The angular nature of road networks

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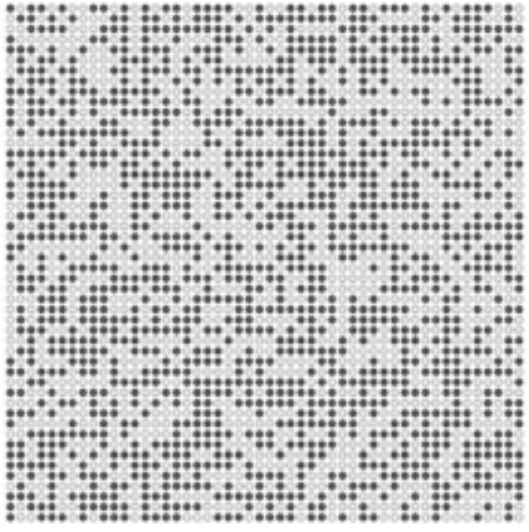
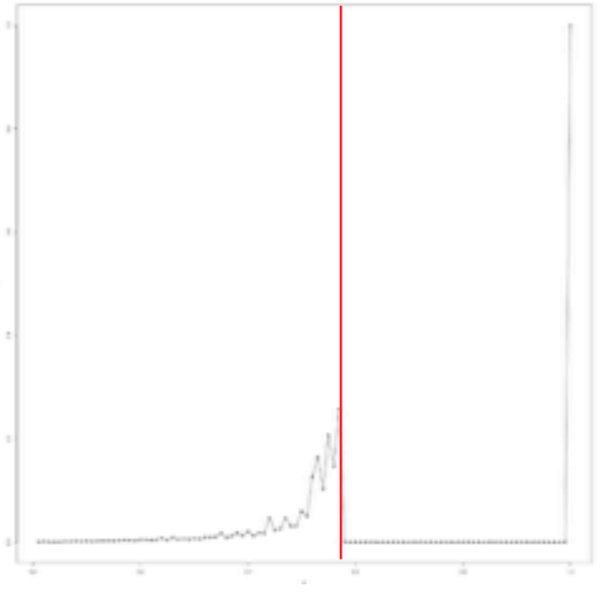
lattice



