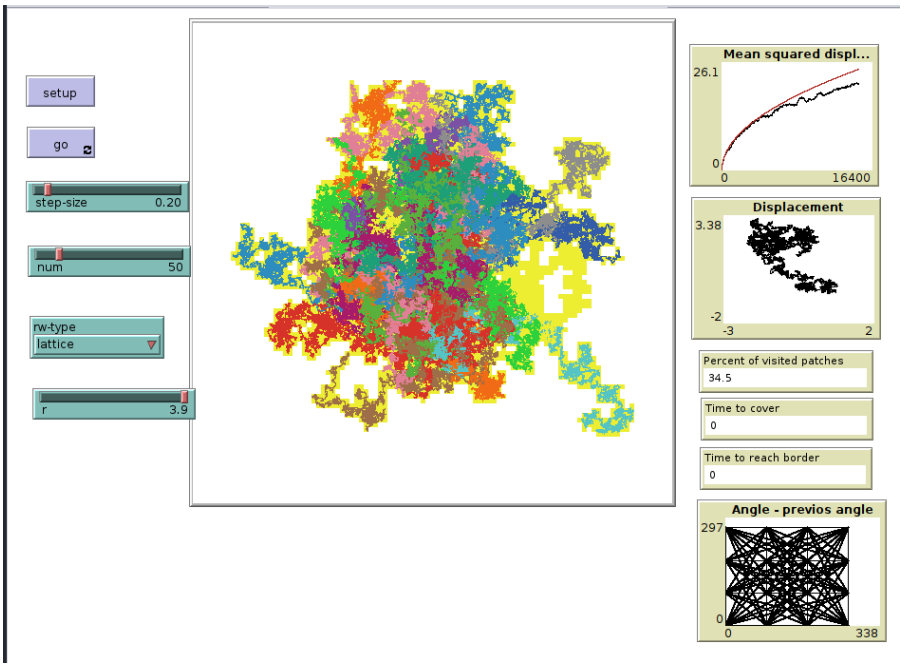
Here are some configurations for the lattice walk that I have run. The parameters changed are step-size, number of agents (and world size). Unfortunately, I can`t run jupyter notebook cause of errors that I can`t fix, so for this lab, I have to send screenshots and comment on some results.

Lattice:

step-size: 0.2
num: 50
world: 50

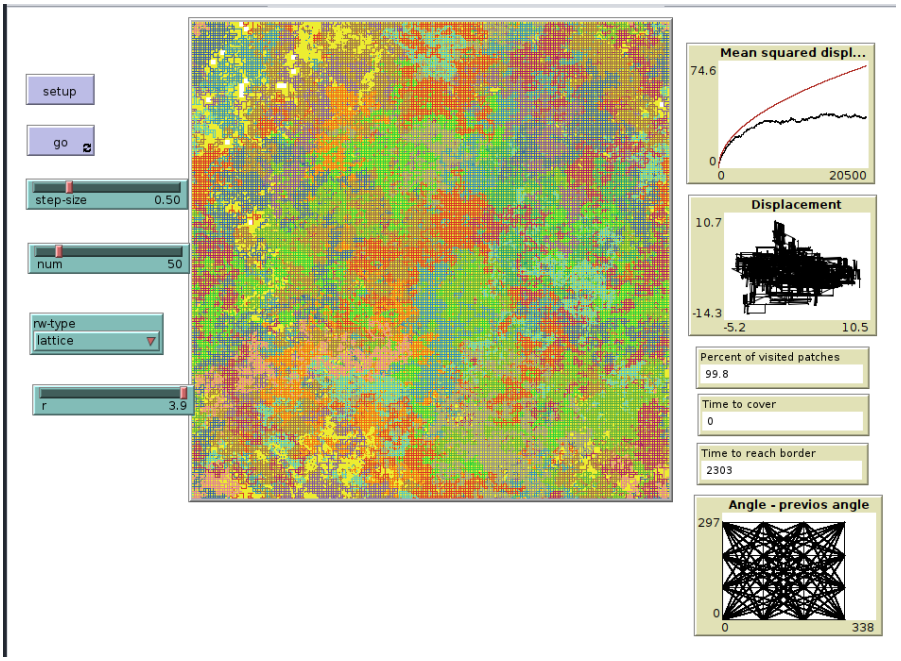
steps: 6300



Lattice:

