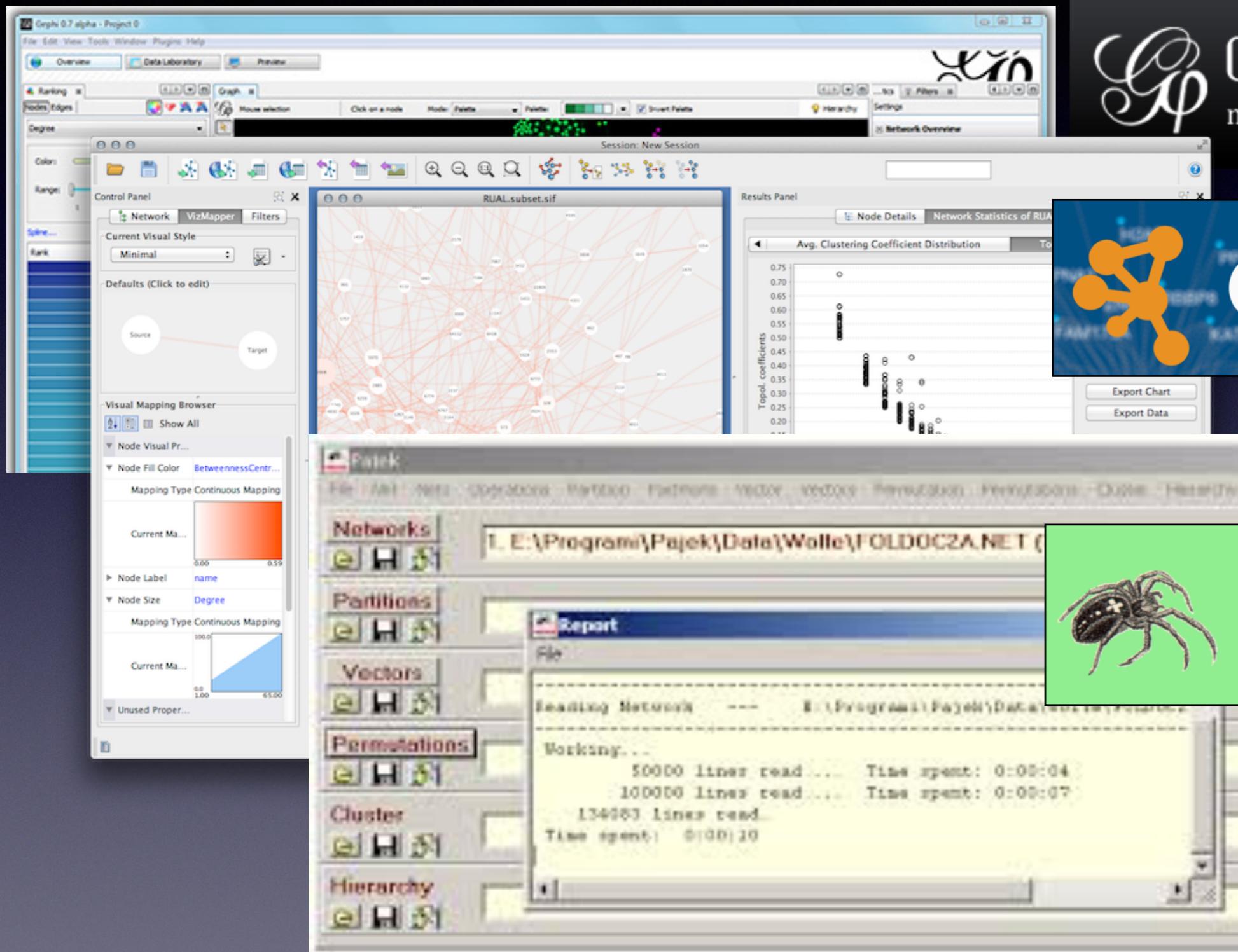


# SIR on Networks

Sergi Valverde  
COMPLEX DISEASES

# Network Visualisation & Analysis



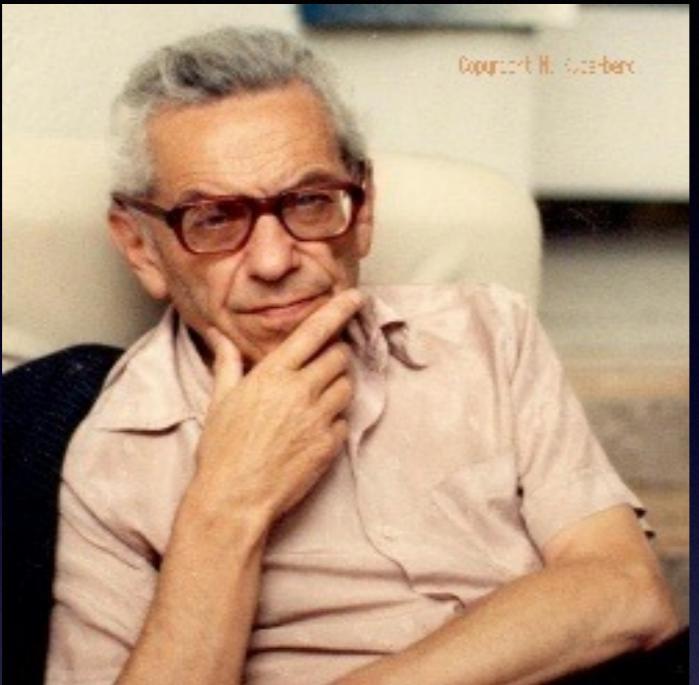
 Gephi  
makes graphs handy



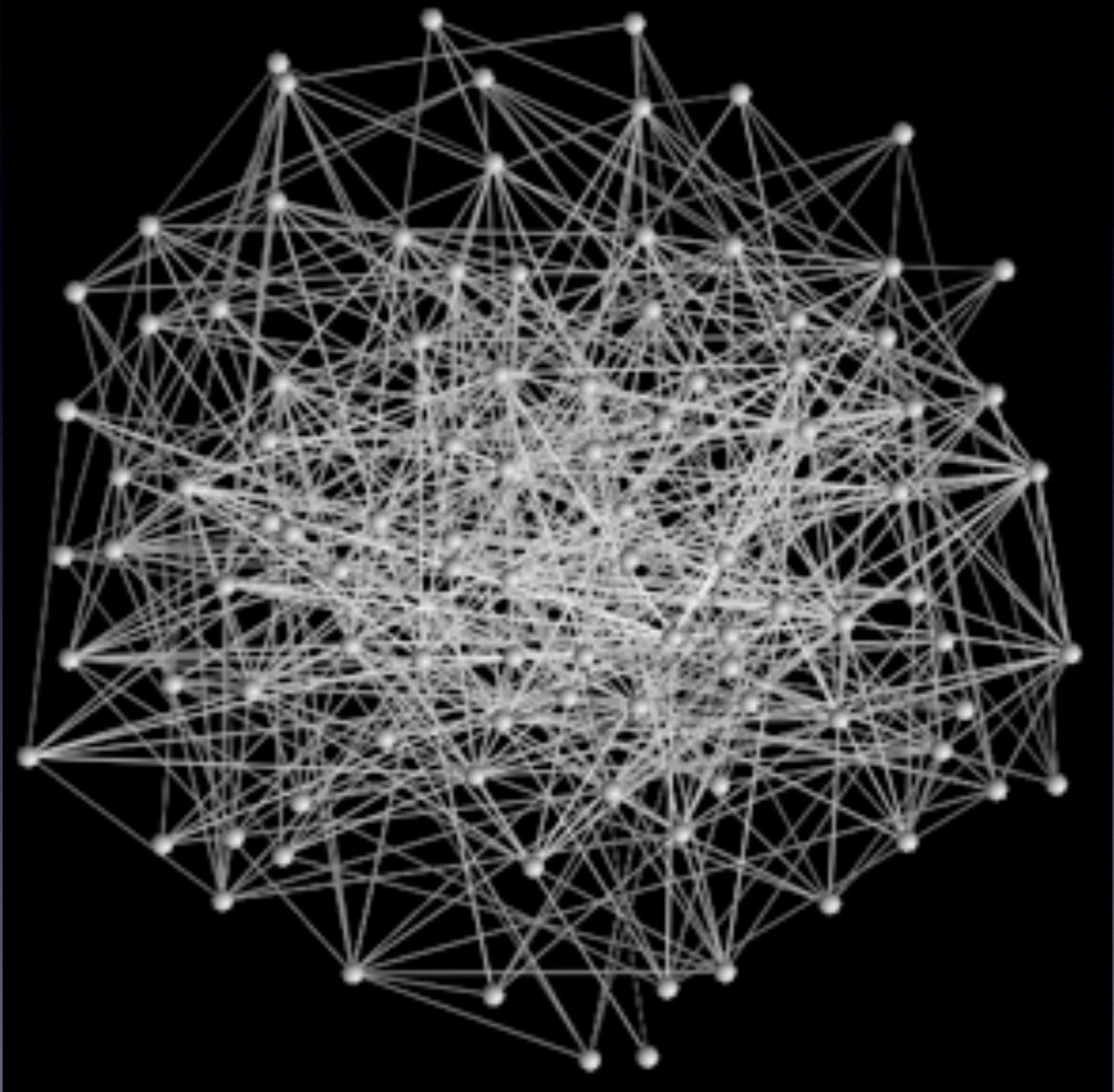
 Networks / Pajek  
Program for  
Large Network Analysis

