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Digital serious game for urban planning: "B3—Design your Marketplace!"

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Abstract. The main goal of this paper is to study the design and implementation of a digital serious game for civic engagement in urban planning. Digital serious games are games that aim to support learning in a playful and engaging way. Learning about the environment and planned changes is essential in civic engagement. The study case is taken from a city district, Billstedt, in Hamburg, Germany. In the implementation of a game concept we concentrated on the design of a marketplace in Billstedt. The game was called "B3—Design your Marketplace!" The B3 game aims to provide a playful digital environment in which the citizens gain information about the current situation in the city district, have the possibility of submitting their own designs for the marketplace, vote for the preferred designs, and chat with the experts and other participants. The prototype of the B3 serious game was evaluated with a group of students and a group of elderly people. The majority of the participants involved in testing expressed appreciation for the digital serious game as a new form of online civic engagement in urban planning. The paper concludes with a discussion about the potential of digital serious games for civic engagement and open research questions.

Keywords: games for civic engagement, urban planning, digital serious games, game design, game testing

1 Introduction

A growing challenge for the urban planning discipline deals with understanding complexity (de Roo, 2010; de Roo and Silva, 2010; Innes and Booher, 2010), its modelling (Batty, 2005), and its management. The idea of perceiving cities as systems that change over time in unpredictable, nonlinear, and adaptive ways is increasingly addressed in the urban planning domain.

> "Many planners view complexity as a qualification of and confrontation with reality, involving a complex situation, a complex constellation of interests or a complex process. They see complex interrelationships, a coherence that is difficult to predict and a potentially unmanageable situation that might prove too much for those involved" (de Roo, 2010, page 3).

In order to deal with these complexities, the focus of planners seems to shift from "object-oriented goals to optimising interaction and participation" (de Roo, 2010, page 114). Novel participatory tools and computer-based models emerged in the last twenty years, many of which aim to support participatory planning and cutting-edge, computer-based methods of learning about the environment.

In the 1990s several geoinformation scientists concentrated on possible implementations of participatory functions in geographical information systems (GIS). The term public participation GIS (PPGIS) was coined and initiated after about ten years of intense concentration on this specialised GIS. It is a technology which could potentially enable citizens to make informed decisions about the future of their district, city, or region. Some of

the fundamental literature includes the work of Carver (2001), Craig et al (2002), Jankowski and Nyerges (2001), Kingston et al (1999; 2000), Pickles (1995), Rinner (1999), Schroeder (1996), Sieber (2003), and Steinmann et al (2005). In this early phase GIS functionalities were deemed to be too complex for the majority of online users (Steinmann et al, 2004), and the technology failed to enable intuitive interactions with online GIS-based maps. The recent developments in Web 2.0 and 3.0, crowd-sourcing, and social networks have brought new possibilities to planners, stakeholders, and citizens. Citizens are often considered to be the source of local knowledge, acting as sensors (Goodchild, 2007); their knowledge can be collected with the help of easy-to-use and freely available participatory applications. Sui (2008) writes about the "wikification of GIS". A similar concept was earlier described by Egenhofer and Mark (1995) as "naive geography".

Digital games represent an emerging research and application area, enabling playful learning about the environment and an exchange of contrasting views on proposed urban, regional, or landscape plans. This emerging research area in planning is gaining attention especially due to the novel interaction possibilities of the users with the game environment, alternative options of modelling reality, and an ever-expanding experimentation with these cyberspace realities. Digital games offer interactive dynamic manipulations of the environment represented in the game, enabling one to learn about urban planning in a playful and emotionally engaging way, with the corresponding alternative production and exchange of knowledge. The game industry discovered the potential of digital games a while ago and enjoys a constant growth in the number of players and revenues worldwide. According to PricewaterhouseCoopers, the global video-game market was worth around US$56 billion in 2010. "That is more than twice the size of the recorded-music industry, nearly a quarter more than the magazine business and about three-fifths the size of the film industry, counting DVD sales as well as box-office receipts" (Cross, 2011). Millions of citizens are playing digital games in their spare time. Some of these digital games are educational and are often referred to as 'serious games'. The concept of learning with the help of digital games is especially interesting for civic engagement in planning, which often requires a fundamental understanding of the planning situation and the planned changes proposed by urban or landscape planners and architects. A serious game can be designed in a playful way and can enable the citizens to learn, interact with the game, and contribute their knowledge and wishes about the planned changes in their environment.

The main goal of this paper is to study the main concepts of digital serious games and to investigate how to design a participatory digital game for a serious, concrete urban planning situation in which civic engagement is needed. We focus on the implementation of a serious online game for civic engagement in urban planning. The central research question is "How to create a fun digital game that deals with complex serious issues related to urban planning?" We are interested in digital games that can educate citizens about their environment and at the same time enable them to express their opinions in a pleasant, enjoyable, and engaging way. In order to explore the possibilities and challenges of creating a serious game for participation in urban planning we implemented a prototype of a serious game "B3—Design your Marketplace!" The B3 game was developed with the help of students from Florida Atlantic University (FAU) and from HafenCity University Hamburg (HCU), all of whom took part in an international student exchange programme. The B3 game focuses on the design of a marketplace in Billstedt, a city district in the city of Hamburg, Germany. Its usability was tested with the FAU students and, as a contrast, with a group of elderly people.

The paper is organised as follows. Section 2 provides a theoretical framework based on the immersive and playful conceptual models for civic engagement in planning. Section 3 introduces the definitions of games with the focus on digital games, enabling immersion,

enjoyment, and playfulness. Section 4 focuses on digital serious games, and specifically on games designed to support playful learning about the environment. It introduces examples of digital educational urban planning games and digital serious games for civic engagement. Section 5 summarises the main goals and the implementation of the "B3—Design your Marketplace!" game. Usability tests of the B3 game prototype are explained in section 6. The paper concludes with a discussion about future development of digital serious games for civic engagement in urban planning.

2 Designing civic engagement: models of immersive and playful participation

Civic engagement and community participation in urban planning are relevant topics in planning theory and practice. Individuals involved in research on information and communication technologies deal with questions on how to design and improve technologies and modern tools for communication in order to better support civic engagement in urban planning. In spite of more than twenty years of technological development, we do not observe a higher participation of citizens in participatory processes in urban planning. The majority of citizens choose to be 'rational' and ignore public participation processes.

> "Ignorance about an issue is said to be rational when the cost of educating oneself about the issue sufficiently to make an informed decision can outweigh any potential benefit one could reasonably expect to gain from that decision, and so it would be irrational to waste time doing so" (Krek, 2005, page 2).

Participation itself is considered to be costly due to the investment of time and energy into studying and learning about the current urban planning situation and changes in the environment proposed by planners.

> "What is often missing from the traditional process is acknowledgement that spatial and urban concepts are difficult to understand and that the lay public is typically not adept at making these decisions when prompted by a verbal description or even set of images" (Gordon et al, 2011, page 508).

The benefits of participation, on the other hand, are difficult to quantify, especially on the individual level of an interested and active citizen. The outcome of the participation process is not predictable and is, at the end of the process, a result of the activities and interests of many stakeholders involved. In this case, one single voice cannot change the situation and turn it into a beneficial one for every individual citizen. However, it could be that one clear voice might answer a crucial question or help to resolve a complex issue. I am aware that simply a development of new technological solutions and tools cannot solve the problem of citizens' rational ignorance and consequently lead to higher participation. A citizen who might not ordinarily participate in urban planning might be stimulated by playful public participation approach. The potential of technological innovations is in bringing additional creative ideas and the original views of citizens to urban or landscape plans.

