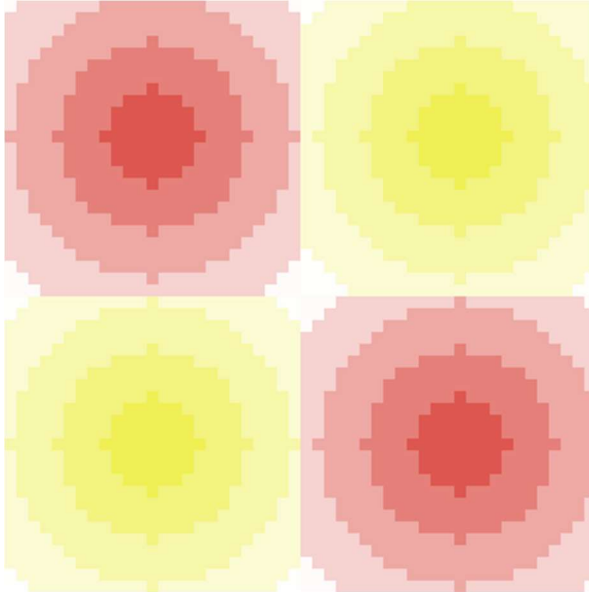**Model description**

This model extends the Sugarscape 3 Wealth Distribution model from the Netlogo library (see Social science / sugarscape) which is based on Epstein and Axtell (1996)'s Sugarscape's model with adding the following elements:

- Include a second resource spice, where the spatial distribution is generated, not imported from a file.

- Agents have a welfare function, where their welfare, W, is defined by the amount of sugar, w_1, and spice, w_2, accumulated by the agent,

$$W(w_1, w_2) = w_1^{m_1/(m_1+m_2)} w_2^{m_2/(m_1+m_2)}$$

and where m_1 is the metabolism rate of sugar, and m_2 is the metabolism rate of spice. Movement decisions are now not dependent on the amount of sugar, but the value of W.

- Reproduction. If an agent derives a wealth beyond a certain threshold of accumulated wealth it generates an offspring if there is an empty patch nearby. The parent will loose half the sugar and spice.

- Agents can trade with neighboring agents. Agents can calculate the marginal rate of substitution (MRS) of agents in the neighborhood, where $MRS = \dfrac{w_2/m_2}{w_1/m_1}$

- If MRS of an agent A is bigger than the MRS of agent B, A buys sugar from B who give spice in return. The reason for this is that B has a relative surplus of spice compared to agent A.

- The trading price that the agents will set on is $p = \sqrt{MRS_A \cdot MRS_B}$. This means that if p > 1, p units of spice are exchange for 1 unit of sugar, and if p < 1, then 1 unit of spice is exchanged for 1/p of sugar. Before the trade is made, both agents will be checked to benefit from the trade in their level of wealth.

This model is part of the textbook *Introduction to Agent-Based Modeling* by Marco Janssen: Which include more discussion of this model version of Sugarscape.

Reference
Epstein, J.M., and R. Axtell (1996) Growing Artificial Societies: Social Sciences from Bottom Up. Brookings Institution Press and The MIT Press.