<https://sites.google.com/site/introcomplexnetworks/>

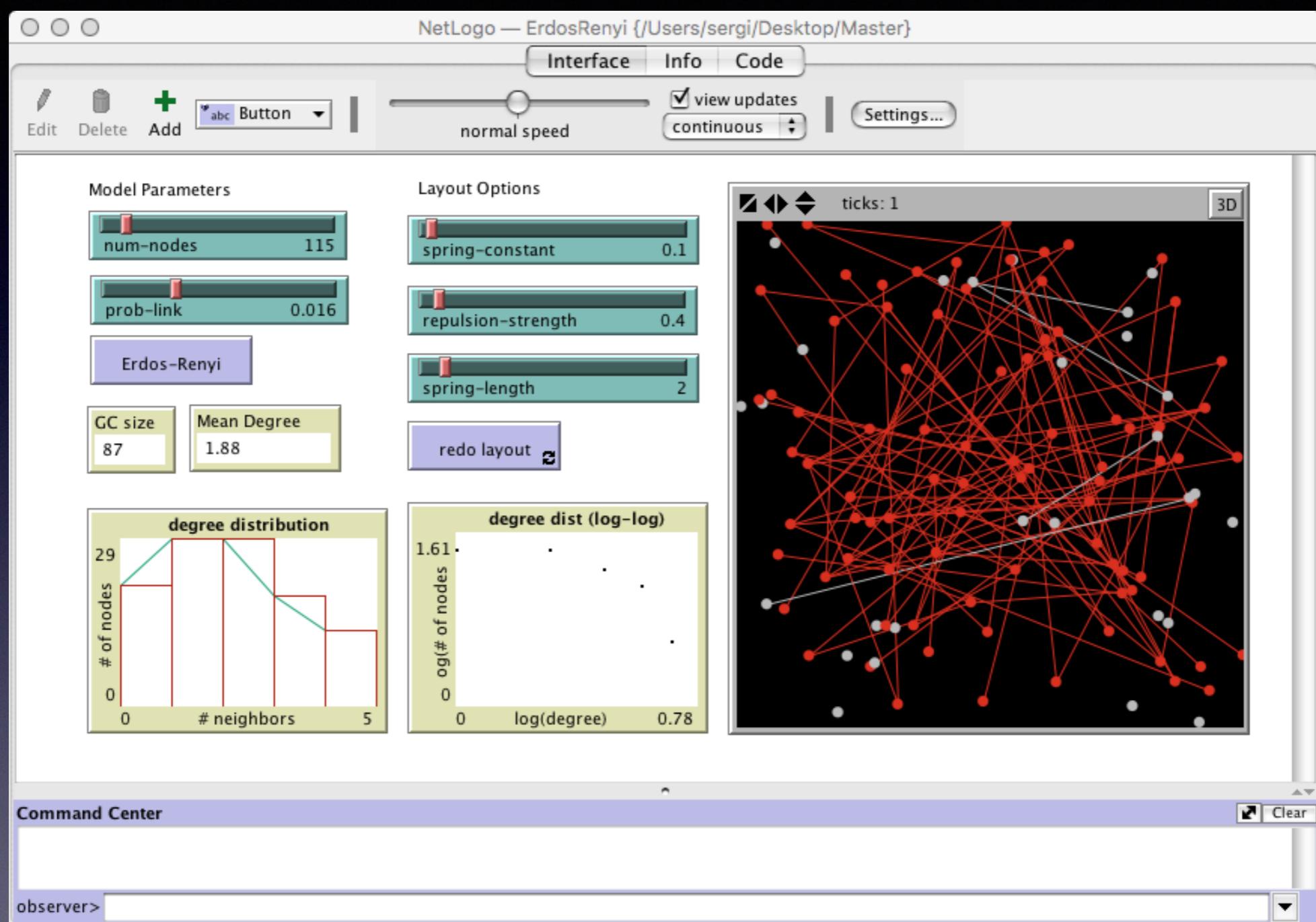
# Random Graphs



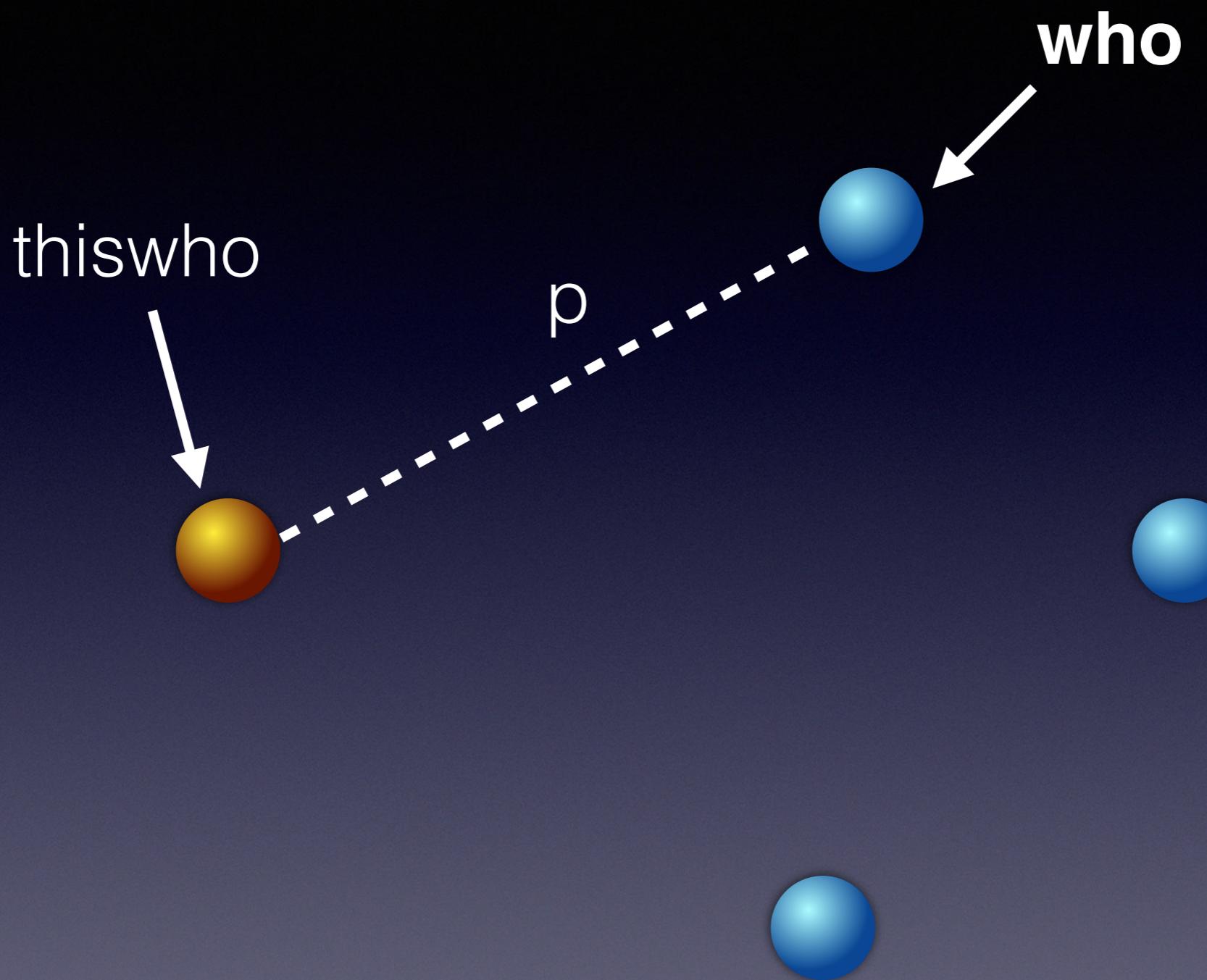
Pál Erdős  
(1913-1996)



