Suppose an elementary morph is a decision-making agent such that $\Psi_{l0}\colon < x|\varphi_{agent} >$ where φ_{agent} is the agent decision-making pattern and x is the agent preference.

Then the group itself can be represented as an *l1* system with a state φ_S which is the system decision-making pattern:

$$\Psi_S\colon < [x_0, \dots, x_n] \mid \varphi_S \mid [\Psi_{c_1}, \dots \Psi_{c_n}] >$$

So, the group emergence fitness, assuming group has a complexity level of 1 and each member is an elementary component, with Δz_{group} representing state changes for the system and N_{agent} number of components:

$$\omega_{group} = \frac{\upsilon_{agent}}{\Delta z_{group}} + \frac{\eta_{group}}{N_{agent}}$$

One can also add a decay variable to the homeostasis component such that

$$\omega_{group} = \frac{\upsilon_{agent}}{\Delta z_{group}} + \frac{\eta_{group}}{\lambda N_{agent}}$$

For the first example, assuming Ψ_{l0} is a roundup pattern e.g. $\Psi_{agent}(x) = \begin{cases} 0, & x < 0.5 \\ 1, & x \geq 0.5 \end{cases}$, and Ψ_{group} is a pattern that picks the most common vote. Also assume υ_{agent} is a function of cognitive dissonance such that $\upsilon_{agent}{}^{-1} = |\Psi_{agent} - x| + 1$. Then partial solution to the survival value looks like below for this example:

$$\frac{\eta_{group}}{N_{agent}} = \frac{\frac{\sum \Delta\, \Psi_{agent}}{\Delta\, \Psi_{group}}}{4} = \frac{\sum \sum |E(\Psi_{agent}) - \Psi_{agent}|}{4 \sum |E(\Psi_{group}) - \Psi_{group}|} = 2$$

$$\omega_{group} = \frac{\sum \frac{1}{|\Psi_{agent} - x| + 1}}{\Delta z_{group}} + \frac{\frac{\sum \Delta\, \Psi_{agent}}{\Delta\, \Psi_{group}}}{4} = \frac{2.64}{\Delta z_{group}} + \frac{1}{\lambda}$$

If we assume decision patterns $\Psi_{agent}(x) = \begin{cases} 0.1, & 0 \leq x < 0.2 \\ 0.3, & 0.2 \leq x < 0.4 \\ 0.5, & 0.4 \leq x < 0.6 \\ 0.7, & 0.6 \leq x < 0.8 \\ 0.9, & 0.8 \leq x < 1 \end{cases}$ and $\Psi_{group} = \begin{cases} 0, & E(\Psi_{agent}) < 0.5 \\ 1, & E(\Psi_{agent}) \geq 0.5 \end{cases}$

instead, the survival value looks like below:

$$\omega_{group} = \frac{\sum \frac{1}{|\Psi_{agent} - x| + 1}}{\Delta z_{group}} + \frac{\frac{\sum \Delta\, \Psi_{agent}}{\Delta\, \Psi_{group}}}{4} = \frac{3.10}{\Delta z_{group}} + \frac{1.92}{4\lambda}$$

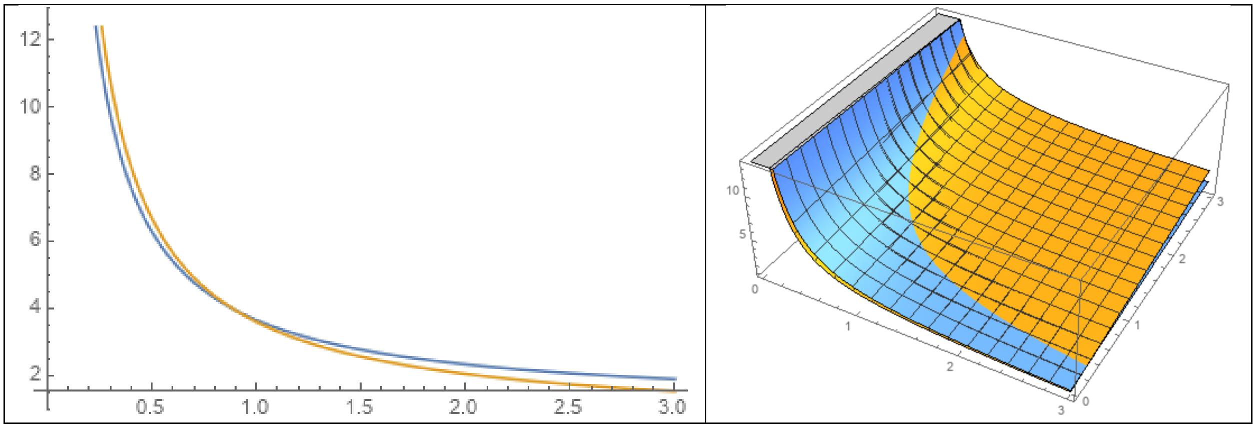

Figure 1: Fitness Trends for 2-option (orange) vs 5-option (blue) agent systems, with decay controlled vs included

Note the system with 5-option agents showing higher fitness values as the external system changes increase, and the opposite for lower external system changes. This suggests a trade-off between reactivity and stability for the system with different morphs, or as I call it, epimorphism and homeostasis.