step-size: 0.5
num: 50
world: 50

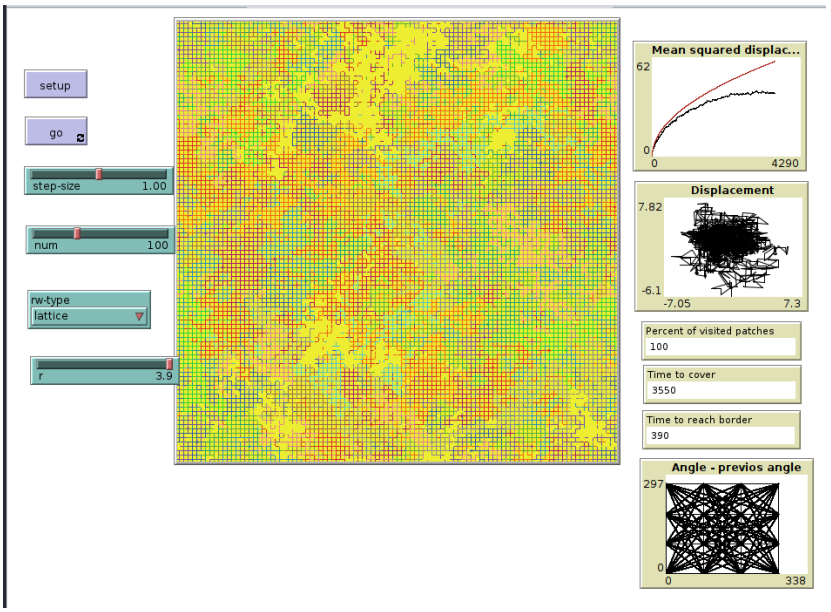
steps: 19200



Lattice:

step-size: 1
num: 100
world: 50

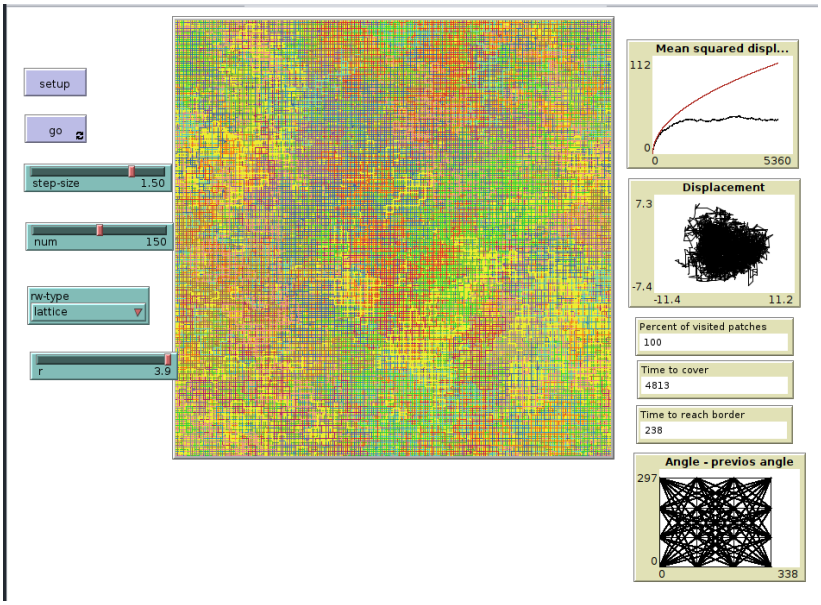
steps: 16700



Lattice:

step-size: 1.5
num: 150
world: 50

steps: 14500



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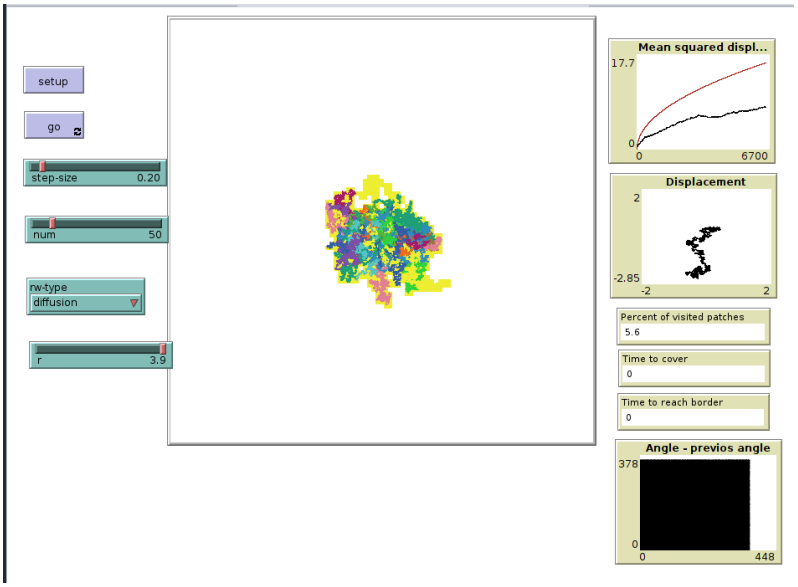
Conclusion:

As expected the number of agents is defining how fast we can reach the border and all cells. The same situation with step-size - the more it is, the faster all cells would be filled. In the first simulation, I stopped the run because with this step-size it would last too long. The graph of angle-prev angle relation has the same pattern as turtles changing directions from one of four states to another, so there are the same lines. Displacement is very similar to chaotic movement but has a pattern because turtles can move only in four directions so the movement vector also depends on it. After some time mean distance to zero of all turtles deviates from step-size* sqrt ticks and the more agents there are the greater the deviation. Everything is as expected, so let's go to the next random walk type.

Diffusion:

step-size: 0.2
num: 50
world: 50

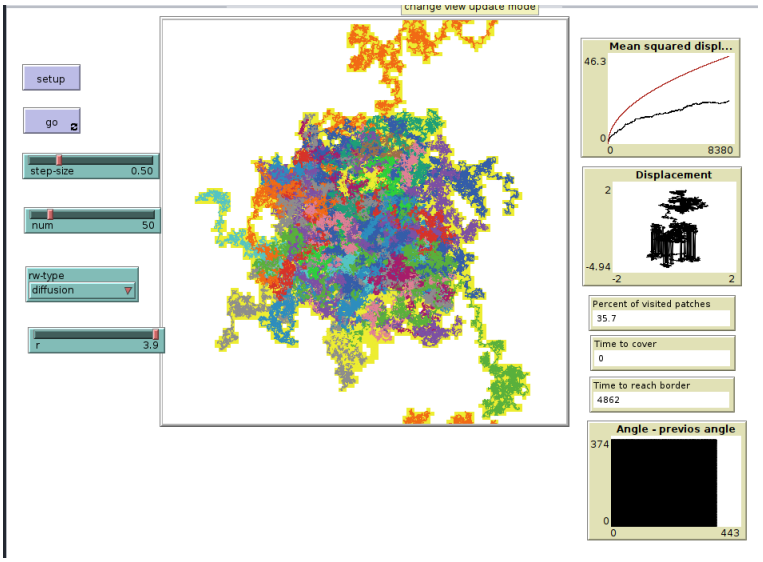
steps: 6500



Diffusion:

step-size: 0.5
num: 50
world: 50

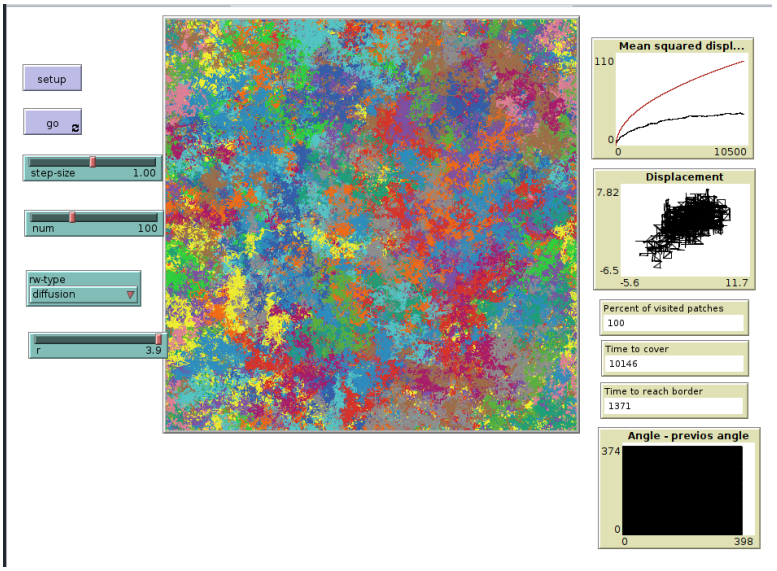
steps: 7500



Diffusion:

step-size: 1
num: 100
world: 50

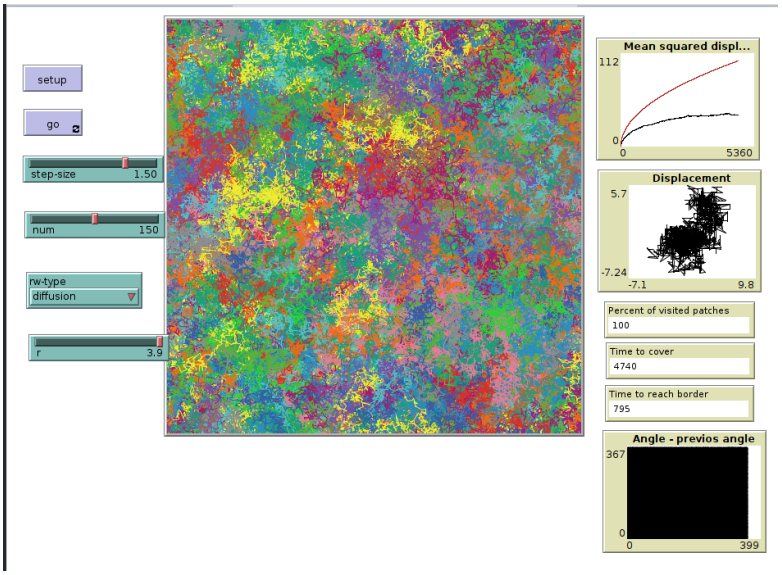
steps: 10100



Diffusion:

step-size: 1.5
num: 150
world: 50

steps: 4740



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Conclusion:

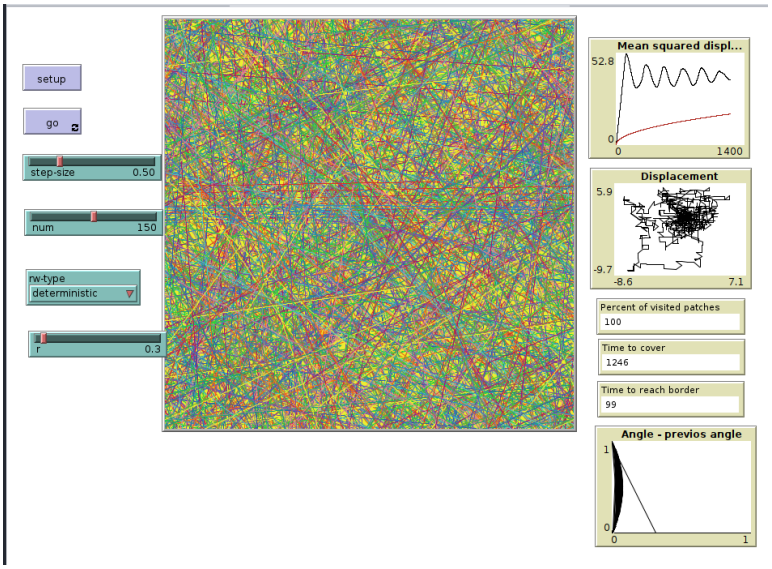
The main difference from the previous type is that the angle and the step-size is the random value. This gives a chance to finish the run faster. The difference in angles is as expected - from every angle, you can move to every angle so the graph is the black box of all possible angle variations. The displacement vector jumps from point to point in a random direction because of the random head angle. Unlike the previous type, MSD is very different from perfect value. The time to reach the border is much smaller than in lattice rw.

In the next type, results depend on the “r” value.
world: 50
Deterministic:

r: 0.3
step-size: 0.5

steps: 1246

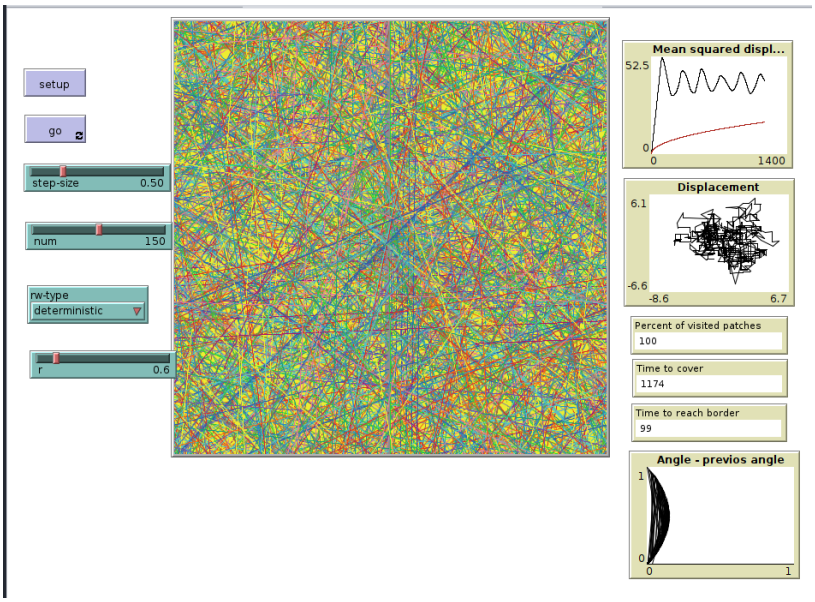
You can cover all world, the lines are straight or near to this.



