

# PERSONALIZATION ENVISAGED IN MUSEUM APPLICATION GUIDES AND THEIR IMPLICATIONS: UNDERSTANDING THE CONTEXTUALIZATION OF THE VIRTUAL MUSEUM WITHIN THE MUSEUMS OF KOREA

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### ABSTRACT:

The emergence of innovative technologies in the museum environment has influenced the development of guide application tools for personalization, greatly contributing to the enhancement of collection accessibility and enriching the museum experience. Most Korean museums have thus developed strategic objectives for the application of evolved technological advances in their guide applications over the past decade. Beyond such endeavors, the critical analysis and understanding of technical aspects, the information and interactive approach of the applications, and their personalization strategies, are still not broadly explored. This study aims to investigate the various types of technologies that museums use to envisage the personalization of museums exhibits in light of a range of classifications and their correlations. In addition to providing an overview of personalization, the paper aims to access the level and degree of user experience and engagement found in different forms of digital storytelling to investigate the realization of virtual museum (VM) within the museum sector of Korea. To this end, this paper contributes toward filling the gap in the literature by addressing how museum communities can do critical thinking on the reflection of resources when creating their application guides in developing the appropriate digital strategies.

## 1. INTRODUCTION

Over the past decade, emerging technologies used in the production of a broad range of materials in Korea have influenced the manner in which information is conveyed in museum exhibitions. By revising the Museum and Art Gallery Support Act of the Republic of Korea since 2009 through the integration of education, including lifelong learning, the social and educational values of Korean museums as inclusive public cultural facilities have been significantly considered in all aspects of museum operations (Museum and Art Gallery Support Act, Republic of Korea, 2007. Revised in 2017) (Kim, 2017). Since 2010, the Korean governments policy directions, notably Government 2.0 and 3.0 and the National Informatization Initiative, have laid the groundwork for establishing a database of cultural digital contents and providing customized service to the public (Government 3.0 Policy, Republic of Korea, 2014) (National Information Initiative from the Ministry of Science and ICT, 2017). The nationally-driven transition has played one of the key impetus to develop and produce application tools in museums for visitors (Kim, 2017). The different types of digital representation of the museum collection have been integrated into the major Korean museums application guides.

These massive growths in digital technology use—particularly for narratives and storytelling—since the latter part of the 2000s coincide with the gradual emergence of understanding the notion of VMs in museum exhibitions, such as the concept of the responsive museum proposed by the V-Must project (Virtual Museum Transnational Network, 2011-2015) (Sartini et al., 2015). The developments provide several challenges and ques-

tions in the museum sector of Korea, in terms of personal experience, diverse and rich contents, and interactivity as well as the role of guide applications in creating effective communication and materializing the VM. A number of project-oriented studies on application guides and their storytelling have been conducted in academia to focus on the degree of technical usability, including their educational perspectives, the establishment of museum guide frameworks, and significant changes to technological communication media (Ministry of Culture, Sports and Tourism, Republic of Korea, 2017). Those studies were to help the museum sector understand the innovative attempts beyond the conventional curation of digital contents (Perry et al., 2017).

However, a large part of the previous research tended to solely evaluate the perspective of content delivery or not fully comprehend overarching strategies and practices about what museums intended to do to create better visitor engagement and the public values (Constantopoulos, Dallas, 2008). Indeed, despite the passion of the museum sector for applying digital representations to create meaningful narratives, the investigation of their added values beyond the physical museum has not been broadly discussed, despite being compulsory understood when establishing the VM (Ioannides, Davies, 2018).

In the application guides, there are major dimensions both in respect to enhancing visitors engagement and in respect of visitors response to digital technologies, as follows: technological aspects as well as information and interactive approaches. The impacts and development of the former have been investigated, whereas the latter, which is closely related to comprehending VM contextualization, is still needed to acquire understanding and their potential on how communication between visitors and collections is built within museum application guides.

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This paper explores the current state-of-the-art application guides of Korea's 36 major public and private cultural institutions. Through synthetic considerations of the integrated technological elements in the abovementioned applications, this study presents an overview for understanding the ways of personalization strategies the museums envisage. To outline the abovementioned examination, this paper draws on museological debates and practice that are relevant to the issue of personalization as a useful and necessary engagement strategy for visitors (Ha, 2014). An emerging conceptual work related to the essential quality of VMs, which is outlined in ongoing discourse such as the V-Must project and Virtual Multimodal Museum (ViMM), is considered a comparative guide to understanding how the VM is defined in Korea (Hazan, Hermon, 2014) (Ioannides, Davies, 2018). Then, the characteristics of the museum application guides are identified through the analytical approach on the types of presented contents, their accessibility, technologies and media forms that are featured in different types of storytelling. Throughout the critical review of the applications from their emergence to date, this research offers a glimpse at affording new opportunities and strategies for better engagement and interpretation within the museum environments. It further sheds light on practical insights for Korea's museum sector, where relevant debates on the VM seem comparatively inactive, to assist in providing recommendations for a viable personalization framework in museum applications that can impact on further discussion and development.

