The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XLVIII-M-9-2025
30th CIPA Symposium “Heritage Conservation from Bits:
From Digital Documentation to Data-driven Heritage Conservation”, 25–29 August 2025, Seoul, Republic of Korea

Digital Heritage Narratives of Korean Stone Pagodas: Documentation, Digitization, and GLAM Contents Disseminations

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Keywords: IIIF, API, Digital Heritage Imaging, GLAM, Iconography, Stone Pagoda.

Abstract

Established in different eras of Korea, stone pagodas have carried similar fates over time: the two identical Ten-Story Stone Pagodas from Gyeongcheonsa and Wongaksa Temple sites have witnessed the ever-changing histories of the peninsula since the mid-fourteenth century. With identical appearances in terms of form, structure, narrative reliefs, and ornaments, the twin pagodas inherit the transformations of religious thoughts and iconography. This paper is dedicated to the symbolic twin pagodas safeguarded in Seoul nowadays, as the vanished stone pagoda in the excavation site of Iksan, Korea. The research spans the history, iconography, digital documentation, conservation process, and the GLAM contents. It aims to investigate the cultural memories of the artifacts and sites through the scopes of digital archaeology and digital heritage imaging. Emerging technologies assist in unveiling the forms, materials, migrations, and dissemination of the tangible heritage through the virtual realm. Through cross-disciplinary studies, the digital heritage narrative takes shape and weaves the cultural skin of the land.

1. The Pagodas and Their Cultural Memories

1.1 History of the Twin Pagodas

The common knowledge of temple site histories can be traced back to the canon - Samguk Sagi. The construction of large temples began immediately after Buddhism was officially recognized on the peninsula. These include the temples but are not limited to Heungrin, Hwangryong, Gion, Jitsugyo, Yeongheung, Saburo, and Bunhwang. Hwangryongsa Temple, for example, was built by King Jinheung, the founder of Silla. With the visit of Jajang to Zen Master Wonhyang at Jungnamsan, thus was told the master, that if Jajang viewed the king's country with contemplation and built a nine-story "stüpa" at Hwangnyongsa Temple, then all the countries in the eastern seaboard would surrender to the king's country. (Huang, 1974) Jajang’s proposition motivated the construction of the nine-story wooden pagoda of Hwangnyongsa Temple.

The Ten-Story Stone Pagoda of the Gyeongcheonsa temple site was established in 1348 A.D (4th year of King Chungmok's reign) according to the inscription at the base tier of the pagoda. It is noteworthy that it has a special form that was greatly influenced by the Yuan Dynasty that ruled Goryeo at the time. The strong ties between them can be examined in the inscription at the base tier of the Ten-Story Stone Pagoda of Gyeongcheonsaji. The wishes for prosperity and stability between the two countries, and the Buddhist belief in the sentient beings are addressed in the inscription (available from NRICH inscription search engine). One hundred years later, it became the base of the Ten-Story Stone Pagoda at the Wongaksa Temple site (1465 A.D.) built in the early Joseon Dynasty by King Sejo, the monarch of Heungbul. The two stone pagodas are almost like the Twin Towers due to their identical height, forms, narrative reliefs, and material (marble). Also, unfortunately, the twin pagodas suffered from looting and displacements.

1.2 Triad of Stone Pagodas at Wanggung-ri Site

Based on the wishes to revive the Baekje Kingdom (1st century B.C. to 7th century A.D.) and pacify the people, monasteries such as the Mireuksa temple were established. The excavated artifacts and site formations reflect the close ties between China and Korea in the earlier époque. Anecdotes and legends related to this history are recorded in the Samguk Yusa. While the Wanggung-ri site is equipped with elements influenced by Yuan architecture, the five-story stone pagoda at the center of the site has a shape more in keeping with traditional Korean stone pagodas. It is a typical Baekje stupa with its thin roof stone and upwardly curved eaves edge. Although there is no clear documentation on the date of construction of the five-story stone pagoda, it is assumed that the pagoda was built during the period of the Unified Silla Kingdom’s restoration of the Wanggung-ri relics. Evidence can be found on the characteristics of the top stone and the foundation structure. The five-story pagoda was dismantled in 1965 for restoration purposes, and the buried foundation stone and Buddhist artifacts preserved in the pagoda were brought back to light.

