REVISION ROUND 1: Authors' Responses

Dear recommender, dear reviewers,

On behalf of the entire team, I would like to sincerely thank you for the time and attention you devoted to reviewing our article, as well as for the interest you have shown in our work.

We have carefully considered all your comments. Each point has been discussed and addressed, as detailed below. We hope that this revised version will meet your expectations.

Of course, we remain at your disposal for any further questions or requested changes.

Best regards,

Julien Looten

In blue: the reviewers' comments ; Black: our comments; Red: the corrections applied to the manuscript

Responses to Reviewer 1:

"Review of the Submitted Manuscript (RTI Section Only)

Thank you for the opportunity to review this article. I have extensive experience with Reflectance Transformation Imaging (RTI), but I am not a specialist in illustration or drawing, and my review will therefore focus exclusively on the RTI-related sections of the manuscript.

General Assessment

In its current form, this text is not publishable. The RTI section lacks the necessary academic rigor, structural clarity, and scholarly referencing expected for publication. Much of the information presented is superficial or incomplete, and essential background literature is either missing or insufficiently discussed. At least half of the required technical and methodological content is absent or underdeveloped. Furthermore, the high degree of similarity in methodology, scope, and content with an article by Robitaille (2025– see below, which appeared online on Dec. 11 2024 on JASRep) raises concerns regarding originality and proper citation practices

Key Issues and Recommendations

1. Lack of Key References and Overlap with Existing Work

The paper omits essential references, most notably Robitaille (2025), which outlines nearly identical RTI methods for use-wear analysis:

Robitaille, J. (2025). Reflectance Transformation Imaging at a Microscopic Level: A New Device and Method for Collaborative Research on Artifact Use-Wear Analysis. Journal of Archaeological Science: Reports, 61, 104914. https://doi.org/10.1016/j.jasrep.2024.104914

This paper provides a detailed account of Micro-RTI applications in lithic analysis, covering aspects such as imaging workflows, file handling, and post-processing techniques—many of which appear mirrored in the submitted manuscript. Proper citation is necessary to avoid any appearance of unacknowledged borrowing."

- **As indicated by the very title of our article, our aim is not to propose a brand-new or radically different imaging methodology**, but rather to initiate a reflection on the combined use of old and new recording methods, particularly in the field of prehistory. Among these methods, we have chosen to focus more specifically on the contribution of **RTI** (Reflectance Transformation Imaging), a technique that is already well known but still not widely adopted in certain archaeological contexts. Our ambition is not to provide an exhaustive overview of this technique, but to present its historical foundations—especially its application in prehistoric contexts—and to offer a simple and proven methodology, based both on existing literature and on the choices we have made over the course of our work over the past five years.

- This section is therefore intended to be **accessible and practical**, aimed at archaeologists who are not imaging specialists. It is not meant to cover the entire body of available literature (which would be vast), but rather to adopt a practical and comparative perspective. For this reason, **it should be understood as part of a broader reflection on visual recording methods** (2D, 3D, drawing, RTI), and not as a standalone methodological article. Unfortunately, the reviewer appears to have approached our manuscript from a very narrow perspective, focusing their critique solely on this section of the text. We will therefore address below, point by point, the specific issues they have raised.

We emphasize this crucial point, as it is fundamental to the integrity of our work: **no form of plagiarism or copying from J. Robitaille's (2025) article was committed in the course of this research**. Several elements clearly demonstrate this:

- **The idea for an article focused on the use of RTI applied to lithic artifacts dates back more than four years,** following the first-year Master's thesis of one of the authors (J. Looten). At that time, he had already experimented with the RTI method—well documented in the scientific literature—on parietal surfaces in the Roche-Cotard cave (Loire, France), as well as on a Mousterian lithic assemblage associated with that occupation. The methodology used then was already very similar, if not identical, to the one described in this manuscript. This work was continued as part of J. Looten's second-year Master's thesis (2022–2023), this time focusing on the lithic assemblage from Grotte XVI (Dordogne, France).

- **An initial version of the article's methodology was written in 2023**. At that time, the article was intended to focus solely on RTI and its application to lithic industries. However, as already mentioned, we wanted to broaden our discussion to include the various methods of representing lithic artifacts, within which RTI is situated. **The publication could not take place before 2025, mainly due to delays in finalizing the section dedicated to 3D modeling.**

If you wish and if any doubt remains, we will gladly send you these three documents, in which the RTI methodology applied is the same as the one developed in this manuscript, from acquisition to black-and-white processing in Photoshop:

- A summary written about the Roche-Cotard site (excerpted from J. Looten's first-year Master's thesis ; 2021)
- J. Looten's second-year Master's thesis (2022)
- The very first (still draft) version of the RTI methodology, written in April 2023

→ If necessary, we can of course provide the original files, including the image metadata, to verify the dates of these works, which clearly predate 2025.