## 2. AN ANALYSIS OF THE STATE OF THE ART OF THE WAYS OF PERSONALIZATION

### 2.1 Understanding of VM in association with the Application Guides

The integration of innovative technologies has challenged the traditional role of museums, and new ways of communication with regard to the collections have developed (RICHES Project, 2016). The enormous potential of the broad range of digital offerings in Korea as learning resources and their capacity for knowledge sharing has been noted, with the result that digital media have been applied by the museum (RICHES Project, 2016). To fulfill audiences' needs and interests, various types of museums, such as digital museums and web museums, have emerged (Schweibenz, 2004(3)) (Sumption, 2006). The definition of the VM has, therefore, gradually evolved to encompass the above-mentioned phenomena. This concept can be broadly understood as the digital footprint of a physical museum or as an independent online experience (Hazan, Hermon, 2014) associated with the physical space.

Korean museums have taken advantage of technological advances and the transformation of the role of museums by developing interactive exhibitions and storytelling. These informative, participatory, spatial and procedural experiences serve as sources for determining what constitutes the representation of the VM (Lee, 2018). These interactive forms of communication have been realized through the development of museum application guides (Ha, 2014). Similar beneficial attributes can be observed in the integration of technologies concerning museum communication and learning perspectives that emphasize both the discovery of contents instead of seeing the contents itself and the process of learning from the collection instead of knowing about the collection (Hawkey, 2004(9)). Considering the transformation of formal education within the museum,

which has broadly covered informal and lifelong learning aspects since the 2010s (Kim, 2017), the VM has received attention for its feasibility of bridging the gap among diverse forms of learning (Eddisford, Prosser, 2004) (Hawkey, 2004(9)).

According to the type of technological adaptation at one hand, the application guides provide opportunities to control the contents and outlook of the collections. This personalization strategy is dominant in the current applications but is still insufficient in terms of explaining the emergence of new museums, which can be described as being beyond the museum walls or as a museum learning network and are critical for understanding the role of the VM (Falk, Dierkins, 2000). This discrepancy occurs because most research related to personalization in the Korean museum sector focuses on how new technologies are adapted to exhibitions at the project level and how these developments affect interactivity without any long-term vision (Kim, 2016). Such the new integration of technologies is closely linked to the discourse on the relationships among the adaptation of educational theories, such as constructivism, an interdisciplinary approach to museum theory, and the evolution of the museums' interpretations and visitors' experiences. However, the abovementioned points have not been evaluated with technological aspects in mind nor from the perspective of museums' engagement strategies for personalization.

Regardless of these deficiencies, a number of museums in Korea have made efforts to establish platforms to work as systematic knowledge sharing systems, such as the e-museum by the National Museum of Korea, not as the sole online museum (Kim, 2016). This initiative has opened up opportunities for a contents platform network device (CPND) (Kim, 2016), and has influenced the prevalence of guide applications within the museum sector. From this point, a critical overview of the application can be a good starting point to understand the matter of personalization.

### 2.2 Personalization Elements and Their Embodiment

The personalization strategy is becoming a central strategy among museums to engage visitors. Many leading experts in museum education and interpretation, including John Falk and Nina Simon, have emphasized personalization experiences (Simon, 2010) (Falk, Dierking, 2016). When obtaining experiences through personal opinions or necessities, we can better understand what we want to identify (Falk, Dierking, 2016). Additionally, personalization can be a key strategy in creating meaningful visitor engagement, with digital contents associated with the objects in the museums (Simon, 2010). The Korean government's policy for the utilization of digital technologies takes up a similar spirit, asserting that personalized and customized service should be provided according to individual needs (Government 3.0 Policy, Republic of Korea, 2014) (National Information Initiative from the Ministry of Science and ICT, 2017). In line with this keynote, application guides are one type of personalized service providers that museums have developed.

In this regard, this paper examines all 36 available application guides that are found at 24 major national and public museums, including 12 art galleries, across Korea. According to the Museum and Art Gallery Support Act, the roles of both museums and art-gallery museums are defined in exactly the same terms, such as collection, management, preservation, exhibition, and education, including lifelong learning (Museum and Art Gallery Support Act, Republic of Korea, 2007. Revised in 2017).

