (LTM). Human Cognitive Architecture (HCA) offers an unlimited LTM able to hold mental representations of varied automaticity degrees, but a limited capacity WM with independent sub-components to deal with auditory and visual material (Robinson, 1998:306).

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

Table 1: The Human Memory Processor

Prime goal of the Roving Museum is to facilitate information processed in WM. However the use of procedures to reduce cognitive loads should not be 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, Renkl and Sweller, 2004:2, Gerjets et al., 2004:39). Schema construction and automation are useful of solving problems of interest, to reduce cognitive loads and capture attention in the long run. 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 within the Roving Museum. Therefore all asset-related information has been analyzed from the perspective of WM limitations, element interactivity continua and 3 types of cognitive loads: Intrinsic Cognitive Load (ICL) is affected by the intrinsic nature of information and cannot be altered by instructional interventions. It depends on the interactivity of the elements, on the nature of the material to be learnt, as well as on personal expertise. 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. The germane CL (GCL) reflects the effort that constitutes schema construction and may be increased by instructional interventions (Kirschner, 2002:1-10).

5.2 Re-directing Attention

Non-captive audiences at heritage places are multi-national, multi-cultural, and multi-generational 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 at heritage places with time-scarce non-captive audiences. 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, information architecture within the RM presupposes a limited WM capacity to deal with visual, auditory and verbal material and 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).

The CH sector suffers a discontinuity of supply and demand as asymmetric information between producers and consumers, is prevailing, sustained by the old fashioned information transmission of the supply side (Caserta and Russo, 2002:247-250; COE, 2009:51-51). For the majority of selected assets in the Project Area, whether UNESCO enlisted or privately managed, heritage information is incomplete, or bound on expert accounts. At major entry gates exists directional signage and/or labeling in expert language. A hypothesis is formulated in regards to the minimum reading time-information correlation: 45' sec. will be spent at each interpretive exhibit, while 60' sec. will be spent for each interpretive unit. This hypothesis leads to a planning decision: namely that information units shall be chunked with max. 3 novel concepts per unit-, below the limit proposed by Miller (1957), Baddeley and Hitch (1981) and Baddeley (2003). Graphic design is aligned with the eye-scan-path movement; information layering follows international standards for the interpretation of heritage (ICOMOS, Papathanasiou-Zuhrt and Sakellaridis, 2009). In order to decongest WM and redirect attention, metaphors, associations and universal concepts have been extensively utilized. Meanings communicated through the use of universal concepts and differ substantially from transmitting formal knowledge (Papathanasiou-Zuhrt, 2012:36).

6 Methodology

The complexity of territorial transformation and the extension of local/global relationships require a revision of planning methodologies and instruments, above all a revision of knowledge and communication tools. The CH Sector is facing a new reality: consumers share their experiences in the social networks, whether positive or negative, influencing the decisions of others and thus regulating supply and demand. The challenge for the Roving Museum is to become 'smart' enough through developing the dynamic capabilities required to respond in real time to user demands in heritage settings.

6.1 Heritage Assessment

Heritage assessment in the Project Area supports asset identity and communicate asset values to different audiences at *spatial* (global, national, regional, local), *scientific* (research, technical), *historic*, *aesthetic*, *social* (national, community, group, family personal), and *spiritual* (tradition, religion, rites and beliefs, lifestyles) level. A multi-criteria Significance Assessment Tool (SAT) was developed to facilitate the selection of 110 cultural heritage assets with interpretive potential in the Project Area. 32 principles have been developed and tested in situ to guide the development of interpretive presentations including context and

graphic design for onsite and virtual environments. 110 heritage assets, evenly spread in 7 countries, are classified according to natural, man-made and spiritual heritage classes. The asset body forms an interactive Heritage Registry, accessible to the general public online.

