

Satellite Meeting: Innovative approaches in engaging people with local history and genealogy

Date: 17-18 August 2023

Location: KU Leuven Libraries

Revealing the Bukit Brown Cemetery underground artefacts

Gaetan Boisson

NUS Libraries, National University of Singapore, Singapore

gaetan@nus.edu.sg



Copyright © 2023 by **Gaetan Boisson**. This work is made available under the terms of the Creative Commons Attribution 4.0 International License:

<http://creativecommons.org/licenses/by/4.0>

Abstract:

The Bukit Brown cemetery is an important historical site in Singapore that was preserved thanks to local activism initiatives seeking to protect it from urban developments in the city-state. While an highway did get built eventually over the cemetery, most of the site was preserved and only a minority of tombs (around 500 tombs) were exhumed to make way for the highway. The underground artefacts are most at risk of being disposed of and forgotten if they are not digitised. There are two main reasons for the vulnerability of the below-ground artefacts. First and foremost, given the nature of many of these artefacts, they cannot be kept under appropriate conditions given cultural taboos associated with them. Secondly, many of these artefacts are already deteriorating as a number of years has passed since they were recovered when the tombs were exhumed as part of the road project.

Yet the story of Bukit Brown will be incomplete without the stories of the underground artefacts. During the documentation of tombs affected by the road project, a rich variety of artefacts were found, from personal items such as dentures, jewellery, shoes, belts, hairpins, clothing, to everyday or symbolic items such as miniature furniture, kitchenware and ceramic cups. Each of these items are reflective of personal lives in various contexts.

Previous projects took care of identifying and cataloguing selected underground artefacts, a subset of which was prepared for 3D scanning through photogrammetry. This work was previously done under a National Heritage Board grant.

Now that these projects have ensured the production of digital artefacts reflecting the underground objects, the project team is implementing an online platform with the aim to engage the general audience with the objects, through the use of digital storytelling. Making these items available online along with a story providing context will make this part of Singaporean local history available to a much wider global audience. However, the sustainability of online projects remains a challenge and the team is looking into the future challenges that this project could face for its own conservation.

Keywords: Digital Storytelling, Local History, Hidden Collections, 3D assets, Photogrammetry

Introduction: Revealing the Bukit Brown Cemetery underground artefacts

Opened in 1923¹ as the first Chinese municipal cemetery in colonial Singapore², the Bukit Brown Cemetery is today a rare patch of wild forest on a very heavily urbanised island. The Chinese community started lobbying for a cemetery as early as 1914 and by 1919, 173 acres had been acquired. Eventually around 100 000 graves were established in the cemetery and burials ceased in 1973.

In a country where space is scarce, the fact that the area occupied by the cemetery grounds could be converted to 15 000 homes for 50 000 residents has jeopardised the conservation of the site. It was not a housing project however, but a highway that was eventually planned in 2011, requiring the unearthing and destruction of a number of tombs.

A Working Committee was henceforth formed to carry out documentation work over the site³. Out of this effort, an initiative supported by the National Heritage Board resulted in the digitisation of twenty-two artefacts unearthed from the graves to be destroyed through the process of photogrammetry.

During Chinese funeral rites, miniatures of real-life objects are buried with the deceased, meant to accompany them in the afterlife where they will be used. The preservation of these remnants of popular folklore is problematic in many ways: they are in a state of disrepair and decay due to their very nature, their existence underground and the lack of conservation facilities for such objects. They are also personal items associated with cultural taboos, making a more usual institutional approach to conservation difficult. With an unclear path on how these items could be preserved, the photogrammetry project, requiring highly technical and specialised skills, was therefore chosen in order to create digital replicas of the artefacts. While imperfect, it would allow to keep a trace of what was once unearthed in Bukit Brown.

Once this process was completed, however, the resulting digital assets were still inaccessible to the public. Another project was therefore started to create a website which would showcase the digital files and allow users to experience them on their devices. Making use of another set of highly specialised skills related to digital storytelling, WebGL and static site generation, a project for a website was born, with the goal to make this data available, sustainable and understandable to the widest possible audience.

