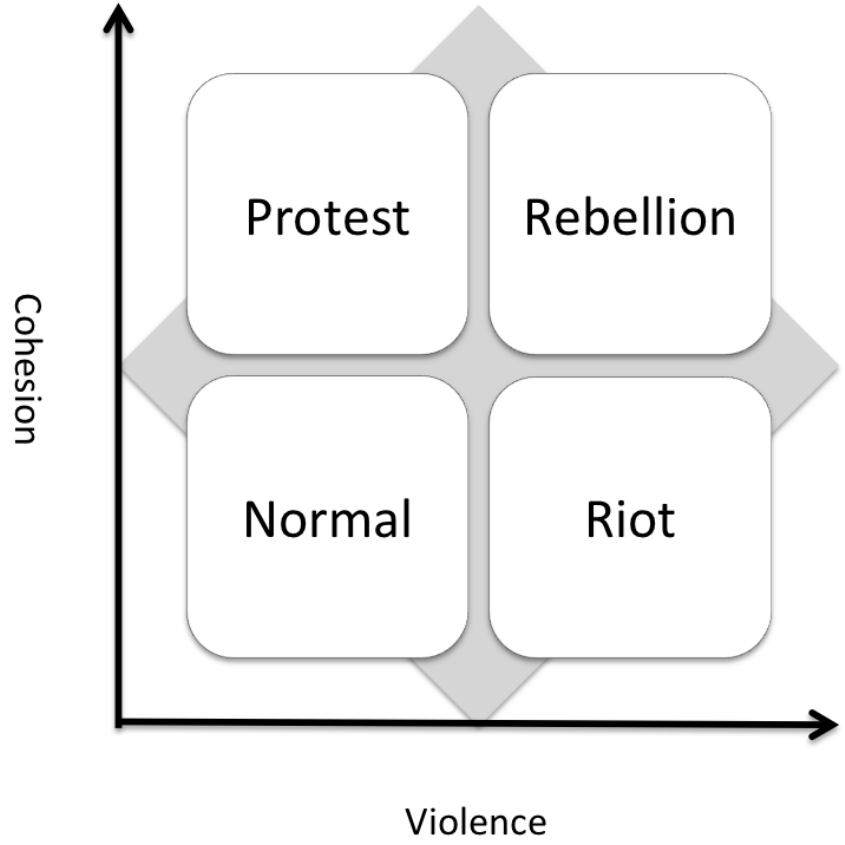
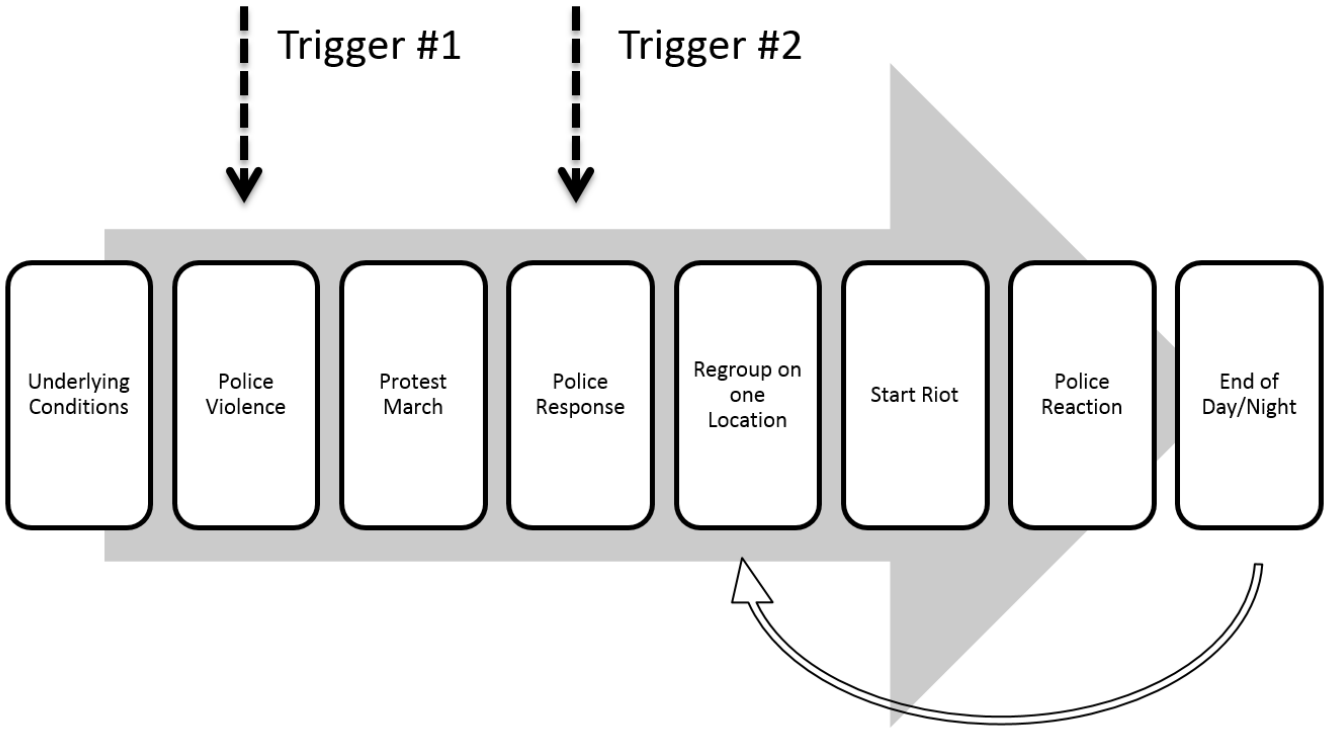
Riot Modelling

