# THE DIGITAL PRESERVATION OF THE PADLEY MILL AS BOTH HERITAGE AND KNOWLEDGE

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**Abstract**

Architecture is a form of tacit knowledge in which ideas can be learnt from the past, and that body of tacit knowledge can be recorded in order to give relevant guidance to today's productions. This methodological paper presents a timely reflection that seeks to document the digitisation of Padley Mill in the Grindleford Village of the U.K., which was the key design output and built heritage of the late British academic and architect Peter Blundell Jones. The paper starts with a brief review on the current developments on digital reality capture methods in architectural heritage studies, followed by the Padley Mill digital preservation case study via its three work stages utilising LiDAR data and photogrammetry data. It closes with a humanities echo after the historian-designer on the layering and storytelling of the historic environment. The distinction of this paper is it combines and enhances the digital visualisation and storytelling of endangered architectural heritage through 3D LiDAR scanning and digital photogrammetry, promoting further methodological debates in the digital preservation of architectural heritage.

*Keywords: 3D LiDAR scanning, digital photogrammetry, Peter Blundell Jones, Padley Mill, digital preservation*

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## Introduction: Architecture and digital documentation

Architecture is a form of knowledge in which ideas can be learnt from the past, particularly around how past architects had negotiated that knowledge and how that body of tacit knowledge can be recorded in order to give relevant guidance to today's productions. The debates on architectural knowledge have been oriented on defining its key terms of references as well as methods and means of communication (Duffy & Hutton, 1998; Dye, 2014; Samuel, 2018). One of the key areas in which architectural knowledge finds its particular relevance and significance is the contemporary challenges related to the historic environment, particularly the challenges of documentation and dissemination facing vulnerabilities to the changes of the ownership or management structures. This paper sets out to offer a new perspective on the use of light detection and ranging (LiDAR) as a digitising tool as part of the construction of architectural knowledge, especially in the conservation of a historic environment and design reuse of a historic building.

Digitising architectural knowledge in and through historic buildings and landscapes has provided a promising start, yet the preservation of architectural heritage and the digital technologies used in this process have shifted and significantly changed, especially over the past decades (Doğan, 2019; Köse & Us, 2023; Muñumer & Lerma, 2016; Vinci et al., 2024). Documenting the built fabric precisely and enabling access to the up-to-date reality capture condition are two key parameters in order to manage the change in the historic environment better. While simple measurement tools were used in earlier years in the field, nowadays, technologies such as LiDAR for 3D surveying and scanning have generated the possibility to accelerate the speed of analysis and maximise the documentation accuracy, furthermore simultaneously providing more information about the built fabric and structures (Tucci et al., 2016).

The new era of digital acquisition permits architects and researchers to investigate challenging aspects of structures in a more detailed way (Bertellini et al., 2019). Especially with the precise settings for the environment in the right conditions, the 3D LiDAR scanner can allow the collection of desired data in ten to fifteen minutes for each individual scan. The data from the point clouds which are collected can be used for various reasons such as research and practice in the heritage sector and teaching in educational institutions (Hadjri, 2006). Furthermore, they can facilitate the digitisation process and the accessibility of the data by a wider audience (Chatzistamatis et al., 2023). According to Crisan et al. (2024), by reaching a wider audience, 3D scanning can also foster cultural understanding, which is crucial in safeguarding heritage. Therefore, the usage of 3D LiDAR scanners has strong potential and advantages in getting closer to the genius loci of an architectural and cultural heritage site than conventional documentation methods. This provides a crucial step further to preserve architectural knowledge from places as found and participate in the accumulative process of layering and identification of historic environments (Ren, 2020).

When documenting heritage objects and their historic environments with 3D scanners, Historic England's (2018) recent report, *3D Laser Scanning for Heritage: Advice and Guidance on the Use of Laser Scanning in Archaeology and Architecture, suggests following three main principles: collecting the data by* paying attention to authenticity and integrity, processing the data accurately, and managing data and store it in a database so that it can be accessible and replicated by others. When all these principles are followed, 3D scanning can contribute significantly to heritage preservation and documenting endangered heritage. Due to the physical conditions of a heritage object or environmental circumstances, and moreover, due to issues related to user or function changes, a building or structure can become open to deterioration (Doğan, 2023). In a situation like that, the documentation process might require being as rapid as possible and 3D scanning provides the needed speed. Combining 3D scanning with digital photogrammetry makes it possible to produce a more detailed model that can be viewed through digital tools anywhere in the world (Kingsland, 2020). Therefore, it can support the interpretations and suggestions of other researchers to allow them to find the best documentation solutions for their endangered heritage.

## Padley Mill case study

### *Background*

The paper focuses on the Grade II listed Padley Mill, which was designed by the late British architect, writer and educator Peter Blundell Jones (1949–2016) in 1995 and since then used as his family house until 2024. The historian-designer had a far-reaching influence on several generations of architects-in-training, practising architects and architectural scholars in the U.K. and around the world. He taught as a professor at The University of Sheffield School of Architecture between 1994 and 2016. His intellectual heritage constitutes a key part of the heritage of twentieth-century British architectural innovation, both in design and theory, particularly for at least 30 years from the 1980s to the 2010s.

Compared to Peter Blundell Jones' widely disseminated written works throughout his stunning academic career, his architectural design works have not been widely acknowledged nor preserved. As an architect, Peter Blundell Jones has completed over ten building projects, mostly residential, such as the Round House he designed for his parents in the Deven village around the mid-1970s (Ren, 2024). These small-scale projects, in particular his last project for his own family home–the Padley Mill renovation, reflected his fundamental position on architecture as a human discipline, which motivated his lifelong discovery, preservation and promotion of architectural history, and place memory. This built heritage also reflected his intellectual curiosity, which lies in the key question of how people come together through architecture (Till, 2016). While most of the Padley Mill knowledge is based on its 1995-built substance and known through several paper publications (Blundell Jones, 2016; Blundell Jones & Ren, 2018; Ren, 2024), there is very little understanding of how this last practice works of a distinguished architectural historian-designer was aged, endured, and weathered with its historic landscape and domestic interiors from nearly 30 years' use. Considering the very recent user and ownership change, it was, therefore, a time-sensitive task to digitally document the Padley Mill building and its surrounding historic landscape in order to establish an evidence base for initiating and informing future conservation and regeneration.

