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Slime-Mould Netlogo simulation to solve a maze in one pass

Presented By
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Report Outline

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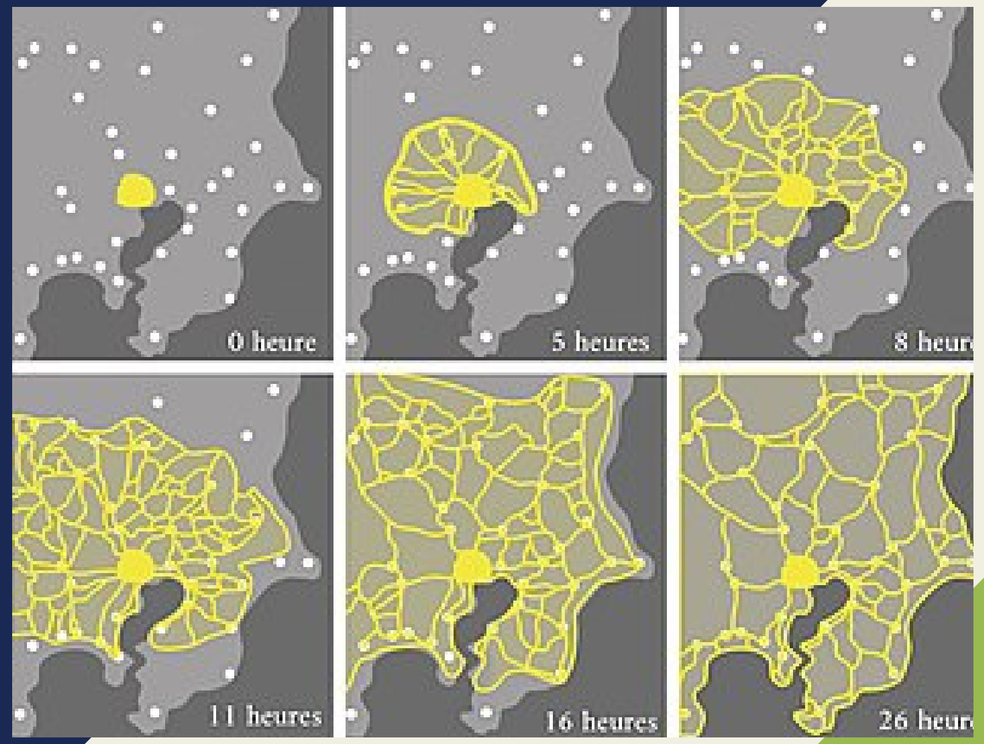
Physarum polycephalum

What is physarum polycephalum, an animal? No. A plant? Neither. It will be a mushroom, then. Wrong again. They call it Blob, but its real name is Physarum polycephalum: it is a polycephalic slime that is part of the kingdom of protists, which has become famous because it continues to amaze scientists. Blob, in addition to having more than 700 genders, has many heads but no brains. And despite this "think". He is attracted by food resources . He can even solve mazes, learn new things and exchange information. Researchers have discovered that this organism decides the direction in which to grow based solely on the physical characteristics of the surrounding environment.



Applications

Physarum polycephalum has very powerful applications and shows how humanity still solves problems in a more complicated way than nature. For example, it was used to recreate the Tokyo subway network. It was a job that occupied months and a lot of engineers to solve efficiently. Physarum polycephalum does that in a few hours.
Other uses of this slime mould is for finding the exit in a maze like in the experiment of Andrew Adamatzky [2] that shows how it solves maze in one pass, assisted by chemical attractants, and this is the simulation I have done.