Jelte Mense

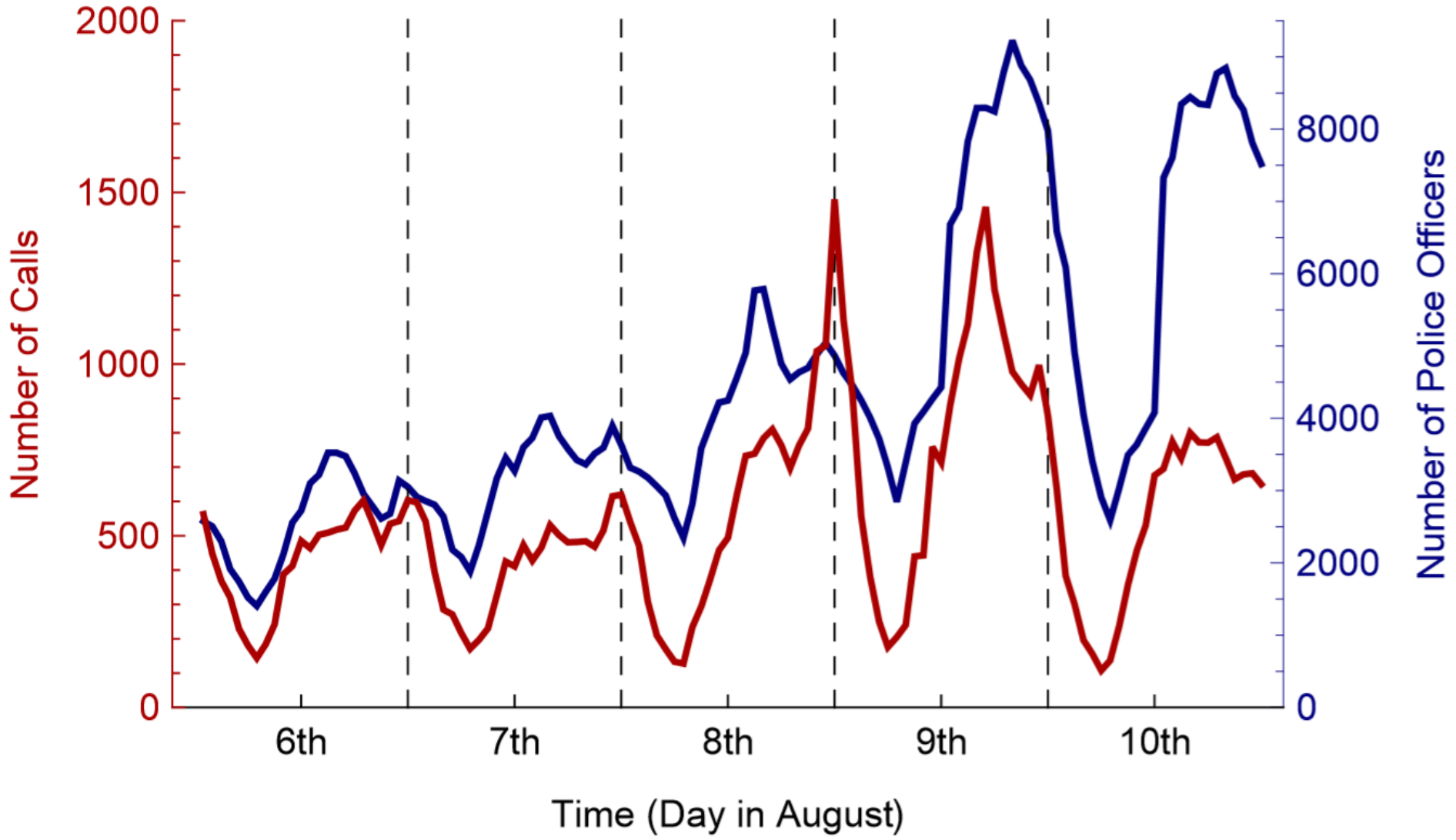
Definitions



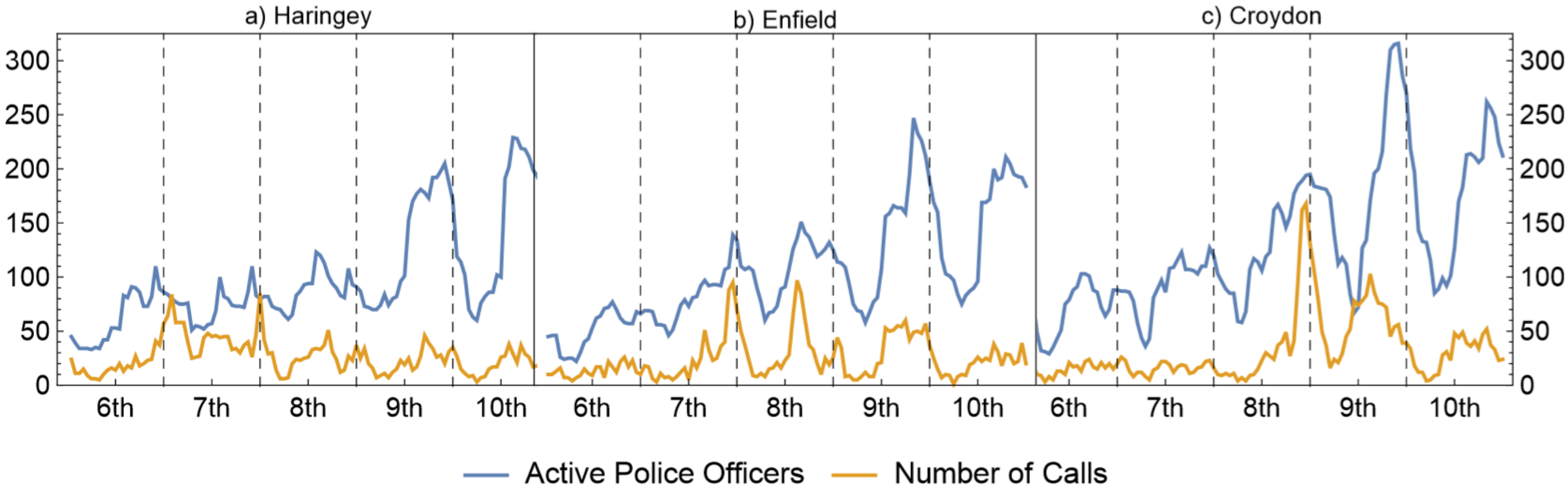
Generic Riot Timeline



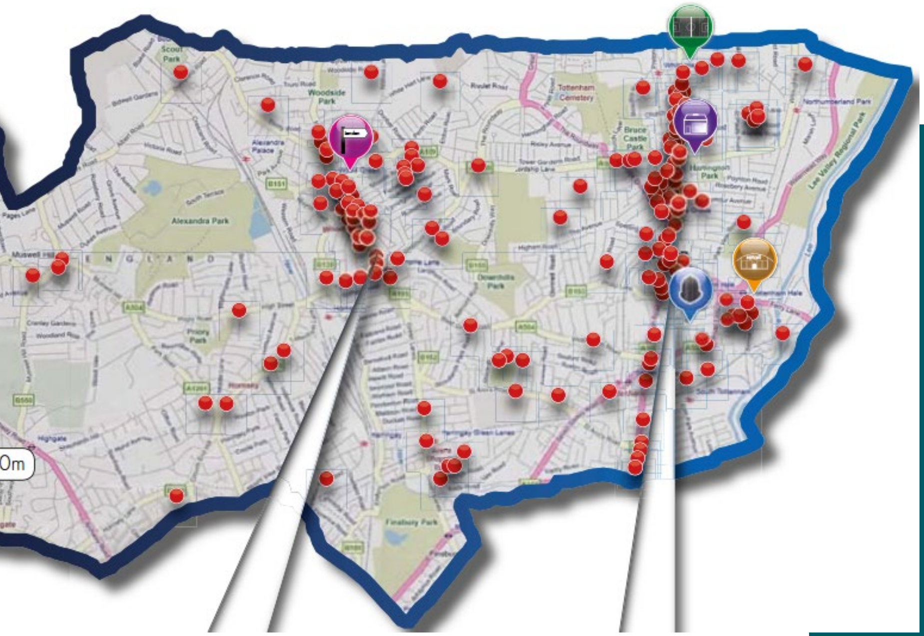
London Data

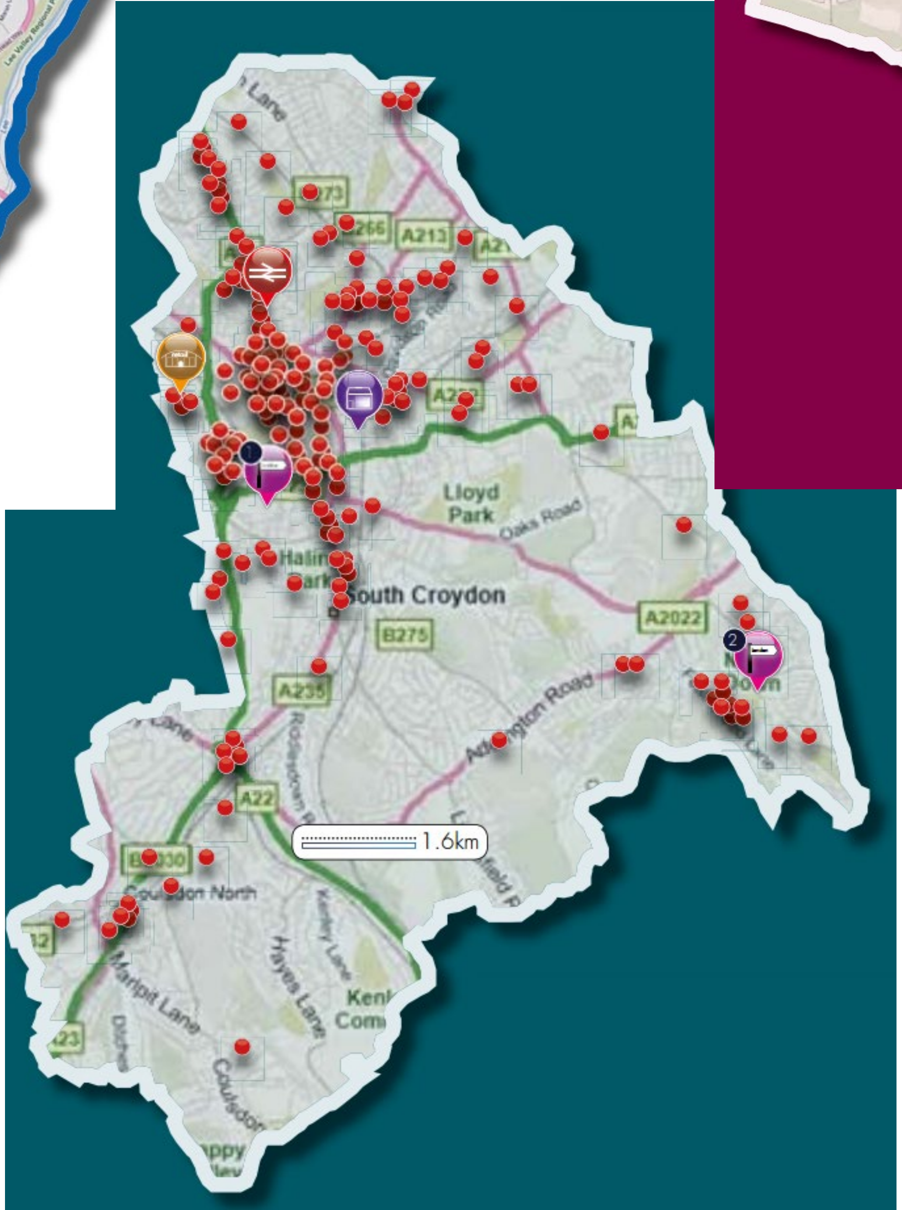

2000
1500
1000
500
0
Number of Calls
8000
6000
4000
2000
0
Number of Police Officers
6th
7th
8th
9th
10th
Time (Day in August)

