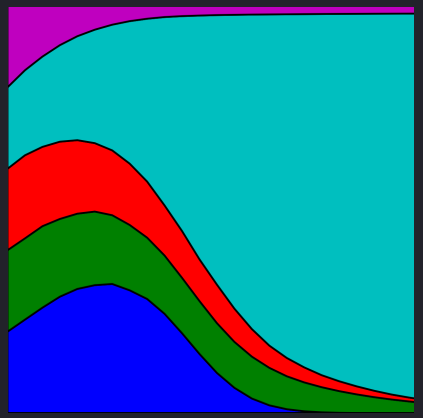
The Evolution of Cooperation

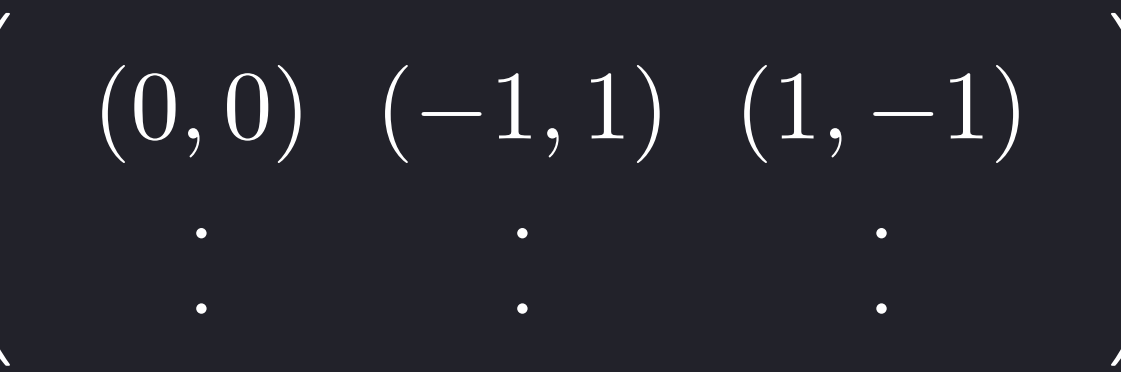
Cardiff University

@NikoletaGlyn

Software
Sustainability
Institute







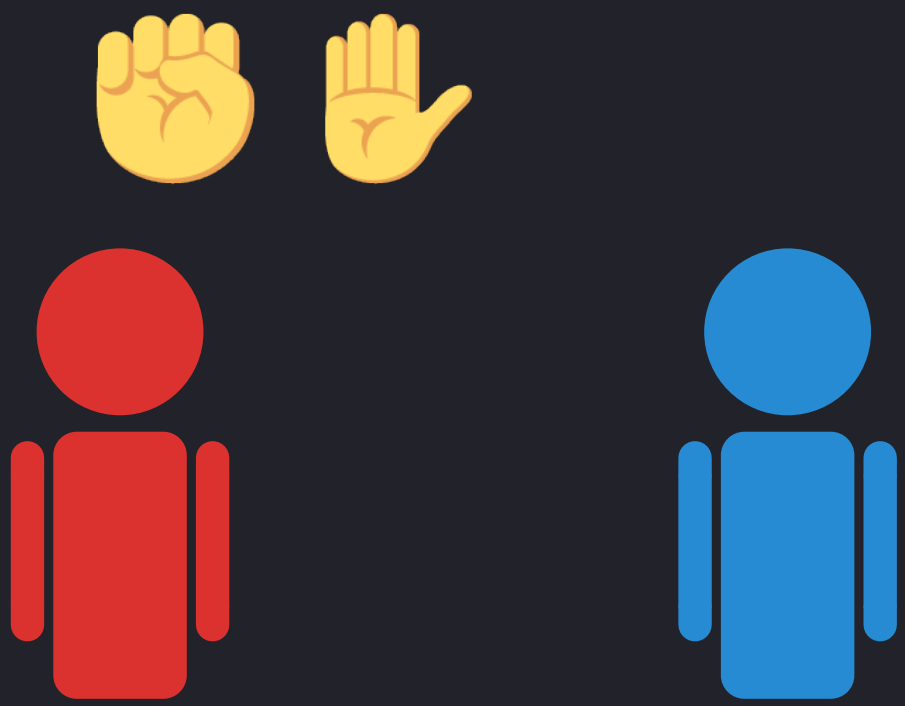
$$\begin{pmatrix} (0,0) & (-1,1) & (1,-1) \\ (1,-1) & (0,0) & (-1,1) \\ (-1,1) & (1,-1) & (0,0) \end{pmatrix}$$

