Interactive comment on "Earth Girl Volcano: Characterizing and Conveying Volcanic Hazard Complexity in an Interactive Casual Game of Disaster Preparedness and Response" *by* Isaac Kerlow et al.

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Firstly, apologies for not submitting this reviewers report sooner. This has been a complex review and I wanted to make sure I had properly considered it before submission.

The article covers the development of the Earth Girl Volcano game. The game itself is extremely well researched, with great consideration to every design and game-play element, a high level of attention to detail, and despite the underlying and background complexity, it creates a simple, intuitive gaming experience, that is fun to play over and

over again. This manuscript itself is a reflection of the game and covers in great detail the rationale and design of the game.

The reason the review has been difficult is because the manuscript does not fall within the defined scope of Geoscience Communication. It has been submitted as a research article but there is no research question, methodology, and no form of evaluation to assess that the question has been answered. There is a lot of detail about the game and its design but the authors do not address and evidence whether those design choices were successful in achieving the objectives. Under the journal's manuscript descriptions, this manuscript is simply reporting on a public engagement activity. It doesn't fall in the scope of the other manuscript types either.

"Research articles report substantial new results and conclusions from scientific investigations of geoscience communication initiatives within the scope of the journal. Please note that the journal scope is focused on qualitative and quantitative studies of geoscience communication rather than simply reporting on public engagement initiatives."

https://www.geoscience-communication.net/about/manuscript_types.html

However, as someone who conducts research in this area and is the target audience for Geoscience Communication, I found the manuscript to be immensely insightful and useful, and wherever it is published, either here or elsewhere (in current form, a book chapter would be appropriate), it is work I anticipate I would reference frequently and use as a case study in teaching. The inter-disciplinary backgrounds of the authors provides new perspectives on designing and using games for science and hazard communication that will be valuable for the readership. Ultimately, this is an editorial decision as it is out of scope, but based on the merits of the work, I recommend it for publication with minor corrections.

Key Corrections

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The main correction is that some points made need greater evidencing, either through citation or with evidence from evaluations of the game. An example is in the abstract, lines 26-29 - "The combination of all these techniques yields a whole that is greater than the sum of its parts, a perfect storm that is able to create an emotional connection between players and the hazard scenarios in the game." This is an ambition of the game design, and many of the game design elements used have been adopted as previous studies have shown they are effective for engendering emotional connections, yet the authors have not provided the evidence that this game has achieved this, and also that the combined effect is greater than the individual elements. Statements like this need either removing or rewording in a way that states this is the aim and not a finding. I have highlighting further examples in the line-by-line comments below.

The authors need to consider the use of the phrase 'natural disaster' as it is often not helpful in communicating hazard risk and many argue is factually incorrect. The hazard, in this case emerging from volcanic activity, is natural but it only becomes a disaster because of human decisions. There are places where the game is described as a disaster simulation, or that the players manage the disaster, however, I would suggest the game itself is a hazard simulation and the outcome is a disaster or not because of the player's choices. It would be useful to more clearly define these terms and their use throughout.

Editor - stylistically, do game titles need to be italicised?

Line-by-line comments and technical suggestions

Line 15 - Add a comma after 'Unfortunately'

Lines 26-28 - the manuscript does not provide evidence to support this statement and should be removed or reworded

Line 31 - Add 'are' inbetween 'and' and 'exposed'

Lines 46-51 - This paragraph repeats what is said in the opening paragraph. Consider

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merging them.

Line 46 - hyphenate easy-to-play and easy-to-learn to be consistent with line 32

Line 48 - A reference is needed for the ranking here. I think it is the same reference used in line 51.

Line 86 - Be careful with use of the term 'natural disaster'. Are disasters natural or because of human actions?

Line 92 - Somewhere in the introduction it would be useful to have a short review of previous hazard awareness games, particularly video games, and place Earth Girl Volcano in context with them. In particular, the video game of Mani et al (2016) has a similar objective but takes a very different approach.https://www.nat-hazards-earth-syst-sci.net/16/1673/2016/

Line 99 - natural disaster again if you wish to change it

Line 110 - volcanic disaster I would suggest is similar to natural disaster

Line 135-136 - Is this rating suggesting the game is well designed to engage this target audience or that it doesn't contain elements that might be inappropriate/harmful for some age groups? The sentence may be misleading due to the sentence immediately before.

Lines 138-139 - I think there is a missing word(s) after 'stay away'

Line 143 - Change 'in' to 'on'

Lines 146-147 - How relevant is this considering Adobe will be removing all support for Flash at the end of 2020? Are there plans to update to html5 or hosting on itch for example?