1 REVEALING A HIDDEN HISTORY

Before being a cemetery, Bukit Brown was also a battle ground: the battle of Singapore was crucial during February 1942 as the island was an important British stronghold in the region.

¹ Natalie Pang and Liew Kai Khiun 2014, "Archiving the wild, the wild archivist: Bukit Brown Cemetery and Singapore's emerging 'docu-tivists'", *Archives and Manuscripts* Vol. 42, No 1, 87-97, <http://dx.doi.org/10.1080/01576895.2014.902319>

² Bukit Brown Documentation project, "What is Bukit Brown Cemetery?", available at <http://www.bukitbrown.info/whatisbbc.php> [accessed 10 July 2023]

³ Bukit Brown Documentation project, "About the Project", available at <http://www.bukitbrown.info/about.php> [accessed 10 July 2023]

It should hence be noted that the unearthing of the tombs revealed several war related items, in particular bullets. The place is therefore rich in history, both on a personal level for the family of the deceased and on a national level as a important location during a pivotal event of the Second World War. It is also seen as an important spot for biodiversity on the island, being one of the remaining places where nature reigns unconstrained.

Most of the wealth of Bukit Brown remains, however, unseen: wild animals are only faintly heard, remnants of the battle are nowhere to be seen and burial artefacts have mostly remained underground. Revealing these objects serves to not only construct narratives that bridge the gap between the past and present, but also to preserve the lesser known and most

