A Virtual Reality to Present Sand Stone Buddha Statue of Phayao's Craftsmen

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Abstract

The project involving the virtual reality representation of sandstone Buddha statues crafted by artisans from Phayao holds significant importance within the realm of Buddhist arts. Originating during the Lanna Kingdom, specifically spanning the 19th to the 22nd Buddhist centuries, these statues have garnered distinction as a unique and exceptional form of artistic expression. A testament to the enduring opulence of the Lanna Kingdom, these artifacts continue to resonate in contemporary times. This research endeavors to adopt a novel approach, fusing artistic and methodological elements to unveil its findings. A comprehensive search was undertaken, underpinned by a creative amalgamation of art and research. A compendium of relevant scholarly sources was amassed, shedding light on the sandstone Buddha statues attributed to the skilled craftsmen of Phayao. Subsequently, employing the innovative technique of photogrammetry, By DSLR camera and use the program (Agisoft Matashape) for processing. intricate three‑dimensional renditions of the Buddha were meticulously created. These digital representations served as the foundation for the ensuing construction of an immersive virtual reality environment—a platform conceived to be accessible to the broader populace, facilitating their engagement with this cultural heritage. The resultant feedback derived from the assessment of the polygonal 3D models of Phayao artisans' sandstone Buddha statues underscores a pronounced level of satisfaction. The evaluative metrics yielded an impressive satisfaction rating of 4.25— Satisfaction is at a high level. a testament to the profound enjoyment experienced by the participants within this virtual realm.

Keywords: Sandstone Buddha Statues of Phayao's Craftsmen, Virtual Reality, Photogrammetry

Introduction

Phayao, situated in the northern region of Thailand along the Ing River, holds a pivotal position within the historical tapestry of the Lanna Kingdom. This province bears considerable historical significance, particularly during the 19th Buddhist century, spanning from 1977 to the present day (Phanintra Teeranon, 2015). Notably, Phayao emerges as a treasure trove of archaeological riches, with a pronounced focus on the unearthing of sandstone Buddha statues. These discoveries, interwoven with Phayao's artisanal legacy, stand as a testament to its vital role within the broader landscape of Thai craftsmanship.

The sandstone Buddha statues of Phayao encapsulate the zenith of Buddhist artistry and craftsmanship, epitomizing the very essence of this city. A plethora of sandstone inscriptions, predominantly from the latter stages of the 20th century.

The investigation of historical artifacts has undergone a transformative evolution with the integration of contemporary data collection technologies. This synergy facilitates the precise and comprehensive documentation of antiquities, encompassing a spectrum of methodologies. Among these, photogrammetry has emerged as a pivotal technique, harnessing technology to measure objects remotely through laser-based measurements directed at the target. This process yields a voluminous dataset, characterized by tens of thousands to hundreds of thousands of coordinate values, colloquially referred to as "point clouds" (Paisan Santithammanon, 2010).

The transformative potential of this technology is underscored by its capacity to further extrapolate the processed information into intricate three-dimensional representations. Beyond mere geometric attributes, this technology's prowess extends to capturing the nuanced facets of an object. Notably, it impeccably documents not only the object's shape and dimensions but also meticulously encapsulates its chromatic and textural attributes. Such a multifaceted analysis is facilitated through a meticulous examination of the accumulated data derived from the subject artifacts. This reservoir of information is not confined to archival purposes; it constitutes a fertile ground for the genesis of novel artistic endeavors. The digital realm becomes a crucible wherein these data-driven processes converge, culminating in the creation of artworks that extend beyond the confines of traditional methodologies.

In essence, the amalgamation of data collection technology with antiquities studies heralds a paradigm shift. It converges historical appreciation with modern ingenuity, facilitating a comprehensive portrayal of objects' intricacies. The symbiotic relationship between technological precision and artistic expression is evident, as the digital repository of information breathes life into contemporary works of art, all while preserving the legacy of the past.

The convergence of creative technology and the articulation of artistic and aesthetic perspectives has engendered a diverse array of methods and tools, reflecting a seamless interplay between innovation, technology, and creative ingenuity. This amalgamation of disciplines has not only facilitated the harmonization of artistic and creative values but has also led to the widespread adoption of integrated tools that traverse multifaceted domains. The utilization of digital tools in the creative process has unveiled a myriad of avenues through which artistic concepts can be realized and extended, encompassing a wide spectrum of innovative techniques that harness the intrinsic potential of digital mediums.

The transformation of creative elements into digital designs is a process that extends far beyond mere replication; it encompasses a dynamic array of approaches wherein information gleaned from existing works serves as the foundation for novel artistic endeavors. Digital data, when dissected and reconstituted, assumes new configurations that possess the capacity to evoke profound artistic expressions. The manifestation and exhibition of artworks within the multimedia and digital realm are underpinned by a versatile framework that draws from the evolving landscape of technology and innovation. This dynamic interplay allows art to be conveyed to its audience through a prism of technological tools meticulously selected by creators to effectively channel their imaginative concepts, rendering the transmission of ideas inherently captivating.

