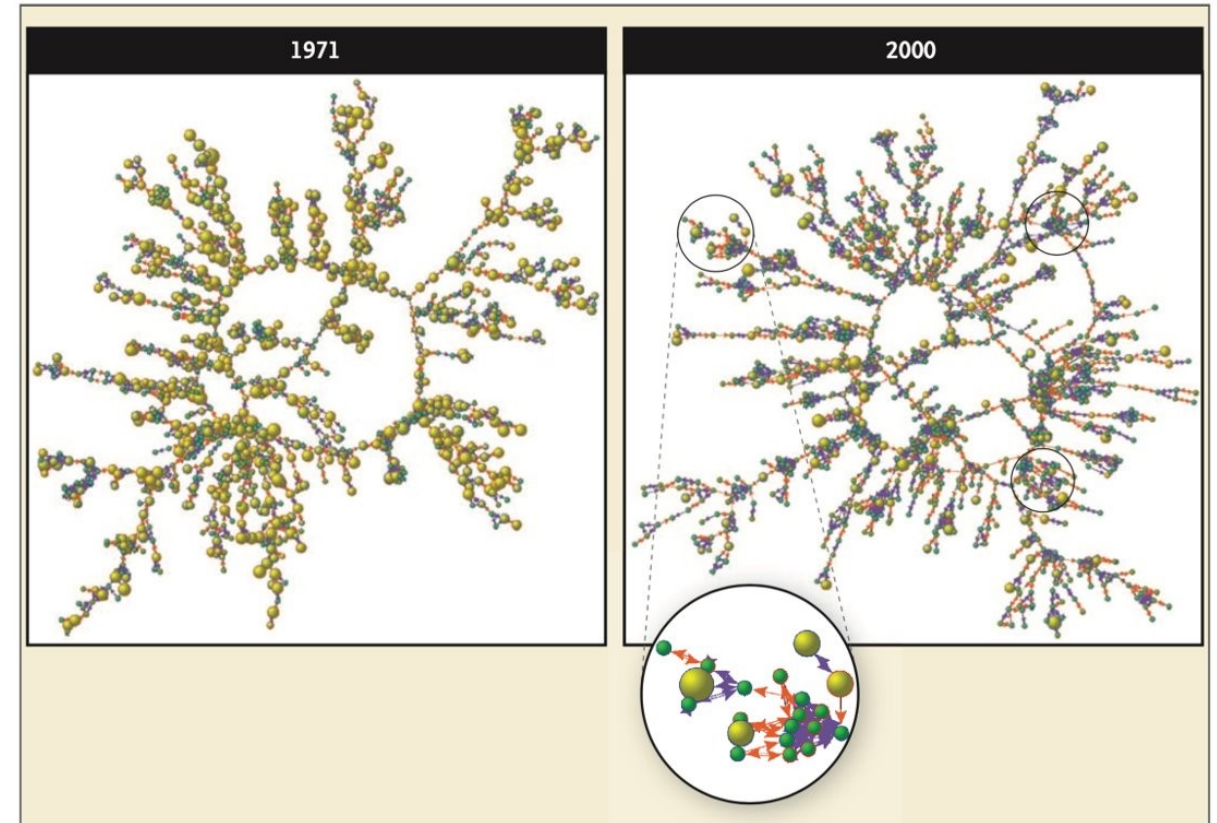


# Dynamics of Smoking

Lecture with Computer Exercises:  
Modelling and Simulating Social Systems

# Paper by Christakis and Fowler

- Data from Framingham Heart Study
- Formation of groups
- Influence of cessation of a family member or a close friend



