GREEN CITY

A cognitive game

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Abstract. The project is about simulation of a sustainable urban scenario, which is developed as a game, that would also serve as a pedagogical tool for sustainability in urban context. The interface is a simulation based city-building game, where the player acts as a town-planner focuses on building a bigger city, while the game design aims at developing it, as a sustainable urban model. This is achieved by encoding sustainable urban development concepts with the sequence of simulation (development) process, through which the game operates sensitively towards sustainability.

1. Introduction:

This project seeks to familiarize individual citizens, communities and city governing bodies with the process of sustainable development through a mass media. This could be done by translating these concepts, in to an appropriate mass medium - |a game| - A game interests many people particularly the future generation.

This game is contiguous to SIMCITY ([2] SimCity series by Maxis'93) in terms of the constructive activities and player roles. The player (acts as a Town-planner/Mayor) proposes various constructive activities to build a bigger city. He always has a choice over an activity, whether it could be sustainable or conventional. Proposing a sustainable activity has high initial cost but lower maintenance cost and would be energy efficient. A conventional activity in contrast has lower initial cost and higher maintenance, also consumes city resources.

2. Game Architecture:

2.1 DESCRIPTION

The interface is as simple as a SIMCITY ([2]SimCity series by Maxis'93) interface, where the player proposes constructional activities from the given construction palette and builds his city. The game starts either with a new city or an existing city. With available resources, the player proposes constructive activities. Once, the city canvas has basic infrastructure fulfilled

for an activity in a particular location, the process of simulation starts over that location. The simulation of development happens with respect to time. Simulation will be governed by the rules of sustainability, and will generate results in terms of social factors like population, pollution, education, health, etc and in turn demands an(y) activity. After the demand is satisfied, the game will simulate further constructional activity; else, the demand increases and would start to deplete a particular resource in the resource meter, ultimately leading to the destruction of the city. As the city grows it consumes resources, unless the city uses sustainable sources of energy, the city cannot grow bigger, as depletion of resources, activates the destruction in the city.

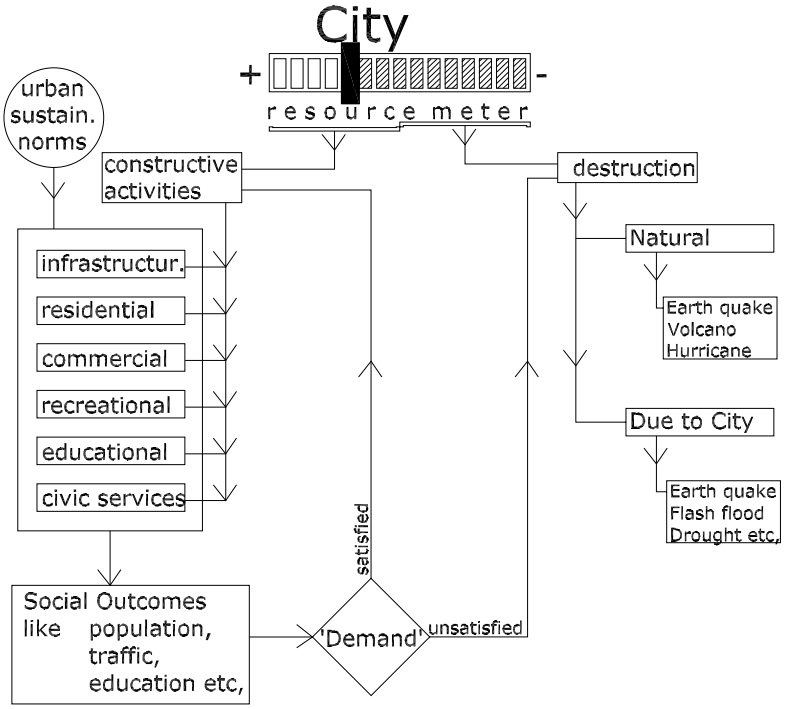

Figure 1. Methodology of the functioning of the city

2.2 THE URBAN ENGINE

The basis of the simulation is derived from a set of case studies ([4] Canary Wharf and [5] Curitiba – Portland) and by tracing the sequential development of the SimCity ([2] SimCity-2000 demo).

Urban simulation starts only after all the basic infrastructural needs of a locality are satisfied. The frequency of demand rises in the major fields, and the level of simulation for each activity depend on the connectivity between those.