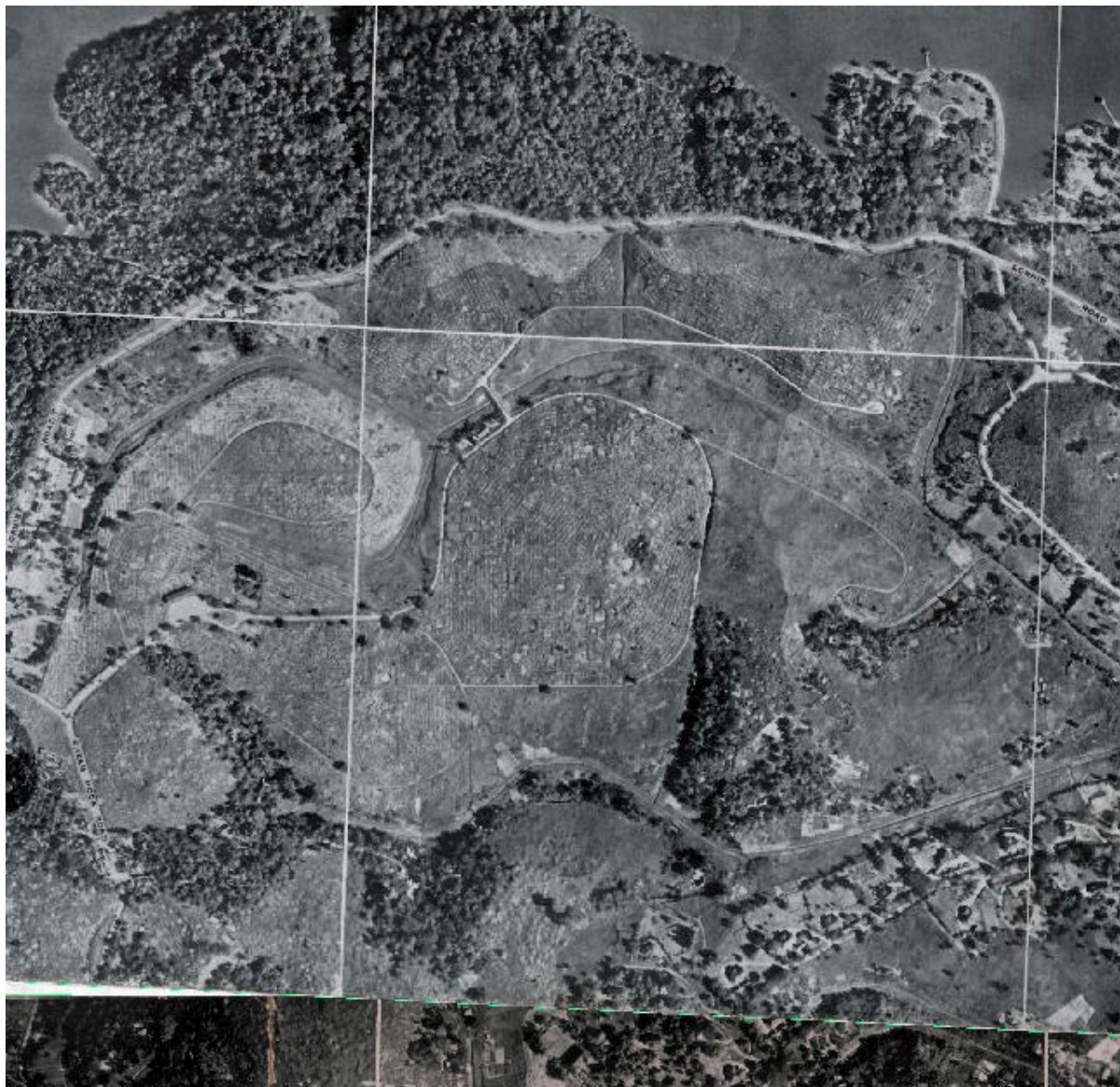


Figure 1: the Bukit Brown Cemetery as seen from an aerial photograph taken in 1950 (<https://libmaps.nus.edu.sg>)

endangered aspect of this site of profound historical and cultural significance.

