Schelling Segregation Model

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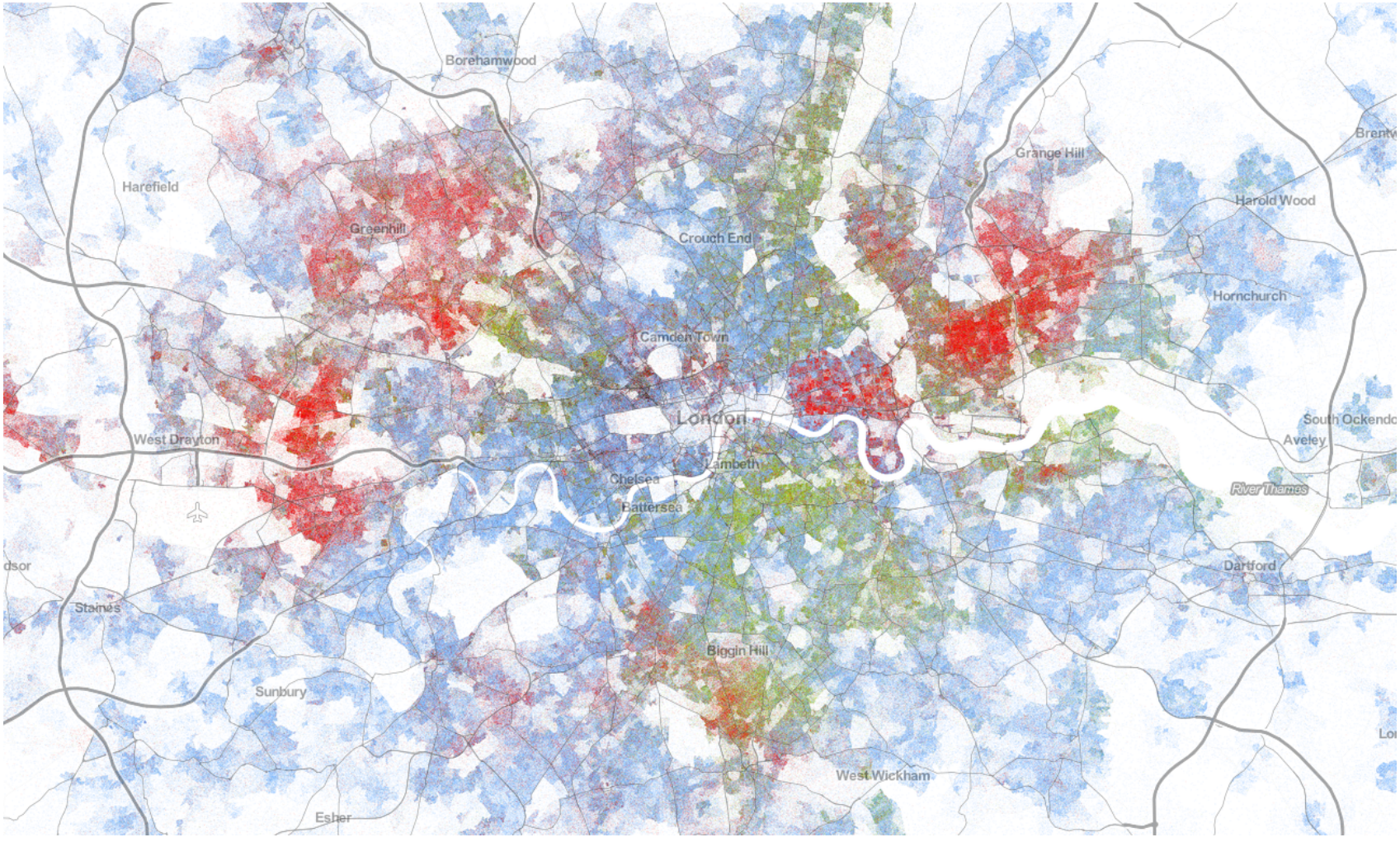


Source: https://andrewwhitby.com/2013/09/04/uk-ethnicity-map/

Description of Schelling Model

In the 70's, Thomas Schelling, the 2005 Economics Nobel Prize winner, was interested in this subject and built an agent-based model called the "Schelling segregation model" for explaining this phenomenon. With a very simple model, Schelling could show that what we see at the macro level may not in fact represent what's going down in the micro level.
Schelling Model is used to show a clear racial segregation. It develops naturally, even if each individual is moderately tolerant towards another groups, . Members of each group do not consciously choose to live in a certain area, but the collective behavior of the individuals gives rise to segregation.