Several conceptual models aim to deal with the issues of rational ignorance and suggest focusing on the user's experiences in civic engagement. They propose creating environments which can enable immersive and playful ways of learning about urban plans and can create experiences of immersion, "being in the flow" (Csikszentmihalyi, 1990), and enjoyment while participating. Gordon et al (2011) propose a conceptual model of immersive planning for civic engagement. They suggest organising civic engagement in a way that can enable the citizens to get immersed or involved in planning situations, to the point as if really "being there", in the sense of "bringing them into an experience, such as walking through space while discussing it" (Pine and Gimlmore, 1999, page 32). Ermi and Mäyrä (2005) suggest three forms of immersion: challenge based, sensory, and imaginative, and all of them can be implemented in virtual environments. Challenge-based immersion is built on the nature of interaction and the challenges the participants/citizens face when they interact with

the application. Sensory immersion is related to the audiovisual experience within the virtual environment. Imaginative immersion is "when players identify deeply with the character or narrative" (Gordon et al, 2011, page 509).

Gordon et al (2011) proposed that new digital immersive technologies may help to achieve a consensus among different stakeholders and move the whole project towards "collaborative rationality". The idea of collaborative rationality is based on the work of Habermas (1981) and others who stress the importance of a dialogue. They claim that through an open dialogue we can understand our collective problems better and start solving them faster. A consensus can therefore be achieved through social and technical constructions which enable unfettered dialogue. Innes and Booher (2010) suggest three conditions for collaborative rationality: diversity of actors, interdependence among the actors, and authentic dialogue. All of them can be implemented within novel technological solutions enabling public participation in urban planning.

Elsewhere (Poplin, 2012) I have promoted concepts of a playful e-participation for civic engagement in planning. I focused on the creation of digital environments that can bring joy, pleasure, and engagement to the citizens while educating them and involving them in community decisions. Playfulness, in my conceptual model of playful public participation, is associated with play, defined as a "free activity" (Huizinga, 1955) that is "accompanied by a state of comparative pleasure, exhilaration, power, and the feeling of self-initiative" (Gilmore, 1971, page 311). I suggested including playful elements such as story-telling, moving, drawing, sketching, and/or games in the participatory environment, which can engage citizens, in a playful way, in serious participatory processes in urban planning and other socially important areas (Poplin, 2012).

Digital participatory games are one of the possible implementations of these emerging models of civic engagement in urban planning (Gordon et al, 2011; Poplin, 2012). They can encourage citizens to get involved in planning situations via playful learning environments. Learning in the context of this paper is defined as intentional or unintentional acquisition of new knowledge or skills through deliberate practice, training, play, or information acquisition. Learning about urban plans with the help of digital serious games can be playful and entertaining. When players/citizens are given the opportunity to face challenges within a game environment dealing with real-world, community issues, they can become more sensitive to or even deeply motivated by local planning projects. Digital games can offer them engaging three-dimensional (3D), audiovisually impressive words and concepts, and can enable the players to use their imagination, and "empathize with characters, or just enjoy the fantasy of the game" (Ermi and Mäyrä, 2005, page 8).

3 Digital games: enabling immersion and playfulness

"The word 'game' signifies one of those incredibly rich concepts of human activity that have many roots and implications" (Abt, 1970, page 5). It is often associated with words such as 'amusement', 'fun', or 'sport'. In several cases, game designers used urban planning as the main topic of a game. One of the most famous examples of such a digital game is "SimCity", which was first published in 1989 and immediately became a success. The concept of urban planning as the main topic or the basic game environment has been used in various other games such as "PlastiCity", "Super City", and "The Grepolis". All these games were designed for entertainment and enable the players to create their own imaginative cities. See Poplin (2011) for an overview of urban planning merged with fun digital games.

In contrast to just playing, games include formal structures such as procedures and rules. Abt (1970, page 6) defines a game as "an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context." Suits (1990, page 48) offers the following definition:

> "To play a game is to engage in activity directed towards bringing about a specific state of affairs, using only means permitted by rules, when the rules prohibit more efficient in favour of less efficient means, and where such rules are accepted just because they make possible such activity."

Games for planning and problem-solving in government and industry can enable participants to analyse or practise solving very concrete and specific problems. They give the players a chance to investigate variables in very complex settings and situations (Abt, 1970). According to Abt (page 6), games have two main components: a rational, analytical one and an emotional, creative, dramatic one.

Enjoyment and playfulness are important goals of digital games. Simply stated, if players do not enjoy playing a game, they will not play it (Sweetster and Wyeth, 2005). Media psychologists and researchers in digital communication refer to enjoyment as the positive response of individuals towards media technologies and content (Bryant and Vorderer, 2006; Bryant et al, 2003; Vorderer et al, 2004). The same phenomenon has been also described as pleasure by researchers in psychology and neuroscience (Aarseth et al, 2003; Berridge, 2003; Damasio, 2006). Vorderer et al (2004) discuss several dimensions of enjoyment including physiological, affective, and cognitive. A multidimensional theory of emotions suggests that emotions incurred while playing a game can be located in a two-dimensional (2D) space as coordinates of valence and arousal (Lang, 1993; 1995; Larsen and Diener, 1992). Psychologists confirm that a playful attitude gives a person the chance to experiment by reducing associated penalties (Lieberman, 1977). Ravaja et al (2006) in their research on emotional reactions to video game events note that not only positive events, but also some putatively negative events, elicit positively valenced arousal. No matter how challenging and immersive a game is, the player knows that it is just a game.

4 Digital serious games: learning about complex issues

Digital serious games are a subcategory of digital games and can be defined as "entertaining games with non-entertainment goals" (Social Impact Games, 2008). 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" (Ritterfeld et al, 2009, page 6). Digital serious games can enable one to learn about complex issues and are therefore especially interesting for often complex urban planning situations related to real-world problems. They can fulfil the requirement of playful and enjoyable learning in three ways:

> "First, game play is intrinsically motivating. Second, the responsiveness of the game environment gives immediate feedback to the user. And third, the content has or can have the complexity that allows for ample learning opportunities" (Ritterfeld et al, 2009, page 5).

Such games have a potential to facilitate deep and sustained learning (Gee, 2003) and cooperative problem-solving skills offering "several different levels of learning simultaneously to students of different abilities" (Abt, 1970, page 23). According to Lemke (1998), people have some advantages when learning with the help of the new media in comparison with the classical curricular paradigm. With new media, people learn in the order that suits them, at the speed or pace that suits them; they decide on the activities they wish to get involved with, and in a comfortable place of their choice. Additionally, serious digital games can enable learning through experimentation with alternative possible solutions and strategies played in a changing and sometimes also competitive environment. Within a safe, restricted, and structured realm, a player can get feedback from each experimental iteration, accumulating new knowledge from the game system (Cheng, 1999).

The majority of digital serious games for urban planning were created for schools and focused on a particular educational topic. Examples of such games include "Londoner", "SCAPE", "Urban Science", and "Land Science". "Londoner" (2011) is an educational, interactive role-playing game. The player can choose between a female or a male role, her or his individual name, and the district in London where she or he would like to live. The game takes the player through some important historical events affecting London in the 17th century. Through playing the game the player learns about the history of this city and some significant events that shaped its development. "Sustainability, Community and Planning Education (SCAPE)" is an educative online game environment which was developed for secondary schools. It is a simulation focused on the principles of urban sustainability. The game offers a learning experience based on creating and imagining a future for an urban area (Podleschny, 2008; Polson and Morgan, 2010). In the game "Urban Science" (2008), players explore professional examples of urban planning, how to tackle urban issues that face their city, and how to use a GIS tool to develop a comprehensive plan for their community. The game teaches students how to become ecological thinkers in the process of urban planning, how to build confidence in presentation skills, and how to see the city through the eyes of an urban planner. The game "Land Science" (2010) is an extension of the game "Urban Science".