### *Study area and site context*

Before being renovated and converted into a family house in 1995, the Padley Mill at Grindleford, Derbyshire was a mid-eighteenth-century gritstone corn mill powered by water. It has two stories and a semi-basement in which the mill resides. It has a gabled roof, which is covered with Welsh slate stones (Figure 1 and Figure 2).

*Figure 1. Padley Mill building viewed from the only entrance bridge to and across the Padley Gorge site (left); Side façade of the Padley Mill upon digitisation (right) (Photographs by authors)*

*Figure 2. Padley Mill building and elevated garden viewed as a whole historic environment (Photograph by authors)*

According to Peter Blundell Jones, there may have been a flour mill serving nearby Padley Hall of 1350s and documentary records confirm a mill, at least as early as 1600, used for smelting lead ore from the nearby Eyam mines. The existing building is a rebuild from the 1760s, a three-storey stone structure with 0.5-metre-thick walls and a simple double-pitched roof, the wheel house set inboard at the west end. It was built as a flour mill on a plan designed for four sets of grindstones, but only the two on the south side were installed.

*Figure 3. Interior photos from various parts of the building (Photograph by authors)*

The building was oriented directly north-south with entry from the east, making an angle of 50° with the pond edge (Blundell Jones, 2016). The conservation and restoration process of both the exteriors and interiors of the building was challenging and always involved a question of interpretation, due to the significant change of use while maximising working with the existing shell and fabric (Figure 3).

However, the result was found more beneficial for the unique place since it clearly demonstrated the historical layers and preserved better than without contemporary interventions (Blundell Jones, 2016). In that regard, the Padley Mill has a considerable place and value for understanding the different approaches which can be used in the preservation decisions of built heritage spanning across pre-industrial to post-industrial times.

## Digital preservation workflow and methods

The digital preservation of the Padley Mill consists of three different stages. The first stage involved efficient and effective fieldwork, which took place in May 2024 in Grindleford, U.K. In this stage, while scanning the building with the 3D scanner, the team also collected photogrammetric data, which was used in the 3D modelling of the building. Since there was a limited time frame for finishing the documentation of the structure and also for access inside the building, two full days were spent in the field to collect most of the data. The goal was to document the building digitally as accurately as possible; therefore, it can be accessed even though there might not be a chance of regaining access physically in the future. This way, the data can reach a wider audience and replicate the data if needed, which improves its usability.

The photogrammetric data involved terrestrial photographs around the building, as well as images of the interior of the building which has authentic design elements added by Peter Blundell Jones. In this study, aerial photographs were not taken due to not having a drone, however, since the topography of the plot is convenient and has different levels, the roof photographs were taken from the higher levels of the plot. The second stage was the data processing and analysis stage, which was conducted by the SCENE software of FARO for the scans and Adobe Lightroom for photograph adjustments to achieve the required photogrammetric data. The third and last stage was the modelling of the structure by merging the point cloud and the photogrammetric data collected by the Reality Capture software. Furthermore, software such as Autodesk Meshmixer was also used for fixing the mesh model (Figure 4).

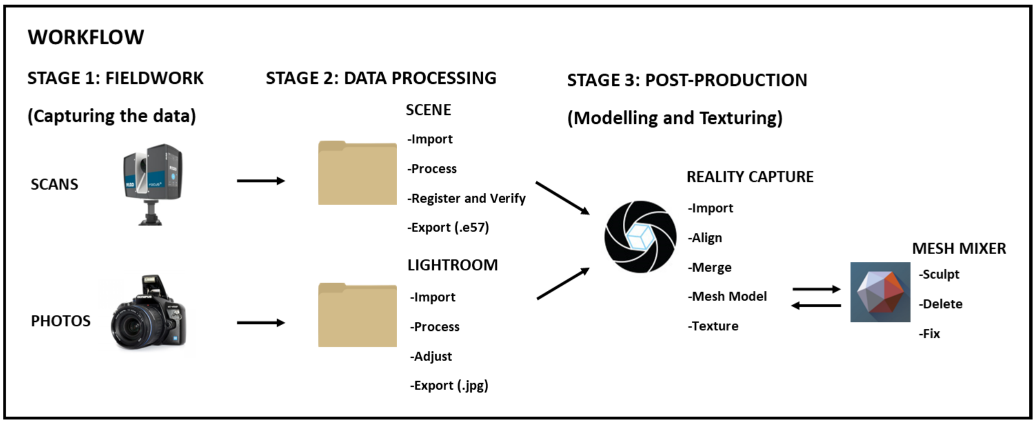


*Figure 4. Diagram of the workflow followed during the project (Image by authors)*

In the scanning process, at some locations of the exterior, optimal settings were used with concerns related to scanning time and the limitations of the area due to traffic. However, for the accuracy and efficiency of the model creation and for catching more details, the highest possible settings were used while collecting the rest of the LiDAR data.

### *Stage 1: Terrestrial data collection*

The 3D scanning of the old mill building was performed by the FARO Focus Premium LiDAR scanner (Figure 5). For better results, weather conditions were closely followed and a day with good lighting without any precipitation was selected for the fieldwork. Before scanning the object, a general investigation was done by the team to decide the locations of the scanning points for the reliability of the data. For the building, seventy-seven scans were conducted from both exterior and interior spaces (Figure 6).

