PCI: Archaeology Review "Removing Barriers to Reproducible Research in Archaeology"

This article is a fantastic piece which explains how and why reproducible and open research in archaeology is attainable and important for moving the discipline forward. I hope there are other follow-up pieces in the works to provide more detailed information for researchers on specific aspects of mentioned within. I really enjoyed reading this piece and its detailed appendices, it is a long overdue article for our field, and will have a lasting resonance across all the archaeological sub-disciplines. I will certainly be adding it to my student resource lists and taking on board many of the suggestions and resources suggested in here for my own research.

Overall, I thoroughly recommend this paper for publication, it's extremely well written, timely, covers important ground about the future of open workflows in our discipline and will serve and a foundational guide moving forward. It has lots of great resources and examples which are extremely helpful to researchers at various stages of their reproducibility and open workflow journeys, and answers many frequently asked questions from colleagues I've seen time and again. Below are my more detailed comments and suggestions, all of which are minor.

The extensive appendices are to be particularly commended as they detail commonly used terms in Open Science and reproducibility literature which are not accessible to the uninitiated. The glossary and Q&A sections are especially helpful, however as a someone who is familiar with many of these terms I'm not sure I am best placed to suggest other areas which other colleagues might want answered or definitions of, so I hope people do interact with this Open format and leave queries for the authors to keep the conversation going.

There are a few suggestions I have for additions to the glossary – binders and containers I think could use a little further explanation for those who aren't familiar with coding and that side of software. Along with R and Python, Git/Github should also warrant an entry as they're mentioned in text for version control. 'Protocol' as a term should also be added, again I think those in more wet lab based archaeological science will be familiar, but it is a term less familiar to others who likely use their own protocols but might not label them as such. I would also recommend that the glossary be more heavily signposted from the start of the article as it is a great key resource you've created and needs to be flagged early on for reference throughout.

Figure 1 whilst nice I think isn't strictly necessary and doesn't add substantially to the text so could be left out.

The differences between replication, reproducibility, robustness, and generalisability are explained well in text but could do with further clarity in Figure 2, especially generalisable as in reality if you got completely different results with different data and different analysis (as shown in Figure 2), it is unlikely you would come up with the same generalizations about a phenomenon. Similarly robust could do with clarification in Fig 2 for the same reasons. But again I stress this is made clear in text, but to limit misinterpretation on reuse of Figure 2 I'd edit it slightly.

Figure 3 needs an explicit citation or source link.

I suggest adding a little more detail around lines 131-133 about the differences described, and the Marwick 2020b reference does not align with how that paper is listed in the bibliography, please cross-check all references before publication as I think a few others with “a” and “b” in text have also slipped through.

The definition of the discipline on line 136, particularly as a scientific study is hotly debated, and I worry that defining it as only that may not remove barriers to all archaeologists working more openly but could put some back up, especially for those who see working reproducibly and openly as something for those on the more laboratory-based side of things. Problematising this more or offering up a broader definition of the field is advised.

The point about validation in line 199-200 is such an important and poignant one, that I feel warrants further explanation or signposting to a future article, you left me wanting more detail here, and I definitely agree with you that it extremely important and underrated.

Where you discuss large meta-analyses in lines c. 215-220 it would be great to have examples of these kinds of studies like you do for other parts of reproducible research later in the article to showcase how data can be collated and re-used.

Table 1 and the steps from line 280 onwards with the examples are fantastic! I particularly like the inclusion of various freely available and easy to use websites and software such as Google Docs alongside the more advanced tools. With the raw data file formats, csv is the only option mentioned in method 1 – perhaps include recommendations for non-tabulated data such as image files, and best practice/formats for other data types. Another suggestion to perhaps improve the uptake of your steps for reproducibility would be to expand Table 1 and parts of the text into a flowchart, checklist, or template(s) of steps for researchers to follow as a workflow as an accessible route for helping to set up either a project from the beginning or ensure your work meets as many steps as possible while preparing for publication.

The “confronting your barriers” section is a great idea and I really commend the authors for this section, especially the inclusion and consideration of CARE principles alongside the more widely touted FAIR principles. Whilst I love the idea of using synthetic data suggested in lines 434-441 I think this is a huge conceptual and training hurdle for many, and so might not be very accessible or executable in a lot of cases. Therefore, any additional resources the authors can point people to here would be a great help for how to go about creating synthetic data that meets replicability criteria.

I would also suggest adding “RLadies” to the list of communities and associations in lines 518-528.

In the appendix under the metadata standards, I would also include those widely used in the journal “Ecology” which have been widely applied in aspects of environmental archaeology, especially isotopic data collation - Michener, William K., James W. Brunt, John J. Helly,

Thomas B. Kirchner, and Susan G. Stafford. 'Nongeospatial Metadata for the Ecological Sciences'. *Ecological Applications* 7, no. 1 (1997): 330–42. https://doi.org/10.1890/1051-0761(1997)007[0330:NMFTES]2.0.CO;2. Also here: https://www.esa.org/wp-content/uploads/2022/05/ESA-Data-Paper-Guidelines.pdf

The pre-registration section is such a welcome addition – thank you! I think this is something we really do not take advantage of enough in archaeology.

In the section "my supervisor won't let me work reproducibly…" I'd also add in links to the Wellcome Trust funding guidelines on working openly here as they are a fantastic resource with lots of signposting to further resources. To make this more globally inclusive perhaps also link to other research councils like those in Australia (https://www.arc.gov.au/about-arc/program-policies/open-access-policy), the NSF in the United States (https://www.nsf.gov/pubs/2016/nsf16009/nsf16009.jsp#q1) and this policy draft for India (https://openaccessindia.org/national-open-access-policy-of-india-draft-ver-3/).

My final suggestion would be that your last sentence referring readers to the Kansa et al. paper could be duplicated earlier in the main text and more frequently – I know you cite it regularly as it's such a key paper but hammering it home as you do here earlier would be beneficial as some people may not look at the very end of the appendices.

Thank you for all of your hard work and dedication compiling this fantastic paper and its thorough appendices!