YouPlaceIt!: a Serious Digital Game for Achieving Consensus in Urban Planning

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Abstract

The main goal of this paper is to introduce a serious digital game for urban planning. We focus on an example of a game that aims to support a process of consensus finding in a diverse and complex urban planning processes. The game is titled YouPlaceIT! and extends the concept presented in B3-Game Design Your Marketplace!. We added a more complex decision-making and human behaviour models to the initial version of the game. The players taking on relevant roles mirroring real-life stakeholders aim to achieve a consensus, which can be achieved by negotiations or financial trade-offs. The scoring will be based on analysis of rating of social interactions and financial status. The complexity of the model lies in engineering human behaviour motivated by perceptions, factual information and socio-political implications. The case study is the largest low-income area Dharavi located in Mumbai, India.

Keywords: serious digital games, urban planning, public participation, consensus.

1 Introduction

Urban planning involves a variety of stakeholders with different interests related to the use of space and distribution of activities in the city. These stakeholders can include the residents of the planned area, various government departments, real-estate developers, industry, and non-government organizations (NGO's). Reaching a consensus among different stakeholders is a challenging task which involves negotiations and compromises among all involved parties. The biggest challenge faced by urban planners is to bring all stakeholders to an agreement. How can this be done? This paper suggest to use a serious game which could involve a variety of stakeholders and enable them to discuss urban planning issues with the help of the game. A game in this case would serve as a common platform, which enables all involved stakeholders to participate constructively in a dialogue about urban planning issues.

We are interested in the use of serious games in urban planning which would enable to support the process of achieving consensus. Urban planning games, are particularly interesting for their social relevance and intriguing for their complexity. In this project we focus an area, Dharavi, which is considered as a city within the city of Mumbai, India. It is the setting for a game requiring a cooperative effort to develop it into a habitual area. It is home to one of the largest low-income residences also called a slum. The businesses in this area have an annual economic output ranging from $600 million to a $billion. The residents are usually unregistered daily wage earners or skilled workers. The area includes about 2000 different categories of micro enterprises located in this area. There is no clear geographical demarcation between residential and enterprises units, leading to exposure to toxic chemicals for the people living in the small shacks with little or no civic utilities. Close to 300,000 people reside here, many of them having no land rights. A long tussle continuous between governments, NGO's and the residents to find a solution to the problems faced by the residents and the development plan prepared by the government. The high cost of land in this area of Mumbai makes this area a hot-spot for conflicts. Due to the very complexity of the problem, which includes interference from the politicians; the government has recently issued a moratirum on any further development.

In our case, Dharavi serves as an example of a complex urban planning situation in which a consensus among different stakeholders is needed. Testing for transfer of knowledge is one of the metric for evaluationg the effectiveness of the game as a medium for learning. The effectiveess of participatory urban planning games for learning and transition to real-time decision making processes has been studied extensively ([1], [2]). Both these aspects will be addressed by incorporating interfaces within the gameplay with information required to make decisions and while testing the game with real stakeholders.

This paper concentrates on the concept of the YouPlaceIt! game which aims to support consensus finding in a selected urban planning situation. Its goal is to enable stakeholders to interact, make cooperative decisions and resolve urban planning issues. The primary research question is: Can a game environment provide an effective platform for decision making and conflict resolution when representing real-life scenarios?

2 Previous Work

2.1 Digital serious games

Serious games are games that aim to support and facilitate learning ([3], [4]) and problem solving processes [5]. They can be "any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed with the intention to be more than entertainment" [6:6]. Often they focus on real-world problems and can be also defined as "entertaining games with non-entertainment goals" [7]. Learning with digital serious games can be facilitated with the help of experimentation [4]; several alternatives can be tested in the game environment without serious consequences which would happen in the case of a non-game, real-world experience. The players can learn in the order that suits them and at the speed and pace that can be optimal for their own personal experience.

2.2 Urban planning games

Urban planning and cities in general have often been selected as the main topic in games. Examples of such online games are SimCity, PlastiCity [8], or City One [9]. Their main goal is to entertain; they cannot be categorized as serious games. One of the first serious games for urban planning was described in the book titled Serious games written by Abt [5]. A few years later Sanoff ([10], [24]) published a collection of games which focus on urban planning. These are spatial, non-digital games, and some of them could be categorised as "serious". Recently several digital serious games for urban planning have been developed. Gordon and co-authors ([11], [21], [22]) describe a pilot project "Hub2", that took place in Boston, Massachusetts from June to August 2008. Devisch [12] focused on the Second Life and its possible use for urban planning. Poplin ([13], [14], [23]) introduces the NextCity and B3-Design your Marketplace! games, which aim to facilitate public participation in urban planning.