2. Iconography of Stone Pagodas in Korea

2.1 The Ten-Story Stone Pagodas at Geyongcheonsai site and Wongaksaji site

The Ten-Story Stone Pagoda of the Gyeongcheonsaji and the stone pagodas of the Mireuksaji site represent the primitive and fusion styles of the architectural structures of Korea (Goryeo and Baekje style) and the influences of Buddhism (Amitābha and Maitreya belief). The belief in Pure Land is manifested by the Buddhas, bodhisattvas, arhats, Heavenly Kings, Jataka tales, Nirvana, assemblies and transformations of Buddhist sutras in tiers after tiers of narrative reliefs. The architectural features depicted on the stone pagoda, are on the contrary inspired by the traditional timber-frame structures in East Asia and China, such as columns, eels, roof, and brackets. The lives, interests, and

values of the Wongaksaji site during the late Koryŏ and early Chosŏn era of Korea were depicted in the Korean scholar's work - Yongjae’s Collection of Essays. In Volume 7 of the collection, the naming, daily and utility functions for education are vividly depicted in the ancient record:

“圓覺寺是古大寺之基。初有大殿及東西禪堂而已。慣習都監寓大殿西禪堂。禮葬都監寓東禪堂。大殿之北。爲中部儒生所會。世祖皆命毀撤。更創大伽藍。名曰圓覺。以銀川君玉山君爲提調。兼大司憲。常於路上用憲官之儀。所由二人呵辟。又令騎士吹簫角前導。士女坌集聚觀。寺成設慶讚會。上屢臨幸焉。有天雨四花舍利分枚之異。屢加百官級。其後中部移於架閣庫之基。禮葬都監。寓松峴行廊。屬歸厚署。慣習都監合於奉常寺之樂學。而名曰樂學都監。未幾改爲掌樂院。洪仁山爲提調。以其地狹人衆。移今之地而大創之。宏堂傑搆。甲於諸廨。爲百官習儀之所。又爲科場取士之處矣。”

The “twin pagodas” referred to in this research paper point to the Ten-Story Stone Pagoda at Wongaksa Temple site and the Gyeongcheonsa Temple site, which share identical form and style. Due to the drifting and historical record of the stone pagoda at the Gyeongcheonsa Temple site, which was dismantled and then reassembled by the Japanese, the evidence and comparisons between the two stone pagodas get even more challenging. Yet we can still dive into the religious aspect and get the facts unveiled. As addressed in the earlier paragraph, Buddhist belief is intended to spread and disseminate through inscriptions, temple sites, and sculptures. These are the common methods to transform the dharma (teaching) in the canons into visual forms for easier comprehension and distribution. The narrative relief, pagodas and temples, deities, and drawings, are very common practices to be seen in the Buddhist heritage sites. Researchers and practitioners get to identify and coin the time, realm, artisans, and different schools of teaching through textual and visual records. From the two-dimensional depictions on the papers to the three-dimensional structures and sculptures on the walls and entrances, it creates a multi-dimensional universe for religious teaching.

The twin pagodas inherit the narrative of religious transformations, and also the fusion of architecture codes and forms - Lamaist building techniques of the Yaun Dynasty in China and the timber-frame-like Dougong structures. The base of the two pagodas, for example, gets shaped with a similar floor plan as the Chinese character 亞. Meanwhile, decorative elements such as lotus and majestic arabesque patterns are found as shared features in the twin pagodas. Even though the format of the depicted motif might not totally be the same, similar types of genealogy can still be found in the subtle details between the twin stone pagodas. Dr. Jung Young-Ho in his comparative trial study of the twin pagodas further points out the similarity and diversity between the twin pagodas: Wongaksaji Pagoda is with outstanding technique under the context of anti-Buddhism of the Joseon Dynasty, therefore it is evaluated not only as a Buddhist sculpture, but also crucial for the study of the Joseon Dynasty. In the earlier days of the Unified Silla period, there were artistic stone pagodas such as Baekjangam three-story stone pagoda of Silsangsa Temple (National Treasure No. 10). Yet it was not like Gyeongcheonsa Pagoda that had both architectural and structural features uniquely equipped, despite the fact that it was dismantled and installation method became unknown. Gyeongcheonsa Pagoda is the only stone pagoda in its form that cannot be found in previous generations, and Wongaksa Pagoda is the only one that gets to juxtapose with Gyeongcheonsa Pagoda in terms of form, material, and timeframe. Religious speaking, Buddhism in the Joseon Dynasty was on the decline due to the national policy of rejecting Buddhism from the beginning. However, during the reign of King Sejo, Buddhism was advocated and the king himself began to worship Buddha. This was the time when Buddhism was revived in the Joseon Dynasty and the time that Wongaksa Temple was founded.