- However, **we acknowledge that at the time of submitting our manuscript, we were not aware of Robitaille's 2025 article**—due to a lack of monitoring of the most recent publications during that period. Had

we been aware of it, we would, of course, have cited it, as we did with his 2024 publication. We apologize for this oversight.

- Finally, it is crucial to emphasize **that the methodology for producing an RTI model has been extensively documented for many years, well before the publication of Robitaille's 2025 article**. Whether applied to a Bronze Age funerary stele, a Roman coin, cut marks on bones, or a Mousterian biface, **the protocols remain fundamentally the same**, with only minor adjustments depending on the study context. The protocol presented by Robitaille is therefore neither fundamentally new nor exclusive, and cannot reasonably be considered a "Robitaille method" in the strict sense.

It is thus **entirely out of the question that our methodology was inspired by—or, even less, plagiarized** from—Robitaille's article.

In our case, we chose to **describe a simple, reproducible method** intended for archaeologists who are not imaging specialists. Our objective is precisely to promote the broader adoption of this technique in prehistoric contexts. While our methodologies are technically comparable, **our goals differ quite clearly**: Robitaille applies the method to very limited areas of an object, in order to detect use-wear traces on specific tools. In contrast, **we apply it to entire artifacts—or even to whole assemblages—from a broader analytical perspective**. We also took care to situate RTI within a wider comparative framework, by contrasting it with other visual recording methods, such as standard 2D photography, 3D modeling, and manual drawing. **The RTI section is therefore not intended as a standalone methodological publication**, but as an integrated component of a broader reflection on analysis and visualization tools in prehistoric archaeology.

Additional relevant publications in wear analysis that should be cited include:

- *Desmond et al. (2021). Documenting Functional Use-Wear on Bone Tools: An RTI Approach. J. Comp. Appl. Archaeol., 4(1), 214–229. https://doi.org/10.5334/jcaa.80*
- *Newman (2015). Applications of reflectance transformation imaging (RTI) to the study of bone surface modifications. J. Archaeol. Sci., 53, 536–549.*
- *Kotoula and Earl (2015). Integrated RTI approaches for the study of painted surfaces. In CAA 2014, Archaeopress, pp. 123–134.*

Other articles that should be consulted are :

- *Chapman, K., Peterson, J.R., Cross, A., 2017. Reflectance transformation imaging (rti): Capturing gravestone detail via multiple digital images. Association for Gravestone Studies 42 (2).*
- *Cignoni, P., Scopigno, R., Tarini, M., 2005. A simple normal enhancement technique for interactive non-photorealistic renderings. Comput. Graph. 29, 125–133.*
- *Cosentino, A., 2013. Macro photography for reflectance transformation imaging: A practical guide to the highlights method. E-conserv. J. 1.*
- *Duffy, S.M., Bryan, P., Earl, G., Beale, G., Pagi, H., Kotouala, E., 2013. Multi-Light Imaging for Heritage Applications, English Heritage, York. www.english-heritage.org.uk/publications.*
- *Earl, G., Beale, G., Martinez, K., Pagi, H., 2010b. Polynomial texture mapping and related imaging technologies for the recording, analysis and presentation of archaeological materials, In: Mills, J.P., Barber, D.M., Miller, P.E., Newton, I. (Eds.), Proceedings of the ISPRS Commission V Mid-Term Symposium 'Close Range Image Measurement Techniques', ISPRS 38(5). Newcastle upon Tyne, UK, pp. 218–223.*

As mentioned earlier, the goal of our article is not to cover the entire existing bibliography on RTI, as this technique is used in a wide variety of research fields. We chose to focus on the **foundational references directly related to our discipline—prehistory—as well as the publications that originated the acquisition methodology itself**. It is precisely within this framework that we have included several of the references **mentioned by Reviewer 1, which are already present in our manuscript**. For example:

- Newman 2015 is indeed cited in section 3.4, line 401 (Version1).
- Duffy 2013, on the other hand, corresponds to an earlier version of a revised work that was republished as follows: *Cultural Heritage Imaging (2018) – Multilight Imaging - Highlight-Reflectance Transformation Imaging (H-RTI) for Cultural Heritage, Historic England, 72 p.* This updated version is cited several times in our text.