Similarity ratio

Similarity ratio is the ratio of neighbors of the same group as the agent.

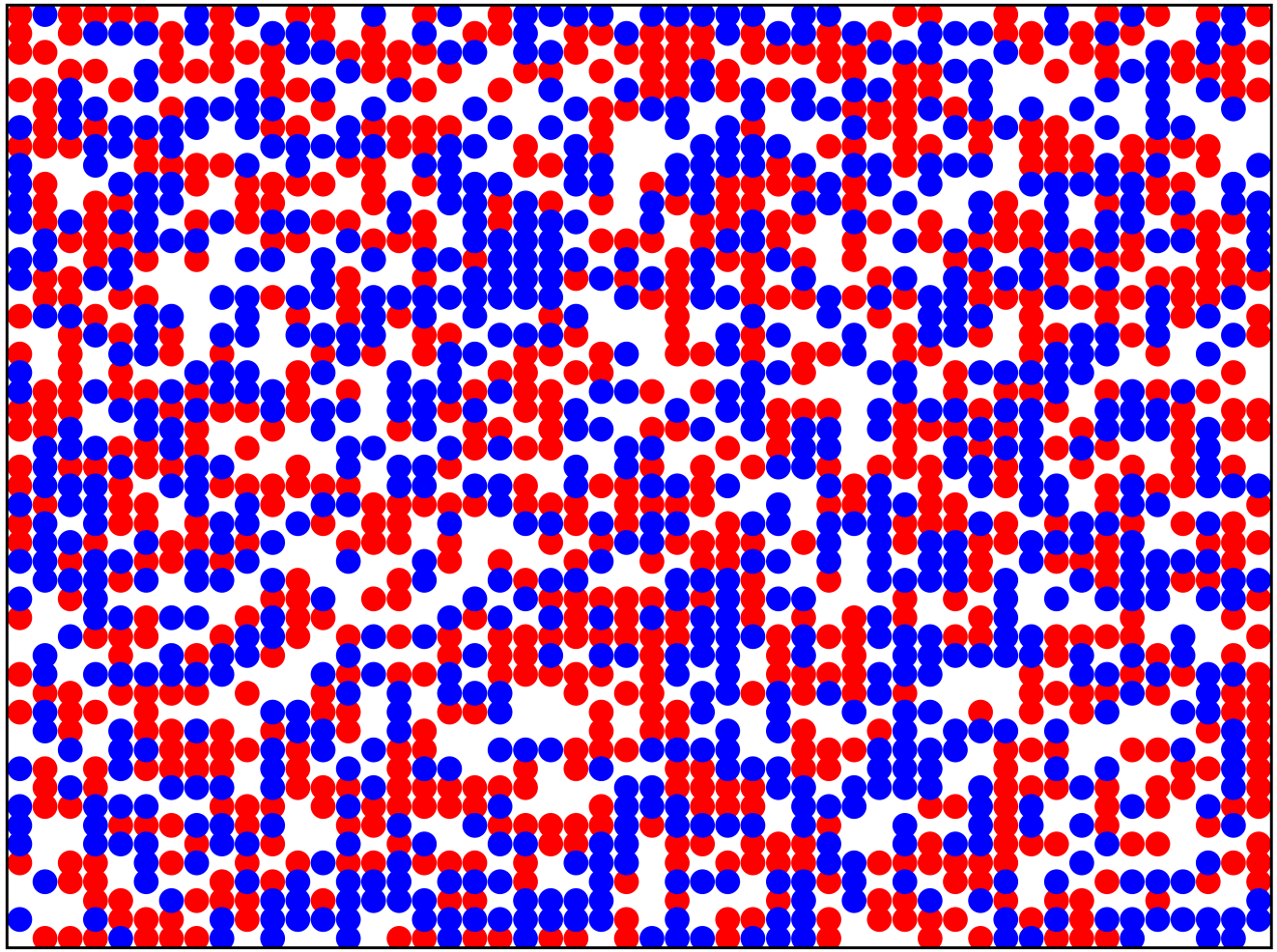
$r_{sim} = \frac{n_{sim}}{n_{neighbor}}$ if $n_{neighbor} > 0$, $r_{sim} = 1$ if $n_{neighbor} = 0$