Museums (Applications)	Primary Technological Factors										Customizable Factors				
	Text	Photography	Audio	Beacon	Video	NFC	QR Code	Voice Recognition	RFID	AR	VR	My Language	My Page	My Favorite	Other Personalization Settings
NATIONAL MUSEUM OF KOREA (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Chuncheon National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Gongju National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Buyeo National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Jeonju National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Naju National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Cheongju National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Gyeongju National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Gwangju National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Gimhae National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Jeju National Museum (Guide: National Museum of Korea)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	○	My Traffic Line
Busan Museum (BusanMuseum)	○	○	○	○	-	-	-	-	-	-	-	Korean, English, Chinese, Japanese	○	○	Stamp
Busan Museum of Movies (Docent - Busan Museum of Movies)	○	○	○	○	-	○	○	○	-	-	-	Korean, English, Chinese, Japanese	-	-	-
Cheongju Early Printing Museum (JKCI)	○	○	○	○	-	-	-	-	-	○	-	Korean, English, Chinese, Japanese	-	○	-
Geological Museum (Geological Museum)	○	○	○	○	-	○	○	-	-	-	-	Korean, English, Chinese	-	-	-
Geological Museum (Doctor G)	○	○	○	○	-	-	-	-	-	○	-	Korean	-	-	Treasure Hunter with Holographic Video
Hansong Baekjae Museum (U-self Guided Tour)	○	○	○	○	-	-	-	-	-	○	-	Korean	○	○	-
Independence Hall of Korea (Independence Hall of Korea)	○	○	○	○	-	-	-	-	-	-	-	Korean, English, Chinese, Japanese	-	-	-
Jeju Aerospace Museum (JAM)	○	○	○	○	-	-	-	-	-	-	-	Korean, Chinese	-	-	-
Jeju Education Museum (Jeju Education Museum: Smart Docent Service)	○	○	○	○	-	-	-	-	-	○	-	Korean	-	-	-
Korea National Maritime Museum (Korea National Maritime Museum)	○	○	○	○	-	-	-	-	-	-	-	Korean, English	-	-	-
NEXON Computer Museum (NCM)	○	○	○	○	-	-	-	-	-	○	-	Korean	-	-	-
Paper Art Museum (JONG IE NARA)	-	-	○	-	-	-	-	-	-	-	-	Korean	-	-	-
Seoul Museum of History (SMOH)	○	○	○	○	-	○	○	-	-	○	-	Korean, English, Chinese, Japanese	-	-	Lighting Control
Art Museums (Applications)	Text	Photography	Audio	Beacon	Video	NFC	QR Code	Voice Recognition	RFID	AR	VR	My Language	My Page	My Favorite	Other Personalization Settings
Amorepacific Museum of Art (APMA VISUAL GUIDE)	○	○	○	-	-	-	-	-	-	-	-	Korean, English	○	-	-
Chang Uchehin Museum of Art (Chang Uchehin Museum of Art)	○	-	○	○	-	-	-	-	-	-	-	Korean	-	-	-
Daegu Art Museum (Daegu Art Museum)	○	○	○	-	-	-	○	-	-	-	-	Korean	-	-	-
Daelim Museum (Daelim Museum)	○	○	○	-	-	-	-	-	-	-	-	Korean, English	○	-	-
DTC Textile Museum (TextileMuseum)	○	○	○	-	○	-	-	-	-	-	-	Korean, English, Chinese, Japanese	-	-	Treasure Hunter Certification
Gwangju Museum of Art (GwangjuMuseum)	○	○	○	○	-	-	-	-	-	○	-	Korean, English	○	○	Stamp, Tag, My Gallery
Inje Mountain Village Folk Museum (Inje Mountain Village Folk Museum)	○	○	○	○	-	-	-	-	-	-	-	Korean, English	-	-	-
National Museum of Modern and Contemporary Art (MMCA)	○	○	○	○	-	-	-	-	-	-	-	Korean, English	-	○	Personal Guide Tour
LeeUngno Museum (LeeUngnoMuseum)	○	○	○	○	-	-	-	-	-	-	-	Korean, English	-	-	-
Seoul Museum of Art (Seoul Museum of Art Docent)	○	○	○	○	-	-	-	-	-	-	-	Korean, English	-	○	-
THE PHONE (Mobile Museum)	○	○	○	○	-	-	-	-	-	-	-	Korean	-	-	-
Uiseong Jomunguk Museum (Uiseong Jomunguk Museum)	○	○	○	○	-	○	-	-	-	-	○	Korean	-	-	-

Table 1. The 15 technical elements that have been applied as part of the 36 guide applications, according to each major museum in Korea: the current state of the art in application guides for personalization.

