Physics > Physics and Society

Percolation threshold determines the optimal population density for public cooperation

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While worldwide census data provide statistical evidence that firmly link the population density with several indicators of social welfare, the precise mechanisms underlying these observations are largely unknown. Here we study the impact of population density on the evolution of public cooperation in structured populations and find that the optimal density is uniquely related to the percolation threshold of the host graph irrespective of its topological details. We explain our observations by showing that spatial reciprocity peaks in the vicinity of the percolation threshold, when the emergence of a giant cooperative cluster is hindered neither by vacancy nor by invading defectors, thus discovering an intuitive yet universal law that links the population density with social prosperity.

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