For an example of a different agent decision pattern, consider this: Abilene Paradox is a story on a simple instance of group decision-making, told first in Harvey's 1974 article where the group decides the opposite of what each group member would decide uninfluenced. It was later criticized in Daniel's 2001 article for not representing how "undiscussability functions as an organizational defense" and indeed, as Hegselmann and Krause discussed for general group models, group consensus is part of the picture for a given group morph to survive across iterations. I also discuss this with my specific case model using the concepts of autonomy and sociotropy, where the former can be said to represent a measure of epimorphism, and the latter, homeostasis.

Lack of epimorphism in Harvey's example is usually given as an example of group dysfunction. Full assertion of member preferences representing full epimorphism, on the other hand, can be also seen as a dysfunction of group mechanisms as modeled by Hegselmann and Krause, which leads to higher rates of group fragmentation and polarization. For the relationship between consensus and sociotropy, which signifies how much the decision of other group members are considered vs self-preference, my model produces similar results as seen below:

Sociotropy vs Autonomy	Consensus	Fragmentation	Polarization
9999:1	7932	1722	346
1:1	3934	4164	1902
1:9999	1239	5040	3721

Table 2: Abilene Model Run Across 10000 Group Instances

Hegselmann and Krause, who use bounded confidence levels of agents in which the agents only consider the opinions of other agents whose opinions are differing from their own by a pre-defined bounded confidence value ε. Increasing values for ε correlate highly with increasing consensus, like my sociotropy values. Both can be thought as homeostasis boosting mechanisms. To represent this phenomenon within this frame, let's redefine the fitness function for an agent where instead of expressing preference, matching group opinion is selected for:

$$v_{agent}{}^{-1} = |E(\Psi_{group}) - \Psi_{agent}| + 1$$

Solving this for the 5-option example from before:

$$\omega_{5-group} = \frac{\sum \frac{1}{|E(\Psi_{group}) - \Psi_{agent}| + 1}}{\Delta z_{group}} + \frac{\frac{\sum \Delta \Psi_{agent}}{\Delta \Psi_{group}}}{4} = \frac{2.423}{\Delta z_{group}} + \frac{1.92}{4\lambda}$$

Compare with an agent decision-making pattern from my model that arguably fits Harvey's example better: $\Psi_{agent} = E(x, E(\Psi_{agent}))$ such that any known preference for another agent is averaged with self-preference: the father declares full preference, the wife declares self-preference with dad's preference and so on. Assuming group decision is still a 2-option and self-decision is a 5-decision on the average of the declared preferences:

$$\omega_{considerate-5-group} = \frac{\sum \frac{1}{|E(\Psi_{group}) - \Psi_{agent}| + 1}}{\Delta z_{group}} + \frac{\frac{\sum \Delta \Psi_{agent}}{\Delta \Psi_{group}}}{4} = \frac{2.477}{\Delta z_{group}} + \frac{1.37}{4\lambda}$$

Lastly for this survival model, let's try a decision-pattern such that the group goes by one person's decision, with a 2-option agent model:

$$\omega_{dictatorial-5-group} = \frac{\sum \frac{1}{|E(\Psi_{group}) - \Psi_{agent}| + 1}}{\Delta z_{group}} + \frac{\frac{\sum \Delta \Psi_{agent}}{\Delta \Psi_{group}}}{4} = \frac{2.614}{\Delta z_{group}} + \frac{1}{\lambda}$$