One noteworthy instantiation of this technologically-infused artistic paradigm is the utilization of virtual reality (VR) technology. Situated at the crossroads of multimedia and technology, virtual reality offers an immersive platform wherein viewers can traverse a simulated environment meticulously crafted by creators. This sensory immersion is characterized by a detachment from the immediate physical surroundings, effectively transporting the audience into an alternate reality centered on visual engagement. The potency of this medium lies in its ability to engender a profound connection between the viewer and the subject, thereby affording an unprecedented depth of engagement and comprehension. By harnessing the power of VR, the presentation of sandstone Buddha statues of the Phayao craftsmen's lineage becomes an innovative conduit for delivering an enriched learning experience and kindling motivation. The transformative potential of this approach is amplified by its capacity to transcend traditional boundaries, reaching an expansive audience in the contemporary landscape.

The endeavor to harness the 3D photogrammetry technique in collecting data pertaining to the intricate patterns adorning the sandstone Buddha statues of the Phayao craftsmen's lineage attests to a broader narrative of preserving cultural heritage. This data-driven initiative not only enriches the artistic landscape but also dovetails seamlessly with modern presentation methodologies rooted in multimedia technology. The immersive potential of virtual reality unfolds as an instrumental vehicle for offering fresh perspectives on traditional art forms. In the present era, characterized by heightened connectivity, this medium transcends geographical limitations, ensuring the dissemination of artistic values far and wide.

In summation, the symbiosis of creative technology and artistic representation epitomizes a paradigm shift that transcends conventional boundaries. This transformative fusion of innovation and aesthetics breathes new life into age-old cultural artifacts, bestowing upon them an enduring legacy poised to resonate with future generations.

Research Objectives

1. To comprehensive study and 3d data collection of Phayao sandstone buddha statues using photogrammetry.

2. To present a multimedia of Phayao sandstone buddha statue artworks through virtual media.

3. To the study evaluating user satisfaction with virtual media usage for Sandstone Buddha statues of the Phayao's Craftsmen.

Methods and Materials

1.Research Scope

1.1 Documentation resources study: The initial phase of this research involves an in-depth study of specific content pertaining to the sandstone Buddha statues of the Phayao's Craftsmen. This encompasses an examination of the artistry inherent in sandstone Buddha statues within the lineage of Phayao craftsmen. Information integral to the production of virtual reality media will be garnered through an extensive review of documents, books, related research publications, photographs, and recorded media. By delving into these diverse sources, a comprehensive understanding of the subject matter will be cultivated, facilitating the synthesis of a rich narrative.

1.2 Sources from expert interviews: Integral to this endeavor is the engagement with experts well-versed in the domain of sandstone Buddha statues. Insights of artisans and specialists within the Phayao technician family will be gathered through structured interviews. These interviews will serve as a wellspring of knowledge, offering unique perspectives and a contextual understanding of the art form's intricacies and significance.

1.3 Field data collection: Field research will be conducted through visits to museums, temples, and historically significant sites across Phayao Province. These locales represent the very crucible in which sandstone Buddha statues attributed to the Phayao craftsman family were unearthed. By immersing in these physical spaces, a tactile connection with the artifacts will be established, supplementing theoretical understanding with a palpable encounter of the art's embodiment.

1.4 Scope of data collection and recording technology implementation: The research scope encompasses the pragmatic utilization of photogrammetry technology. Employing this technique, a comprehensive compilation of field data will be conducted, encompassing high-resolution images and supplementary information. This concerted effort will culminate in the development of a detailed repository, capturing the nuanced intricacies of sandstone Buddha statues within the Phayao craftsman family lineage.

1.5 Scope of presentation style: The culmination of this research effort will be manifested through the presentation of artworks in a virtual reality medium, facilitated by an immersive exhibition format. To access this multimedia experience, participants will don VR Headsets, thereby submerging themselves within a captivating digital environment that mimics the intricate aesthetic and cultural nuances of the sandstone Buddha statues.

1.6 Scope of population and sample: Central to the research's methodology is the establishment of a specific sample group comprising 100 Phayao sandstone Buddha statues. This cohort is emblematic of a particular variant of virtual media usage, and their engagement with the virtual reality presentation will serve as a cornerstone for gauging the impact and efficacy of the chosen medium.

In essence, the comprehensive approach outlined in these distinct scopes collectively underscores a meticulous and holistic exploration of the artistry embedded within the Phayao sandstone Buddha statues, culminating in a multi-dimensional virtual reality experience that fosters a deeper appreciation and understanding of this rich cultural heritage.

2.   Methodology

The research methodology employed in this study embodies a fusion of creative art-research and meticulous information retrieval. The research process was meticulously orchestrated, with each step designed to seamlessly contribute to the comprehensive exploration and presentation of Phayao sandstone Buddha statues through the innovative medium of virtual reality. The sequential steps and methods undertaken were as follows

2.1 Planning and work process allocation: The research endeavor commenced with meticulous planning, wherein the responsibilities and duties of the research team were delineated. This phase also entailed a critical assessment of the research timeline, ensuring adequate time allocation for each facet of the investigation.

2.2 Data collection and storage: After planning, the data collection process was initiated. Various sources were tapped into, encompassing documentary materials, research-related content, photographs, recorded media, and interviews with knowledgeable individuals possessing expertise in Phayao sandstone Buddha statues. These diverse sources collectively furnished a comprehensive repository of information.

2.3 Data categorization and analysis: The amassed data underwent a rigorous process of categorization and analysis. Information gleaned from field visits, which included immersive studies of museums, temples, and historical sites, was meticulously examined. This step facilitated the organization and systematic interpretation of data obtained from physical locales.

