Reply on RC3
Thomas Clements et al.

Author comment on "The perception of palaeontology in commercial off-the-shelf video games and an assessment of their potential as educational tools" by Thomas Clements et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-84-AC3, 2022

Thanks to Andrea for their detailed and in depth comments on our manuscript. Below we address their thoughts and explain our implementations based on their comments:

1) The authors present a classification of the palaeontological videogames, but it seems to me that a clear and straightforward definition of what they consider a "palaeontological videogame" is missing but could be useful prior to list and explain how these videogames can be categorised. Indeed, it emerges from different parts within the text which games are included as "palaeo-vg" and which are not, but stating this clearly with a few sentences defining the term may be of help in avoid any ambiguity (and it could be also seen as a starting point for future developments on the topic made by either the same or other scholars).

In the manuscript we state: In this review, we focus on COTS video games that incorporate fossils and/or ancient animals as one of the playable or interactive aspects of the game.

We have moved this text to the start of the general introduction section and amended this text to be more explicit. It now reads: In this review, we focus on COTS video games that incorporate fossils and/or ancient animals as one of the playable or interactive aspects of the game, which we term ‘palaeo-video games’. This review does not include games based on human remains or artifacts (archaeology).

2) The authors explicitly exclude from their classification of palaeontological videogames those games where, in their words, ancient animals and palaeontological objects are incorporated as “set dressing” or as cosmetic/aesthetic content. I would have a different point of view on this, and I would like to present it to the authors. As said before, this is mainly a discussion point, and the authors are free to ignore my suggestions here.

In spite of often not being an interactive part of the experience, environmental features of
the levels/worlds in which a game takes place can be pivotal in favouring the immersion of the player. As such, these features can play an important role both in depicting palaeontological objects, concepts and extinct organisms and in accustom players to palaeontological objects/subjects as part of a real and diverse community in contrast with a narrative of unconventional and exceptional topic/individuals (thus contrasting a classic view of exceptionality that may have problematic effects on the depiction of palaeontology and palaeontologists; if not intentionally fostering it, of course).

Just to make a few examples of what I mean, considering games that are mentioned at some point within the text:

- a) the museum sequence in The Last of Us Part II has a strong value in the narrative of the game, being functional to describe the relationship between two of the main characters and their life together previous to the events narrated in the game. The museum itself, and its content and exhibitions, is used as a tool to develop this narration, including interactions with and line of dialogs on dinosaur skeletons and movies. This is of interest when discussing videogames that have something to do with palaeontology under many levels, I think. The sequence includes themes such as representation of fossils, musealization, the relationship between palaeontological exhibitions and the public (in the dystopic context of TLoU, of course), as well as the cultural references that have shaped the representation of extinct animals presented by the developers...

- b) whale fossils in Assassin’s Creed: Origins, in spite of being completely disconnected from the plot of the game, still represent a chance to highlight Egyptian palaeontological heritage (and to create a discourse on it). Now, criticism may be moved on how the AC team developed the Discovery Tour and palaeontology definitely plays a very minor role in the specific case of this game, but still I think that features like this in a game may be of interest in a discussion of palaeontological themes in videogames.

It is true that, at least in some of the examples mentioned by the authors at p. 4, lines 126-127, palaeontological contents have a very minor “screen time” and so they may not be really useful as educational tools, in particular for streamers that are employing them for long sessions with a need for continuative presence of the main object of interest. However, I would say that it would still be worthy to mention them at least as a specific category within palaeo-vg (intended in a wide sense), in order to acknowledge their existence and to open to possible future investigations about this type of representation of palaeontology within videogames. A similar line of reasoning may apply to skins and other aesthetic-only content, as they are also representing palaeontology (either in a good or bad way) in the medium.

*Andrea makes very valid points here, and we do not disagree with any of them! Set dressing and skins could be a paper in their own right, and this is part of the issue. We are restricted to what we can cover in one manuscript. However, we do feel that Andrea’s point is valid, so we have amended this section of text to reflect the points raised here. It now reads: While some of these games, such as The Last Of Us Part II, do integrate museum levels into the gameplay that allows players to interact with fossils, typically the*
palaeo-content of many of these games is purely aesthetic and, therefore, would be of limited use to science communicators.

3) There are at least some parts of the text where the authors seem to criticize exaggerated or unrealistic content developed in the context of a fictional (comic, fantasy, sci-fi...) game under the light of inaccuracy towards the real world and subsequent misrepresentation and disinformation. Examples of this may be p. 12, lines 398-402 ("However, issues arise because other fossils items, ranging from the ridiculous (fossilised cow udders) to the bizarre (‘perfectly preserved moustaches’) are presented as genuine fossil remains. While clearly light-hearted and for comedic effect, the indiscriminate mixing of real and fake fossils is problematic and would not necessarily be discernible for all players.”) and p. 15, lines 501-502 ("It is often not made clear to players that, currently, we are not able to ‘resurrect’ extinct animals, nor can we extract viable genetic material from fossils."). Issues like these are basically inherent when fiction is present in a media, being it a videogame, a movie or a novel. Works in genres such as sci-fi and fantasy are grounded in some discrepancies with our real world (being them the existence of some alien/fantastic organism, the availability of particular technologies, or else), and the acceptance of this (the so-called suspension of disbelief) is part of the approach the consumer has towards the work.

