

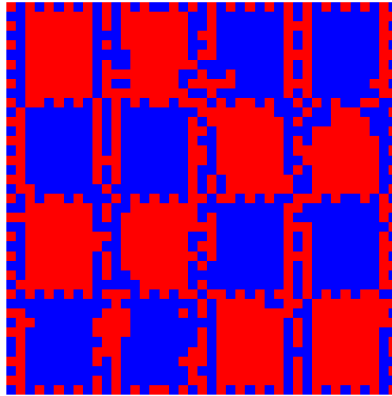
I think that consciousness and Life are the same concept.

I think that an entropy engine near a critical point is conscious, so that I try to obtain an artificial life using the simplest system to be studied numerically: the Ising model for a two-dimensional system near a critical temperature.

I study the Ising model using the Metropolis algorithm, that optimize a spin (in random position) at a time, and I use a mean over 800 Metropolis solutions to obtain the energy on a square lattice 40x40 on a torus.

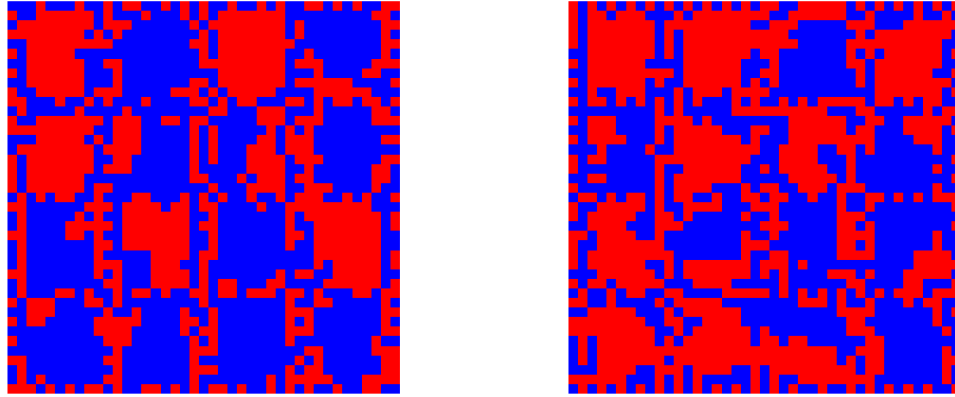
The Ising energy have a single energy minimum (like the Hopfield network) at zero temperature, and this is the problem for the consciousness (there cannot be a single mental state): I obtain multiple zeros of the Ising model using different interactions  $J_{ijkl} \neq J_{i'j'k'l'}$  for different spins in the Ising grid.

I try the simplest change in the interaction: I create square clusters with equal ferromagnetic interactions, separated by antiferromagnetic borders: at zero temperature there are N clusters with random magnetization (all the spins +1 or -1), while for temperatures near the critical point there are a change in the time of the magnetization because of the interaction between clusters.

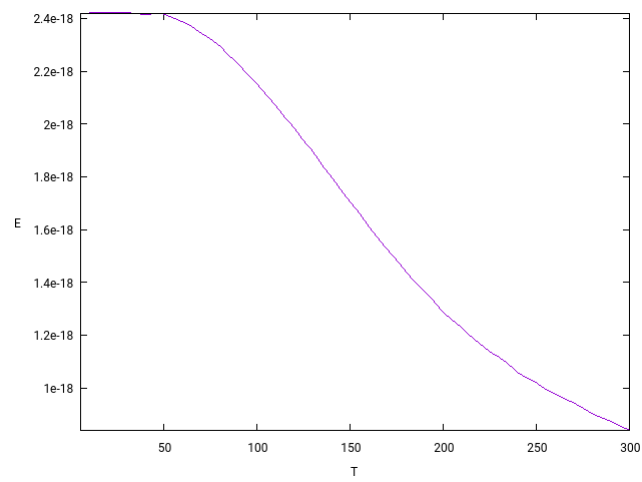


Single Ferromagnetic-antiferromagnetic Ising model for  $T=10^{-6}$  °K

If the clusters have regions that are connected with an external sensor or an actuator, then there might be an evolution with the environment (changing the  $J_{ijkl}$  with the genetic evolution); a more complex interaction between spin give more complex Ising model; I hyphotesize that any complex two dimensional Ising network have transition temperature, and that the Life is an entropy engine near a statistical critical point (like this Ising model with complex interactions).



Ferromagnetic-antiferromagnetic Ising model for  $T=143$  °K, at different times



Mean energy for ferromagnetic-antiferromagnetic Ising model (800 execution)