Deterministic:

r: 0.9
step-size: 0.5

steps: 1174

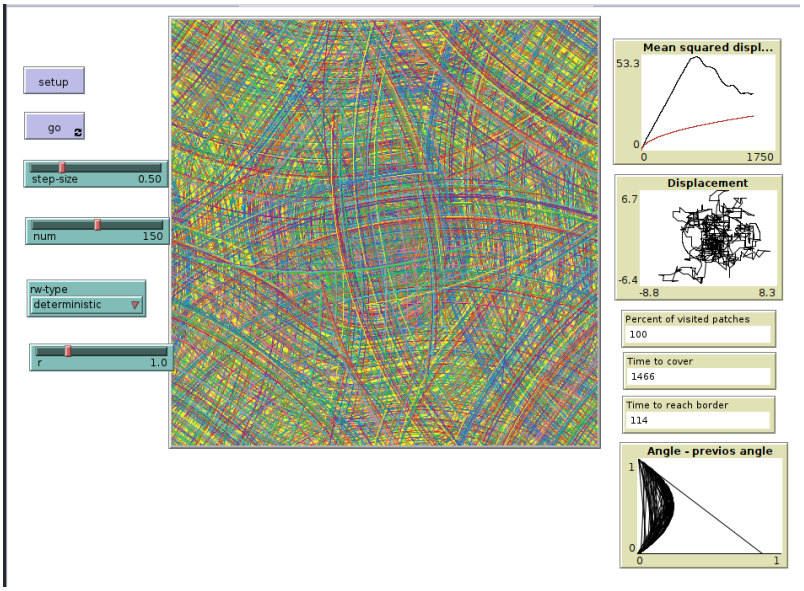


Deterministic:

r: 1
step-size: 0.5

steps: 1466

“The lines” have a curvature but also can fill the whole world.



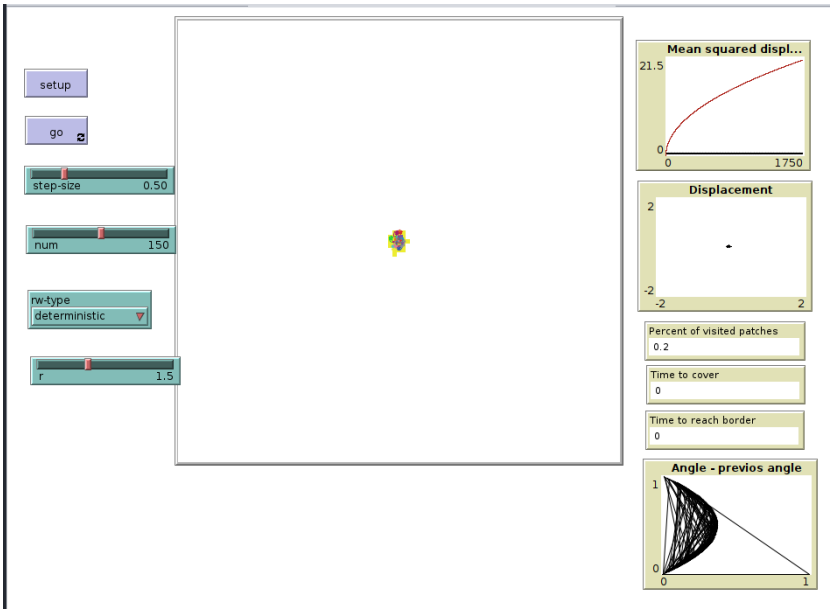
Deterministic:

r: 1.5

step-size: 0.5

steps: -

Turtles move in a small radius and can`t leave their trajectories.