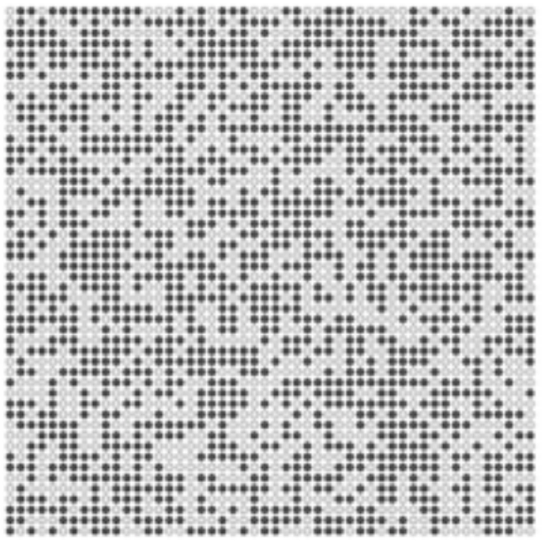
clusters

giant cluster

Probability of belonging
to the infinite cluster

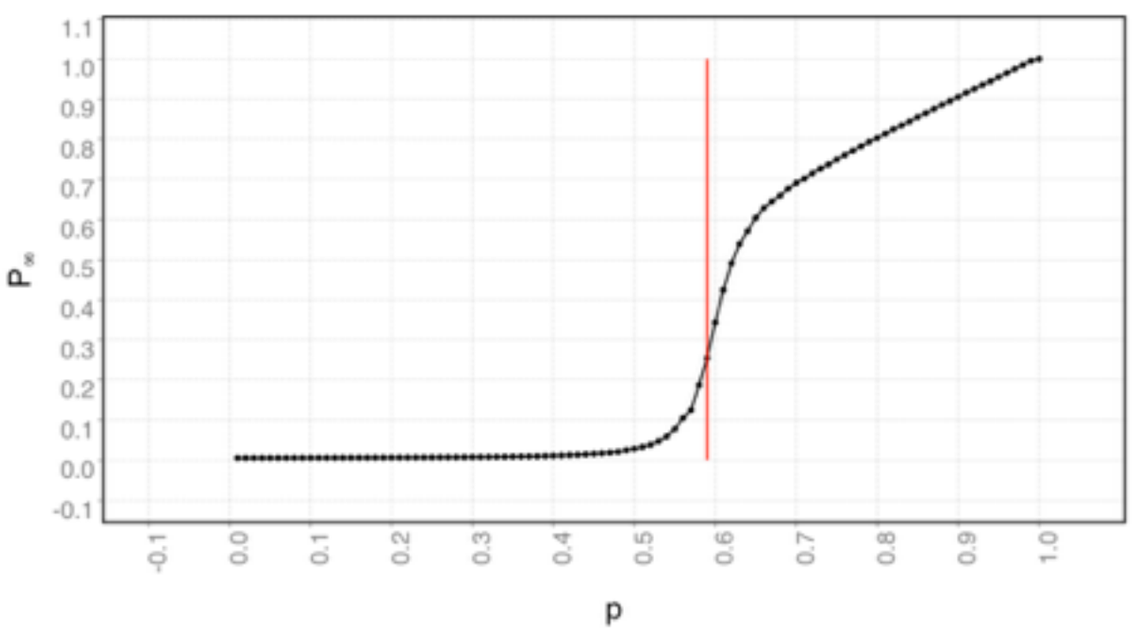


p_c
critical probability

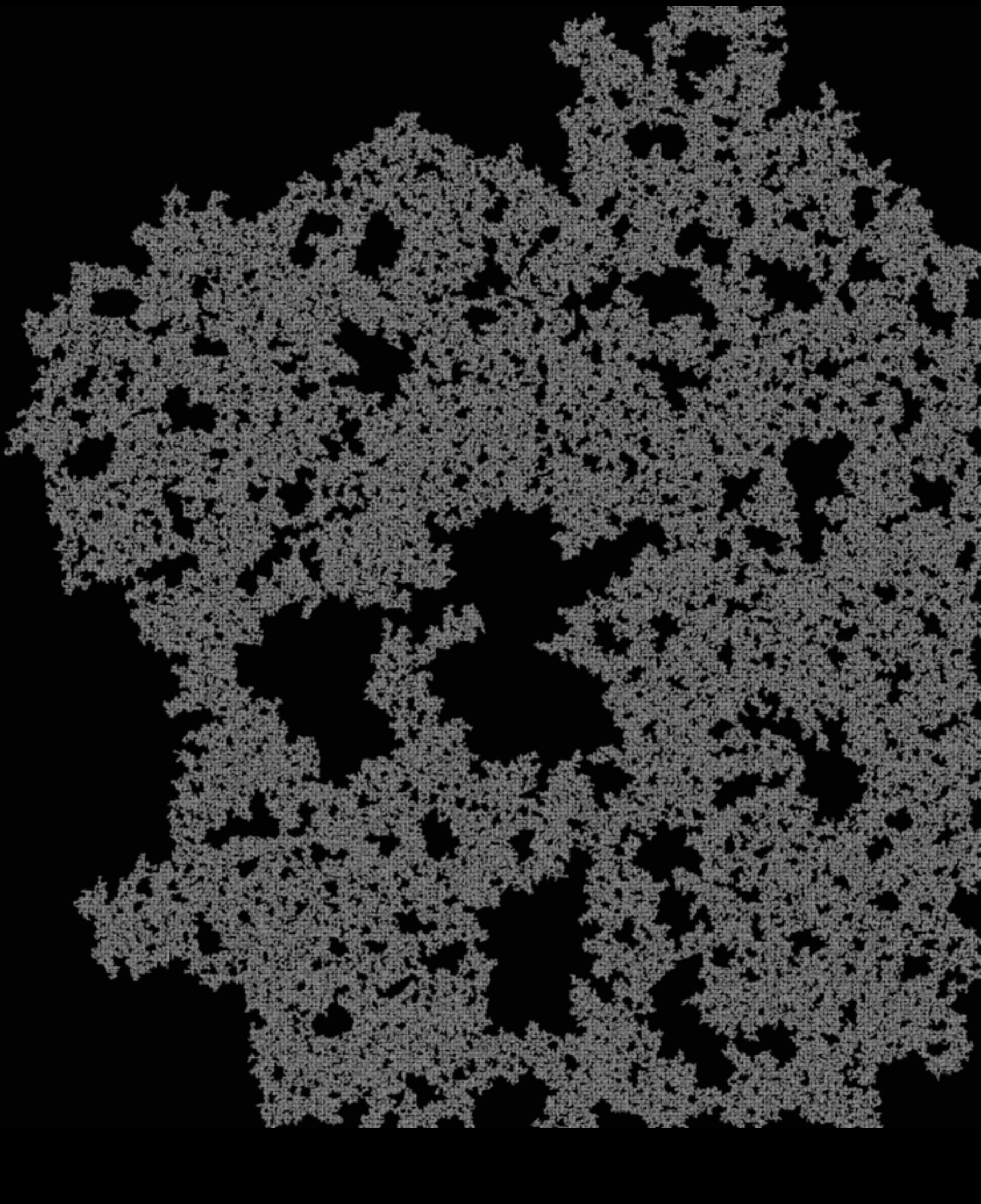


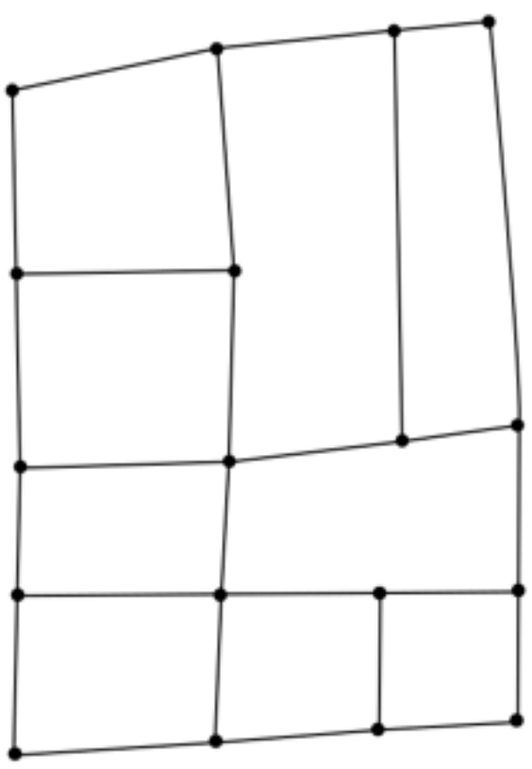
lattice at p_c

giant cluster at p_c

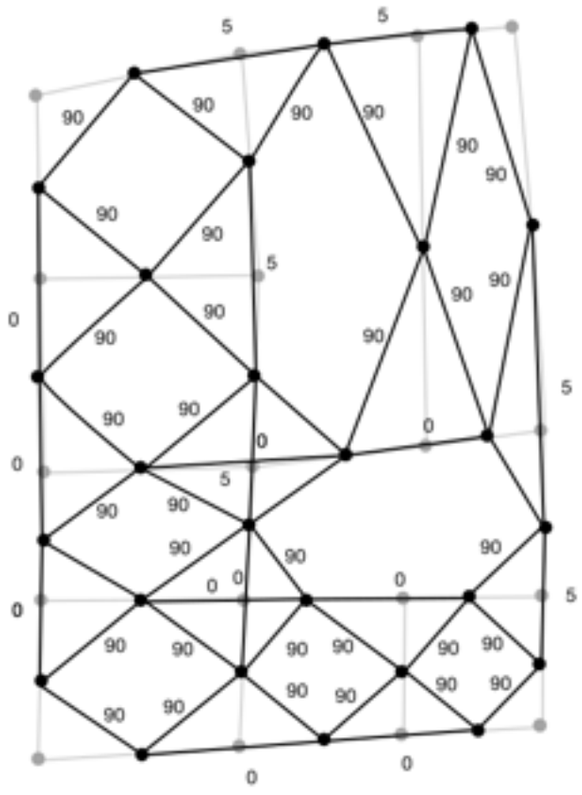


averaged probability of belonging
to the infinite cluster

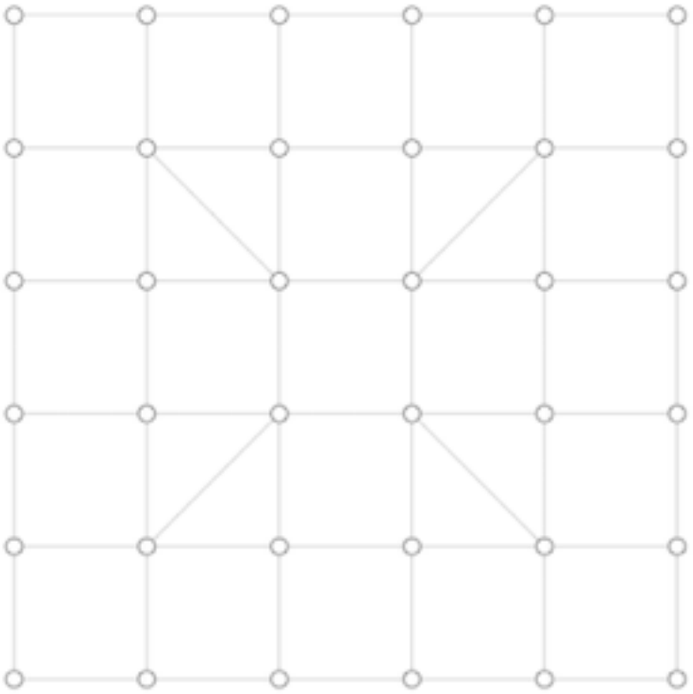




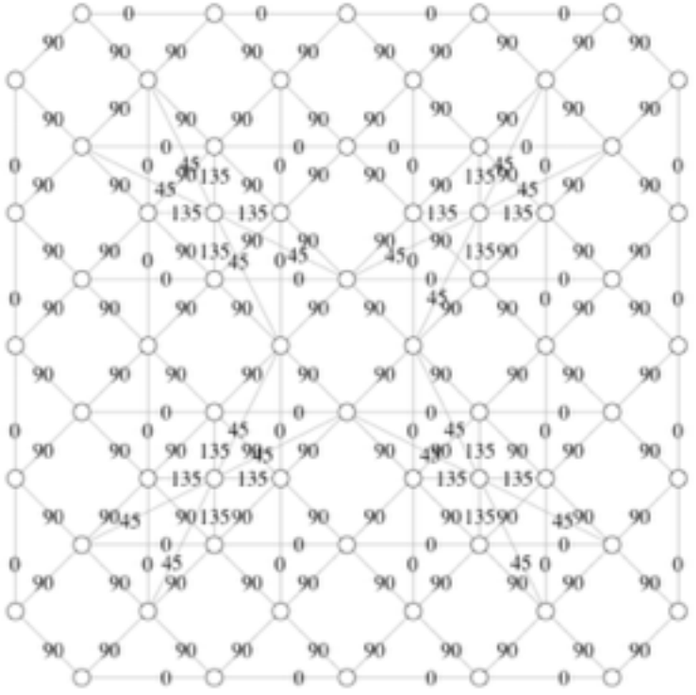
LG(G)


