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## Reply on RC2

Marleen Carolijn de Ruiter et al.

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Author comment on "*Breaking the Silos: an online serious game for multi-risk disaster risk reduction (DRR) management*" by Marleen Carolijn de Ruiter et al., Geosci. Commun. Discuss., <https://doi.org/10.5194/gc-2021-3-AC2>, 2021

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(Please find attached PDF for the properly formatted rebuttal)

We thank the reviewer for these very kind words.

We like the reviewer's suggestion and have therefore changed the structure of the manuscript accordingly. We have also made some adjustments in the abstract and the conclusions to reflect this.

This is a very useful suggestion, and we will take it into consideration when playing and analysing future games. However, at this point we are unable to include such analysis based on the past plays. Nevertheless, we add this suggestion to the discussion section:

[686] When playing the game in the future, it can be considered to involve social scientists, specialised in participatory methods and behaviour, to further analyse the participants' game play and how behaviour changes over the course of the game through the learning-by-doing process.

We agree that the moderator deserves its own dedicated heading. We have therefore restructured the game design and set up section (previously section 2.2) and expanded the moderator section. Initially we had addresses Lara Mani's comment and changed all mentions of moderator to game master, but we agree that the term moderator is probably more suitable for a wider audience, and we have therefore re-adjusted it and explained that the moderator can be perceived as a game master. We also included a brief explanation of how the moderators were recruited and trained. The role of the moderator is important in the debriefing process and can therefore not be omitted (this was removed from the manuscript). The moderator guides lead the moderator step by step through the game versionation process which should minimize the negative impact of less good moderators. The section now reads as follows:

### [198] **2.3 Role of the moderator**

The game requires a moderator, who can be thought of as a game master. The moderator

is not actively participating in the game but narrates the storylines, runs the impact and DRR calculations in the background, and keeps track of time. All participants (and the moderator) communicate using an online meeting software such as Teams, Zoom or Skype. The game board and players cards are all shown on the MIRO platform, an online whiteboard for visual collaboration (see Fig. 1). Actions in the gameplay take place on this game board. Additionally, the moderator has access to a calculator tool for keeping track of the score. This is a series of spreadsheets containing the exposure, hazard, and vulnerability relationships between the disasters. As the moderator enters the DRR measures selected by the team, summary tables are automatically updated. These tables indicate whether the team met the round's objectives, the updated budget for the next round, and the difference in risk with the DRR measures selected to a situation in which no DRR measures would have been taken (in terms of population, building and critical infrastructure impacted). During the games played at UR2020 and ETH Zurich, the moderators were part of the research team. While the moderators' guidelines and storylines (Supplement I) are self-explanatory, we do recommend moderators to first play the game themselves before moderating the game.

We fully agree with the reviewer and have added a new section and expanded another relevant section as follows:

#### [212] **2.4 Learning through debriefing**

While often lacking, a debriefing element in serious games is of utmost importance to support the learning process (Crookall, 2010; Kolb et al., 2014). It is even argued that real learning comes not from playing serious games but from the debriefing element (Crookall, 2010). Several more recent studies have addressed this by including feedback on actions within the game, so-called "learning by doing", which can increase learning (Solinska-Nowak et al., 2018; Terti et al., 2019). Therefore, we decided to create three rounds, which demonstrate disaster and DRR interactions and allow players to change their approach to DRM in each round. Each round starts after a disaster and the team is asked to agree on the implementation of (a set of) DRR measures. We expect to see the teams responding to the particular hazard type that just caused a disaster rather than to also anticipate future risk of other hazards. Each round begins after a new disaster, and with the moderator explaining the impacts of that disaster as well as highlighting the impacts of DRR measures that were taken in the previous round. This intermediate debriefing that follows each round and is led by the moderator, was designed as such to enable a reflection on the effects of the actions taken, to allow players to adjust their behaviour in subsequent rounds, and to experience the effects of changing one's behaviour. We expect that this influences the team's behaviour during the next round. Finally, it was decided to include a discussion that takes place at the end of the game to enable players to reflect on the effects of the debriefings. The discussion can be supported by looking at the overview tables that summarize the actions taken after each round and the effects of these actions on subsequent disaster impacts.