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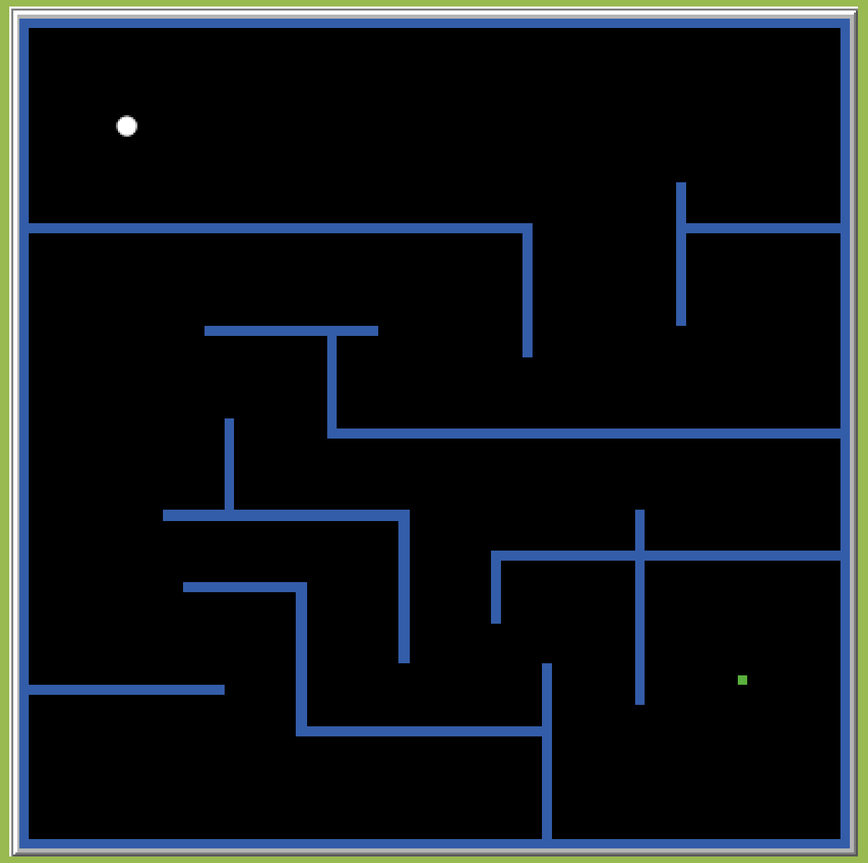
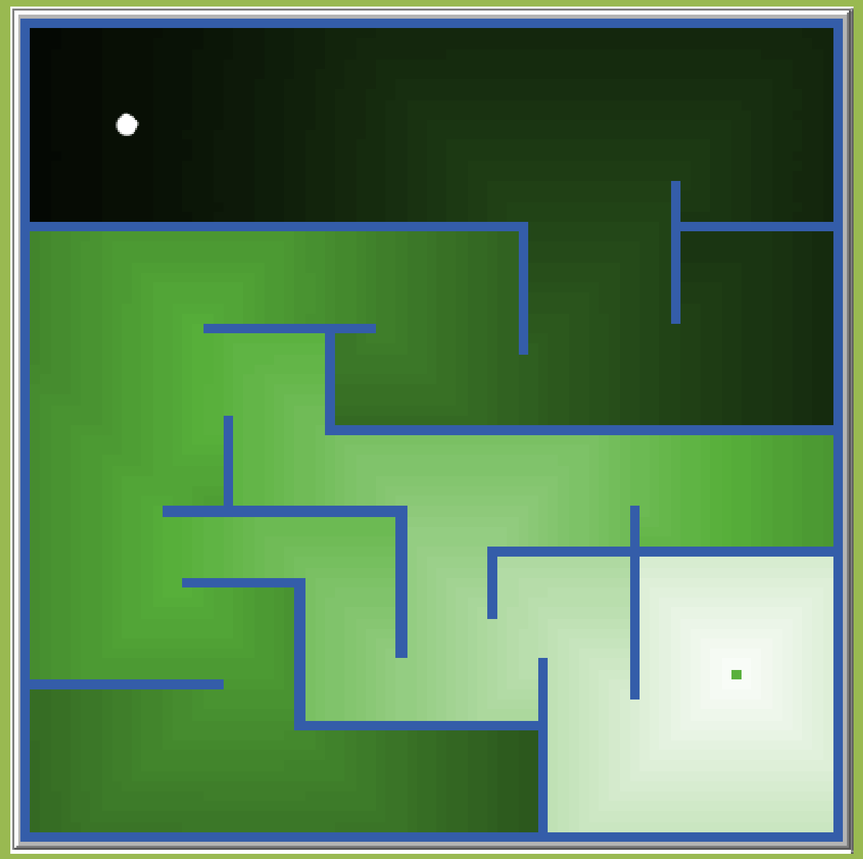
My work



The maze

A simple maze is done by hand in order to test the functionality of the simulated Physarum polycephalum.