where r_{sim} is similarity ratio, n_{sim} is the number of neighbors belonging to the same group, $n_{neighbor}$ is the total number of occupied houses in the neighborhood.

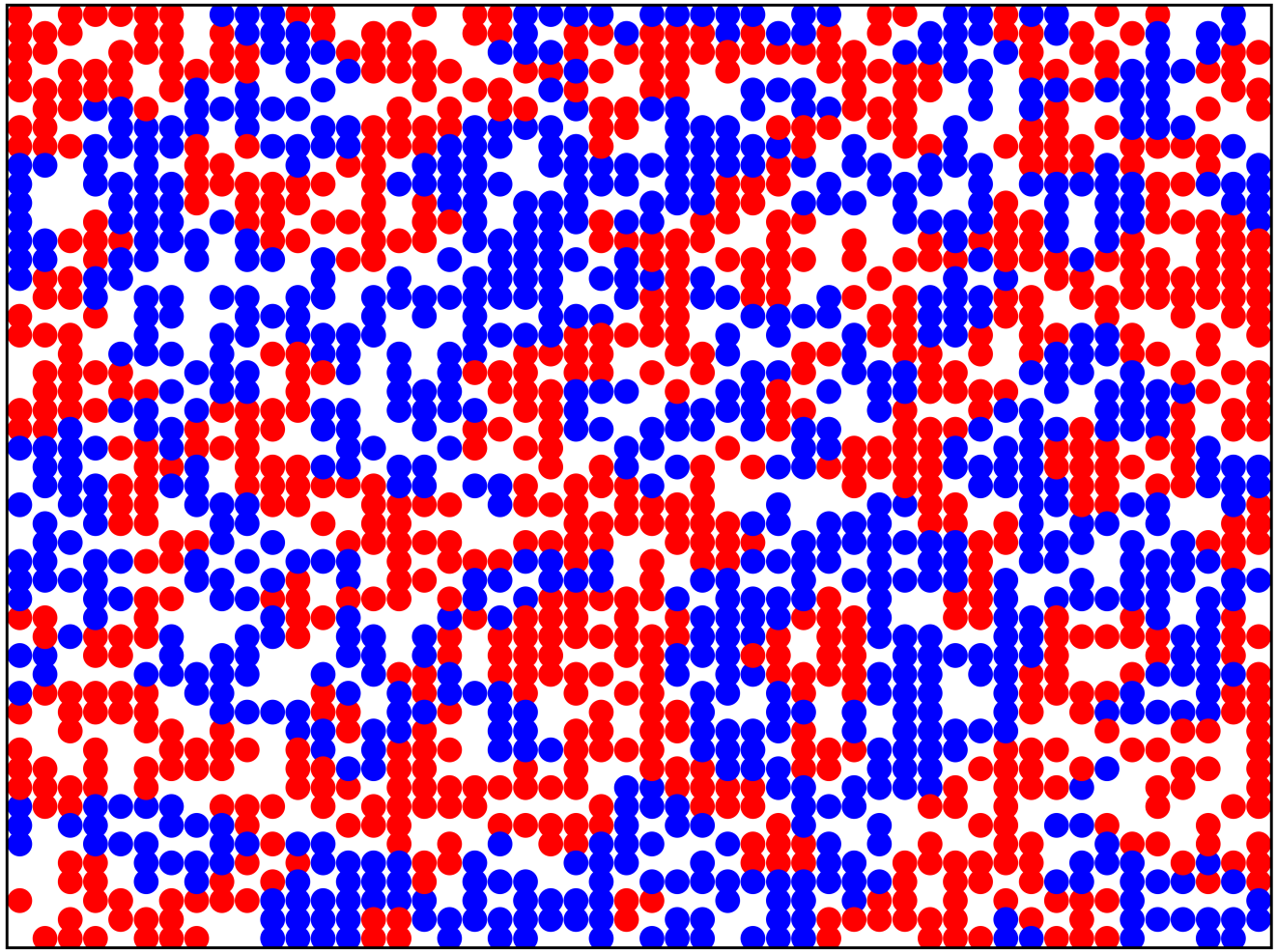
Similarity threshold

Similarity threshold represents what is the minimum percentage of neighbors belonging to the same group as the agent (i.e. how intolerant the agent is).