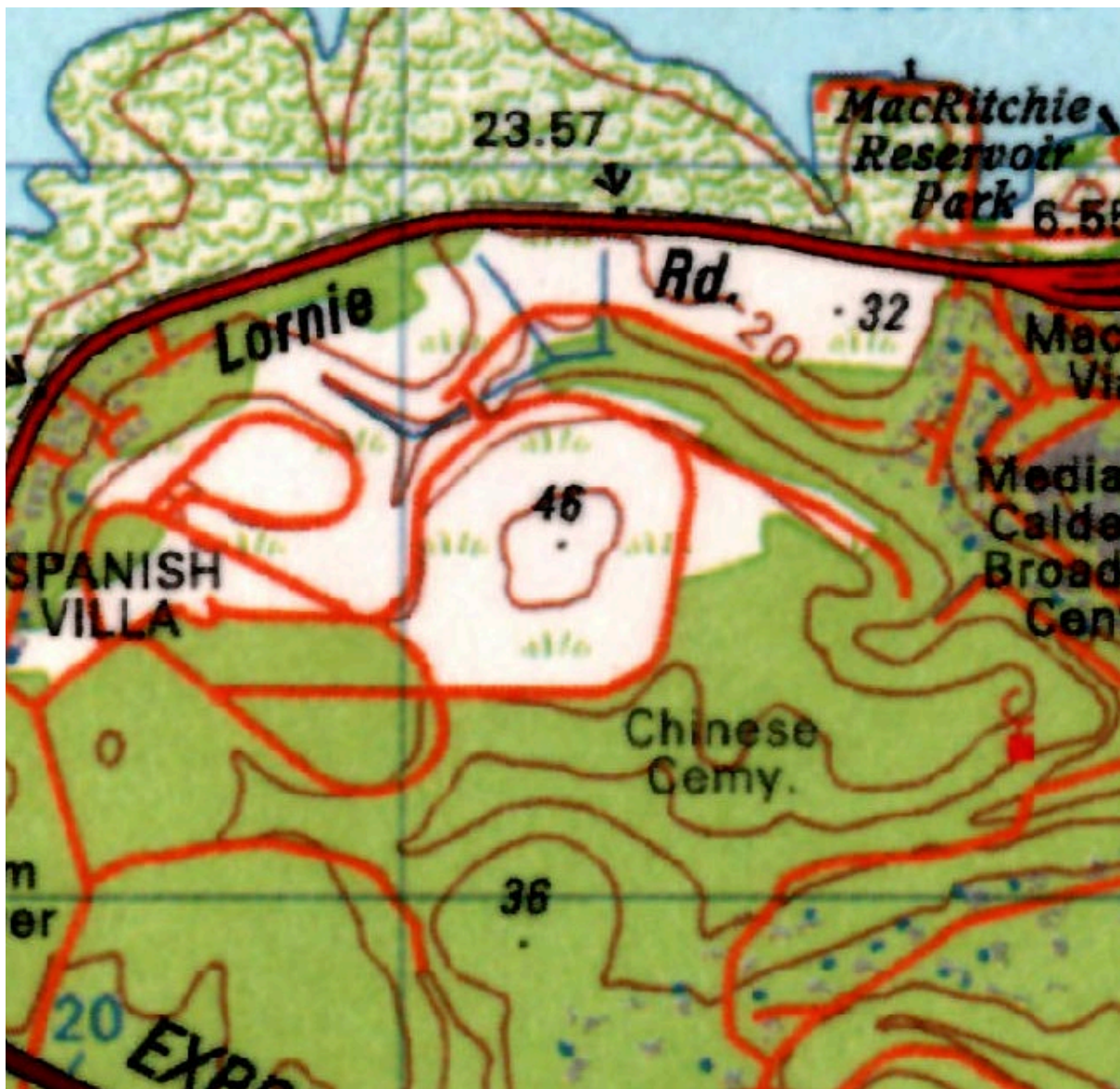


Figure 2: Bukit Brown Cemetery, same area as figure 1, on a historical map from 2010, before the construction of the highway. Note the abbreviation “Chinese Cemey.” for “Chinese Cemetery”. (<https://libmaps.nus.edu.sg>)

Making this knowledge available to a general audience did come with challenges however, as most people will be unfamiliar with Chinese burial rites and will be baffled by what the collection has to show. A balance had to be struck between keeping some mystery of the objects themselves, like a pot filled with colourful threads, whose use in the netherworld remains mysterious, and the more relatable tea set whose role to provide comfort will be more obvious.

To aid comprehension without overwhelming the reader, a main story is constructed focusing on a limited number of key items. Emphasising more universal themes and human experiences on one hand to allow individuals to connect with the historical significance of Bukit Brown Cemetery on a more personal level, while on the other hand displaying some more peculiar objects to also underline the uniqueness and relevance of the collection. While this story driven approach is very efficient at making the content relatable, it is inherently lacking, and another page working as a catalogue allows users to explore the full collection by themselves.