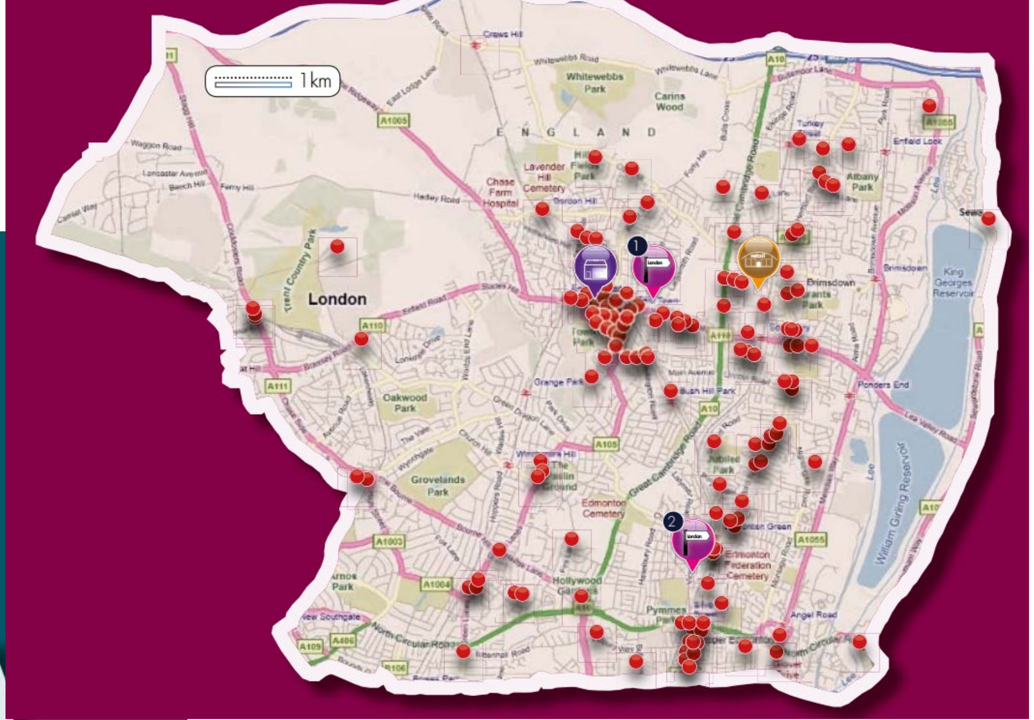
Individual Boroughs



London geography




A213
Lloyd Park
Oaks Road
South Croydon
B275
A2022
A235
Addington Road
A22
1.6km
Coulsdon North


