

URBAX GAME AS A COMPUTER ASSISTED SIMULATION OF URBAN DEVELOPMENT

**Malgorzata Barbara Havel
Kauko Viitanen**

Helsinki University of Technology

Abstract

This article presents the Urbax game as a pedagogical tool used at the Institute of Real Estate Studies (Helsinki University of Technology). Urbax game is a computer assisted simulation of urban development. In this article rules of the game and pedagogical objectives of the game are presented. The article ends with the suggestion about future development of Urbax game at Helsinki University of Technology.

1. INTRODUCTION

Since academic year 2003/2004 students participate in the course at Helsinki University at Technology, Department of Surveying, Institute of Real Estate Studies in which they play a game called Urbax. The pedagogical product Urbax is a computer assisted simulation of urban development. The city is developed through the Urbax software and the actions of the participants to the session. The software program in this case is only an aid and does not assume the simulation by itself. The simulation is done essentially by the participants. The target audience for Urbax game comprises those who want to acquire a holistic understanding of urban planning and development. This game is played in the frame of the course Maa-20.3317 Game in Urban Planning and Development.

2. Urbax 2 PROJECT

Urbax game was set up in the frame of a first European project “Urban planning systems in Europe” (1996 -1999). Project was funded by the E.U. “Leonardo da Vinci projects”. Urbax2 was a continuation of ‘Leonardo’ project in years 2002 - 2004. 15 partners from nine countries constituted the network: Italy, France, Denmark, Finland, Estonia, Czech Republic, Slovenia, Hungary and Slovakia. The Polytechnic of Turin, Italy was the promoter of the Leonardo project. The Urbax 2 project is built upon the hypothesis that a common structure of urban development (tools, actors, levels of regulation) exists in different countries regardless of the specific variations of each national context. Therefore it is possible to constitute the training tool based on this common structure, which will be usable at the European level. The objective of the project was twofold, where the first one was to constitute the training tool and second to train a sufficient number of trainers in each partner country to reach a critical mass allowing further extension of the use of the pedagogical product. In order to develop the training tool the examination of the system of urban development in participating countries were undertaken. The research follows the common study raster, which enables a comparison between the various national systems. Each country elaborated the description of their system. Further comparative structural analysis of the urban development and planning systems in European countries associated with the project were prepared. The results are published in a

project web page and in the book “An overview on Planning Systems and Urban Markets in Europe”.

Recently the project "Urban planning systems in Europe - Urbax2" has been chosen as one of the 50th "best practice" in Europe in the period 2000 - 2005. More information about Urbax2 project is available in the project home page: <http://www2.polito.it/ricerca/urbax2/>

3. THE COURSE GAME IN URBAN PLANNING AND DEVELOPMENT

According to the Urbax2 project principles training based on a common tool allows the possibility of bringing together three categories of actors - elected members, professionals and citizens - from the various countries involved and enables them to get a new perspective on their own context. In year 2004 an experimental session of the Urbax game was held at the Helsinki University of Technology, Department of Surveying, in a frame of especially designed for this purpose course. There were 25 participants in the course, including regular students, PhD students, as well as professionals working in town administration. There were also two Estonian colleagues. After the course the students' opinions were examined in terms of their overall satisfaction from the course, as well as their perception of the importance of the Urbax game. The survey was undertaken using evaluation questionnaires called “Course feedback test” which is based on the system of course evaluation used at the Department of Surveying, Helsinki University of Technology. The students evaluated the course very high, 4,27 on the average (grading scale 1-5) (Viitanen & Mierzejewska, 2005). The Finnish students are normally critical, even though they may be rather satisfied with a course. This shows that they really liked and appreciated the course. Therefore the decision was made to continue the course.

Nowadays the course Maa-20.3317 Game in Urban Planning and Development is a four-day course designed for students and participants from the professional field. The course is lectured by Malgorzata Barbara Havel and Saija Ettanen. The course consists of lectures, interactive exercises – teamwork and the Urbax game session. The lectures introduce the students to the economic base theory and prepare them for the game session. Teamwork done prior to the actual game session introduces the participants to the contents of the Urbax2 project and especially to the planning and development process in the participating countries. This phase was included in the program from the beginning because it was known that the planning, plan implementation and administrative structures in the game program differ from the Finnish system. In the first years the work was carried out in a way that each team concentrated on its own theme and made a comparison between the participating countries in the Urbax2 Project. The main material was the country analyses made in the Urbax2 Project. The themes were as follows: (1) principles of town administration, (2) planning system, (3) plan implementation instruments, (4) actors and their roles in urban development, (5) fees and cash flows in the town economy. Recently in this part of the course students also make a comparative research containing other countries like the US or Spain. Because currently there are more international students in the course, it is possible to ask them to compare some aspects of system of development and planning from their country of origin. In this case other sources of information are also advisable for the students. The goal of this part of the course is to make students aware of the influence of the institutional factors on the process of urban development. The practicing of presentation was also important aspect in the learning process. After the course students prepare obligatory a learning diary. Learning diary should provide information regarding what students learned on the course. The course Maa-20.3317 Game in

Urban Planning and Development is recommended after the course Maa-20.4630 Real Estate Development, which introduce students to the economics of the development process.