Figure 5. Site scanning process (Photograph by authors)

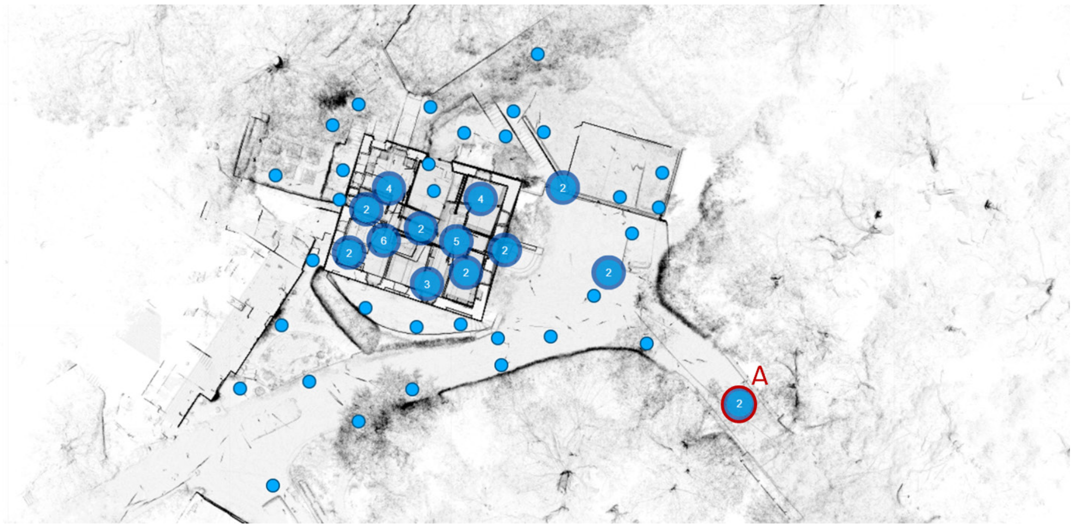


Figure 6. Overall map of the scanning locations of the Padley Mill and its historic surroundings (Image by authors)

Various characteristics of the locations were considered when deciding the scanning positions for the integrity of the results. Each scan point requires seeing at least two other points (preferably three) so that it is easier to locate and connect the different clusters while processing the data. Therefore, while choosing the scanning positions, it is essential to set the locations in order to avoid obstacles that prevent the visual connection. In the case of Padley Mill, it was challenging due to the topographic characteristics of the plot. It was not always possible to see the other scan locations from the lower levels, which led to making closer scans to each other in threshold locations. Some of the scans were made from the garden of the neighbouring building or from the higher points of the plot's topography, allowing the scanner to see the roof of the structure.

On the other hand, the traffic around the bridge and the road towards the hill was occasionally disturbed during the scanning process. The scan time with the arranged settings was between ten to twelve minutes and sometimes, the cars needed to be allowed to pass since the passage was narrow and there was no possibility of stopping them (Figure 6, Point A). Therefore, the same scan is required to be performed more than once due to the traffic conditions.

While arranging the scanner's settings regarding resolution, most of the time, the same resolution was used in both exterior and interior spaces. The scan resolution indicates the number of points which contain data and the distance between these points. It is found essential to collect as much data as possible and, at the same time, use shorter distances between the data points. Therefore, the setting 1/4 was used for visual documentation. However, in various interior locations, the resolution was increased to capture more details, especially in spaces with important architectural details. It is possible to use increased scan resolution outdoors as well; however, this might cause longer recordings with details that might not be useful for the project, such as the leaves of the trees. Furthermore, increasing resolution can be problematic in rainy weather since the scanner would scan more droplets and that can create noise in the scan. However, since the days with good lighting without any precipitation were selected, this issue was avoided.

For the scan quality, setting 3 was used, which implies that the scanner will measure the same data point three times and confirm its location. Even though decreasing the setting to 2 and measuring the same data point two times can give an optimal result and also be less time-consuming, it is chosen to scan with setting 3; therefore, it would be possible to generate more accurate and reliable results.

While the structure was scanned with the scanner, photogrammetric data was also collected by the team (Figure 7). The camera used while collecting the terrestrial photogrammetric data was a Sony A7R3 camera. For the aperture, *f*/8 was used for light exposure since it gives more depth of field in the outdoor environment and takes sharper photographs. Therefore, the building was easily separated from the background. On the other hand, ISO 100 was used for light sensitivity since it gives the ability to achieve photographs with less noise and better colour accuracy in outdoor environments on bright days. Furthermore, even though 1/250 shutter speed can produce darker photographs, in the case of photographing the building, this shutter speed was chosen for better-quality photographs. After collecting all the data, the second stage of the study began.

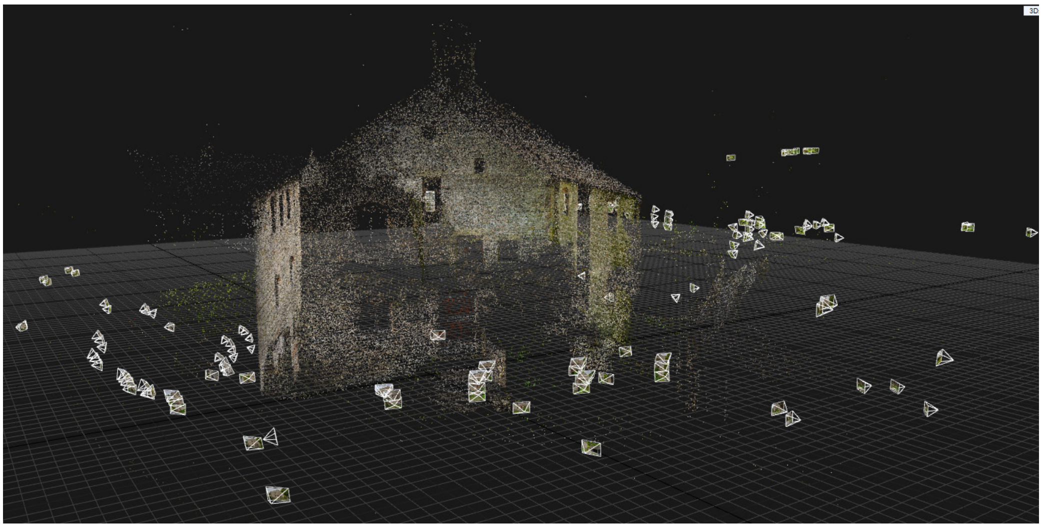
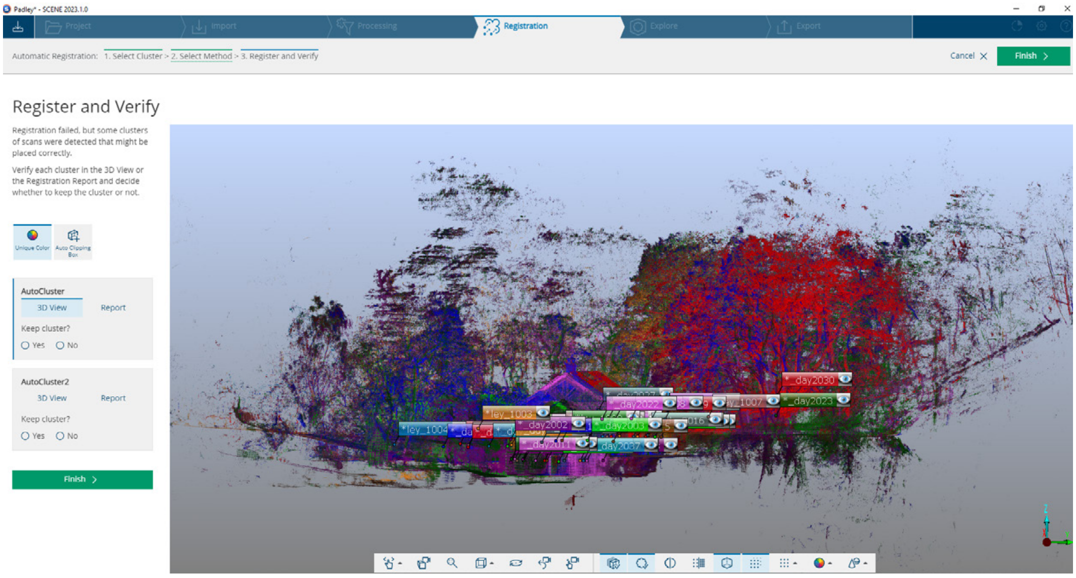