# ErdosRenyi.nlogo

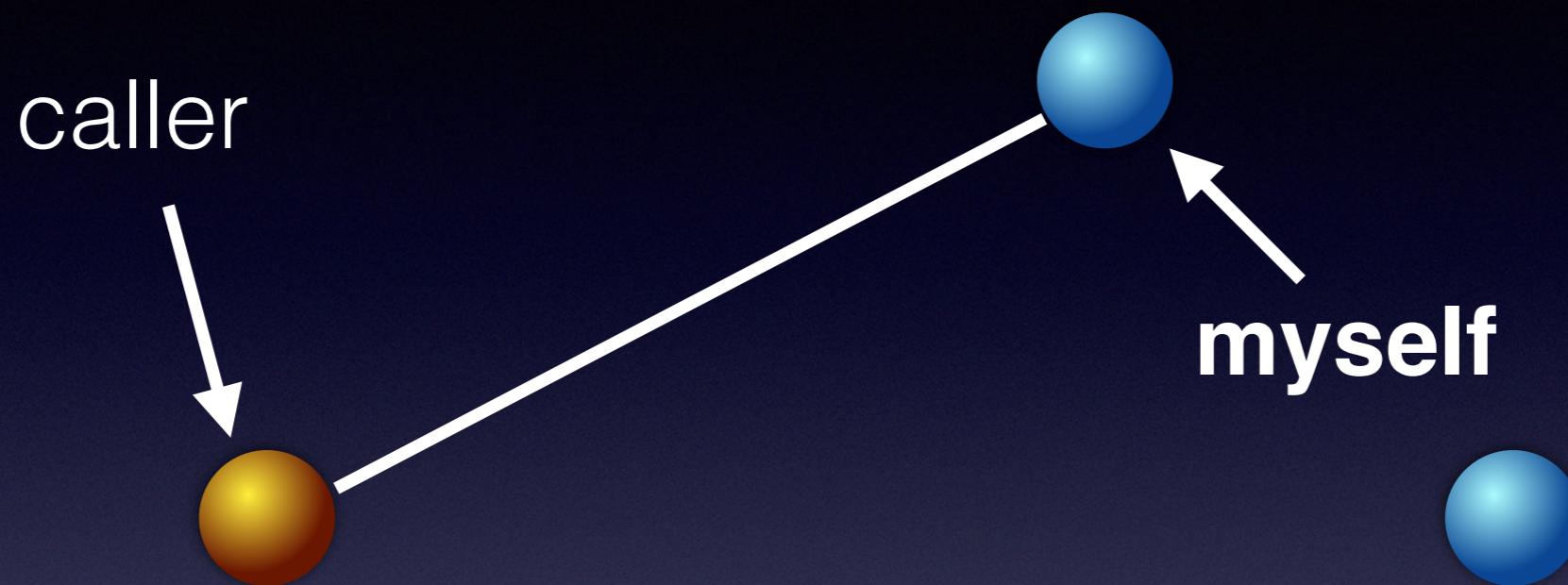


# How it works?



# How it works?

## create-link-with myself

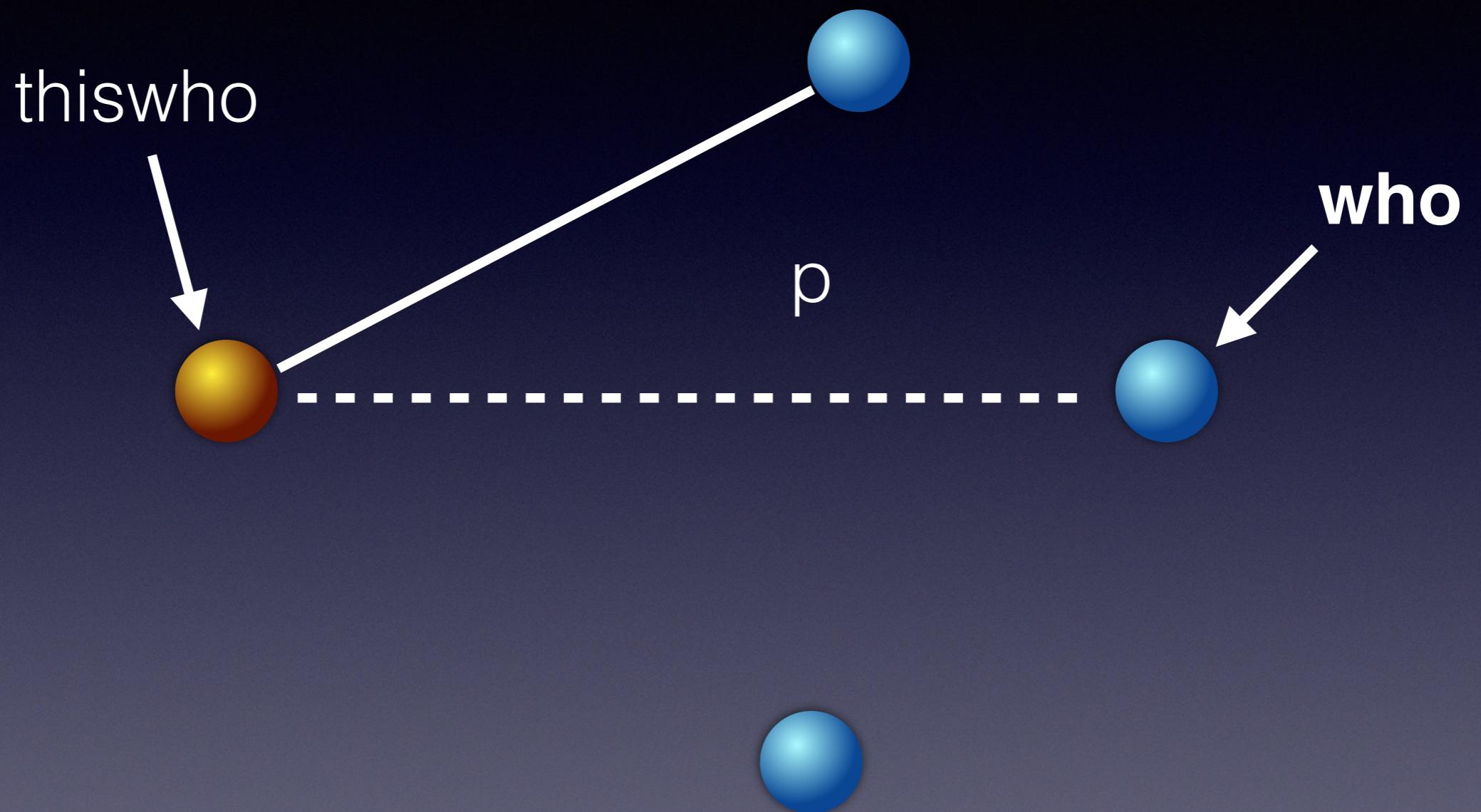


### Links

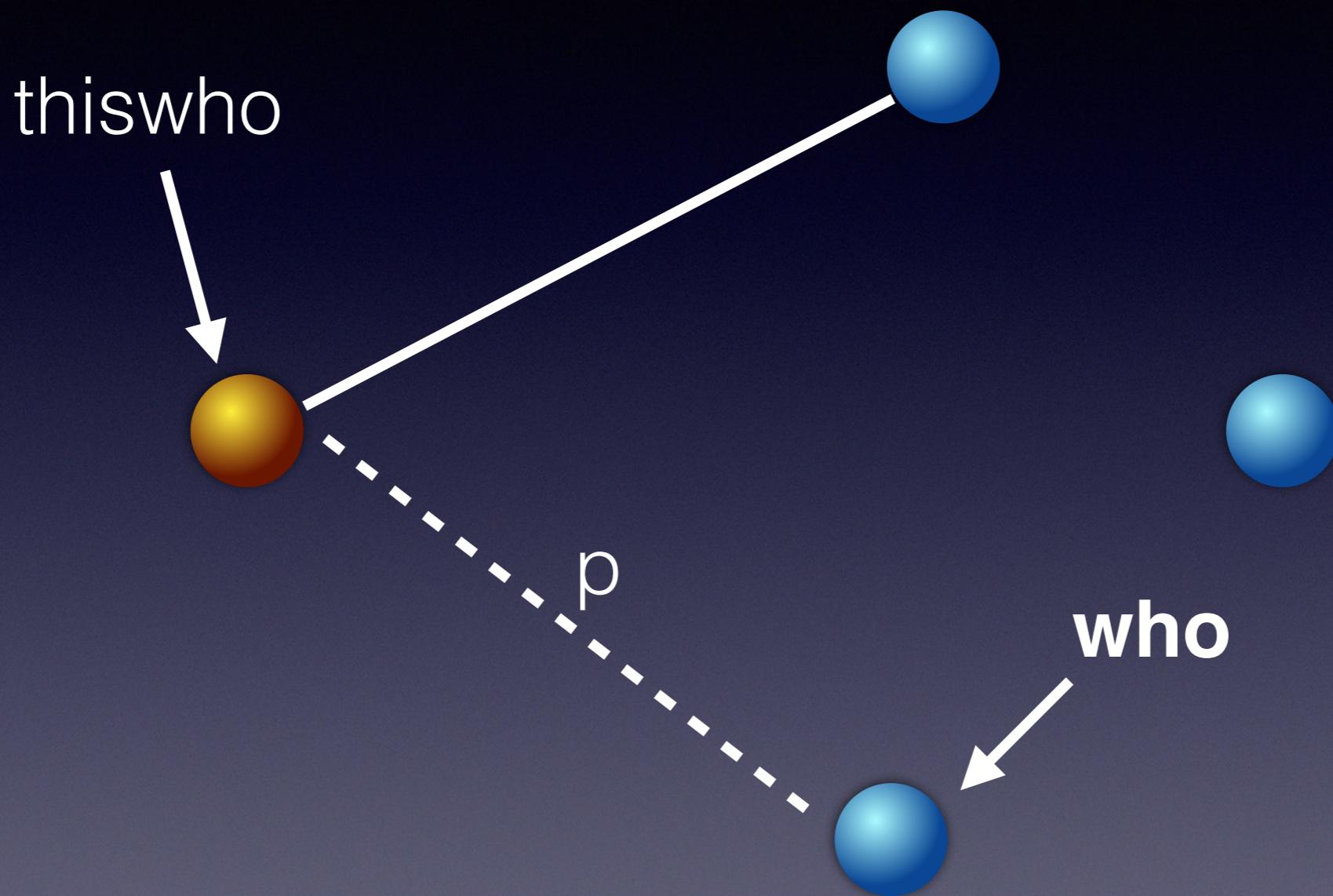
both-ends clear-links create-<breed>-from create-<breeds>-from create-<breed>-to create-<breeds>-to create-<breed>-with  
create-<breeds>-with create-link-from create-links-from create-link-to create-links-to create-link-with create-links-with die hide  
link in-<breed>-neighbor? in-<breed>-neighbors in-<breed>-from in-link-neighbor? in-link-neighbors in-link-from is-directed-link?  
is-link? is-link-set? is-undirected-link? layout-radial layout-spring layout-tutte <breed>-neighbor? <breed>-neighbors <breed>-with  
link-heading link-length link-neighbor? link links links-own <link-breeds>-own link-neighbors link-with my-<breeds> my-in  
<breeds> my-in-links my-links my-out-<breeds> my-out-links no-links other-end out-<breed>-neighbor? out-<breed>-neighbors  
out-<breed>-to out-link-neighbor? out-link-neighbors out-link-to show-link tie untie

