Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2017-297-RC3, 2017

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Learning in an Interactive Simulation Tool against Landslide Risks: The Role of Amount and Availability of Experiential Feedback" *by* Pratik Chaturvedi et al.

Anonymous Referee #3

Received and published: 8 November 2017

General Comments:

The study described in the paper addresses an important and very relevant issue in natural disaster risk management – to explore potential ways to improve risk awareness and knowledge. The authors reported how they used feedback in an Interactive Landslide Simulator to influence people's risk reduction investment behavior. The manuscript was written generally in good English that can be relatively easily understood, but the ILS model still needs to be better elaborated and explained. While the study represent a good initiative, it also suffers from a number of design problems.

Specific issues:

1. The ILS model and simulator structure Significant information about the ILS model was from the authors' published conference paper in 2016. The authors need clearly state this. Much of the information needs not to be repeated. Even so, the current description of the model is still not clear enough. More details are needed to help understand how the rather sophisticated landslide probability calculation relates to damage estimation. For example, the total P is an additive results of the two constituting components, P(I) and P(E), however P(E) is the multiplicative results of its two constituting components. The authors did not give full information to justify this choice. The authors mentioned "study area" only in 2.1.1, while very limited information was provided. The authors also did not give any explanation on how W is determined.

2. The assumptions of the ILS model

The ILS was designed with the assumption that people susceptible to landslide hazard aims to maximize their total wealth and the authors started that "a high probability of landslide damages will make people suffer monetary losses and people would tend to minimize these losses by increasing their mitigation actions". This assumption neglects much of the social science research on people's risk perception, attitude and behavior, that people do not behave as an economic rationale individual in the face of extreme events. The authors assumed that "damages concerning injury and fatality affect one's income levels". This is rather naïve. While reduced income level is going to be a consequence, but it would be much less a concern for most people than the injury and fatality itself. In reality people can also choose to migrate when mitigation cost is too high and adaptation becomes impossible. The nature of landslide hazard, including its notorious fame of being extremely hard, if not impossible, to predict, makes it quite different from other hazards such as flood and drought, and general climate risk. The authors' choice of P(I) formula from Hasson et al. 2010 does not seem to be appropriate.

It may seem to be obviously useful by applying specific parameters from the Mandi area in India as the participants seem to be mostly from the area (the authors did not clearly elaborate this), however, since the algorithms was not disclosed to the partic-

ipants and a random number generator was used in producing damages, using the seemingly sophisticated algorithms is in fact not much related to the authors' main objective, instead, a more generic algorithm would serve the same purpose and potential be more useful for testing with participants from other areas.

Day was used as the time unit for simulation and people make daily choice in landslide mitigation investment. This is not relevant for real world situation either. In most cases, especially in developing countries, households and communities themselves almost never have resources substantial enough to mitigate landslide risk, which is often financed by government and/or international donors. The huge disparity between the average asset (calculated as per capital GDP) and the salary (with the former being 2000 times of a person's annual income) also supported my above statement.

The authors chose a value of 0.8 for W, indicating that the landslide risk can largely be mitigated by human. This is in general not the case, especially for the type of mitigation measures mentioned by the authors – tree plantation. There has been studies showing that afforestation does not help with landslides in similar areas to Mandi in the Sivalik Hills.

3. The study design

The high damage scenario is simply not realistic at all. With such a high risk of mortality and 90% change of injury, no one would still choose to stay in the landslide area, even in least developed countries. The low damage scenario would already be a very high risk area in reality, in any countries.

In Fig. 3b, The authors give a smiling face followed by "Landslide did not Occur". This gives a false feeling that the fact that landslide did not occur because of mitigation investment, while in reality much of it should be due to stochastic in the nature of landslide.

4. The results

First, part of the results were already included in the 2016 paper (apparently including 43 of the 83 participants reported in this study) and this should be fully disclosed. Second, the part of the results on people's increasing investment in mitigation seems to be largely an artifact of the choice of M being 0.8. It'd be more interesting to study, with a much larger sample, how how changing M will affect people's behavior, given that the authors choose more realistic scenarios.

Some detailed comments on texts:

1. In Abstract, the first sentence is incomplete. 2. "Different amount of feedback" was used, but in fact the difference between the two different levels of feedback may better be described as "intensity" of "strength" of feedback. 3. Fig. 2 is similar to the Fig 2 in the authors' 2016 conference paper and needs to be disclosed. 4. Fig. 5b, it should be high/low damage instead of more/less damage. 5. Reference – Mathew et al. was published in 2014 and should be rearranged in alphabetic order.

While the study represents an interesting attempt, it suffers from seriously false model assumptions and weakness in study design in relation to reality. I personally even think that the simulator may falsely influence participants in terms of how they should make decisions in the face of landslide risk. But I strongly recommend the authors to continue developing the simulator with stronger social science understanding and better design.

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