Dr. Jung further addresses the potential research directions for the twin pagodas:

“Every time I look at Gyeongcheonsa Pagoda, I wonder if each part was placed in its original place during restoration…..the tenth-floor roof stone appears to be larger than the seventh, eighth, and ninth-floor roof stones. Therefore, I think that Gyeongcheonsa Pagoda should also undergo detailed measurements as soon as possible like Wongaksa pagoda, and that permanent preservation measures should be established through detailed observation and diagnosis by experts. This is because it suffered a lot of damage to each part during its long ordeal, and although it was partially reinforced during restoration, it is thought that there are still some shortcomings.” (Jung, 1993)

In terms of religious iconography, Jataka tales depicted on the twin pagodas represent the quintessential Buddhist scriptures which get transformed into part of the architectural languages. The numerous moral tales that recount the former incarnations of the Buddha, either in human or animal form, get deployed for the learning and teaching of the Dharma, and we get to identify the correlations between the sites and the structure for better understanding. Cave temple sites like Mogao Cave in Dunhuang embrace Buddhist iconography such as Jataka Tales (Prince Sudojeja's life, Lady Nokmo, Prince Seonban, Lion who Vowed a Firm Oath, Seonhye, Sudae Ra, Lion after death, Mahasattva, king Sibi and King Deer), transformations of sutras (Sutra of Observation, Pure Land of Bhaisajyaguru, Pure Land of Maitreya, Repaying the Grace of the Buddhas, Repaying the Grace of the Parents, Lotus Sutra, Buddhavatamsaka Sutra, Vimalakirti Sutra) and Assemblies (Amitabha Buddha's Assembly, Tryadhva Buddha Assembly, Gugak Assembly, Dragon Flower Assembly, Prabhutaratna Buddha Assembly, Buddhavatamsaka Assembly, Complete Enlightenment Assembly, Lotus Assembly, Bhaisajyaguru Buddha Assembly, Disaster Relief Assembly, Shakamuni Buddha Assembly, Shurangama Assembly) (Hong, 1993).

The diverse transformations from the Jataka tales and the sutras possess diverse levels on the twin pagodas and assist in conducting comparative studies toward the structural design of the twin pagodas from the above aspects. One of the shared depictions on both of the pagodas is the well-known tales of Journey to the West – the earlier tales where Xuanzang's journey to India in search of Buddhist scriptures with Sun Wukong, Zh Bajie, and Sha Wujing. For the purpose of popularizing and drawing the attention of international visitors in the contemporary era, we witness the efforts of the museum to depict this famous story through contemporary transformation – computer animation and projection mapping.

2.2 Stone Pagodas Triad at Wanggung-ri Site

In the Wanggung-ri archaeological site, the uniqueness is the three-main-hall, three-pagoda structures. The structures are nowhere else to be found in other Korean historical sites related to the Three Kingdoms era. The Five-Story Stone Pagoda

