

Peer-Review Report

Peer Review of “Population Interaction in the Jōmon Society via 3D Data of Human Crania: Geometric Morphometric Study”

Osamu Kondo

Nippon Steel Res Inst Corp, Tokyo, Japan

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This is the peer-review report for “Population Interaction in the Jōmon Society via 3D Data of Human Crania: Geometric Morphometric Study.”

Round 1 Review

General Comments

This paper [1] studied 3D data of Jōmon and Yayoi cranial series and analyzed them in terms of temporal and geographical variations. While conventional craniometric studies of Jōmon specimens have been much accumulated, almost no comprehensive ones have analyzed both temporal and regional variation at once. In this sense, the approach of this paper is promising. However, I have major reservations regarding the approaches used to achieve this target; the authors' present approach is not able to clarify the smallness or wideness of the temporal and/or regional variation among Jōmon crania. Another major reservation is the data, as the 3D morphology of the Jōmon crania sustains unavoidable destruction and deformation during burial processes; thus, most of them were manually repaired. The data used in this study did not mention this bias properly.

Specific Comments

Major Comments

1. One major reservation is in the analytical design; the present one seems suitable for the study target, which aims to clarify the temporal (between Jōmon phases) and geographical (between regions in Japan) variations of the Jōmon crania. The authors concluded that there were pronounced morphological variations within individual populations versus smaller variations between different phases and geographical regions (from the Abstract). Unfortunately, this seems unclear to me. Probably a reason for this could be the lack of comparative targets. Figures 5 and 6 present the temporal and

regional variations along principal component (PC) 1 and PC2 and indicate only regional variations along PC2 as being significant, but this seems too weak for readers to reconfirm the conclusion of smaller temporal and regional variations. In my idea, as the authors perform the geometric morphometric and principal component analysis procedures for all the Jōmon and Yayoi individuals, all the comparisons can include all the subdivisions of the Jōmon and Yayoi. Afterward, readers can understand the temporal variation among Jōmon crania and also compare the degree of variation compared to those of the Yayoi, and the same is the case for the regional variation.

2. Another aspect that needs to be considered is the power of expression in the PC scores. The present analysis almost confines the results to PC1 and PC2 scores, which explain only 20% of the total variation (Table 2). When we accept the authors' idea of the advantage of 3D geometric morphometric analysis being inclusion of whole cranial morphology, selection and only a portion of the PCs may lead to disadvantages. I do not have any ideas for tackling this problem; the authors should care about this.

3. One other reservation is about the Jōmon cranial reconstruction. Most of the fragmentary and heavily reconstructed specimens suffered unavoidable skews and deformation. Because most researchers cannot repair the reconstruction, available options are few, but the authors should mention that they care about this bias. I suggest checking for the position in the plot (eg, outlier position) and the degree of preservation.

Minor Comments

Page 3, lines 3-5. Subdivision of the Jōmon period is usually capitalized (eg, Incipient or Initial Jōmon phases).

Page 7, line 1. “Facies symphysialis” can be rephrased as “pubic symphyses.”

Page 7, line 12. Cranial morphology should be considered as an outcome being affected by many factors; it should not be simplified as “a human trait.”

Page 7, lines 18-21. The purpose of the selection of several Jōmon site data for comparison with the Yayoi site is unclear—do you mean site-to-site comparison?

Page 8, line 15. “We also deform a cranium” is better reworded as “We also show deformation patterns of a cranium...”

Page 8, line 19. “Statistical tests on PCs...no significant differences” test results (Steel-Dwass test?) should be indicated (probably in a table).

Page 8, line 21. Significant regional differences were found only along the PC2, is that right?

Page 37, Figure 7. The legend of the Kuma-Nishioda site should be in the same color.

Page 37, Figure 7. The plot of Kuma-Nishioda and Nakazuma seems wrong; many individuals were overlapped at the same points among those from the two sites. It is unusual.

Page 37, Figure 7. Several individuals fall at the outlier positions.

Page 37, Figure 7 and page 7, lines 23-24. Description of the method of the second comparison is unclear. When and from where do you calculate the PC score data in Figure 7? Did you recalculate them based on the selected pairs? The PC1 and PC2 scores of Kuma-Nishioda sites are different from each case of pairs.

Page 10, lines 1-2. “Remarkably small interphase differences.” I think the authors should indicate the evidence of the “smallness.” Please see the major comment.

Page 10, lines 8-9. “Discrepancy may be due to methodological differences...” The authors’ inference seems to have been made without a reason. Please explain the reasons if you have them. The authors wrote “Geometric morphometrics could examine morphological variation as a whole,...” However, they analyzed only portions (PC1-PC5) of the whole variation. If they insist on the methodological superiority of geometric morphometrics including the whole morphological variation, the authors should use higher-order PC scores.