4. RULES OF THE URBAX GAME

The game is based on the economic base theory that leads to economical way of studying the changes and change patterns in urban structure. The economic base consists of the industries and economic activities that generate employment and income in the area. When employment opportunities are growing, the economy of the area is healthy. Economic base theory assumes that all local economic activities can be divided into two general sectors: a basic sector (non-local) and a non-basic sector (local). Basic sector constitutes of local businesses that are entirely dependent upon external factors and non-local firms. Basic sector generate sales to areas outside the local community. The produced goods are not consumed locally, but they are exported. Basic sector is the engine of the local economy and the main source of employment. The impact of the basic sector upon the local economy is the ratio between total employment and basic employment. The certain number of non-basic jobs (in the non-basic, service sector in the city) is created by one base job. (e.g. <http://garnet.acns.fsu.edu/~tchapin/urp5261/topics/econbase.htm>)

In case of the hypothetical Urbax city players decide about development of basic or non-basic sectors. Impacts of player's decisions on the local economy (e.g. jobs, per capita average income and number of population) are calculated by the program according to economic base theory. Each new direct job generates 0.8 indirect jobs. Each new job (direct or indirect) increases the housing demand by an area equivalent to that occupied by 0.7 resident (some 23 sq.m.). The disappearance of a job has the reverse effect but not all residents move away (some 70 % stay put).

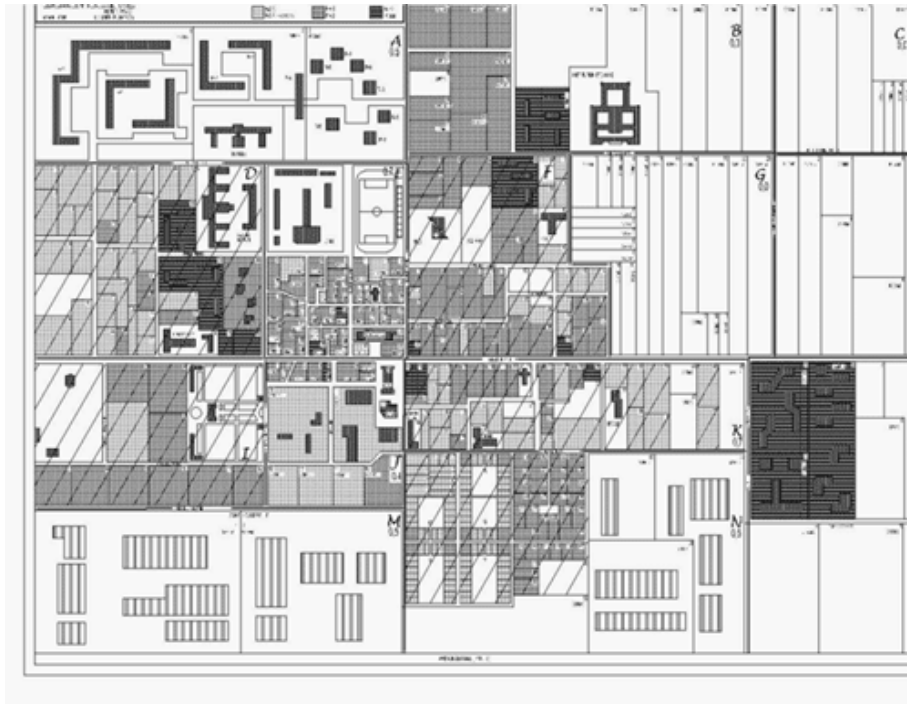
The Urbax city has about 8000 inhabitants and an area of 157 hectares. The town includes various types of urban fabric: a historic central area, industrial areas, a large housing estate, areas for future development with agricultural activities in decline, transitional areas, and housing development areas which relates poorly to the rest of the town (see Map 1.).

Participants of the game session play the following roles: the public sector, private developers and industrial enterprises. In public sector there are two groups: the major and the social housing association. There are three groups of developers in the game: Blue, Green, and Red. There are two industrialists: Yellow and Violet. Each group has an initial portfolio of buildings and land. Each group receives the paper map of the city. The Urbax game is simulated on the game leader computer.