(National Treasure No. 289) and the Stone Pagoda at the Mireuksa Temple Site (National Treasure No. 11) represent diverse shapes and forms from the Ten-Story Pagodas in Seoul - the polygonal structure of the stone pagodas in Wanggung-ri Site represent more primitive and the most ancient style in Korea than the hybrid structure of the stone pagodas preserved in Seoul. Listed in the UNESCO World Heritage Site in 2016, the pagodas, the site, and the unearthed artifacts (e.g., Sarira Reliquary) confirm the laid foundation and the exchanges of culture and religious belief between China and Korea back then. In 2016, the Wanggung-ri Site was inscribed on the UNESCO World Heritage List. In the Wanggung-ri archaeological site, the uniqueness is the three main halls and three pagodas structure. The structure is nowhere else to be found in other Korean historical sites related to the Three Kingdoms era. The Five-Story Stone Pagoda (Korea National Treasure No. 289) and the Stone Pagoda at the Mireuksa Temple Site (Korean National Treasure No. 11) represent diverse shapes and forms from the Ten-Story Pagodas in Seoul - the polygonal structure of the stone pagodas in Wanggung-ri Site represent more primitive and the most ancient style in Korea than the hybrid structure of the stone pagodas preserved in Seoul. The main part of the pagoda, which stands on a pedestal, has a three-tiered roof support structure on each floor, which is symmetrical from every angle. The five-story stone pagoda is constructed of sturdy stones, and its top shape is similar to that of the mountains in the Iksan region. Such features show the localized development of stone pagoda-type architecture in Korea at that time, reflecting the development of local aesthetics and technology in the visual form, and creating a clear difference from stone pagodas with Chinese architectural elements of the same period.

The five-story stone pagoda has no obvious relief or floral patterns around its circumference, but the image of a lowly Baekje man at the base of the pagoda is meant to pay homage to the heavens, reflecting the prevalent religious spirit of the time. A series of Buddhist artifacts such as a glass relic vase and a gold relic jar, which were found enshrined in the pagoda in 1965, show that the pagoda was built for a Buddhist function. Although the five-story stone pagoda is a traditional Korean stone pagoda in appearance, it contains many elements from China. In China, there were stupa bases as early as the Northern Wei Dynasty and relics in the Sui Dynasty. The system of burial, which was developed through continuous localization practices after the introduction of Buddhism to China, is nevertheless embodied in the stone pagodas of the Baekje period in Korea. In addition, the stone pagodas, the ruins, and the excavated artifacts (e.g., Sarira Reliquary) confirm the laid foundation and the exchanges of culture and religious belief between China and Korea back then.

3. Documentation, Restoration and Digitization

3.1 Documentation of Gyeongcheonsaji Stone Pagoda

Knowledge gained from excavations and field research is stored in the museum for multifunctional applications. Institutions established next to the archaeological or heritage sites are to meet the above needs. Digitization of sites and artifacts has become the standard and preliminary step along with the excavations and unearthing of objects and structures. Onsite digitization not only assists in keeping the integrity of the physical objects but also fulfills the demands of remote access later on. The raw data further transforms into digital assets for the narrative of museums.

The Ten-Story Stone Pagoda of the Gyeongcheonsaji has been through various relocations and dismantling due to illegal exportation and the challenges of storing. The 120 years of drifting by smuggling, dismantling, and temporary outdoor placement deteriorated the integrity of the stone pagoda. Through the joint forces of NRICH and the National Museum of Korea, the Ten-Story Stone Pagoda of Gyeongcheonsaji finally settles down in the NMK and provides the opportunity for cross-disciplinary research, public education, and digital heritage content dissemination.

3.2 Ten-Story Stone Pagoda Restoration at Wongaksaji Site

The earlier restoration effort of the Wongaksaji Ten-Story Pagoda was back in the 20th century by American military engineers toward the pulled-down portion on the top of the pagoda since the 1590s. In J.S. Gale’s “The Pagoda of Seoul”, the stone pagoda also left evidence of existence in his texts and photos. Introduction by Gale toward the visiting experience and the historical context of the stone pagoda get disseminated to the global readers in English.

Cultural Heritage Management Bureau's comprehensive survey project and documentation spanned from June to December 1992 for the Ten-Story Stone Pagoda of the Wongkaksaji site. It went through planar measurements, photography, and rubbing documentation to record material analysis, weathering status, and contaminations. Through the joint efforts of academia, conservation labs, and research institutions in Korea, sophisticated records unveil subtle details all over the pagoda. All the way from level one to level ten, delicate line drawings document the structures in detail: wooden-carpentry-like Dougong structures, columns, rafters, reliefs, railings, tiles, eves, elevations, cylindrical corners, multi-roofed pavilions, and three-tiered pedestals are all included by the breakdowns of each level. Plan views of thumbnail sizes for each level are provided along with drawings to specify the coordination and position of the level. The spectators know exactly which part to look into without being lost in the navigation - a ten-story marble pagoda with a three-story base and a ten-story body.