5
5
90
90
90

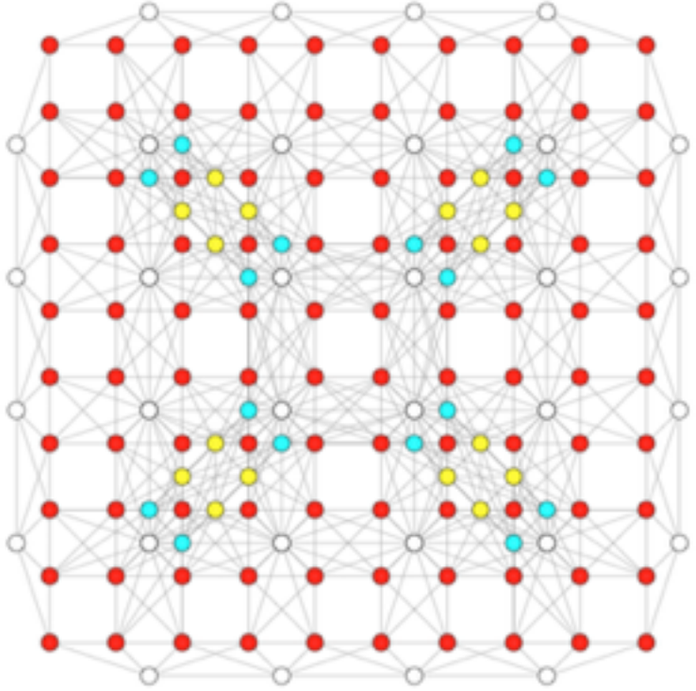
A.

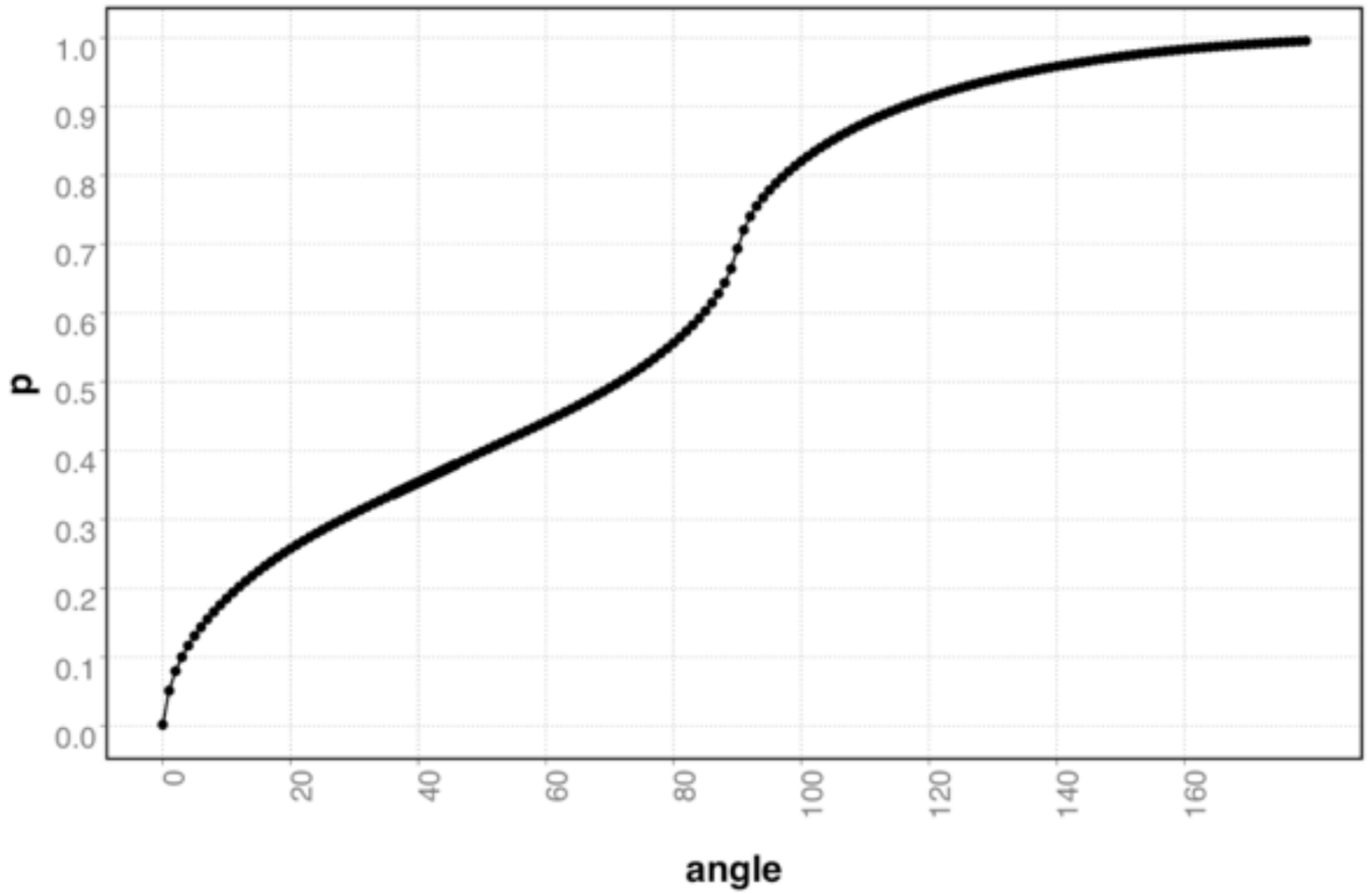


B.

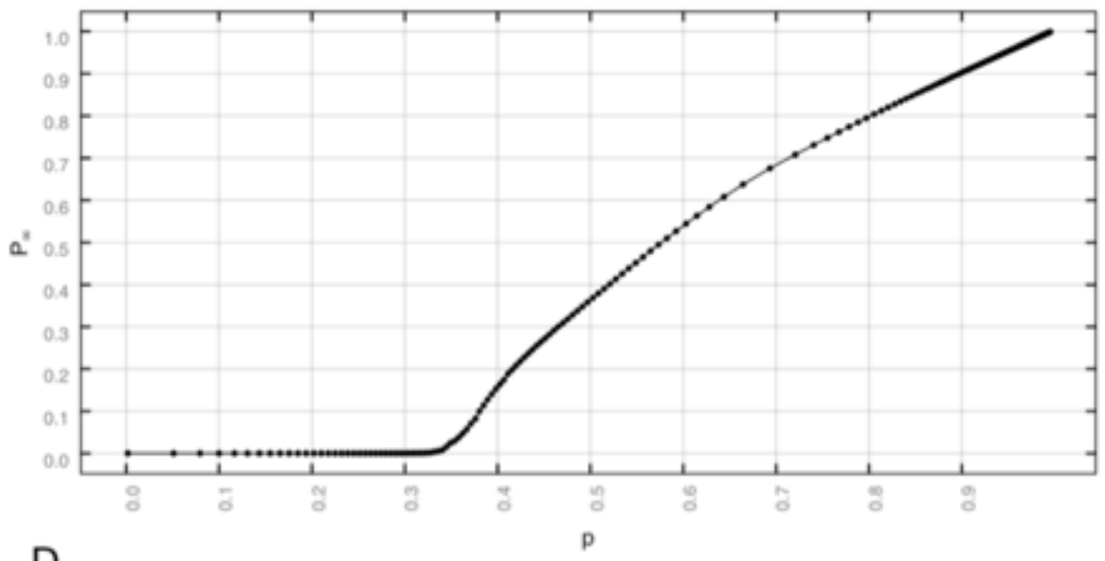


C.