In order to properly test the correct behavior of the slime, different maze versions are made. One with one only possible pathfor reach the food, another one with multiple paths that leads to the source of food.



Chemical attractant

A function, executed by a button, start spread the chemical attractants, basically food odor, around the map, losing intensity while the source of food gets far.

It is developed in an iterative way, based on a time-to-live variable that indicates how far a patch is from the source, and spread the food odor in that patch proportionally to the TTLvalue.

Business
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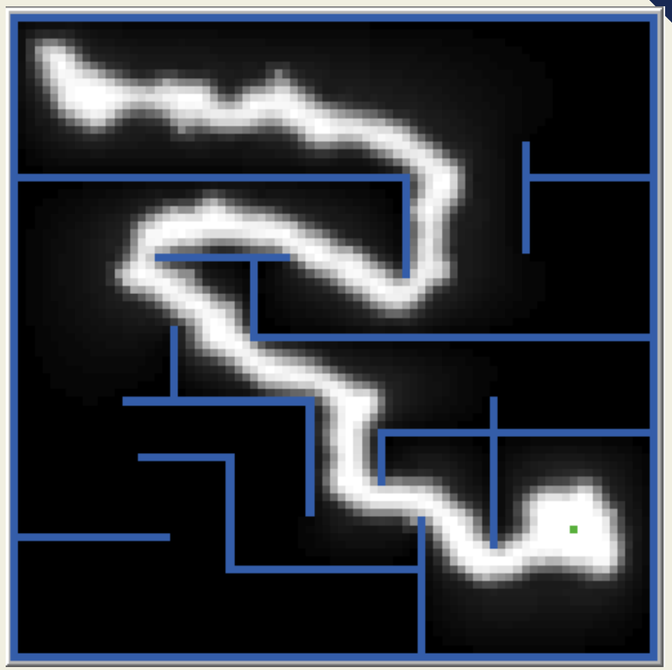
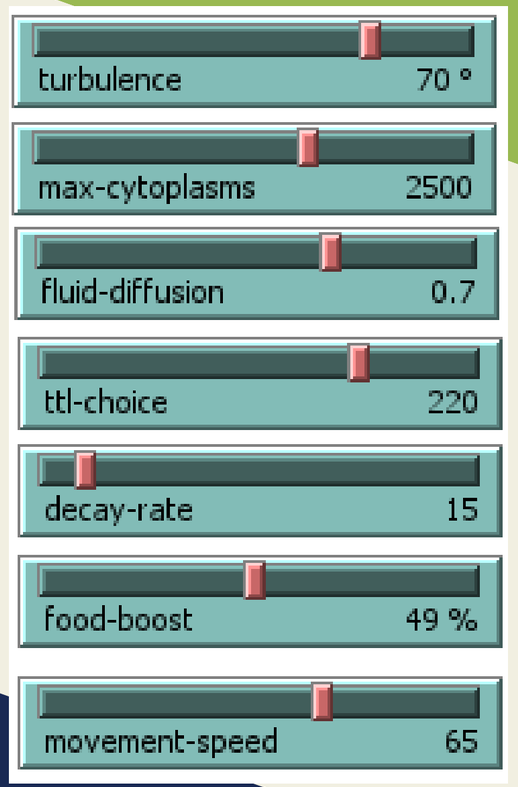
Physarum polycephalum simulation



There is a nucleus that spawns cytoplasms, they are in charge of exploring the environment in order to find the shortest path to the source of food.
The cytoplasms are the agents that interact with the environment basing their behavior on the amount of fluid on the patches, their carrying signal, and the intensity of the attractant.