Prisoner's Dilemma

$$\begin{pmatrix} (3,3) & (0,5) \\ (5,0) & (1,1) \end{pmatrix}$$

$$\begin{pmatrix} (R,R) & (S,T) \\ (T,S) & (P,P) \end{pmatrix}$$

. . .

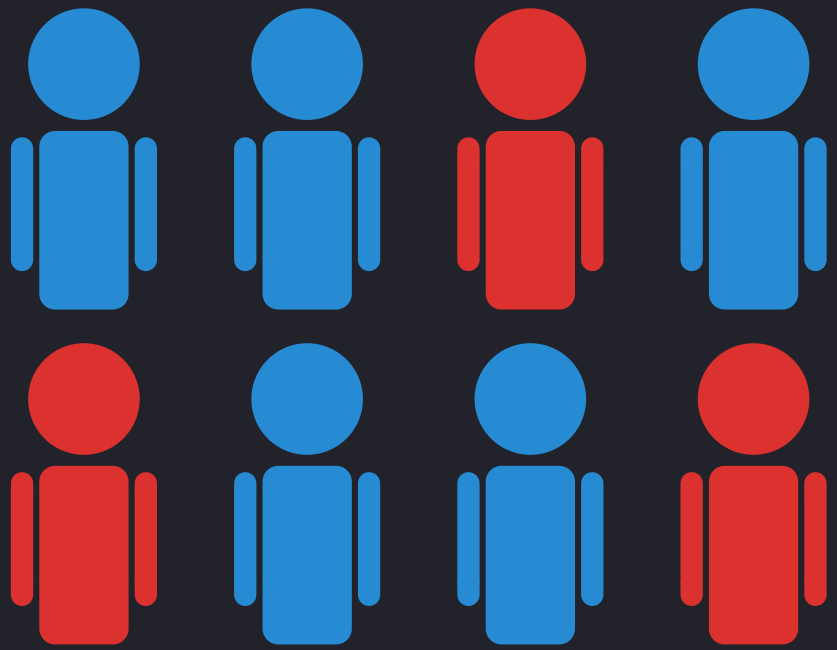


Understanding responses to environments for the Prisoner's Dilemma: A meta analysis, multidimensional optimisation and machine learning approach