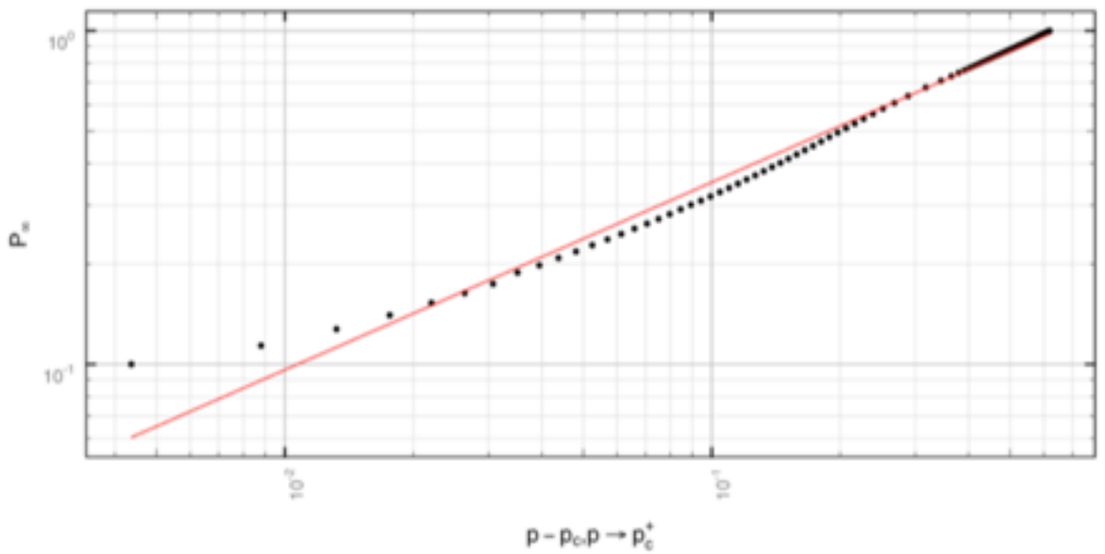



p
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
20
40
60
80
100
120
140
160
angle

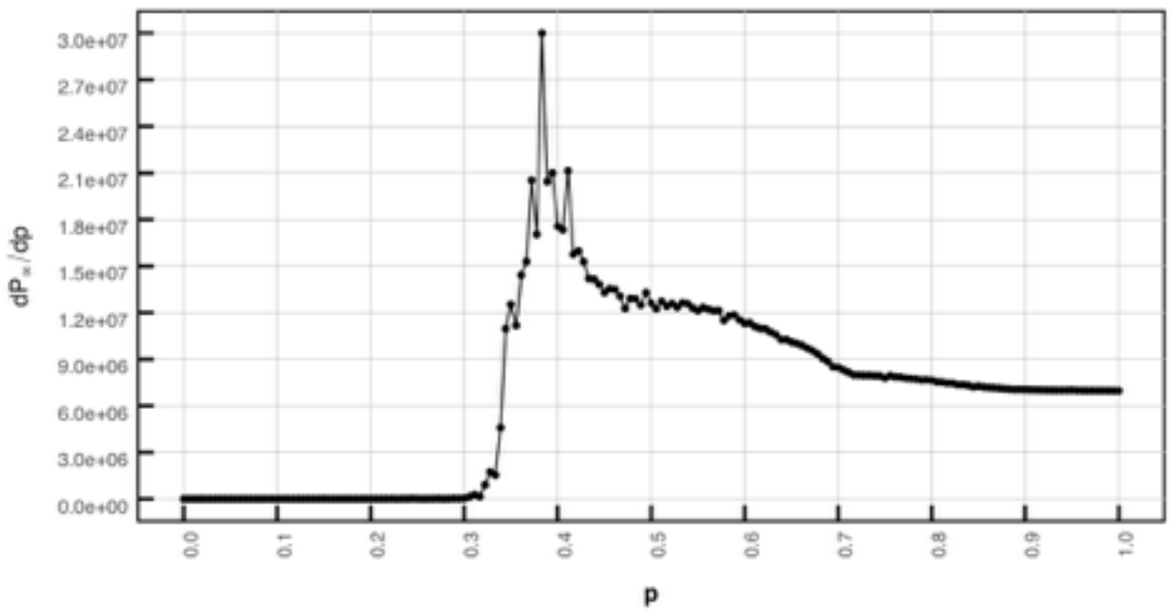
B.



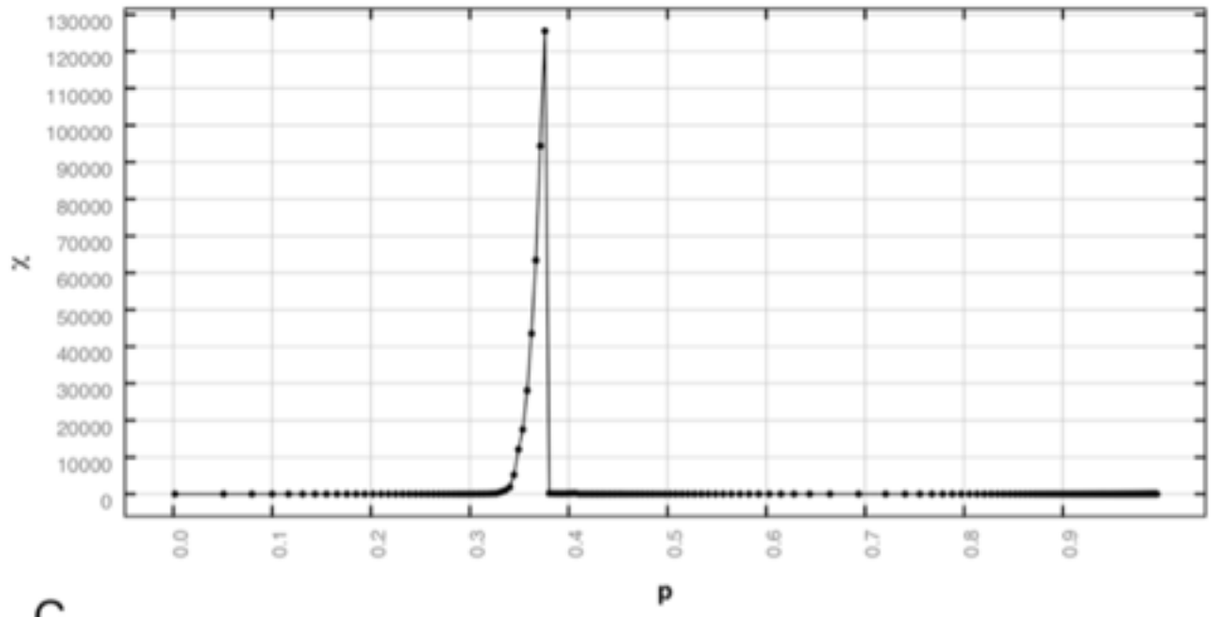
D.



