JAC Journal of Arts & Culture

e-ISSN: 2976 – 2855

Volume 2 Number 1 December 2023, 12 ~ 17

DOI: https://doi.org/0.37698/jac.v2i1.213

Mah Meri Mask Digital Preservation Via White Light Three-Dimensional (3D) Scanner in Malaysia

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ARTICLE INFO

Article history:

Received Aug 18, 2023
Revised November 9, 2023
Accepted Dec 10, 2023

Keywords:

Mah Meri,
Digital Preservation,
Culture Heritage,
3D Scanning

Conflict of Interest:

None

Funding:

None

ABSTRACT

This paper presents a process of capturing three-dimensional(3d) data using a coloured 3D scanner of the Mah Meri mask for a culture and heritage digital preservation effort. Mah Meri is among many indigenous people who reside in the peninsular of Malaysia. The mask of Mah Meri was once used in their ritual to cask out the sickness from the patient. Each mask has its name and story inspired by the shaman's dream. Now, mask carving become one of their sources of income. Around the world, artefacts of culture and heritage are decaying due to human activities and mother nature. Mah Meri tribe also is not excluded from this gruesome threat. Being hampered by modernisation and deforestation, the number of carvers is declining, and the wood source is also disappearing. The effort of preserving the mask was conducted with the collaboration between the Digital Capture (Digicap) Research Group of Multimedia University and the Centre for Creative Content and Digital Innovation (3CDI) of University Malaya with the support of the Museum of Asian Art is one of many efforts to preserve this tangible culture and heritage artefact of Malaysia.

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1. Introduction

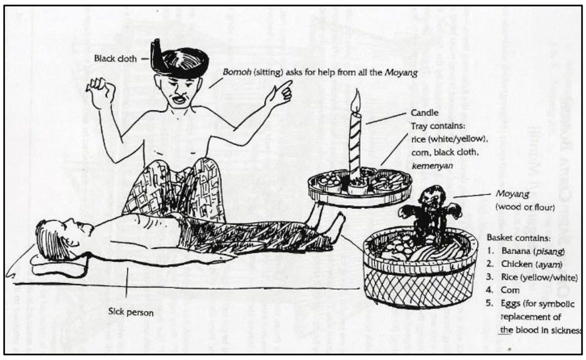
In this paper, we outline a process for digitally preserving the cultural and heritage significance of the Mah Meri mask by capturing its three-dimensional (3D) data using a coloured 3D scanner. This preservation effort was done together by the Digital Capture (Digicap) Research Group of Multimedia University and the Centre for Creative Content and Digital Innovation (3CDI) of the University Malaya with the support of the Museum of Asian Art.

Throughout time, physical, cultural, and heritage artefacts have been exposed to various threats such as insect infestation (Heng, 2000), human activities such as deforestation (Noor, 2018), corrosion from salt efflorescence (Taha, 2005), natural disasters like flood and earthquake (Cheng, 2012), and even traditional ritual practices (Pang et al., 2014). This has sparked preservation efforts all over the world. The traditional techniques such as manual recording (Patel, 2009), manual drawing, and tape measuring (Yilmaz, 2008) to record and preserve the artefact have proven to be time-consuming and not repeatable or reproducible, as they are dependent on operators' skills (Angelo,2018). Angelo also mentions that due to this limitation, the digitalisation process, such as 3D scanning become popular even though there is no 3D scanner that meets all the technical and economic constraints of that culture and heritage domain presented.

The Mah Meri means “forest people” (Werner, 1997), an indigenous people of Malaysia who primarily reside in the coastal areas of the Klang and Sepang districts of Selangor, with the most well-known village is Kampung Bumbun in Carey Island (Zuhairi et al., 2020). As a sub-ethic of Senoi, they speak in the Bersisi language though nowadays, most youngsters speak in Malay (Rahim, 2007). They have a rich cultural heritage and have maintained their traditional way of life, including their unique customs, beliefs, and rituals, through which some convert to Christianity or Islam.

The Mah Meri people are known for their intricate woodcarvings. One of their wood carving artefacts is in the name of Moyang Harimau Berantai by UNESCO's Asean Handicraft Promotion & Development Association (Pauzi,2017). According to Heng (2000), the Mah Meri tribe used masks made from locally sourced wood varieties, known as Nyireh Batu and Tingkong Pulai, in various traditional events and ceremonies, including Joh, Tenkeng, and Sakat Buang.