The only difference between these terms is the types of object that each institution handles (Museum and Art Gallery Support Act, Republic of Korea, 2007. Revised in 2017). In light of this, this study includes the application guides produced by art-gallery museums for analysis. The earliest application was created in 2011, and since this study considers all material from 2011 to the present, all guide applications mentioned in Figure 1 are therefore within the study's scope. Both quantitative observations through an evaluation of the use of applied technologies and qualitative analysis through an online interview with a focus group consisting of curators were conducted.

In order to determine the criteria needed to evaluate the implementation of personalization, this research examines most technical elements used in guide applications. The 15 most commonly used elements were selected to understand current technological adaptations, and the applications were then classified into two groups based on their characters: personalization with primarily technical factors (11 categories) and customization that allows participatory access by users (4 categories). As seen in Table 1, the detailed classifications according to these categories include the following functions:

- Integrated technologies: Text, photography, beacon, video, near field communication (NFC), quick response (QR) code, voice recognition, radio-frequency identification (RFID), augmented reality (AR), and virtual reality (VR).
- Customizable profile with participatory access: Language, My Page settings function, My Favourite settings functions, and other personalization settings items such as My Traffic Lines and Treasure Hunter with Holographic Video.

### 2.3 Identification on Types of the Application Guides

On the basis of the classifications in section 2.2, 36 application guides were categorized by type of digital storytelling through a comparative analysis between the seven classifications presented by Digital Storytelling within the framework of Athena Plus (Europeana), forms of which notably include digital, interactive, collaborative, locative, transmedia, immersive, and generative storytelling (Brouillard et al., 2017). These elements were considered based on their interactive supports and access conditions, types of interfaces, technologies and functions, and presentation of contents (Brouillard et al., 2017). Categorizing the application guides allowed to comprehend what ways are focused on in Korea and which perspectives are lacking compared with other elements. Each type of storytelling that appeared in the application guides was identified by its rating from 0.0 to 1.0 (Measurement—degree of technological adaptation). It was completed the identification of the types of application guides was achieved by assessing on the settings: 15 primary technologies and customization elements mentioned in section 2.2 as well as through a comparative analysis with components that explain the abovementioned seven types of digital storytelling services.

Previous studies in museum communication have proposed different classifications of digital storytelling based on personal, social, or educational aspects, and so on (Park, 2014). However, in Korea, little research has been done on a conceptual framework defining types of digital storytelling, despite the rapid adaptation of technologies in technically demanding environments like VMs. These are essential criteria for evaluating how museum collections and visitors are connected in the context of

a VM. The informative and interactive dimensions of personalization that are found in museum guide applications are not based only on a single source of technology. The applications are an amalgamation of numerous sources, such as devices, information, and functions.

Given this situation, the inclusion of multiple aspects of digital storytelling is a useful tool that can explain the digital storytellings characters appropriately. The differentiation proposed by Athena Plus is thus an effective analytical framework, as one of the rationale for this study, to understand models of personalized digital storytelling in application guides of Korea.

### 2.4 Focus Group Interview with Museums Curators

Along with the aforementioned analysis, this study involved 11 major national museum curators from institutions that have acted as leaders, not only in implementing their museums personalization strategies but also in adopting advanced technologies. They were invited to participate in an online interview. The goal of the interview was to discover how museum staff understood the level of personalization in the applications that they used. Their answers were applied to the analysis of open-ended questionnaires administered to illuminate each museum's method of personalization and their visitor engagement strategies, re-use of digital contents, and understanding of the definition of a VM.

## 3. FINDINGS ON THE TECHNICAL FRAMEWORK OF PERSONALIZATION IN THE GUIDE APPLICATIONS

The analysis and results of the findings are presented to understand the state of the art of personalization within the museum context, that is, trends in the adaptation of technical elements to the museum guide applications, frequencies and preferences of the use of these technologies in the personalization frameworks, and the level of understanding of personalization by the relevant stakeholders.

Figure 2 shows the adoption distribution of the 11 technology categories. The chart shows that most museums preferred to integrate texts, photography, and audio applications, the combination of which comprised more than 90% of what the museum guide applications adopted. Video is one of the simplest communication methods; however, less than one-third (27%) of the museum guide applications introduced it. NFC, QR codes, and AR and VR technologies, all of which emerged in 2011 and have been understood as the ideal tools to maximize the interactivity and the immersiveness of an environment, stood at less than half of the total applications. There was also minimal adoption of RFID (2%) and voice recognition technology (2%).

Figure 3 demonstrates that most museums provided profile customization functions. Language (100%), for example, was a common function in the mobile application guides that were provided to the museum visitors. The functions of My favorite and Other personalization settings, which include My Traffic Lines, Lighting Control systems for the exhibitions, and so on, were less popular (47%) than other former settings, but their introduction may enhance participatory visitor access to museums, as they help visitors to more actively navigate museum narratives and content based on their own interests, curiosity, and needs.

