What do we mean by the directions “cranial” and “caudal” on a vertebra?

# General comments

Overall this is a worthwhile research question and will have broader implications in taxonomy, morphometrics and biomechanical studies focused on the axial column. The current manuscript, however, requires restructuring and a tonal shift in order to portray a concise argument about how to best orientate vertebrae for analysis. In it’s current iteration the manuscript reads akin to a blog post and would benefit immensely from a restructure to fit a more traditional journal publication format (Introduction, Material and Methods, Results, Discussion). This similarity to a blog post is echoed in the current manuscript’s tone and scope. The central motivation for the project appears to be hinged on reviewer comments from a previous publication, whilst this is a realistic and valid way of generating hypotheses, making it the focal point of the submission is detrimental to the paper. This focus reduces the impact of the findings as the introduction doesn’t introduce the reader to wider problems that this publication may solve (e.g. biomechanical measurements that are mentioned much later in the manuscript). It also sets an informal precedent for the tone of the entire manuscript which leads to unnecessarily specific callouts of previous work (Saegusa & Ikeda 2014), and odd inclusions about mugs which are best excluded from journal publications.

Some general suggestions for improvement are suggested herein. The overall focus of the paper should be shifted away from addressing reviewers comments from Taylor 2018b. This should entail the replacement of much of the commentary on the review process of Taylor 2018b with wider implications for the field (biomechanical measurements, taxonomic character states etc.), both in the introduction and in the discussion. The rest of the manuscript should be restructured in a more traditional manner. Anatomical Nomenclature, institutional abbreviations and the methods used to delineate horizontal (e.g. 3D printed *Xenoposeidon* models, the rolled up paper method, as well as a brief description of the 4 definitions of horizontal) should be compiled to form a ‘Materials and Method section’. The more comparative aspects of the 4 definitions should be moved to a ‘Results’ section and the remainder of the manuscript from ‘Comparison of definitions’ onwards should be combined to form a ‘Discussion’ section. Currently there are too many figures and this leads to unnecessary bouncing between pages. There are many instances where one point is illustrated by two or three figures which are spread over multiple pages, (e.g. Figures 5, 6 and potentially 7 could be combined). By combining these figures the flow of the manuscript is improved and the comparisons that you draw upon to illustrate the advantages and disadvantages of particular methods are more easily identifiable. This work is almost entirely qualitative and would benefit from some more quantitative measures of variation to compare between methods of assigning ‘horizontal’. Perhaps comparing multiple quantitative measures of vertebral anatomy across a range of organisms/vertebral regions would enhance the findings of this paper. Finally the general tone of the paper should be aligned with traditional journal publications, dropping informal references and colloquialisms.

# Specific comments

* Pg. 3 - References to the review process of Taylor 2018b should be drastically reduced. Whilst it is a good framing device for outlining the problem, it should be restricted to one or two sentences. The rest of the introduction should introduce the wider implications of vertebral orientation in palaeontology and other closely related fields (taxonomy, functional morphology, biomechanics) and discuss the issue in non-sauropod taxa.
* Pg. 4 – Figure 1: be mindful of colour blindness in the readership, use online filters to check if red, blue and green lines can be distinguished by people with different visual impairments. Remove “in blog posts (e.g. Taylor 2007) and even on mugs (Taylor 2017)” to improve the tone.
* Pg. 4 – “In the absence of such criteria, it is perhaps inevitable that we will continue to see inconsistency such as that in Saegusa and Ikeda's (2014: figure 8) illustration of the caudal vertebrae of Tambatitanis amicitiae”. This reads as confrontational. You later discuss your own inconsistencies, thus it would be better to remove the comments made regarding Saegusa & Ikeda 2014 and use your own work as examples of these inconsistencies.
* Pg. 5 – Figure 2. Remove and replace with an example of inconsistencies from your own work.
* Pg. 5 – Generalise your point about parrot cervical vertebrae to bird cervicals in general, mentioning the S-shaped curve on the cervical column. This is more informative and removes the need for Figure 3.
* Pg. 6 – Remove Figure 3, not needed with previous comment.
* Pg. 7-13 – Take short definitions for each of the 4 definitions of ‘horizontal’ and move then into a ‘Materials and Methods’ section. Take the rest of the text that further discusses the definitions into a ‘Results section’.
* Pg. 8 – Perhaps expand Figure 4 to include vertebrae of other taxa that show a similar pattern?
* Pg. 8 – “… but to determine half-height ***we*** need to determine …” drop the ‘we’ and rephrase. This needs to be done throughout to ensure a more formal tone is upheld. Third person writing should be utilised throughout the manuscript.
* Pg. 9 – Consider combining Figures 5, 6 and 7.
* Pg. 9 – “In this approach, ***we*** …”. Write in the third person throughout.
* Pg. 11 – “… is more an art than a science”. Remove this colloquialism.
* Pg. 12 – Perhaps consider taking the mean/median angle between neural canal roof and floor to alleviate some of the issues associated with ‘trumpet-shaped’ neural canals? Could easily be done digitally.
* Pg. 13/14 – Figures 8 and 9 could potentially be combined as they address the same point.
* Pg. 16 – Assign sections from ‘Comparison of definitions’ onwards to a new ‘Discussion’ section.
* Pg. 16 – “… and indeed when we floated these notions on our blog …” write in the third person and remove these colloquialisms.
* Pg. 17/18 – Combine Figures 11 and 12 they both address the orientation of the spinal cord.
* Pg. 19 – For definition 4, not only is preservation a detrimental factor to fossil vertebrae, but duplicating vertebrae is not appropriate for transitional vertebrae or in similar situations whereby there is a sudden change in vertebral morphology (C2/C3 in mammals, for example).
* Pg. 19 – “good enough” sounds unprofessional. You can also mention that the paper roll method can be implemented using digital techniques (Maya/Blender) which could potentially increase the accuracy of alignment using the neural canal method.
* Pg. 21 – Move the *Xenoposeidon* model to the relevant subsection in ‘Results’. Remove the recognition of Mannion (and subsequent quibbling over a few degrees), it wont be needed after it is not the sole focus of the Introduction.
* Pg. 22 – Add in more widespread discussion on how this can aid in other fields; functional morphology, taxonomy, biomechanics etc. Reduce the amount of discussion allocated to spinal cord diameter to compensate.
* Pg. 24 – Whilst I appreciate the need for open peer review, when the Introduction is reorganised I no longer see the need for this ‘Open peer review’ section. It again makes the tone less formal. This is not a blog post, it is a publication. A shortened version of this may be present in the Acknowledgements.

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