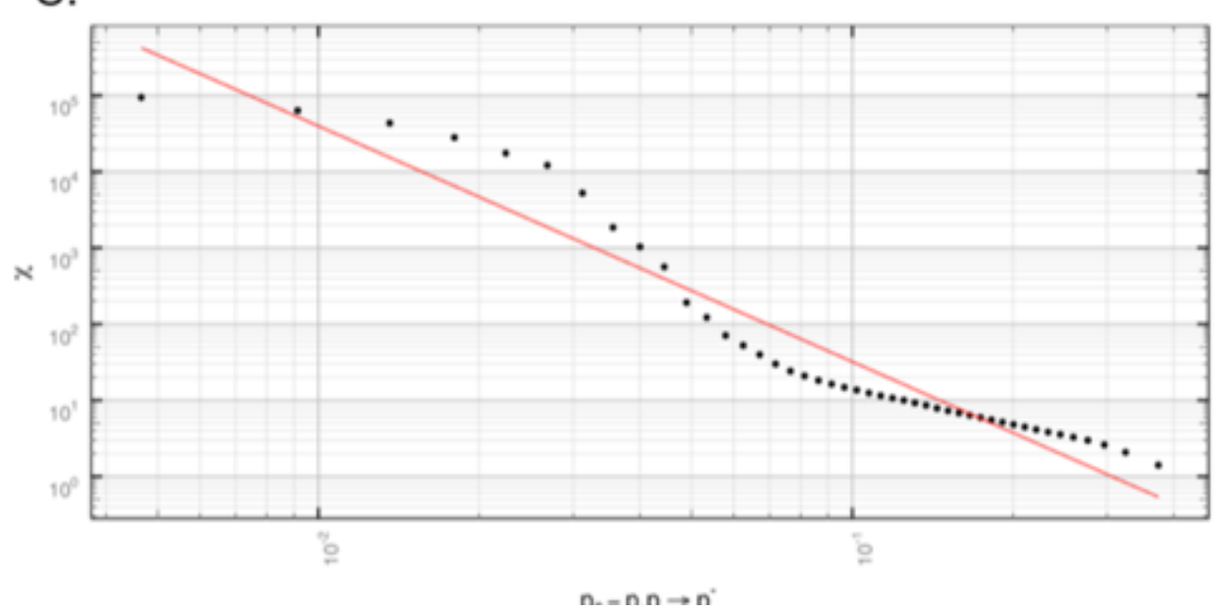
$$P_\infty \propto |p - p_c|^\beta, p \to p_c^+$$



A.

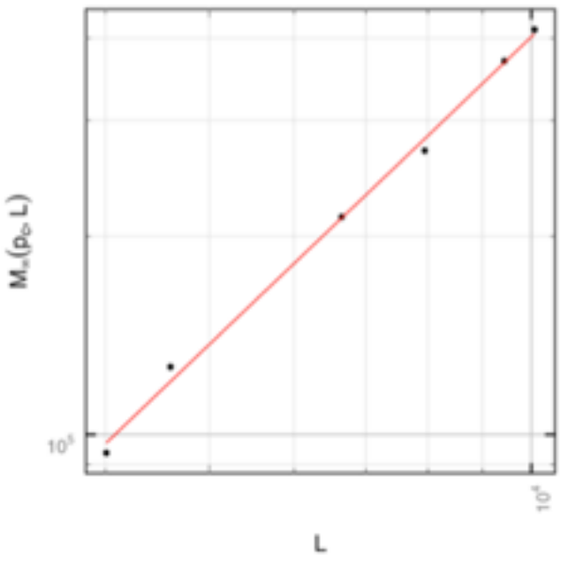


C.

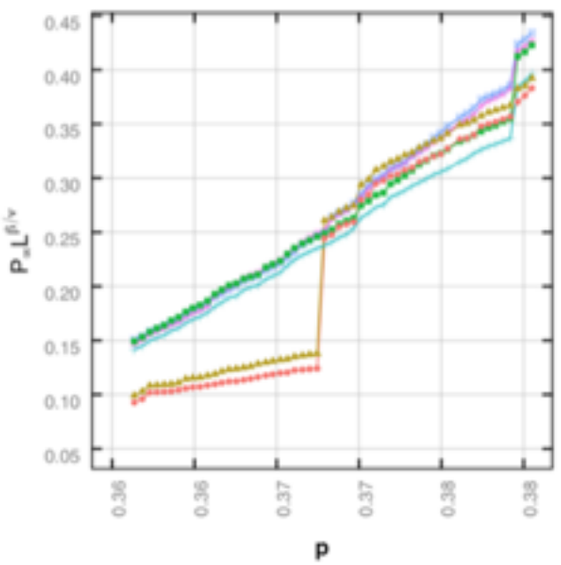


$$\chi \propto |p_c - p|^{-\gamma}, p \to p_c$$

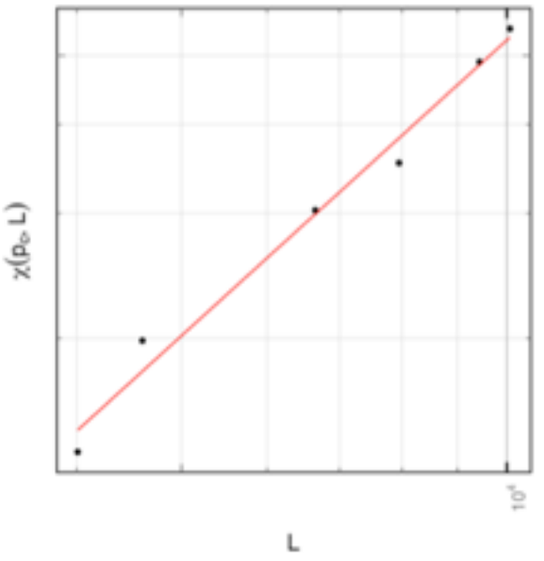
E.


$M_\infty(p_c, L)$
10^{-5}
10^{-4}
L

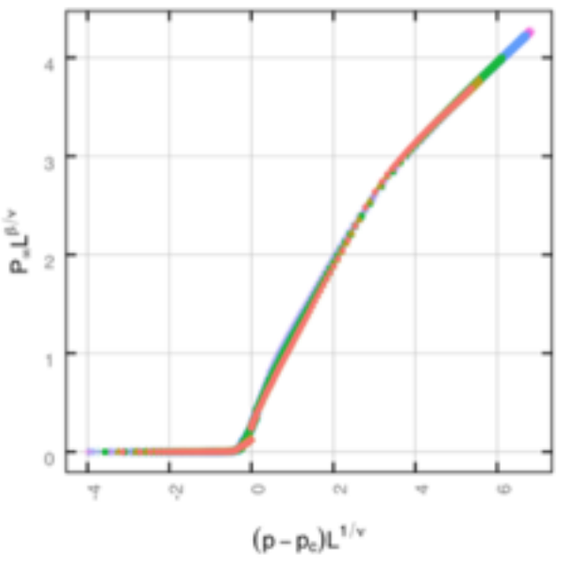
F.

