ANARQUIA- INTERFACING HYPERMEDIA AND SYSTEM DYNAMICS FOR URBAN MANAGEMENT

António Câmara, Paula Antunes, Julia Seixas and Lia Vasconcelos

Environmental Systems Analysis Group,
Department of Environmental Sciences and Engineering,
New University of Lisbon, 2825 Monte da Caparica, PORTUGAL

ABSTRACT

A game for environmental urban management based on system dynamics models is being developed. Named *ANARQUIA*, this game uses Hypercard as a front end. *ANARQUIA* considers a town managed without a government. The goal of the game, played by teams of five players operating under anarchist principles, is to manage the environment of a city optimizing environmental quality during the maximum amount of time. The game was applied to the town of Caparica, a traditional fishermen's town in Portugal.

INTRODUCTION

An important component of anarchist thought is the theory of spontaneous order: the theory that, given a common need, a collection of people will, by trial and error, evolve order out of the situation - this order being more durable than any kind of externally imposed authority could provide (Kropotkin, 1898). Ward, based on this theory, used the example of the instant city of the Woodstock Festival to show that anarchy could be an unique system of urban management (Ward, 1973).

ANARQUIA is a game that serves to illustrate the merits of this approach to environmental urban management while teaching the system dynamics approach. The game is implemented using Hypercard as a front end and Stella as the system dynamics simulator. *ANARQUIA* was applied to the anarchist management of Caparica, a small portuguese town for illustrative purposes.

PRINCIPLES OF *ANARQUIA*

A game requires the pre-definition of (Greenblatt and Duke, 1975): the players and their roles; the scenario defining the problem; the rules; an algorithm to operate and control the game and an accounting system to record decisions and their outcomes.

In *ANARQUIA*, a game for urban management following anarchist principles, the players are five typical urban dwellers. These players form a team. The main hypothesis is that environmental urban management may be achieved by the players single or collective action withouth the existence of a government.

Thus, the evolution of a town is mainly dictated by the players actions. These actions are taken, in each iteration of the game, considering the qualitative information available on their needs and impacts. There are two types of actions: individual actions (promoted by only one player) and collective actions (promoted by several players, i.e., garbage collection).

The compatibility between the players actions is evaluated using a matrix. Incompatibilities are solved among the players in each team by readjusting their actions. The compatibilities of the actions are achieved by using a negotiation process based on anarchist principles.

Mid and long range environmental impacts of those actions are then evaluated and environmental quality indices are obtained. Whenever these indices exceed pre-defined thresholds, the town collapses. The team that manages the town optimizing the environmental quality during the maximum amount of time wins.

The main algorithms behind this game are system dynamics models to determine the environmental impacts of a set of actions established for a given iteration. *ANARQUIA* was implemented using Hypercard (Atkinson, 1987) and Stella (Richmond, 1987). Using Hypercard one could easily provide a symbolic representation of the scenario defining the problem and process the inputs and outputs in a friendly manner. Stella was used to implement the system dynamics models.

APPLICATION

The game was applied to Costa da Caparica, a fishermen's town south of Lisbon. The hypothesis is that Caparica adopted anarchist principles in the late 1990's. Then, widespread computer

networks, friendly interfaces and modelling techniques, high cultural levels and no financial restrictions of the town's population made possible urban management without a government.

The players in this application of *ANARQUIA* are five: a Fisherman, a Developer, a Merchant, a Farmer and a Citizen (Fig. 1). Each player owns two parcels of land with 5.000 m2 each.

