First Thoughts on a Simply CPR Model

Hey group, these are just a few ideas for a potential outline of our Common Pool Resource model. As previously discussed, we should probably start with something simple and then expand upon it later. It seems it would be fairly easy to have an array of *Fisherpeople*, and pass them through some *Fishing Function* iteratively. Each iteration would represent an arbitrary step in time(a day), which could account for *Fish Consumption* with some negative coefficient multiplied by time and for *Fish Storage* with a positive coefficient. The total *Fish-Effect* would have to be subtracted from the *Fish-Population* in the lake. We should also include some lower-bound where people die at some negative fish-count.

Adjustments to the function could be represented by different motivational parameters and because this is a Multi-Agent Systems course, we will want those parameters to be based on an interaction with the agents and their environments. I posit three principle environmental-knowledge parameters that will influence three main attitude parameters. If an individual does not know something, that knowledge parameter would be zero.

Individual Knowledge: The individual knows how many fish they have.
Collective Knowledge: The individual knows how many fish everyone else has.
Resource Knowledge: The individual knows how many fish are in the population.

Individual Conservation: Concern level for individual well being, ranging from greedy to generous.
Collective Conservation: Concern level with collective well-being, ranging from envious to empathic.
Resource Conservation: Concern level with resources, ranging from wasteful to conservational.

Example of a fish-function:
Fish stock of individual = (IC/IK) - (CC/CK) - (RC/RK) – daily fish consumed + fish in storage

*Note that we may want to make the knowledge parameters time-derivatives. Also, we may want interaction between the terms.

Initially every fisherperson could have the same fish function and we could observe how to optimize both a healthy population of fish and a healthy population of people. Then we could tweak the system with *Fishpeople Factions* where sub-tribes in the population adopt their own fishing functions and maybe some will live and some will die. For finer detail, we could even have individual functions. If we are feeling fancy, we could randomize all parameters and train individual parameters with a neural net.

Verheij's Five Key Questions

1. What is the problem addressed?
   How can multi-agent systems reach an optimization for satisfying all agent-motivations in a common-pool resource environment? The tragedy of the commons refers to individual motivations superseding resource limitations to the detriment of the collective (and environment). How can this be overcome?

2. What is the state of the art concerning the problem?
   Social coordination optimizes resource management and longevity of the system.

3. What is the new idea addressing the problem?
   By focusing on three categories of knowledge and action (individual, collective, and resource), we hope to optimize individual behavioral characteristics with regard to the longevity of the system as a whole.

4. What are the results (expected)?
   We expect social cooperation/empathy combined with moderate resource conservationism to maximize system health.

5. What is the relevance of the work?
   Earth is a Common-Pool Resource system and our behavioral parameters are NOT OPTIMIZED

[1] https://arxiv.org/pdf/1707.06600.pdf (non-peer reviewed, but simple)
[2] https://dl-acm-org.proxy-ub.rug.nl/doi/pdf/10.5555/3091125.3091194 (peer-reviewed)
[3] https://onlinelibrary-wiley-com.proxy-ub.rug.nl/doi/pdfdirect/10.1002/bdm.2111
[4] https://onlinelibrary-wiley-com.proxy-ub.rug.nl/doi/pdfdirect/10.1111/nrm.12249 (Use of coalitions for CPR game)