> "In Land Science, players become interns at the office of a fictitious urban and regional planning firm, Land Management Associates, players weight the trade-offs of land use decisions in ecologically-sensitive areas, interact with virtual stakeholders and use iPlan, a custom-designed geographical information system, to develop land use plans for local and national sites" ("Land Science", 2010).

This game helps to teach the students or pupils about a certain selected urban planning topic, but does not necessarily support participatory processes.

In the last several years, a few digital serious game environments for civic engagement in urban planning have been created. Gordon and Manosevitch (2010) report on a pilot project, "Hub2", that took place in Boston, Massachusetts from June to August 2008. It employed the virtual world "Second Life" "as a means of engaging residents in the planning of a neighbourhood park" (Gordon and Manosevitch, 2010, page 81).

> "The project consisted of formal in-person workshops, where groups of participants immersed themselves in a virtual space, moved things around, proposed ideas, role played, and experienced various spatial configurations" (pages 81–82).

Altogether, "Hub2" facilitated eight workshops with a total of 120 participants. Hollander (2011) demonstrates another implementation of a digital serious game within the "Second Life" game environment. "Town officials worked with a team of Tufts University faculty and students to experiment with visualization strategies for public participation" (page 591) in the town of Action in Massachusetts, USA. They designed a web-based virtual model of Kelly's Corner, which allowed the players to explore the neighbourhood, fly over it, and interact with the citizens. The users were also asked to provide feedback using the Google Map crowd-source interface. With the help of a virtual kiosk they were invited to redesign the neighbourhood using new structures, greenery, roads, and additional paving (Hollander, 2011). Over 500 players used the platform and participated in the process. Gordon and Schirra (2012) show their latest experience with digital role-playing games in public meetings. The 3D game "Participatory Chinatown" aimed to engage the residents of Chinatown in Boston in the decision-making process related to a master plan of their neighbourhood. It was as a multi-user game designed to be played in real time, in a shared physical space. The participants could play the role of one of fifteen characters called 'virtual residents' and were instructed to use nine decision cards within thirty minutes. These cards represented unique

decisions related to employment, housing, or social space. At the end of the game they were involved in a scenario-based design of their neighbourhood.

5 Digital serious game: "B3—Design your Marketplace!"

5.1 The main goal and the background of the B3 game

Research on digital serious games for civic engagement in urban planning is in its initial phase and is still dealing with basic understandings of how to create digital game environments that can support immersive and interactive planning. The main goal of this research was to create a serious digital game that would support immersive and playful learning focused upon a real-world situation in the city of Hamburg. The challenge in designing a serious game for civic engagement is to create a playful game-based story which encourages immersion and playfulness and results in reliable and practical suggestions that can be used by urban planners in preparing designs and projects.

The main goals in creating a serious digital game were to:

- select a real-world, realistic study case in which civic engagement is needed;
- develop a concept of a digital serious game which can enable playful learning about the complex, real-world, urban planning situation;
- include participatory functions which can enable the citizens to participate, express their opinions, vote for the best solutions, and communicate with experts and other citizens;
- design the game in such a way that it could generate usable and reliable suggestions which can be used by urban planners.

The designed and created game "B3—Design your Marketplace!" was a result of a one-year student project organised in collaboration with HCU and FAU. These two groups of students collaborated in the game design process, learning about games, serious games, and online civic engagement in urban planning. Two student exchanges were planned and implemented in which the students from Hamburg would visit the students in Florida, and vice versa. We used the visits for presenting and discussing the ideas about the study case in Hamburg and the game story and design, and for developing and testing the prototypes of the game (figure 1).

The German students focused on the Hamburg district of Billstedt. The B3 in the title of the game stands for three German words, Bürger–Beteiligung–Billstedt, which means Public–Participation–Billstedt. The B3 game is designed as an online serious game for civic engagement in urban planning and aims to support immersive and playful learning and civic engagement. It is the result of the collaboration between the two universities, and was designed by the German group of students under the supervision of the author of this paper.

(a) (b)

Figure 1. Printed copy of the marketplace (a) and first sketches for the serious game (b).

The main results are summarised in the project report (Ben Hiba et al, 2009). The user interface of the B3 game was designed in the Adobe Flash program and implemented in German. The current version was prepared so that it can be tested on a computer screen with the help of the interactive application designed in Adobe Flash.

5.2 The case study: the marketplace in Billstedt, Germany

The game is designed around the idea that citizens can design the marketplace according to their own wishes and can submit their suggested designs online to the responsible urban planners. The game concentrates on a selected marketplace in Billstedt (figure 2), a city district in the second largest German city, Hamburg. Billstedt suffers from a poor reputation caused by an unbalanced social structure and low wages. It has around 70 000 inhabitants of whom about 47% are immigrants. The county's five-year investment programme "Schau nach Osten" which translates as "Look to the East", was launched in 2006 to support participatory planning of Billstedt aiming at involving the citizens in the development of their district.

The marketplace is located in the centre of the city district Billstedt, close to the main bus and subway stations. It is surrounded by a big shopping mall and large parking lots on the northwest side, a major street to the south (Mölner Landstraße), and a variety of shops to the east. Scattered trees surround the marketplace on three sides of the lot (figure 2). A twice-weekly market is held on Tuesdays and Fridays. On those days the local farmers bring their produce in big trucks and sell it in the marketplace, which can get very crowded and lively during these two days. On all other days it looks abandoned, like an empty lot, and does not provide any interesting infrastructure for citizens. There is a need to redesign the marketplace in order to make it more attractive and useful for citizens. What are their wishes? How can these wishes be gathered? These were only two of the central questions we concentrated on in our study. With these goals in mind, we designed a serious digital game "B3—Design your Marketplace!" that could solicit the wishes and views of citizens and encourage them to participate in the design of the marketplace in Billstedt.

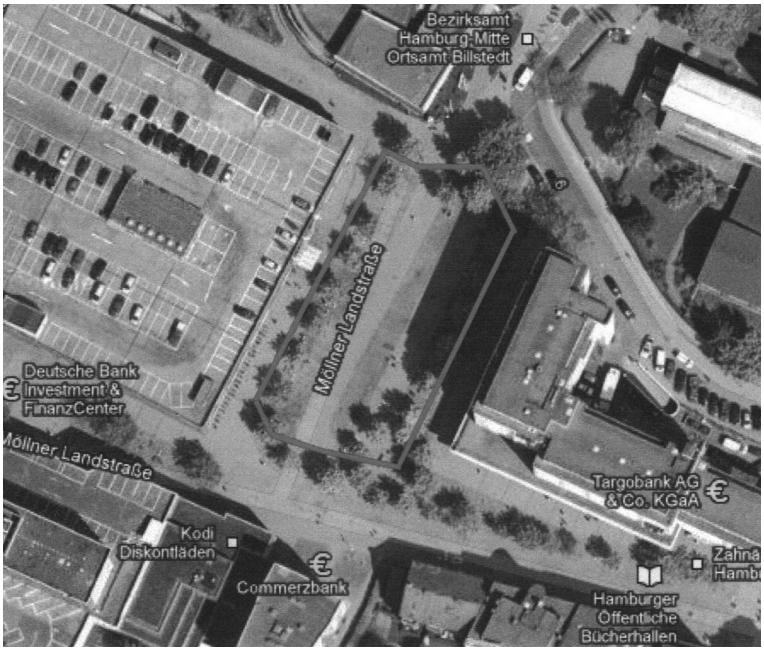

Figure 2. The marketplace in Billstedt.