Throughout the understanding on the overview of the composition concerning technological elements in the applications, Figure 4 shows which types of digital storytelling are used in the

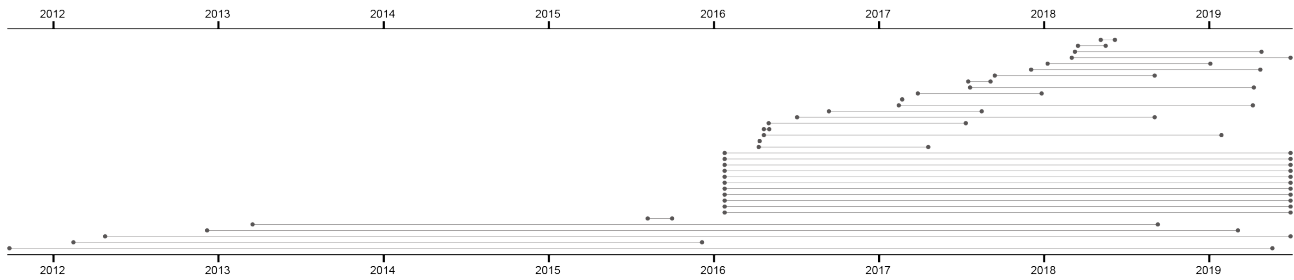


Figure 1. Overview of timespan between release date and recent update date of each museum guide application (Android) from 2011 to date. Only one dot means no update.

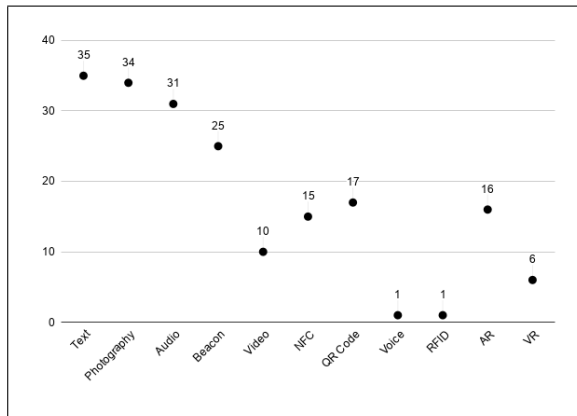


Figure 2. Application of Technologies for the Personal Mobile Guides in 36 museums of Korea.

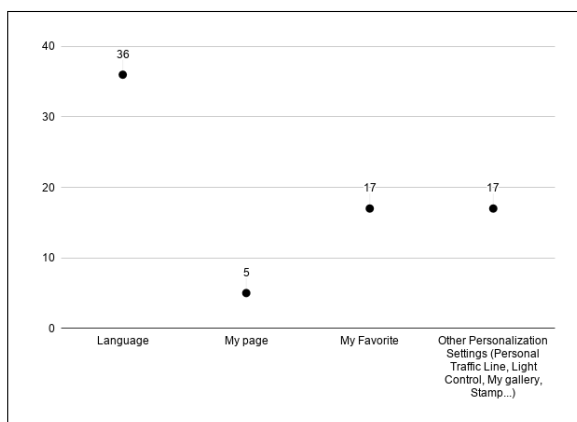


Figure 3. Customisable profile that shows participatory access in 36 museums of Korea

museum sector in Korea. The radar plots in rainbow colors describe the use of each museums guide application of the different types of digital storytelling. The bold, black line illustrates an average value of the classification of the digital storytelling in all 36 museums.

As seen in Figure 4-A, a majority of museums used both digital and transmedia storytelling. These storytelling types are meant to provide rich narratives around the objects and their attributes through photos, texts, and three-dimensional content; they need a logical layout for the multimedia resources, not complicated technologies. They also allow visitors to concentrate on the stories in more continuous and immersive environments with the help of devices such as smartphones and multi-touch

screens (Brouillard et al., 2017). The second-most commonly adopted digital storytelling types were collaborative and locative. The museums tended to rely on user-generated content, social networks, web 2.0, hyper-text, or recombined-content narrations to provide these types of storytelling (Brouillard et al., 2017). The least-prevalent storytelling types were generative, immersive, and interactive. To develop these three types, advanced technologies such as AR, AR games, and artificial intelligence have to be applied (Brouillard et al., 2017). These tools require more sophisticated technical expertise, sufficient time and budgets, so only a few major, national museums had such functions, like data visualization and generative movies, in their guide applications. Finally, as can be seen in Figure 4-B and 4-C, the adaptation of storytelling varies between the 24 museums and the 12 art-gallery museums. Paintings, sculptures, handicrafts, architecture, and so on, which are more common in the art-gallery museums, have great potential to provide more immersive, interactive, and collaborative environments for visitors. Ironically, such storytelling is rarely found.

