|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Guiding Questions | Description |
| OVERVIEW | **1. Purpose** | What questions the model tries to answer? | How the formation of norms modifies the behavior of agents in a public good game? In which ways the public good is affected by the composition of norms? What type of norms increases the public good? What type decreases it? What type of norms emerge?  [Need implementation: What type of coalition are formed? How the presence of coalitions modify agents behavior, norm diffusion, and the amount of public good provided? Is it possible to observe the formation of one coalition that has all the agents inside ( a Covenant)]? |
|  | **2. Entities, state, variable and Scales** | *What types of agents can be found in the model?* | Only one type of agent is present. |
|  |  | *What defines the entities in the model?*  *How space is modeled?*  *What are the external variables?* | Agents are defined by:    Wealth, Metabolism, Vision, Vision-points, norms, cooperation-rate (the altruism of the agent), lambda ( the percentage of the wealth owned by the agent that is given to the storage), epsilon ( the probability that an agent gives wealth to the storage), age, threshold-1, threshold-2, expectations, observed-norm-actions, selected-norm.  Every agents own a cognitive scheme, obtained by the Java extension Cogologo (<https://github.com/suroFr/CogLogo>) that models his/her cognitions, connect them to a certain NetLogo procedure, calculate the weight of the desire, and then select the procedure associated with the desire that has the strongest weight.  Patches are defined by:  The sugar on the patch, the maximum amount of sugar on the patch.  The agents operate in a 50 x 50 grid, generated using a .txt file, with different amount on sugar in each cell of the grid.  The model is built upon a SugarScape enviroment. – Epstein & Axtell (1996)  A random process to assign individual variables, the storage, a counter that counts the time passed, the ticks that accounts to a redistribution of the wealth from the storage (,this mechanism can be toggled of in the graphical interface), a list that evaluate the amount of wealth present in the storage, and multiply the storage by a factor of 1.2 when certain conditions are met |
|  | **3. Process Overview and Scheduling** | *What entities do, and in what order?* | The patches:  - Regrow the sugar eaten by the agents  - Recolor themselves  The agents:   * Age * Color themselves by the visualization procedure selected * Eat the sugar on the patch, subtracting from their wealth the value of their metabolism, and adding to their current wealth the amount of sugar on the patch they are standing. * Calculate the two threshold values. * Set their expectations on the turtles in sight. * Observe the cooperation-rate, epsilon and lambda values of other agents in sight, and store the informations obtained by evaluating the proportions of their behaviors. * Act according to their cognitive scheme, evaluating if moving to a neighbor patch with more sugar, staying in the current patch, or giving some wealth to the central storage. * If the first threshold test is successfull, internalize the observed beahviors, transforming them in norms. More frequently a behavior is observed, more weight the norm has in the mind of the agent. * If the second threshold test is successfull. select the norm with the highest weight. More agents have the current agent in their expectations, more likely s/he will select a norm (highly cooperative agents are more prone to select altruist norms) * Try to enforce a norm * Chose the cognitive plan for the next turn, and report the weight of the current congitions into the coglogo extension interface. * If the right conditions are present, reproduce, hatching another agent that has *0.5p* of sharing the same values (cooperation-rate, epsilon, and lambda) of the parent. * If the right conditions are present, die. |
| DESIGN CONCEPTS | **1. Theoretical**  **And Empirical**  **Background** | *What theories are employed in the model?* | The procedures that accounts for the formation and the selection of norms follows Bicchieri (2006), in which norm creation and diffusion mechanisms are built on: 1. The presence of a number of conditional followers 2. The presence of an expectation on the subject to comply to a set of norms.  [Need implementation: A theory that accounts for the impact of group dynamics into the decision process of an individual ( Minimal group theory?). A modelization of the public good contribution and covenant formation into a game-theoretic framework (Samuel Bowles, Brian Skryms) |
|  | **3. Learning** | *What type of learning process is included*? | N/A |
|  | **4. Sensing** | *What type of sensing processes are present?* | Agents have a different set of vision points ( randomly assigned at setup) that allow them to see other agents and other patches.  Agents are able see what type of agents are around them, and behave consequently. |
|  | **5. Prediction** | *What type of prediction mechanism is present?* | N/A  [Need Implementation: a mechanism to evaluate the expected utility for following a norm or donating, in which expected payoffs are computed using the variables that define the agent, and a mechanism in which, once coalitions are implemented, also groups themselves can be decision-makers] |
|  | **6. Interaction** | *What type of interactions are present?* | Agents, at each tick, interact with the patch s/he is standing on, eating the present sugar  Agents do not interact directly with each other but modify their behavior according to the behaviors of others in sight. [Need Imlementation: a persuasion mechanism based on the presence of coalitions 2. A mechanism in which agents can interact stealing from each other (represented by a payoff matrix )], |
|  | **7. Collectives** | *What type of collectives are present?* | N/A [Need implementation] |
|  | **8. Stocasticity** | *What process are modeled randomly?* | All the elements that defines a single agents (like his/her cooperation-rate, metabolism, initial wealth. ecc.) are randomly generated.  Lambda (the percentage of the wealth owned by the agent that is given to the storage) and Epsilon ( the probability that an agent gives to the storage), are partially randomical, given that higher values are more likely to be found in more cooperative agents.  Lambda, Epsilon, and Cooperation rate of child agents are partially randomical, given that they are inherited with a 0.50p by the parent’s values. |
|  | **9.Observation** | What datas are collected? | What type of norm are present.  How the norm composition changes the public good.  How norm composition in the population changes the types of agent in the model  [How a set of coalitions influence the diffusion of norm] |
| DETAILS | **Implementation** | How is the model implemented? | Netlogo  Coglogo Extension |
|  | **Initialization**  **Submodels** | What are the starting conditions of the model?  What submodels are present? | The number of initial agents is set by a slider, and the cognitive model extension is activated. Agents are randomly placed into the world.  The amount of sugar on each patch is generated accordingly to a .txt file.  The Coglogo extension is used for describing the internal states of every action and for selecting action plans. |

