Mystras Captured from the Air – Digital Recording Techniques for Cultural Heritage Management of a Monumental Archaeological Site

Jitte Waagen 🆔 *based on peer reviews by Nikolai Paukkonen and 1 anonymous reviewer*

Cite this recommendation as:
Waagen, J. (2024) Mystras Captured from the Air – Digital Recording Techniques for Cultural Heritage Management of a Monumental Archaeological Site. *Peer Community in Archaeology*, 100420. 10.24072/pci.archaeo.100420

Published: 27 June 2024

This paper (Panagiotidis et al. 2024) discusses the digital approach to the 'digital storyline' of the Monastery of Brontochion of Mystras, Peloponnese, Greece. Using drone and terrestrial photogrammetric recording techniques, their goal is to produce maps and 3D models that will be integrated in the overall study of the medieval city, as well as function as a comprehensive visualisation of the archaeological site throughout its history. This will take shape as a web application using ArcGIS Online that will be a valuable platform presenting interactive visual information to accompany written publications. In addition, the assets in the database will be available for further advanced purposes, such as suggested by the authors; xR applications, educational games or digital smart guides. The authors of the paper do a good job in describing the historical background of the site and the purpose of the digital documentation techniques, and the applied methods and the technical details of the produced models are dealt with in detail.

The paper presents a compelling case for an integrative approach to using digital recording techniques at an architectonically complex site for Cultural Heritage Management. It can be placed in a series of studies discussing how monumental sites can benefit from advanced digital recording techniques such as those presented in this paper (see for example Waagen and Wijngaarden 2024). The paper is recommended as an interesting read for all who are involved in this field.

References:

Panagiotidis V. Vayia, Valantou Vasiliki, Kazolias Anastasios, and Zacharias Nikolaos. (2024). At the Edge of a City: The Digital Storyline of the Brontochion Monastery of Mystras. Zenodo, 8126952, ver. 3 peer-reviewed and recommended by Peer Community in Archaeology. https://doi.org/10.5281/zenodo.8126952

Waagen, J., and van Wijngaarden, G. J. (2024). Understanding Archaeological Site Topography: 3D Archaeology of Archaeology. Journal of Computer Applications in Archaeology, 7(1), 237–243. https://doi.org/10.5334/jcaa.157

Reviews

Evaluation round #2

DOI or URL of the preprint: https://doi.org/10.5281/zenodo.8126953
Version of the preprint: 2

Authors' reply, 25 May 2024

Thank you for your thorough review.
We have made the following adjustments:

- Enlarged the images for better clarity.

- Separated Figure 2 into two images.

- Added Figure 8 to serve as a visual aid for the chronological phases used in the database.

- Corrected a few typographic errors on lines 30 and 46.

- Edited lines 202-208 to explain the digital storyline.

Kind regards,
Vayia V. Panagiotidis

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Decision by **Jitte Waagen** ⓘ, posted 08 May 2024, validated 13 May 2024

minor revisions

Dear authors,
Your revised version was positively reviewed,I only have a few minor points.
First, in line with reviewer 2, I agree that the photos and maps should be larger to effectively illustrate the information discussed in the text. Second, I still miss a clear explanation of the 'digital storyline', which should be there (it features prominently in the title of the paper). Third, there are some minor typos, like 'Tur-key' and a few double spaces I identified here and there, that should be fixed.
If you can process these final minor adaptations, I am happy to recommend the paper!
Thanks again for your contribution so far.
Best wishes,
Jitte

Reviewed by Nikolai Paukkonen, 24 April 2024

The changes made for this version have greatly improved the quality of the paper. Especially the expansions with the background of the methodology and a concise section on earlier similar research have made it more understandable and clarified the context of current research. Conversely, cutting down the amount of text dedicated explaining the historical background has made the totality more focused. Overall I think the updated work is an interesting piece of scholarship and could be recommended for publication as it is.