In addition to the quantitative interpretation provided above, the results of the focus group interview with the 11 curators introduced plenty of room for further improvement and discussion. The interview group consisted of curators who actually implemented digital strategies in museums and continuously developed application guides. Some of them do not directly deal with the development of the digital strategies and the application guide but are responsible for creating and operating the contents of the museums. The open-ended questions consisted of 10 survey questions covering the following topics:

- Digital strategies of each museum: whether they concern the Government 3.0. of the Republic of Korea, international trends on the creation of digital and virtual museums, and adaptation of International Council of Museum (ICOM) principles;
- How museum staff perceive the definition of the VM and the level of personalization in the application guides;
- Preferred types of digital storytelling for the development of application guides;
- When the museum applications were initiated and how likely the museums were to create personal digital collection systems for specific purposes.

Most curators pointed out that the role of the application guides is relatively limited within the museum environment. The application guides are mainly utilized to raise the visitors awareness regarding the museums and their collections or to provide additional informative content associated with the physical museums, particularly for educational purposes. The applications

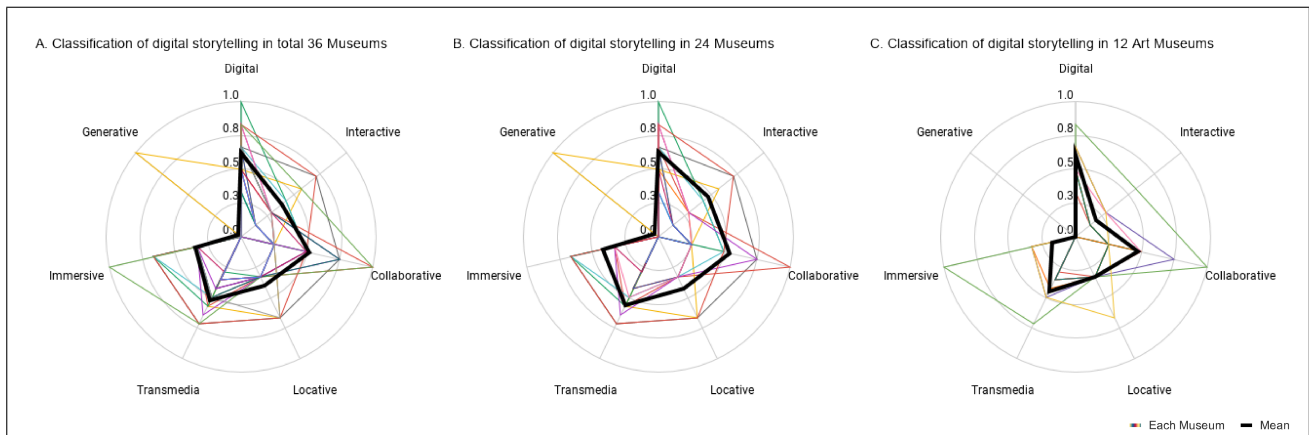


Figure 4. The radar plot shows which type of storytelling is using in the guide applications in 36 museums. A-total 36 guide applications from museums and art museums(B+C); B-24 guide applications of museums; C-12 guide applications of art museums. The Bold Black line shows the mean of all data, and the colored lines show each museum.

potential was certainly considered. They can convey the narratives as well as contexts of the exhibits and displayed objects; therefore, appropriate constructive narratives are necessary from the beginning stage of the application guide design. However, in accordance with a governmental policy, providing personalized or customized service is also a reason for operating the application guides in the museums. Their views are not very different from the conventional communication methods applied to connect visitors with the museums contents, such as the roles of labels and signboards in front of the objects. Despite the implementation of national research and development (R&D) on the creation of digital and/or virtual contents and technologies for public cultural institutions supported by a tremendous budget (Ministry of Culture, Sports, 2019), the gap between the perception of the museum sector and the governmental policy enforcement in this field seems to be very large.

Moreover, the most preferred technologies to be integrated in the applications are focused on text, photography, audio, and beacon. They agree with the usefulness and effectiveness of the application guides in terms of enhancing accessibility, interactivity, enjoyment, learning and enriching museum experience but, interestingly, there were quite skeptical views on the technological adaptation. This is because too many different types of technology can interfere with the visitors concentration on the exhibition; technologies are useful only based on the principle that they provide the visitors with an immersive environment inside the exhibition space. Also, issues of maintenance and sustainability for the adopted technologies are influenced by this viewpoint.