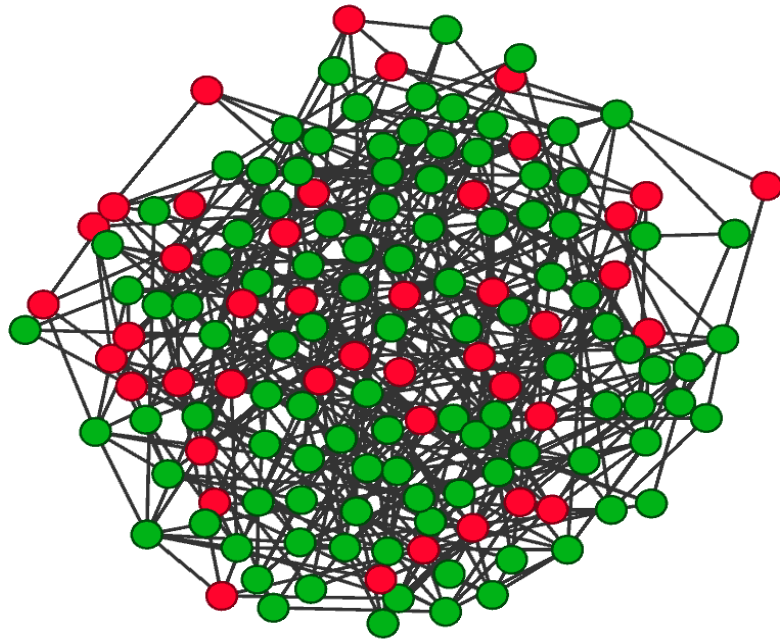
Nicholas A. Christakis and James H. Fowler. "The Collective Dynamics of Smoking in a Large Social Network"  
In: New England Journal of Medicine 358.21 (May 2008), pp. 2249–2258.

# Goals

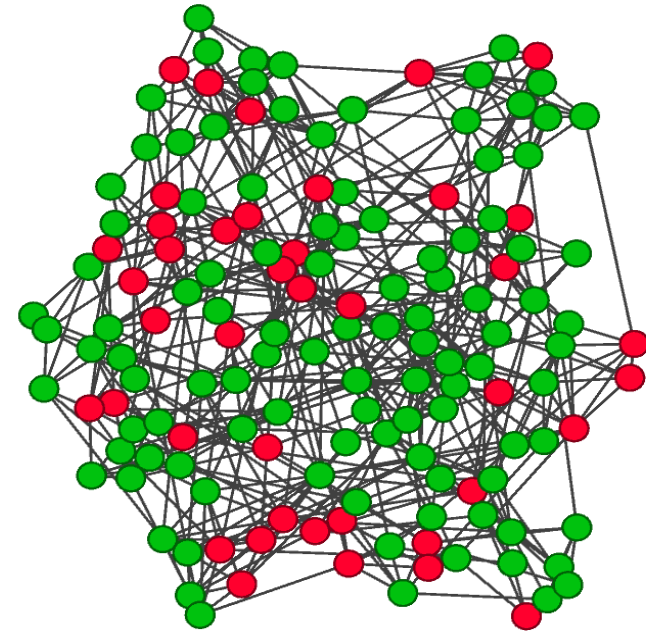
- Reproduce the results found by Christakis and Fowler
- Investigate the formation of groups in our society
- Observe the time evolution of our model
- Comparison to reality