# How it works?

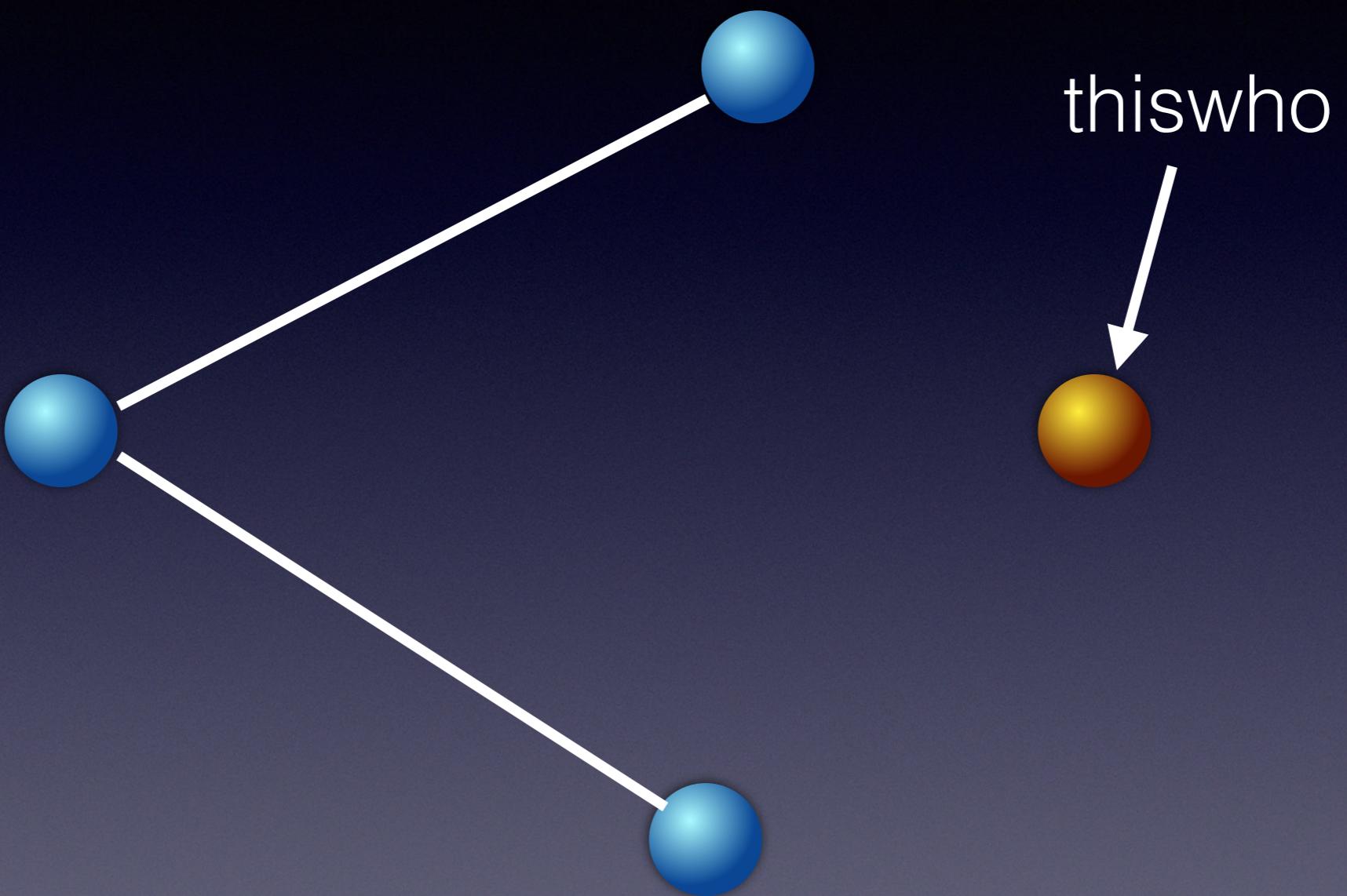
create-link-with myself



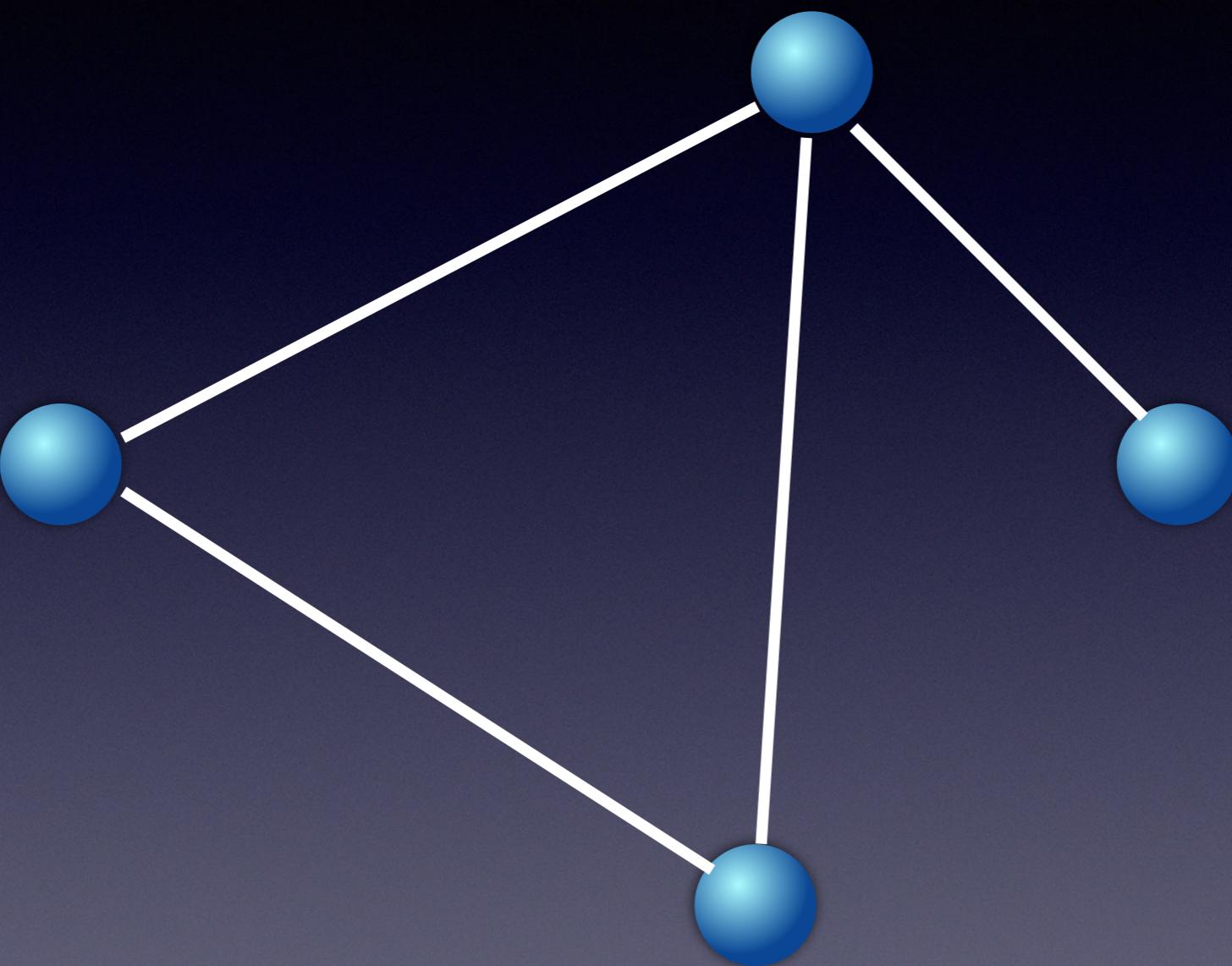
# How it works?