Round 2 Review

General Comments

I read the Word file as the revised one in this revision, not the PDF file, which seems like an older version. After reading the revised version, I could find some revised points and progressed. However, I still have some reservations about the main conclusions on the wide and continuous interaction among temporal and geographical subpopulations of the Jōmon period.

Specific Comments

Major Comments

1. The most serious reservations are the main conclusions of the widespread and continuous population interactions in the Jōmon population. The related results are seemingly found in two portions; one is the cranial variations within the Jōmon population and the other is the comparison of those of the Jōmon and Yayoi populations.

As for the former, the authors hypothesized that “If the populations interacted widely and continuously, there should be less morphological differences among different regions and phases, ie, fewer statistically significant differences between each region and phase are found” (page 8). In this context, however, the results indicated that statistically significant differences are found in PC2. The hypothesis was thus rejected at least in the results along PC2. The authors stressed in the results that “there are no significant differences observed in PC1 and PC3, and the regional differences remain relatively limited” (page 14). There seems to be no reason for this statement. In addition, the authors also mentioned in the Discussion section that “the boxplots of PCs in Figure 6 by region, with the exception of PC2, do not exhibit such clear clinical patterns” (page 15). However, this result seems to me to indicate that a clear morphological cline can be found (at least along PC2) in the Jōmon cranial series, as with those previously proposed by traditional biometric studies. In sum, the conclusion of the small regional differences seems much less confident to be accepted.

2. Concerning the temporal differences, I feel the same kind of ambiguity about it. The principal component analysis results seem to indicate that the interphase differences are small. This is correct, but it is also without any confidence. A couple of interphase comparisons are actually significant. In the Discussion section, the smallness of the interphase difference was contrasted with those previously reported claims (page 15). This is also without any confidence.

3. In the case of comparisons of Jōmon and Yayoi specimens, the authors hypothesized that “interregion and interphase variations should be lower than the populations from a different period (Yayoi period)” (page 8). In this context, the result in Figure 7 was described as “interregion and interphase variations should be lower than the populations from a different period” (page 14). This description is also without any confidence. The authors should provide several statistical test results to compare the magnitude of interphase and interregion differences among the Jōmon and Yayoi samples.

Minor Comments

4. In the Results section of the Abstract (page 3), “individual populations were more than the Yayoi population” is ambiguous. It seems “more variable than...,” but it still contradicts the preceding expression of “the Jōmon populations were spatiotemporally less various than the Yayoi populations.” When I seek the corresponding lines in the text, they seem to match the site-to-site comparisons in Figure

8. If this is true, it seems to match the line of “the Jōmon individual populations are more various than the Yayoi population (page 14-15).” If this is the case, the authors’ expressions seem wrong. As Figure 8 presents the site-to-site comparison, each circle represents the individual variation within each site. Thus, the correct expression seems to be “individual variation within a site was more variable in the Jōmon site than that of the Yayoi site.”

5. Page 4, lines 17-19. The following expression is not acceptable: “shift in subsistence patterns and significant technological developments...are conspicuously absent in Jōmon society.”

6. Page 7, lines 3 and 5. “Middle” and “late” phases should be capitalized as Middle and Late.

7. Page 14, line 23. Please check the site of “Ebishima,” which is correct? Is this indicated to Nakazuma?

8. Page 15, line 1. Please describe how to make Figure 9.

9. Page 16, lines 3-5. The suggestion of “the morphological and genetic diversity among the Jōmon populations was not relatively limited, but homogeneous across regions and phases” is not understandable.

10. Page 16, lines 10-11. The expression is not understandable: “The reason why fewer evidence of such a societal changes were found in the Jōmon period is possibly wide and continuous population interactions.”

Conflicts of Interest

None declared.

References

1. Nakao H, Kaneda A, Tamura K, Noshita K, Yoshida M, Nakagawa T. Population interaction in the Jōmon society via 3D data of human crania: geometric morphometric study. JMIRx Bio. 2025;3:e72432. [doi: [10.2196/72432](https://doi.org/10.2196/72432)]

Abbreviations

PC: principal component

Edited by Amy Schwartz; This is a non-peer-reviewed article; submitted 09.Oct.2025; accepted 09.Oct.2025; published 12.Nov.2025

Please cite as:

Kondo O

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JMIRx Bio2025;3:e85567

URL: <https://bio.jmirx.org/2025/1/e85567>

doi: [10.2196/85567](https://doi.org/10.2196/85567)

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