Although some of the other references mentioned are either not very relevant to our specific context or redundant with works already cited, we have taken your comments into account: **we will include these additional references in the revised version.**

"2. Use-Wear Analysis and RTI

The claim that this work is "novel" in its application of RTI to use-wear is inaccurate. Some studies—including Robitaille (2025), Desmond et al. (2021), and Newman (2015)—have already demonstrated RTI for both stone and bone tool wear. The section spanning lines 394–404 must be revised to acknowledge prior work and accurately situate the research within the existing literature."

At no point did we claim that our work constitutes a "new" approach to the study of "use-wear" traces of artifacts. A careful reading of the passage between lines 394 and 404 shows that this is in no way an emphasis on our own results. This passage merely presents general considerations on the value of RTI, followed by a summary of various existing works in different application contexts.

Furthermore, in the section dedicated to our results, we make no reference to functional analyses. Our discussion is limited to the description of the marks related to the chaîne opératoire (technological study). The terms "knapping marks" and "micro-reliefs" used in our text should in no way be equated with the term "use-wear" in its functional sense, which could indeed refer to the works of J. Robitaille.

"3. Technical Inaccuracy and Incompleteness

Lines 432–441: inadequately describe RTI principles. A clearer explanation of Polynomial Texture Mapping (PTM) and Hemispherical Harmonics (HSH) algorithms is required, along with a rationale for choosing HSH for detailed surface analysis. For instance:

- *What advantages does HSH offer in visualizing micro-wear patterns? – which is very important when playing with photoshop.*
- *How is this algorithm implemented in the post-processing workflow?*

Furthermore, regarding the RTI sphere, the manuscript fails to mention the critical point that the sphere must be placed slightly higher than the object to ensure full light reflection is captured. The authors' reference to an 8 mm sphere to be used under a stereoscope is problematic under stereomicroscopy. RTI under a stereoscope requires

spheres smaller than 1 mm in diameter, such as a ballpoint pen head, as demonstrated in previous literature (e.g., Desmond et al., 2021; Kotoula & Earl, 2015).

- *In the case of stereoscopy at low magnification, why not using a microlens for detailed photographs at 10x?"*

This paragraph (L-432-441) aims to present the main RTI acquisition methods. We mention the existence of devices such as domes and motorized arches, noting that our study relies on the H-RTI method. For each of these techniques, we simply cite the key works that established the protocols, without going into technical details. Indeed, it is not our place to explain in depth how these systems function. On the one hand, this would amount to paraphrasing the original authors; on the other hand, our approach is to propose a simple, accessible, and easily reproducible methodology. Going into such details would unnecessarily complicate the discussion, whereas it is more relevant to refer to the foundational publications. **We thus reformulate the previous paragraph to address the distinction between PTM and HSH**:

"Reflectance Transformation Imaging (RTI) combines the advantages of both drawing and photography. It was developed by a research team at Hewlett-Packard led by Tom Malzbender (Malzbender et al., 2001) and was quickly applied to the fields of natural sciences and cultural heritage (Mudge et al., 2008; Earl et al., 2010, 2011; Cultural Heritage Imaging, 2018). RTI relies on two key algorithms: **Polynomial Texture Mapping (PTM)** and **Hemispherical Harmonics (HSH)**. We will use the **HSH** in this work. The main difference between **PTM** (the original algorithm) and **HSH** (the more recent algorithm) is that the latter offers enhanced capabilities for handling high-frequency surface details by approximating the reflectance behavior across the surface using spherical harmonics. This method is particularly useful for capturing fine textures and subtle variations (Robitaille, 2025)."

The reasons for our choice of the H-RTI method are stated at the end of the paragraph: it is a non-invasive, low-cost technique that is easy to implement, highly portable, and requires minimal training.

Regarding the placement of the spheres, we do not agree with the suggestion given by Reviewer 1. **We will address this point further in a comment from Reviewer 2** (who, on the contrary, states that the sphere should be positioned at the same level as the surface of the subject).

Regarding the size of the spheres: an error slipped in, as the sphere mentioned actually has a diameter of 0.8 mm, which meets the requirement of approximately 250 pixels on the sensor (CHI, 2018). **We simplify this statement, as the size of the sphere varies depending on several factors** (the most important being that it measures around 250 pixels on the image), with the following phrasing: "The size of the spheres used ranges from approximately 1 mm to 30 mm."