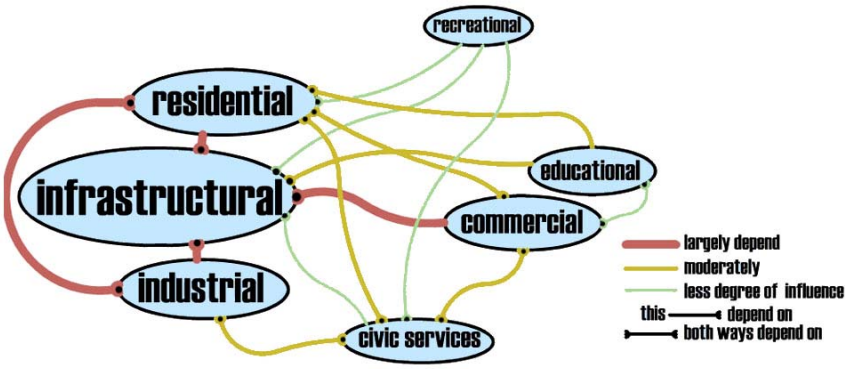

Figure 2. The sequence of simulation

2.3 SUSTAINABLE URBAN FACTORS:

The basis of evaluation for the simulation is derived from a set of widely accepted sustainable urban development norms of LEED ([7]LEED _ ND) and Design Guidelines Manual ([8]City of Tucson, Arizona).

PLANNING EFFICIENCY	ENVIRONMENTAL PRESERVATION	RESOURCE EFFICIENCY:
Transportation Efficiency	Imperiled Species and Ecological Communities	Heat Island Reduction
Water and Stormwater Infrastructure Efficiency	Parkland Preservation	Energy Efficiency
Access to Public Spaces	Wetland & Water Body Protection	Wastewater Management
School Proximity	Erosion & Sedimentation Control	Recycled Content
Open Community	Farmland Preservation	
Transit-Oriented Compactness	Steep Slope Preservation	
Housing Diversity	Outdoor Hazardous Waste Pollution Prevention	
Diversity of Uses		
Street Network		
Pedestrian Network		
Access to Nearby Communities		

Table 1. Derived Norms for Sustainable urban development

2.3.1 TRANSLATION OF NORMS:

The norms as specified in the above mentioned sources are translated to logical and computable equations, which are applicable over the interface design. For example ‘proximity to school’ is manipulated on the basis of reading of close range pixels to the school activity. The statistics were generated in terms of children health level, literacy level, and health of citizens.

3. Interface design:

The game's interface is almost like a normal city-building game's interface ([6] Wikipedia).

3.1 City chooser window:
The game is preloaded with a set of fresh and existing city canvases. These cities vary in their initial funds & resource availability to set the difficulty levels with in the game.

3.1 Construction palette:
Constructional activities could be zoned (painted) over the canvas, where actual simulation of development will take place. All the activities have choices in terms of density, built area, and sustainable design guidelines. The construction palette has provisions for various civic programs with preset areas and allied facilities.