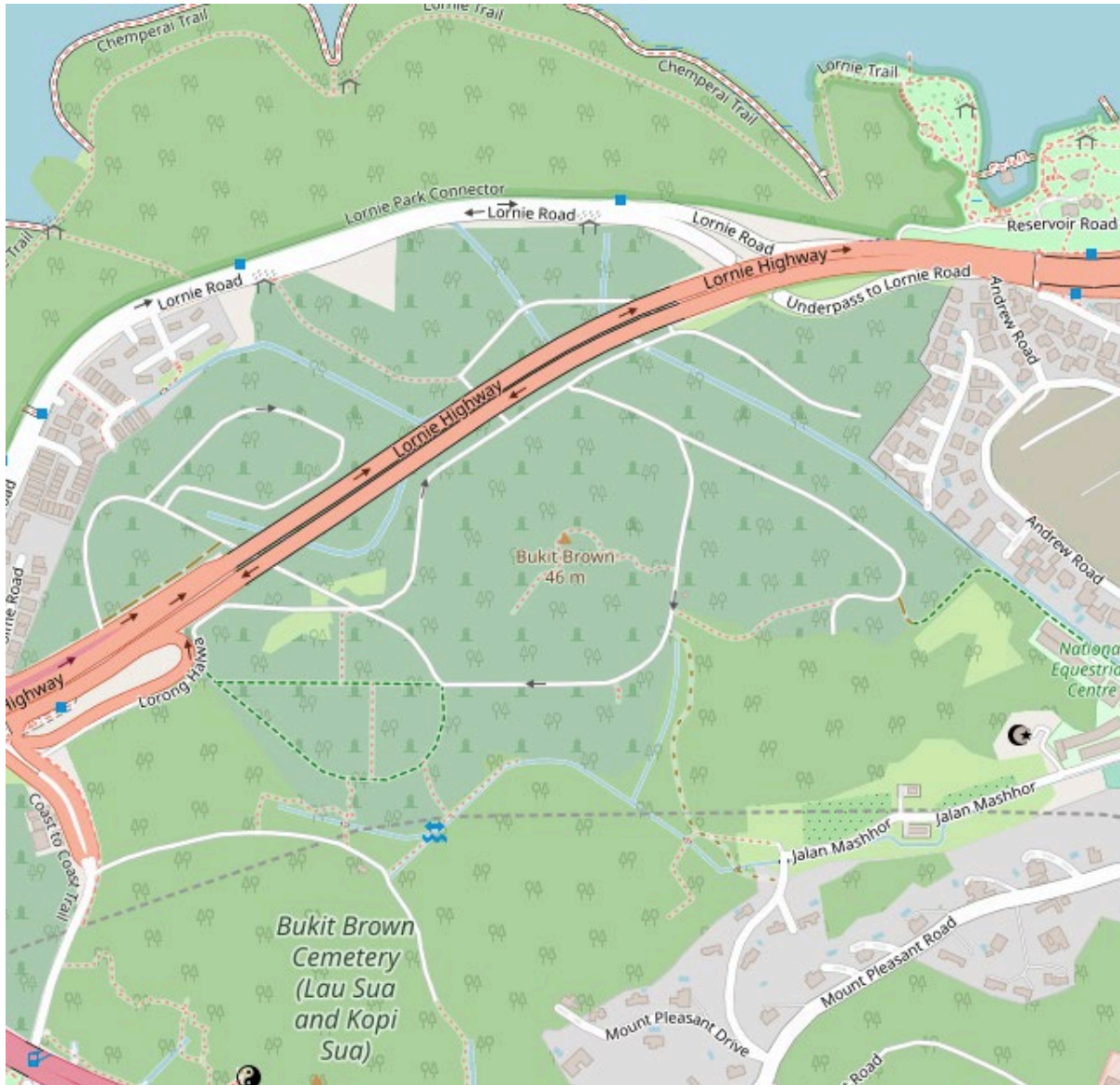


Figure 3: same area as figure 1 and 2, on a modern map. Note the newly built Lornie Highway that cuts across the cemetery. (<https://libmaps.nus.edu.sg>; © OpenStreetMap contributors)

2 DIGITAL STORYTELLING IN THREE DIMENSIONS

In order to deliver the information in an engaging manner, the “scrollytelling” user experience pattern was chosen. With this technique, we leverage the most natural interaction of users on a website (scrolling) in order to progressively unveil parts of the story to the user. While it has been demonstrated many times with data visualisation⁴ and interactive maps, it is still uncommon with 3D models.

⁴ Connor Rothschild, 2022, “Build your first scrollytelling visualization with svelte”, available at <https://www.connorrothschild.com/post/svelte-scrollytelling> [accessed 10 July 2023]

The technical challenges of telling a story around 3D models are multiple: while the only web API currently available for 3D graphics in the browser will be WebGL, it is extremely unwieldy, and several layers of abstraction are necessary before a less advanced web developer will be able to write appropriate code for creating such an experience.