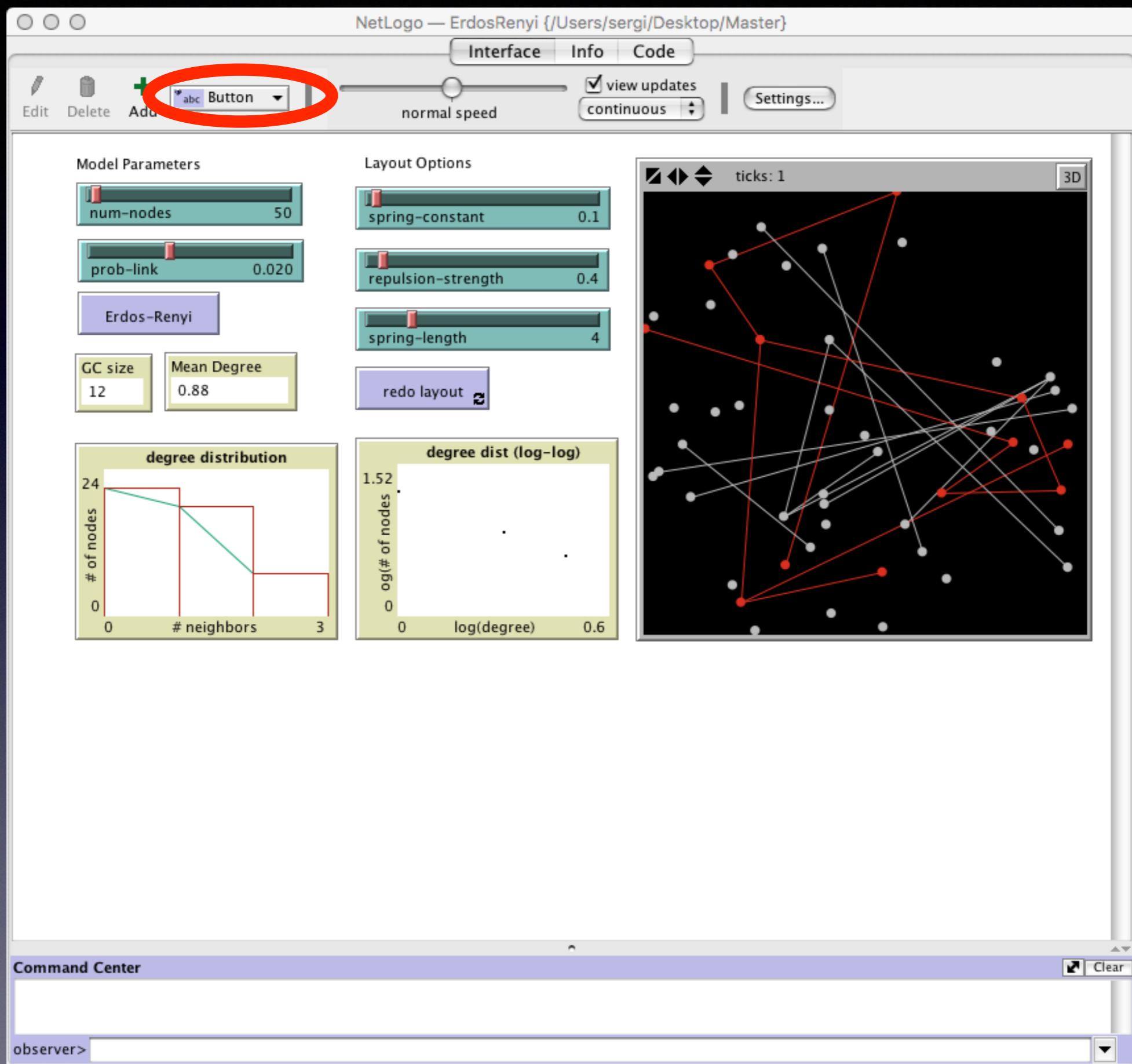


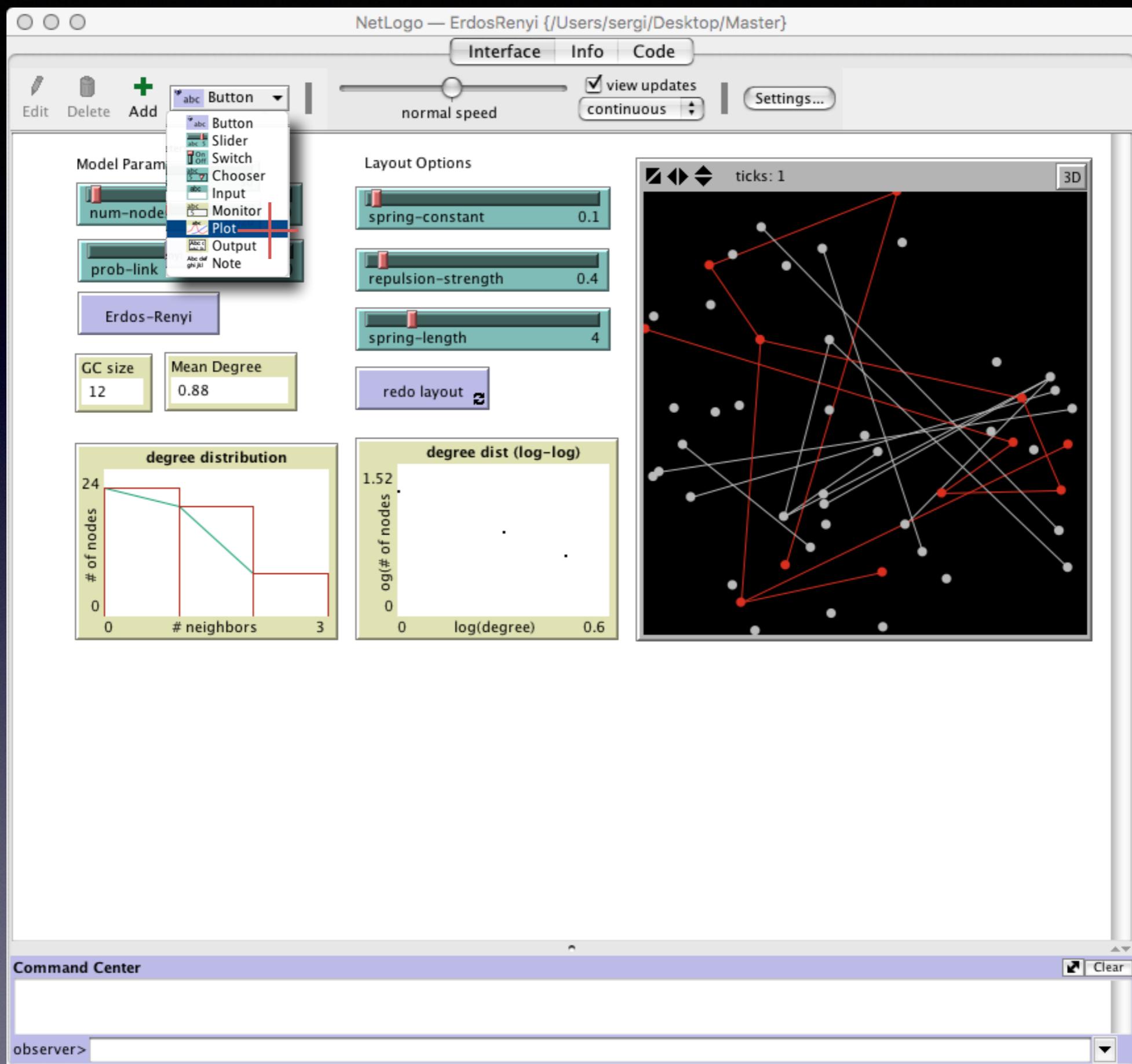
# How it works?