# Our model – Creation of the Society

- Agent based approximation of a real social network



Random graph



Our graph

# Our model – Simulation

```

for friend in friends do
   $r = \text{random} \in N(1, 0.3)$ 

  
$$\text{state\_con} = \begin{cases} \text{state\_con} - r * \frac{\text{impact\_smoker}}{\text{number of friends}} & \text{friend} = \text{smoker} \\ \text{state\_con} + r * \frac{\text{impact\_non-smoker}}{\text{number of friends}} & \text{friend} = \text{non-smoker} \end{cases}$$


  
$$\text{next\_state} = \begin{cases} \text{smoker} & \text{state\_con} < 0 \\ \text{non\_smoker} & \text{state\_con} \geq 0 \end{cases}$$

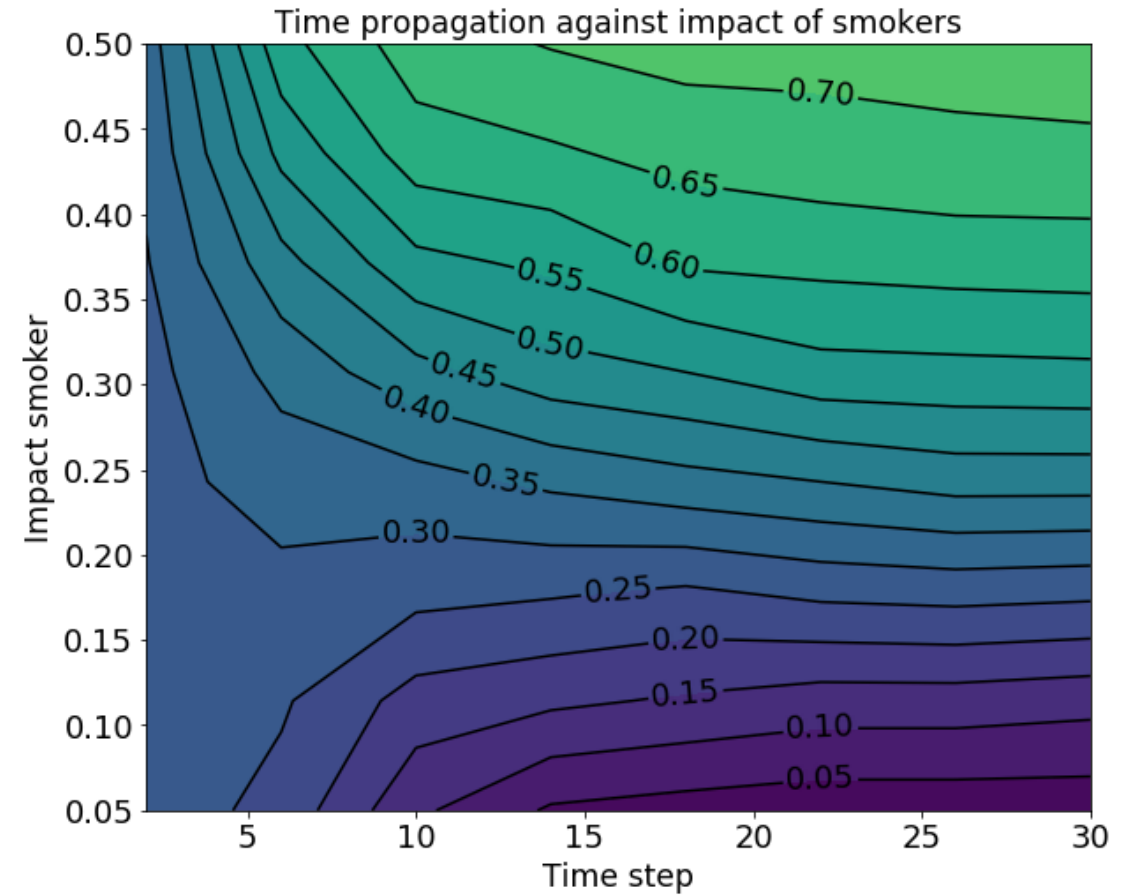