NATURAL HERITAGE ASSETS		
Wildlife		
Man-nature interaction (parks, cultural landscapes, theme parks, battlefields etc.)		
MAN-MADE HERITAGE ASSETS		
Built Heritage (Heritage sites, historic, religious, vernacular monuments and built structures)		
Movable Cultural Heritage (Objects and Collections)		
Material Cultural Heritage (Serial and Hand-made objects)		
SPIRITUAL CULTURAL HERITAGE		
Religion, Values, Beliefs, Traditions, Customs, Lifestyles		

Table 2. SEE TCP SAGITTARIUS. Heritage Classes

The SAT documents exactly why assets are significant using a multi-criteria assessment process. Asset-use is evaluated by usability modifiers. The SAT is not an absolute measure of timely bound value: some heritage values are not negotiable, others are. The SAT documents all cultural values of an asset and clearly demonstrates its significance for society suggesting the means to utilize it for development; it demonstrates needs in protection, conservation and interpretation, and motivates to entrepreneurial activities. *110 Statements of Significance* are produced in the Project Area on the basis of 6 intrinsic qualities: inherent values, visibility in the landscape, spatial importance, social recognition, physical accessibility and interpretive potential, carrying and service capacity included.

1	PROVENANCE	1.1 Authenticity; 1.2 Originality; 1.3 Designation
2	INTEGRITY	2.1 Completeness; 2.2 Exemplarity; 2.3 Bio- and Cultural Diversity
3	DISTINCTIVENESS	3.1 Novelty; 3.2 Familiarity
4	ACCESSIBILITY	4.1 Availability; 4.2 Carrying Capacity; 4.2 Condition; 4.4 Facilities; 4.5 Service Capacity
5	INTERPRETIVE POTENTIAL	5.1 Legal Status; 5.2 Intervention Possibilities; 5.3 Asset Knowledge; 5.4 Knowledge of the Audience; 5.6 Media Selection; 5.5 . Experience Opportunities

Table 3. SEE TCP SAGITTARIUS. The Asset Use Evaluation Matrix

6.2 The Planning Concept

A **Roving Museum** (RM) with 5 components has been designed: it includes 110 portable display panels, a Social Media-driven participatory space, an app for smart devices, a 15' min. film, a 1,5' min. project advertisement spot and a transnational heritage game, including 6 national game areas connected culturally to each other. All selected media consider working memory constraints, element interactivity continua and cognitive loads. Information layering is reinforcing the association chain enabling new cognitive content to relate to prior knowledge. Interpretive narratives in panels and in the app environment are restricted to 350 words, while larger narratives do not have a word, but a reading limit of 5'min.

The Roving Museum is connecting 110 geolocations in 7 countries (GR; BG; RO; HR; IT; SI; HU) through an Inventory of Quick Response Codes (QRC). The QRC is a specific matrix bar code (or twodimensional code) readable by smart devices. QRCs do not require typing URL addresses of tiring web searches. They 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).

A transnational game, played at 50 geolocations, connects culturally the Partnership. Each local game offers play units (geo-locations) connected to each other at spatial scale. Each play unit interprets the asset value and creates a special meaning and a task for players. Main goal is to inspire players customize their play, co-create contents, get to know and valorize local heritage in a playful way without alienating the socio-historical context. All games tell a story with sub-themes at each play unit. Depth and complexity depend directly on the task required at each play unit, which affects the time required to play at each location. Each game is linked to Social Media (Facebook, Pinterest, Instagram) with the aim to virally disseminate the local identity.

By mastering all relevant tasks winners are awarded. Tangible benefits, ensured by the local stakeholder map, include diplomas, winner photo-galleries, souvenir baskets with traditional products, free meals and drinks, gifts, free access to tourism products and cultural services etc. In this way a triple task, economic, educational and social, is accomplished simultaneously:

- by offering a diversity of cognitive-emotional experiences the Roving Museum helps mitigates conflicts occurring among publics who expect various outcomes from using heritage and culture, as they may opt for products and services close to their consumption motives;
- by offering cognitive-emotional experiences for both located and dislocated audiences the Roving Museum promotes cultural heritage settings as democratic, participatory places for self-directed learning;
- by facilitating project-driven local stakeholder synergies from the wider public, private and third sector, the Roving Museum is contributing to closing the gap between supply and demand in the cultural heritage sector.