Finally, the non-use of a "microlens for detailed photographs" is simply explained by the fact that we did not have one at the time of the tests. That being said, if a binocular loupe works, a suitable macro lens should also work. Each user should adapt the method according to the equipment they have available.

4. Photoshop Workflow and Normals Conversion

The section discussing post-processing in Photoshop closely aligns with the method described in Robitaille (2025), particularly regarding:

- *Conversion of RTI Normals into monochrome images*
- *Integration of static color references for transparency and reproducibility*
- *Emphasis on maintaining a non-destructive and replicable workflow*

The authors should explicitly acknowledge this methodological precedent. Without such citation, this portion of the text may appear as plagiarised. Also, the article of Robitaille (2025) was the first to describe this technique in use wear

5. File Handling and Storage

The discussion of production time, file storage, and workflow scalability is almost identical in structure and phrasing to Robitaille (2025). If the authors had access to Robitaille's publication, they must cite it to acknowledge this intellectual overlap (Robitaille p. 5-6).

From the earliest publications regarding the normal maps generated by RTI, several researchers have considered converting these maps to black and white (intensity level), mainly for visual and aesthetic reasons. The first (to our knowledge) to apply this method to lithic artifacts and share it with the community is **PAWLOWICZ, D. (2015)** in his work titled *Reflectance Transformation Imaging for Lithics* (website: https://rtimage.us/). On this website, not cited by Robitaille (2025), this same manipulation is illustrated through various RTI visualization modes, including the conversion of normal maps to black and white. Additionally, two videos presenting the results obtained during the SAA 2015 and CAA 2015 conferences are available on this site. These works were carried out more than ten years before the publication of the methodology proposed by Robitaille (2025). As such, it was not necessary to wait for Robitaille's (2025) publication to convert a normal map to black and white using Photoshop's simplest tool, namely the 'Black and White' adjustment. Two of the authors, J. Looten and M. Villaeys, are professional photographers and use these tools daily, which form the foundation of image post-processing techniques, whether in Photoshop, Camera Raw, Lightroom, or other similar software.

One of the main challenges encountered during the writing of our manuscript was accurately **estimating the values related to the time required, costs, difficulty, and storage of each method, due to the wide variety of factors influencing these results.** We would like to reaffirm, once again, that this work was carried out completely independently, and the data we measured are the result of rigorously conducted tests. They are in no way the outcome of plagiarism, despite the reviewer's insistence on suggesting this hypothesis. We are pleased to see that these data align with those mentioned by J. Robitaille. Regarding drawing, the acquisition time varies more than for RTI, which led us to conduct a survey among different draftsmen. However, for RTI, whether applied to "complex" objects (such as a handaxe) or simpler pieces (like a blade), the acquisition time remains stable. Only factors related to the operator's skill and the equipment used can affect this time. However, after about ten tests, this time tends to decrease and stabilize, both for image acquisition and processing. **It is therefore not surprising that our results match those obtained by other researchers**. Moreover, the size of the images and files varies very little between the different cameras used, further reinforcing the stability of the obtained data.

6. Missing References (Lines 406–430)

This section of the manuscript is under-referenced and underdeveloped. It should be revised to incorporate the broader literature on RTI in archaeological applications. The lack of scholarly depth significantly weakens the paper's academic credibility.

Final Recommendation

The RTI section of the manuscript, in its current state, is not suitable for publication. The authors need to:

- *Add the missing references*
- *Provide greater technical accuracy and detail*

- *Clarify the originality of their contribution*
- *Substantially revise the structure, depth, and referencing of the RTI section*

Until these issues are fully addressed, I cannot recommend this manuscript for publication in a scientific journal. I am not sure whether the author had access to the Robitaille (2025) article or whether the timing of writing coincided with its release. Regardless, proper citation is necessary.

Suggestion

In addition to addressing the issues mentioned above, to avoid plagiarism, and circumnavigate the aforementioned overlap with published literature, the author could perhaps present their findings under the light that, following Robitaille's (2025:4, 9-11) recommendation, the author tested Robitaille's model, i.e. the RTI's potential in use wear analysis; built their own dome, and here presents their findings.

