

MATer

Territorial Self-Organization Model

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June 1, 2007

Abstract

MATer is a model of territorial self-organization. The aim of the model is to mix computational models, GIS, and Historical and Archaeological evidence in order to understand how self-organizational processes shape human settlements throughout a real territory, producing a Zipf distribution of the size of the settlements.

The model uses real-world topography and hidrography, loaded through an image and the correspondent color-altitude map (including rivers and sea). The used territory is the Baixo Mondego (Portugal), with size 2400x1200, at the scale of 1px:25m.

An artificial society lives in this world, in cities, and can move from one city to another. New cities can be born (founded by the agents in suitable terrain) and uninhabited cities are removed. Growing cities expand their territory based on the kind of terrain, that is, the territory in the lower lands can support more agents than in the mountains.

Agents living in cities raise their energy according to the occupation of the city. All the others loose energy each tick. Agents can migrate if they are waiting for a long time for a place in the current city, or mass migrations can happen if the agents in a city are consecutively getting less energy. Those which migrate, first calculate the trajectory, using an A* algorithm, trying to reach the destination city with the less effort possible. The cost is mapped according to the type of terrain, its altitude, and its use as a road by other agents. This makes possible the emergence of roads between cities.

The model was built using RePastJ. Some parts of the toolkit have been modified for feature addition and because of performance issues. Several modes of display are available using the keyboard keys. The architecture uses design patterns to allow the extension of the model.