3.3 Five-Story Stone Pagoda Digitization at Mireuksaji site

In the 1990s, the Five-Story Stone Pagoda at the Mireuksaji Temple site was dismantled due to safety checks, contaminants removal, and deterioration restoration. The stone pagoda located in the Mireuksaji Temple site is the oldest and largest surviving wooden-style pagoda in Korea, constructed of granite in various combinations of sizes. It is representative of the transition from wooden to stone pagodas, which is significant in architectural history. In the 1990s, the stone pagoda at the Mireuksaji Temple site was dismantled for safety inspections, removal of contaminants, and repair of deterioration (Kim, 2017). During the demolition process, artifacts such as gold jars of relics and gold plates recording relics were found inside the pagoda, reflecting the state of Baekje culture at that time and cultural exchanges with Silla, China, and Japan. The gold plate records detailed information such as the time when the jars of relics were enshrined and the purpose of the construction of the temple. The unearthed relics greatly fill the gaps in the knowledge of Baekje’s architectural form and construction techniques in the academic world, and provide the basis for the historical authenticity of the connotations of Mireuksaji Temple and the stone pagoda itself.

As Korea's 11th National Treasure, the Mireuksaji Temple Stone Pagoda has only six floors and is severely damaged, but it carries Korea's architectural techniques and religious culture of the time and is of great historical significance. The Mireuksaji Temple Stone Pagoda is currently undergoing a nearly two-decade-long restoration that ended in 2019. During the dismantling of the stone pagoda, the staff used 3D scanning technology to record in detail the flat image of the stone pagoda and the shape of the materials, etc., and the resulting three-dimensional image data, along with records of the on-site survey and other records, were included in the database of the National Research Institute for Cultural Heritage. This valuable information is not only a digital record of the original state of the pagoda but also the basis for future academic research on the structural restoration of the Mireuksaji Temple pagoda and the causes of its collapse. During the restoration process, the Cultural Heritage Committee insisted on inferential restoration, respecting the original materials and state of the Stone Pagoda and minimizing the impact of modern technology on the Stone Pagoda.

The excavated artifacts from the Mireuksaji Temple site are stored in the Iksan National Museum in the southwestern part of the Mireuksaji Temple site, forming a sustainable conservation system that combines the site, the artifacts, and the restoration. In addition to the exhibits, the museum also breaks through the boundaries of interpretation through multimedia digital technology such as VR to visualize the era of King Baekje-mu, using 3D restoration data to recreate a three-dimensional image of Mireuksaji Temple and the stone pagoda based on the research and evidence conducted. Storing and displaying the stone pagoda in digital form realizes the inheritance of culture in both time and space and visually conveys the value and significance of the Mireuksaji Temple stone pagoda to visitors.

4. Documentation, Restoration and Digitization

4.1 Documentations and XR Experiences of Twin Pagodas

The virtual displays under the museum context work as consecutive storytelling paths alongside the collections to provide immersive experiences. National Palace Museum of Korea is known for its abundant collections and immersive experiences such as the digital corridor of the Sharing Room, Interactive Media Wall, and VR/AR Experience Zones. Large-scale video installations also get applied to demonstrate the conservation process of the royal textiles. For the digital narrative of the twin pagodas in Seoul, the National Museum of Korea (NMK) profoundly blends the immersive experiences into the storytelling of the Ten-Story Stone Pagoda of the Gyeongcheonsa temple site.

Situated at the heart of the Capitol area, NMK in Seoul provides all possible means to depict the structure, relief, motif, and drifting history of its permanent collection - The Ten-Story Stone Pagoda of the Gyeongcheonsa temple site. AR info of the iconography towards the reliefs gets triggered by pointing mobile devices to the targeted parts of the pagoda. Touch-screen Kiosk displays are available around the pagoda with detailed information while the audiences escalate to the upper floors. Audiences will get access to the information of the collection at their fingertips without being restrained by the scale and height of the pagoda. The Immersive Digital Gallery program further pushes the boundary by utilizing projection mapping to seamlessly introduce the pagoda to the audiences in a performative and entertaining way. The mapping performance takes advantage of the Ten-Story Stone Pagoda of the Gyeongcheonsaji inside the museum to create attention while the light is off. The story of Journey to the West is taken to life by the protagonists' traveling along the appearance of the pagoda. The heritage object gets transformed by the technology to dynamically tell the story. The unique structure from the base to the top of the pagoda gets illuminated level-by-level from the dark. Reliefs that represent significant iconography get emphasized by the vivid animation for storytelling. The project mapping technology transforms the tangible national treasure (No.86) into a "narrative pagoda".