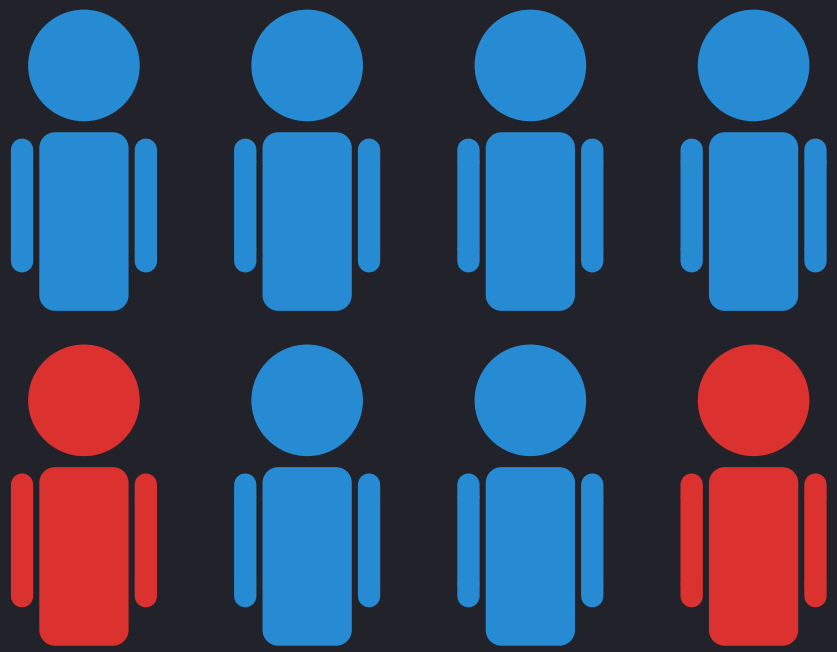
Nikoleta E. Glynatsi

Submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy.

