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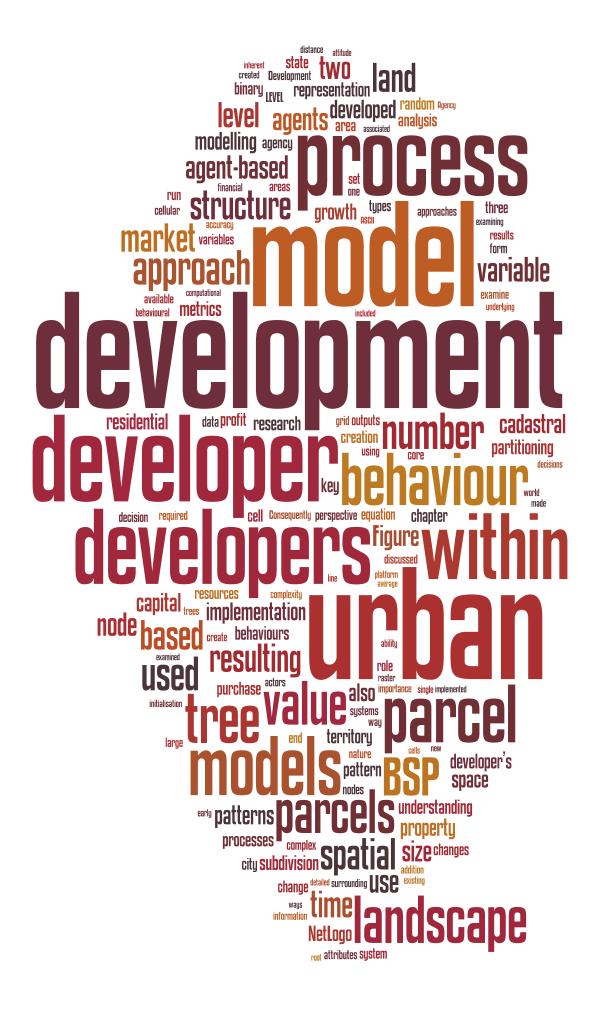
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Residential property developers in urban agent-based models: Competition, behaviour and the resulting spatial landscape

Fraser John Morgan

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Geography. University of Auckland, 2010



It is not the mountain we conquer, but ourselves.

Sir Edmund Hillary

Abstract

While it is widely acknowledged that property developers are the most important agent in the urban development process, existing urban agent-based models often fail to examine the diversity of their types, strategies and behaviours and the resulting effects this differentiation has at a spatial level.

To examine this, a spatial multi-agent model that accounted for the variation in how developers purchase and subdivide land was created. Developer agents within the model all accessed the same set of behaviours, but implemented them differently based upon the capital available to the developer. These behaviours include how developers: assess the property market, evaluate parcels for purchase, evaluate the timing of subdivision, manage their risk, and focus transactions within a defined territory. To enable the subdivision of parcels, a hierarchical landscape was created that provided the framework for developer agents to understand, analyse and enact the mechanism of subdivision on the urban environment.

Using this agent-based model, two experiments were conducted. The first experiment varied the level of developer competition to examine how the diversity of capital affects the development of the urban landscape. The second experiment compared the default heterogeneous application of the behavioural traits with a homogeneous application to explore the resulting affects on the pattern of development. This was done to both understand the importance of the behaviours but to also explore the way in which heterogeneity affects urban agent-based models.

The resulting contributions to the field of urban modelling vary from methodological to more applied knowledge. Methodologically, this research has developed a more accurate representation of space that enables a realistic form of residential property development to be modelled. In addition the research moved away from the mathematical formalism found in other urban models and developed a more process-based approach that enables more behaviourally focused agents to be included.

Building on the methodological achievements, the research answered a range of applied questions that highlight the importance of residential developers when examining the changes in urban growth and form. These focused on how varying levels of developer competition can shape the resulting development pattern, and the role that developer behavioural heterogeneity has in shaping the form of urban development, particularly around the importance of satisficing in their decisions.

From this analysis, it is clear that residential developers play a substantial role in shaping the resulting urban landscape, through the structure and composition of the residential developer market as well as the spatial application of their behavioural activities.

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Glossary

ABM Agent-based models

ASCII American Standard Code for Information Interchange

BSP Binary Space Partitioning

CA Cellular Automata

DRAM Disaggregate Residential Allocation Model

DS Developer Set

DUEM Dynamic Urban Evolutionary Model

GIS Geographic Information System

HHI Herfindahl-Hirschman Index

IAN Image Analysis

LIDAR Light Detection and Ranging

LUCC Land Use and Land Cover Change

ODD Overview, Design Concepts, and Details

PCA Principal Component Analysis

PLUM Projective Land Use Model

PNG Portable Network Graphics

SLEUTH Slope, Landuse, Exclusion, Urban extent, Transportation and Hillshade

SLUCE Spatial Land Use Change and Ecological Effects at the Rural-Urban

Interface