The parameters



movement-speed : adjust the velocity of the agents relating it also with the fluid on the patch

turbulence : degrees of random wooble (random rt and lt)

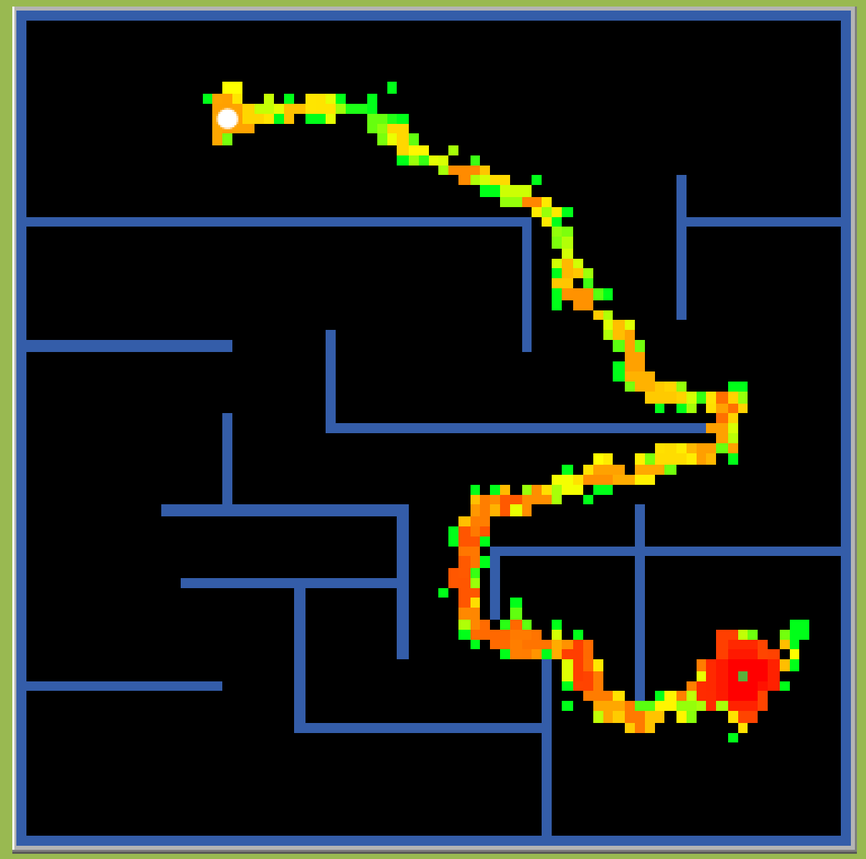
food-boost : percentage of the increased carryied signal from an agent that is over the food patch

ttl-choice : impose a limit in propagating the odor

decay-rate : treshold over which the fluid stop to decay

max-cytoplasms : max number of cytoplasms spawned by the nucleus

fluid-diffusion : parameters of the "diffuse" command, related to fluid



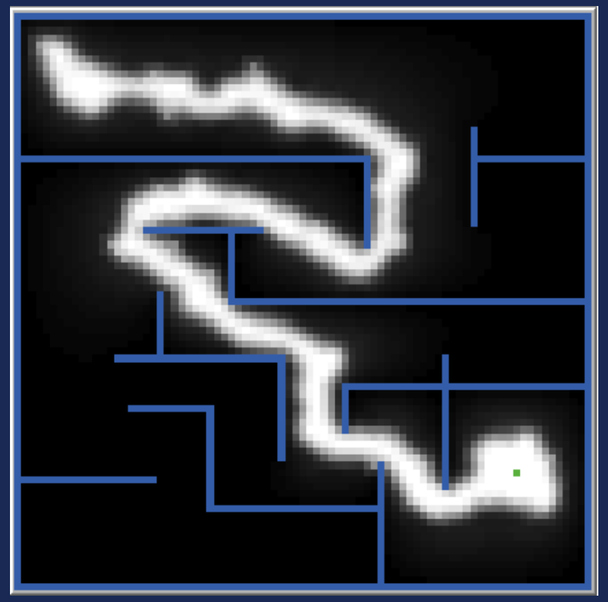
Visualizing velocity

We can also visualize the velocity of the Physarum polycephalum.
It is a factor that depends on the environment's stimuli to the cytoplasm (the agents).
From the figure, we can see that once the slime mould reaches the food, it has a greater velocity with respect to the origin.
In this way, cytoplasms that are near to the source of food are faster and propagate the signal through the overall slime mould in a more effective way