Likely considering the rather passive and conventional views on the guide application and adaptation of technological advances, each curator showed a different perception of the definition of the VM within the Korean museum sector. One of the similar opinions is the VMs role in enhancing the richness of the contents; many curators tended to regard the VM as an on-line museum that can substitute for physical exhibition spaces. Again, the VM is not a fixed term, and it has been constantly evolving by referring to changed environments and technologies (Ivarsson, 2009), as substantially discussed in the current debate on how to perceive the VM in V-Must, ViMM, or other Europeana Initiatives. However, such discussions and in-depth critical thinking on the VM look quite inactive, making it premature to establish a largely agreed consolidated notion of the

VM among the museum sector.

Finally, despite the efforts to provide application guides over the last ten years, we noticed a lack of reviews on measuring visitor satisfaction, current status of use, or effectiveness of the applications in diverse aspects (educational, social, entertaining, emotional, immersive, and the m-learning field related to personalized application within multiple contexts) (Messenger, 2015). This situation may explain why the features in the latest application guides look similar to those in the early stage, as well as the large gap between the public museum sector and the content creation industry sector. Indeed, there has been no opportunity to identify and consult the growing demands and needs related to the applications.

#### 4. DISCUSSION

In addition to offering an overview of the current state of the art of personalization observed in application guides across the museum sector of Korea, this study analyzes their level and degree of communication with and engagement for visitors via different forms of digital storytelling. Such an analysis draws the attention of the museum community to the critical roles of VM and technological adaptation in the museums primary functions. Moreover, it aims to offer insights to the museum sector; based on these insights, recommendations can be derived for synthetically developing future application guides that consider the currently overlooked important factors.

As shown, various technologies are available for the production and operation of application guides and each guide implements a different combination of technologies. Figure 5 is a map visualization presenting the correlation between the distributions of technical elements in all museum application guides. The size of the circles and their connections to various technologies represent the current frequencies and preferences, respectively, of the use of these technologies in the personalization framework of each museums application guide. The major national museums adopted advanced technological functions in user interfaces and user interactivity. However, the small- and medium-sized museums as well as local public museums adopted rather conventional narrative methodologies.

These findings can be used to categorize the types of digital storytelling and identify their roles in describing the tenden-