1km
E N G L A N D
London
Oakwood Park
Grovelands Park

Three models

1. Protests → Riot time and intensity

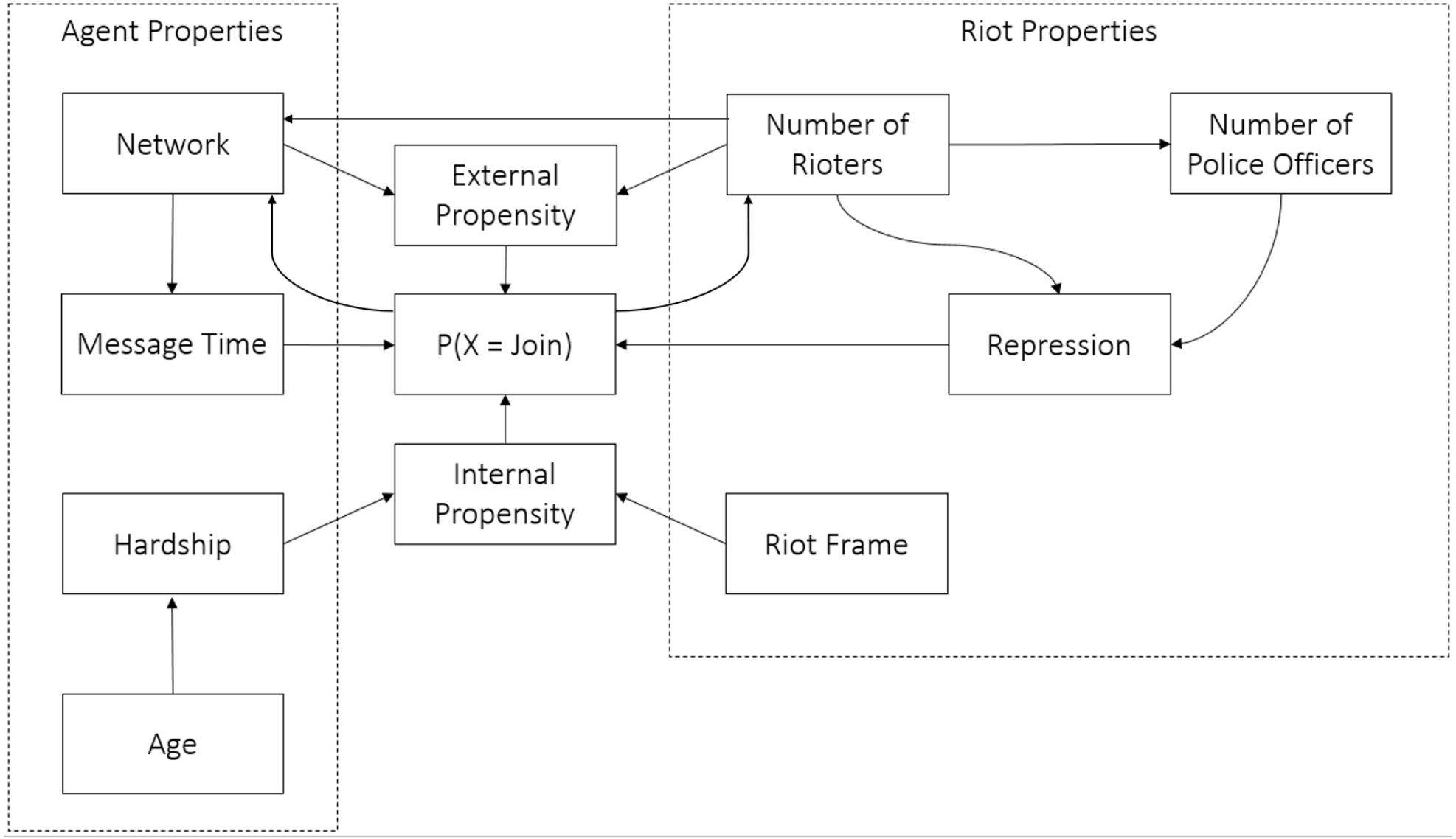
2. Social networks → Riot spread

3. Effect of demographic structures and segregation

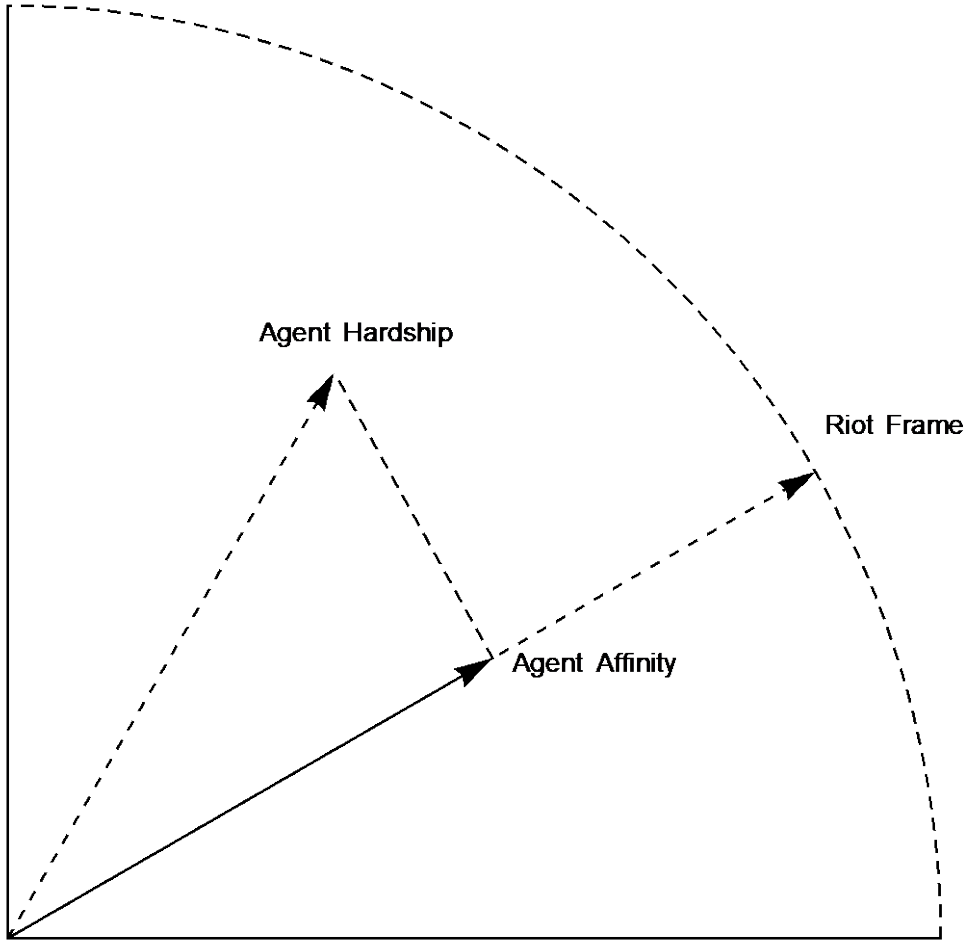
Every tick

- Only model potential rioters
- Agents can join
- Agents can leave
- Police responds

Join variables



Agent affinity



Join equations

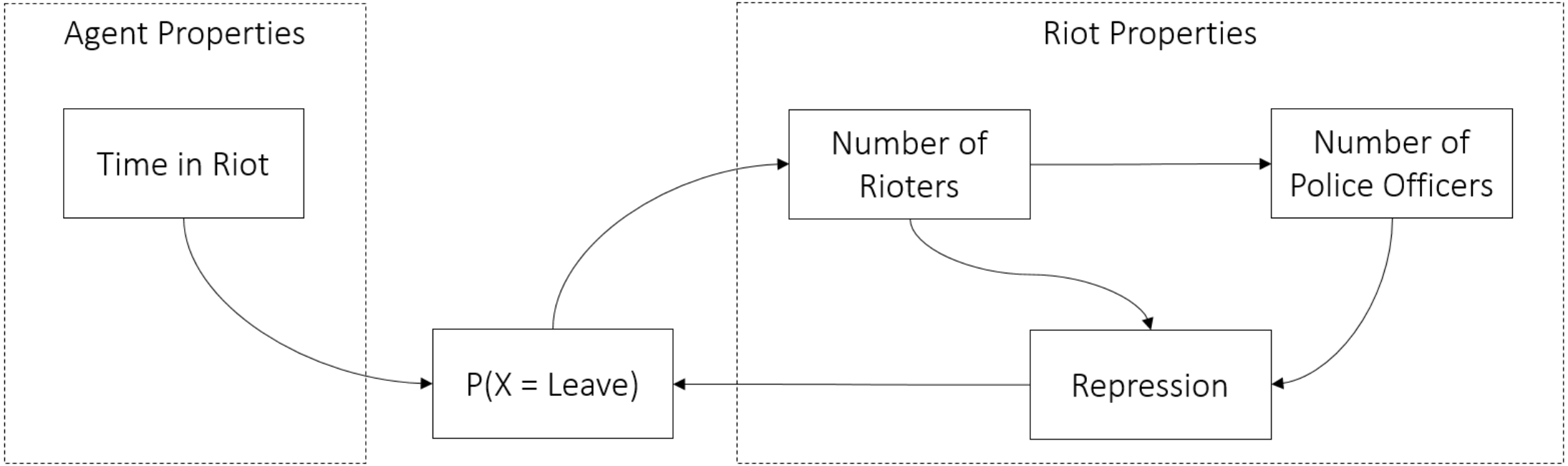
$$P(X = \text{communicate}) = \alpha \cdot e^{-\omega T_M},$$