Sakat Buang is the ritual to cast the sickness and the bad omen out of the patient. When there is a patient, the bomoh in shaman in the Malay language will examine the patient and ask for guidance from their ancestor. Based on the guide he received through the dream, the shaman will later carve or ask the master carver to carve a “moyang” (the ancestor) in the form of a totem or a mask. During the ritual, the shaman will transfer the sickness from the patient to this mask. The mask is thrown into the sea or the deep jungle to end the



ceremony. This ritual diminished the unique and valuable artefact (Pang et al., 2014).

Figure 1. Sakat Buang Ritual (Heng, 2000)

The Museum of Asian Art has already initiated efforts to preserve these artifacts. However, even the saved masks have been vulnerable to deterioration over time due to issues like fungus erosion and water bug infestation, as noted (Heng, 2000). To mitigate these risks, implementing digital archive technology is a protective measure to preserve these valuable cultural assets, as stated (Levoy, 2000).

2. Types of Equipment

We used the Artec MHT 3D scanner from www.artec-group.com for the scanning process. This scanner operates as a 3D video camera, capturing each frame as a three-dimensional image. What sets Artec’s technology apart from other scanning devices is that it does not require markers; its software utilises the object's unique geometry to align and fuse the captured 3D frames together correctly. Additionally, the Artec MHT 3D scanner boasts a high resolution of up to 0.5mm, high accuracy of up to 0.1mm, and a measuring speed of up to 500,000 points per second. Furthermore, its handheld design makes it easy to operate. The accompanying software for this scanner is Artec Studio 9.1.

This study used a white light 3D scanner to preserve the Mah Meri mask digitally. The white light 3D scanner is a non-destructive and non-invasive (Xu, 2017) tool that captures the mask's physical features in a detailed and comprehensive manner (Zhang, 2018). The scanner works by projecting a pattern of white light onto the mask's surface, which is then captured by a camera from different angles. Specialised software then processes the resulting images to create a 3D mask model.

Figure 2. Artec 3D Scanner MHT (Pauzi, 2018)

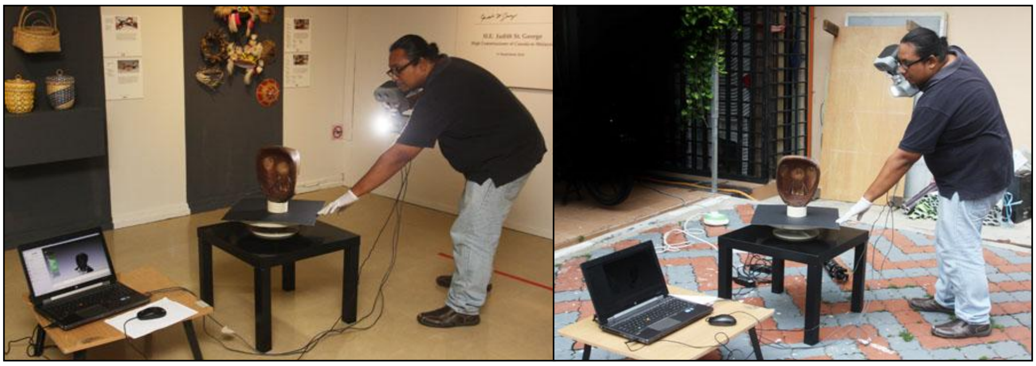
While the 3D scanner is handheld, the limited space and cables may hinder the scanning process, restricting movement. To address this issue, a turntable is employed to assist in scanning. By rotating the artifact 360

degrees horizontally, the turntable lets the operator focus on capturing the entire object area.

Figure 3. Mah Meri Mask on Turntable (Pauzi, 2018)

3. Location

We conducted the scanning process at the Asian Art Museum of the University of Malaya, home to the most extensive collection of Mah Meri masks. We identified two locations for the scanning process: the first was in the Main Gallery of the Asian Art Museum, which provided a controlled environment with a pendaflour (fluorescent) lamp providing illumination between 300-330 lux. The second location was in the workshop area of the Asian Art Museum at the University of Malaya, which offered natural lighting ranging from 18,000-



18,300 lux.

Figure 4. Location of The Scanning Process, Asian Art Museum, University Of Malaya (Pauzi, 2018)

4. Process

The initial stage involves a pre-scanning session, where the mask is inspected, and relevant details are recorded to plan for the actual scanning process. Several factors, such as accessibility to the mask, handling limitations, and the mask's condition, are assessed, and its physical data, such as size, material, and shape, are recorded. The mask's mobility is also considered to determine whether it can be moved or needs to be scanned in situ. The next factor that needs to consider is the location for the scanning session, whether it should be done indoors or outdoors, to avoid any disturbances that could affect the scanning process. In this

process, indoor locations are preferred to allow for better control of lighting conditions.