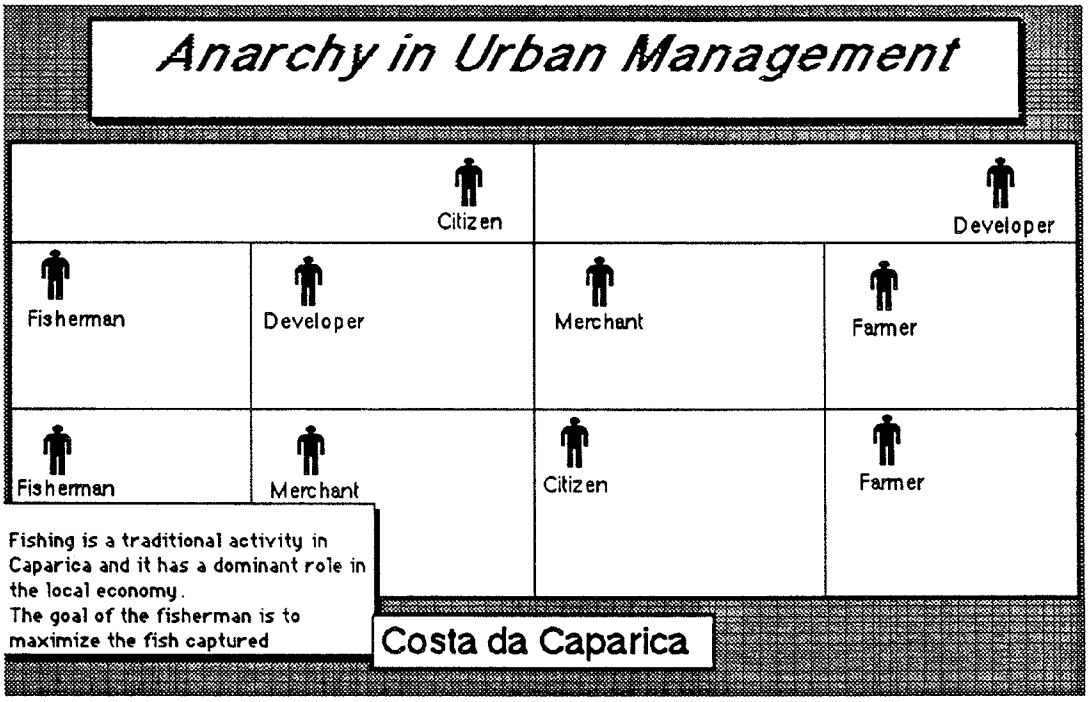

Figure 1 - Players of *ANARQUIA*

Fishing is a traditional activity in Caparica. It has a dominant role in the local economy. The goal of the Fisherman is to maximize the fish captured.

In the last two decades, Caparica is in great demand as a recreation site for Lisbon's inhabitants. The Developer is trying to respond to that interest building beach homes.

With increasing tourism, there is a an increasing demand for services. Many small merchants are starting their activities in Caparica. The Merchant is the owner of a restaurant .

Fertile land between the limits of the town and surrounding fossile cliffs, traditionally used for farming, is being sought by developers. The Farmer intends to resist to these demands and expand its activity.

Finally, the Citizen is a Caparica resident that works elsewhere. The Citizen is devoted to the preservation and improvement of the town's environmental quality.

Each Player may assume a number of Actions. Each Action has a time to be implemented and a time of useful life. A player has to specify the characteristics for the proposed Actions such as the number of people and the area involved in each Action (Fig. 2). *ANARQUIA* also provides information on the requirements and impacts of each Action (Fig. 3).