$$E = \frac{e^{\beta \cdot C_R - \gamma}}{1 + e^{\beta \cdot C_R - \gamma}},$$

$$R = \frac{N_R}{N_R + \delta \cdot N_P}.$$

$$P(X = \text{join}) = R \cdot \frac{I + E}{2} \cdot e^{-\omega T_M}.$$

Leave variables



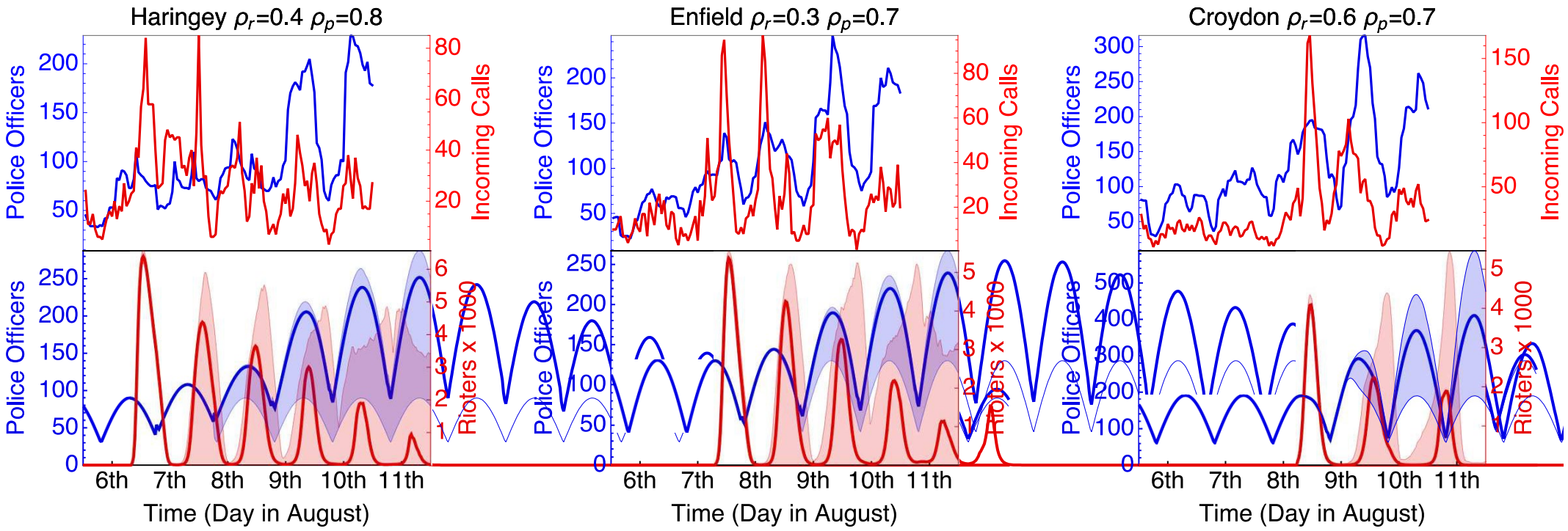
Leave equations

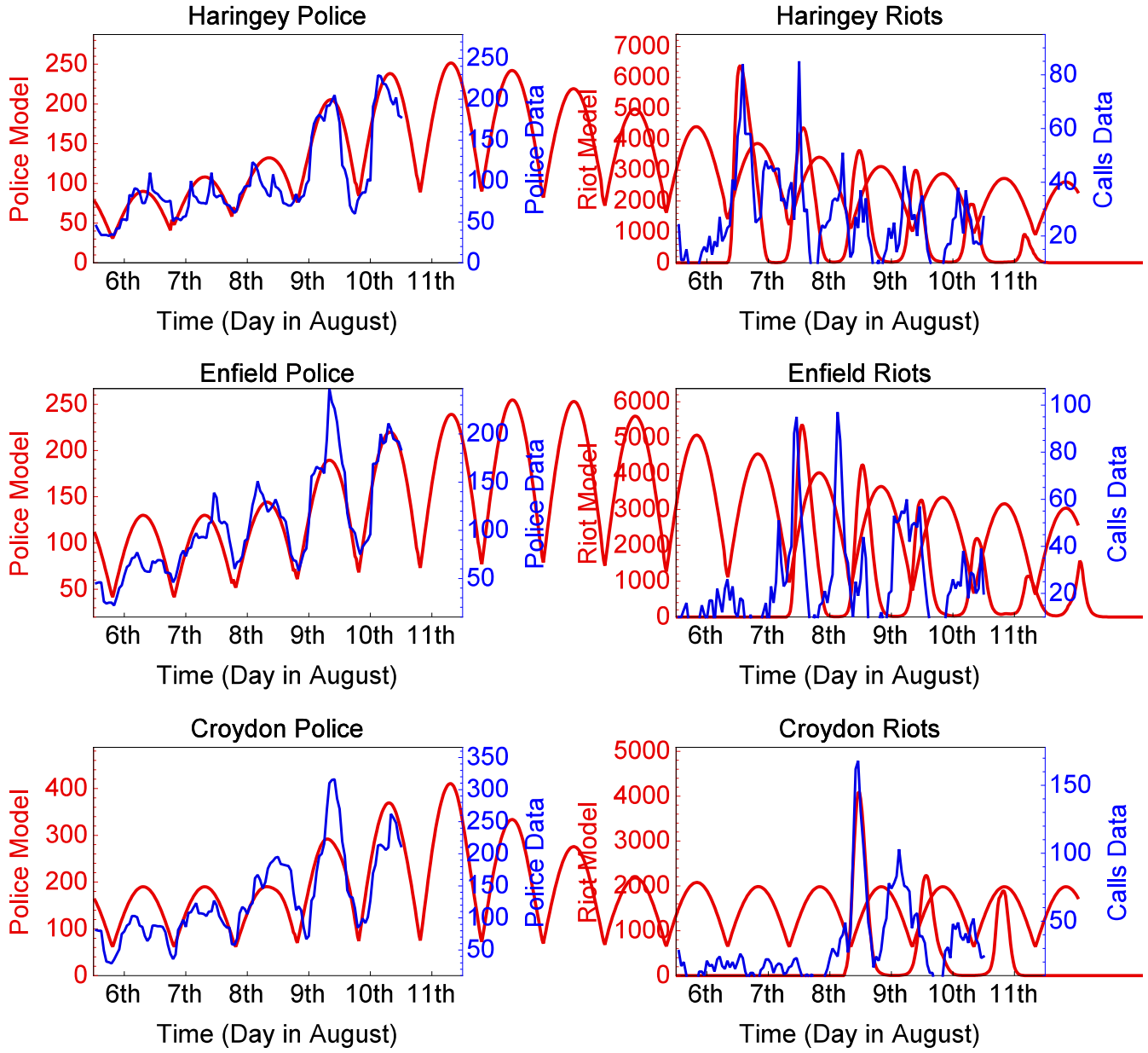
$$P(X = \text{leave}) \;=\; (1-R)(1-e^{-\varepsilon \cdot T_R}),$$