If this requirement is satisfied, then the agent will do nothing. Otherwise he will move to an unoccupied house, where similarity ratio exceeds or reaches similarity threshold. If none of the houses satisfy this requirement, then the agent moves to a house with maximum similarity ratio.

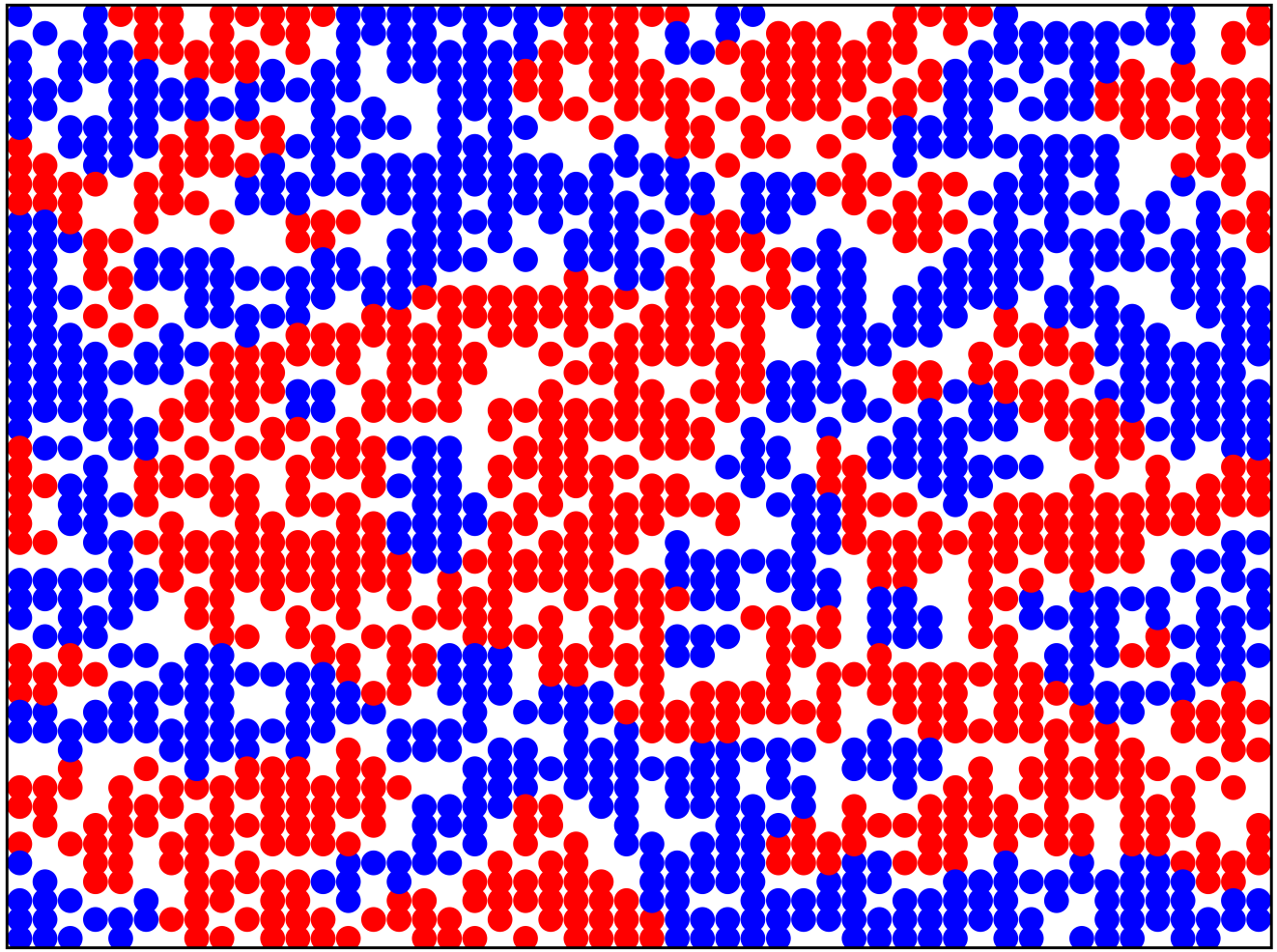
Schelling Model with 2 colors: Initial State