[515] At the end, the participants are encouraged to reflect on the game. The moderator first asks the players to share their general thoughts on the game and the moderator asks the players to discuss their decision-making process, to reflect on their behaviour in different rounds, and the effects of the information provided during the debriefing.

We agree that it would have been very timely to include COVID-19 or a pandemic in the games played at UR2020 and ETH. As described in the game development Section 2 (previously section 3.1), alternative game versions can be developed and included. As our

own expertise is within the field of natural hazards, we would prefer to develop such an alternative game version by involving experts in the field of health-related diseases. This would also allow us to include, for example, a post-flood cholera outbreak, which would be a realistic consecutive disaster type to include. We therefore added the following:

## [235] 2.5 Different game versions

The primary game version reflects a fictional country, with a strong economic dependence on the agricultural sector, facing tropical cyclones, droughts, and floods. Different game versions can be developed, each with their own storyline, socio-economic and political characteristics, hazard types, available financial funds, DRR measures and DRM roles, to adapt the game to players' specific needs or hazard environments. For example, future game versions could include the occurrence of a pandemic, outbreak of a vector-borne disease, or natural-technological disasters. The role cards can also be adjusted such to mimic different government systems.

We fully agree that an in-depth analysis of the decision-making process, including the influence of participants' background, would be very valuable to include in a future analysis. Insights obtained from such an analysis could for example also be used to feed into an Agent Based Model.

The role cards allow for the development of game versions that mimic different government systems. We really like this suggestion and have included this (see previous answer).

Missing multiple players would hamper game play. If this is known in advance, the game version and roles can be adjusted. If this happens at the start of the game, it can be decided to add the tasks of the missing player(s) to the other players. I have added the following to better explain this:

[435] In case fewer than eight players are playing, this would mimic the concept that in real life, important stakeholders can also be absent from key meetings. Alternatively, it can be decided to add the tasks of the absent player to other player(s).

Theoretically this would indeed be possible. The chance of having three consecutive high intensity floods for a storyline is  $(1/3)^6$  so 0.13% chance, but the number of cells impacted (5 to 15) and the location can still be different. We have explained this in the text as follows:

[444] These selections are not shared a priori with the players and will define the storyline of the game. Each hazard type, level, and timescale have an equal chance of being selected (uniform distribution). Theoretically, it is possible that three of the same hazard types, levels, and timescales are selected. However, the chance of having three consecutive high intensity hazards of the same type for a storyline is 0.13%, but the number of cells impacted (5 to 15) and the location can still be different.

Many thanks for pointing this out, we have adjusted the sentence accordingly.

During the online games, players were not explicitly asked to not discuss game strategy outside of the game environment as the online set-up did not allow participants to continue talking during the break, but this is indeed a valid point when playing the game in-person. I have therefore included the following:

[475] The end of the second timer signals the end of round 1 and a break of 10 minutes for participants to relax. During the game, participants are asked not to discuss game play outside of the game (for example during breaks) to ensure that reflections on game play and on the debriefing take place within the game's environment.

We agree and have adjusted the sentence as follows and changed all other instances of "game version" to "game version":

[237] Different game versions can be developed, each with their own storyline, socio-economic and political characteristics, hazard types, available financial funds, DRR measures and DRM roles, to adapt the game to players' specific needs or hazard environments.

We would like to thank the reviewer for his thorough review of our manuscript and the very valuable feedback, which we believe has improved the quality of the manuscript.

Please also note the supplement to this comment:

<https://gc.copernicus.org/preprints/gc-2021-3/gc-2021-3-AC2-supplement.pdf>