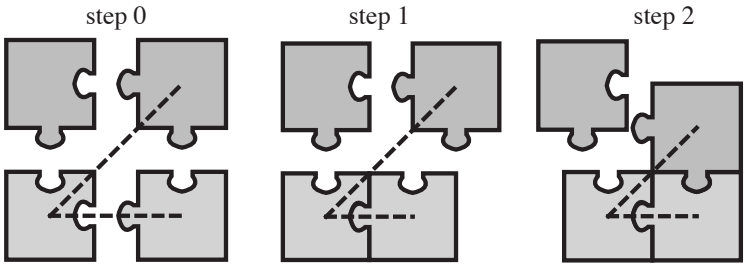
Jigsaw percolation: What social networks can collaboratively solve a puzzle?

Charles D. Brummitt

Columbia University

We introduce a new kind of percolation on finite graphs called *jigsaw percolation*. This model attempts to capture networks of people who innovate by merging ideas and who solve problems by piecing together solutions. Each person in a social network has a unique piece of a jigsaw puzzle. Acquainted people with compatible puzzle pieces merge their puzzle pieces. More generally, groups of people with merged puzzle pieces merge if the groups know one another and have a pair of compatible puzzle pieces. The social network solves the puzzle if it eventually merges all the puzzle pieces. For an Erdős-Rényi social network and a fixed puzzle graph, we study the phase transition in the social network's chance of solving a puzzle. We summarize a few rigorous results for various puzzle graphs. Surprisingly, with high probability, social networks with a power law degree distribution cannot solve any bounded-degree puzzle. This model suggests a mechanism for recent empirical claims that innovation increases with social density. We hope that it is a step toward the goal of understanding what social networks stifle creativity and what networks collectively innovate. Joint work with Shirshendu Chatterjee, Partha Dey, and David Sivakoff.



Here we show a complete trajectory of the jigsaw dynamics. In this case, the social network (dashed edges) does not solve this 2×2 lattice puzzle.