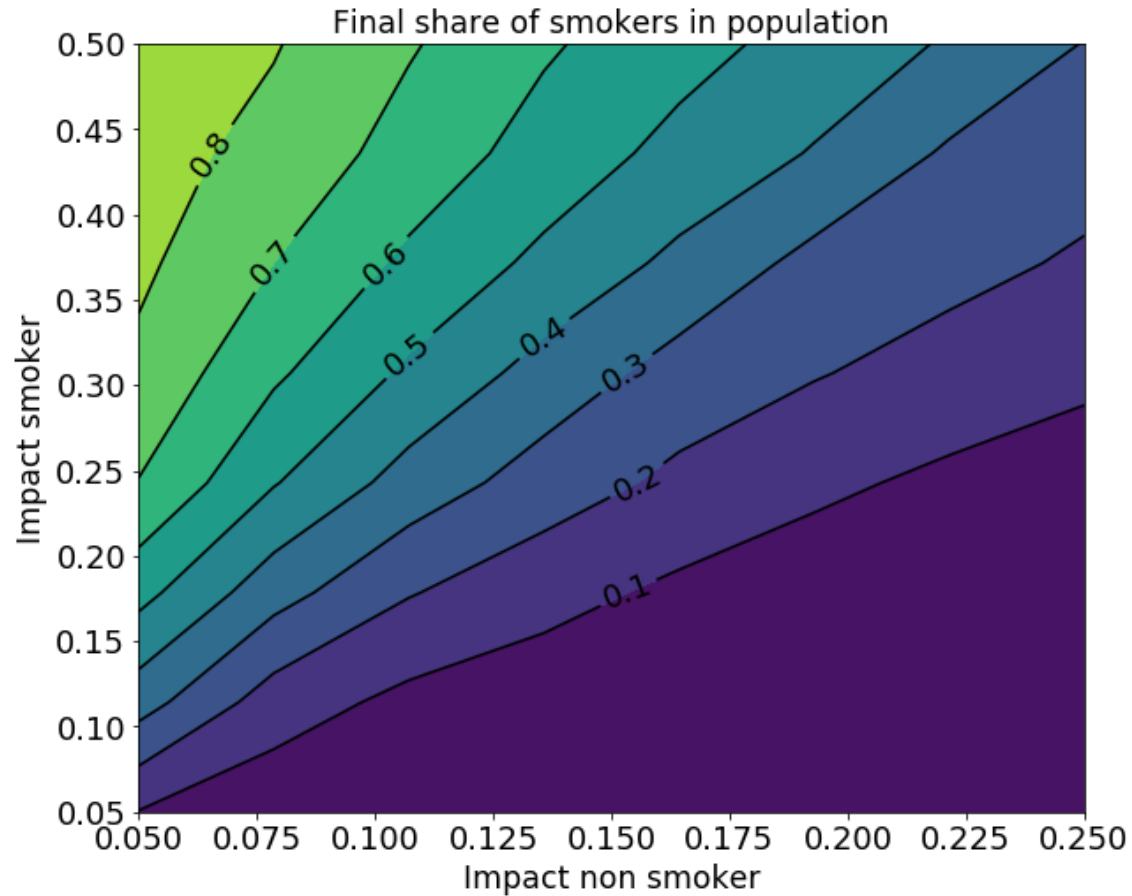

  if  $\text{state} \neq \text{next\_state}$  then
    
$$\text{state\_con} = \begin{cases} \text{state\_con} - 0.3 & \text{next\_state} = \text{smoker} \\ \text{state\_con} + 0.2 & \text{next\_state} = \text{non-smoker} \end{cases}$$

  end
end

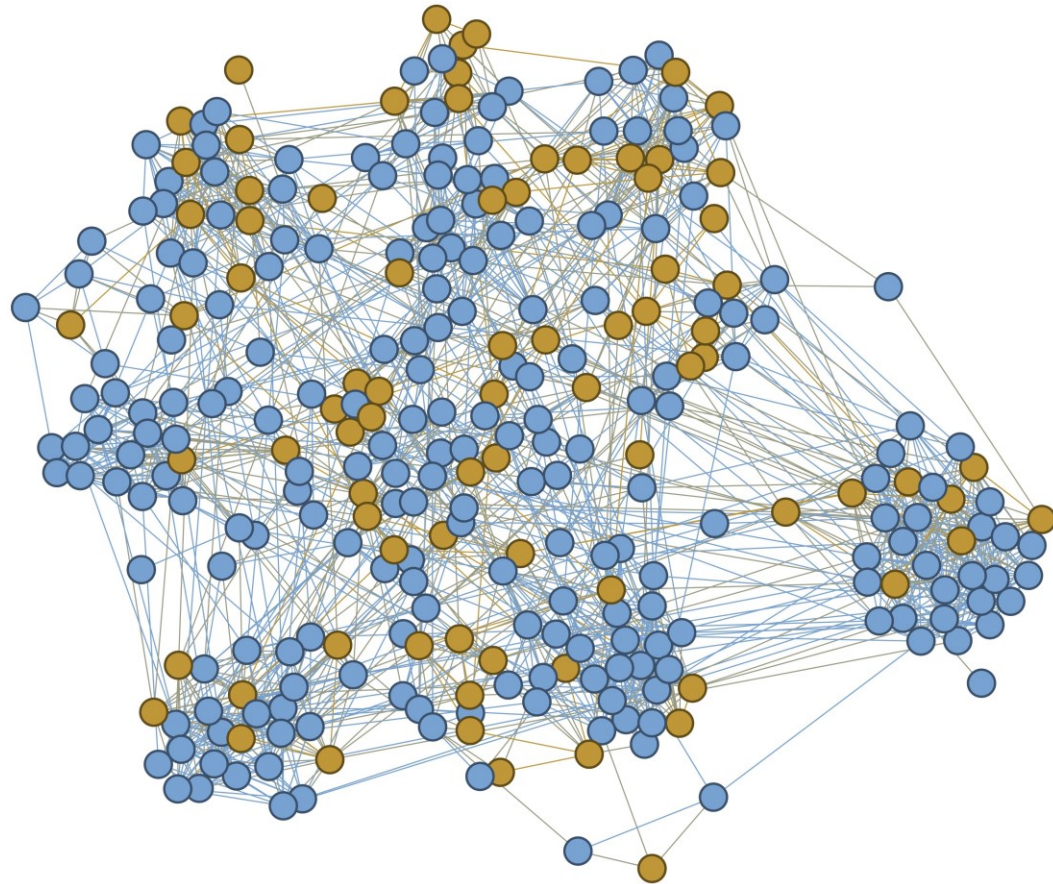
```