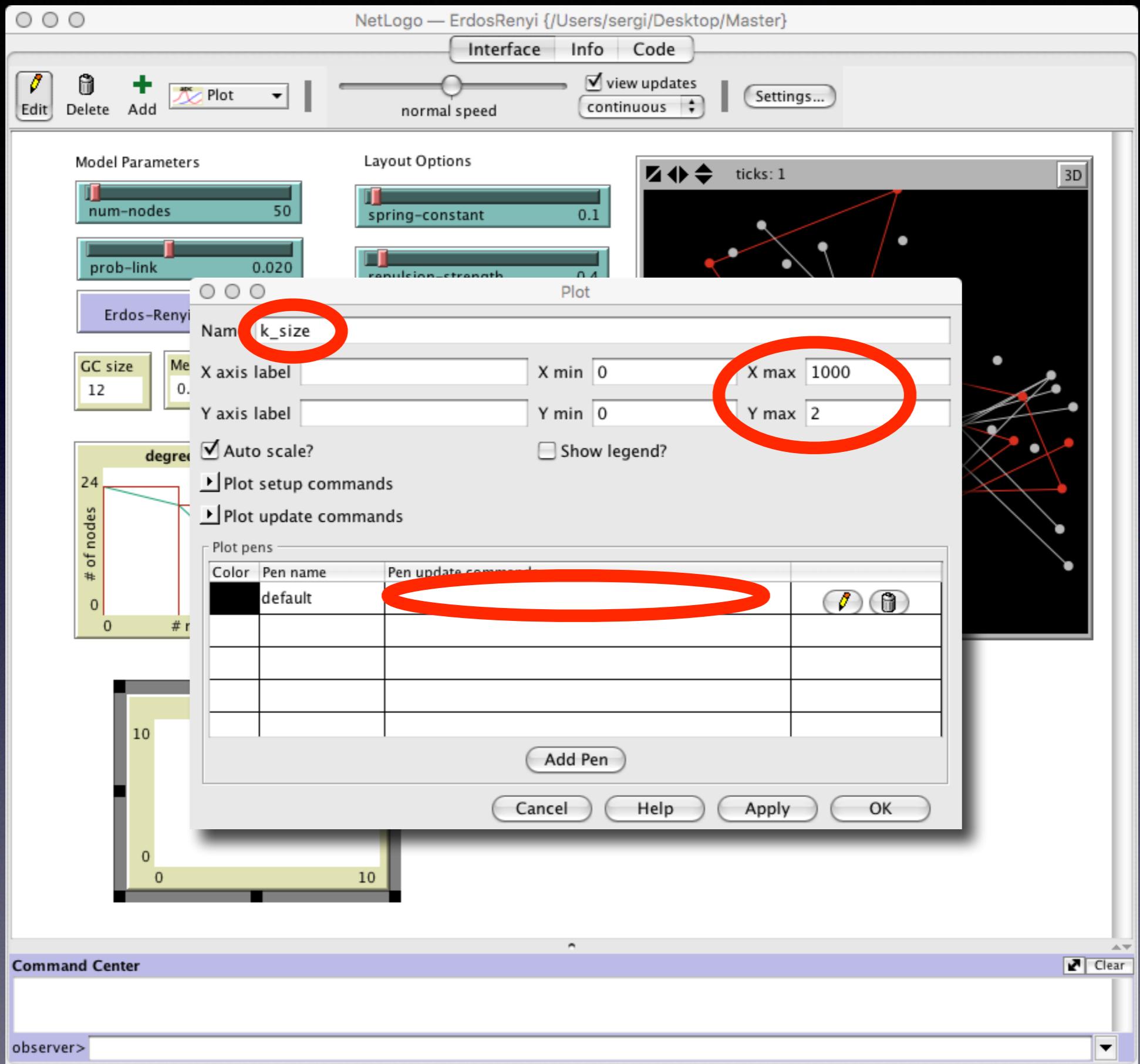


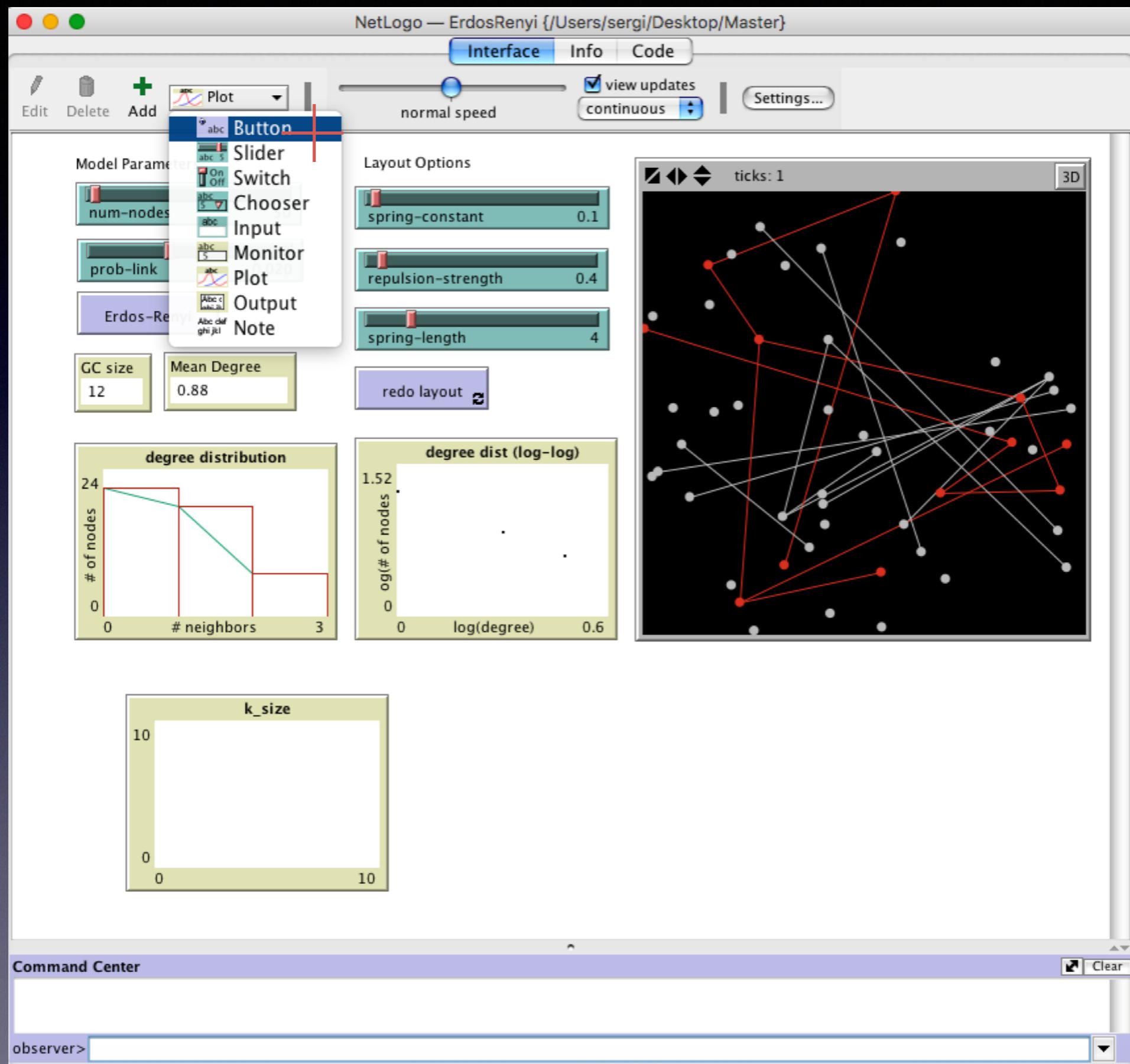
# How it works?