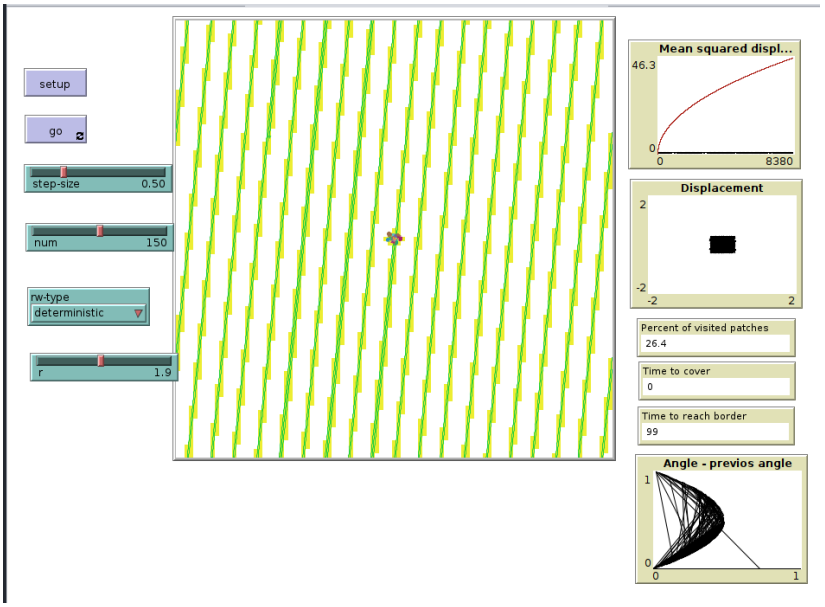
Deterministic:

r: 1.9

step-size: 0.5

steps: x < inf

The same as in the upper variant but new lines appeared that theoretically could fill the world.



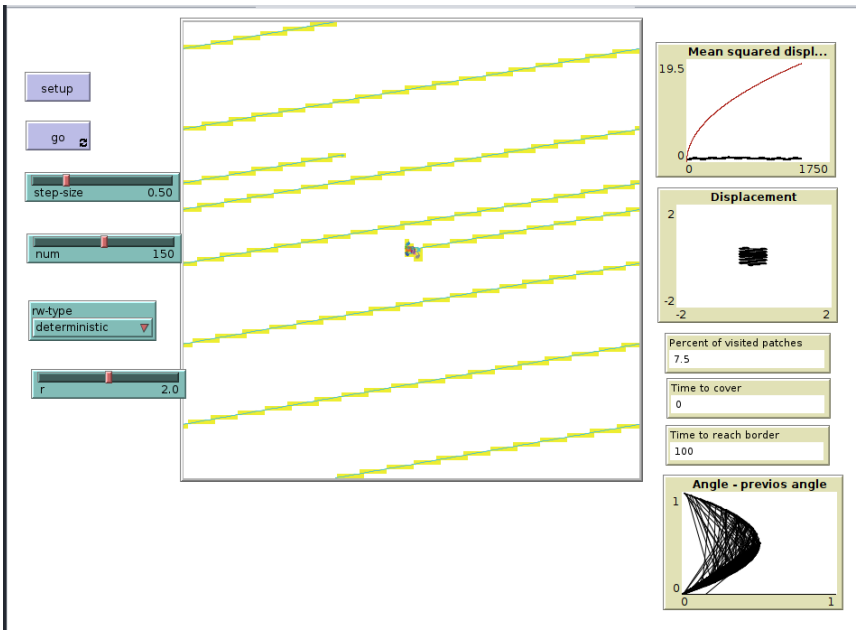
Deterministic:

r: 2

step-size: 0.5

steps: x < inf

Similar situation to the previous but the lines are horizontal.