Reviewed by anonymous reviewer 1, 30 April 2024

Thank You once again to the editors for considering me for a further review of the manuscript. Most of the suggestions were considered, and the manuscript was revised accordingly. On my side, I have two suggestions: provide a proper location map of the site and increase the size of the photographs used in the manuscript.

I strongly recommend this manuscript for publication. Thank You.

Evaluation round #1

Authors' reply, 16 April 2024

Initially we would like to thank the Reviewers for their insightful suggestions and comments. We have incorporated most of them to our work. The comments were helpful for us to understand some of the limitations in our expression of the work described and gives us a chance to elaborate in some cases or clarify in others.

The research question has been described more accurately in the Introduction and Results lines 48-55 as well as 286-289. We have tabulated the numbers regarding the technical methodology and summarized the description of the processing methodology lines 154-158. Finally, reference to the reprojection errors is made in lines 175-179.

The abstract has been reduced as far as the historical information is concerned and the description of the project, lines 22-24 & 32-35. Previous work use SfM and UAVs has been added in lines 46-54. The version of Agisoft Metashape used in this project has been added, line 158. The availability and further use of the results are described in lines 300-302. Future plans have been enhanced, lines 305-309.

AD has been added in two points, the abstract (line 19) and the Introduction (line 75). Since there is no significant alteration in the timeline it has been omitted from the subsequent mentions to chronology. Figure 7a is a reproduction of G. Millet's topographical plan of Mystras and has been georeferenced to our basemap and displayed overlapping to present additional usability of the digital products from our work.

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Decision by Jitte Waagen ⬡, posted 08 January 2024, validated 09 January 2024

major revisions

Dear authors,

Your very interesting paper received two reviews containing some very good suggestions. Addressing these are in my opinion necessary to increase the quality and impact of the paper.

One of the main points is aptly commented on by the first reviewer; the paper needs a clearer structure in terms of a research question, and how methods and results help in answering this. I agree that the introduction should be about that, and that the site should be described in as far as that is relevant to the digital research

project. The rest of the paper should then follow the process of addressing the research question. For example, a clear point is what the digital storyline is; there is a reference, but as one of the main goals of the digital mapping, it warrants some discussion. And how the results (that appear quite interesting!) then address that. I.e., it is stated the 3D mapping allows a unique insight in the site, but this is not explicated. Making that more explicit will definitely increase the value of this contribution.

A second point, made as well by the first reviewer, is that the technical methodology is well-known, and does not need a long treatment. I agree it would be better to make it more concise and refer already published studies. My own suggestions here would be to 1) tabulate the numbers (UAS operations, numbers of photos, GSDs, etc.), and 2) comment on the reprojection errors and dGPS control point errors (since the work aims for an accurate mapping), and use the freed up space to go into more detail on the discussion.

I further agree with the other suggestions of both reviewers, except for point 4. of the second reviewer, I think that a short summary relevant to the digital project suffices.

I hope you find the time to work on these!

Thanks for your contribution so far.

Best wishes,

Jitte

Reviewed by Nikolai Paukkonen, 03 November 2023

Peer reviewGeneral commentsThe paper "At the Edge of the City: The Digital Storyline of the Brontochion Monastery of Mystras", by Vayia Panagiotidis, Vasiliki Valantou, Anastasios Kazolias and Nikolaos Zacharias, presents a digital documentation project of the medieval monastery of Brontochion in Mystras, Greece. Whereas the measurement methodology is not novel by any means – DJI drone photography combined with SfM photogrammetry by Agisoft Metashape have both been used and published in various projects for several years – the larger context of creating a geodatabase of different construction periods and functions is a valuable case study. The methods used are described carefully, as is the historical background of the site. However, the paper still needs some expanding regarding its ultimate research question and the aims, in addition to adding some background and references to earlier research regarding the technical methods used. Title and abstractTitle represents the contents of the article. However, the concept of "digital storyline" should be more explicitly defined and contextualised in the article. Same applies to the abstract: it is generally well written and represents the paper, giving some background information and spelling out the methods and technologies used. However, the goals and the results of the work should also be included more clearly.

