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Hydrology and Earth System Sciences Discussions

Interactive comment on "Irrigania – a web-based game about sharing water resources" *by* J. Seibert and M. J. P. Vis

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We thank Maurits Ertsen for raising some important points, which will allow us to improve the manuscript. Below we respond to the different points (in the same order as in the referee comment).

1) Thanks for making us aware of these interesting games (and references). These will be included in the revised manuscript.

2) We agree and will add some discussion on the different ways to simplify reality. The main point is that the real situation or conflict is reduced both in terms of considered state variables and possible handling actions in order to make the situation (or game

rules) easier to understand for the players. With Irrigania we chose a larger reduction than in most other games. The aim is that the players should fully understand the rules and their effect and take informed decisions. It is interesting, that even with such simplifications, interesting patterns can evolve when playing the game.

3) Numerical aspects: in the revised manuscript we will include an analysis on how long it is beneficial from a single farmer's perspective to overuse the common resources. Due to the implemented non-linearity, there is certain point after which it is even from this perspective better to not increase the use of this resource.

4) "What does a winning farmer have more than the others?": winning farmers have to find a balance between cooperation and competition within the village.

5) We agree that the upstream/downstream asymmetry is an important aspect in many water resource issues. It could be interesting to consider this both between and within villages, but this would make Irrigania more complex. To keep the game interesting the power of being upstream has to be balanced by some downstream power (as often found in real world conflicts), which quickly makes the game much more complex. The interesting aspect of Irrigania is its simplicity, equal initial conditions for each player and the conflict between competition and cooperation within a village. The fact that rules and conditions are equal for all farmers might not be realistic, but it is explicitly chosen as an important characteristic of Irrigania. The interesting aspect is that although conditions are identical, results, when playing the game, have shown huge differences between farmers and villages. Also, identical conditions make it easier for the students to experience the game theoretical aspects of Irrigania. Therefore we chose to let students start in fully identical situations in Irrigania. All differences that arise, are caused by the students (/villages) themselves. However, the asymmetry of water resource problems is something that should be discussed when using Irrigania in teaching and we will include the above discussion in the revised version.

6) Non-numerical (or socio-political) arrangements: yes, we agree that there is little

possibility for side-agreements in Irrigania.

7) “There seems to be considerable pre-definition in what would be the best solution”: Yes, but so far in classes none of the students managed to gain the maximum profit, due to lack of trust, selfishness (which then was punished by the other farmers) or too good cooperation within a village. These are the ‘political’ aspects in Irrigania.

8) “overuse of the resource is not expressed indirectly through gains, but rather directly in water being available or not for players.”: actually for groundwater there is a direct accounting. However, we assume that farmers are more driven by economical aspects (gains) than the actual water being available. We argue that this is a realistic aspect of Irrigania.

9) “Irrigania appears to be based on assumptions that 1) there is a best solution for a game setting and 2) results of actions need to be quantified.”: 1) Yes, but the best solution for a village differs from the best solution for an individual farmer, 2) Yes. We argue that this has been done in some way in any game. In Irrigania we chose to keep this rather strict to have a clear and simple set of rules.

10) Cooperation in a web-based game: we agree that being in the same room makes interactions easier and probably more interesting. While Irrigania in principle could be played in a distant setting, this is nothing we have tested so far. The major reason for having a web-based implementation is that this makes it easy to use Irrigania in classes as no software has to be installed on several computers.

11) Conjunctive use of groundwater and surface water and differential access: this is an interesting aspect. This could be considered by introducing an initial cost to be able to use groundwater or groundwater from below a certain depth.

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