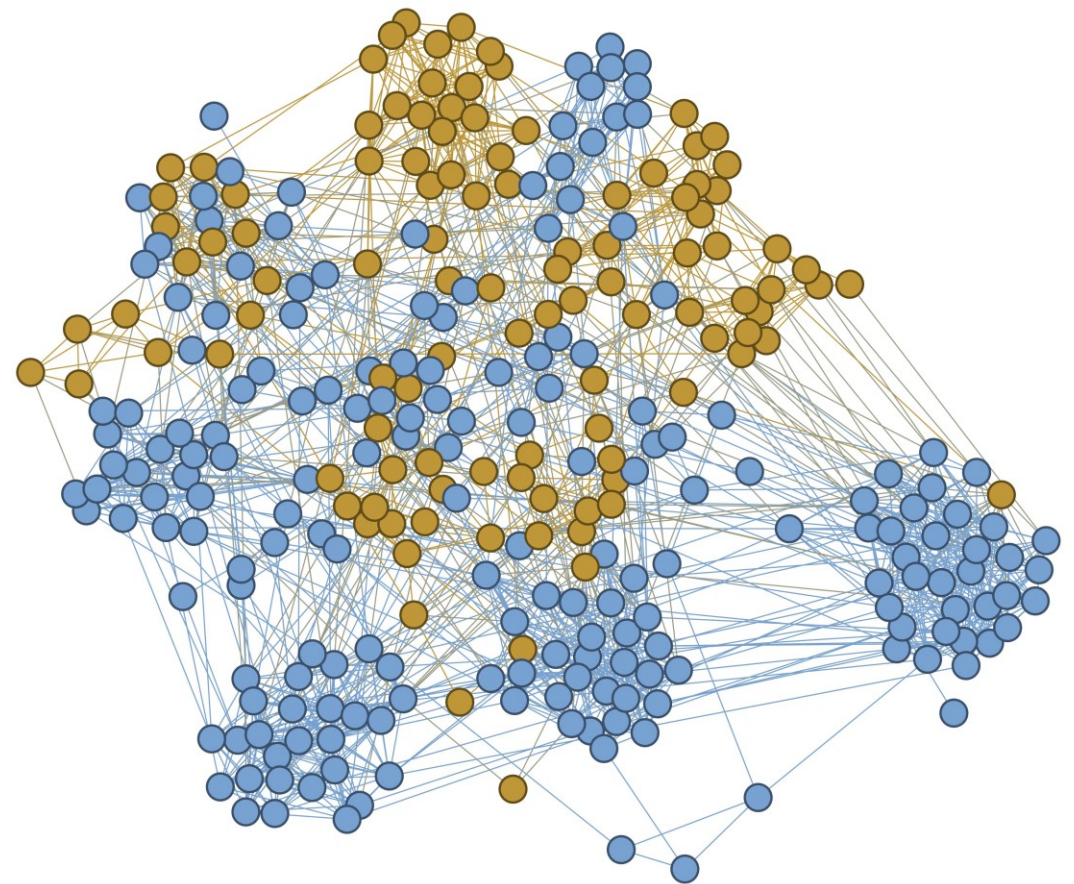
# Results –Impact Parameters and Time Evolution