2.3 Behavioural models

One of the most interesting output from any game play is the human behavior in decision making processes, conflict resolution and cooperation by social interactions. Some of the behavior models that can be applied in our study case include the Nash equilibrium, QRE-quantal response equilibrium [15], cognitive hierarchy [16], or the level-k ([17], [18]). The level-k model model strategic thinking which adopts a best response to beliefs about other players. This model relates the closest to real-life conditions and situations. It is based on some traditional or simplified models of other players, but it captures the essence of each role the player has in the game. These models can provide insights into effectiveness of the game in real-life negotiations.

2.4 Physical vs. virtual space

Urban planning games can be of relevance in assessing whether certain spatial configurations (physical vs. virtual) can support collaboration better than others so that communication and knowledge exchange is facilitated. It is important to take into account how virtual activities influence new conceptions of physical layouts. More specifically, it becomes possible to analyze whether there are differences in the nature of the interactions that arise in the physical urban space vs. the 2D or 3D representation of the digital game. While physical space plays an important role in triggering socialization, it might be the case that in online urban games this role is taken over by language. The style of communication used or the vocabulary adopted can be a relevant indicator of a community and identify cultural differences [19]. Language can play a similar role to spatial order in identifying cultural differences between one social formation and the other. This seems to be the case also for digital games in which social roles are created through language with the support provided by the dynamics of the game while the identities one has in the real world play a marginal role [20]. Players come together mainly because of their interest in the game and the game with its 2D or 3D representation constitutes the shared space that sets the basis for the emergence of communities and their language.

3 Case Study: Dharavi

This case study for an urban planning game that supports finding consensus among stakeholders focuses on one of the largest slums in India, Dharavi. Its populations is estimated to more than 1 million inhabitants. It is located in Mumbai and was founded in 1880s during the British colonial area. It is a very diverse, poor and multi-religious settelment. It currently covers an area of about 230 hektares which is about 557 acres. Figure 1 shows a bird's eye perspective of this area.This area represents a very complex urban area, requring diverse stakeholders representation in designing an acceptable urban plan for its further development. Figure 2 demonstrates the study area on the satellite image. Figure 3 shows a busy street in one of the business districts.

Figure 1: The bird's eye on the study area.

Figure 2: The satellite image of the study area.

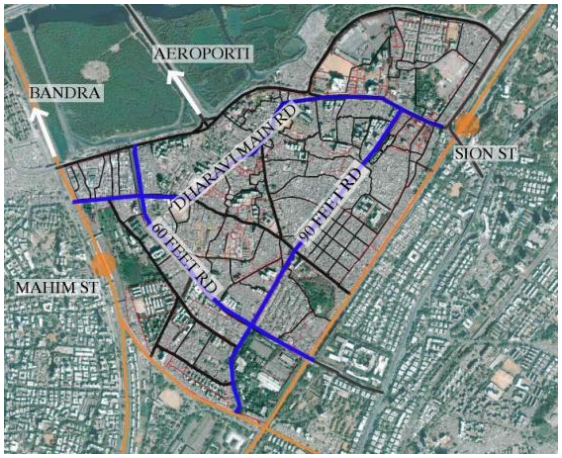

Figure 3: Street view of a busy business area.

4 Serious Digital Game: YouPlaceIt!

The game will extend the B3-Game: Design Your Marketplace! ([13], [14]). The game engine will be implemented in Java/Java Script; the user interface in Unity 2D or 3D platform. It will include representation of business districts, industrial estates, residential complexes and hospitals, with the possibility of creating new types of spaces and places. The representation will be in 2D and/or 3D with an implementable walk-through option. The objects included will be the residential structures of different types, utilities, industrial structures, schools, hospitals, benches, trees or lights. The players will be able to select a common area of their interest. The game play will start off with one of the players proposing a plan to develop a certain land area. The other players will take turns to raise objections, negotiate price or agree with the suggestions of other players. The game will converge when the area selected is balanced on economic and social parameters. An additional convergence will be achieved by forcing a limited budget for each plan. The interactions among the players will be enabled by multi-lingual text-chats and representational icons. The scoring for each converged decision will be calculated on a social development and return on investment ratio. Factual knowledge related to each object, as well as about material, geological conditions like soil type and ground-water, will be presented to the players. In the following we describe the main game mechanics.