*Figure 7. Various camera points from the exterior of the building which were used for photogrammetry (Image by authors)*

### *Stage 2: Data processing—Point cloud and photograph editing for photogrammetric data*

The point data collected by the scanner was processed by the SCENE software. After importing the scans to the computer, the scans were registered by dividing them into clusters. The average point distance for uniform subsampling of the scans was chosen as 0.05 metres for outdoor scans, even though the default setting of the software is 0.035 metres since higher values are better for outdoor scenarios. The clusters were registered in both top view and cloud to cloud to make the merging more accurate. The maximum distance in which cloud-to-cloud registration searches were selected as 10 metres and the maximum number of iterations was selected as 30. These settings were suggested by the SCENE software for increasing the signal strength and reducing ranging noise. With all these settings, the point data started to be processed.

In this stage, the scans were registered as a point cloud and the positions and interactions of the clusters were processed for verification. Before verification of the point cloud, the software gives the option to check the maximum point error and the mean point error of the registration of the clusters. In the reports for the scan point statistics, while maximum point error represents the parameter that has the highest values among all the frames, mean point error is the sum of all the error values divided by the number of scans. Therefore, when the maximum point error is larger, it suggests that the alignment of the scans is less accurate. In that regard, it is important to have a lower number for the maximum point error. In the case study, the parameters were 12.3 mm maximum error and 6.6 mm mean error, which makes it considerably low.



Register and Verify

Registration failed, but some clusters of scans were detected that might be placed correctly.

Verify each cluster in the 3D View or the Registration Report and decide whether to keep the cluster or not.

Keep cluster? ○ Yes ○ No

Keep cluster? ○ Yes ○ No

*Figure 8. Registration and verification of the scans and the clusters (Image by authors)*

Even though the software can locate the clusters regarding the matching points, occasionally, it is necessary to locate them manually or visually for registration (Figure 8). Due to the plot's topography, control points needed to be added to register the point cloud. After registration and verification of the point cloud, it is possible to visualise the point cloud with the scanner positions and their connections (Figure 9 and Figure 10). If there are any missing connections, it is also possible to manually create them. However, in the scanned structure, due to sensitively selected scanning positions, this step was not needed.

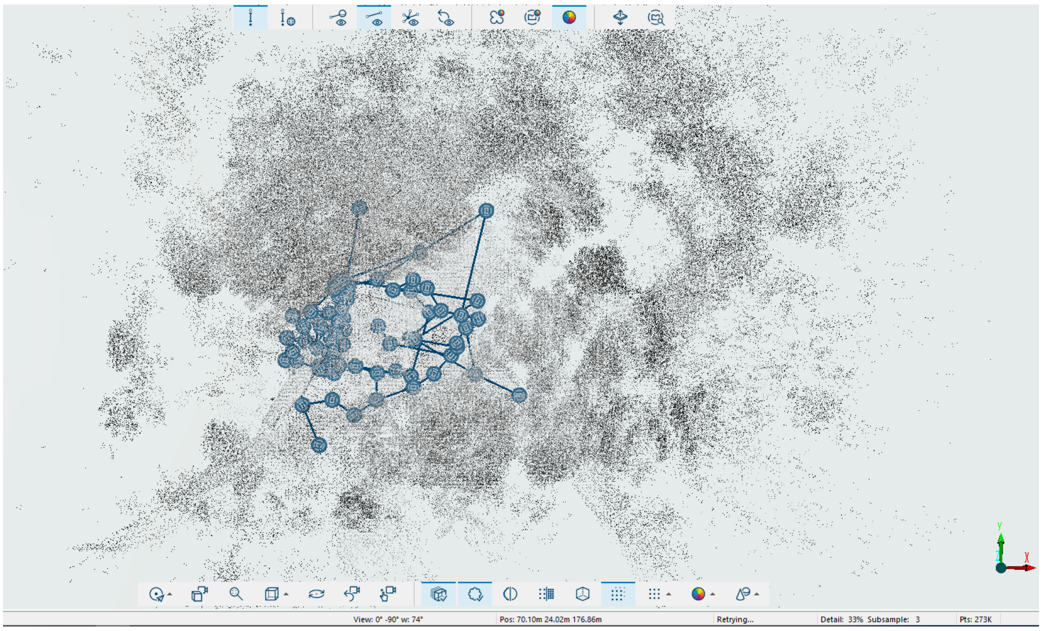


Figure 9. Screenshot of the point cloud with the scan positions and their connections (Image by authors)