In order to stay close to our commitment to sustainability, the pages were built using the Astro static site generator. This piece of the stack ensures great flexibility while allowing us to stay as close as possible to the web standards (HTML, CSS and JavaScript) in the delivered output. The story will however feature a number of interactive elements, and a framework for the required JavaScript is needed to allow for a cleaner and more manageable code base. The chosen framework was Svelte, for its ease of use and readability. The last part of the challenge is of course the WebGL framework itself, thankfully a renderer and component library to build and render three.js (the state-of-the-art JavaScript 3D library) for Svelte is under active development under the name threlte.

With these elements brought together, it became possible to focus on the story while keeping the source code remarkably clean and declarative. The code base of the site will mostly read like encapsulated elements, similar to HTML, and the complexity will be managed through the successive layers of abstraction.

3 OVERCOMING HURDLES TO MAXIMISE AVAILABILITY

While building the platform itself was challenging, an enduring issue was the size of the data: objects produced through the photogrammetry process would typically result in file size from 85 to 125 MegaBytes. These file sizes would require a loading time of several minutes for each object, a delay that regular viewers on the internet would not be able to accept.

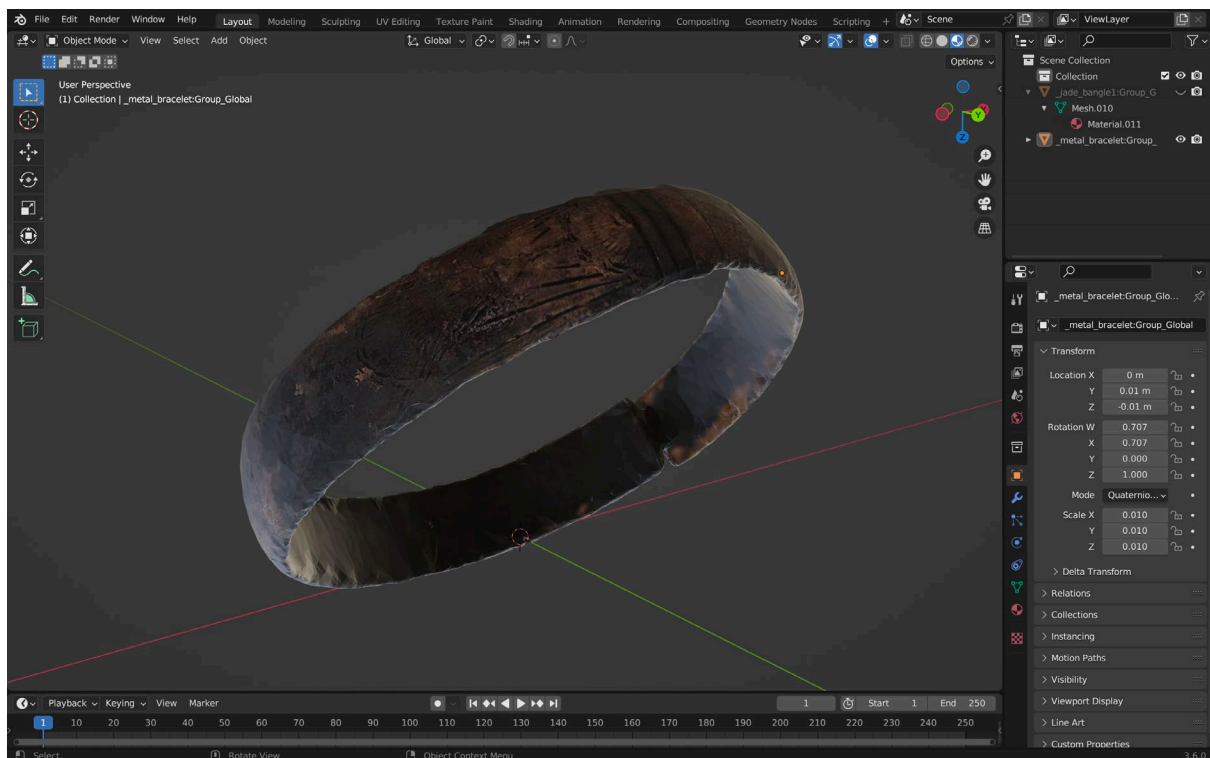


Figure 4: A metal ring from the collection, seen in Blender, the software which was used to optimise the models for online viewing

While 3D models usually look surprisingly natural to us on a screen, the data behind them can get very complicated. Such a model typically stores coordinates in space defining a number of triangles (polygons), which will be put together as a “mesh” on which a texture will be projected.