The other half of the twin pagoda - the Ten-Story Stone Pagoda at the Wongaksa Temple site (National Treasure No.2), is the significance of how documentation and restoration come into place during the digitization process. As addressed in the above paragraph, the details of the pagoda were thoroughly surveyed by traditional documentation. The high-density point cloud model gets piled up to represent the three-dimensional perspective of the pagoda. The open-data platform of CHA further provides the protocol for global users who need to apply the data toward academic and research. The high-density point cloud model can further be compiled into a polygonal model based on needs or directly imported into the authoring engine which supports the point-cloud visualization. The ubiquity and open access demonstrate the potential of global collaboration and international interoperability.

4.2 Immersive Representation of Triad of Stone Pagodas at Wanggung-ri Site

Alongside the permanent collections of excavated gilt-bronze objects from the Mireuksaji site, the Iksan National Museum is equipped with wearable devices ranging from cardboard viewers to Magic Leap. These devices enable AR narrative onsite for the needs of the audiences, while the animation accompanies the collected objects through displays and LED walls. The animated contents demonstrate the building process of the structure. Video recordings of the interviewees' testimonies and memories of the surrounding works as holographic displays to symbolically recall the visiting experiences and oral histories of the site. Curatorial approaches of mapping the memory to the unearthed objects get visualized through the motion graphics of the related inscriptions and literature works.

The miniature reconstructions of the Mireuksaji site and the infographic of history deployed in the Iksan National Museum assist in comprehending the dimensions and time of the site. Utilization of the digitized heritage data further takes the audiences to experience the knowledge, memory, and aesthetics beyond the vanished sites and objects. To integrate the immersive experiences onsite and in the virtual realm, the stone pagoda and temple site virtual representation of the Iksan National Museum manifests the good practice of preserving historical memories through virtual visualizations and curatorial approaches.

4.3 Adolescents and Disability Community

The visual impacts of the curatorial approaches are able to strike the minds of usual audiences. For the visually impaired community or spectators with limitations to digest the regular programs (such as disability, various age groups), GLAM institutions (Gallery, Library, Museum, Archive) are supposed to take care of the above communities by addressing the accessibility design in the exhibited works and deployed collections. In terms of digital heritage collections, printed

materials, 3D models, miniatures, interactive displays, and visiting routes need to be considered and organized as a whole. To fill the above needs, we have witnessed the facilitation of accessibility design in the museums of Korea. From the height of the touch-screen kiosks along the exhibited works, to the large-LED interactive gallery for multi-user interactions, the concepts and consolidations to take care of various user groups and communities get manifested in the game-play, storytelling, haptic interactions, and takeaways from the visits.

5. Digital Heritage Narrative of the Wongaksa Ten-Story Pagoda

5.1 IIIF and Open Source API For Interoperability

International Image Interoperability Framework (IIIF) is explored in this paper for its ubiquity, annotation, data processing, and crowd-sourcing features. SPARQL, manifest.json, image server (e.g., Cantaloupe), storage server (Aliyun OSS), MySQL, Mirador, and Diva.js viewer are among the common usages in the existing projects to integrate digital heritage data. Institutions employ IIIF for project integrations and academic exchanges such as Academia Sinica Center for Digital Cultures, Intellectual Computing Laboratory for Cultural Heritage, Chinese Academy of History….., etc. The projects range from semantic data of cave temples, and oracle bone scriptures to the history records of WWII. Chicago House, for example, employs IIIF as well to combine the 2D line drawings and 3D models as interactive navigation for the global audiences to explore the King’s Chamber prototype (one of the six chambers in the inner Sanctuaries of the 18th Dynasty temple at Medinet Habu). It further inspires this paper to apply IIIF as the possible option for the Ten-Story Stone Pagoda at the Wongaksaji site.