How it works

Results

Single path



Multiple path

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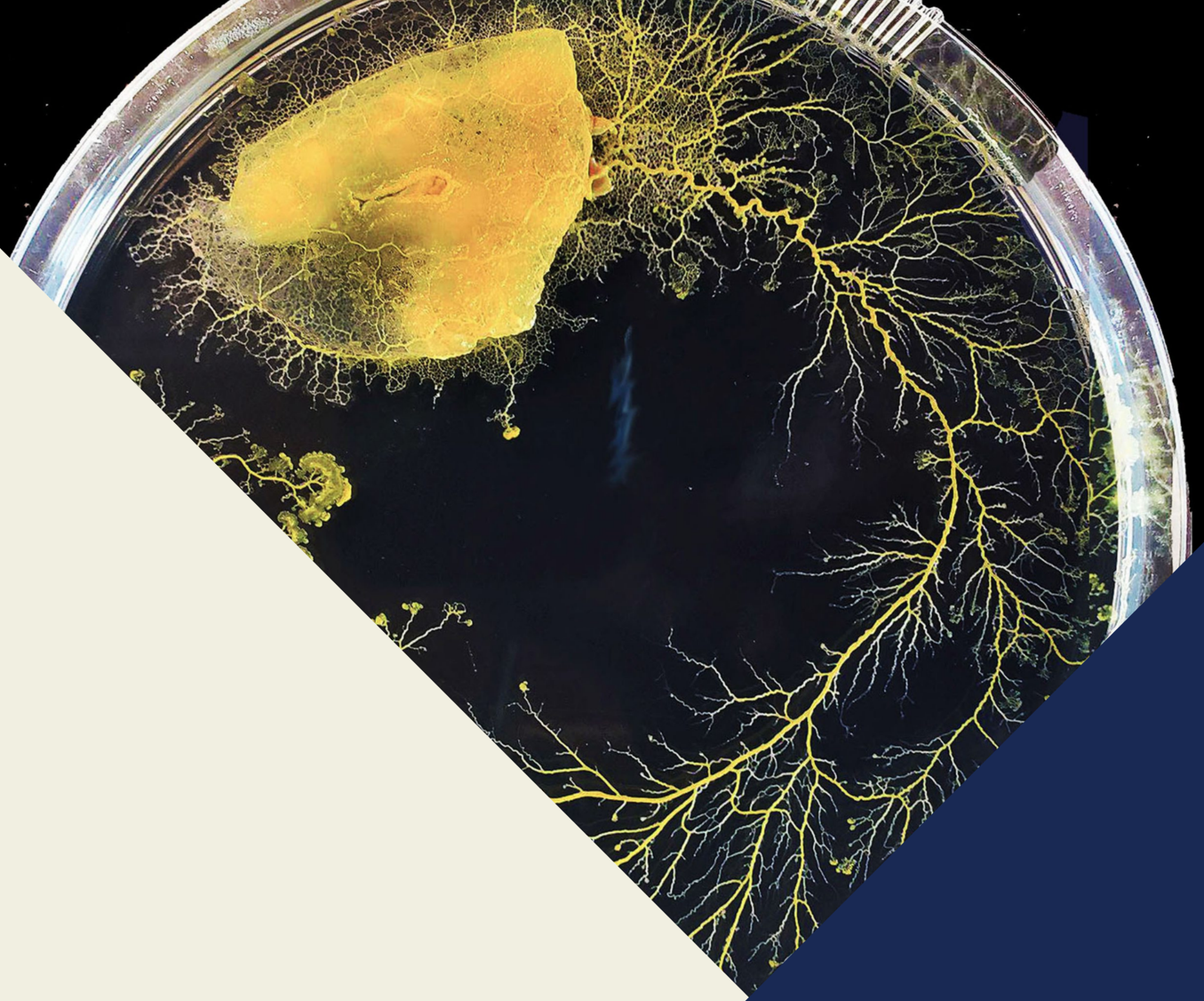

Thanks for the attention

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