$$R \;=\; \frac{N_R}{N_R + \delta \cdot N_P}.$$

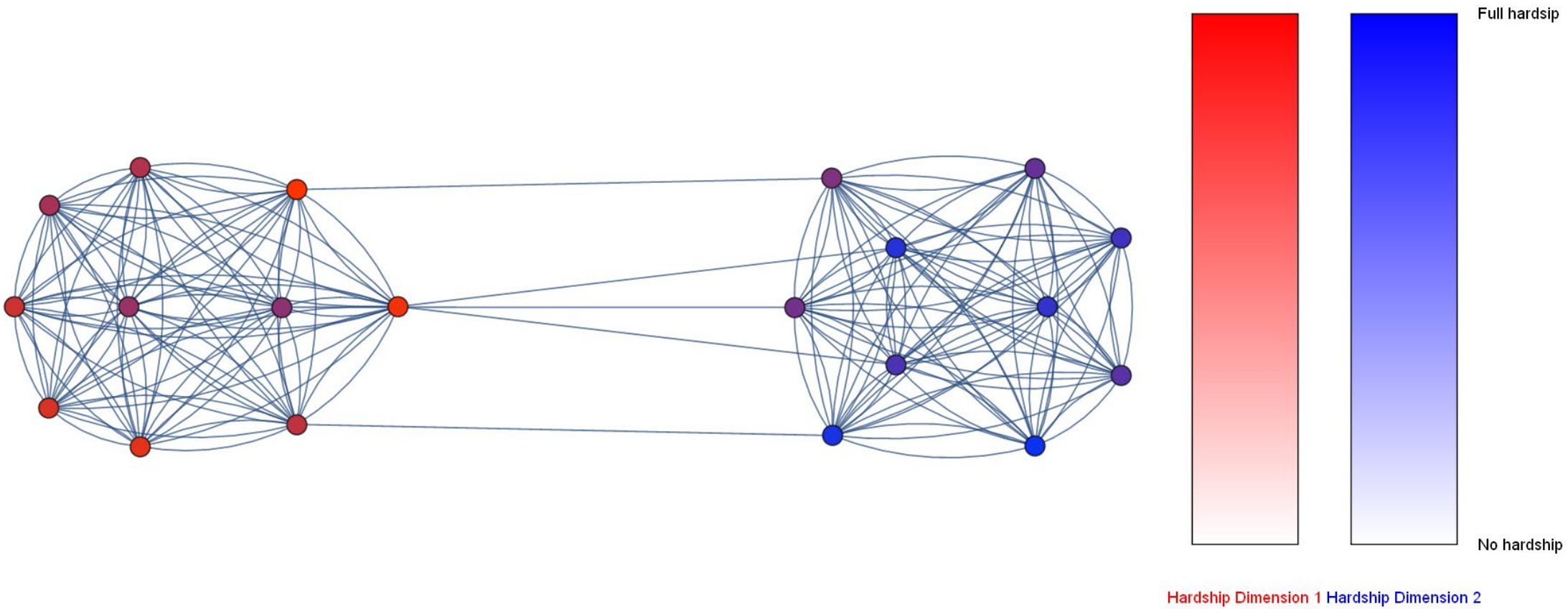
- Cooldown prevents rejoining

Calibration results

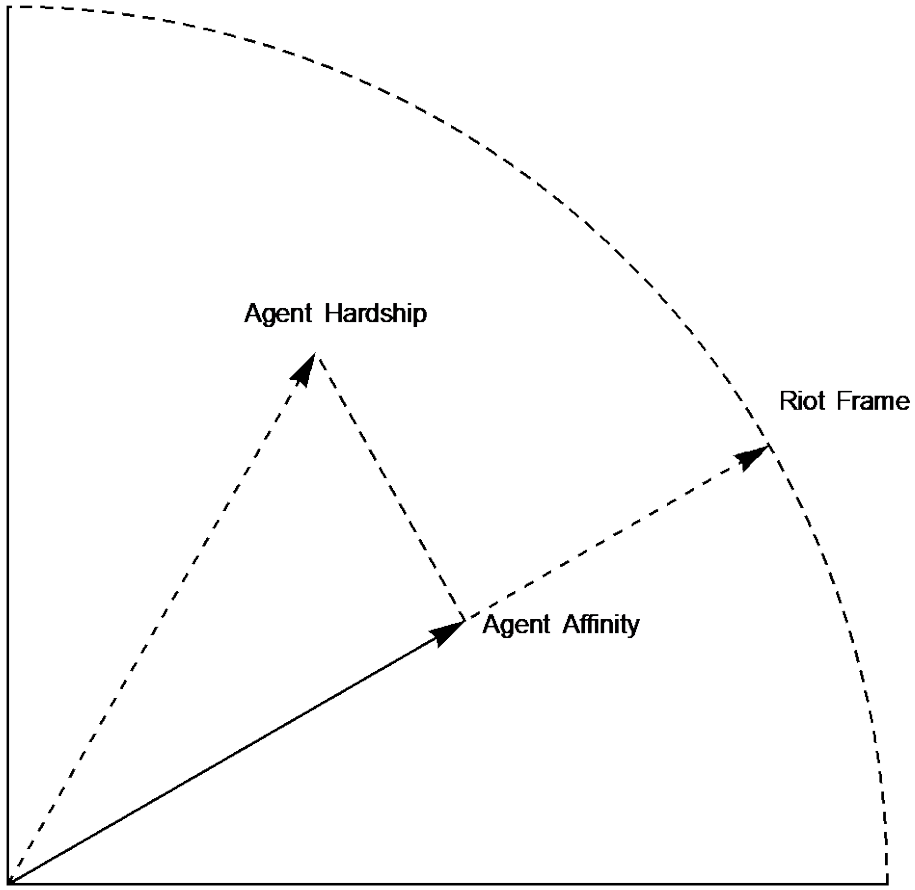


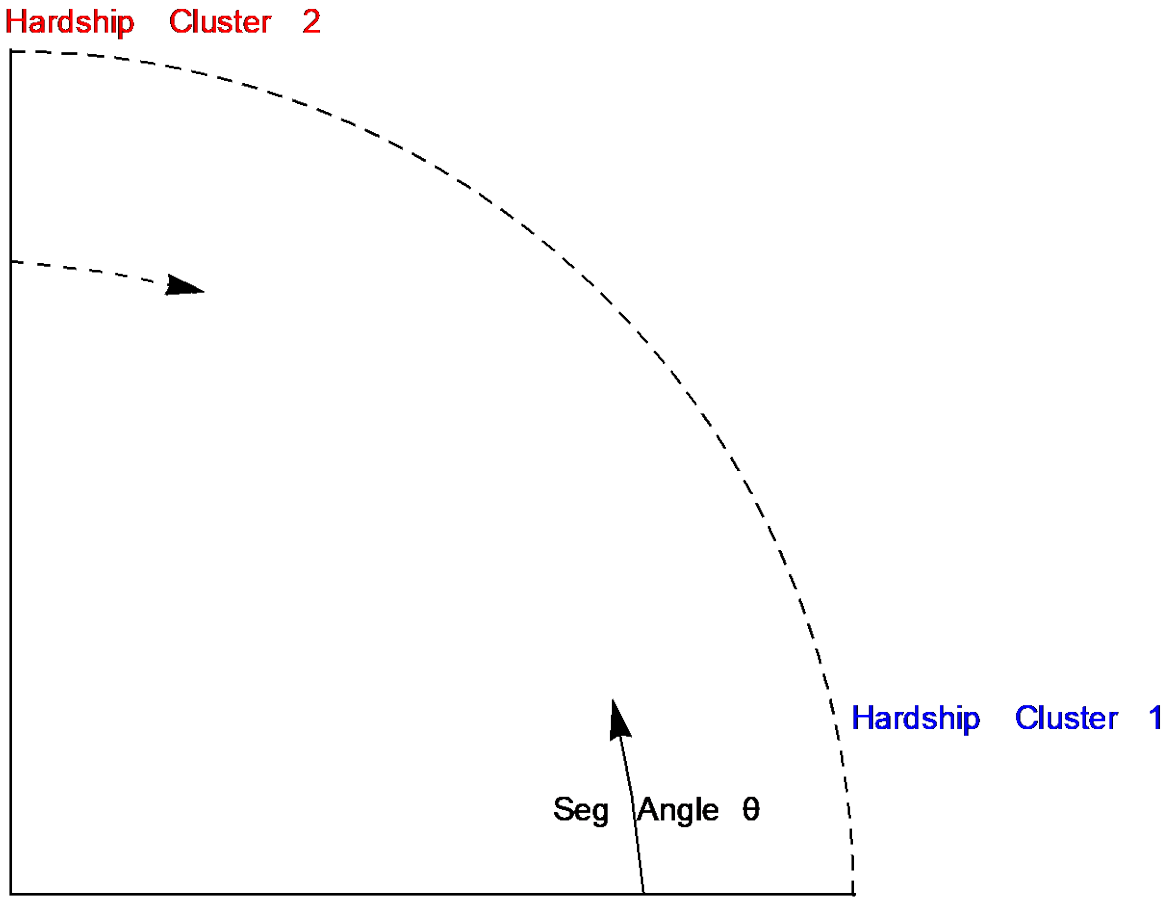

Haringey Police
Police Model
Police Data
Time (Day in August)
6th
7th
8th
9th
10th
11th
Haringey Riots
Riot Model
Calls Data
Enfield Police
Enfield Riots
Croydon Police
Croydon Riots