June 2020

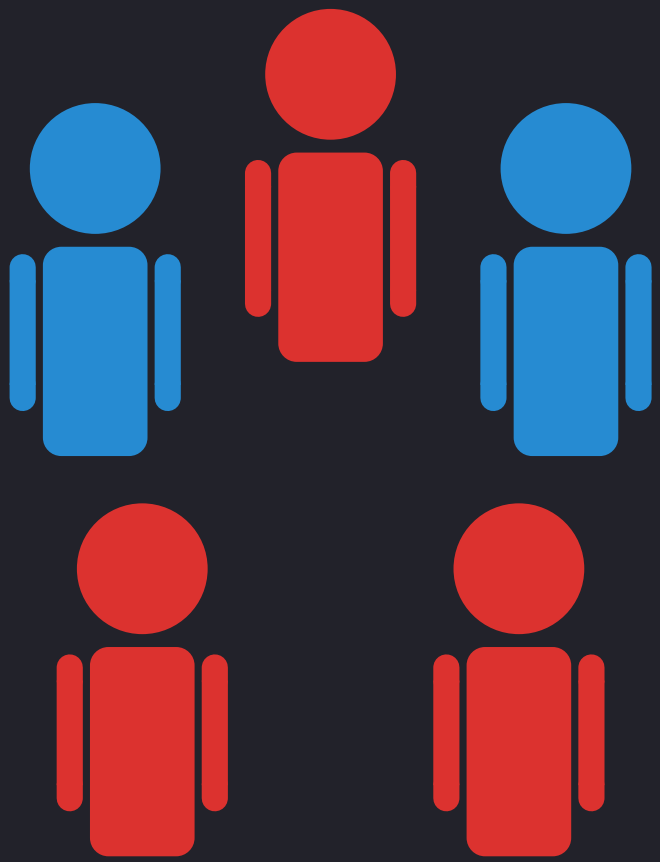


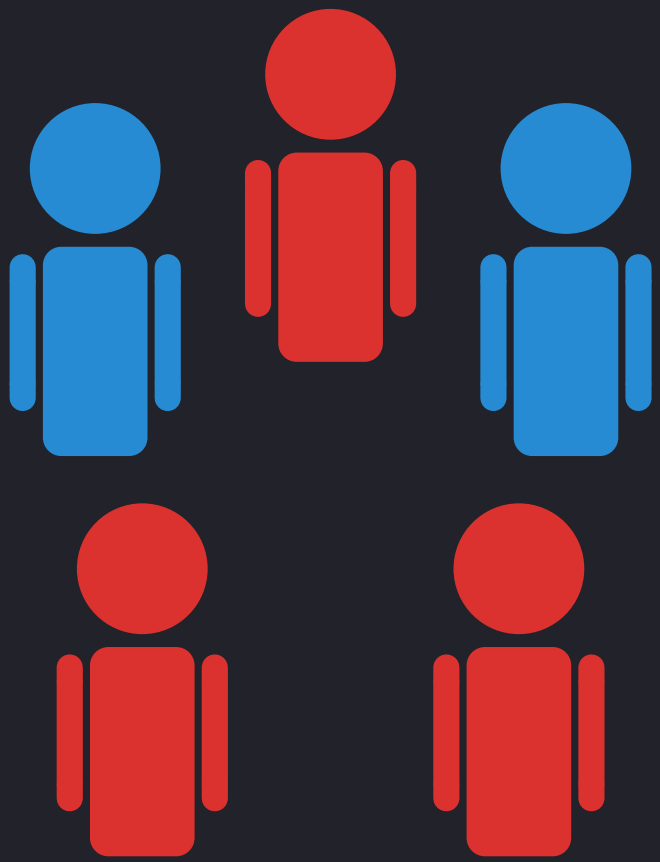
Oh no



Moran Proccess

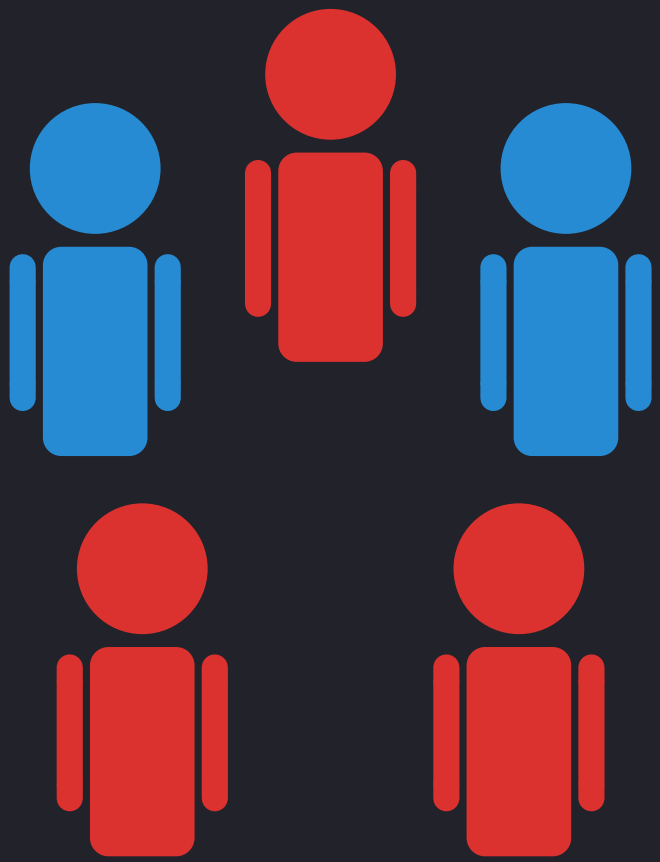

Selection
Birth
Selection
Death