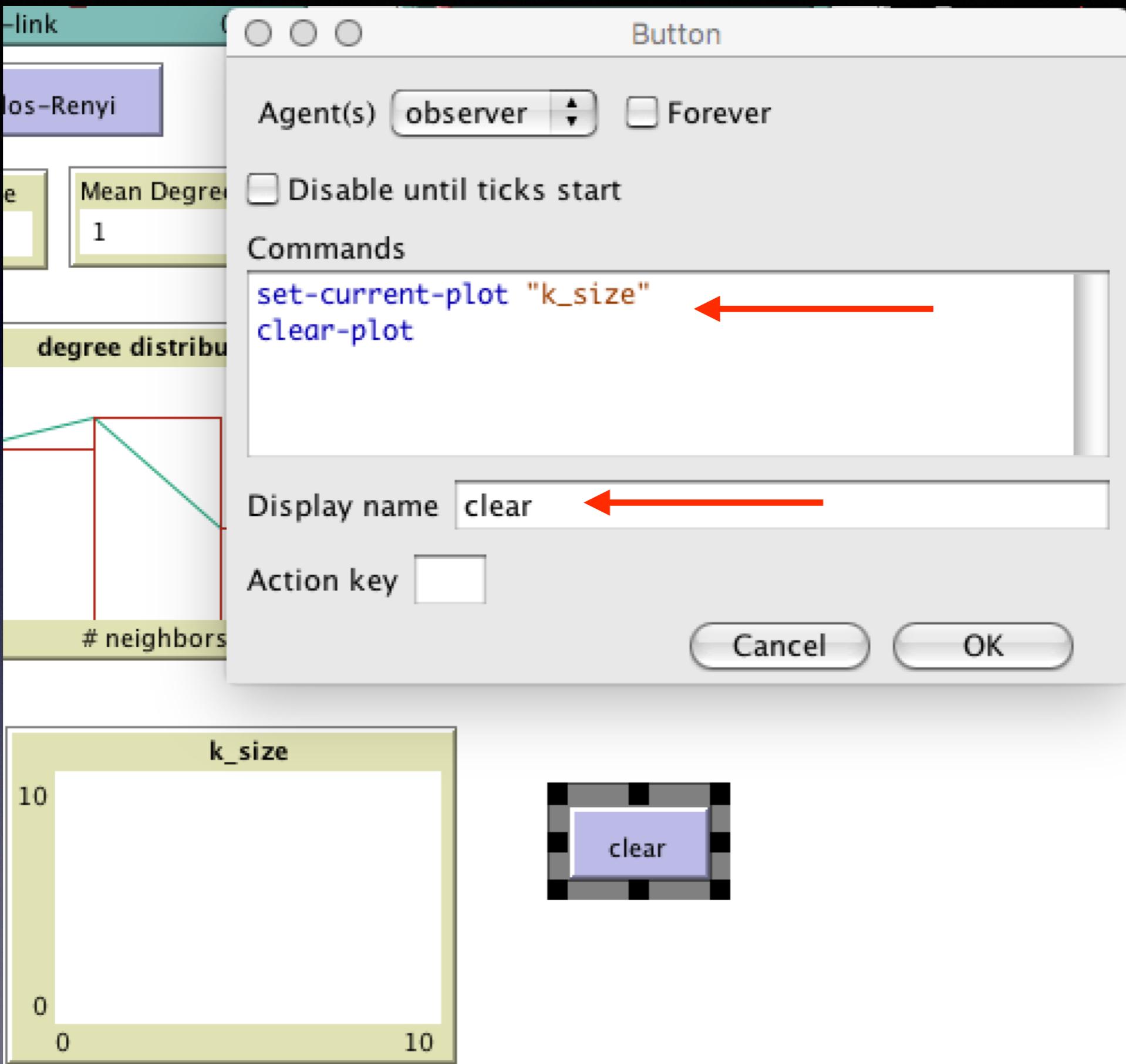


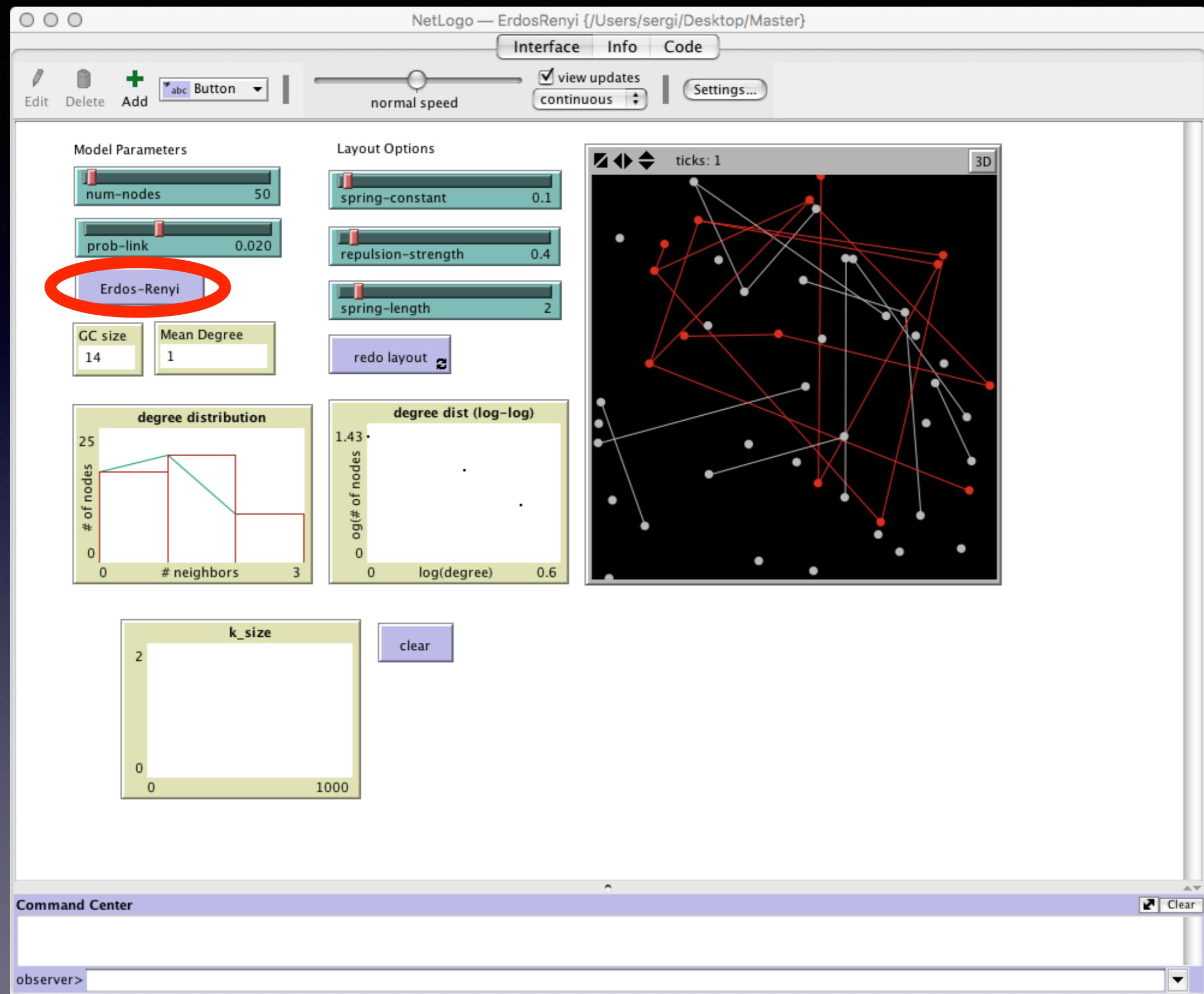


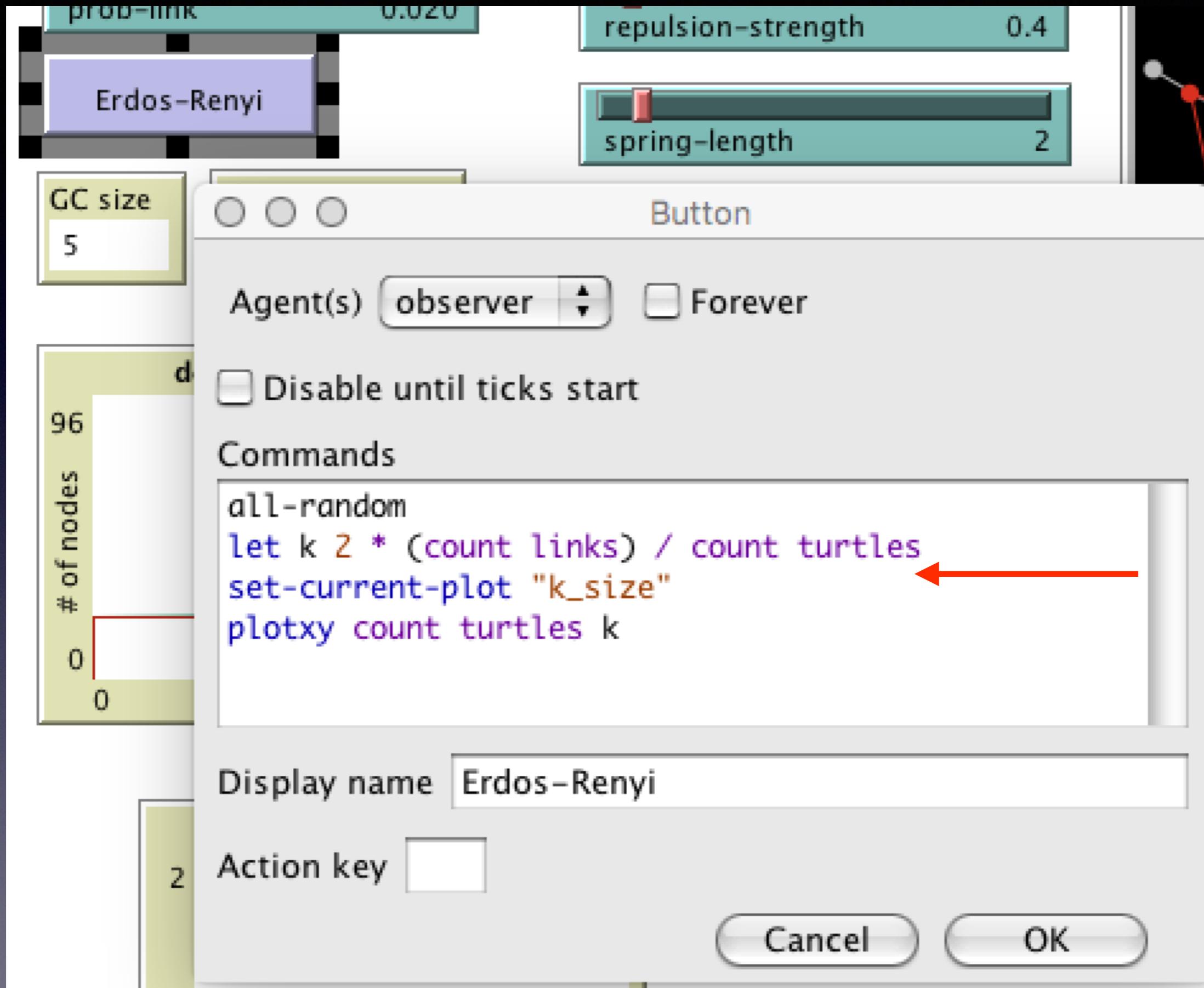






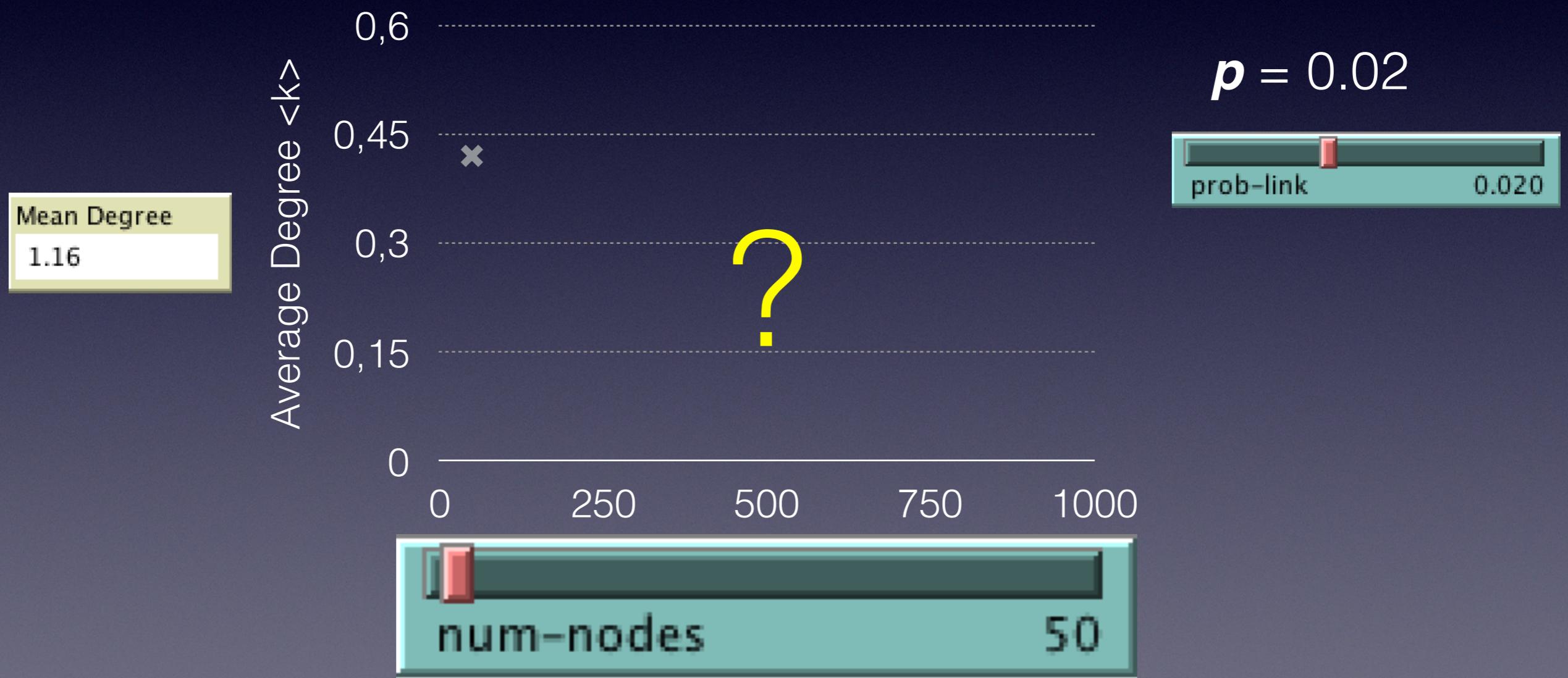






# Average Degree

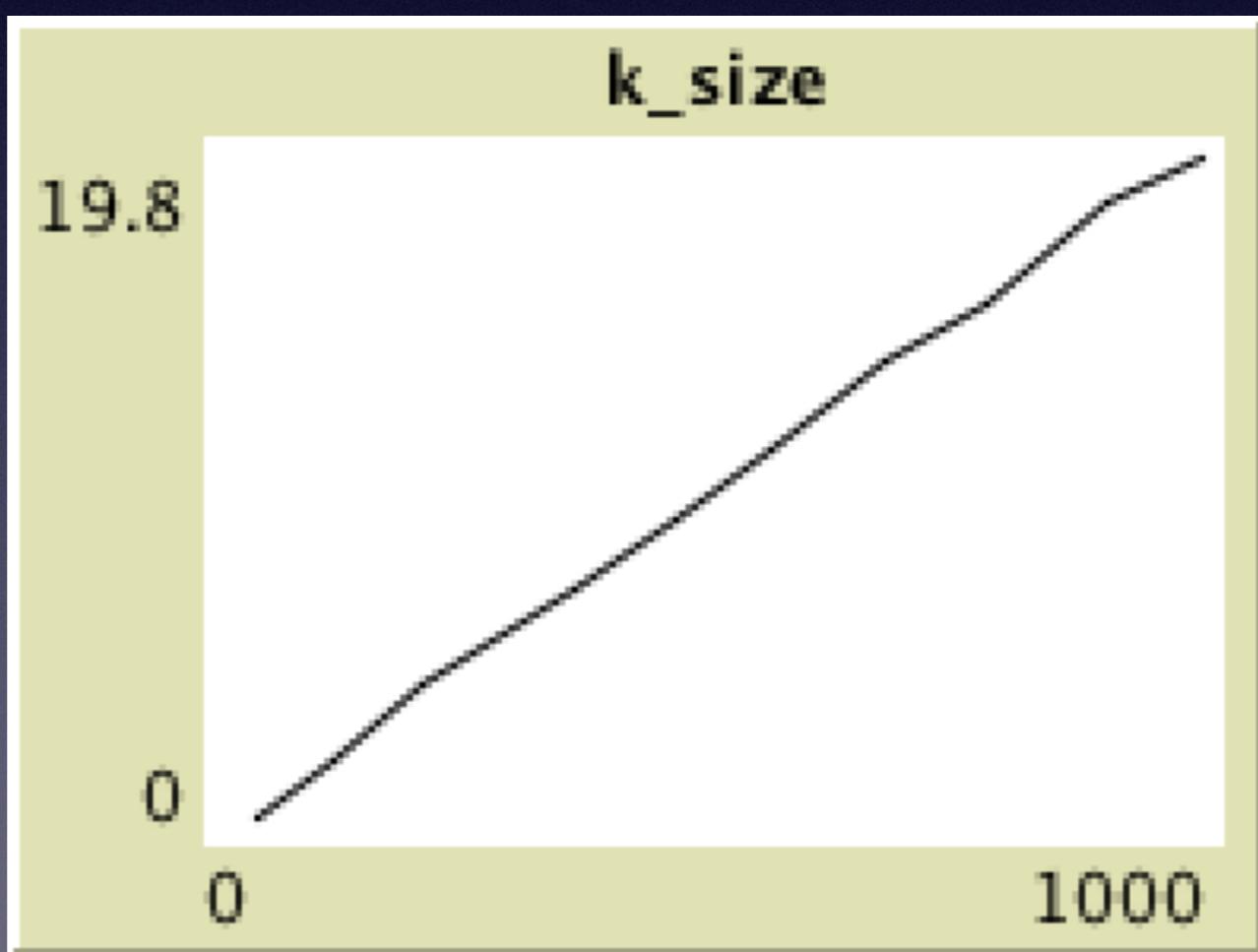
As the size  $N$  of the network increases, if you keep  $p$ , the probability of any two nodes being connected, the same, what happens to the average degree  $\langle k \rangle$ ?