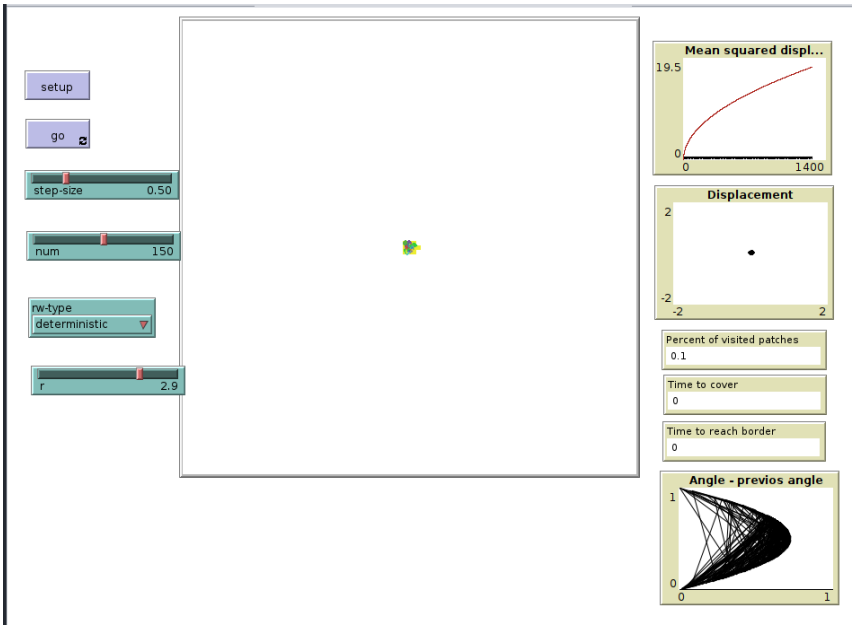
Deterministic:

r: 2.9

step-size: 0.5

steps: -

Small radius and never leave a trajectory.



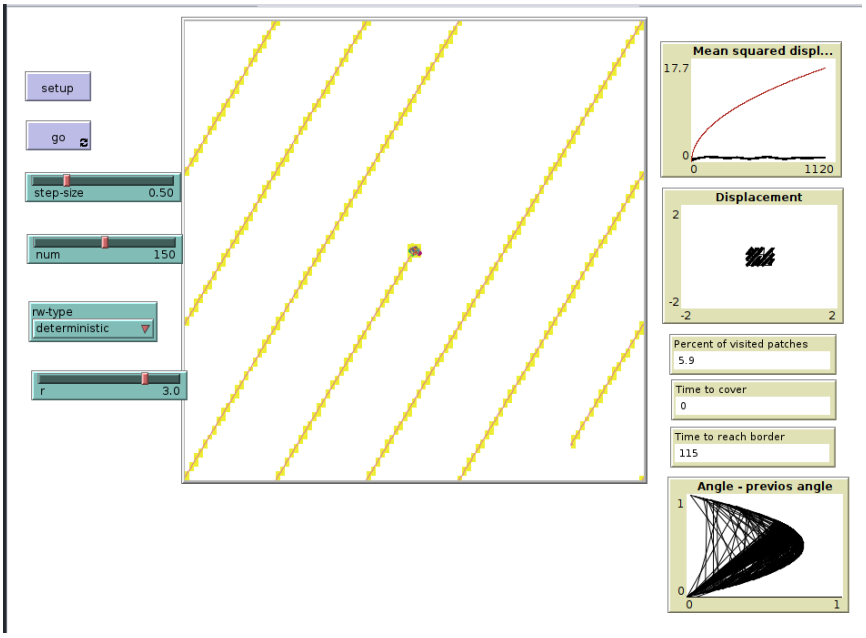
Deterministic:

r: 3

step-size: 0.5

steps: x < inf

The same but with lines and a possibility to finish the run.



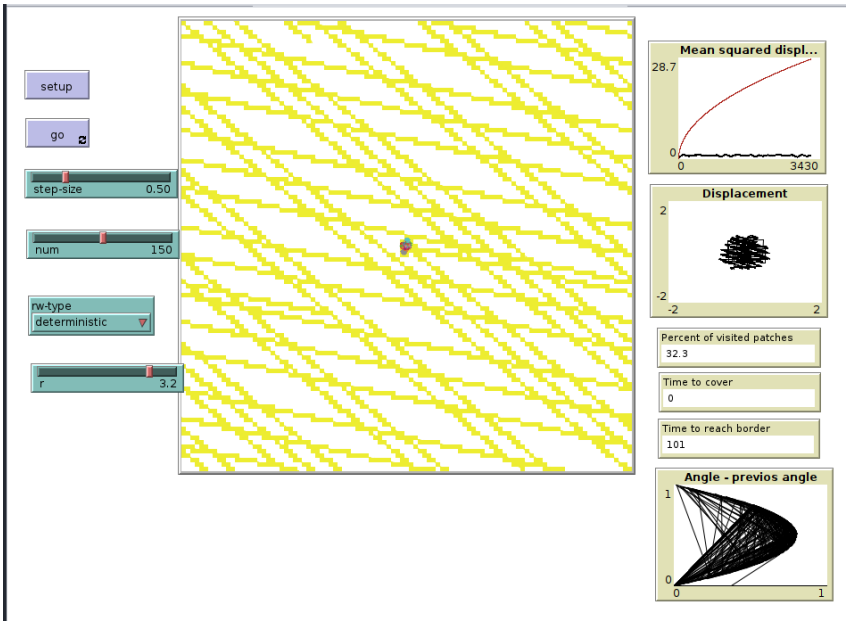
Deterministic:

r: 3.2

step-size: 0.5

steps: x < inf

Lines are parallel but not only horizontal but vertical also.



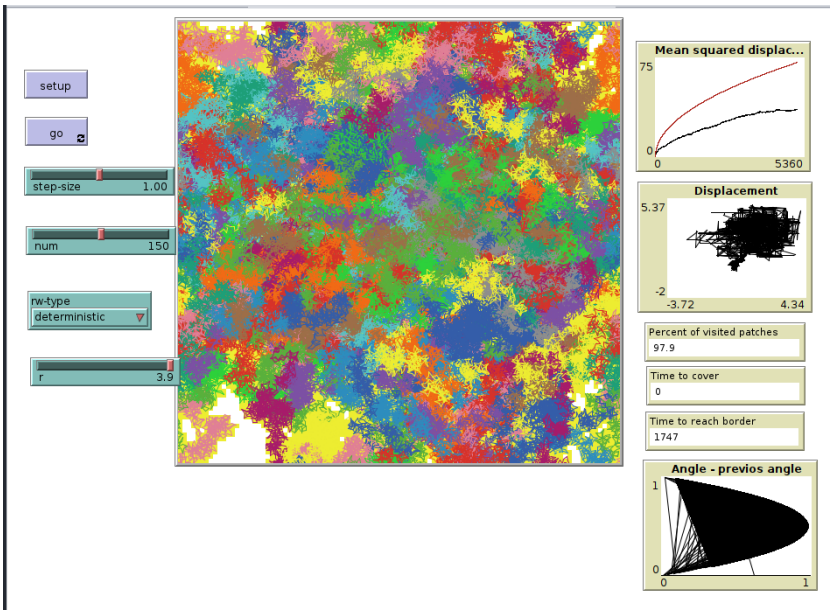
Deterministic:

r: 3.9

step-size: 1

steps: 5500

Whirligigs are spinning, they can fill the whole world very fast.



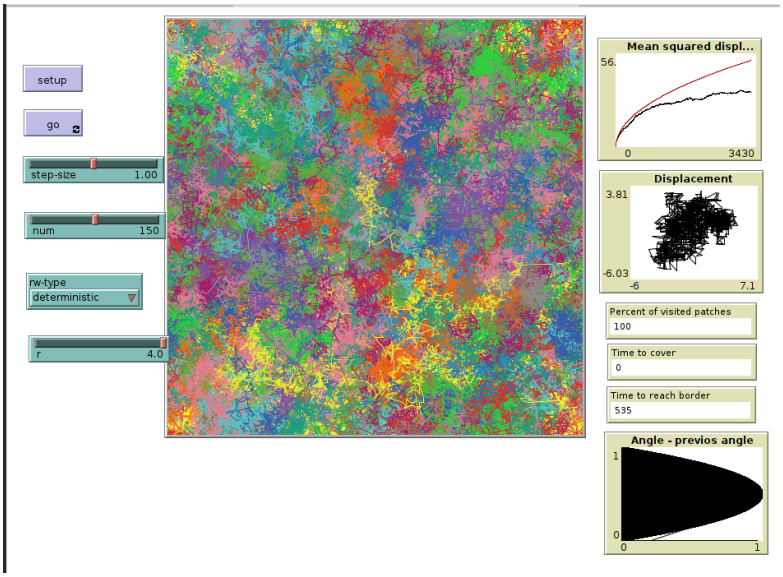
Deterministic:

r: 4

step-size: 1

steps: 4200

The same, but faster.



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Conclusion:

With special values of “r” this method is the best to walk through the whole world because heading moves are deterministic and they have less chance to make the same movement over and over. As we see angle dependence is distribution because of the head turn formula and with greater r the graph is more stable. Also want to note that true MSD is more like sqrt of the real mean. So my preferences for a mid-world would be: deterministic, then lattice, and the last - diffusion because of walk time.