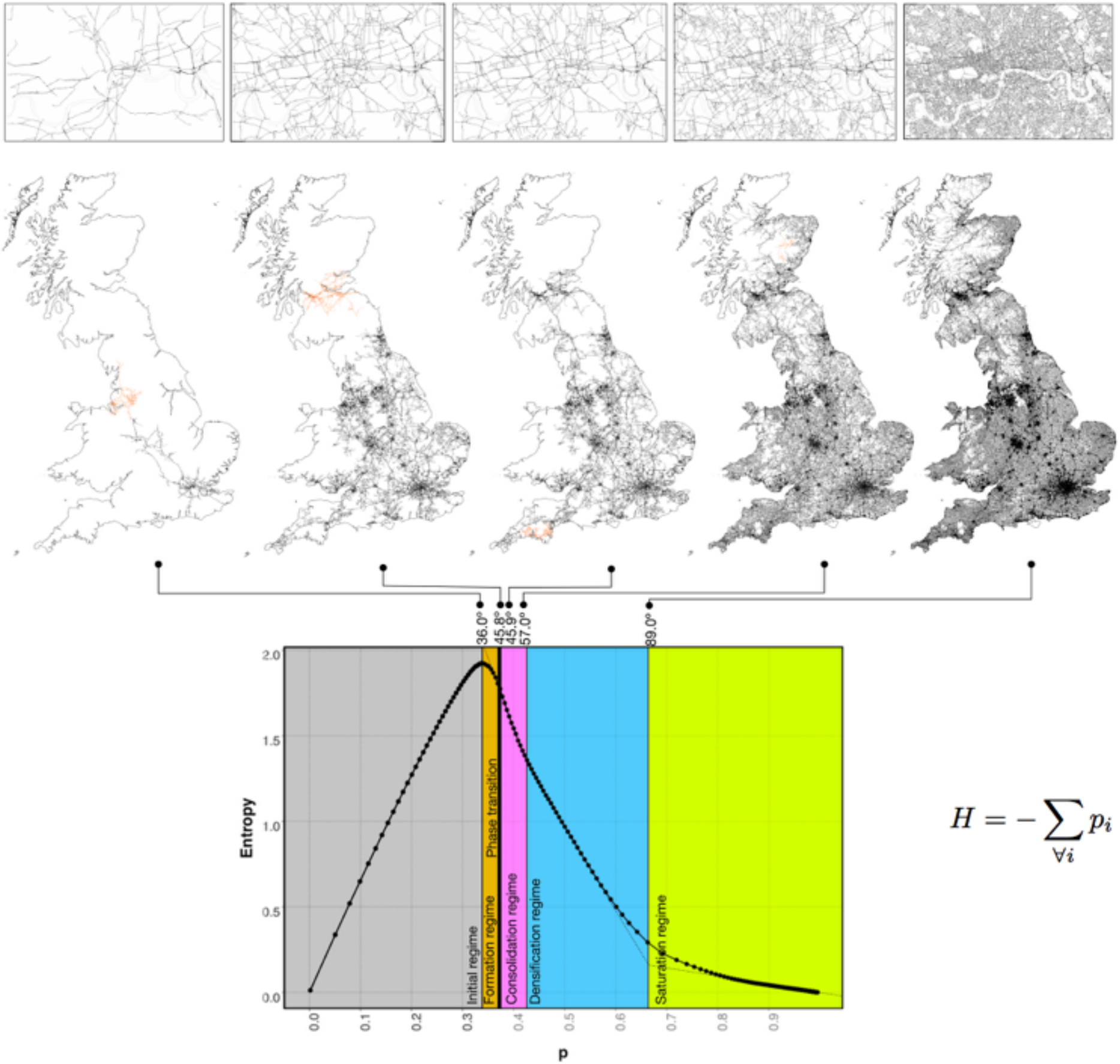

$P_\infty L^{\beta/\nu}$
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.36
0.36
0.37
0.37
0.38
0.38
p

G.