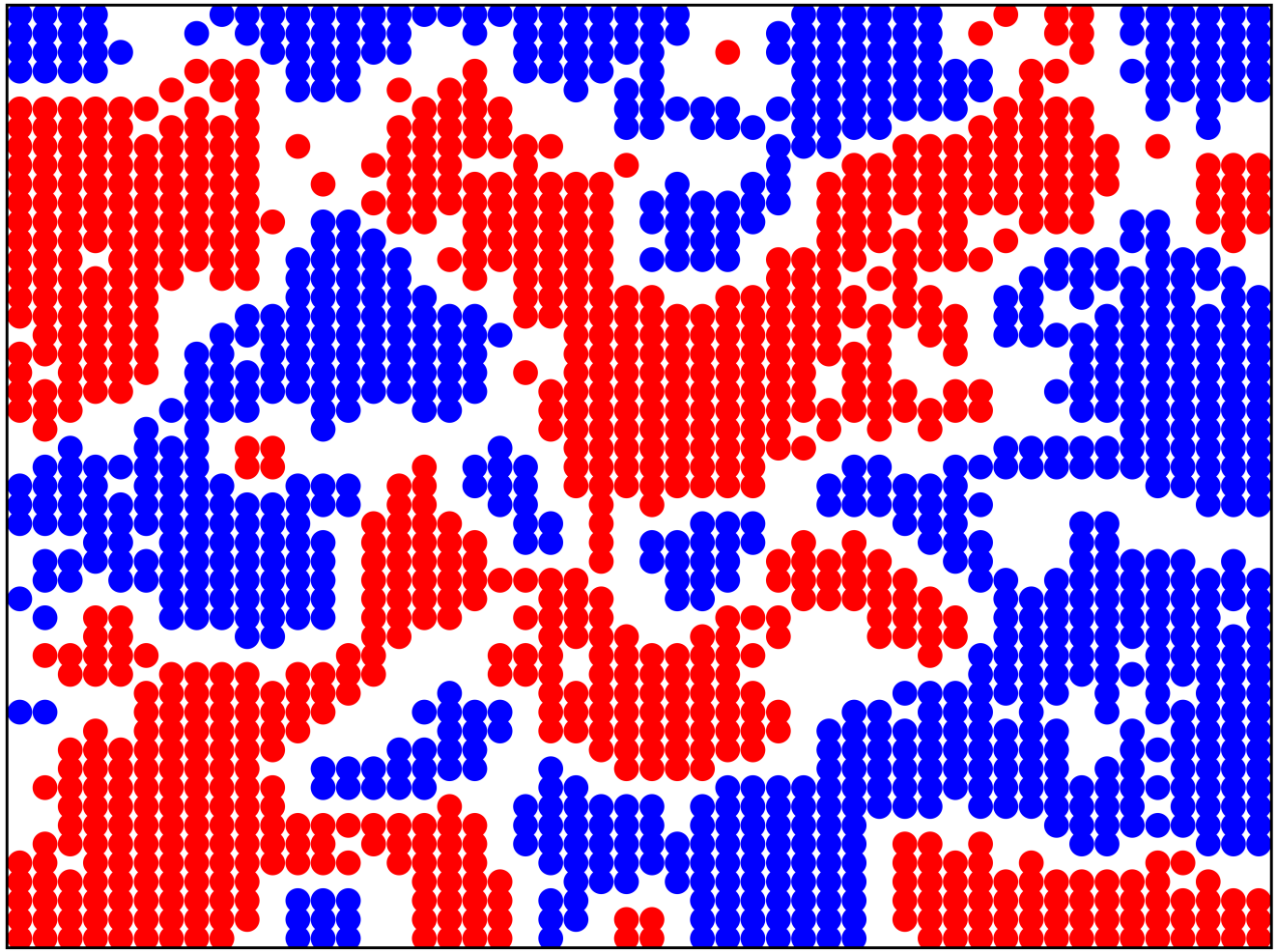
Schelling Model with 2 colors: Final State with Similarity Threshold 30%



