

# Simulating urban growth dynamics in Latin American cities

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## Abstract

Urban systems have been traditionally studied by using modelling techniques. Since the 1960s a number of models have been developed and, more recently, with advances and popularisation of computer tools, the possibilities to explore urban systems from this viewpoint have increased considerably.

In the present paper some experiments with an agent-based model will be presented. The aim of our study is to develop a heuristic-descriptive model on the decentralised process underlying the process of growth in Latin American cities, investigating different aspects of urban growth.

The urbanisation process in cities of developing countries is often insufficiently planned and poorly coordinated and Third World cities are known for their inherent chaotic and discontinuous spatial patterns, and rapid and unorganised development process. The present paper focuses on the development of Latin American cities in space and time, focusing on a specific kind of urban growth that happens in these cities, called 'peripherisation'. Peripherisation can be defined as a kind of growth process characterised by the expansion of borders of the city through the formation of peripheral settlements, which are, in most cases, low-income residential areas. These areas are incorporated into the city by a long-term process of expansion in which some of the low-income areas are recontextualised within the urban system and are occupied by a higher economic group while new low-income settlements keep emerging on the periphery.

We explore these ideas with a number of simulation experiments that were carried out using agent-based modelling techniques. The model reproduces some features of the locational process in order to understand the formation of the global residential pattern of these cities. The model was built on a Starlogo platform, that is a friendly user parallel programming tool developed by the Epistemology and Learning Group of the Massachusetts Institute of Technology.

From the result of the experiments, some of the traditional issues on Latin American urban growth and development are reinterpreted in the light of Complexity Theory in order to improve the understanding of the relation between the dynamics and the resultant morphology of rapid urbanisation.

We argue that the development and interpretation of simple simulation models can help in the understanding of dynamic phenomena, enhancing our perception of the city's mechanisms of growth.

Preliminary results suggest that the actual development process consists of a socio-economic inequality that is reproduced in space by the locational process. The peripherisation process was initially caused by the high rates of urban growth in these countries but it is now consolidated as the normal process of development of these

cities. The result is an emergent pattern of spatial segregation characterised by strong differences between core and periphery, which is consolidated as the residential spatial pattern of Latin American cities. The perpetuation of both process and spatial pattern reinforce the social inequality, which was their cause in the first place, in a vicious cycle that can be seen as an 'evolution of inequality'.

The simulation exercises allow us to unfold the rapid urbanisation process and investigate its dynamic process, testing hypothesis and analysing the relationship between different elements. This gives us a different perspective of the phenomenon, from which we can study how planning policies could drive the urbanisation of Third World cities to a different path, rather than simply trying to control it.