As mentioned earlier, the methodology for producing an RTI model is well-established and widely documented for many years, well before the publication of Robitaille's (2025) article. Regardless of the application field, the protocols employed remain fundamentally similar. **It is therefore inaccurate to describe our work as "an application of the Robitaille method"**: neither in the creation of the RTI images nor in the analysis of use-wear traces. In this regard, we wish to emphasize that our article (as indicated in its title) aims to present and discuss methods of representing lithic industries — particularly the transcription of **knapping marks** — in comparison with drawing, photography, and 3D. It is by no means a study focused on functional analysis, which we barely mention, and which the reviewer seems to mistakenly confuse with technological analysis.

To clarify this point, **we will add the following lines to the introduction of the RTI section**: « The RTI has recently been adapted at the microscopic scale for the functional analysis of lithic artifacts, with the goal of providing detailed documentation of use-wear traces, which were previously difficult to access using conventional imaging methods (Robitaille, 2025). »

Responses to Reviewer 2

Dear Authors,

You perfectly present the issues involved in the graphic representation of lithic artefacts, then follow up with a fine state of the art. You present your RTI experience and compare with drawing, photography and photogrammetry. The illustrations are very eloquent.

However, a few points need to be clarified, partly to expand the subject and make it clearer and more accessible to novices. As a frequent user of photogrammetry and RTI, I disagree with some of the technical decisions made. However, it is mainly a case of 'squabbling' over working methods. I sometimes feel that the discussion is too Manichean, photogrammetry vs RTI. It would be useful to emphasise the complementary nature of the two techniques. It may also be interesting to discuss about web viewers and web distribution. All these comments are listed below.

This work will help neophytes and contribute to the dissemination of new technologies within the community of prehistorians and beyond. Thank you for this very interesting preprint.

- ***Line 202: 3.1. Photography***

The problem of optical distortion needs to be mentioned.

The Prehistorians community didn't use transparency to combine images taken in different lighting conditions?

Although we mention the issue of distortions related to 2D imaging (photography) in the section dedicated to RTI (L. 447), we will add this sentence:« Unlike 3D models, 2D photography often presents optical distortions that can affect the accuracy of the representation of an archaeological object. These deformations are caused by several factors, mainly optical and geometrical misalignment or deformation of the sensor.»

The problem of transparency overlay between different layers of images (seems like a good idea at first): Let's imagine we have two or three photographs of the same artifact, each taken with side lighting from a different direction. Each image reveals specific details that are not visible in the others. By using a tool like the opacity adjustment in Photoshop to overlay these images, we manage to reduce overexposed or underexposed areas (which is a positive aspect). However, this **operation also smooths the surface and causes some fine details to disappear.**

An alternative would be to create multiple localized layers: for example, one for the right edge of the object and another for the left edge, each highlighting details revealed by different side lighting. But such an approach resembles heavy retouching — or even a composite image — which raises questions about methodological reproducibility. Indeed, this type of manipulation heavily depends **on subjective choices,** which are difficult to track or repeat by another operator.

- ***Line 232:*** *Why only « small objects »? It's not a question of size, but of the surface/thickness ratio.*

That's true. We correct it as follows: « When photographing objects with a thickness that is too high relative to their surface area, the operator quickly encounters a shallow depth of field, which directly impacts …. »

- ***Line 296:*** *« €3000 ». What does this prize mean? « Nikon D850 DSLR camera combined with a fixed focal length 60mm Nikon macro lens and a GODOX AR400 ring flash »? Line 719 - « a camera and lens costing around €750 each ». Why this difference? If the €1,500 difference is for flash and 3D software, please explain.*

Indeed, establishing an average price for the equipment is complex and depends on the operator's specific use and requirements. To clarify this point, we have agreed that a camera body costing €1000, a lens costing €500, and a flash costing €100 (without mentioning the cost of processing software, which is higher for 3D) are more than sufficient to produce publishable quality images. **This results in a setup of approximately €1500-2000. Here are the corrections made according to the lines:**

- L 296: We lower the cost to €2000.« This method is accessible for under €2,000, unlike structured light scanners or CT scans, which often pose challenges related to availability and equipment costs".

- L 719 : "Photographic methods, such as RTI and photogrammetry, offer a more economical alternative, as they only require a good quality setup to produce publishable results. An equipment costing between €1500 and €2000 could be more than sufficient, as for us, a camera body costing around €1000, an appropriate lens (e.g., macro) at €500, along with a flash and various accessories (cables, etc.) at around €100-200, make up a functional setup. We must not forget the cost the software either, whether it is for 3D creation software or image processing software such as Photoshop/Illustrator.