Space/Environment. The space represented in the game will be the actual geographical area of Dharavi. The topography will be taken from the Indian satellite images Bhuvan. The 2D representation will be a virtual recreation of the top view with ability for a tilt to get a depth perception enabling feature depictions. Colours as per natural conditions will be used and lighting will be daylight representation. Sub-space or discrete spaces like market-places, hospitals or schools will be designed with customised rules. Physical barriers like weather conditions will be introduced as a random effect to test for validity of a plan proposed by the players.

Objects, attributes and states. In this role-playing game, the objects accessible to the players will be the following: commercial buildings, houses, flat lets, trees, school buildings, roads, hospitals, market-places, civic facilities like water treatment plants, garbage recycling units, parks, water bodies, and religious structures. They will have attributes attached to the graphical representation, which will describe each object with factual static or dynamic knowledge. This knowledge will be provided either by the game engine or by the players.

Actions. As in a multi-player game, the actions or moves of each player will be logged in a database. As the game--play continues, the initial rule-based play will evolve into emergent game play. For example: the player representing a resident cannot undertake to build a road, as this falls into the government body's responsibility. An NGO's cannot build a commercial building, but can raise objections against its placement in a certain location. But, in emergent behaviour the action by each of the above can change to even suggesting alternate methods to lay a road or design an eco-friendly commercial building.

Rules. Rules form the basis of the game. They include the operational rules of the hardware and/or graphical interface of the game and the official rules based on real-life conditions. The rules for game tokens – like budgets, costs, and defining the player's goals - as well as the need to finish the game within the sanction budget, reward mechanisms and achievable targets will form the game play and its rules.

Game play. The game is designed as a cooperative game. Disagreements can be resolved by negotiations, financial, social and political benefits. The goal is that each player, depending on her or his role in the game, need to accomplish a task with a minimal conflict. All information is accessible to all the players and can be acquired upon request. The game starts with a budget for the development and a social index goal. The scoring for each player will be related to the cooperation index and payoffs.

An example of the game play process:

- Resident representative proposes a plan and he/she places the proposed objects in the map space.
- The government representative raises restrictions and regulations in addition to calculating the costs.

- The real-estate agent brings in the commercial aspect to off-set some of the costs in rebuilding the space.
- The NGO's (environmental, rights activists etc.,) check balances for each object and the interlinks between the objects.

The game engine will calculate the costs and provide the financial sheets for every object selected by the player.

Communication. Multilingual text chats and icons will be used as a way of communication among players to support reaching consensus. This corpus can be analysed to assess how language and dialog are employed to build social roles and social groups within the game. In particular, we will analyse whether the mechanics of the game and the identities of the "real world" have an impact in determining social roles. Furthermore, we will investigate whether there are difference and similarities within the digital and the physical urban context setting. This will be tested by using standard knowledge transfer analytical methods when played by urban planners or residents, and customized surveys to check for changes in perceptions in the pre-post game play.

5 Conclusions and Future Work

This article introduces a game that aims to support consensus finding in a complex urban planning situation. The study case is taken from India and focuses on a very diverse slum area Dharavi. The complexity emerges due to the variety of different stakeholders' interests and their specific visions about how this area could be developed and renewed.

In the process of development of the game we will also discuss the issues of consensus, whether it can be achieved with the help of a game and how the results of the game play can be used. The game interface will be presenting factual knowledge to the players, and testing will be conducted to measure knowledge transfer. We are now in the phase of discussing the presented concept, details of the game mechanics, and the models used to support the main ideas and concepts.

In the next phase we plan to acquire a substantial amount of human behaviour data, which will be optimized into the artificial intelligence engines. An extension can also include children as one of the role-play options, and provide rules or expectations from children. We also aim to capture human cognitive behaviour. The player's data at every move will be analysed by fitting them to graph theoretical models. A substantial testing is planned after the completion of the first version of this game. The tests will be executed in India, Germany and Holland. The results of this testing will have an impact on further development of YouPlaceIt! game.

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