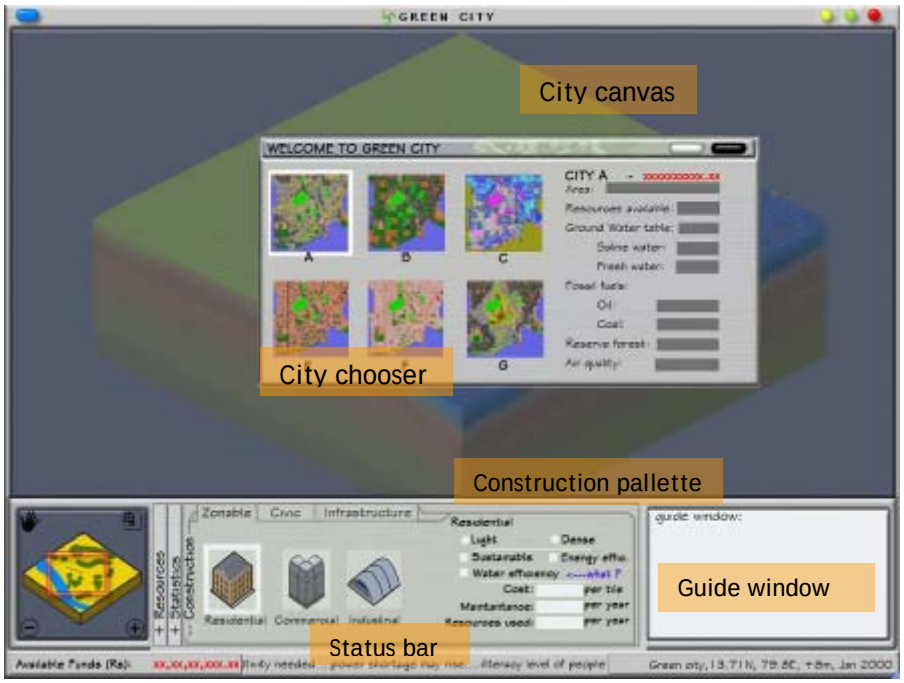

Figure 3. The interface design of Green city

3.1Infrastructure palette:
Similarly, the infrastructure palette houses the infrastructural needs of the city, such roads, service plants, water lines, electricity lines, drainage lines, communication lines etc.

3.1 Status bar & Guide window
Status bar gives current statistics and flashes the current demand, the speed of the time break. The guide window, flashes planning tips and also external links while choosing an activity and also at the time when a particular zone is taken for analysis.

4. Methodology of simulation:

Simulation happens in terms of pixel by pixel, a pixel or group of pixels houses an activity. Every pixel generates output in terms of the statistical parameters. The simulation of an activity depends on the activity on the neighboring range of pixels. Conceptual simulation of a road pixel:

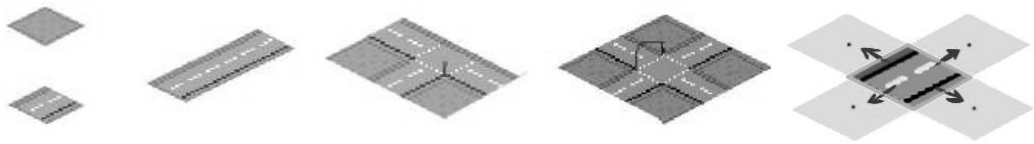

Figure 4. simulation of traffic flow, where a pixel reads the others connected to its edges

Rules:

- According to the development of the adjacent sides of the tile, the tile's traffic intensity is calculated.
- If the adjacent of the road is another road, then it has zero impact from that side, if it has third side, it reduces the impact of traffic by half in that region

Remedy:	Output:
Fly overs	in pollution
Tube stations	in accident
	in city resources

5. Gaming parameters:

Statistics, gives various output of the city functioning n terms of percentage, player by understanding these, should propose activities that are in critical demand. The most critical demand is flashed in the status bar ([3]SimCity series by Maxis'93).

Figure 5. conceptual statistics panel, showing output in a graphical view.

The time break is the speed of the happening time in the city with relation to the real time. eg., 10years in 10 mins… indicates, 10 years of city time with relation to 10 mins of time spent in reality(time of gaming). Perhaps, it's a critical factor responsible for a player to really understand the need of sustainability because, in reality we rarely feel the causes of depletion of natural resources, but this could be felt here, in this game, because of the time break.

The ranking of the player is determined on the basis on bigness of the city, strength of the economy and utilization of renewable resources. Special

rewards and recognitions are awarded if the player performs well in any of the aspect.

6. Structure of the project:

The game is developed from the dynamic interaction between two basic modules, the structure of simulation and the aspects of its evaluation. Each of them is derived from a set of case studies. The latter one makes the game different from a normal city building game to a sustainable city building game, by assessing the rules and other simulation criteria from the sustainable urban development norms.

Further, the scope of the project could be extended as an online gaming tool, where a player could import the city canvas, through virtual globe ([9]Google Earth). This would increase the level of understanding of sustainability, when a player experiences, global warming and destruction in his own city.

Figure 6. Snapshot showing 3D buildings of Manhattan – 'Google earth'

Further more, the project could be extended out from a gaming tool to an online simulation tool in virtual earth, for simulating the statistical and the geological change that would happen, if a new activity is proposed in a city.

7. Expected Contributions:

- Creating a sustainable city building game to facilitate greater awareness of sustainable urban development amongst the public and design community
- Creating an accessible and interesting game environment for the 'Green city' to be an effective pedagogical tool.

8. References:

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5. Wikipedia - Curitiba – '*Urban Planning*' & '*Transportation*' via – "http://en.wikipedia.org/wiki/Curitiba" [Revision as of 17:45, 23 January 2007]

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8. Design Guidelines – City of Tucson, Arizona – '*All Development'* – http://www.tucsonaz.gov/planning/codes/design/dgsec1.pdf

9. Virtual globe - Google Earth –Google Inc- *Google Earth – 4.0.2416(beta)* – October 31, 2006.