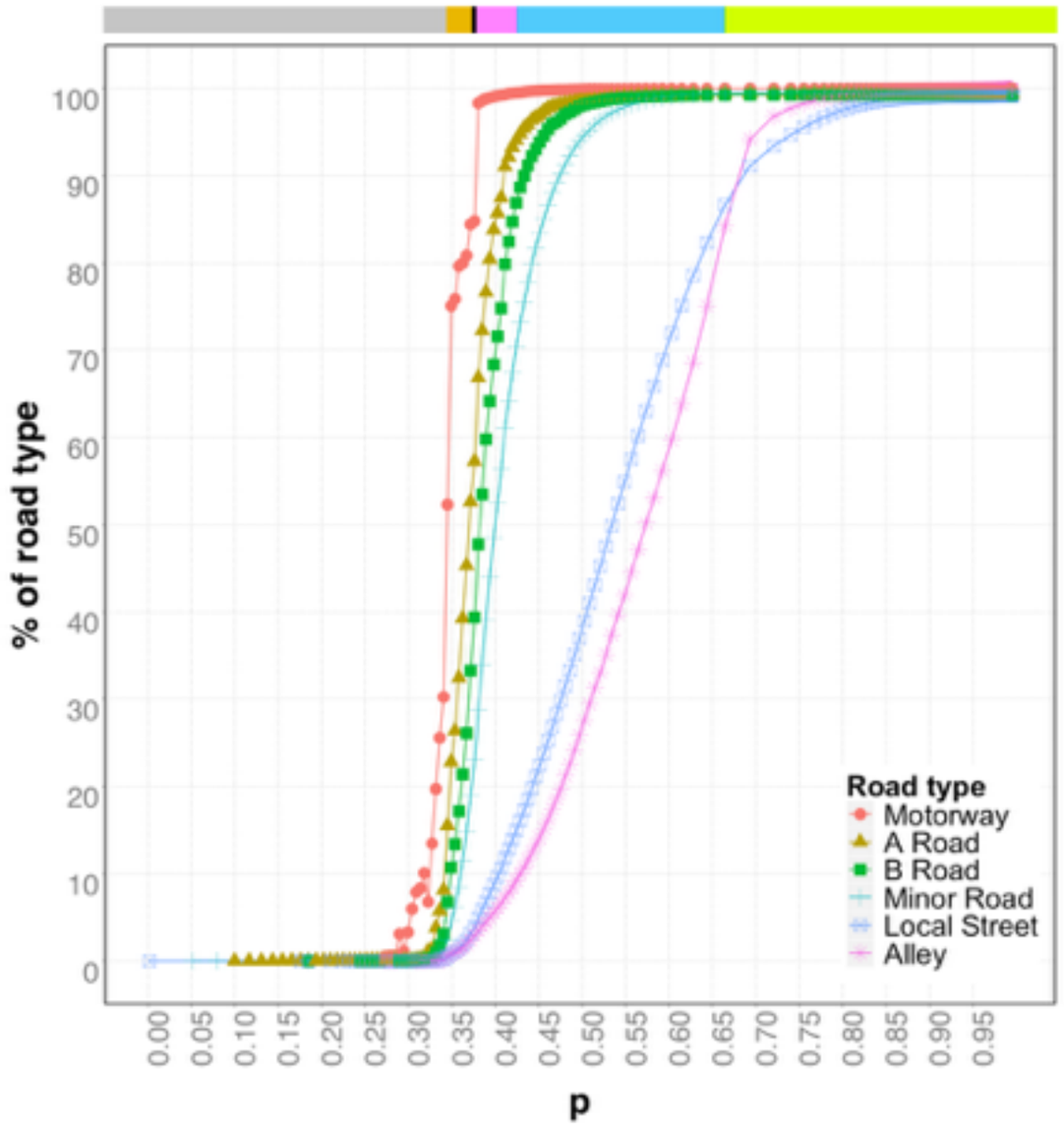

$\chi(p_c, L)$
10^{-4}
L

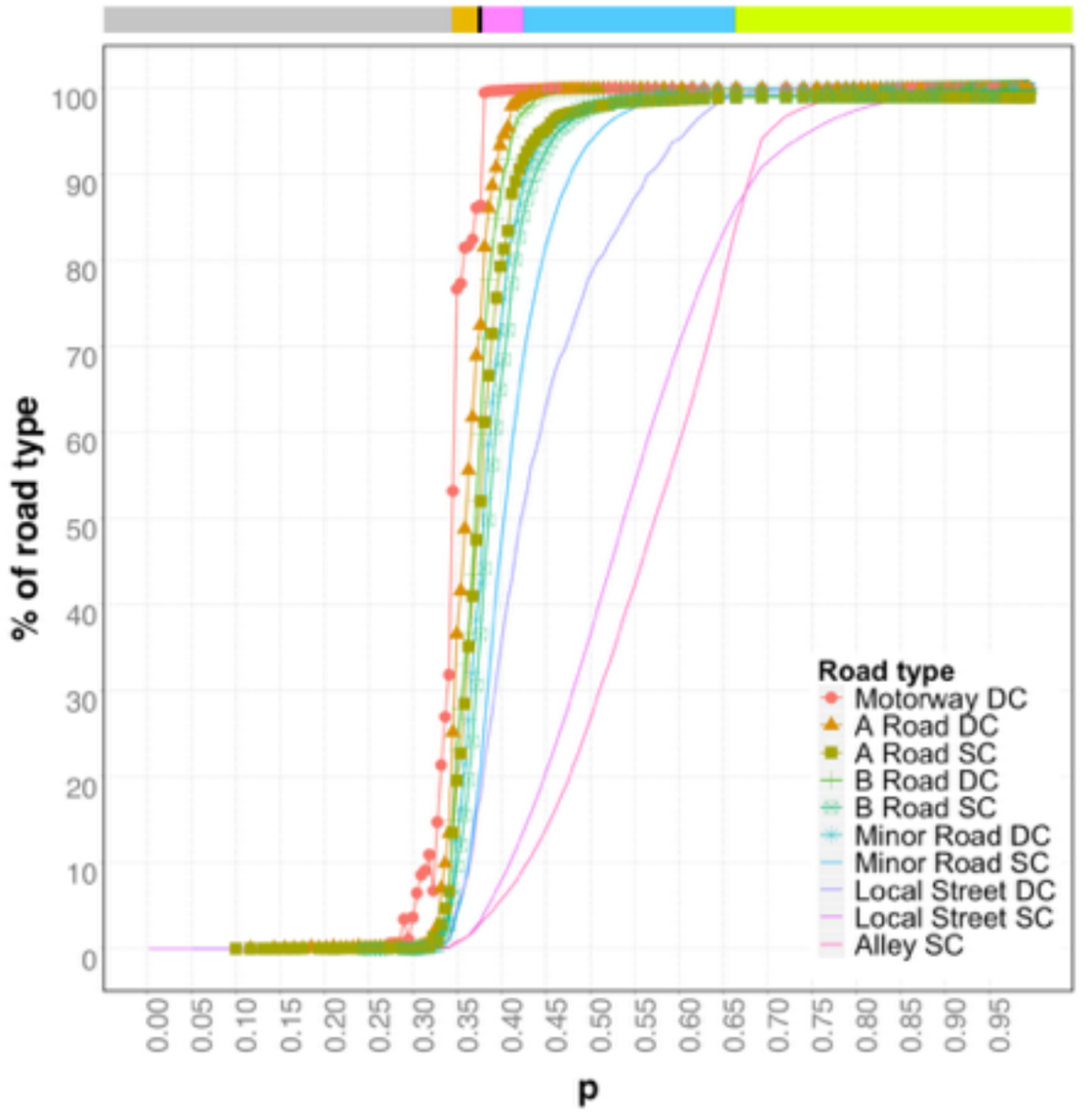
H.