# Results – Formation of groups

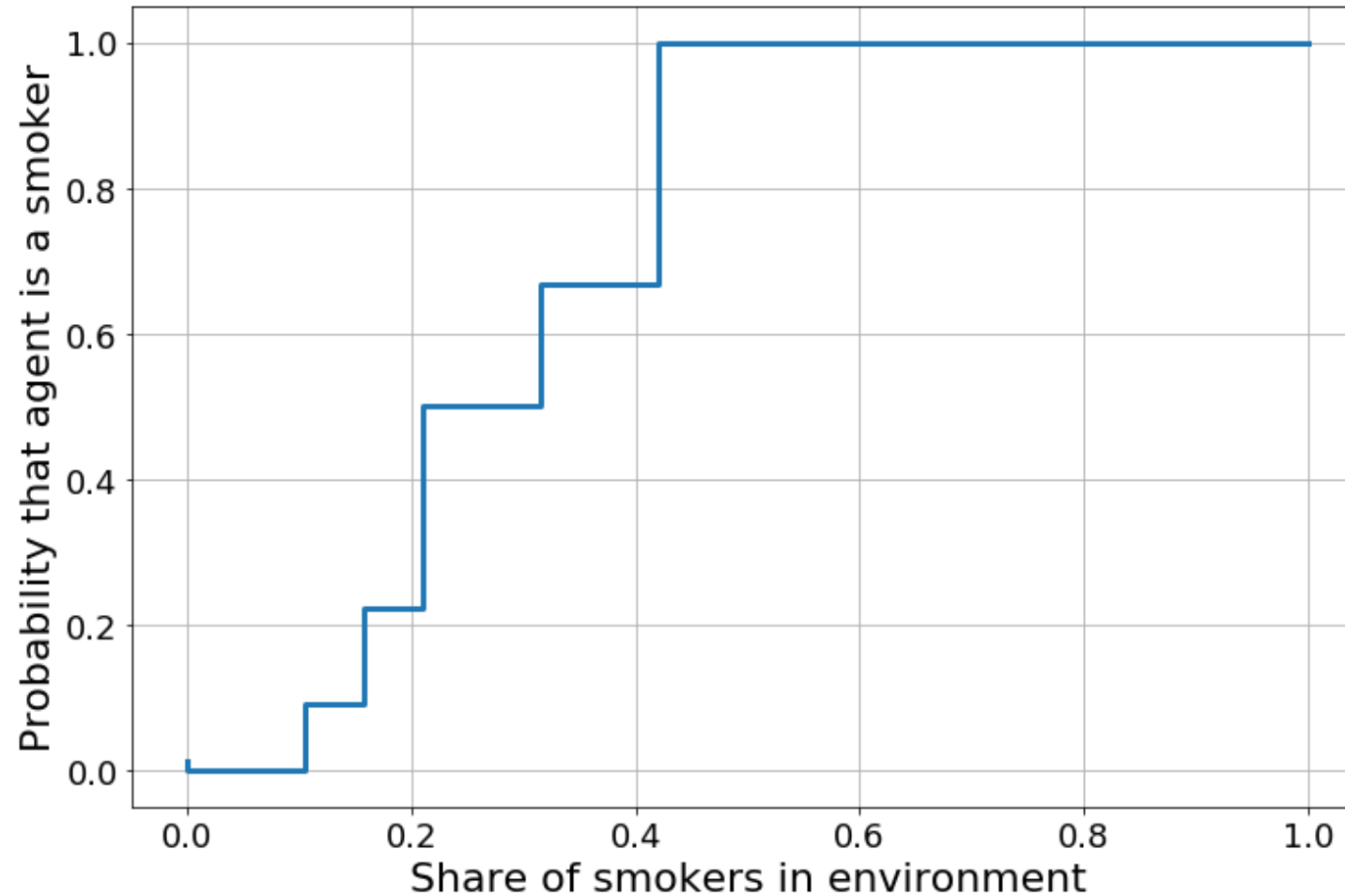


initial state



final state

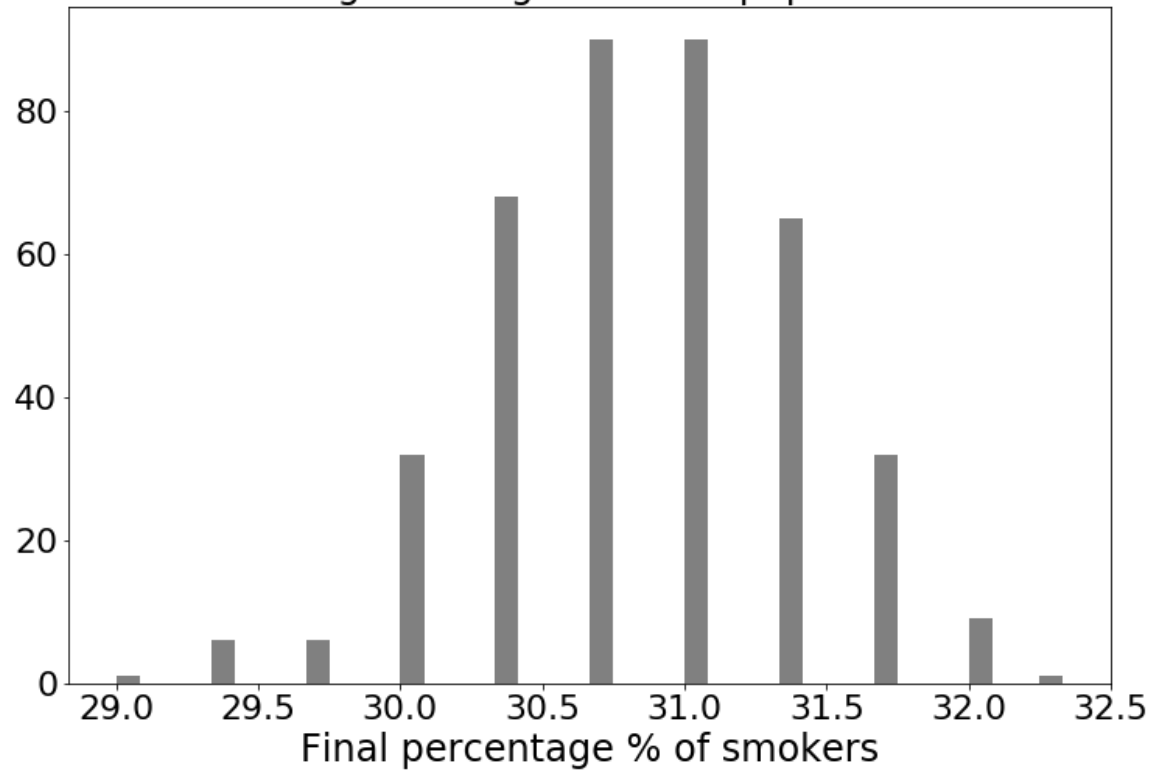
# Results – Influence of Environment



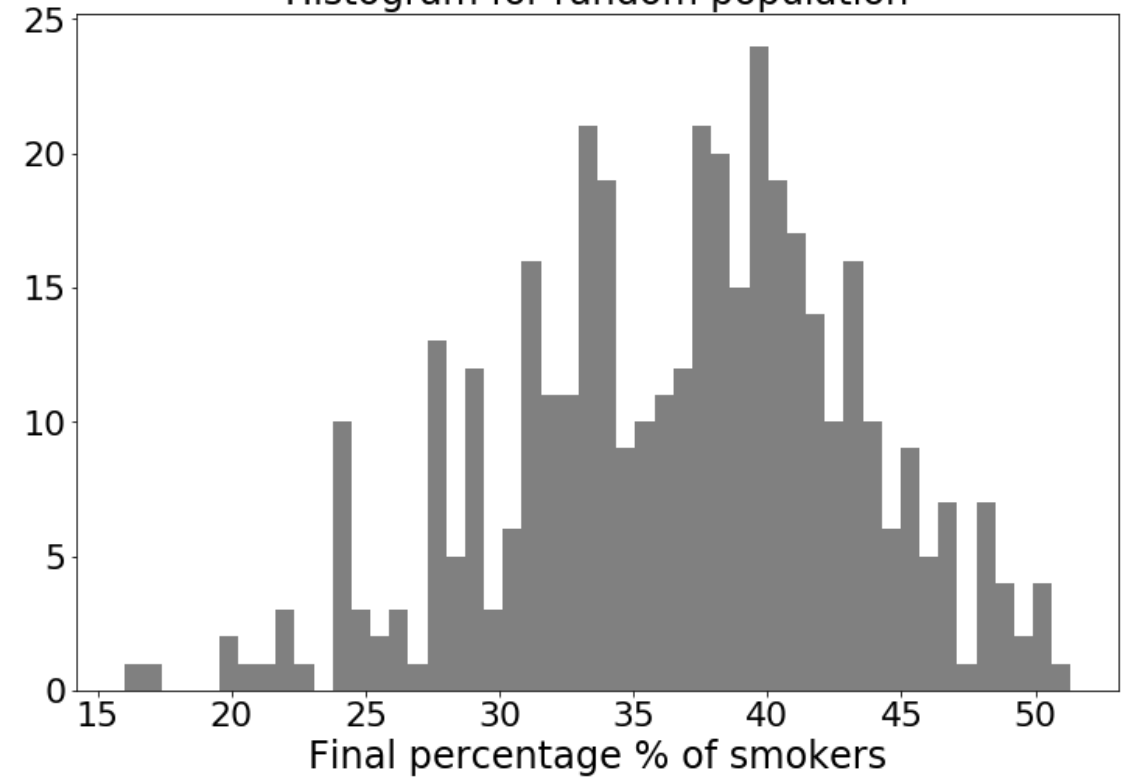


# Stability of our model

Histogram for given initial population



Histogram for random population



# Summary

- Model can not reproduce the results of Christakis and Fowler quantitatively
- Qualitative phenomena like the formation of groups and the positive influence of friends quitting can be observed