6.3 Field Research

The field research includes the investigation of supply and demand with emphasis on young audiences. It is extends in the time period November 2012-June 2013 and includes 3 different target groups: young audiences, local stakeholders and foreign visitors. Young audiences from 7 countries were involved in 9 local study visits (November 2012 - June 2013) in the Medieval Town of Rhodes, and Ancient Acharnes (Greece); in the Castle of Lagopesole (Italy), in Historic Sofia (Bulgaria), in Lake Tisza (Hungary), the Zagreb Chocolate Museum (Croatia) Mogosaia Palace and Natural History Museum (Romania), Lake Cerknica (Slovenia). The sample consists of 140 young individuals between 10-17 years in 7 countries. The sample has ignored at 89% heritage presentations where parallel processing is required for visual and auditory stimuli, reading included. An 11% has repeated efforts to assimilate new cognitive content by reading labels and panels, however without success, due to barriers in understanding expert language and to poor quality in graphic design. A sample of 190 individuals (local stakeholders and foreign visitors) gave feedback about heritage presentations in the aforementioned locations through personal interviews. The sample was presented 12 digital narratives accessed via the QRCs, or via the portable devices, where connectivity gaps disable retrieval. 78% of the sample has devoted attention to presented narratives, whilst the minor part of the sample (22%) has explicitly stated that learning outcomes are paramount to recreational objectives.

The field research has facilitated deeper understanding of how users are engaging QRCs and how these codes create connection points with consumers. It has verified the hypothesis, that information which requires recipients to engage in complex reasoning and involve combinations of unfamiliar elements, is rejected. The deployment of a QRC-Inventory across the project area enables an unlimited user number to retrieve key information about heritage assets on- and off site and customize it according to the personal preferences and the own points of enthusiasm, building simultaneously an effective heritage marketing tool.

7 Implementation

The Roving Museum, bears the titled GOLDEN ARROW, includes 110 interpretive narratives accessible via 110 QRCs in the territory. The QRC Inventory is retrieved via smart devices. The narratives are connected to 110 heritage assets under a theme story per country, which are communicated to the public via a an exhibition with 10-20 portable panels per heritage area, a mobile telephony application and a Social Mediadriven participatory space: Facebook TimeLine, Pinterest Collection and Instagram Competition. The mobile telephony application for iOS and Android enables the transfer from graphical user interface to experience user interface. To enhance end-user experience 6 heritage games are played via hashtags and QRCs.

8 Conclusions

The field research has also demonstrated that heritage consumers do share their experiences in the social networks, whether positive or negative, influencing the decisions of others and thus regulating supply and demand. The prevailing scholar view that consumption is stratified by education and not by class (Harvey and Lorenzen, 2006:13; Chan and Goldthorpe 2007:379; Lizardo and Skiles, 2008:10), has been verified at transnational level, as skilled individuals created self-designing collaborative consumption patterns at research locations. The field research has also verified the scholar argument that the new race of consumers is looking for authentic experiences at heritage places, exploiting all possibilities for the co-creation of context (Potts et al., 1998, Prahalad and Ramaswany, 2004; Neuhofer, Buhalis and Ladkin, 2013). While most cultural and tourism-oriented services include exceptional scenic or heritage assets to attract consumer flows, the Roving Museum generates customized experiences and points of enthusiasm, broadens and deepens their interpretation through visitor-centric heritage narratives. By highlighting cultural experiences at 110 heritage locations, win-win scenarios for host communities and visitors are offered. A series of outcomes describe what visitors do, think, or feel as the result their encounter with the Roving Museum:

Supply-side driven cultural heritage presentations

Heritage presentations to the public, as authored by the supply side, ignore the principles of Human Cognitive Architecture: the eye scan path movement, the general cognitive ability g/category learning, the ability to perceive and process information, to retain and evoke mental representations. Human memory capacity mechanisms are not recognized as particular conditions that regulate the informal learning environment (Sweller, van Marriernboor and Pass, 1998:255-258; Prasada: 2000:66-72; Paas, van Gog and Sweller, 2010). The Roving Museum builds a first attempt to exploit human cognitive architecture to establish a paradigm for modeling cognitive-emotional experiences in the participatory heritage space.