Time constraints and ease of implementation are also crucial factors, especially when dealing with multiple artifacts or an entire lithic assemblage."

- ***Line 297**: « CT scans » Why tomography for lithic tools? Are you speaking about laser scanning?*

Here is a clarification: "This method is accessible for under €2,000, unlike 3D laser scanners or structured light scanners (not to mention CT scans, which allow internal analysis of objects — a feature with limited relevance for lithic artifacts). These devices can become very expensive while providing results comparable to those obtained through photogrammetry."

- ***Line 298**: Please, develop a little bit about photogrammetry softwares. You mention Colmap in the text, but Metashape in the legend of Figure 7. Advantages and drawbacks of each. Figure 6: Metashape?*

- In the case of our work, Metashape was used because, essentially, we are accustomed to it. However, the idea was to inform the reader that free or even open-source solutions are perfectly usable for this type of work.

- We add to the title of Figure 6: « Example of acquisition geometry for a lithic artifact, generated using Metashape software. Scraper from Pech-de-l'Azé I (Dordogne, France). »

- ***Line 320**: « a nearly constant distance from the digitized surface ». Which one?*

Here is a clarification:

« Instead, images were manually positioned to ensure complete coverage of the object's surface while maintaining a nearly constant distance from the digitized surface. In order to get the best resolution of the native images (and thus the resulting 3D model), the distance to the object is fixed by the minimal focus distance enabled by the macro lens (in our case with the Nikon 60mm macro we have roughly 32 cm). This method was applied to a Mousterian scraper from the cave site of Pech-de-l'Azé I…."

- ***Line 323**: Number of shots?*

"Depending on the object complexity, between 200 and 500 images are required to get a complete coverage with the highest resolution possible with the macro lens 60mm. The amount of pictures could be reduced, fixing a higher distance to the object, but the level of details of the 3D model finally obtained will be deprecated"

- ***Line 389**: « minimal times ». In my opinion, this technic requires between 48 and 72 pics to create a smooth *rti file. Time consuming is equivalent in terms of acquisition compared to photogrammetry. The main difference is postprocessing.*

We agree with this point, which we clearly indicated in the summary table (line 777).

« low cost » for manual acquisition, but this kind of acquisition is time consuming and not precise for the position of light

We add this clarification at line 439: "Although H-RTI may be less precise in determining light position compared to dome RTI or motorized arcs, it offers the advantage of requiring no specialized equipment, is easily transportable (e.g., in a backpack), and is easy to use, requiring only minimal training."

- ***Line 411-412**: « from which it initially contacted the surface ». Sorry, but I don't understand.*

Here is a developed version: "Absorption occurs when the light flux is taken in by the material. Transmission happens when the light passes through the medium without being absorbed. Diffusion takes place when light is scattered in all directions within the medium. Finally, reflection occurs when the incident flux is redirected into the same hemisphere from which it contacted the surface (Vila, 2017, p.18). RTI is based on the principle of reflection"

- ***Line 433**: Semi-automatic system, very easy to produce: Porter et al. 2016: https://doi.org/10.1016/j.jasrep.2016.07.013*

  Openhardware: HASOR open RTI: https://mbouhier.github.io/HASOR/introduction/

We add the citation : Porter et al., 2016

- *Line 455: « A black, reflective sphere is placed near the subject.» Why not talk directly about 2 or 3 spheres as mentioned in figure 8 and line 510?*

Here is our reformulation: "Two or three black, reflective spheres are placed near the subject. The size of these reference spheres depends on the size of the artifact as well as the distance from the camera sensor, and they should correspond to 250 pixels (ibid, 2018)…"

- ***Line 468**: « A 5 cm scale marker is positioned near the subject, at the focus level ensuring that the artifact remains completely still—even at the micron scale—to prevent calculation errors and the creation of a blurry model. » Do you want to say to control after acquisition if dataset is usable?*

Here is our reformulation:

"Photographs should be taken without touching the camera to avoid any vibrations or movements that could introduce calculation errors. The shutter should be triggered remotely, using either a wired or wireless remote control, the camera's Bluetooth smartphone app, or a computer. Make sure that the object remains perfectly still, even at the micron scale, in order to avoid any errors in the calculations and the generation of a blurry model. For RTI acquisition of artifact profiles and striking platforms, the artifact can be stabilized using adhesive putty or placed in a tray of sand. A 5 cm scale marker is positioned near the subject"

- ***Line 500**: « complete darkness ». In my experience, it's better to create low diffuse light to avoid over and underexposures.*

Here is our reformulation : “All photographs are taken in complete darkness (or with a very slight diffuse light), ensuring that neither the subject nor the camera is moved.”