5.3 Elements of the B3 game

The main elements of the B3 digital serious game are the environment of the game, the objects included in the game, the goals and rules of the game, and a player.

Environment: The game concentrates on the design of the marketplace in Billstedt (figure 2). The environment in the B3 digital game is designed in 2D and 3D views and the player can easily switch between them.

Objects: The objects in the game are either static or dynamic. Static objects include the real-world buildings which are always present in the game and cannot be manipulated nor moved. They include the main shopping mall called Billstedt Center, and the buildings on the east side of the marketplace representing the shops, coffee houses, and a drug store. Dynamic objects are the objects that can be manipulated and changed, moved, and deleted by the player. The finished game would include a variety of trees, flowers, and other plants, different kinds of lights, and other urban furniture such as benches. These objects could be placed into the marketplace by the player of the game by using a simple drag-and-drop function.

Another dynamic object, a 'little helper' (figure 3), is designed to interact with the player and offers suggestions on how to use different functionalities of the game. It is included in the game to encourage and guide the player, and to communicate with her while navigating through the game environment. Due to its fun and humorous depiction, it adds yet another playful dimension into the game environment. The player can choose one playful character from five different designs: the monkey, fish, penguin, lady-archer, or the little captain (figure 3). All playful characters perform the same tasks in a slightly different way; the language they use depends on the character, but the level of their help and the way they approach the user depend on the level of help selected by the user. Helpful suggestions appear in the form of text on the screen-A little helper can be turned on or off according to the needs and desires of the player.

Goals: The main goal of the game is to create the player's own design of the marketplace in Billstedt. Additional interests and motivation were added to the game, such as a competition among different suggested designs and the possibility of voting for the preferred design. The players can give up to five stars to the selected design. The number of stars for each design is calculated as the mean value of all votes contributed. Thus, the player's goal can also be to win an online design competition. A chat section was added to the game to stimulate

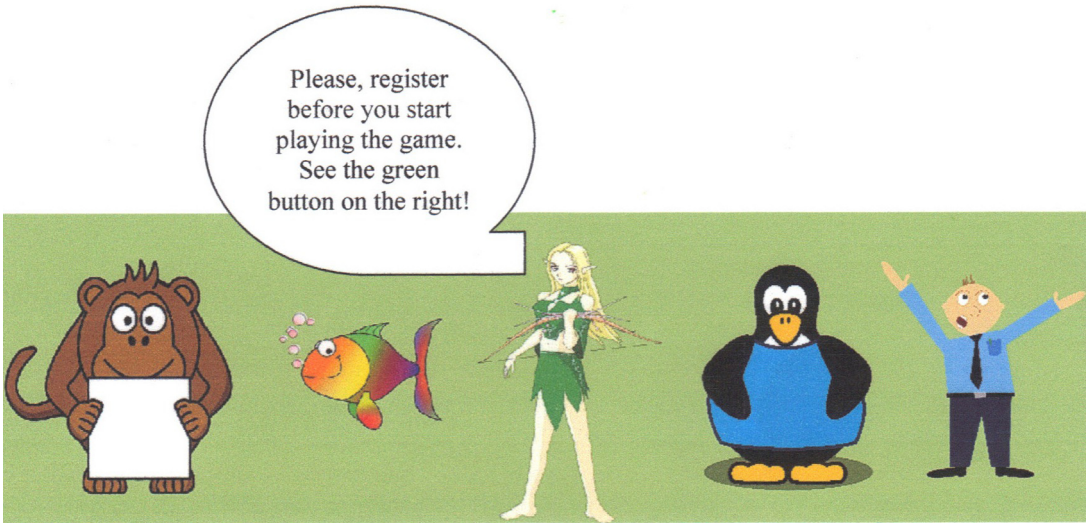

Figure 3. [In colour online.] The little helper characters.

discussion and brainstorming. A player can communicate or discuss with experts and urban planners possible solutions for the marketplace or just chat with the inhabitants or other players interested in the development of Billstedt marketplace, or this city district in general.

Rules: Every player officially registers in the B3 game. The registration form is short and simple (figure 4). The player chooses a user name and a password which is entered twice for security and consistency reasons. The player enters her e-mail address, zip code of residence, her year of birth, and gender. She can also upload a picture if she wishes. The player then accepts the conditions of the B3 game and thus starts playing. Once registered, the player can use the created password any time she wants to start playing the B3 game.

Player: This game is designed for an individual player, but enables collaboration through the dialogue enabled in the chat session. Every player can design her own marketplace and apply her own wishes, needs, and inspirations. The players can exchange their ideas with urban planners or other players in the chat section.

5.4 Implementation of the B3 game prototype

The user interface of the B3—Design your Marketplace! game was designed in Adobe Flash. It is implemented in German due to the location of the study case in Hamburg, Germany. English translations included in figures 4–9 were added for the representation in this paper and are not part of the current version of the B3 game. Figure 5 shows the entrance page which provides an introduction to the B3 game. The description over the next pages is of a fully functional B3 game; presently we are working with the implemented prototype of the game. The final version of the game should be available in Arabic, Turkish, English and German, as one will see via the various flags on the bottom right. The text top-right describes the main focus of the game, which is the marketplace in Billstedt, and invites the player to start playing the game. The icon below-left invites her to watch the video about Billstedt marketplace (Billstedter Platz). It is combined with pleasant music and enables the player to understand how the marketplace looks in reality. If she needs additional information about the marketplace she can find it under the green button (mehr Info) placed under the icon with the video. The icon in the form of a grey arrow on the right provides instructions about

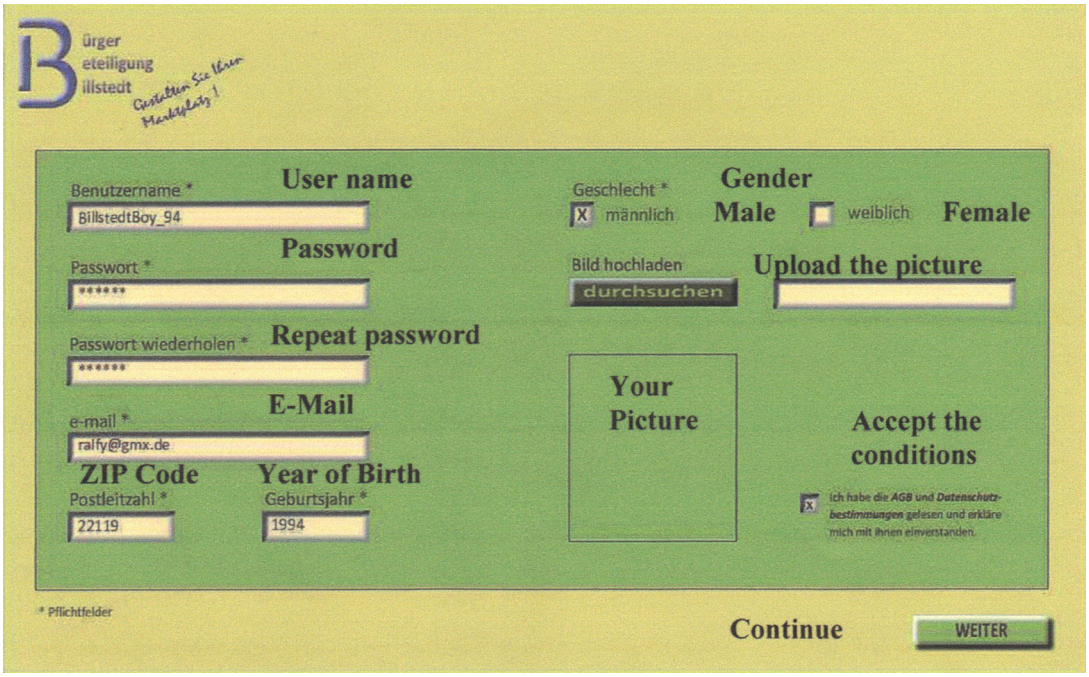

Figure 4. [In colour online.] B3: Official registration form.

