

The Cybernetic Emergence of Ants

2 Cultures, 2 Stories

AUTOPOIESIS: WHEN THE QUEEN IS MISSING

"An autopoietic machine is a machine organized (defined as a unity) as a network of processes of production (transformation and destruction) of components which: (i) through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them; and (ii) constitute it (the machine) as a concrete unity in space in which they (the components) exist by specifying the topological domain of its realization as such a network."

The Tree of Knowledge: The Biological Roots of Human Understanding
– Humberto Maturana and Francisco Varela –

Diacamma rugosum is a species that belongs to the ponerinae subfamily. Ponerines are solitary hunters who form small colonies and apply a basic division of labor in the organization of the colony. In contrast to the advanced caste system of the leafcutter ants, Ponerines are innate hunters, who like to predate on insects, they capture and sting them so that their sisters back in the nest can eat them alive. Ponerines are professional killers that altruistically share their booty with the rest of the colony.

The most interesting behavior in Ponerines is by far its unusual and unique reproduction strategy. Normally a queen is considered to be a different caste within the colony structure of ants, that's how reproduction focuses only on one individual and the rest is division of labor based on specialized castes that take care of getting the resources for the colony. The queens of *Diacamma rugosum* are not a specialized caste with morphological characteristics that distinguish them from the rest of the workers. *Diacamma rugosum* queens are gamergates, which means reproductive workers with the same morphological features like any other worker in the colony. To make the story short, any new born worker in a colony of *Diacamma rugosum* could be a queen. Future queens are chosen by the actual queen of the colony, therefore the inevitable key figure for the development of the colony is she. When new females are born, the queen extracts, like in a sterilization procedure, the reproductive organs of several females leaving only a few, or even just one, to be able to develop sexually as new queens with the desire for reproduction. The ones who lose the organs become workers.

The whole process is controversial. Every new born ant can potentially become a queen with the capacity to reproduce, so the queen plays an important role by electing who would be her heiress in order to minimize the conflict and the dispute for the throne. The queen extracts the organs, responsible for reproduction behavior of the potential virgins, in order to influence the division of labor in the colony. Thus, the queen becomes really, and literally as her name states, a hierarchical director for the development of the future system.

It seems that nepotism has found its way into the dynamics of yet another society. Here we have an out of the ordinary ant colony which does have, if we play along with our human imagination, a monarchy. The central administrative figure is the queen and she decides which of her daughters is a peasant and who deserves to be crowned as a future queen. Hereto, ants function pretty much like a human state. If there is a central figure that has the power to decide its legacy, then self-organization is questioned because the participation in the creation of a state shrinks from a total form of altruism (open source contribution) to a controlled form of altruism (honorary distribution).

But what happens when the workers revolt against her nepotistic mother? A coupe d'état. What happens when the queen is missing? Transformation and destruction. The unity has to auto-regulate in order to survive as a network in the recently established new order. Chaos precedes order. The symbiotic connection and interdependence with its external environment was suddenly destroyed, its nepotistic leader removed and the external influences cut off. The *Diacamma rugosum* colony became self-contained.

AMEISENGRIPPE : THE APOCALYPSE OF THE LEAFCUTTER ANTS

"Rose, thou art sick!
The invisible worm,
That flies in the night,
In the howling storm,

Has found out thy bed
Of crimson joy;
And his dark secret love
Does thy life destroy."

The Sick Rose
- William Blake -

The highly evolved leafcutter ants of the New World Tropics have been cutting vegetation to culture a special fungus for as long as 50 million years. They depend on each other, the ants cut vegetation, process it and plant the fungus garden, and the fungus provides them with food and shelter. They were the first society that actually started agriculture on this planet. A symbiotic system that relies on mutualism: a love story.

But mutualism implies everything has to be shared, even sickness. My leafcutter ants got a virus, which turned into a disease and evolved into a pandemic killing the whole colony. The pandemic unfolded upon my ants, as I, being the generator of their environment, creator of their ecology, provider of their resources and keeper of their limits, disappeared from their life for a period of 5 days.

On my return I was summoned as a powerless witness to contemplate their suffering and pain. Too late my arrival was, to revert the terminal illness that was destroying them. The evolution of sickness can be better understood as a network of actions, positive and negative, undertaken by both invader and invaded, to occupy the same biological space, an embodied coevolution to pursue eternity; a never ending battle constantly emerging from different ecological circumstances and from the rich interactions of the populations that inhabit them.

A pathogen virulence may have been the cause: an infectious agent was born, stimulated by the humidity, within the confines of the artificial ecology I created for them. There was a contamination of the soil in the feeding chamber that was not handled on time. There was a mutation and the infectious agent started to easily propagate through the discarded organic material laid in the soil of the foraging arena. The illness attacked every single worker who came in contact with the virus, thus quickly propagating the infection to every other member of the colony. Ants strength relies on the sharing of information, so the presence of any unwanted guest infiltrated in the territory of the colony needs to be dealt with, needs to be communicated, from the guards to the transporters to the fungus care takers. Regrettably, in this apocalyptic case, the information being transmitted were pathogenic microorganisms, which using the ants as living carriers, expanded throughout the whole colony.

Transmission and replication are the key mechanisms of a pathogen. Since a colony of ants is in fact a population which depends on local interaction and the influence of its nestmates, the ants are in permanent contact, feeding back the local events flowing in the network. Thus, the colony becomes a perfect target for the evolution of an illness. Just like the so called 'swine-flu' pandemic, a deadly virus finds its way to debilitate the fitness of its host progressively by spreading through the network of social agents, in order to transmit and replicate itself. Taking into consideration that the ultimate goal of an ant colony is the reproduction of a new ant colony, itself becomes the perfect habitat for the incubation of microorganisms, bacteria and parasites, present altogether at the same time or emerging individually.

I will not feel her cutting blades anymore... I will not suffer for them anymore.