2.4 Photogrammetric scanning and recording: Integral to the research was the application of photogrammetric principles and techniques. This involved the scanning and recording of Buddha statues using advanced imaging methodologies by using a DSLR camera lens 50 mm. To photograph the details of the Buddha statue from a distance of 50 centimeters, In every angle, the image of the original Buddha image. The data collection process synergistically accompanied these efforts, Including the use of images in processing. With the ready-made program (Agisoft Matashape) for completeness in creating 3D models.

2.5 Taking data from processing with a ready-made program (Agisoft Matashape) and recording Buddha image data in 3D format.: The research ventured into the realm of three-dimensional data synthesis and analysis. This intricate process involved the creation of 3D representations of Buddha statues, encapsulating their structural intricacies. Central to this endeavor was the generation of point cloud structures, a product of the photogrammetric data processing. The digital depth measurements enabled the recreation of minute details, while simulation techniques facilitated the generation of the Buddha statues' structural components. This intricate digital repository was primed for deployment within the virtual reality medium.

2.6 Virtual media presentation and dissemination: The research culminated in the creation of virtual media for user engagement. An interactive exhibition titled "Phayao Stone Sculptures and the Creation of Virtual Media" was established within the Cultural Exhibition Hall at Wat Si Khom Kham, Mueang District, Phayao Province. This immersive display facilitated users' exploration of sandstone sculptures through virtual reality

media. The audience's experience was further enriched through the administration of questionnaires, serving as a means to gauge satisfaction, gather opinions, suggestions, and inquiries, while concurrently forging a nexus between the sandstone Buddha statues and the aesthetic essence of the media employed.

2.7 Research results summarization and documentation: The culmination of these multi-faceted efforts led to the synthesis of research findings. The creative art-research undertaken yielded a corpus of artistic creations, which were meticulously documented. A comprehensive book and research report were prepared, encapsulating the journey, insights, and outcomes of the study.

In essence, the research process represents an intricate tapestry woven with creativity, meticulous data collection, immersive presentation, and analytical rigor. This holistic approach not only unraveled the artistic and cultural tapestry of Phayao sandstone Buddha statues but also paved the way for their enduring preservation and enriched appreciation in the annals of cultural heritage.

3. Data Analysis

The process of collecting information from viewers and analyzing virtual reality media data involves a rigorous application of statistical methodologies, specifically mean ($\bar{x}$) and standard deviation (S.D.). These statistical tools are paramount in deriving meaningful insights from the collected data, particularly from questionnaires and additional suggestions provided by participants.

Results

1. The study's outcomes encompassed a meticulous and comprehensive collection of 3D data for Phayao sandstone Buddha statues, achieved through the application of photogrammetry. This innovative methodology facilitated the transformation of these cultural artifacts into detailed digital representations, ensuring their preservation and accessibility for future generations.

The Study of Phayao Sandstone Buddha Statues

The sandstone Buddha statues stand as a quintessential emblem of Phayao craftsmanship, embodying a profound historical and cultural significance. The evidence garnered from explorations and discoveries underscores their prominence within the 19th to 21st Buddhist centuries, marking a golden era for Phayao's artistic endeavors. This period witnessed a vibrant efflorescence of sandstone sculptures, a testament to the flourishing artistic milieu.

The influence of the Sukhothai Kingdom is discernible in the design of these Buddha statues, characterized by distinctive features. Notably, the statues exhibit a semblance to a long Sangha robe, with the Sanghati's tip evoking the imagery of a centipede. The square configuration of the Buddha statues is a discernible hallmark. Despite this influence, intriguing observations emerge. While Phayao boasts an abundance of sandstone Buddha carvings, the same cannot be said for Sukhothai and Sri Satchanalai, where such artifacts appear to be absent.

Intricacies in the crafting process also emerge. While laterite lacquer was employed to frame Buddha statues, and outer plastering was commonplace, a notable proportion of these statues were crafted from bricks, stucco, and bronze. The bronze Buddha statues, contemporaneous with the early Ayutthaya period, present a

distinctive facet of artistry during that epoch. It is intriguing to note that, during the early Ayutthaya period, bronze was predominantly combined with masonry for Buddha statue construction.

An assessment of the existing Phayao sandstone Buddha statues reveals a rather poignant state of affairs. Many of these statues are in a state of disrepair, bearing visible signs of deterioration such as broken heads and arms. The number of fully intact Buddha statues is limited, with a majority requiring restoration efforts. Such restoration has sometimes led to alterations, including the application of plaster or paint, thereby modifying the original form.

Constructing 3D Buddha statues using photogrammetric methods and procedures (Photogrammetry)

The culmination of the study and meticulous data collection process has been harnessed by the researcher to craft invaluable digital representations. Central to this endeavor is the utilization of 3D technology, a sophisticated technique employed to meticulously generate and preserve accurate models of the Buddha statues. This approach ensures the fidelity of the 3D renditions, capturing the intricate details and essence of these revered artistic creations.

A total of 9 Buddha statues were chosen as the subjects of data collection. These selections were made deliberately, focusing on Buddha statues that retain their original completeness and authenticity, untarnished by modern interventions or alterations introduced by contemporary craftsmen. The core objective was to curate a dataset that serves as a faithful reflection of traditional Buddhist art, thereby enabling the transmission of this cultural heritage to a wider audience through various media platforms.

The process of selection involved grouping the Buddha statues into three distinct size categories: small, medium, and large. This systematic categorization facilitated a comprehensive representation of the diverse dimensions that these artistic masterpieces encompass. The subsequent phases of the study involved the intricate task of translating this curated dataset into intricate 3D models, a harmonious fusion of technology and artistic legacy.