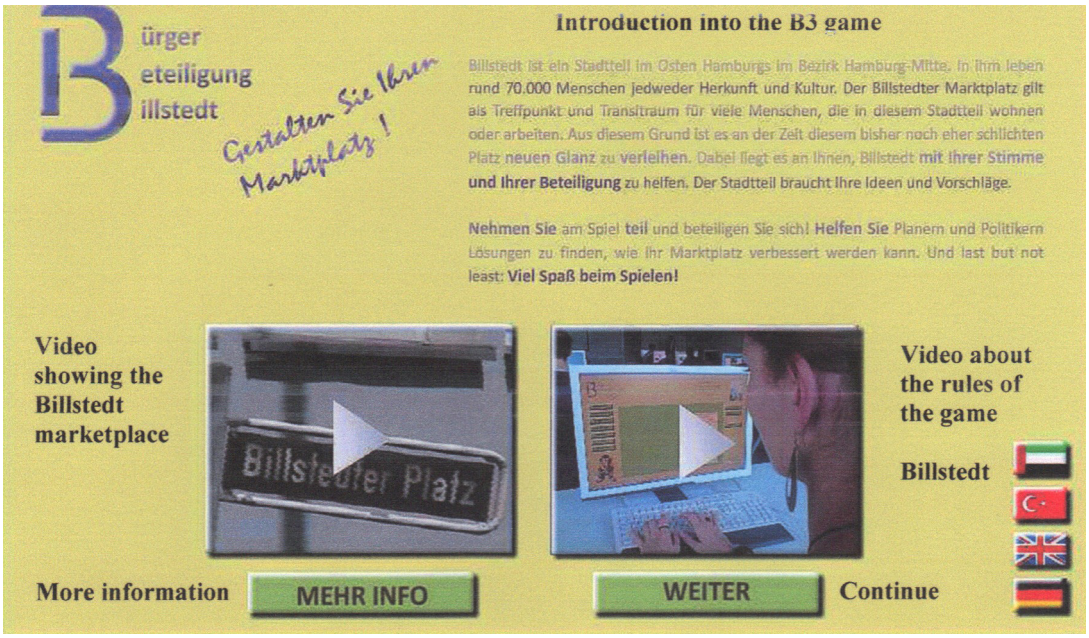

Figure 5. [In colour online.] The first page of the B3 game.

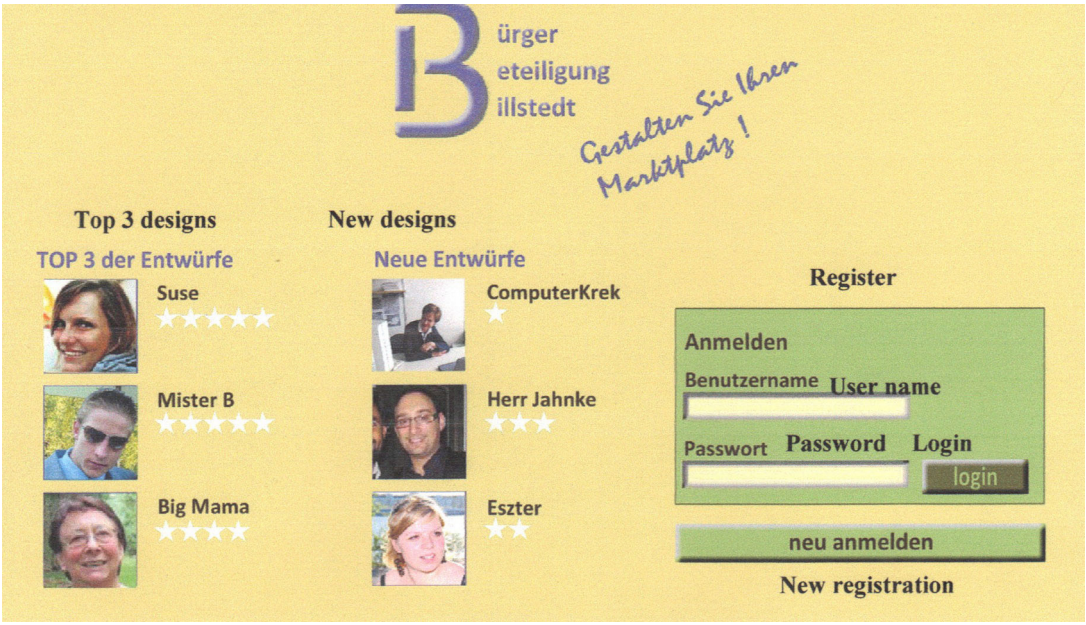

Figure 6. [In colour online.] Registration with the user name and password or new registration.

the use of the game in the form of another video. This section explains the basic structure of the game, the rules of the game, and its main functionalities. The green button under this icon invites the player to continue to the next step.

After registration, the player enters her own B3 game environment (figure 6). At this stage the player can already see the top three designs (in terms of votes) of the marketplace contributed by other players (left side, figure 6), and the three most recently posted designs (right side, figure 6). The displayed, completed marketplace designs aim to inspire the player and to encourage her to explore the possibilities of creating a variety of her own designs,

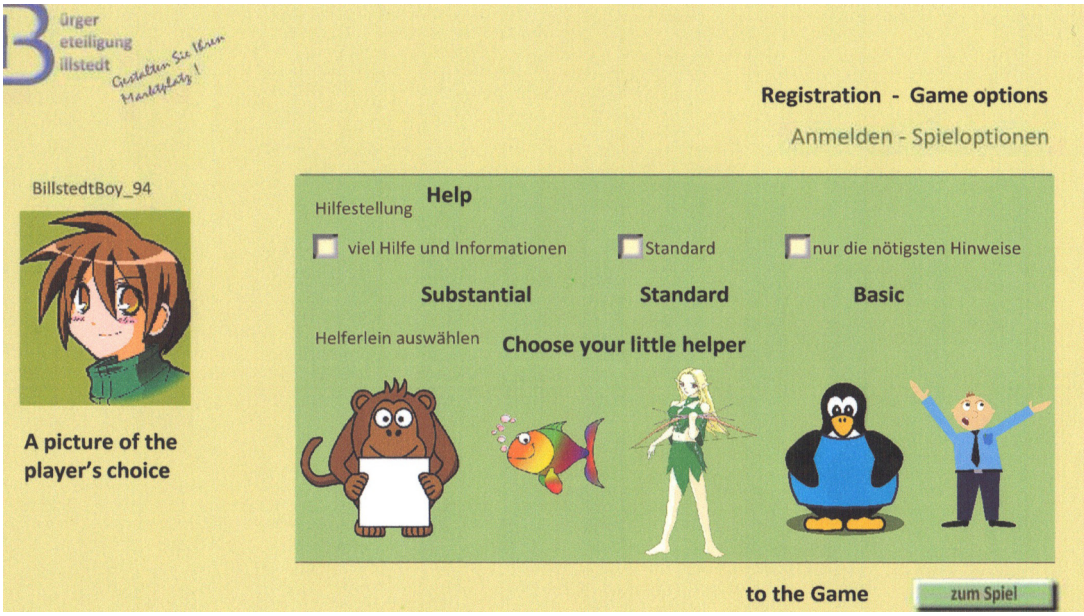

Figure 7. [In colour online.] Choosing the little helper and the level of help.