Research setup

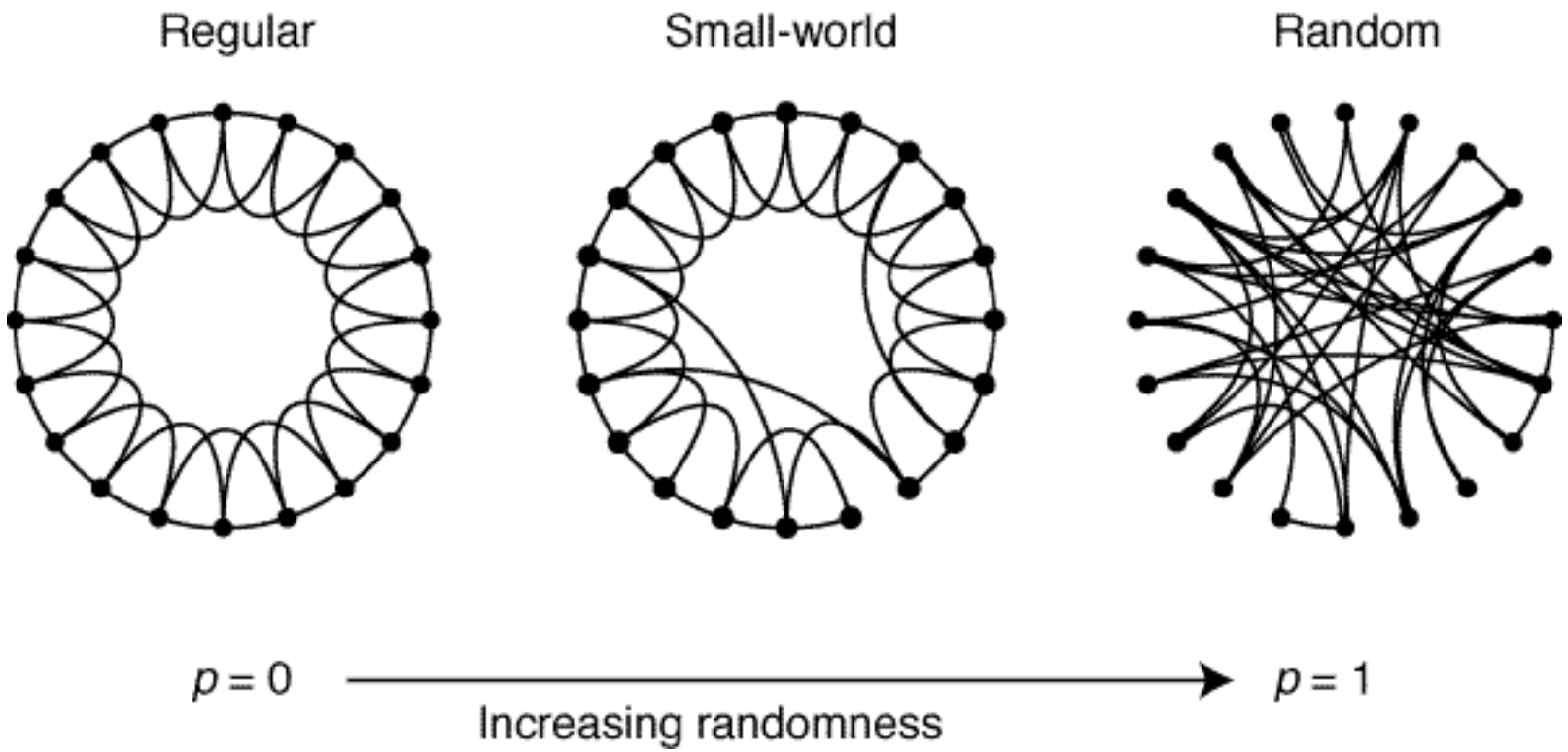


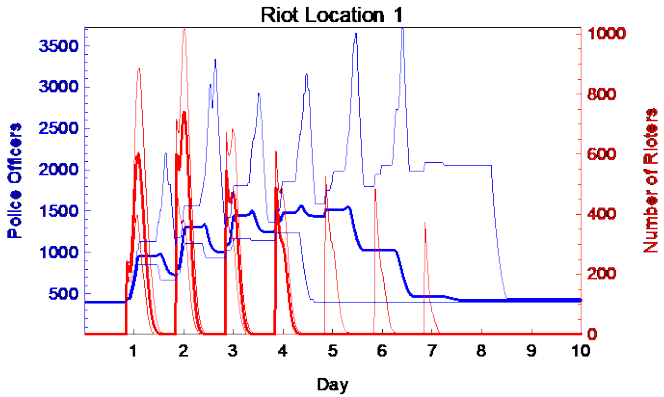
Hardship allocation

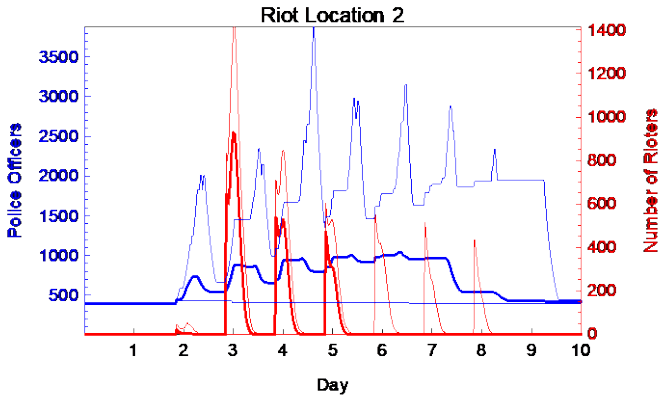


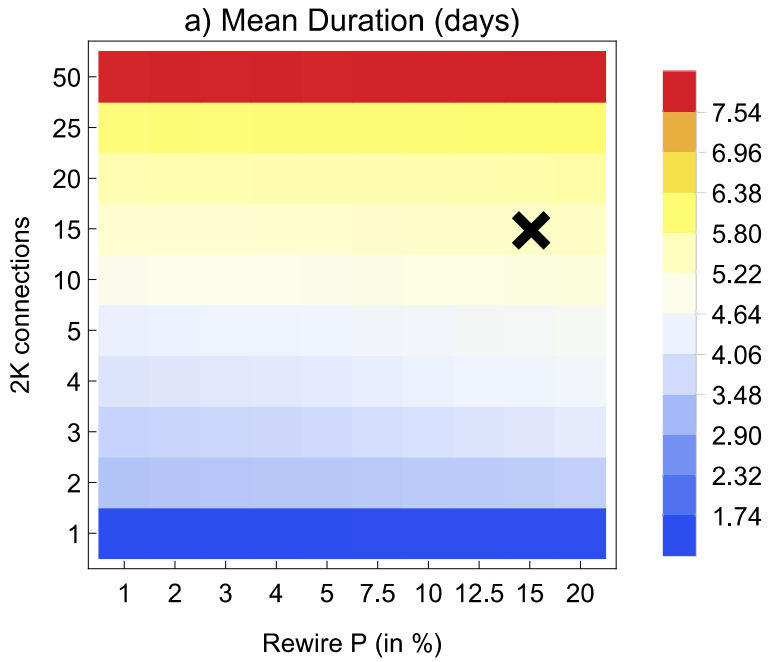


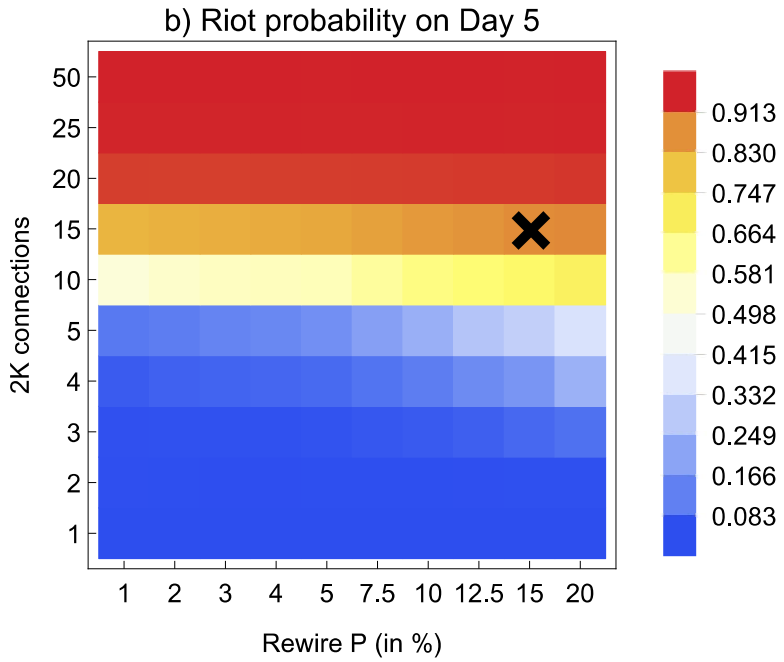
Small world network + variation

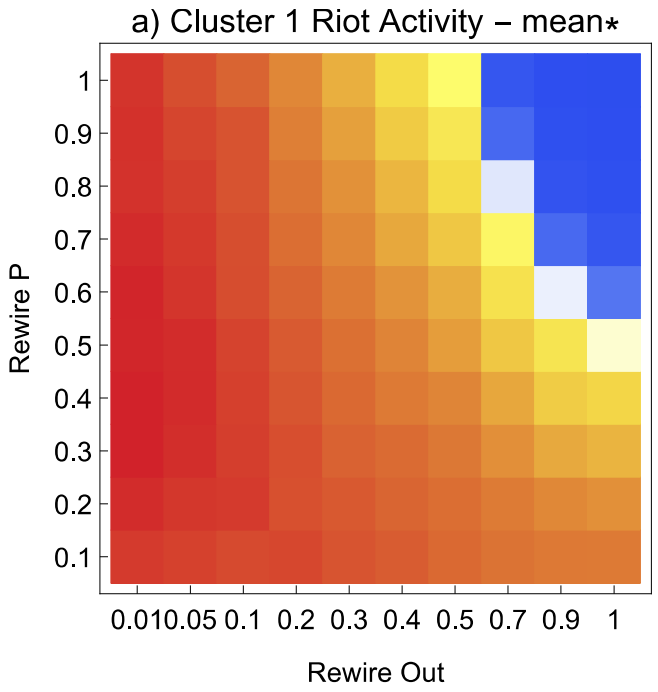



Riot Location 1
Police Officers
Number of Rioters
Day

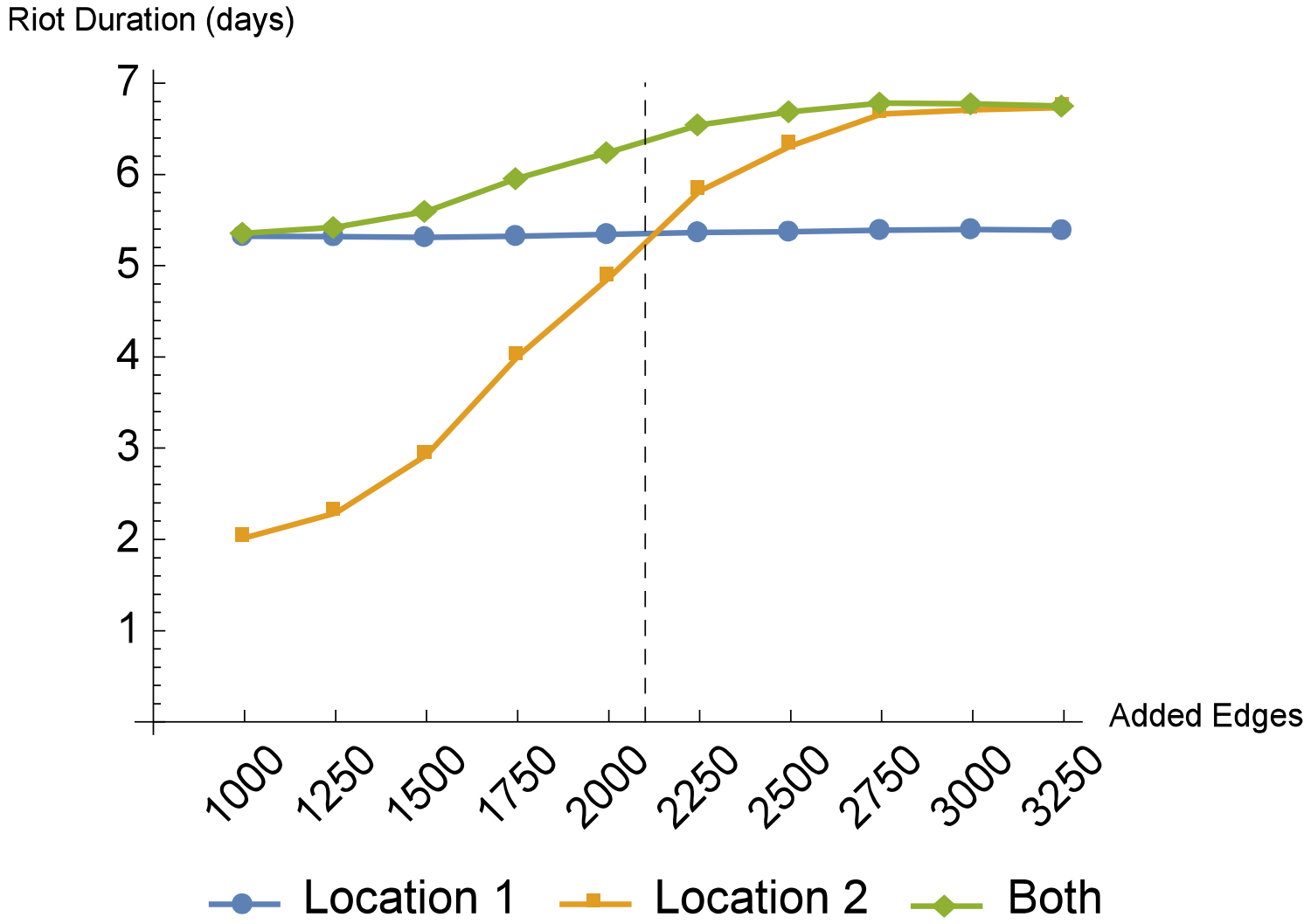

Riot Location 2
Police Officers
Number of Rioters
Day

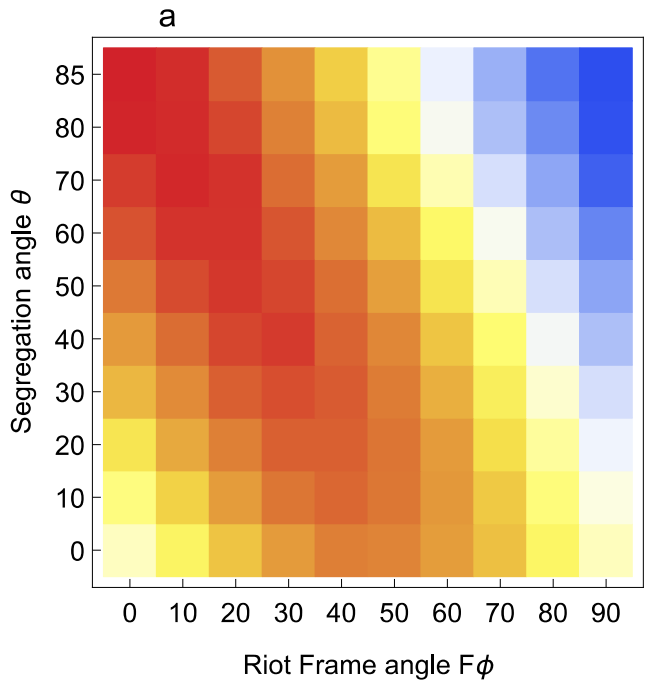

a) Mean Duration (days)
2K connections
Rewire P (in %)
7.54
6.96
6.38
5.80
5.22
4.64
4.06
3.48
2.90
2.32
1.74


b) Riot probability on Day 5
2K connections
Rewire P (in %)
0.913
0.830
0.747