The resulting 3D Buddha statues, meticulously crafted from the amalgamation of data collection efforts, expert analysis, and advanced 3D modeling techniques, stand as a testament to the confluence of tradition and innovation. Through this multidimensional approach, the researcher has succeeded in immortalizing the timeless beauty of these Buddha statues within the digital realm. The subsequent sections provide an insightful delineation of the specific Buddha statues that have undergone this transformative journey, illuminating the culmination of this pioneering endeavor.
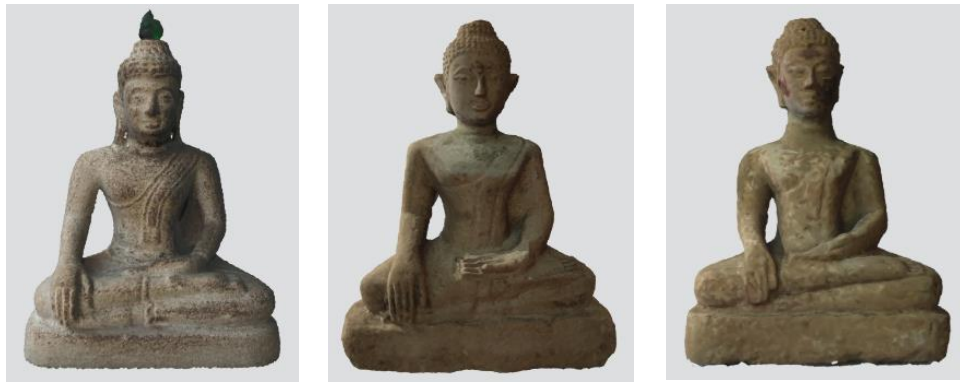
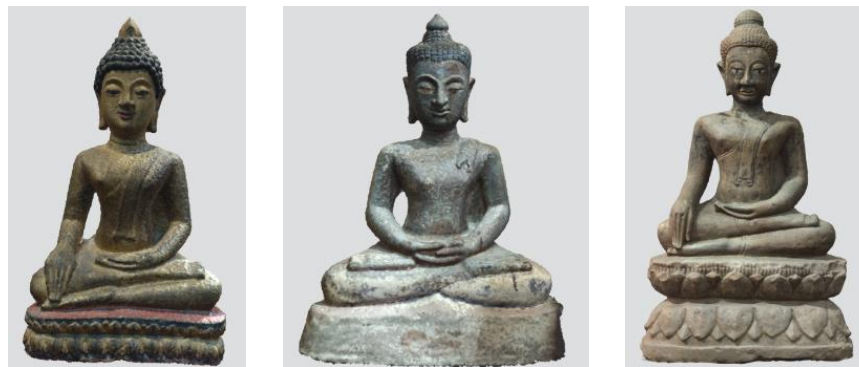**Figure 1** Small Sandstone Buddha Statues in 3D Format.

Figure 2 Medium Sandstone Buddha Statues in 3D Format.

Figure 3 Alarge Sandstone Buddha Statues in 3D Format.

Point cloud data from photogrammetric data collection (Photogrammetry)

The process of data collection, utilizing the advanced technique of photogrammetry, has yielded a comprehensive dataset imbued with intricate insights into the three–dimensional structure of the depicted artwork. The essence of this 3D structure serves as the focal point, a pivotal element harnessed for the creation and subsequent presentation of the artwork. Notably, the research endeavor revealed intriguing pigmentations that manifest on the surfaces of the Buddha statues. These observed pigment spots, upon scrutiny of the study's outcomes, have ignited an inspiring creative spark.

This inspiration has led to the incorporation of the aforementioned pigment–related information into the digital representation. Real photographs, meticulously capturing the highlighted pigments alongside the underlying structural nuances of the Buddha statues, have been seamlessly integrated. The intention behind this integration is to empower viewers with the immersive experience of traversing the intricate visual landscape of the Buddha statues through virtual media presentations.

The salient characteristic of the structural portrayal lies in its remarkable semblance to translucency, akin to the ethereal quality of light passing through a delicate veil. This effect is achieved through the strategic arrangement of sand grains, thoughtfully spaced and orchestrated according to the inherent color structure of each Buddha statue. This meticulous orchestration results in a visual tapestry marked by a diverse array of Buddha statues, each distinctly different from the next.

Within this captivating display of structural characteristics, a myriad of intricate details is unveiled, capturing the dynamic essence of each Buddha statue at different stages. This presentation provides an unprecedented window into the nuanced world of Buddhist art, inviting viewers to perceive dimensions beyond their prior encounters. It is paramount to acknowledge that the color point information, encapsulating unique colorations and patterns, is a testament to the stone's innate composition and texture. This includes the artistic ingenuity of the artisans who contributed to the decorative aspects of the Buddha statues.

Considering these revelations, the researcher has undertaken a comprehensive classification and analysis of the distinct rock compositions. This meticulous categorization, marked by its meticulousness and rigor, paves the way for a deeper understanding of the intricate interplay between natural elements and human craftsmanship, ultimately enriching the appreciation of these culturally significant artifacts.

Figure 4 Sandstone Buddha Statues in the Form of Point Clouds and
the Set of Colored Dots Found in the Buddha Statues.

Depth Map Data

The data collection process, executed through the utilization of Model 3, centers on the comprehensive assessment of the dimensions inherent in the sandstone Buddha statues. This encompassing approach enables the researcher to capture the intricate measurements and proportions of the statues. These collected dimensions are then seamlessly integrated into the realm of 3D software, where they serve as the foundational data for the subsequent calculations.