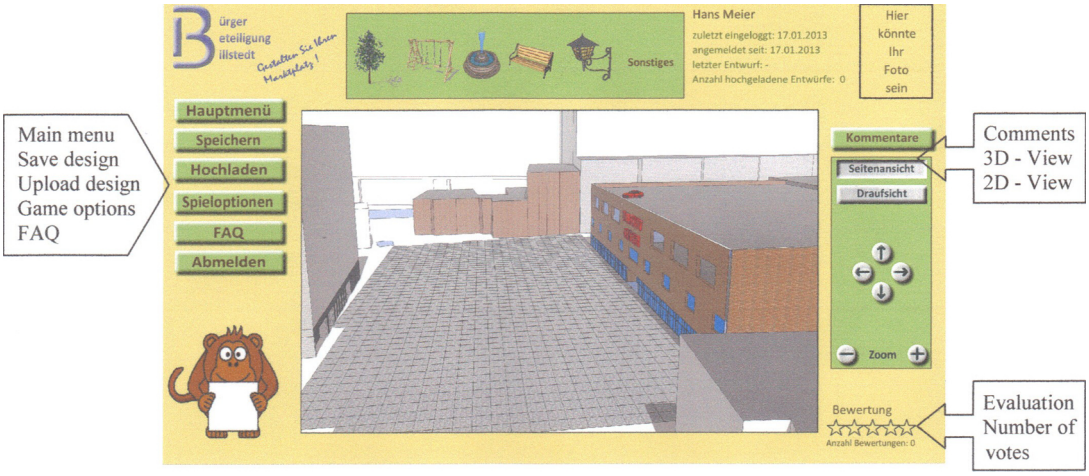

Figure 8. [In colour online.] The marketplace in Billstedt ready for the player to start the design process.

Figure 9. [In colour online.] The completed design of your marketplace.

as each version could be saved individually. Furthermore, they suggest that others are in the game and contributing, which gives a feeling of an online community interested in a future vision of Billstedt marketplace.

Once in the game environment, the player can choose a little helper represented by one of five playful characters (figure 7). The player can also choose among three different levels of help: (a) substantial help and additional information; (b) standard help, and (c) basic help. On the left side of the user interface the player can already see the uploaded picture and her user name displayed above the picture (figure 7). After choosing the little helper and the level of help, the player can move to the next step by choosing the button "zum Spiel/to the Game". The player is ready to start playing the B3 game.

In the next step the player goes to Billstedt marketplace, which is represented for all players in the same way (figure 8). The top-right corner of the user interface displays the picture uploaded by the player, her user name, and some basic information related to the online interaction; the last time the player logged-in, the registration date, date of the last design, and the number of uploaded designs.

The central part of the game environment contains the buildings surrounding the Billstedt marketplace and an empty platform/space which is ready to be designed by the player of the game. The marketplace is georeferenced and the dimensions of the represented buildings are a model of the reality. The tool above the central space representing the marketplace in Billstedt is a drag-and-drop tool. It enables the player to choose the element on the picture and drag-and-drop it onto the empty space of the marketplace. The drag-and-drop tool contains a variety of elements such as trees and vegetation, kindergarten elements, water elements, benches, lights, and other urban furniture. Behind every icon there is a variety of designs for each particular element. Under 'trees' one can choose bushes, small trees, bigger trees, etc. By clicking on the preferred design, the player can choose an element or fixture and place it into the marketplace anywhere she wishes. She can select already-placed elements and move them to another location. She can vary the orientation of the placed elements; turn them around until she finds the location and the orientation of the urban element she most prefers. This activity can be repeated as long as the player wants. The goal of the game is to achieve a design that is liked and preferred by the player of the game and can be published within the B3 game.

The marketplace is available in both a 2D and a 3D view. The 2D view is an orthogonal view from above and reduces the representation of all objects into a 2Dview. The 3D view offers oblique views, as from the top of the nearby building as illustrated in figure 8. It also offers a street-level view as it would appear to someone walking through the marketplace. The player can easily switch between the two different views, choosing the button on the right side of the screen. She can also use the navigation tools and navigate in the four cardinal directions: west, east, north, and south. The player can zoom in and zoom out of the marketplace. The left side of the user interface in figure 9 includes the following seven options represented by seven green buttons from the top down: (1) main menu, (2) my designs, which enables an intermediate save of the design, (3) top designs, which are the most often voted designs, (4) new designs, which are the most recently submitted designs, (5) game options, (6) frequently asked questions (FAQ), and (7) log-out from the game. The right side of the user interface enables the player to include comments related to her own design, to comment on other players' designs, or to vote for her favourite design.

After she has placed all the elements into the marketplace (figure 9), she can save the design and not yet submit it, or save and submit it. The submitted design is checked by the moderator of the B3 game and can then be published online. All published designs can be viewed and commented on by the registered community. The registered players can vote

for the design of the marketplace they like most. The evaluations of the marketplace designs are visible in the bottom-right corner and marked with stars. The best designs get five stars. The average evaluation of the marketplace design presented in figure 9 is marked by two stars, and was evaluated by thirty-three players of the B3 game. The players can also chat with available experts, planners, or municipality employees, or other registered users. The top three designs and the most recent three designs are available for viewing by the general public interested in either the B3 game or the planning suggestions for Billstedt marketplace.

6 Testing "B3—Design your Marketplace!"

The usability test of the B3 game was executed in two phases. In the first phase we tested the game story and the draft sketches of the user interface design. These informal tests and discussions were executed with the help of the group of students from FAU. The process was interactive; the input gained in these discussions and unstructured tests led to the improved concept and design of the game. In the second step the students from FAU played the role of play-testers in the designed game. Play-testers are people who play the game and provide feedback on the experience so that the game designer group can move forward with a fresh perspective (Fullerton, 2008). Via this quick and useful feedback, we observed them playing the game and the interaction with this group helped to substantially improve the concept of the B3 game, the game story, and its user interface.

The pilot study of our testing methodology was executed in a primary school in the city district of Billstedt. After the execution of the pilot study, a few additional changes were made in order to improve the methodology of testing and to simplify the testing procedure. The final B3 game test consisted of a PowerPoint presentation, two main tasks that need to be accomplished by the test player and are designed for interactive use on the computer, and a questionnaire with twenty-one questions. In the PowerPoint presentation we explained the main goals of the game and the basic rules of the B3 game test. They included suggestions for independent work on the questionnaire, honest answers on the questions, and independent work with the game simulation on the computer screen. The PowerPoint presentation was also used to display the two main tasks designed for interactive use on the computer. Task 1 required the participants to log-in to the game and to start playing the game. Task 2 invited the participants to drag-and-drop the urban elements and to create their own design of the marketplace. After accomplishing these two tasks, the participants answered a questionnaire. On average the participants needed 30 minutes to listen to the introductory presentation, complete the two tasks in the interaction with the B3 game on the computer screen, and to answer the questions in the paper questionnaire.