Depending on where the final paper is to be submitted, the abstract might need some shortening – in that case I recommend that the historical background be limited to a few general phrases (since the history of the site is not the main topic of the paper).

Introduction

I think that the introduction should be begun with a description of the project at hand, and only then the background should be given (line 46 onwards). At the moment, the Introduction chapter **does not clearly explain the motivation of the study** and **does not spell out the research question**. Rather, it focuses on explaining the historical background and development of the monastery. While interesting by itself, all this material should be separated into a subdivision of its own, or depending on the word limits available, cut down and made the ending part of the Introduction.

As the main topic of the paper are the UAS-based measurements and the processing of the data, it would be appropriate to have some background information about earlier research and experiments in these fields. The methods and software used are well established now, so there is no need for an extensive survey of earlier publications – one or two paragraphs would be enough. Here the concept of "digital storyline" could be explained more, perhaps with using examples from other projects.

Regarding the research project context of the paper, its background should be spelled out more clearly: mainly, which institution runs the research project "Digital Mystras", who is funding it, and in which timescale is

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it active?

Methods The methods and materials are appropriately described. A sufficient amount of images makes the material easy to follow. For the purposes of reproduction, the versions of the software used (Agisoft Metashape, ArcGIS) should be clearly stated, either in the text itself, or in the references section.

Results

The results are interesting and well presented, except for the ultimate question: where is the end result to be used? Is the geodatabase "Castle City of Mystras (lines 203–204) intended for public or other researchers, and how and when can it be accessed? Regardless, the result are impressive, and I hope there will be more detailed research based on the now created geodatabase and its functions.

Discussion

Conclusions are adequately supported by the results. A more detailed description of the future plans would help contextualise the project – for instance, are they intended to be used in some installations at the site of Mystras or in some mobile application aimed for the visitors, or only for research purposes? Here some evaluating of the results would be adequate, as well – what was the research question, and do the results answer it? Other comments

Some typos and other mistakes still remain in the paper, and the language could use a check from a professional in English language. Tables and figures are well selected and also referred to in the text, with the exception of Figure 1 – the reference to Figure 2 in line 60 should most likely to be Figure 1.

Concerning the references section, some entries (at least Chatzidakis 1992, Chase 2003, Georgiades 2002, Runciman 1980 and Sinos 2021) seem not to be referred to in the actual text.

Reviewed by anonymous reviewer 1, 22 December 2023

I am thankful to the editors and management team for allowing me to review this research paper. Though I am not an expert in the field of Photogrammetry, so I might not be able to help the authors with the technicalities, but I will try my best to give a conscience review along with sharing my opinions regarding the writing….

1.   The paper intends to give a detailed summary of the work that had been carried out to digitally document the Monastery of Brontochion of Mystras located towards the southwest of the city. The entire construction of the monastery was done in several phases and through the digital documentation the authors tried to depict the above.

2.   I found that the aims and objectives of the article are very clear and precise.

3.   The article contains a detailed description of the methodology. This is good indeed but can be concise.

4.   It would be good indeed if the authors could add a separate section by analyzing critically why and how the city is important to understand the historicity of the region/country.

5.   While reading I found that the authors several times gave the reference of the years but didn't give the chronological marker (BCE/CE/AD). So I will highly recommend the authors to put the chronological markers.

6.   On Line number '93' please correct the word representation. It's written as 'repre-sentation'

7.   The authors should emphasize to increase the size of the figures which they put in the article

8.   Also I will recommend including proper maps of the city (Location Map and city layout with all existing architectures [which I can see already in figure 7(a), but it should be properly geo-referenced])

9.   I found the subject matter of the article is good and if the corrections are being made then the paper will make a significant contribution to scholarship.