The calculated dimensions converge within the realm of 3D software to breathe life into accurate 3D renditions of the Buddha statues. This calculated transformation employs innovative techniques, including the strategic manipulation of depth of field. The shallow depth of field effect is meticulously calibrated, achieved through the intricate computation of the depth map derived from proportional 3D model data. This calculated depth of field mimics the visual characteristics observed in the physical counterparts, effectively recreating the nuances of depth perception that emanate from the original statues.

The calculated depth of field assumes a pivotal role in accentuating the key features and distinctive attributes inherent in the Buddha statues. By artfully highlighting the crucial corners and intricate details, the depth of field manipulation brings to the fore the patterns and noteworthy characteristics embedded within these revered artworks.

This calculated and refined representation of the Buddha statues forms the bedrock of the subsequent presentation within the realm of virtual reality media. The statues, imbued with meticulously calculated dimensions and strategically highlighted features, are artfully showcased through virtual reality, affording the audience a unique vantage point. This immersive experience empowers viewers to perceive the proportional intricacies of the Buddha statues with unparalleled clarity and precision.

In essence, this integration of advanced techniques, ranging from data collection to 3D software manipulation and virtual reality presentation, culminates in a transformative encounter. Audiences are bestowed with the privilege of engaging with these cultural treasures in a manner that transcends traditional viewing paradigms, enriching their understanding and appreciation of the intricate beauty encapsulated within the sandstone Buddha statues.
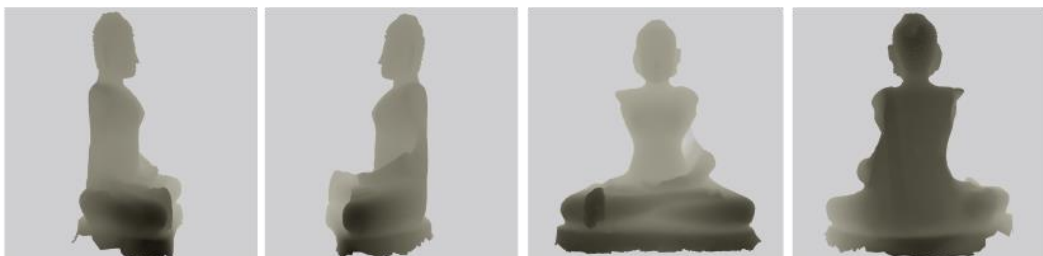

Figure 5 Shows the Display of the Depth Map in Each Corner of the Buddha Statues.

2.   The results of the presentation of artworks of Phayao sandstone Buddha statues through virtual media

The process of sculpting Phayao Buddha statues involves a meticulous amalgamation of distinctive attributes and structural elements extracted from the collected Buddha statues. These facets are intricately interwoven to craft a three-dimensional digital model, meticulously informed by the actual structural analysis of the Buddha statues themselves. This meticulous approach engenders accuracy in both structure and proportion, resulting in faithful representations of the sandstone Buddha statues.

The inception of each 3D digital model is rooted in the profound examination of the physical Buddha statues. This process unveils the intrinsic proportions and unique features characteristic of Phayao craftsmanship. The culmination of this endeavor yields a captivating tapestry that weaves together the artistic evolution of Phayao's sandstone Buddha statues across different periods.

Through this creative journey, the distinctive characteristics of Phayao's artistic lineage are meticulously distilled and infused into each Buddha statue. This infusion births a realm of imagination, where the artistic heritage of Phayao thrives in all its completeness. The process culminates in the realization of the remarkable artistry ingrained within the Phayao craftsmanship, encapsulating the outstanding proportions that have been unearthed from the annals of time.

The evolution of Phayao's sandstone Buddha statues is a rich tapestry, woven from diverse influences and artistic paradigms spanning different epochs. From the very inception of sandstone Buddha statue construction within the Phayao region, the influence of the Chiang Saen Buddha statues is discernible. This influence is palpable in the oval and subtly round countenance, characterized by a small yet prominent nose. The visage is distinctively egg-shaped, with the nose prominently accentuated, and a double line adorning the mouth's edge. These elements converge harmoniously, constituting the hallmark of Buddha statues that grace the expanse of Phayao Province.

The creative process entails the careful curation of these significant proportions, a process wherein the Buddha statues are meticulously brought to life. This endeavor doesn't merely reflect the artistry of professional artisans; it extends to encompass the contributions of villagers, artisans, and temple offerings. The separation and discernment of these pivotal proportions are the bedrock upon which the creation of Buddha statues rests, an intricate interplay of historical legacy and artistic ingenuity.

Figure 6 Reproduction of the Buddha Statues from the Phayao Sandstone Buddha Statues Structure.

The comprehensive compilation of information meticulously gathered by the researcher culminates in the creation of immersive virtual reality media, a medium expressly designed to showcase the splendor and significance of Phayao's sandstone Buddha statues. This multimedia presentation is thoughtfully divided into distinct content segments, each strategically curated to convey a specific facet of Buddha art and the cultural heritage encompassed within Phayao's sandstone masterpieces.

2.1   General information content of buddha statues: This segment serves as an introductory immersion into the realm of Phayao's sandstone Buddha statues. Drawing from the dimensions meticulously captured through Model 3, the audience is granted a virtual journey that transports them into the very essence of the statues. This immersive experience encapsulates the exquisite craftsmanship and proportions that distinguish these artistic creations, offering an unparalleled encounter with the Buddha statues' majestic presence.