To reduce the file size of the models to download, several techniques were applied:

- The models were stored in the glb binary format
- The models were further compressed using the Draco algorithm
- The models were simplified, and their textures “baked” in order to keep a high level of fidelity while greatly reducing the number of polygons⁵

Conclusion

As the platform is being finalised to be made public during the second half of 2023, we are reminded of the perennial difficulties of archival work: in an effort to make heritage data more widely accessible and sustainable, we often build tools and platforms that are themselves brittle and subject to the assaults of time. While it is tempting to consider digital platforms as a silver bullet to solve these issues, they often end up aging much faster than we expected and it is important to keep sustainability issues in mind.

In this case, the most obvious possible problem would come from the platform’s reliance on WebGL. While this API is currently the only widely supported API for 3D graphics in the browser, and therefore the only solution that could be considered for the project, it is being superseded by the newer WebGPU API, and we can foresee a very probable deprecation in WebGL in a few years. Thankfully, the communities behind the different layers of abstraction used in the construction of the platform are already looking into this transition, and the reliance on standard tools for package management and version control should allow us to manage the updates relatively easily in the coming years.

In an ironic but fitting twist a project focused on the decay of artefacts meant to accompany the deceased in the netherworld will also be facing a difficult fate and might be erased by the arrival of new technology and infrastructure, as the tombs in Bukit Brown had to make way for a highway.

Acknowledgments

The historical maps referenced in this paper were scanned and georeferenced by Department of Geography, NUS, with kind permission from Singapore Land Authority and Ministry of Defence for NUS Libraries to provide viewing of the map services over the internet.

The contemporary map in figure 3 is thanks to the OpenStreetMap contributors, copyright and license information can be found at <https://www.openstreetmap.org/copyright>

⁵ Markom3D, 10 September 2021, “Blender how to Reduce Poly Count and Bake Textures”, available at <https://www.youtube.com/watch?v=Yx9TvvnxCAM> [accessed in July 2023]

References

Natalie Pang and Liew Kai Khiun 2014, "Archiving the wild, the wild archivist: Bukit Brown Cemetery and Singapore's emerging 'docu-tivists'", *Archives and Manuscripts* Vol. 42, No 1, 87-97, <http://dx.doi.org/10.1080/01576895.2014.902319>

Natalie Pang and Liew Kai Khiun 2020, "Mediating Community in Bukit Brown", in "The Hard State, Soft City of Singapore", Simone Shu-Yeng Chung and Mike Douglass, 2020, <https://www.jstor.org/stable/j.ctv12sdvh2.14>

Bukit Brown Documentation project, available at <http://www.bukitbrown.info> [accessed 10 July 2023]

No. 2 Air Survey Liaison Section R. E. and 81 (P. R.) Squadron R. A. F. 1950. Singapore Photomaps, [ca. 1:6,336]. Sheet 1 to 4, 7 to 12, 15 to 18, 20 to 22, 27. [London]: [Royal Air Force]. In: "Historical Maps of Singapore, digitised by Department of Geography, National University of Singapore." <https://libmaps.nus.edu.sg>

Mapping Unit, Ministry of Defence 2010. Singapore, 1:50,000. Series SMU 075, Sheet 1, Edition 9. Singapore: SO Publication, Ministry of Defence. In: "Historical Maps of Singapore, digitised by Department of Geography, National University of Singapore." <https://libmaps.nus.edu.sg>