Schelling Model with 2 colors: Final State with Similarity Threshold 50%

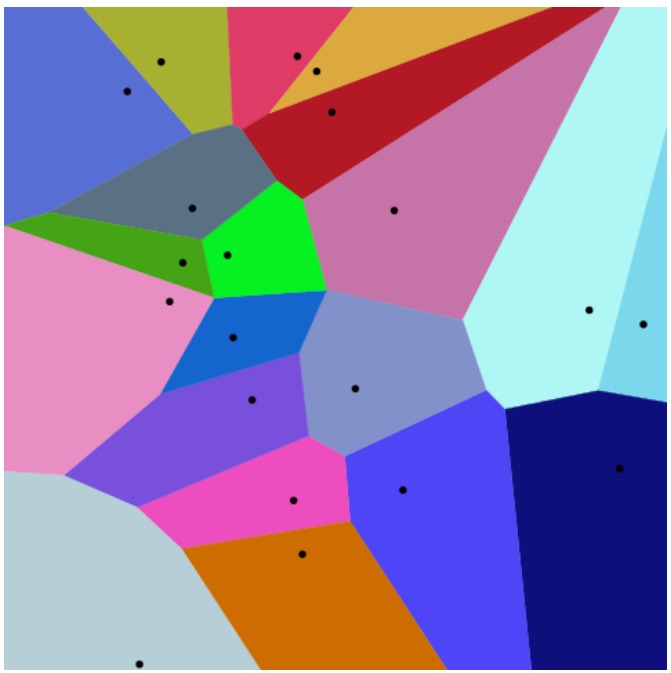


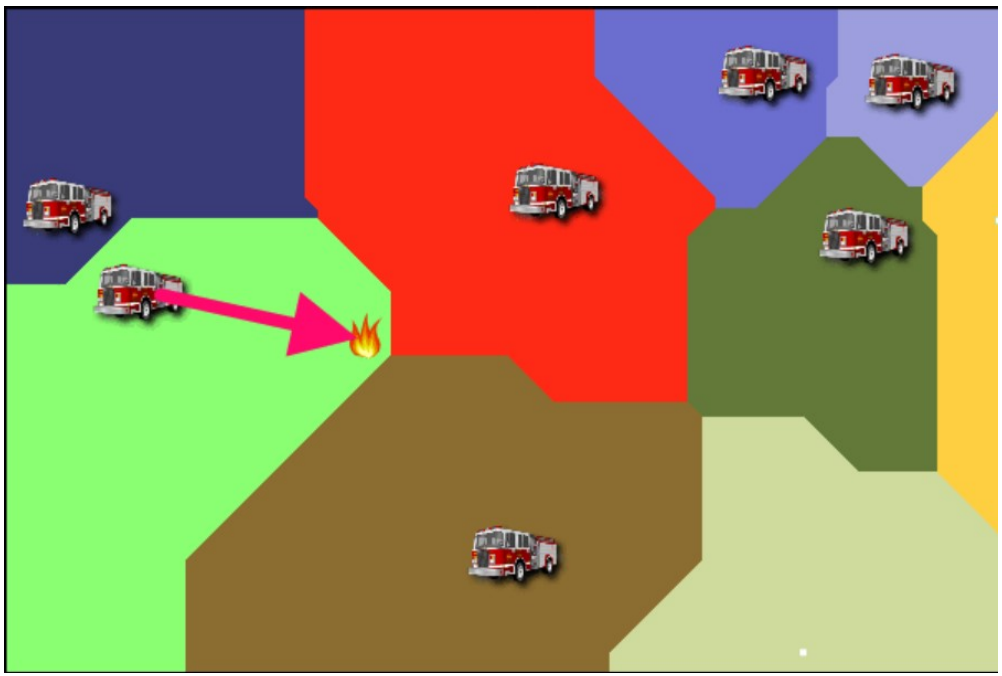
Schelling Model with 2 colors: Final State with Similarity Threshold 75%