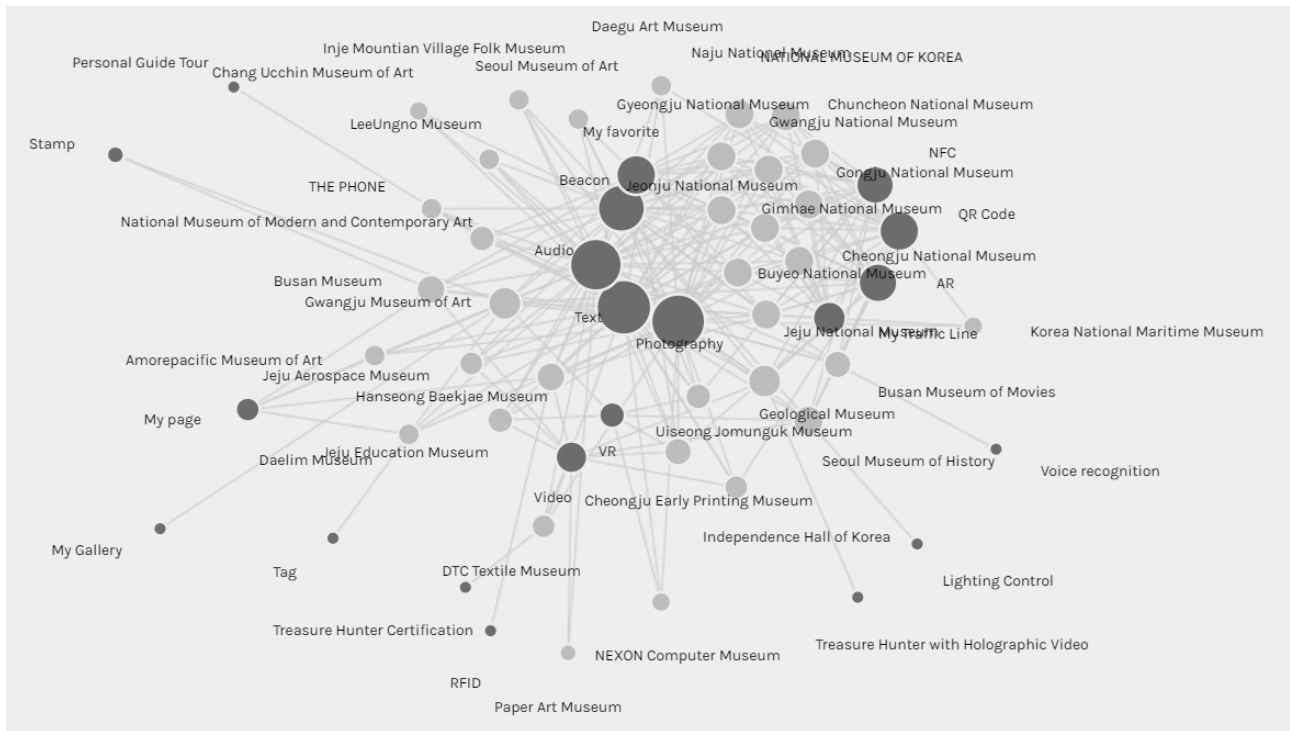


Figure 5. Visualisation of the various technologies adopted in total 36 museum applications from 2011 to 2019

cies that have developed with the conceptualization of VM in Korea. As outlined in the V-Must project, the essential qualities of VM comprise issues related to personalization, interactivity, and richness of the content (Perry et al., 2017). Based on these elements, VM is often considered as a responsive museum or space (Roy, Christal, 2002). Owing to the integration of technology into museum application guides, visitors can access a wide range of collections, personalize their experience, and actively re-use the information for their own interests. They can also contribute their own interpretation and input to engage in new dialogues within the museums.

Results of the digital storytelling analysis show that most Korean museums applied user-generated content, social networks, web 2.0, and hyper-text to their guides or recombined content narrations, which is not as advanced as other approaches such as artificial intelligence, AR, and AR games that enable generative or locative storytelling. In other words, Korean museums primarily present two essential qualities of the VM: personalization and richness of the content. However, the level of reciprocity or user-driven engagement shown in the museum application guides is not sufficiently applied in comparison to the latter approaches.

Utilization of technologies in application guides are also connected to the learning perspectives in museums. Lifelong learning is a priority in Korean museums. As indicated in section 2.1, constructivist learning principles are valid to the creation of a VM environment because learning is a process of constructing knowledge (Styliani et al., 2009). The integration of technology in application guides can allow visitors to create the immersive environment associated with museum collections based on visitor interests, thus fostering fruitful interactions. Therefore, to offer visitors a sense of engagement, the appropriate design of digital technology in guides can be a key strategy to transform multidirectional learning activities into a more participatory experience by adopting visual tools and technologies (Ross,

2013).

Finally, the focus group interviews showed that some issues related to communication and interpretation as well as understanding technologies in implementing personalization still need to be resolved. Using advanced technologies and sophisticated communication devices in relation with museum collections involves collaborations between the theoretical knowledge of museology and pedagogy and practical knowledge of digital technology or sciences. To achieve the aim of museums, a consolidated and common vision is required. Moreover, reviewing and evaluating both the technical and theoretical aspects of application guides will help create new opportunities and strategies for better engagement and interpretation within the museum environments.

## 5. CONCLUSION AND FUTURE WORK

This paper discussed all available museum guide applications in Korea to present an overview of the museums personalization strategies highlighting the technical efforts behind personalization and visitor interactions. To date, most previous research projects investigating the application of ICT tools in museum exhibitions have focused on evaluating how each museum presented its digital media using an analysis of case studies. However, there is no overall synthetic understanding of the characteristics of the museums application of digital media by examining the types of media used to present the museums content, especially digital storytelling. This paper contributes to filling this gap in the literature by addressing how museum communities can avoid duplication of resources when creating their application guides when developing the appropriate digital strategies to realize the VM in their exhibitions, as pointed out by the focus group interviews conducted in the museums.

In addition to its contribution to the literature, this study has some limitations. It is not possible to comprehensively map the



technological tendencies of museums, which, to a certain degree, limits the a wide-range discussion of the digital strategies used by museums (Ministry of Culture, Sports and Tourism, Republic of Korea, 2017). The latter limitation is due to the fact that the analysis of the personalization is limited to the museum guide applications; personalization methodologies in the VM have multiple meanings that also cover virtual reconstructions of the museum collections so on. However, the scope of this paper does not include those types of elements. Moreover, the focus group interviews only included people from the major museum in Korea, so different local contexts relating to how museums in that country adopt technologies were not considered.

Nonetheless, this study's findings will help museums in Korea establish a personalization environment within their museum exhibitions by identifying the practical considerations that prevent them from delivering the messages they want to convey using technology, so they can provide educational learning opportunities. Hence, it would be worth mentioning that, in Korea, the museum communities involvement in global debates on the VM is somewhat static. However, understanding the current state of how VMs are being implemented could act as a driving-force for these museums to participate in the on-going discussions on the evolving definition of a VM.

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