# Average Degree

As the size of the network increases, if you keep  $p$ , the probability of any two nodes being connected, the same, what happens to the average degree  $\langle k \rangle$ ?

$$\langle k \rangle = (N - 1)p$$

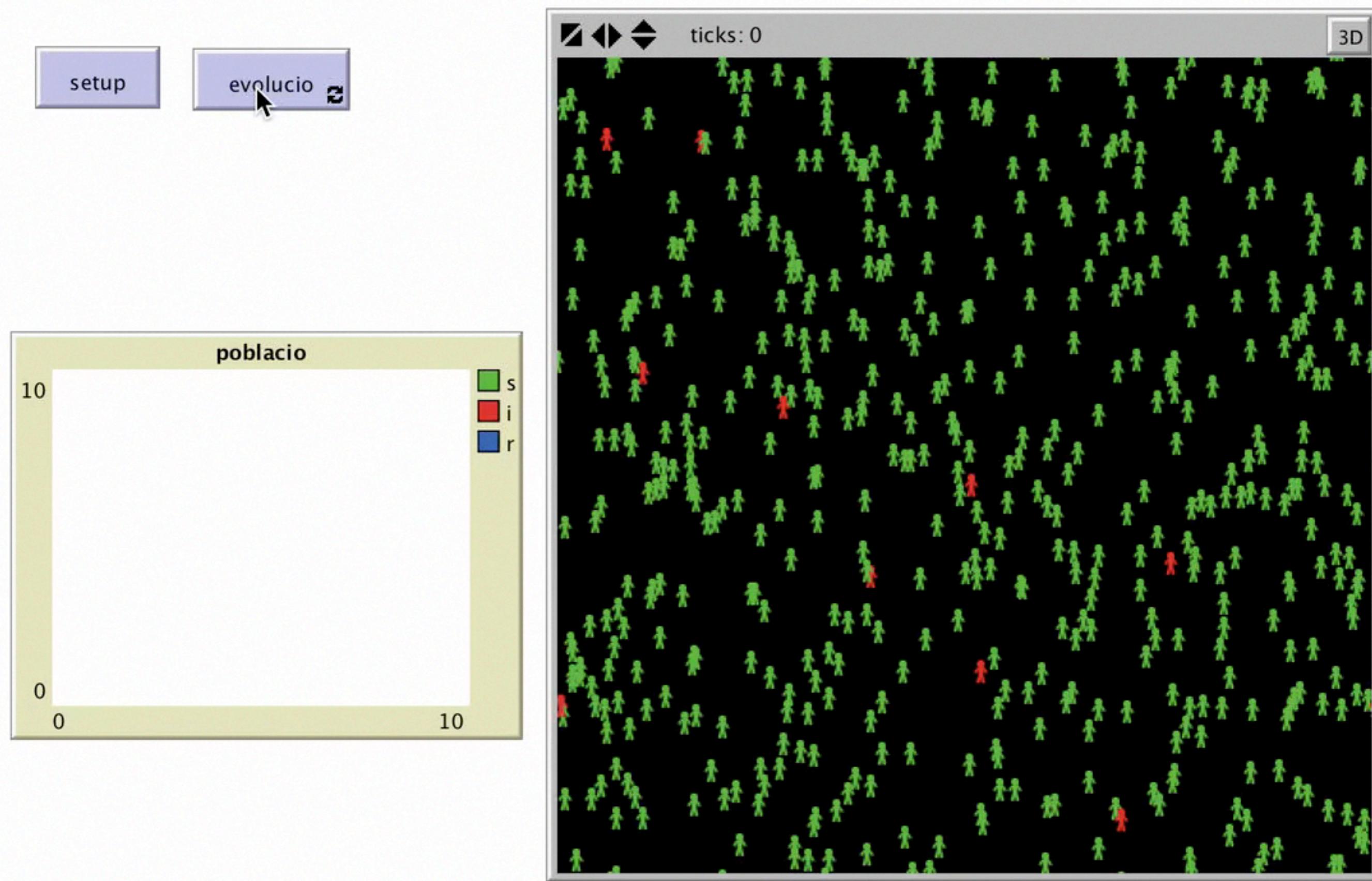


SCALE-FREE

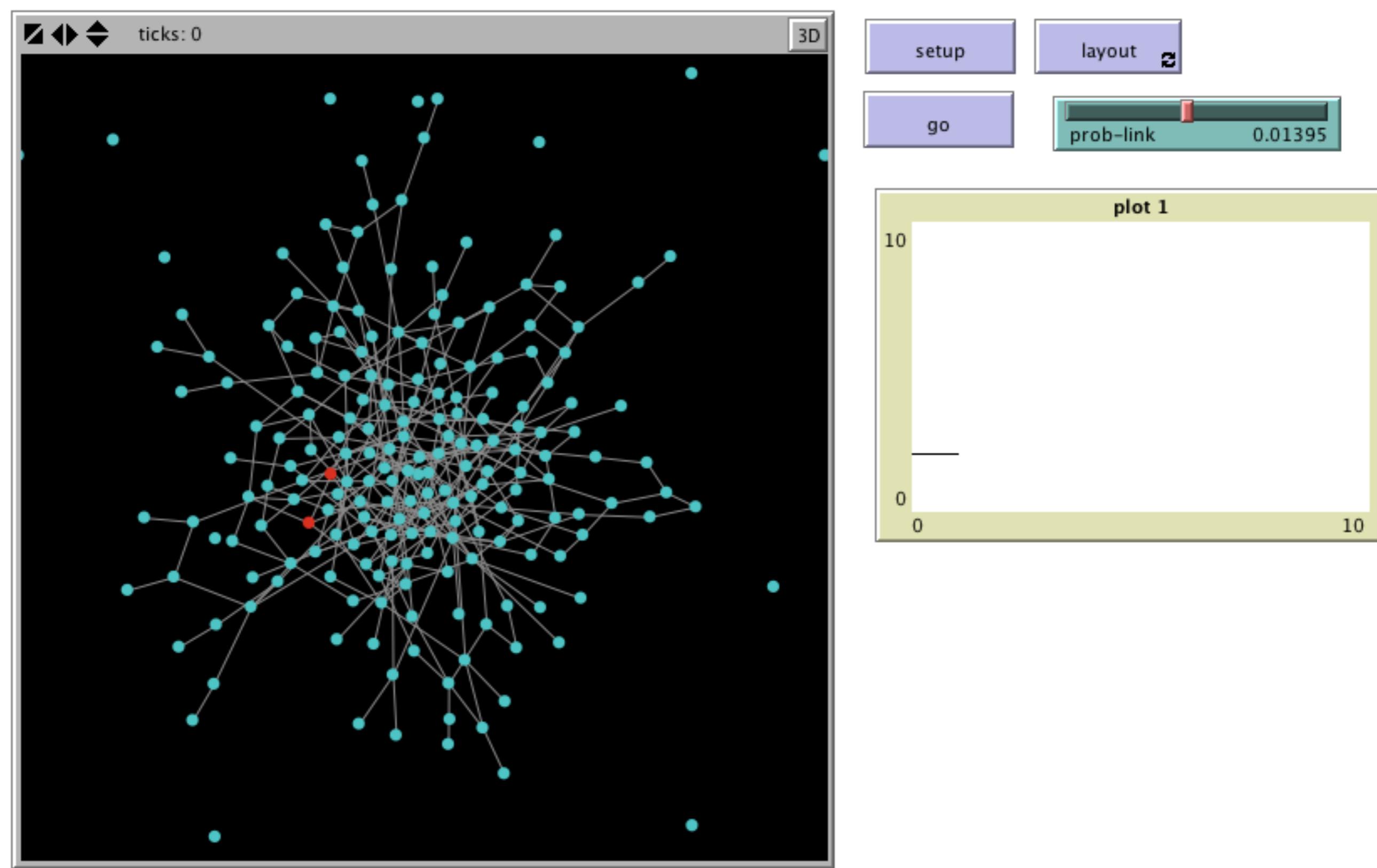
# Epidemics on Networks



# Previously...



# SI on Random Graphs



# Project

Implement the SIR model

Study Epidemics on Random, Lattice &  
Scale-Free Networks

Design effective vaccination strategies  
for each network.