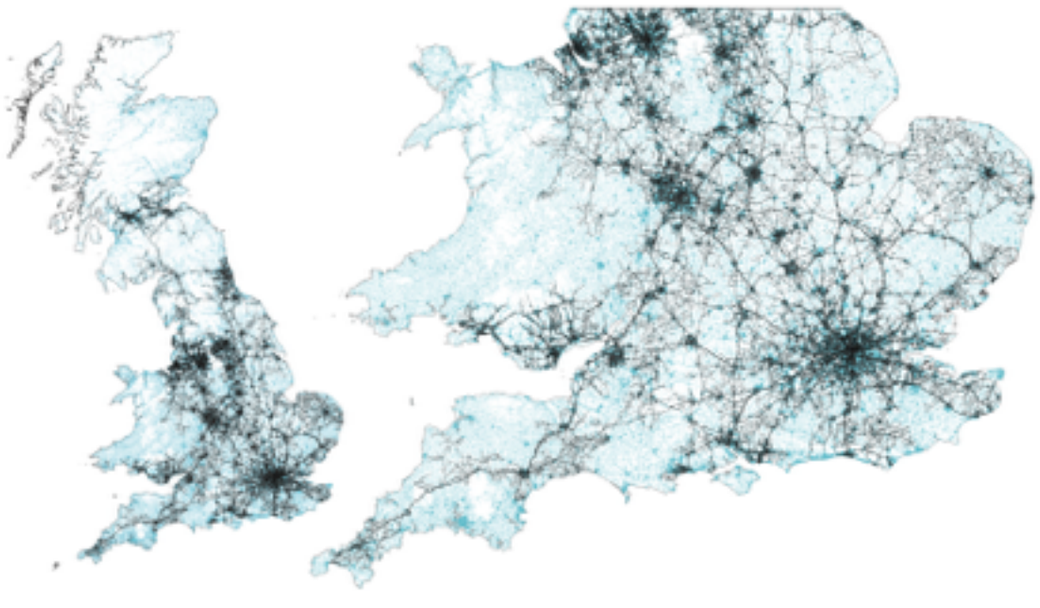

$P_\infty L^{\beta/\nu}$
4
3
2
1
0
-4
-2
0
2
4
6
$(p - p_c)L^{1/\nu}$



$$H = -\sum_{\forall i} p_i \cdot log(p_i),$$


% of road type
p
Road type
Motorway
A Road
B Road
Minor Road
Local Street
Alley

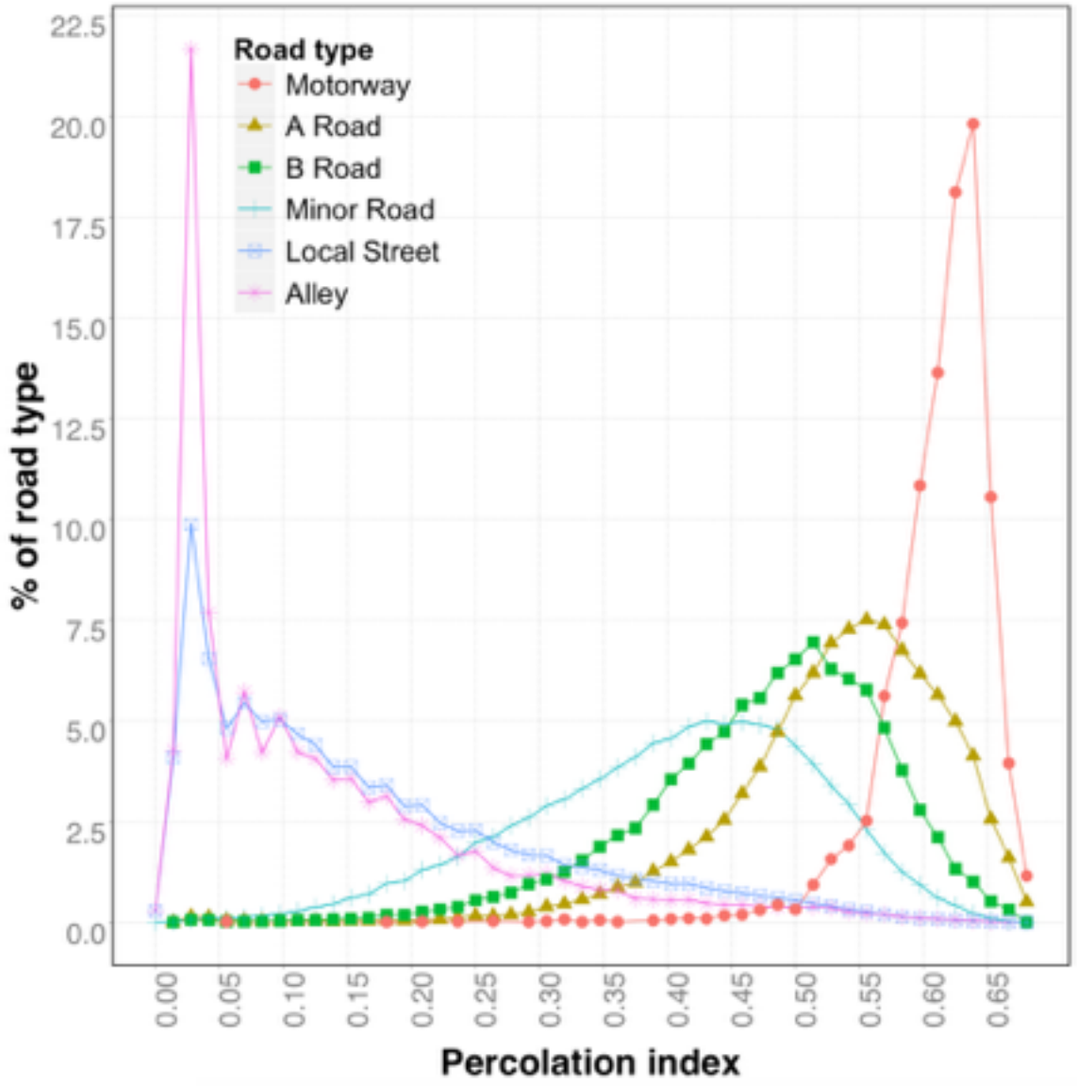

% of road type
p
Road type
Motorway DC
A Road DC
A Road SC
B Road DC
B Road SC
Minor Road DC
Minor Road SC
Local Street DC
Local Street SC
Alley SC

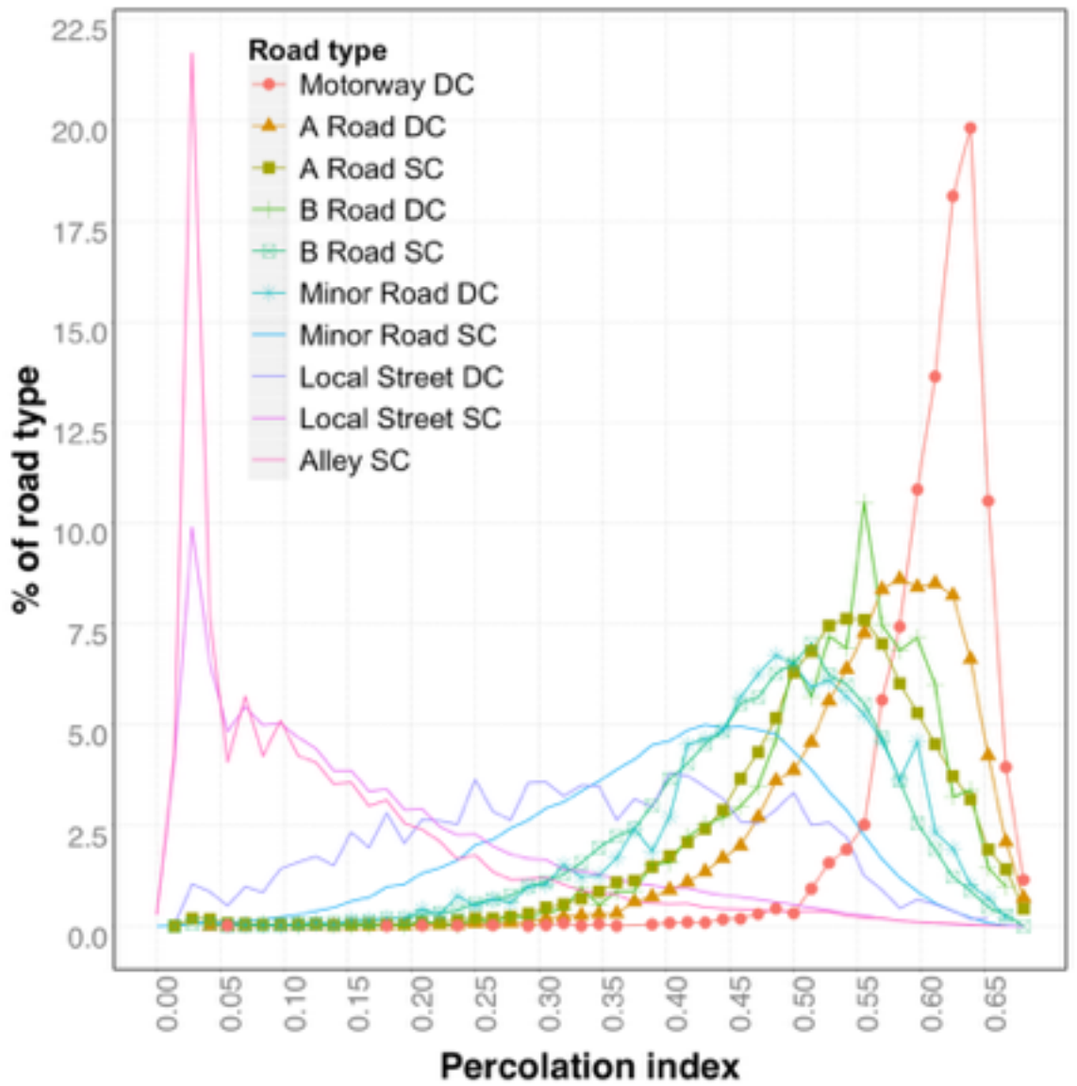


Hierarchical index based in the percolation process

$$I_i = \frac{\sum_{j=1}^{t}(H_j \cdot log(M_{i,j}))}{log(M) \cdot \sum_{j=1}^{t} H_j}$$

Where j goes through all the percolation thresholds (t), and $M_{i,j}$ is the mass of the cluster that contains road i at the j-th threshold, H_j is the entropy of the distribution of the cluster sizes at the j-th threshold and M is the total mass of the system.


Road type
Motorway
A Road
B Road
Minor Road
Local Street
Alley
% of road type
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
Percolation index


Road type
Motorway DC
A Road DC
A Road SC
B Road DC
B Road SC
Minor Road DC
Minor Road SC
Local Street DC
Local Street SC
Alley SC
% of road type
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
Percolation index

Thank you

The Angular Nature of Road Networks

C. Molinero, R. Murcio and E. Arcaute
http://arxiv.org/abs/1512.05659