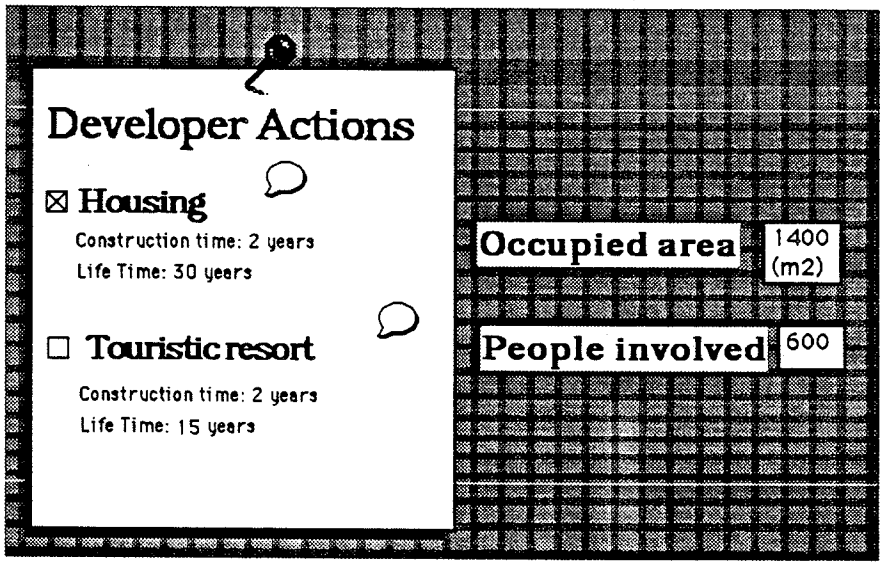

Figure 2 - Developer's actions

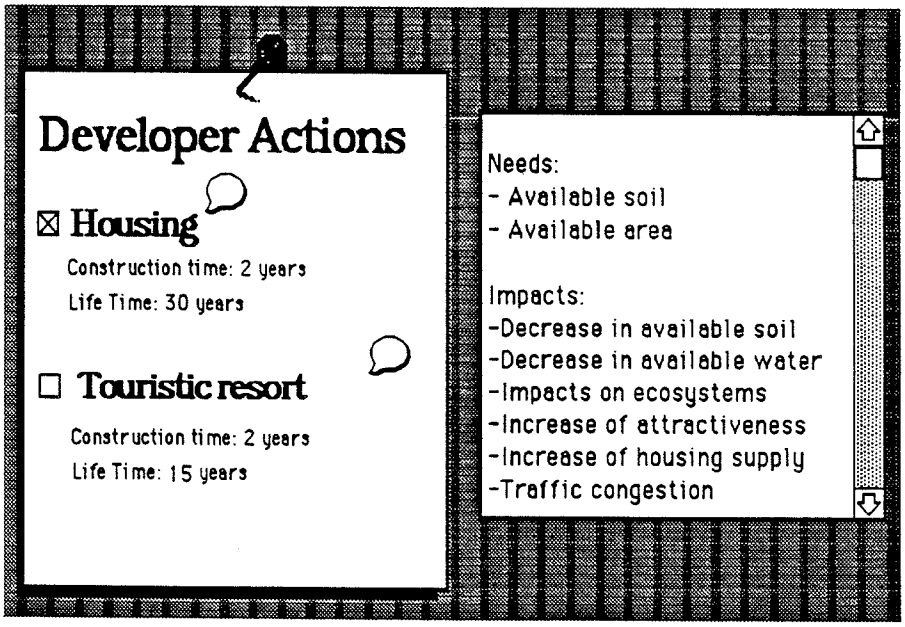

Figure 3 - Needs and impacts of developer's actions

After selecting the Actions, they are analyzed according to acceptance rules involving several factors and classes of acceptance for each one of them, as exemplified in Fig. 4.

	ACCEPTED	CONDITIONALLY ACCEPTED	REJECTED
ENVIRONMENTAL QUALITY	> 80	60-80	<60
FACILITIES/ INFRASTR. (unhab.)	0-1000	1000-1500	>1500
WATER AVAILABILITY (m3)	0-500000	500000-1000000	>1000000
OCCUPIED SOIL (m2)	< 6000	6000-8000	>8000

Figure 4 - Acceptance Rules for the Touristic Resort Action

The Actions are then analyzed to assess the level of compatibility among them considering a set of factors such as environmental quality (EQ), water availability and occupied soil. As shown in Fig. 5, housing generates an environmental quality which is incompatible with the required values for a leisure area and a touristic resort, but is compatible with the watering requirements. This process identifies incompatibilities to be solved in the next round by the players following an anarchist consensus rule.

		REQUIREMENTS		
		LEISURE AREA	TOURISTIC RESORT	WATERING
IMPACTS		PI >= 80	PI= 80	PI >= 10
HOUSING	PI=70	X	X	V

Figure 5 - Compatibilization Matrix for the Housing Action

The final stage of the decision process is then carried on involving the choice of actions for the next five years (the time step for each round). The specifications of the Actions are then translated into inputs for the system dynamics models. The structure diagram for this model is shown in Fig. 6.