2.2   Point structure and dimensions of buddha statues: Delving deeper, this segment unveils the meticulous structure of the Buddha statues through the lens of 3D representation. The intricate dimensions are meticulously brought to life, harmoniously integrated with the pigments that adorn the statues' surfaces. This presentation underscores the interplay between form and color, enriching the audience's understanding of the statues' visual allure.

2.3   Depiction of statues' depth structure: The third segment delves into the dynamic dimension of depth within the Buddha statues' intricate structure. Through the strategic utilization of depth maps, the audience gains insight into the captivating interplay of light, shadow, and contours that breathe life into these artworks. This immersive exploration offers a unique perspective, allowing viewers to appreciate the statues' intricate features from a multidimensional vantage point.

2.4   Reproduction of sandstone buddha statues: The final segment delves into the technical process behind the reproduction of Phayao's sandstone Buddha statues. Through the meticulous assembly of 3D skeletal components, the intricate journey from conception to creation is unveiled. This segment showcases the artistry of transformation as the statues' essence is brought forth from digital realms into tangible, awe-inspiring representations.

Each content segment contributes to an immersive and enlightening journey, wherein audiences are invited to explore the rich tapestry of Phayao's sandstone Buddha statues. The virtual reality media presentation serves as a testament to the dedication of the researcher in preserving and sharing the cultural legacy encapsulated within these masterful artworks.
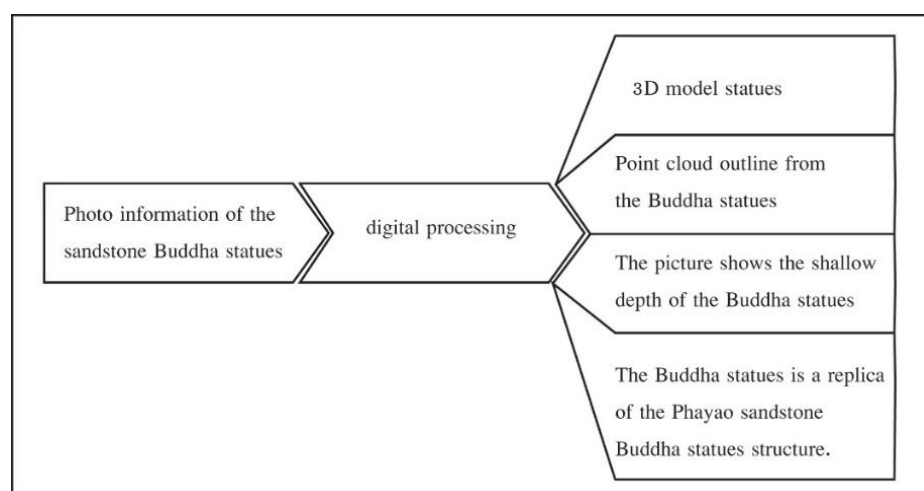

Figure 7 Schematic Showing the Analysis from the Digital Process
in the Sandstone Buddha Statues Create Content within Virtual Reality Media.
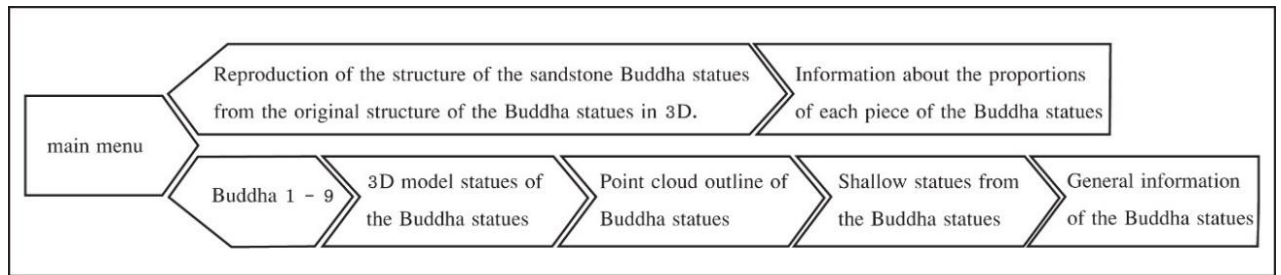
Figure 8 Diagram Showing the Layout of the Virtual Reality Media Workflow.
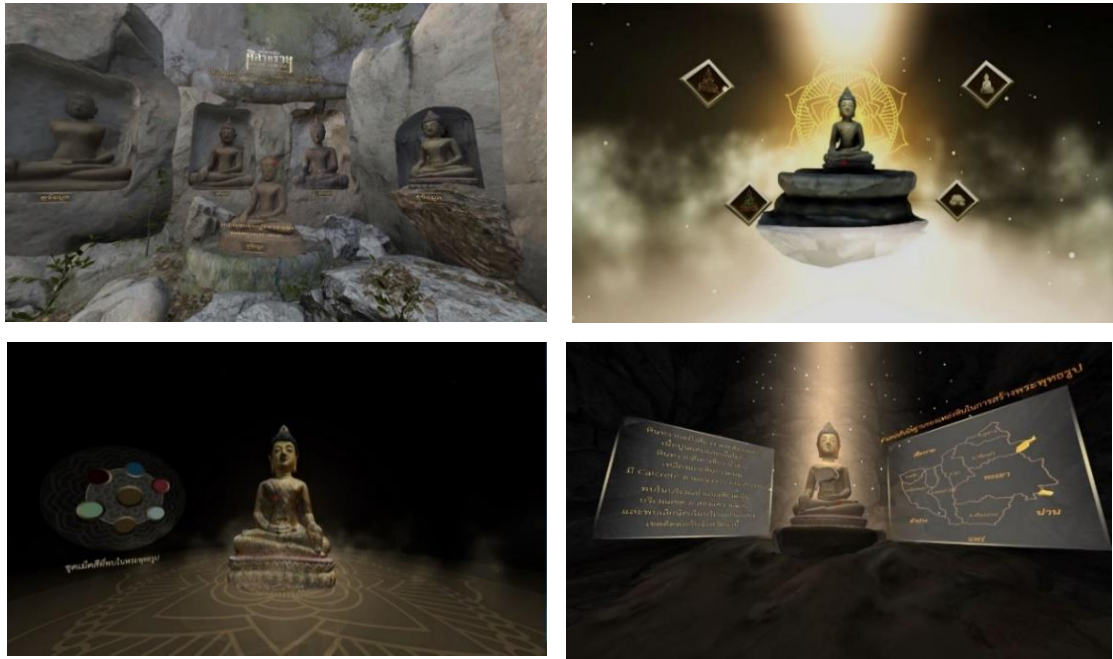