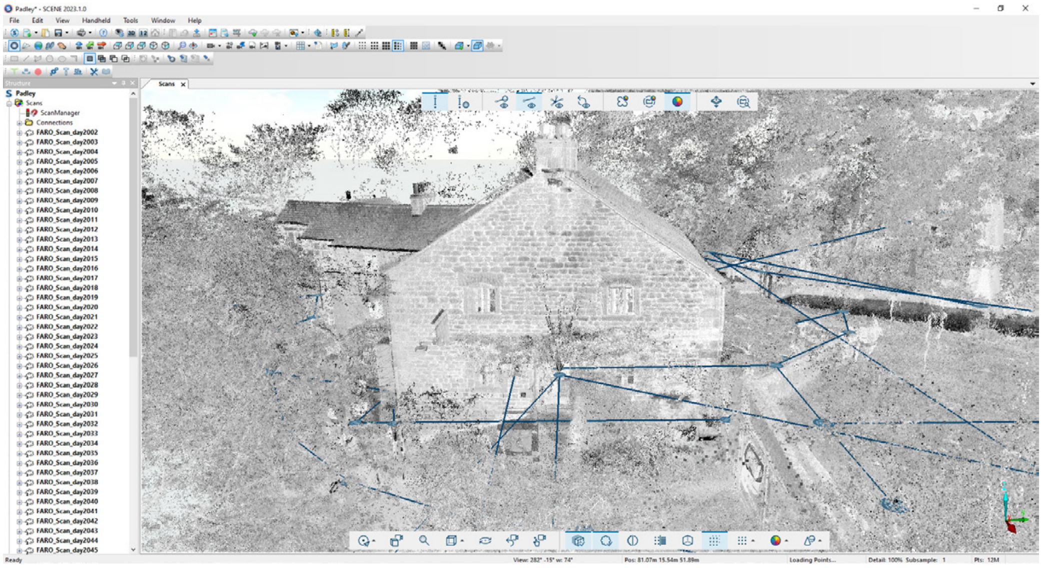


Figure 10. Black and white point cloud with an isometric view of the structure and its surroundings (Image by authors)

If the scanning and registration were performed in colour, the point cloud could also be visualised in colour. The coloured point cloud can be exported in a.e57 file format, which can be used to store points, images, and metadata created by 3D scanners efficiently and flexibly. However, one of the reasons for using this format is related to the fact that it is vendor-neutral, which means that many 3D design applications can support it and it can be shared easily by different types of software. In this case study, it was preferred to export the point cloud in colour since it can help identify the elements and improve the clarity of the project for working on it in the process of creating a model (Figure 11).

After finishing with the data processing of the point cloud, before starting to model, the photographs taken require processing as well so that they can be used as photogrammetric data. The reason for processing the photographs is related to the fact that there might be different highlights and shadows and at the same time, different white balances on the photographs due to the position where the photo was taken. Therefore, all the photos need to be in the same settings on the histogram to have a better result while modelling. In that regard, all the photos taken were processed by the Adobe Lightroom software and the adjusted settings were applied to all the photographs (Figure 12).

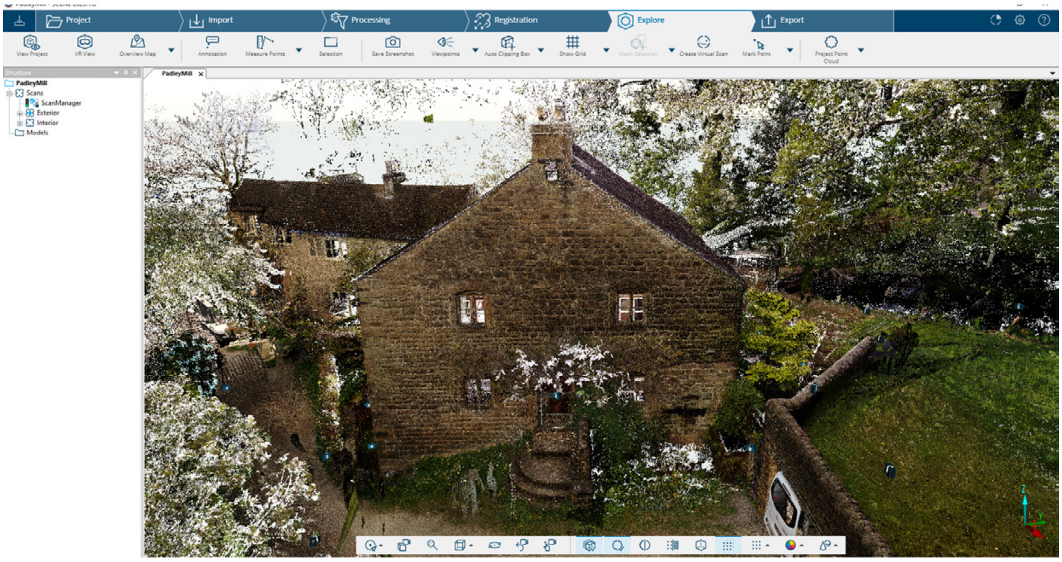


*Figure 11. Point cloud in colour with an isometric view of the structure and its surroundings (Image by authors)*