The participant who plays the role of the major sets up the planning and development principles in the city. He/she decides about which part of the city will be available for development, negotiates with the other players participation in the provision of necessary infrastructure, changes the development principles (e.g. defines plot ratio, changes the land use plan) and finally approves all building permits in the city. The major can use different land policy tools: expropriation, pre-emption, incentive taxation system, etc. Therefore the major decide about the land policy in the city and set up in details the objectives and methods. It could be for example to revitalise the town centre whilst retaining the social structure of the city or to ensure the development of new neighbourhoods in order to better integrate block L with the rest of the town or to increase employment in order to have the means to implement the policies of the development of the high-tech city with high quality living environment.

The industrialists and developers are aware of the income generated by its real estate portfolio and potential profitability of their business. They decide freely how much housing or their developments to put on the market and at what price. They have to consider what would be the level of their activity and what price to pay for land. The business income of industrialists is made of the gross margin resulting from each of its operations plus the rent accrued from housing portfolio and the interests of its financial investments.

The players can invest in a wide range of activities and build different facilities in the city. There is a list of activities and facilities available to them.



Map 1: Urbax city

All changes regarding the development principles are put to the Urbax computer system. Computer program simulate the following phases in the game:

- PHASE 1: LAND (Land for sale, Buyer's market, Expropriation, Transaction, Subdivision, Regrouping)
- PHASE 2: BUILDING PERMITS
- PHASE 3: REGULATIONS (Plot ratio, Planning obligations, Development tax, Compulsory purchase order, Preemption right, Renewal scheme subsidies, Land readjustment, Fees)
- PHASE 4: HOUSING MARKET
- PHASE 5: INVESTMENTS (Rehabilitation, Demolition, Streets and utilities, Construction, Public services, Enterprises, Conversion)
- PHASE 6: END OF YEAR. CHANGES

All these phases constitute one year of the game. Each phase must be strictly followed. Participants of the game session play four years. At the end of each year the changes in the city structure, the financial situation of each player, and the reaction of the voters to the election of the major of the city are observed.

5. URBAX GAME AS A PEDAGOGICAL TOOL

Pedagogical objectives of the Urbax game were defined as follows:

- 1. To understand the **actor's strategy**: local authorities, public-private developers, and industrialists.*
- 2. To understand the **urban planning system** and to be able to appreciate the interaction between the various urban policies in order to put forward a global urban planning strategy.*
- 3. To be able to use the **planning tools** and methods relevant to a historic quarter, new neighbourhoods and areas of economic activity. (<http://www2.polito.it/ricerca/urbax2/>)*

From the teachers' point of view the course is very successful. The students put their minds keenly to the subject and play eagerly. The atmosphere during the game is enthusiastic. Students are obviously motivated to playing, which may be considered as one of the most important prerequisites for learning (see e.g. Rauste- von Wright & von Wright (2000 p. 34-36), Hakkarainen et al. (2002 p. 82-88), and Wankat (2002 p. 134-139, 166-170)). It is, however, arguable how well the pedagogical objectives set for the original Urbax game were met. We would say that one does not learn anything about the actors' strategies, as the actual formation of strategies was neither treated in the game nor in the course. It was mainly a matter of understanding the ways of acting and thinking of the various parties. The game also was much too rapid for learning the planning system. It was necessary to have a good command of the principles in advance. It was the reason that in the course the teamwork was proposed. The course succeeded very well, as the students knew the basics of the Finnish planning system well and some of the participants had experience in planning in their working life. The teamwork in the beginning of the course was undoubtedly also very useful for understanding the planning system greatly differing from the Finnish system. The same points of view as for the planning system also relate to the third objective, i.e. learning to use the planning tools. Although it seems that the game itself does not give straight answers to the set objectives, it gives, however, a very good concept of the functions within a planning and developing process, the interest of the various parties, the difficulties involved in the process, and the difficulties in managing the overall process, and its consequences on the urban level. Thus the game teaches to understand the entire functioning and the impacts of the various matters in a manner motivating to the students. It will enhance the students' expertise, and therefore the existence of the course is important. (Viitanen & Mierzejewska, 2005).

Negotiations between players are the most important part of the game. The local authority cannot finance the entire necessary infrastructure without the participation of the developers. Developers have to ask the local authority for a building permission. A possible activity of developers and industrialist depends on the stage of the development of city, which is measured by an average income in the city and the city attractiveness. Therefore the well-developed city should be a goal of all players. The students practiced understanding and negotiation over the urban land development process, as well as working in teams, which constitutes the different development forces. In today's changing European context the whole idea of spatial planning has undergone some marked changes from formal and legally binding

documents to project-based settings. The outcome much depends on the interest, negotiation skills and power position of actors. The role of negotiation, an interactive network of actors and public-private partnership is emphasized in urban development. The Urbax game gives an excellent opportunity to discuss these aspects with students.