It is not clear if these are just warnings for science communicators approaching this kind of games (as it may be, given these are one of the main targets of the paper itself) or actual criticism towards the games. However, at least some passages seem to hint (likely unwillingly) at some sort of “responsibility” of the developers as propagators of misinformation because of not specifying the fictional nature of something featured in their game. I would suggest to maybe better clarify the target and scope of some of the criticism presented in the paper (such as the two examples mentioned above).

This paper is primarily directed towards science communicators (although if game developers read it, then that would be great!). We were careful to not attribute any form of direct criticism explicitly towards game developers while writing the manuscript - we are aware (and point out in the manuscript several times) that developers are typically not scientists and that game mechanics are prioritised over robust science (e.g. we state in the text: Here, we highlight harmful tropes (i.e. unethical behaviour, misogyny, racism etc.) to inform science communicators of the perception of palaeontology that is disseminated by COTS videogames. Furthermore, this review may be of interest to COTS game writers, developers, and video game artists who may be unaware that they are propagating damaging tropes pertaining to palaeontological science.

The first example you use clearly states that we acknowledge that including fossil cow udders is for comedy reasons, but players may not be able to discern between fake and real fossils. This is accurate.

However, your point about the cloning section is fair, and we have addressed the text to avoid this issue. It now reads: Because the trope of DNA extraction from fossiliferous material is so prevalent in media, video game players may not be aware that, currently, we are not able to extract viable genetic material from fossilised remains to ‘resurrect’ extinct animals.

Furthermore, we have gone through the sections and addressed them to make sure that there are no areas that proportion “responsibility” of the developers to avoid misinformation and instead, put the onus on science communicators to highlight these problematic areas.
4) The authors correctly highlight, in various part of the manuscript, the conflict between search for accuracy and commercial/entertainment needs game developers are facing when including any kind of palaeontological content within their games (and this of course apply to any other scientific feature). Just as a thought-provoking question (and I know this is the one-million Golden Coins issue), do the authors think a mixed approach towards palaeo-themed games, balancing accuracy-directed development and other needs, is possible and viable for COTS products? Maybe this topic could be briefly explored in the conclusions...

Some games do try to address the balance between accuracy and gameplay and we mention this in the paper (see simulation games). Based on your previous comment, and the aim of the paper towards scicommers, we do not believe it is suitable for us to discuss this directly. However, from the other reviewer comments, we do say: Many COTS video games contain elements of good science communication — and some games, especially dinosaur simulators, strive for scientific accuracy. Indeed, aspects of many palaeontological themed COTS video games can be used by science communicators to highlight, engage, and educate the public regarding core concepts of palaeontological science.

5) While preparing this review I had the chance to read the comments already posted by the other reviewer, Dr. Flavia Strani, on the preprint web-page of this article. I agree with most of her comments and especially on the needed references she mentions, with particular respect to the palaeontoethics paper (DeMiguel et al. 2021).

See comments made in Reviewer 1 section.

In the end, some other minor changes can be found in the attached pdf.

Thanks. They are addressed below:

Line 112: Typo
Amended

Line 122: I am not sure whether genre can be used here: the following list mainly present games featuring palaeontological content that have common characteristics. Sometimes these are indeed related to a particular genre (park sims, for example), but this is mainly due to the fact that the characteristics used as discriminants for the classification are inherent to that particular genre. In other cases, the categories include very different kind of games, which are lumped together only by a particular use of the palaeo content.

Thus, I would suggest to simply speak about "categories" here.

We agree and have removed the word ‘genres’ in the title completely.

Line 215: Collectables? Given this was the spelling used in the previous part of the paragraph.

It has been amended as per review 1 comments.

Line 281: Is there a reference for this? Like a paper, or else, where the term is defined.

See comments to reviewer 2.

Line 343: No italics for sp.
Amended

Line 362: Maybe better to use taxa (or even genera) here, rather than groups as the list only includes genera. This is mainly a personal feeling, though, as I would use groups for e.g species complexes, unranked clades, or families... I leave it up to the authors to chose as they prefer, however.

*We have already changed this section based on reviewer 1 comments.*

Line 492: Typo

*Corrected*

Line 525: accession > access?

*In this context the meaning of accession is to add something to a collection.*

Line 564: Cisneros et al. (2022: https://doi.org/10.1098/rsos.210898 ) may also be another useful reference here.

*Agreed. Added.*

Line 578: collectables? Simply to be consistent with previous spelling

*Amended.*

Line 673: No space

*Fixed*

**Figures**

Figure 1: Only a minor thing on the 1996 Pokémon release: the first two japanese versions were red and green, with the japanese blue being released only months later (still in 1996, but I think it would be better to either mention all three colours here or just the two "originals").

*Fixed.*

Figure 2: J is missing from figure.

*Fixed. Thanks*