Figure 9 Shows the Main Menu Page for Selecting Buddha Statues.

3. To the study evaluating user satisfaction with virtual media usage for Sandstone Buddha statues of the Phayao's Craftsmen.

Throughout the course of this research endeavor, the primary focus was the creation of a digital masterpiece—a virtual presentation and cinematic exploration of Buddhist art manifested through the intricate Phayao sandstone Buddha statues. This innovative research yielded a dynamic digital composition that possesses the remarkable advantage of accessibility and distribution, enabling audiences to engage and study at their convenience—a distinct attribute of digital artistry. Beyond its exhibition and showcase, this virtual reality medium offers a viewer-centric encounter, facilitated through specialized viewing apparatuses or personal computers, thereby extending its reach and impact.

The dissemination strategy encompassed three integral components, each meticulously crafted to reach diverse audiences and facilitate engagement:

3.1 Presentation and Dissemination at National Exhibition Hall, Wat Sri Khom Kham, Phayao Province:

The inaugural phase of dissemination entailed an exhibition held at the esteemed National Exhibition Hall within Wat Sri Khom Kham, Phayao Province. During this presentation, viewers were guided through the intricate work's highlights, accompanied by recommendations and insights provided by the research team. Following their engagement, attendees were invited to partake in questionnaires designed to elicit their impressions and experiences.

3.2 Public Access via Virtual Media:

In a bid to ensure widespread access and foster public engagement, the virtual media content was made available for download through the dedicated research website, http://pysandstonestatue.ict.up.ac.th. This approach empowers individuals to delve into the immersive world of Phayao sandstone Buddha statues at their leisure, equipped with personal virtual reality viewing apparatuses.

3.3 Viewing via Personal Computers:

Recognizing the diverse array of platforms accessible to the modern audience, the digital artwork was thoughtfully adapted for personal computer viewing. This strategic adaptation aimed to broaden the reach of the creative work, catering to those who may prefer the familiar interface of a personal computer. Interested parties can access the content via http://pysandstonestatue.ict.up.ac.th.

3.4 Data Collection and Analysis:

The research further entailed a meticulous data collection process through questionnaires, employing a purposive sampling methodology with 100 Phayao sandstone Buddha statue enthusiasts. The demographic breakdown revealed 66.0% male and 35.0% female participants, with 25.0% under 20 years of age, 38.0% between 20 and 30 years, 22.0% between 31 and 40 years, and 10.0% aged 41 to 50 years. Data analysis underscored a high level of satisfaction among users, as indicated by a mean ($\bar{x}$) of 4.25 and standard deviation (S.D.) of 0.34. Particularly noteworthy were the high levels of satisfaction regarding positive attitudes toward Buddhist art antiques ($\bar{x}$ = 4.36, S.D. = 0.66), appreciation for Chang Phayao ($\bar{x}$ = 4.35, S.D. = 0.67), heightened interest in Buddhist art via digital media ($\bar{x}$ = 4.32, S.D. = 0.75), appropriate exhibition and presentation ($\bar{x}$ = 4.30, S.D. = 0.69), as well as the conveyance of the Buddha statues' aesthetic allure and components ($\bar{x}$ = 4.25, S.D. = 0.66). The comprehensive dataset is detailed in Table 1.

In summation, this research journey has culminated in the creation of an intricate digital marvel—an evocative portrayal of Buddhist artistry manifested in Phayao's sandstone Buddha statues. Through meticulous dissemination strategies, this creation has been shared with audiences across various platforms, fostering engagement, appreciation, and understanding of this treasured cultural heritage.