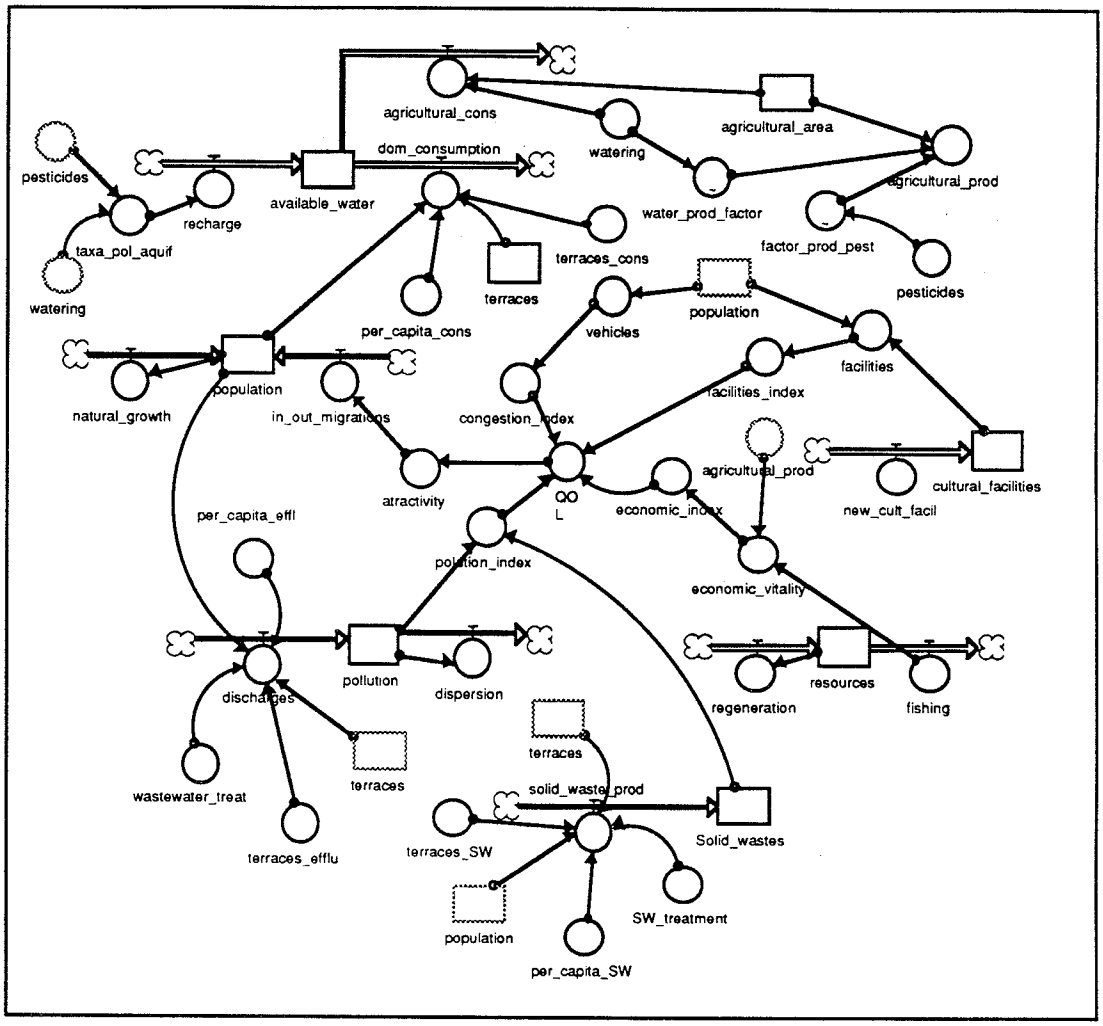

Figure 6 - Model Diagram in STELLA

The simulation results obtained for each round are summarized in the quality of life index (QOL). The value of QOL is used as the final score for each team. This index is an aggregate value resulting from several indexes: environmental quality, congestion, economic and facility indexes.

The players examine together the results of each round and formulate the next play. For this purpose, a small data base of ideas for non-conventional actions (such as new environmental control technologies) is available.

SUMMARY AND CONCLUSIONS

ANARQUIA is a game for environmental urban management adopting anarchist principles. Interfacing Hypercard and system dynamics, *ANARQUIA* is a teaching tool of environmental management, anarchy and system dynamics.

This game was applied to Costa da Caparica, a fishermen's town in Portugal, for illustrative purposes. *ANARQUIA* was played, in this case, by teams including five players, each one with a different role. Simple system dynamics models were used to operate and control the game. *ANARQUIA*'s accounting was done using indices derived from the trajectories of the system dynamics models. The goal was to maximize the environmental quality during the maximum amount of time.

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