- ***Line 504****: "Additionally, a single photograph is taken with a lighting angle close to 90° » Not orthodox. Please explain why.*

Correction : “Additionally, a single photograph is taken with a lighting angle close to 90°. This image, not included in the RTI process, provides a simple lighting setup that will facilitate the automatic selection of the subject during post-processing (in Photoshop). Indeed, it is not possible to make this selection automatically with the RTI images in normal mode, nor with the photographs taken with grazing light.”

- ***Line 508 / 509-510****: « The reflective sphere should be placed next to the subject, but not too close to avoid casting shadows that could distort calculations » « To mitigate potential errors caused by grazing light, it is advisable to use two spheres placed on opposite sides of the subject. If one sphere is obscured by the object’s shadow, the other will remain well-lit. » You have to place item surface on the same elevation as the sphere.*

“*You have to place item surface on the same elevation as the sphere.”*

This indication refers to that of reviewer 1, who, conversely, recommends placing the sphere slightly above the surface of the subject. This is why we chose to simply state that the sphere should be placed next to the subject, integrated into the same depth of field, and that it should avoid casting shadows (shadows) on the surface of the subject. As reviewer 2 mentions, if one of the spheres is in the shadow of the object, then the second (or even the third) sphere will allow the recovery of the light position. Here are the corrections made

Line 455 : "Two or three black, reflective spheres are placed near the subject. The size of these reference spheres depends on the size of the artifact as well as the distance from the camera sensor, and they should correspond to 250 pixels (ibid, 2018). The spheres should be positioned at the same height as the subject's surface, ensuring they are fully within the depth of field, thereby guaranteeing proper focus. It is important to ensure that they are not placed too high, to avoid casting shadows on this surface, nor too low, to prevent them from being constantly in the subject's shadow. If one of the spheres becomes invisible due to grazing light, the use of another sphere will help identify the position of the light source.”

- ***Line 518****: It’s useless, everything is online.*

https://github.com/ExeterDigitalHumanities/rti/blob/main/RTI%20processing%20with%20RelightLab%20v2.pdf

We agree with the reviewer's observation, and as a result, we are adding the link to the more detailed methodology. However, as mentioned previously, our goal is for this manuscript to provide everyone, even those with little knowledge of imaging, with a comprehensive methodology covering the entire process, from setting up the equipment to the completed board. This process includes the use of the software. To this end, we are adding the following clarification:

Line 521 : « You will find below a link to a detailed process of the software (https://github.com/ExeterDigitalHumanities/rti/blob/main/RTI%20processing%20with%20RelightLab%20v2.pdf), but here are the key steps of the process :»

- ***Line 533****: Very clear, but it could be great to present possibility to create some bookmarks, a useful tool to transfer to colleagues.*

Good idea, we are adding this sentence: "From this software, you will also have the ability to create bookmarks, pre-define close-up views, a specific lighting angle, or frame a particular area, which is a useful tool for sharing with colleagues."

- ***Line 578****: « directory ». Please crop figure 9 and it could be great to include bookmarks.*

Done.

- ***Line 587****: « Photographic acquisition: also around 5 minutes.» « Each view is made up of approximately 50 to 100 photos »: 300 secondes / 50 shots = 6 secondes. 300 / 100 = 3 secondes. So it means you spend between 6 and 3 seconds per shots. In my opinion, it's unrealistic.*

With experience, we spend about 2-3 seconds (maximum) per photo: 1 second to trigger the shot via the smartphone (exposure time), and about 1-2 seconds to reposition and trigger again. In most cases, we use the smartphone's flash as the light source, and we trigger the photos using an app installed on it. This allows us to do everything with one hand, very quickly. You just need to position yourself properly, but with practice, it becomes almost automatic. If you wish, we can provide a video of the ongoing acquisition.

- ***Line 600****: « 700 megabytes »: less if you crop before to export.*

We would like to specify: "The RTI file itself is around 700 megabytes (but this size can easily be reduced by cropping the model before export),..."