The second phase of testing was carried out within a bachelor thesis designed by Franzke and Menzel (2010). It was executed with a group of eleven retired people from the retirement home, Ruckteschell-Heim, in Hamburg-Eilbek. This elderly group provided some interesting observations and questions in contrast to the younger student groups. Their average age was 77; five men and six women. The participants described their computer skills as follows: one (male) was a complete beginner; six were at an advanced beginner's level; and four at the advanced level. None described themselves at a professional level.

6.1 Observations: made by the majority of the participants

The general and positive conclusions from both testing phases included appreciation for the game as a new form of online civic engagement in urban planning. The majority of the participants involved in testing expressed appreciation for the idea of a digital game for participatory process in urban planning. The selection of the colours, contrast, and the size of the letters in the text was positively evaluated by the majority of the participants. The role of the little helper was evaluated as very positive, and it should be included in the next

versions of the B3 game. The participants missed sounds in the game, which was noticed as a disadvantage of the game at this stage of development and can be improved in the next phase.

6.2 Observations: made especially by the seniors

Some conclusions were unique to the seniors. According to them, participation in an online game can represent less effort than attending a public meeting. This is especially important for citizens in wheelchairs. This remark from one of the participants is especially significant: online games could potentially enable physically handicapped people easy access to information and potentially a more pleasant way of civic engagement.

The problems that seniors had, trying to accomplish tasks 1 and 2, were related to their general computer skills and less to the game itself. An example of this was in task 1 in which the users had to log-in to the B3 game. This is a fairly standard operation that needs to be accomplished often in a variety of online applications. It represented a problem to people who do not use the Internet very often. The same was true of some other symbols. In our B3 game, the symbol with a fat arrow indicates the possibility of starting a video. This was not self-explanatory for many of the elderly participants. The urban elements such as trees and lights, visualized on the top of the website, were sometimes not recognized as the elements that can be dragged-and-dropped onto the empty field of the marketplace. To develop an online game with the aim of attracting seniors, these kinds of elements would have to be marked in a special way. A little helper could, potentially, point towards these elements and make them visible, combined with recommendations on how to use them.

Surprisingly, the seniors stated that they preferred the information presented in text form to videos. We can only guess the reasons. Most likely they can control the speed of the information consumption, and they are used to getting the information in text form, such as in newspapers. Furthermore, they expressed fears of "damaging the game" or "doing something wrong". Some participants expressed worry related to the "test situation" and we had to explain that we were not testing their abilities or computer skills, but rather the developed B3 game prototype.

7 Discussion and conclusions

Digital serious games are an emerging area of research in urban planning and civic engagement. In the last few years they have gained increased attention; their value over other media and technologies is that "they are interactive, marrying the power of modern technology to the human desire for play" (*The Economist* 2011). In our experience with designing the B3 game, we faced a challenge to design a fun game with playful elements that can deliver useful results to the urban planners in charge. The test of "B3—Design your Marketplace!" proved the usability of the suggested concept of a serious digital game and its likability by the majority of the test persons. In further development of digital serious games for urban planning, sounds should be included. Further research is needed in order to understand the combination of different graphical representations and accompaning sounds.

In general, very few studies are available concerning the enjoyment and the feelings associated with the use of digital serious games in urban planning. To measure the feelings and the users' emotional reactions to the games is a challenging future research area. There is some limited evidence of the user's experiences with digital serious games for civic engagement. For instance, Gordon and Schirra (2012) studied the user's experience with the game "Participatory Chinatown". Their research examines how a game-based "role-play can affect the way people understand local issues and engage with their community." The main focus of their study was related to the influence of playing a character in the game on their understanding of the planning situation discussed. They used a paper-based questionnaire and asked forty-eight players about their experiences playing the game in a community

planning meeting. The players responded that playing a character was a powerful element of the game experience; it created different expectations of what was to happen at the meeting, and it attracted different people to the meeting. The mean age of participants was 30, which is quite young compared with the general "perception that these meetings tend to be populated by senior citizens" (Gordon and Schirra, 2012). The authors conclude that

> "This study of Participatory Chinatown demonstrates that an immersive, role-playing experience can give participants in a community meeting a strong feeling of connection to the neighbourhood and a deep understanding of the issues in play."

Additional research on the benefits of creating digital serious games for urban planning is needed. Can the costly creation of these games bring benefits and outweigh the effort and expense of creating them? How can these games be created in such a way as to enable them to be used in different civic engagement processes? The advantage of the B3 game is that its main concept can be used for any marketplace or any open space that needs to be redesigned. The economy of scale can be achieved by designing a digital serious game that can use the same game story and a multipurpose design and can be implemented or adapted with minimal effort and cost to a variety of civic engagement processes and projects. This strategy might attract the game industry, universities, and governments, and could lead to further expansion and more extensive development of digital serious games for civic engagement in urban planning.

Who could potentially play serious games for civic engagement in urban planning?

> "Today the average age of players in America, the biggest market, is 37, and 42% of them are female, according to the Entertainment Software Association (ESA), an American trade group" (Cross, 2011).

We tested the B3 game with two very different, contrasting groups of potential users; (a) university students studying urban planning and (b) elderly people. The usability study of the "B3—Design your Marketplace!" game showed a high level of acceptance of the game concept and its implementation for civic engagement by both groups. Additional research is needed to understand the motivations to play a serious game for civic engagement in urban planning by a variety of users. What are their preferences related to the game story, characters included, implementation environment, and visualisation techniques? One of the main challenges in the future will be to design digital serious games which will be able to attract different players with a variety of computer skills and educational and social backgrounds.

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References

Aarseth E, Smedstad S M, Sunnanå L, 2003, "A multi-dimensional typology of games", in *Computer Games: What's in a Game?* Utrecht University and Digital Games Research Association, pp 48–53

Abt C, 1970 *Serious Games* (Viking Press, New York)

Batty M, 2005 *Cities and Complexity: Understanding Cities with Cellular Automata, Agent-based Models, and Fractals* (MIT Press, Cambridge, MA)

Ben Hiba M, Fischer R, Franzke S, Gutbier H, Landahl B, Lubbe S, Menzel F, Rossius S, Schmidt F, 2009, "P3 Project: Playful Public Participation report", HafenCity University Hamburg, Germany

Berridge K C, 2003, "Pleasures of the brain" *Brain and Cognition* **52** 106–128

Bryant J, Vorderer P (Eds), 2006 *Psychology of Entertainment* (Routledge, New York)

Bryant J, Roskos-Ewoldsen D R, Cantor J (Eds), 2003 *Communication and Emotion: Essays in Honor of Dolf Zillmann* (Routledge, New York)

Carver S, 2001, "The future of participatory approaches using geographic information: developing a research agenda for the 21st century" *URISA: Journal of the Urban and Regional Information Systems Association* **15** 61–71

Cheng N Y-W, 1999, "Playing with digital media: enlivening computer graphics teaching", in *Proceedings of the Association for Computer Aided Design in Architecture* Eds O Ataman, J Bermudez, Media and Design Process [ACADIA '99/ISBN 1-880250-08-X] Salt Lake City 29–31 October, pp 96–109, http://design.uoregon.edu/nywc/old/design@darkwing/nywc/pdf/acadia99-play-cheng.pdf

Craig W J, Harris T M, Weiner D, 2002 *Community Participation and Geographic Information Systems* (Taylor and Francis, London)

Cross T, 2011, "All the world's a game" *The Economist* 10 December, http://www.economist.com/node/21541164

Csikszentmihalyi M, 1990 *Flow: The Psychology of Optimal Experience* (Harper and Row, New York)