Table 1 Satisfaction of Virtual Reality Users of Phayao Sandstone Buddha Statues

Satisfaction List	$\bar{x}$	S.D.	Meaning
1. The artworks that have been viewed were new and exciting.	3.93	0.79	good
2. Watching the work helps to see the beauty of the Buddha statues and the elements that have been conveyed.	4.25	0.66	good
3. Are the elements of the Buddha statues shown in the digital form suitable or not?	4.24	0.74	good
4. Viewed media adds more interest to the works of Buddhist art compared to viewing other digital media that have been viewed in the past.	4.32	0.75	good
5. Watching such media helps create interest. More about Phayao sandstone Buddha statues.	4.35	0.67	good
6. A positive attitude towards viewing more antiquities and Buddhist art works.	4.36	0.66	good
7. The display and presentation are appropriate.	4.30	0.69	good
Total	4.25	0.34	good

The satisfaction of virtual media users engaging with Phayao sandstone Buddha statues yielded noteworthy insights. Upon analysis, it was determined that there existed no discernible difference in the level of satisfaction when comparing both sexes and different age ranges. This outcome was established with a statistical significance level of .05, indicating that the varying demographic factors of gender and age did not significantly influence the degree of satisfaction experienced by users interacting with the virtual media presentation of Phayao sandstone Buddha statues. This observation underscores the universality of the virtual media's appeal and effectiveness in conveying the essence and allure of these cultural artifacts, transcending demographic differentiations.

Table 2 Comparison of User Satisfaction Levels of Virtual Reality Media of Phayao Sandstone Buddha Statues. There was a Level of Satisfaction Towards the Virtual Media of the Phayao Sandstone Buddha Statues According to Sex.

Satisfaction	Male		Female		F	Sig.
	$\bar{x}$	S.D.	$\bar{x}$	S.D.		
Total	4.21	0.33	4.31	0.31	0.35	0.85*

* Statistical significance at the .05 level

As indicated in Table 2, the data gleaned from the sample of users who engaged with the virtual media of Phayao sandstone Buddha statues revealed that both male and female participants exhibited similar levels of satisfaction. Notably, this lack of disparity in satisfaction levels between genders was statistically significant at the 0.05 significance level. This suggests that the virtual media presentation of Phayao sandstone Buddha statues resonated equally with individuals of both genders, showcasing a consistent and equitable level of satisfaction across male and female users.

Table 3 Comparison of user satisfaction levels of virtual reality media of Phayao sandstone Buddha statues. There was a level of satisfaction towards the virtual media of the Phayao sandstone Buddha statues by age range.

Satisfaction	under 20 years old		20–30 years old		31– 40 years old		41–50 years old		upper 50 years old		Mean	S.D.
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.		
Total	4.29	0.28	4.21	0.37	4.25	0.39	4.30	0.17	4.11	0.25	4.24	0.33

* Statistical significance at the .05 level

As illustrated by the data presented in Table 3, the analysis encompassing users of the virtual media showcasing Phayao sandstone Buddha statues across different age groups revealed a consistent level of satisfaction. Importantly, this level of satisfaction remained statistically indistinguishable at the 0.05 significance level. Thus, it can be inferred that the satisfaction derived from engaging with the virtual media presentation of Phayao sandstone Buddha statues was uniform across the various age segments represented in the sample. This suggests that individuals spanning different age groups experienced comparable levels of contentment and gratification when interacting with the virtual representation of these cultural artifacts.

Discussion

Based on the study evaluating user satisfaction with virtual media usage for Sandstone Buddha statues of the Phayao's Craftsmen.

In order to compare user satisfaction with virtual media for Phayao Sandstone Buddha statues across different gender and age groups, a comprehensive examination was conducted. The study revealed that there existed a notable level of satisfaction with the virtual media representation of Phayao Sandstone Buddha statues. Importantly, this satisfaction was consistent across both genders and various age ranges, and no statistically significant differences were observed at the 0.05 significance level.

This finding underscores the efficacy of virtual media in satisfying users' curiosity and interest in Phayao Sandstone Buddha statues. The virtual media successfully stimulates engagement and cultivates a positive attitude toward experiencing antiquities and Buddhist art within a simulated virtual reality environment, facilitated by visual perception.

This outcome is in line with prior research conducted by Narut Soontranon, Panu Setthasethian, and Preesarn Rakwatin (2017). Their investigation into 3D modeling of multiple statues for cultural heritage emphasized the utility of accurate 3D data capture, which can be effectively utilized through various media channels such as websites, DVDs, and high–precision datasets. These resources serve as essential references, particularly in the restoration of culturally significant heritage sites.

Furthermore, when assessing individual elements of satisfaction, the study revealed that the most highly rated aspect was the positive attitude toward exploring additional antique Buddhist art pieces (Mean = 4.36, S.D. = 0.66). This observation highlights the potential of virtual reality technology in conveying information about

the Buddhist art and antiquities present in Phayao sandstone Buddha statues. Virtual reality, as an accessible and engaging learning medium, promotes continued exploration and facilitates the dissemination of clear and comprehensive information.

This conclusion aligns with the research conducted by Nat Disjaret, Korawat Phonyaem, Panida Wangkhahat, and Purim Jaruchamrat (2014), which demonstrated that augmented reality technology enhances content comprehension in a more accurate and efficient manner compared to conventional 2D learning methods. Moreover, users exhibited a consistently high level of overall satisfaction.

Similarly, the study corresponds with the findings of Wiwat Meesuwan (2014), who determined that users reported heightened sensations of novelty, excitement, enjoyment, and satisfaction when engaging with augmented reality technology developed by the researcher.

In summary, the study underscores the significant role of virtual media in fostering user satisfaction, generating interest in Phayao Sandstone Buddha statues, and cultivating positive attitudes toward exploring and appreciating antiquities and Buddhist art. This positive trend aligns with existing research highlighting the effectiveness of virtual and augmented reality technologies in enhancing learning experiences and overall user satisfaction.

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