The spatiotemporal gap in heritage settings

CH settings are knowledge cells in non-formal and informal contexts, where individuals become selfproviders and distributors of knowledge utilizing Social Media-driven platforms. However CH authorities hold the monopoly of CH information and often reject the individual expressions and aspects about heritage assets as untrue. On the other hand some individuals expressions can be hold true, while others cannot. The conditions and means to produce validated knowledge patterns and establish a new learning paradigm in CH settings shall be researched in depth. CH settings are frequented by multigenerational-multicultural audiences. This particular audience cannot be satisfied with a monolithic presentation/explanation of culture. Any information presentation that disregards HCA is ex principio deficient. Therefore the condition of perceiving novel information and knowledge in CH settings shall be explored to facilitate learning in disguise. The spatiotemporal gap in heritage settings is of cognitive nature: to promote heritage values and effectively bridge the gap between asset and user and thus create an added value heritage experience, the Roving Museum connects the tangible form of the object to its intangible dimensions, symbols, meanings, inherent and social

values facilitating customized personal heritage experiences in situ.

Cognitive-Emotional Engagements and universal concepts

The Roving Museum acquires a very specific significance onsite: heritage narratives retrieved by QRCs have been retrieved, contextual information has been assessed by users, comparisons are drawn in direct proximity of authentic assets, geolocations were disseminated, new meanings are created and shared via Social Media Tools. Visitors engaged mentally with heritage assets in situ through retrieved narratives – actively and passively, reflected on suggested topics, and made connections between ideas. Visitors deployed onsite QRCs allocating from 0,5' min to 4' min. for each interpretive story retrieved. Longer narratives have been reserved for reading at a later time. Shadow, sitting, catering and resting opportunities prolonged both the rehearsing and reading time for all 12 prototype stories developed to test the Roving Museum onsite. Aided by smart devices an average of 2 hours is allocated to the *Great Hospital of the Knights* in Rhodes, Greece utilizing a longer interpretive narrative to freely move across the site and learn in a collaborative style. Aided by smart devices an average of 1 hour is allocated to the game play *Last Conspiracy*, at Race Castle, in Race-Fram, Slovenia. On the basis of universal concepts visitors have discussed how the experienced heritage assets relate to their own lives. Indicative examples are:

- *income and economic crisis* (wages for medical staff, earnings of sailors, cost of living and construction works in the 15th cent . Medieval Town of Rhodes, Greece; coins and debts in Ancient Acharnes, Athens, Greece);
- treason and conspiracy (spies and agents, 17th cent. Race Castle, in Rače-Fram, Slovenia);
- gold and jewelry (5th cent. B.C Dacian Treasure at the National History Museum Bucharest, Romania);
- *hospitality and travelling* (15th cent. St. Catherine's Hospice in the Medieval Town of Rhodes; 19th cent. Hanul Manuc, in Bucharest, Romania);
- fear and punishment (15th cent. Prince Vlad Dracula, Romania, 17th cent. Leopold of Habsburg, Slovenia)

Emotional engagements described how visitors have felt after having acquired heritage 'expertise' about places and sites visited. Perception, understanding and new knowledge have led to excitement, passion, awe, inspiration, but also to familiarity and security. The field research 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 Grand Master's Palace*". Landscape familiarity has impacted length of stay in the proximity of selected assets 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 are advancing, further inquiries are needed to identify experienced based products and services with commercialization potential through a renewed focus on the personalized cultural heritage experience.

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