Damasio A, 2006 *Descartes` Error: Emotion, Reason and the Human Brain* (Vintage Books, London)

de Roo G, 2010, "Planning and complexity: an introduction", in *A Planner`s Encounter with Complexity* Eds G De Roo, E A Silva (Ashgate, Farnham, Surrey)

de Roo G, E A Silva (Eds), 2010 *A Planner's Encounter with Complexity* (Ashgate, Farnham, Surrey)

Egenhofer M, Mark D, 1995, "Naive geography" *Spatial Information Theory* Eds A Frank, W Kuhn (Springer, Berlin) pp 1–15

Ermi L, Mäyrä F, 2005, "Fundamental components of the gameplay experience: analysing immersion", presented at DiGRA Conference: Changing Views—World in Play, Digital Games Research Association, Vancouver

Fullerton T, 2008 *Game Design Workshop: A Playcentric Approach to Creating Innovative Games* (Morgan Kaufmann, Burlington, MA)

Franzke S, Menzel F, 2010, "Usability Test des Spiels B3 mit Senioren", bachelor thesis, Computer-based Methods in Urban and Regional Planning, HafenCity University Hamburg

Gee J P, 2003 *What Video Games Have to Teach Us About Learning and Literacy* (Palgrave Macmillan, New York)

Gilmore J B, 1971, "Play: a special behavior", in *Children's Play* Eds R E Herron, B Sutton-Smith (John Wiley, New York) pp 311–325

Goodchild M F, 2007, "Citizens as sensors: the world of volunteered geography" *GeoJournal* **69** 211–221

Gordon E, Manosevitch E, 2010, "Augmented deliberation: merging physical and virtual interaction to engage communities in urban planning" *New Media and Society* **13**(1) 75–95

Gordon E, Schirra S, 2012, "Playing with empathy: digital role-playing games in public meetings", in *Proceedings of the 5th International Conference on Communities and Technologies* (ACM, New York) pp 179–185

Gordon E, Schirra S, Hollander J, 2011, "Immersive planning: a conceptual model for designing public participation with new technologies" *Environment and Planning B: Planning and Design* **38** 505–519

Habermas J, 1981 *The Theory of Communicative Action: Reason and the Rationalization of Society* (Beacon Press, Boston, MA)

Hollander J B, 2011, "Approaching an ideal: using technology to apply collaborative rationality to urban planning processes" *Planning Practice and Research* **26** 587–596

Huizinga J, 1955 *Homo Ludens: A Study of the Play Element in Culture* (Beacon Press, Boston, MA)

Innes J, Booher D, 2010 *Planning with Complexity: An Introduction to Collaborative Rationality for Public Policy* (Routledge, Abingdon, Oxon)

Jankowski P, Nyerges T, 2001 *Geographic Information Systems for Group Decision Making* (Taylor and Francis, London)

Kingston R, Carver S, Evans A, Turton I, 1999, "Virtual decision making in spatial planning: web-based geographical information systems for public participation in environmental decision making", http://www.geog.leeds.ac.uk/papers/99-9/index.html

Kingston R, Carver S, Evans A, Turton I, 2000, "Web-based public participation geographical information systems: an aid to local environmental decision-making" *Computers, Environment and Urban Systems* **24** 109–125

Krek A, 2005, "Rational ignorance of the citizens in public participatory planning", in *Proceedings of the CORP 2005, International Symposium* Vienna, 19–21 May, pp 557–564, http://www.corp.at

"Land Science", 2010, "http://epistemicgames.org/eg/category/games/land-science/"

Lang P J, 1993, "Looking at pictures: affective, fascial, visceral, and behavioral reactions" *Psychophysiology* **30** 261–273

Lang P J, 1995, "The emotion probe: studies of motivation and attention" *American Psychologist* **50** 372–385

Larsen R J, Diener E, 1992, "Promises and problems with the circumplex model of emotion" *Review of Personality and Social Psychology* **13** 25–59

Lemke J L, 1998, "Metamedia literacy: transforming meanings and media", in *Handbook of Literacy and Technology: Transformations in a Post-typographic World* Eds D Reinking, L Labbo, M McKenna, R Kiefer (Lawrence Erlbaum Associates, Hillsdale, NJ) pp 283–301

Lieberman N, 1977 *Playfulness: The Relationship to Imagination and Creativity* (Academic Press, New York)

"Londoner", 2011, "The history game", http://www.wizardits.com/Londoner/

Pickles J, 1995, "Representations in an electronic age: geography, GIS, and democracy", in *Ground Truth: The Social Implications of Geographic Information Systems* Ed. J Pickles (Guilford Press, New York) pp 1–30

Pine B, Gimlmore J H, 1999 *The Experience Economy* (Harvard Business School Press, Boston, MA)

Podleschny N, 2008, "Playing urban sustainability: the ecology of a simulation game", in *Proceedings of the 20th Australasian Conference on Computer–Human Interaction: Designing for Habitus and Habitat (OZCHI '08)* (ACM, New York) pp 231–234, http://doi.acm.org/210.1145/1517744.1517749

Polson D, Morgan C, 2010, "The 10% rule: maximising learning through collaborative game design", in *Proceedings of IADIS International Conference Mobile Learning 2010* Eds I Arnedillo Sanchez, P Isaías (IADIS Press, Porto) pp 197–204

Poplin A, 2011, "Games and serious games in urban planning: study cases", in *Computational Science and its Applications—ICCSA2011, Part II* Eds B Murgante, O Gervasi, A Iglesias, D Tanier, B O Apduhan (Springer, Berlin, pp 1–14

Poplin A, 2012, "Playful public participation in urban planning: a case study for online serious games" *Computers, Environment and Urban Systems* **36**(3) 195–206

Ravaja N, Saari T, Salminen M, Laarni J, Kallinen K, 2006, "Phasic emotional reactions to video game events: a psychophysiological investigation" *Media Psychology* **8** 343–367

Rinner C, 1999, "Argumentation maps—GIS-based discussion support for online planning", GMD Research Series 2, German National Research Center for Information Technology, Sankt Augustin

Ritterfeld U, Cody M, Vorderer P (Eds), 2009 *Serious Games: Mechanisms and Effects* (Routledge, New York)

Schroeder P, 1996, "Report on Public Participation GIS Workshop", TR 96-97, Scientific Report for Initiative 19 Specialist Meeting, National Center for Geographic Information and Analysis, University of California, Santa Barbara, CA

Sieber R E, 2003, "Public participation geographic information systems across borders" *The Canadian Geographer* **47** pp 50–61

Social Impact Games, 2008, http://www.socialimpactgames.com

Steinmann R, Krek A, Blaschke T, 2005, "Can online map-based applications improve citizen participation? ", in *E-government: Towards Electronic Democracy* Eds M Böhlen, J Gamper, W Polasek (Springer, Berlin) pp 25–35

Sui D Z, 2008, "The wikification of GIS and its consequences: or Angelina Jolie's new tattoo and the future of GIS" *Computers, Environment and Urban Systems* **32** 1–5

Suits B, 1990 *Grasshopper: Games, Life and Utopia* (David R Godine, Boston, MA)

Sweetster P and P Wyeth, 2005, "GameFlow: a model for evaluating player enjoyment in games" *ACM Computers and Environment* **3**(3) 1–24

The Economist 2011, "The importance of fun: Homo ludens", http://www.economist.com/node/21541160

"Urban Science", 2008, http://edgaps.org/gaps/projects/past-projects/urban-science/

Vorderer P, Klimmt C, Ritterfeld U, 2004, "Enjoyment: at the heart of media entertainment" *Communication Theory* **14** 388–408