$$f_{1i} = \frac{R \times (i-1) + S \times (N-i)}{N-1}$$

$$f_{2i} = \frac{T \times i + P \times (N-i-1)}{N-1}$$



$$f_{1i} = \frac{R \times (i-1) + S \times (N-i)}{N-1}$$

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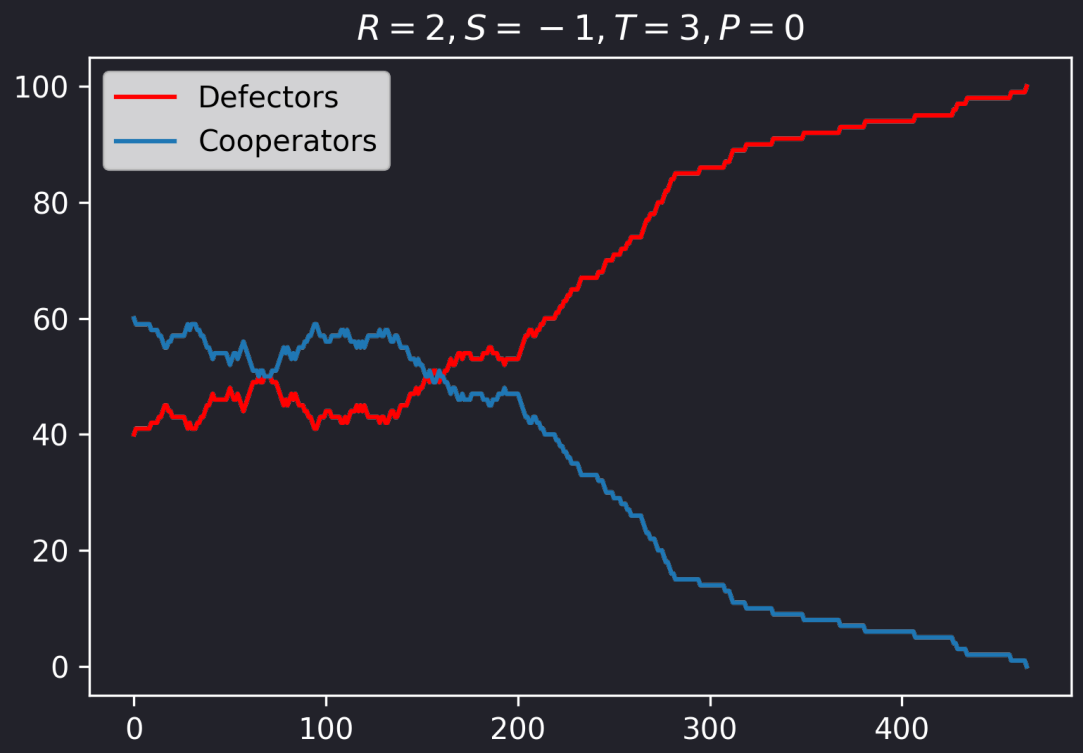
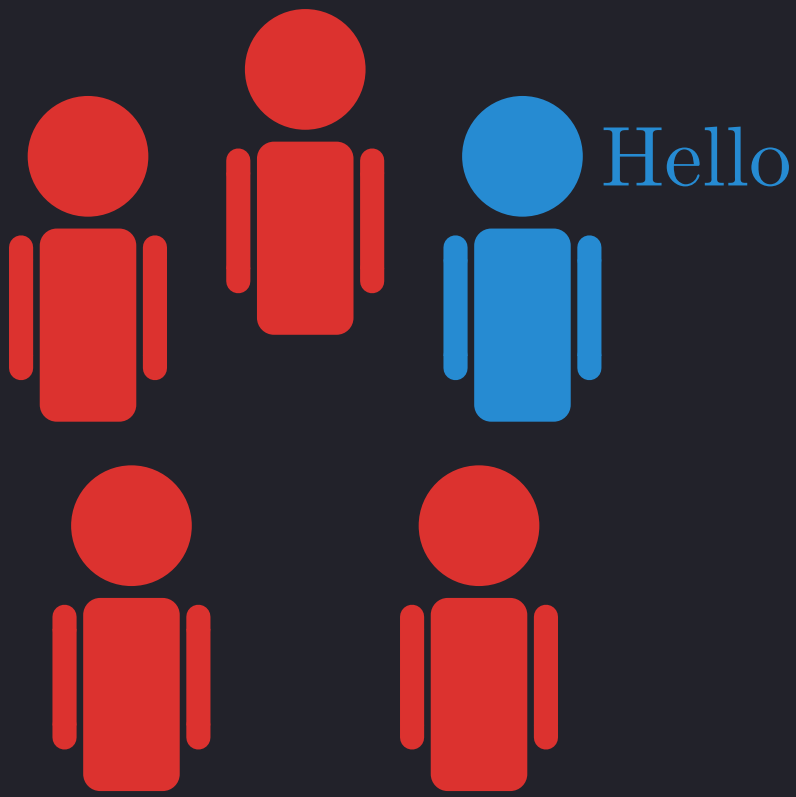
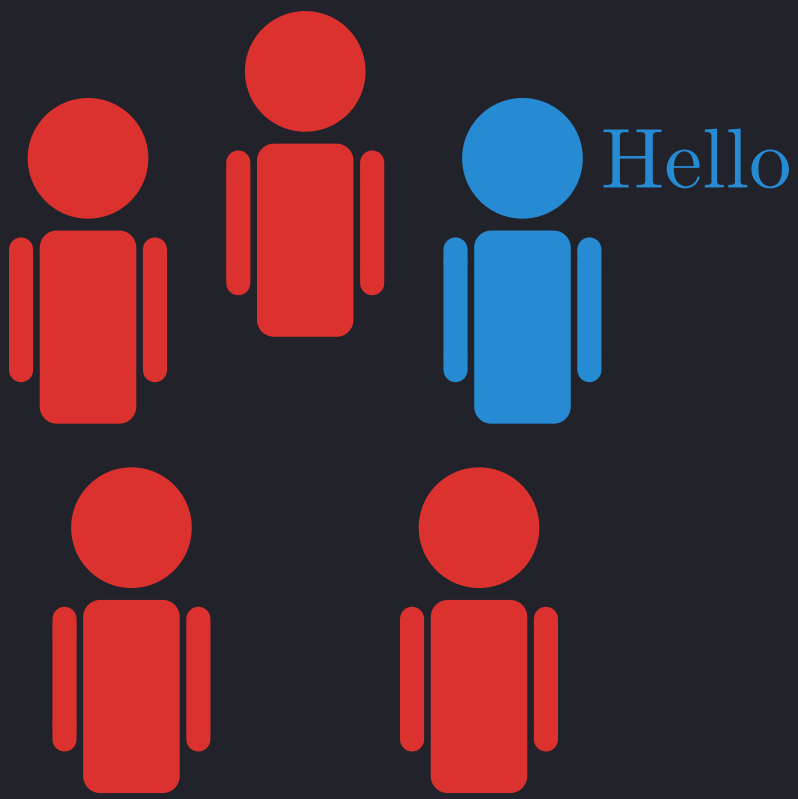
$$p_{i,i+1} = \frac{i f_{1i}}{i f_{1i} + (N-i) f_{2i}} \frac{N-i}{N}$$