Urbax game is only a tool. Like all computer tools it can help by doing simulation but cannot replays players or game leaders who can together find the explanation of what's happened during the game. The changes in the city give the incentive to discuss with students. The discussions are important part of the process of learning. The unexpected effects of actions of the Urbax simulation players are stimulating for discussing effects of land policy. What would be the social profile in the city, which instead of investing in the basic sector invests in excellent social housing and infrastructure? Urban development is a complex process. It consists of other processes like planning, plan implantation and changes in ownership and property structure. People who interact in groups do all actions. It depends on the game leader which from the theories can be discussed with students. There is of course the economic base theory, which gives the background for the discussion, but during the game different situations appear which lead to different reflections. It gives an incentive for example to critically discuss the theory of collective action in governance of natural resources used by many individuals in common (the tragedy of the commons, the prisoner's dilemma game or the logic of collective action). In the heart of all three theories is a free rider problem, which could be observed sometimes during the game.

Majority of the student's learning diaries emphasized that playing the game from the position of different actors enhanced the understanding of the process of urban development and planning.

Every year city is developing differently in the game. The program is the same and the game leaders but every year the interaction between players results in different development outcome. Besides the rules of the Urbax game students create their own rules for interaction. Depending also on the background of the students some elements of land policy are more emphasized which leads to different decisions in the city.

6. FUTURE OF THE URBAX GAME AT HELSINKI UNIVERSITY OF TECHNOLOGY. GIS APPLICATION TO URBAX.

In the last decade Geographic Information System became accessible not only for GIS experts. Customizable, user-friendly spatial applications are also used in urban planning field. (Guszlev 2005)

The need for establishing a GIS for Urbax game has been expressed a few years ago. In result a parcel-based information system were created and used at the University of West Hungary. From the several available choices, Intergraph's GeoMedia has been selected, which is known for its superb data integration and digitizing capabilities. It is a first step towards the development of an utilizable URBAX GIS. MS-DOS-based URBAX3 (U3) software handles no spatial data. Many descriptive attributes about the land parcels, blocks, buildings and activities are stored by the system. On the paper map of the town only a limited number of static information are presented. A parcel-based information system developed in Hungary linked the data stored by the system to the map. The system is based on the parcel identification number. Following thematic layers were created: base map, parcel and block names, building permits, housing vacancy, plot ratio, services, social housing, built housing,

existing activity, authorized activity, average income, block attractiveness, amenities, quality of construction, condition and land price. This enables to visualize given topics (e.g. plot ratio). The results can be browsed both in tables and on maps with different colors. Computer aided visualization enabling also complex analyses, like correlation between data. An experimental session on this new GIS has been held in Slovakia, in October 2004 and was regarded as successful. One additional computer with GeoMedia was installed and used in parallel with paper maps, color pencils, and the game leader's computer. There is still a need for some additional experiments with the system in order to merge the Urbax simulation and the GIS modules into one comprehensive application. (Guszlev 2005)

At Helsinki University of Technology there was no attempt to apply the GIS to the Urbax game. Students use the paper map, where they monitor all changes using color pencils. At the same time they have possibilities to ask the game leader about attributes of the land parcels and blocks. At the last game session student who play the role of the major of the city has elaborated the map of Urbax city using the Excel software. He has monitored all the changes in ownership structure and development process. Follow up of changes in the game done in this way improve the decision making process and made easier the discussion between the major and other players. It expresses the need for better distribution of information during the game session. Improve of the availability of information was also often emphasized in students diaries.

It would be advantageous to employ the complex capacities of GIS to Urbax game at Helsinki University of Technology. A well-developed information system is vital for efficient decision-making process. In this way all players can better work together on a common vision of their city development.

References:

Economic Base Theory. Florida State University.

<http://garnet.acns.fsu.edu/~tchapin/urp5261/topics/econbase.htm>

Guszlev, A. (2005) *GIS Applications in Urban Planning*. In Lami, I.M. (Ed.) An overview on Planning Systems and Urban Markets in Europe. Aracne. ISBN 88-7999-973-7

Hakkarainen, K., Lonka, K., Lipponen, L. (2002) Tutkiva oppiminen. Älykkään toiminnan rajat ja niiden ylittäminen. Porvoo. (Learning by studying. Limits of intelligent actions and exceeding the limits)

Rauste-von Wright, M., von Wright, J. (2000) Oppiminen ja koulutus. 7. p. Juva. (Learning and education)

Urban planning systems in Europe - Urbax2, project home web page:
<http://www2.polito.it/ricerca/urbax2/>

Viitanen, K., Mierzejewska, M. (2005) *Playing the Urbax game with students – Finnish experiences* In Lami, I.M. (Ed.) An overview on Planning Systems and Urban Markets in Europe. Aracne. ISBN 88-7999-973-7

Wankat, P.C. (2002) *The Effective, Efficient Professor. Teaching, Scholarship and Service*. USA.