Line 674 - Figure 10*: Maybe move it up one page?*

Table 1 – Photography + Focus stacking + RTI*. Include « optical distortion » in disadvantages.*

*- « **RTI + Relight, RTI Viewer, et Photoshop** ». Beware of the French word "et"*

*- « **3D – Photogrammetry - Processing** ». Long, but scripts can decrease time consuming for 3D model edition.*

*- « **Disadvantages – Sensitive to capture conditions** »: like RTI, but you can create good diffuse light and use cross polarisation filters.*

Done.

Responses to Reviewer 3

Title and abstract

Does the title clearly reflect the content of the article? [x] Yes, [ ] No (please explain), [ ] I don't know

Does the abstract present the main findings of the study? [x] Yes, [ ] No (please explain), [ ] I don't know

Introduction

Are the research questions/hypotheses/predictions clearly presented? [x] Yes, [ ] No (please explain), [ ] I don't know
Does the introduction build on relevant research in the field? [ ] Yes, [x] No (please explain), [ ] I don't know

The introduction is quite light on references, particularly for lithic photography and illustrations.

Materials and methods

Are the methods and analyses sufficiently detailed to allow replication by other researchers? [x] Yes, [ ] No (please explain), [ ] I don't know

Are the methods and statistical analyses appropriate and well described? [x] Yes, [ ] No (please explain), [ ] I don't know

Results

In the case of negative results, is there a statistical power analysis (or an adequate Bayesian analysis or equivalence testing)? [ ] Yes, [x] No (please explain), [ ] I don't know

Not applicable

Are the results described and interpreted correctly? [x] Yes, [ ] No (please explain), [ ] I don't know

Discussion

Have the authors appropriately emphasized the strengths and limitations of their study/theory/methods/argument? [x] Yes, [ ] No (please explain), [ ] I don't know

Are the conclusions adequately supported by the results (without overstating the implications of the findings)? [x] Yes, [ ] No (please explain), [ ] I do

This article reviews both traditional and modern approaches for capturing lithics. The authors then present the potential of RTI, a method allowing for more detailed high-resolution details of flake scars, use wear etc, and compare its performance against photogrammetry. The paper is thorough and well written, although the introduction is a little light on references, particularly for lithic illustrations and photography (e.g. see Cerasoni et al. 2021; https://doi.org/10.1371/journal.pone.0251466, Timbrell

2022; https://doi.org/10.1080/01977261.2022.2092299). The authors also state that 3D morphometric methods are minimally affected by inter-observer errors and optical distortions; I would say that this is not necessarily the case, particularly as many 3D methods of statistically analysing shape still require user-input for landmark digitisation etc.

Since each of the methodologies described in this manuscript (2D, 3D, RTI) is analyzed in separate sections before being compared, we chose to integrate the associated references directly into the relevant sections. The introduction, therefore, was conceived differently from those typically found in scientific articles, which often present a detailed state of the art. Here, it primarily aims to explain our approach, which we intend to be novel.

Regarding works on lithic drawing, we presented the main references. The bibliography in this field remains relatively limited, with M. Dauvois' (1976) work still being an essential reference — even a "disciplinary bible" — to this day. **We will add the references you mentioned.**

The authors provide very highly detailed step-by-step instructions for how to carry out RTI, including time estimations for processing and storage considerations. I find these details are seldom mentioned so explicitly, but are extremely useful for early career readers when planning funding bids etc. I note that the post-processing is done in Adobe Photoshop. I wonder if the authors could provide some examples of free/more accessible software that the reader could use as an alternative?

Indeed, this is a recurring problem, especially among students, who may not necessarily have access to Photoshop. To address this, it is often recommended to use Gimp (a free alternative to Photoshop). However, we prefer to mention **Photopea**, an online platform with an interface very similar to Photoshop and completely free of charge. **We will add this option to the text.**

The figures are generally very good and informative. I would suggest that the caption of Figure 6 needs more details to help the reader interpret the figure. What are the blue squares and black lines? How does what is shown relate to the final 3D model created? Currently, the caption is not sufficient to understand the process being detailed.

Figure 6 : Example of acquisition geometry for a lithic artifact. Scraper from Pech-de-l'Azé I (Dordogne, France). The poses (positions and orientations) of the pictures relative to the object are presented by the blue rectangles (dark blue rectangles presente the poses of the images used for the 3D reconstruction and the light blue ones the poses of the images used for the scale calibration). However, the black axis is a redundant way to also show the poses of the pictures.

The authors also provide the data used for the production of the RTI models, in case readers want to try out the methodology for themselves.