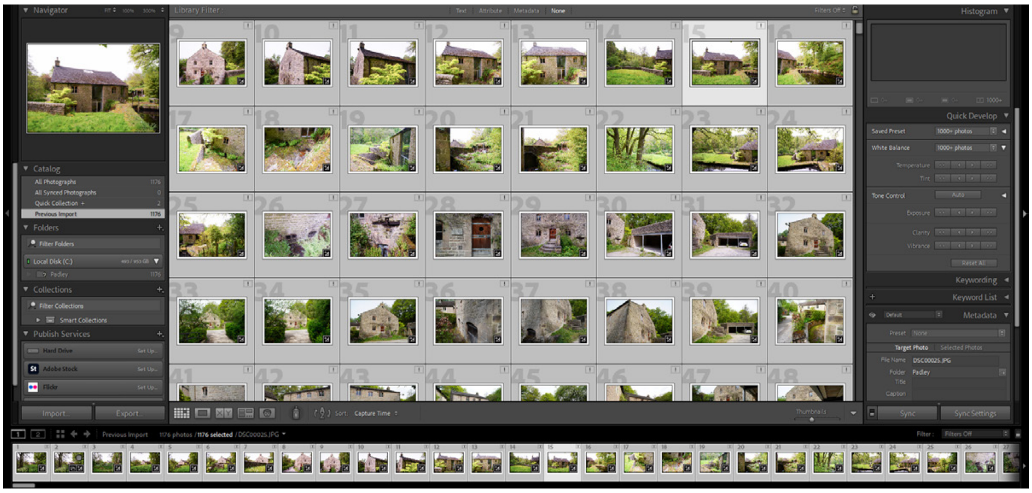
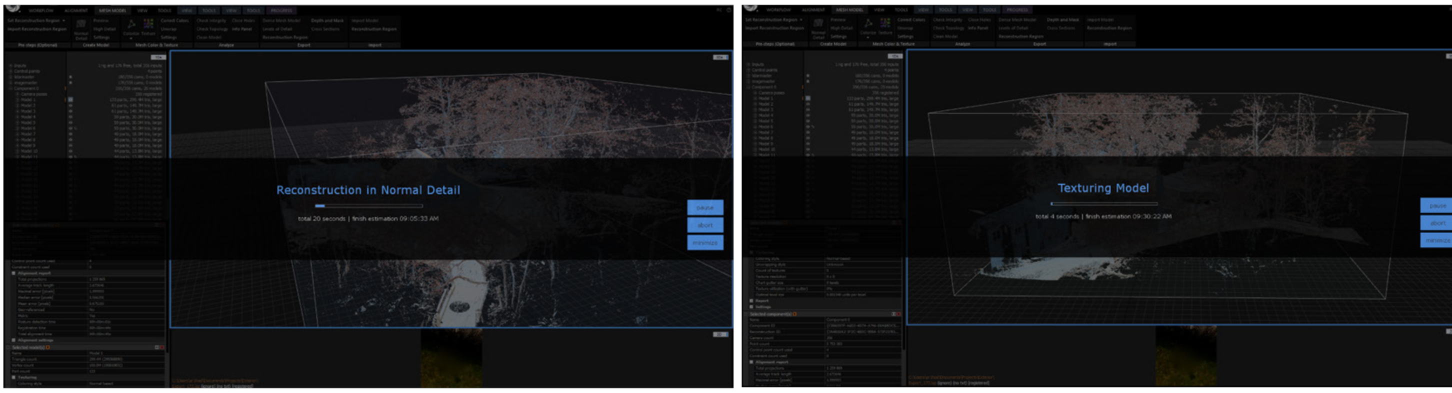


*Figure 12. Processing the photographs in Adobe Lightroom for adjustments (Image by authors)*

### Stage 3: Post-production—Modelling and texturing

The post-production stage can be carried out by following various steps to create the best outcome for the model. The model of Padley Mill was prepared by the Reality Capture software. Reality capture is a program which can combine photographs and point cloud data and create a mesh model which can be textured. According to the software's website, reality capture uses proprietary algorithms so that it can register all different inputs simultaneously and combine them into one component (Epic Games, 2024). Therefore, it allows the convention of data collected from a physical object into a digital model. However, for using various formatted data, all the different data is required to be registered in the program. In the registration process, the data needs to be aligned and divided into components, which can be merged into one component. Depending on the quality of the data and the overlap between the different data, the processing time for alignment can vary. Especially if the overlap is low, it is possible that the program cannot align the components into one. In this case, the manual creation of control points is needed.


Reconstruction in Normal Detail

total 20 seconds | finish estimation 09:05:33 AM

Texturing Model

total 4 seconds | finish estimation 09:30:22 AM

*Figure 13. Reconstruction and texturing process of the model (Images by authors)*

The post-production stage can be time-consuming since it requires identifying and marking matching features in different photographs. However, if control points are located correctly, they can be used as a reference for alignment and it can increase the accuracy and reliability of the model. In the case of Padley Mill, matching the scanning data and photogrammetric data was troublesome due to not having aerial photographs, which is helpful in finding matching points since it can combine most of the angles with a bird-eye view. Nevertheless, by creating the correct control points for reference, which can be detected by a large number of photographs from various angles, it was possible to align the data into one component. The crucial point in this stage was finding the overlapping images, especially at the corner of the buildings where the direction of the façades are changing, so that the program can estimate the transition between these different surfaces. In that regard, taking extra-terrestrial photographs at the corners of the building with a scan path of an arc was found beneficial.

After aligning the components and merging them, it is possible to reconstruct a mesh model with either normal details or high details, which have more triangulation. In the case of Padley Mill, a normal detailed model was used since the building does not have ornamentation or any small details on its façade. Creating the mesh model stage can be challenging sometimes since there might be areas which were not possible to scan or take a photograph of. Furthermore, people, cars, or objects blocking the structure need to be deleted as well. Therefore, before creating the mesh model, it is required to clean, filter, segment, and classify. In this case, the mesh model needs to be exported to another program for adjustments and imported back. For the model of Padley Mill, the software called Autodesk Meshmixer was used for sculpting the holes, deleting objects, and fixing topography defects. When the mesh model becomes in a desired form, it can proceed to the next step, which is texturing (Figure 13).

While texturing the mesh model of Padley Mill, a total of 1,523 terrestrial photographs were used. The photographs taken by the integrated camera of the scanner were not used, since the quality of it is lower than the Sony A7R3 camera. After finishing the creation of the model, it is possible to define clipping boxes, which can allow the creation of photogrammetric cross-sections of the structure. However, this can also be achieved by the SCENE software by converting the point cloud into orthoimages. Therefore, it gives the ability to have image-based output, a scaled image with measurements, that can be converted into vectorial drawings by tracing on CAD. By doing this, it is possible to generate illustrations, animations, and visualisations to provide practical and physical information about the heritage object. While modelling the Padley Mill, both software were used for preparing façade images and cross sections of the building. Key visual findings of the study are as follows (Figure 14—18).

*Figure 14. Site layout generated from the 3D scanning model (Image by authors)*

## Result and discussion

This digital preservation of the Padley Mill is both a digital preservation and presentation of a sample of built heritage and a form of architectural knowledge from Peter Blundell Jones.

Its result not only seeks to facilitate the long-term access to key information assets of the historic built environment in and around the Padley Mill but also to safeguard the deep disciplinary knowledge and intellectual heritage of Peter Blundell Jones, which were embedded in the historic environment. The result echoes the five digital attributes from The University of Sheffield's digital preservation policy, which are: Accessibility–the ability to access the data over the period of time required; Integrity–the data is complete and unaltered; Authenticity–what the data purports to be; Reliability–trusted contents which accurately reflects the output of a transaction; Usability–can be located, retrieved, presented, and interpreted (The University of Sheffield, 2023).