Figure 5. Initial Stage; Mask Inspection and Location Observation (Pauzi, 2018)

The second phase of the scanning process involves the actual scanning of the mask, and this begins with the setup of the scanner and the mask after the scanning location is identified. While scanning, we require additional equipment, such as a turntable to rotate the artifact, a blackboard as a background, and a stand or holder to secure the mask on the turntable.

Scanning begins once the scanner is set up and the mask is positioned. The operator carefully positions themselves to move with the artifact's movements, using the scanner to capture the entire surface area. If the mask cannot be turned, the operator must move around the artifact while moving the scanner up and down. Maintaining a constant distance between the scanner and the artifact is crucial as the scanner has its depth of field and needing to be too far or too close may not capture the artifact's surface. The mask's position may also need adjustment to ensure the scanner captures the entire surface area.

As scanning continues, the operator can recognise and formulate a scanner and artifact movement pattern. After the artifact is fully scanned, the scanned file containing point cloud data and texture data is saved and ready for the final stage of the scanning process, which is the post-scanning process.

In the third stage of the scanning process, all the point cloud data files are pulled together, cleaned, edited, aligned, and fused to create a 3D file that can be viewed and interacted with. For a complete 3D form of the scanned artifact, at least three scanning sessions are required - topside, bottom side, and 360 views to cover the entire artifact surface. The first step in the post-scanning process was editing, which involves erasing unwanted surfaces from the mask's point cloud data. This unwanted surface can be erased by selecting the proper size of the eraser, turning the point cloud data around, zooming in and out, and erasing the unwanted area permanently. This process needs to be done in each session.

Once the point cloud data is cleaned, the next step is aligning the three files by identifying the identical texture, shape, and unique features. The aligned point cloud data are fused, resulting in a polygon mesh file. The polygon mesh may have some unwanted surfaces that cannot be seen before the fusing process, which can be erased using the eraser option. The polygon mesh file may also have several deformations, which require patching up work.

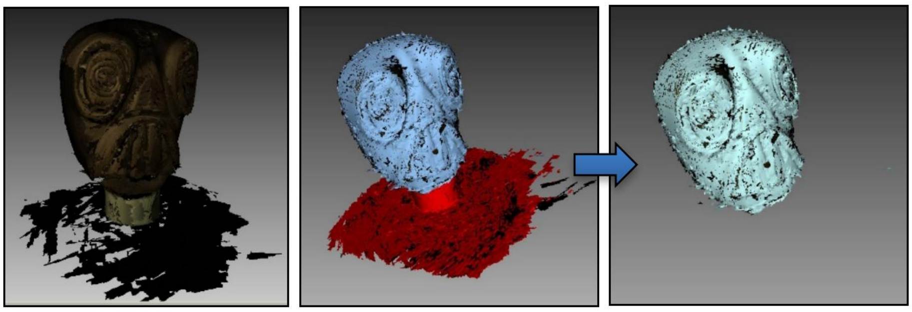


Figure 6. Raw File and Cleaning Process (Pauzi, 2018)

Mesh simplification is required to minimise the number of triangles in the polygon mesh, making the file lighter and easier to work with. The appropriate number of polygons is between 30,000 and 50,000 triangles. Texture mapping is the process in which the texture captured by the scanner's camera is mapped onto the polygon mesh. If three scanning sessions/point cloud data are used to form a polygon mesh, then these three sessions must also be included to map the texture to the polygon mesh. The operator can produce a map file with a triangle or atlas map. Atlas map is recommended as it produces a more recognisable texture.

Once the map is created, the operator can change the brightness, contrast, and saturation. The captured colour of the artifact texture may be slightly different from the original colour due to the temperature of the light during the scanning session. The operator can adjust these variables accordingly to suit the actual colour of the artifact. Once done, the file is saved as a 3D file using the Virtual Reality Modeling Language (VRML) format, the standard format for 3D representation.

Figure 7. Outcome (Pauzi, 2018)

5. Discussion and Conclusion

This paper describes digitising the Mah Meri mask as an attempt to preserve it in a digital format using 3D data. The process begins with an inspection of the mask and an assessment of the scanning location. Scanning involves at least one operator holding the scanner and rotating the mask on a turntable to capture a 360-degree view. After collecting the data, the point cloud data is cleaned, aligned, and simplified to produce a 3D file. The entire collection of 114 masks in the Asian Art Gallery has been scanned and digitally stored. The 3D data from this session can be used to create a physical replica using additive manufacturing (Pang et al., 2014) or presented as an augmented reality module or virtual reality experience (Santano et al., 2021).

Regarding future research, there is an opportunity to utilise this data for conducting studies on user experience and acceptance of digital representations of cultural and heritage artifacts, especially in a multicultural country like Malaysia.

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