$$p_{i,i-1} = \frac{(N-i) f_{2i}}{i f_{1i} + (N-i) f_{2i}} \frac{i}{N}$$


$R = 2, S = -1, T = 3, P = 0$
Defectors
Cooperators
100
80
60
40
20
0
0
100
200
300
400

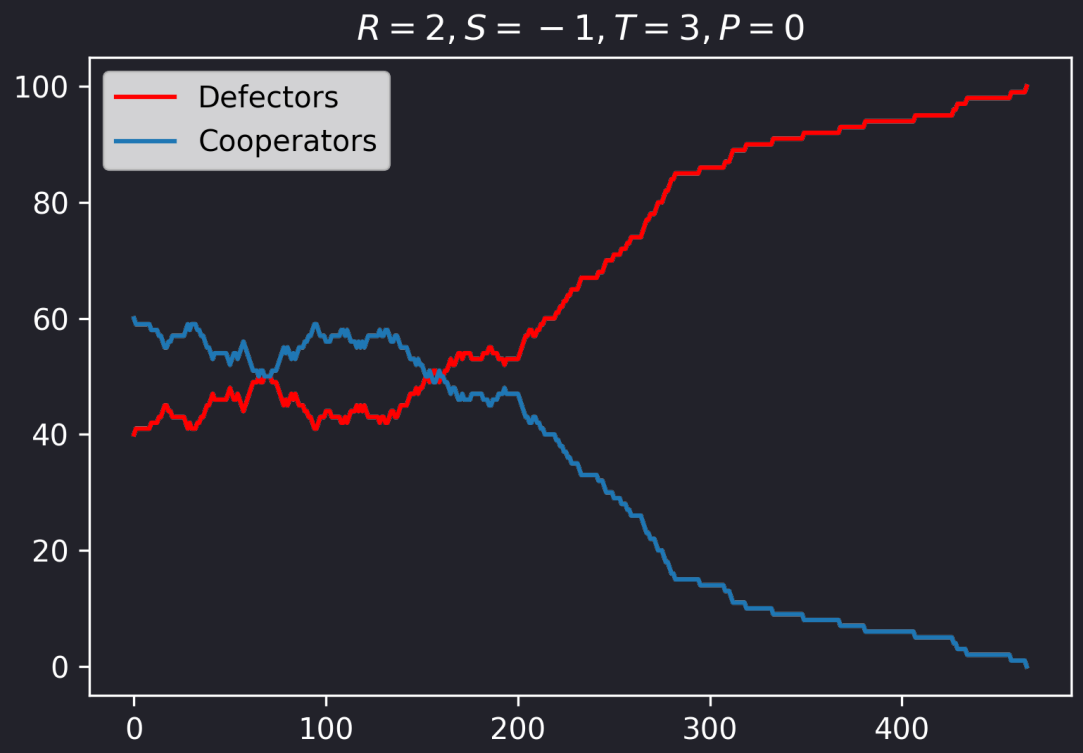

Hello



$$p_{i,i+1} = \frac{i f_{1i}}{i f_{1i} + (N-i) f_{2i}} \frac{N-i}{N}$$

$$p_{i,i-1} = \frac{(N-i) f_{2i}}{i f_{1i} + (N-i) f_{2i}} \frac{i}{N}$$

$$\varphi = \frac{1}{1 + \sum_{j=1}^{N-1} \prod_{i}^{j} \frac{p_{i,i-1}}{p_{i,i+1}}}.$$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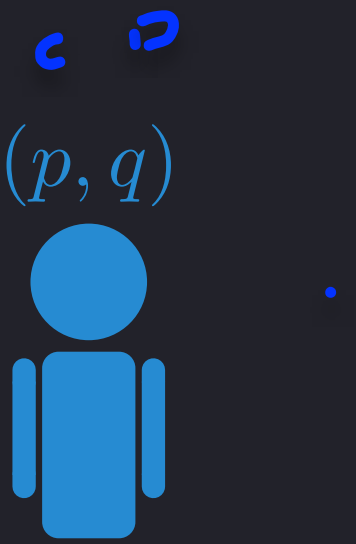
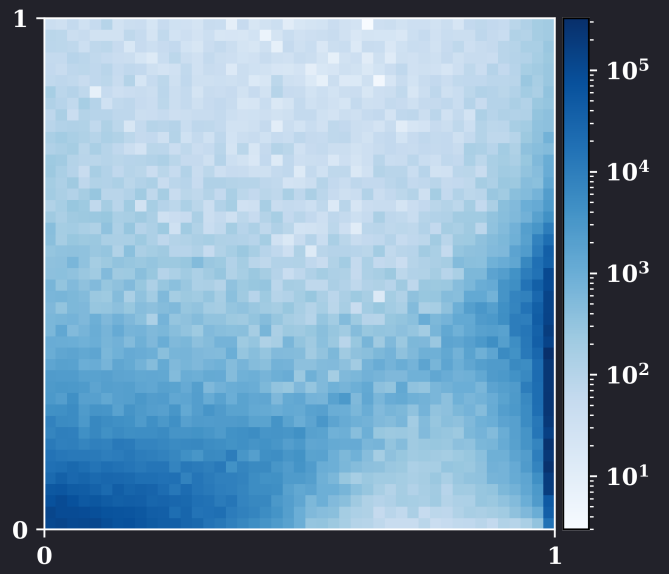

(p, q)

(p, q)



$S_1 = P_1, P_1$ $S_2 = P_1 P_2$

- $U(x_1, x_2)$ $U(y_1, y_2)$

$$f_{1i} = \frac{R \times (i-1) + S \times (N-i)}{N-1}$$

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http://web.evolbio.mpg.de/social-behaviour/