*Figure 15. The juxtaposition of the building-in-site axonometric post-produced after scanning (left) (Image by authors); The original design drawing (right) (Image by Peter Blundell Jones)*

*Figure 16. Aerial perspectives on the relationship between the building and landscape generated from the 3D scanning model (Images by authors)*

Different from the traditional way of preservation and presentation of knowledge in physical and digital archives, such as The Peter Blundell Jones Archive (2023) and The Peter Blundell Jones Digital Library (2021), the digital preservation of the Padley Mill through 3D LiDAR scanning and digital photogrammetry carved and captured a specific moment in the history of the historic site and environment to its maximum potential precision and reproduction.

The storytelling of this built heritage, therefore, is focused on the immediate present without losing its interconnectedness to the accumulative layers of the built heritage recent past and near future, centred around its designer, Peter Blundell Jones. Through 3D data assemblage and visualisation, the tacit knowledge around how to preserve a historic environment and design reuse of a historic building from Peter Blundell Jones has been digitised, decoded, and ready for wider dissemination. In this way, the Padley Mill also becomes a mnemonic, as Peter Blundell Jones argued for the Red House (Blundell Jones, 2000).

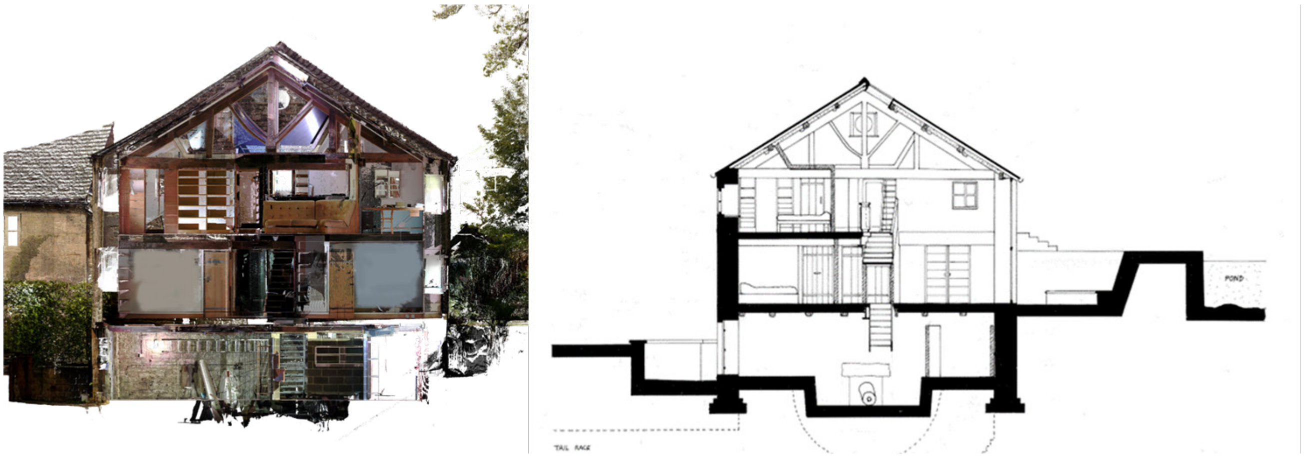


*Figure 17. The juxtaposition of the cross-section post-produced after scanning (left) (Image by authors); The original design cross-section (right) (Image by Peter Blundell Jones)*

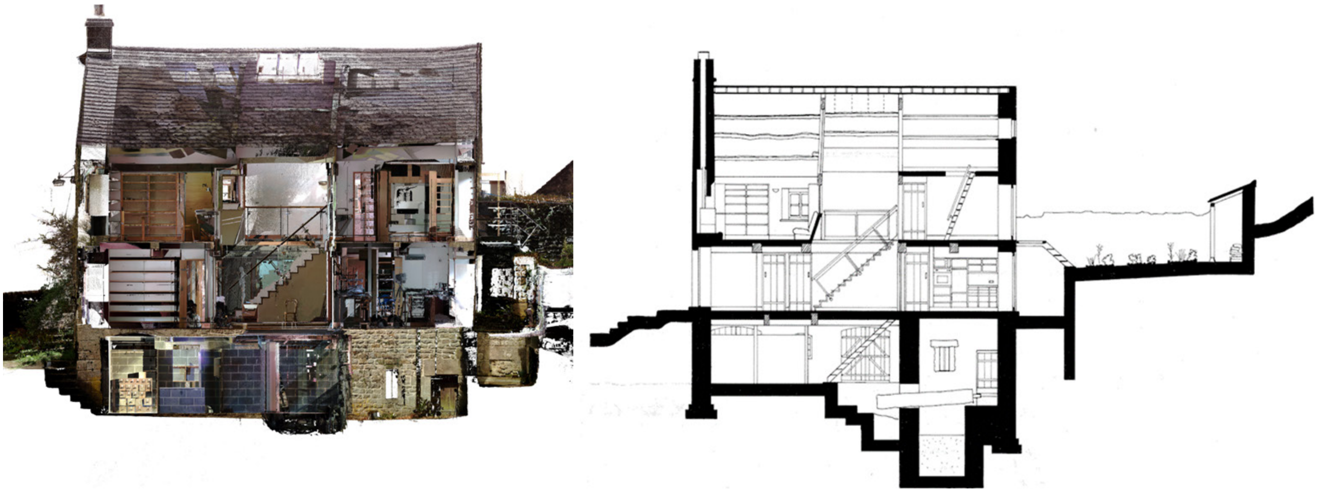


*Figure 18. The juxtaposition of the longitudinal section post-produced after scanning (left) (Image by authors); The original design section (right) (Image by Peter Blundell Jones)*

## Conclusion

As demonstrated from this pilot project, 3D LiDAR scanning and digital photogrammetry have strong potential and advantages to complement and even replace manual methods, which are more time-consuming and labour-intensive, particularly in the need for rapid response to endangered sites and precise documentation of the present status at its most authenticity. Even though there is a pragmatic need to strike a balance between extreme precision and appropriate efficiency, the latter of which is often met by conservation researchers due to resource scarcity, the end result can be highly controlled down to details of millimetres, which increases the reliability and reproducibility of the end product. One particular highlight during this pilot study is that 3D LiDAR scanning can effectively and efficiently record irregular geometries in specific locations, such as the details of the stone façade and the uneven surface of the timber beam work. This coincidently aligns with one of Peter Blundell Jones' central ambitions to promote a more geometrically irregular, subtly organic modernism in architecture (Blundell Jones, 1985).