Voronoi Diagram

The partitioning of a plane with n points into convex polygons such that each polygon contains exactly one generating point and every point in a given polygon is closer to its generating point than to any other.

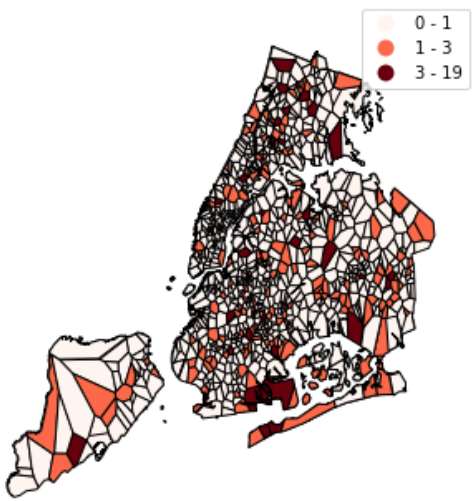


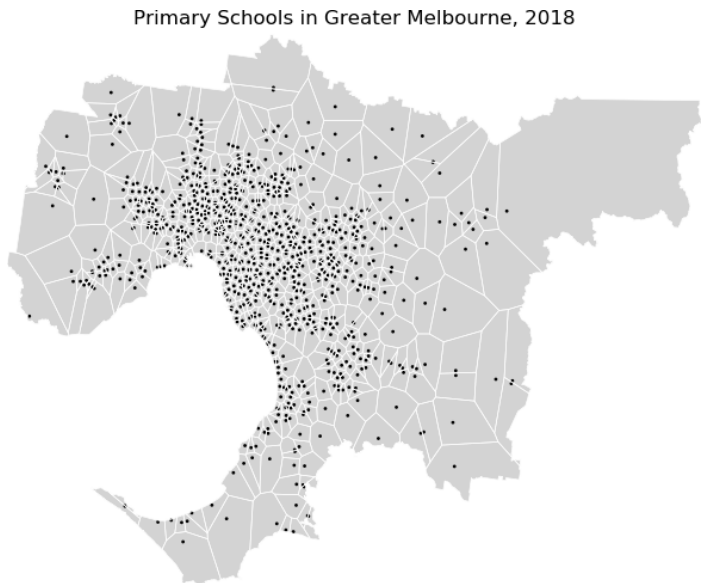


Sources: https://en.wikipedia.org/wiki/Voronoi_diagram/media/File : Euclidean_Voronoi_diagram.svg
https://www.codingame.com/playgrounds/243/voronoi-diagrams/what- are-voronoi-diagrams