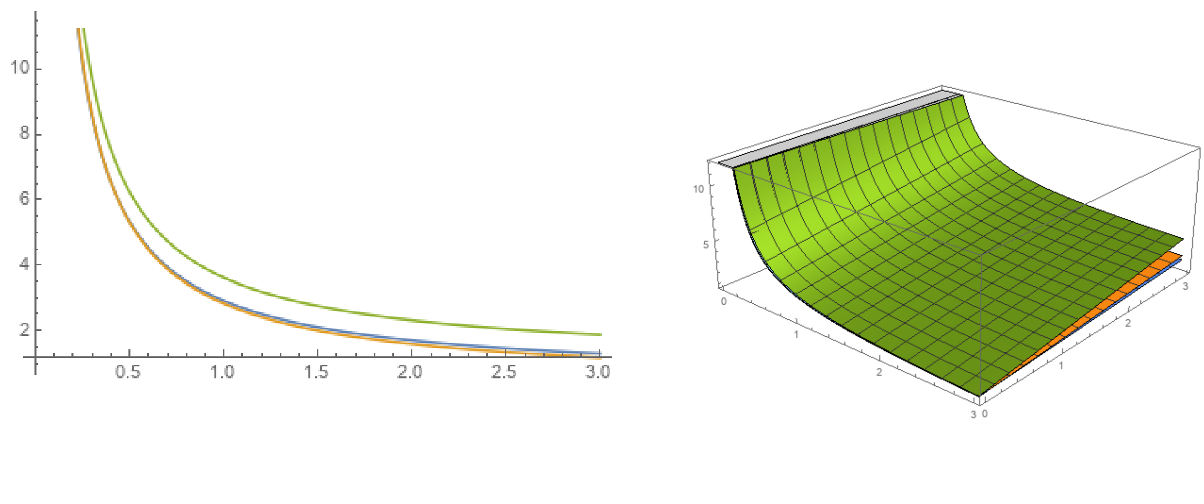

Figure 3: Fitness Trends for selfish (blue) vs considerate (orange) vs dictatorial (green) agent systems Decay controlled (left) vs included (right)

Finally, assume the survival function for an agent considers both the agent's preference decided upon compounded by the degree agent's decision being in sync with the rest of the group:

$$v_{agent}{}^{-1} = \left|E(\Psi_{group}) - \Psi_{agent}\right| + \left|\Psi_{agent} - x\right| + 1$$

Then the calculations for the three decision patterns yield:

$$\omega_{5-group} = \frac{\sum \frac{1}{|\Psi_{agent} - x| \cdot |E(\Psi_{group}) - \Psi_{agent}| + 1}}{\Delta z_{group}} + \frac{\frac{\sum \Delta \Psi_{agent}}{\Delta \Psi_{group}}}{4} = \frac{3.190}{\Delta z_{group}} + \frac{1.92}{4\lambda}$$

$$\omega_{considerate-5-group} = \frac{\sum \frac{1}{|\Psi_{agent} - x| \cdot |E(\Psi_{group}) - \Psi_{agent}| + 1}}{\Delta z_{group}} + \frac{\frac{\sum \Delta \Psi_{agent}}{\Delta \Psi_{group}}}{4} = \frac{3.197}{\Delta z_{group}} + \frac{1.37}{4\lambda}$$

$$\omega_{dictatorial-5-group} = \frac{\sum \frac{1}{|\Psi_{agent} - x| \cdot |E(\Psi_{group}) - \Psi_{agent}| + 1}}{\Delta z_{group}} + \frac{\frac{\sum \Delta \Psi_{agent}}{\Delta \Psi_{group}}}{4} = \frac{2.513}{\Delta z_{group}} + \frac{1}{\lambda}$$

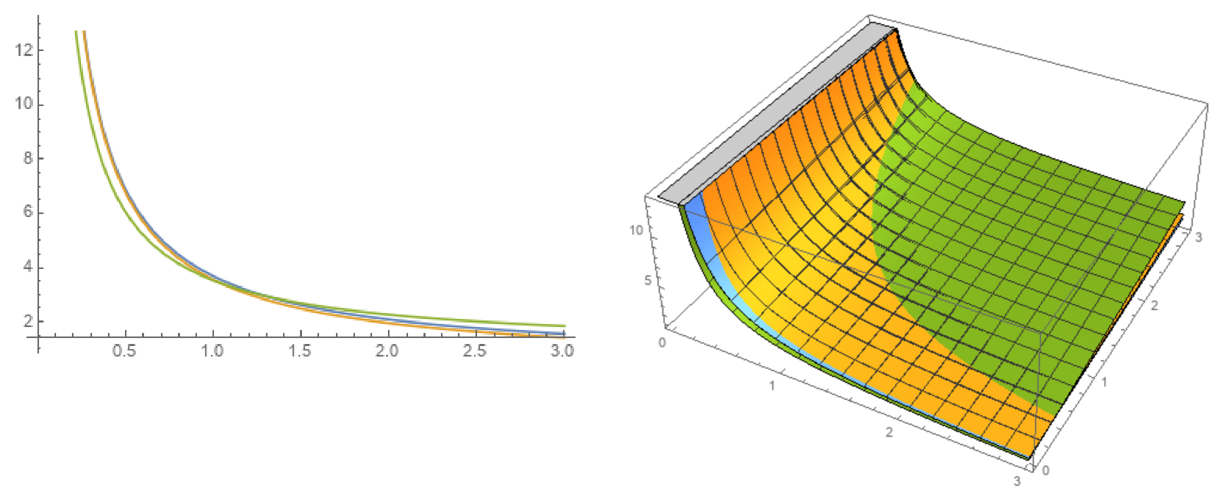

Figure 3: Fitness Trends for selfish (blue) vs considerate (orange) vs dictatorial (green) agent systems
Decay controlled (left) vs included (right)