Lines 148-152 - This is a repeat of information provided in the Introduction.

Line 154 - It would be useful to define what is meant by 'a casual game' for readers

who may not have any gaming background.

Line 159 - Change 'device' to 'devise'

Line 160 - Define what is meant by 'adventure' and 'management' games

Section 1.7, lines 212-231 - This section is really interesting and these insights are valuable. Were these responses recorded in any way that could be used as evidence for this? If not, you need to make it clear that this is anecdotal information from the process and that it is not based on a formal evaluation. Have there been previous studies analysing collaborations between scientists and artists that would support the observations?

Line 224 - My understanding of gamification is that it is the use of gaming elements as part of something but stopping short of making an actual game itself, so the use of the term here wouldn't be correct.

Line 239 - 240 - This statement needs evidencing or removing.

Line 241 - 'classical theatre' has a specific disciplinary meaning (i.e., the theatre of ancient Greece) that could be ambiguous here. 'Traditional theatre' might be more appropriate.

Line 241 - Theatre usually doesn't have a screen therefore don't have screenplays - script or text would be a more suitable term.

Line 250 - 253 - These statements could use evidencing by referencing appropriate sources.

Line 291 - 292 - This sentence needs evidencing or re-wording, for example replacing 'helps' with 'intends'

Line 295 - Suggest replacing 'disaster' with 'hazard' in both cases

Line 316 - How was this observed/recorded? If it is anecdotal, please state that it is

Line 336 - Change 'payer' to 'player'

Line 392 - 411 - Make it clearer in this section when you refer purely to the in-game effect of the tools and when referring to real-world effects. For the latter, this should be accompanied by supporting evidence (like for Sabo dams in lines 402-403).

Line 412 - Add a comma after 'Initially'

Line 418 - Change 'loose' to 'lose'

Line 419 - As a matter of interest, have you tried using a more advanced version with all the tools in to run with practitioners?

Line 426 - Add a comma after 'speaking'

Line 429 - the tool names are capitalised here but not elsewhere. It doesn't matter if there are or are not capitalised but should be consistent.

Line 442 - Change 'cannot mitigated' with 'cannot be mitigated for'

Line 451 - Add 'the' between 'than' and 'others'

Line 458 - Move '(also known as check dams)' to the first reference of sabo dams in line 402.

Line 479 - 480 - It is not enough to say it is well documented, please provide references to this documentation as evidence.

Line 481 - 482 - I'm not sure I understand this sentence - does this refer to people who have evacuated from nearby towns trying to find shelter in the town the player is trying to help?

Line 507 - Remove 'for no good reason' as this could read as they refuse to evacuate until given a good reason to do so.

Line 514 - Change 'he or she' with 'they'

Line 532 - Remove 'interactive game'. It is superfluous here and could be read to mean a different version of the game.

Lines 538 - 548 - Do you have formal observations/evaluations for these? If so, please provide information on the methodology used. If not, please make it clear these are anecdotal observations.

Line 542 - Change 'student' to 'students'

Line 554 - 555 - Are there studies that show this that can support your belief?

Line 578 - Add a comma after 'hazards'

Line 578 - Change 'in which' to 'that'

Line 604 - 609 - All these statements require supporting evidence - how do we know explaining alone does not create emotional response?

Line 616 - 618 - Was this observed via a formal methodology or is anecdotal information?

Line 629 - I know it seems obvious, but you need to provide evidence that suspense and tension create an emotional connection.

Conclusions, lines 647 - 665 - The conclusion is weak and doesn't really say much, but as the manuscript is a detailed description of the design process rather than addressing a research question, this is to be expected. There is reference to user feedback throughout this section - please provide more details of how this was collected and recorded. Has this been a formal evaluation or is it anecdotal?

Line 660 - 661 - It maybe that this is required for publication in Geoscience Communication. If it is decided it is and you wish to continue, I would suggest a focus on how well the game manages to create emotional connections for players, and then how well that leads to increased hazard preparedness.

The manuscript is missing sections -

Data/Code Availability - please include in this section where people can access the game (this information is already in the manuscript but should be repeated here. If any of the information was based on formal evaluation, details of the availability of that data should be placed here.

Author contributions

Conflict of interest statement

It is not listed on the journal website but should there also be a research ethics statement. Thank you for the manuscript, I enjoyed reading it

Chris Skinner

Interactive comment on Geosci. Commun. Discuss., https://doi.org/10.5194/gc-2020-16, 2020.