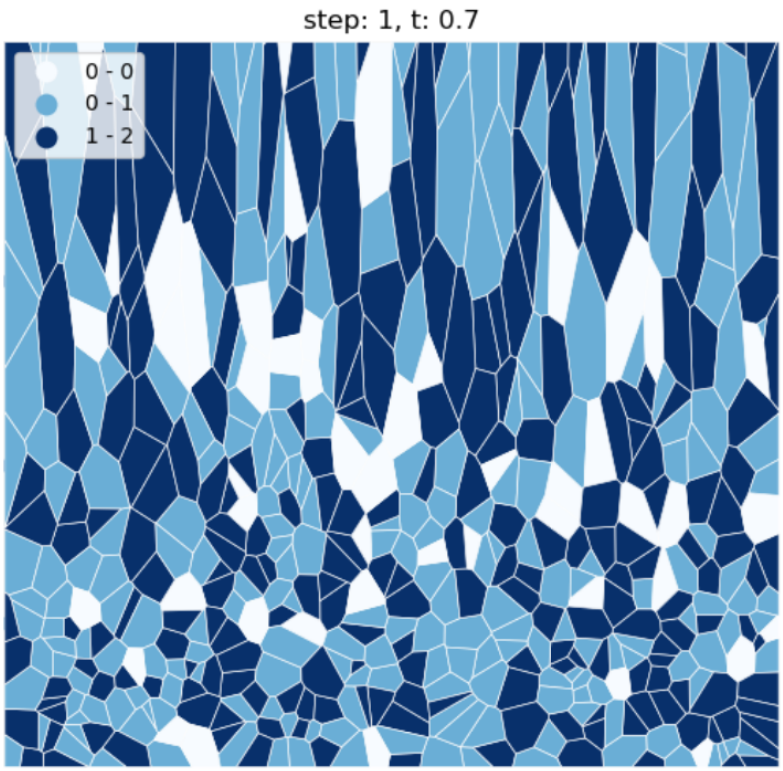
Geopandas

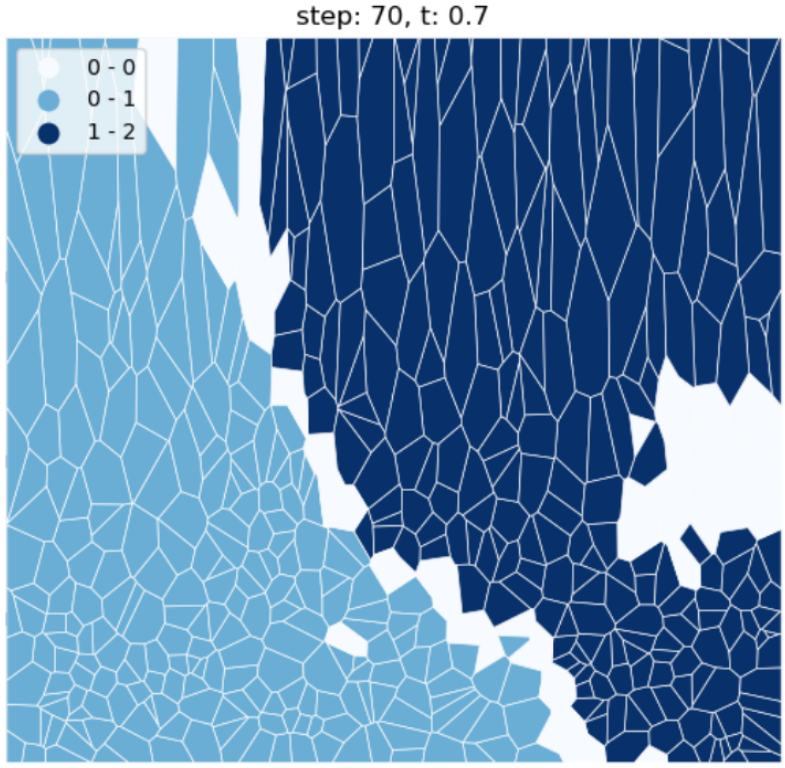
```
import geopandas as gpd
import geoplot as gplt
import geoplot.crs as gcrs
import pandas as pd
import matplotlib.pyplot as plt

melbourne = gpd.read_file(gplt.datasets.get_path('melbourne'))
melbourne_primary_schools = gpd.read_file(gplt.datasets.get_path('melbourne_schools')
    .query('School_Type == "Primary"')


ax = gplt.voronoi(
    melbourne_primary_schools, clip=melbourne, linewidth=0.5, edgecolor='white',
    projection=gcrs.Mercator()
)
gplt.polyplot(melbourne, edgecolor='None', facecolor='lightgray', ax=ax)
gplt.pointplot(melbourne_primary_schools, color='black', ax=ax, s=1, extent=melbourne
plt.title('Primary Schools in Greater Melbourne, 2018')
# plt.savefig("melbourne-schools.png", bbox_inches='tight', pad_inches=0)
plt.show()
```





Schelling Model with Voronoi Diagram





Thank You for Your Attention!