The 3D LiDAR scanning can technically safeguard the reproduction of the Padley Mill at full scale and details whenever needed in the worst-case scenarios of changing appearance or surrounding environment. However, there will still be a human scale presenting and persisting—the irreplaceable need for human judgement and decision-making both during collecting the raw data and achieving the end product. The process of determining the point clouds with relation to topography, for example, demonstrates human sensitivity towards the existing condition of the historic environment. This again echoes one of the key ethos Peter Blundell Jones held on architecture as a human discipline.

The digital documentation of Padley Mill as a living heritage of Peter Blundell Jones' architectural philosophy on specificity and authenticity of place-making through LiDAR scanning and digital photogrammetry methods resonates with the original design reuse of the mill with a focus on irregularity and authenticity. Thus, the inquiry extends the layered dialogue towards a virtual dimension between a passed-away historian-architect, a present heritage building, and an ever-changing historical environment.

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## References

Bertellini, B., Gottardi, C., & Vernier, P. (2019). 3D survey techniques for the conservation and the enhancement of a Venetian historical architecture. *Applied Geomatics*, 12(S1), 53–68. https://doi.org/10.1007/s12518-019-00267-6

Blundell Jones, P. (1985). Leader: Organic response. *The Architectural Review*, Article 1060, 23–24.

Blundell Jones, P. (2000). Architecture as mnemonic: The accumulation of memories around Morris's red house. *Nineteenth-Century Contexts*, 21(4), 513–540. https://doi.org/10.1080/08905490008583491

Blundell Jones, P. (2016). Padley Mill: A question of interpretation. *Cuaderno De Notas*, 17, 160–170. https://polired.upm.es/index.php/cuadernodenotas/article/view/3488

Blundell Jones, P., & Ren, X. (2018). Padley Mill: A question of interpretation (with postscript). *Heritage Architecture*, 1(9), 71–82.

Chatzistamatis, S., E.Tsekouras, G., & Anagnostopoulos, C. (2023). The quality in 3D acquisition of cultural heritage assets: Challenges and risks. In M. Joannides & P. Patias (Eds.), *3D research challenges in cultural heritages III: Complexity and quality in digitisation* (pp. 65–76). Springer. https://doi.org/10.1007/978-3-031-35593-6_4

Crisan, A., Pepe, M., Costantino, D., & Herban, S. (2024). From 3D point cloud to an intelligent model set for cultural heritage conservation. *Heritage*, 7(3), 1419–1437. https://doi.org/10.3390/heritage7030068

Duffy, F., & Hutton, L. (1998). *Architectural knowledge: The idea of a profession*. Routledge.

Dye, A. (2014). *Architects and research based knowledge: A literature review*. Royal Institute of British Architects.

Doğan, H. A. (2019). Implementation of eye tracking technology on cultural heritage research and practice. *Igra Ustvarjalnosti*, 7, 16–21. https://doi.org/10.15292/iu-cg.2019.07.016-021

Doğan, H. A. (2023) Reasons for deterioration of historical buildings and the significance of memory in the adaptive reuse process of architectural heritage: Case study of Saint Vincent de Paul School in Istanbul. *Wiadomości Konserwatorskie–Journal of Heritage Conservation*, 73, 24–33. https://doi.org/10.48234/WK73ISTANBUL

Epic Games. (2024). *Processing without limitations: Process lasers & images automatically*. Reality Capture.

Hadjri, K. (2006). Experimenting with 3D digitization of architectural physical models using laser scanning technology. *International Journal of Architectural Computing*, 4(2), 67–80. https://doi.org/10.1260/1478-0771.4.2.67

Historic England. (2018). 3D laser scanning for heritage: *Advice and guidance on the use of laser scanning in archaeology and architecture*.

Kingsland, K. (2020). Comparative analysis of digital photogrammetry software for cultural heritage. *Digital Applications in Archaeology and Cultural Heritage*, 18, Article e00157. https://doi.org/10.1016/j.daach.2020.e00157

Köse, S., & Us, H. (2023). Application of Terrestrial Laser Scanning (TLS) technology for documentation of cultural heritage buildings and structures: A case study Sarı İsmail Sultan Tomb. *Advanced LiDAR*, 3(1), 35–40. https://publish.mersin.edu.tr/index.php/lidar/article/view/977

Muñumer, E., & Lerma J. L. (2016). Fusion of 3D data from different image-based and range-based sources for efficient heritage recording. 2015 *Digital Heritage*, 1, 83–86. https://doi.org/10.1109/DigitalHeritage.2015.7413840

Peter Blundell Jones Archive. (2023). *The Peter Blundell Jones archive*. The University of Sheffield Special Collections and Archives.

Peter Blundell Jones Library. (2021). *Peter Blundell Jones library*. https://sites.google.com/sheffield.ac.uk/peterblundelljoneslibrary/

Ren, X. (2020). Thin mask, thick mnemonic: The idea of the wall and genius loci in two contemporary buildings. *Arq: Architecture Research Quarterly*, 24(1), 37–48. https://doi.org/10.1017/S1359135519000460

Ren, X. (2024). The built heritage of Peter Blundell Jones: The architectural critic's own houses as built criticism. *International Conference on Architecture as Built Criticism*.

Samuel, F. (2018). *Why architects matter: Evidencing and communicating the value of architects*. Routledge.

The University of Sheffield. (2023). *The University of Sheffield's policy for digital preservation for students and staff* [Policy].

Till, J. (2016, August 23). *Obituary: Peter Blundell Jones* (1949-2016). Architects' Journal. https://www.architectsjournal.co.uk/news/obituary-peter-blundell-jones-1949-2016

Tucci, G., Bonora, V., Fiorini, L., & Conti, A. (2016). The Florence Baptistery: 3-D survey as a knowledge tool for historical and structural investigations. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLI-B5, 977–984. https://doi.org/10.5194/isprs-archives-xli-b5-977-2016

Vinci, G., Vanzani, F., Fontana, A., & Campana, S. (2024). LiDAR applications in archaeology: A systematic review. *Archaeological Prospection*. https://doi.org/10.1002/arp.1931