0.664
0.581
0.498
0.415
0.332
0.249
0.166
0.083

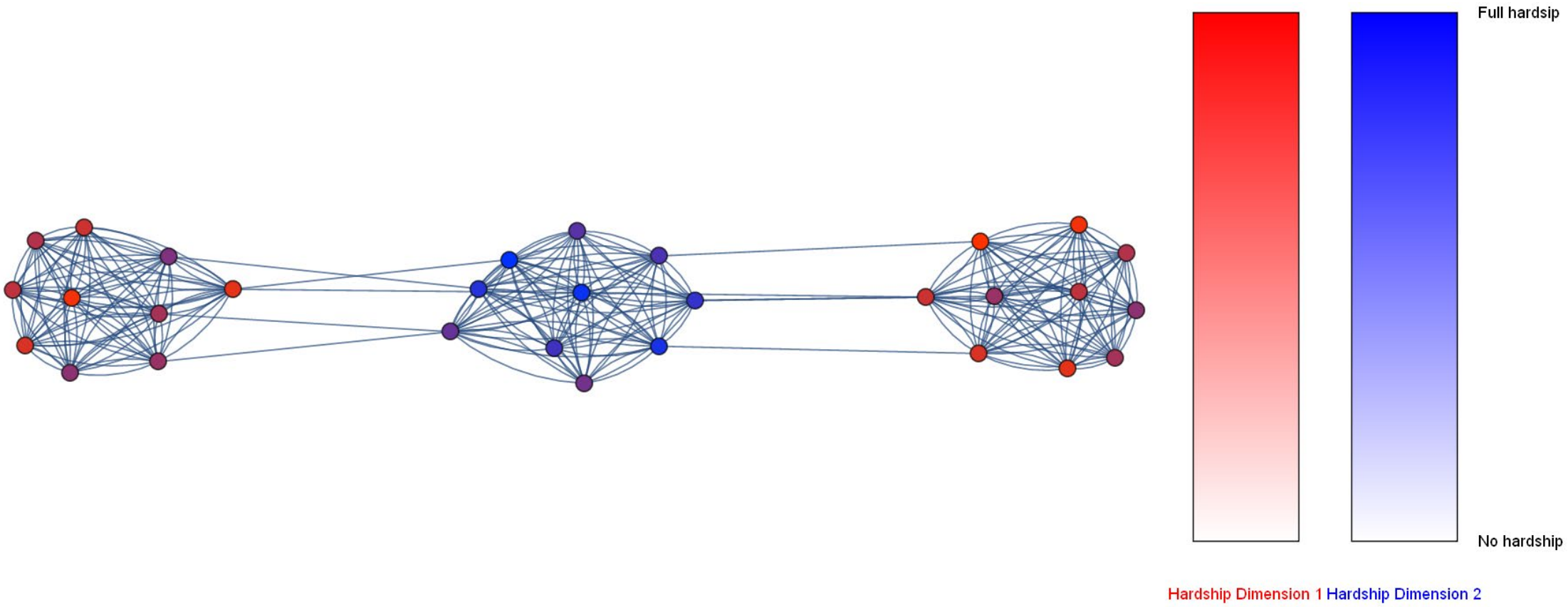

a) Cluster 1 Riot Activity – mean*
Rewire P
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.01 0.05 0.1 0.2 0.3 0.4 0.5 0.7 0.9 1
Rewire Out

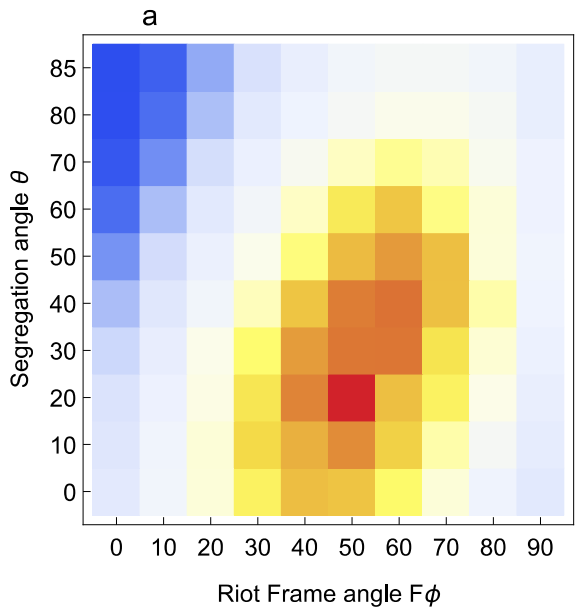
Constant N Edges



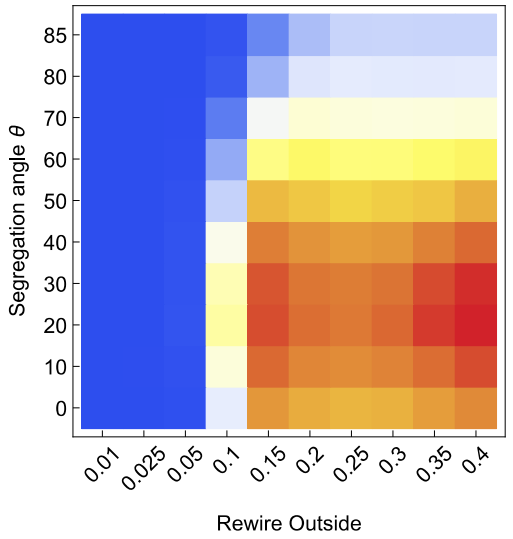

a
Segregation angle θ
85
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90
Riot Frame angle Fϕ

Riot spread in 3 clusters




a
Segregation angle θ
85
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90
Riot Frame angle Fϕ

a


Segregation angle θ
85
80
70
60
50
40
30
20
10
0
0.01
0.025
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Rewire Outside