As addressed, documentation of hand drawings, rubbings, and high-density point cloud model for the Ten-Story Stone Pagoda of Wongaksaji Site was accomplished by the local institutions. Once the effort is made by further utilizing frameworks such as IIIF to interactively navigate different levels, pagoda structures, two-dimensional line drawings, and rubbings, and map them onto the high-density point cloud model with the annotations contributed by the academia and researchers, the existing documentation data can get transformed into a further dynamic knowledge repository for potential interoperability.

5.2 Wongaksa Ten-Story Pagoda API Prototype

The open data support by the Cultural Heritage Administration of Korea makes possible the potential API prototype - the cultural heritage 3D data for scan, modeling, 3D printing, and videos available (except sell and distribution) through the official inquiry to CHA. Wongaksa Ten-Story Pagoda 3D data assists to visualize and integrate into the API prototype. Chicago House and its open-source project of the King’s Chamber inspire the 2D/3D heritage data integration prototype of this research.

The National Cultural Heritage Portal of CHA publishes detailed line drawings of the Ten-Story Stone Pagoda at Wongaksa Temple Site, Seoul. The thumbnail navigation marks identify the coordination of the stone pagoda, and the hand drawings break it down into categories based on levels, structures (plans, rafters, columns), and motifs (reliefs). Since the majority of the structure has similar features to the wooden carpentry architecture, the motifs are almost identical to the untrained eyes. Breaking down into categories makes it easy to recognize, comprehend, and study. By utilizing the Chicago House open-source repository, this research will further integrate the data of Ten-Story Pagoda into the global framework like IIIF for further interoperability. As addressed, IIIF has been adopted by academic researchers to provide an open and ubiquitous framework for scholarly annotations. The research will further investigate the integrations of low-polygonal 3D model navigation, superimposing of line drawings to the high-density point cloud visualization, and interactive contents for labeling and annotations.

5.3 Digital Heritage Imaging as Safeguarding

The legend of pagodas such as the nine-story wooden pagoda of Hwangnyongsa is to be found only in the historic record nowadays. All the rest of the original temple structures in the surroundings were also destroyed during the Mongol invasion. A new opportunity to reimagine the existence of the stupa was taken to life by the National Research Institute of Cultural Heritage (NRICH) through augmented reality technology. Thus have we realized that the life span of the tangible and intangible heritage is as ephemeral and fragile as life itself – catastrophes arrive unpredictably, and mankind is subtle while facing challenges. The earlier pandemic has once again proven the vulnerability of civilization. Even under the drastic challenges, we have fought our way to the daylight for the spark of humanity. GLAM institutions respond to the social distancing and disconnect of daily functions by employing virtual platforms and digital data to resume the opportunities for learning and academic exchange despite the physical burdens caused by human factors. The objective is not only limited to resurrecting the aura or haptic experiences in the in-person visits to the collections but also to sustain and augment the exchange of knowledge and ideas while any onsite accessibility is an exhausted opportunity. These scenarios are not from the cause of the pandemic alone, but also the natural disasters and unexpected incidents conducted by mankind. In the era that we live through, numerous events have taken place in front of us such as floodings around heritage sites, fires over historical cathedrals, vandalism on top of objects and sculptures, and destruction of the structure out of ideology. In some cases, we are lucky to have the previous efforts as preventive conservations to keep the whole or part of the sites and objects in the virtual realm before the incidental loss of them in the physical world. In other cases, we don’t.

Before the vanishing of the sites, objects, and rituals, digital documentation is among the various solutions such as risk assessments and preventive conservation to save at least some portions of the collective memories. To facilitate the above, raw data obtained by digitization is the preliminary and indispensable step with the archaeological excavation and unearthening. The virtual platform works as a medium to augment knowledge and preserve the tangible heritage in a non-intrusive way. Archaeologists, conservators, and practitioners employ these procedures along with in-situ research as common practice nowadays. Transcending from the scope of interpretation and the debate of authenticity, digital heritage methodologies carry further obligations to sustain and preserve collective memories for mankind.

Acknowledgements

Sincere gratitude toward the unconditional supports from Chicago House, Cultural Heritage Administration, National Research Institute of Cultural Heritage, Research Institute for the Mahan-Baekje Culture and KAIST.

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