Usability in Browser Games - Design and Evaluation of a City Development Simulation
With the distribution of the Internet in the last ten years, the number of browser games rapidly increased. According to optimistic estimates in 2003, there were about 100,000 browser game players. Today, more than 20 million players are registered at the biggest browser game company only. As with video games in the early eighties of the last century, today a change from textual games to extensive designed and highly graphic-oriented games becomes apparent.

This thesis focuses on the transfer of well-known software-ergonomics concepts to the domain of browser based games with respects to the special requirements of massively multiplayer online games which are solely played in the web browser. Genres are evaluated for their feasibility as browser games, player typologies are identified and usability concepts are reviewed in the context of browser games. After describing the game design of a city development simulation with strategic and economic elements this design is empirically tested by a questionnaire as well as by a user experiment.
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1. Introduction

The Internet, still in its teenage years, has changed our everyday life in such a breathtaking speed as no other technology before. Banking, shopping, social networking, learning; today we even order our pizza online. The circulation of classic print media like newspapers is constantly declining, while more and more people have access to the Internet. On the Internet, news is available worldwide within fractions of a second. Internet sites can have a potential audience of billions of people. Almost as many people have a private homepage or a weblog, where they share news, gossip or photos with their friends and the world.

Over the past few years, a new technology has arrived on the scene. Playing games over the Internet has become more and more popular. While the first generation of online games bore resemblance to classic video games with the addition of simple multiplayer features, today there are highly specialized online games that entirely depend on the Internet as gaming platform. Another kind of online games is evolving at the moment. Only a few years ago, browser games were projects by committed amateur programmers. Today, specialized browser game companies develop attractive browser games, making use of modern browser technologies. These companies earn hundreds of thousands of Euros per year by providing browser games via the Internet. At the moment, these kinds of games are still in their early stages. With the evolution of Internet technologies, these games will become more and more sophisticated, and some day they might even close the gap to classic video games regarding multimedia technology. But even with all of these technological advances, the user still must be at the center of endeavors to develop excellent browser games.

These browser games, as well as their users, are subject of this thesis. I will attempt to define the term “game”, and why people love playing games. I will show that one of the main purposes of playing games is socialization, which is encouraged by playing
1. Introduction

games with or against other human players, which is naturally supported by Internet technologies. I will define the category of browser games and their key differences to video games and give an overview of the most common game genres. After reviewing these technological aspects of games, I will analyze the user structure and their demands. Every good software product should be developed with the users’ demands kept at the back of one’s mind. These demands on a game’s usability will be examined in general, and with respect to the special requirements of the Internet and browser games.

The next chapter will introduce a newly developed game, a city development simulation with economic and strategic elements. I will show how the genre of city development games has to be extended to fit the special requirements of a massively multiplayer online game. Since a complete game design document would go beyond the scope of this thesis, only some aspects of the game are reviewed in greater detail. Technologies used to develop the game will be introduced briefly.

In chapter 4, assumptions made in the previous chapters will be tested empirically. A survey is used to identify the browser game players’ demography as well as their demands. A few details of game interfaces will be tested as well as complete game interfaces. Additionally, the newly developed game will be tested by conducting a user experiment.
2. Games and Usability

Before talking about browser game design in this chapter, I will lay the foundations of game design and usability. First of all I will point out why human beings feel the need to play games at all. To explain that, I will give a definition of the term “game”, and explain the fundamental characteristics of games. The role of games in society will close the first section. In the second section, I will attempt to define the term “browser games”. Since browser games have different premises in regard to technology or distribution, I will review the differences between browser games and video games in the third section of this chapter. Later on, I will review several game genres and evaluate their relevance for browser games. Before talking about general usability in section six, I will analyze the players’ demography by reviewing several studies about video game players. The last sections will review usability in the context of the Internet and in the context of browser games.

2.1. Why people play games

Before the question why people play games can be answered, the term “game” has to be defined, as well as the fundamental characteristics of games. Then, a closer look at the motivations for people to play games will be taken and different groups of player types will be diversified. Another interesting question is, why people favor some games over other games. The section will be closed with a closer look at the role of games in the social context.
2. Games and Usability

2.1.1. Definition of “game”

Interestingly, the English language differentiates between the terms “playing” and “gaming”. While “playing” generally describes the activities of children, “gaming” describes more or less the same activities of adults. Before the term “game” can be defined, a definition for “play” has to be given. “If we want to get back to the origin of games, we must go beyond the realm of the archaeologist and into the realm of the paleontologist” [Cra84], Crawford states, “they are not a human invention” and underlines this theory by giving an interesting example of two lion cubs wrestling in a zoo. They can be watched growling and biting each other. They crouch, creep through the grass to their prey, and pounce on a butterfly. The cubs are playing a game. But why are they doing it; are they merely doing it for enjoyment?

We don’t actually know, if the cubs can experience fun. But it is obvious, that this form of playing is important for the cubs. By playing, they are able to learn the rules of life. They learn where their boundaries are, learn how to defend themselves, how to fight and of course how to stay alive. They are learning by doing, in a safe way. “Games are thus the most ancient and time-honored vehicle for education”, Crawford concludes, “Game-playing is a vital educational function for any creature capable of learning.”

By this small example, the fundamental characteristics of games can be pointed out. Playing happens in a safe way, so safety is one of these characteristics. Since the cubs interact with each other and with their prey, interaction is another characteristic. Representation and conflict complete the fundamental characteristics. These will later be reviewed in detail. Of course there is a difference between the way children play cops and robbers and the way adults would, for instance by playing a board game such as Scotland Yard1. But since Singer and Singer believe that children as well as adults will never stop to participate in all forms of playing [SS05], I will not differentiate between the two terms in the future.

2In the United States, this game is called NY Chase
2.1.2. Fundamental characteristics of games

In section 2.1.1, I have named the four fundamental characteristics of games. Now I will take a closer look at them. The terms Conflict, Safety, Interaction and Representation are derived from the classification of games by Crawford [Cra84].

2.1.2.1. Conflict

Conflict is a major element in all games. While the player tries to win the game, either the rules or the player's opponent (or both) will prevent him from achieving this goal easily. In video games, the opponent is not necessarily a human player. More often it is an AI-controlled software agent which actively tries to keep the player from winning the game. Avoiding every conflict in a game is impossible. Crawford remarks that removing each type of conflict could only be achieved by eliminating the active response to each of the player’s actions, which, however would destroy the game. A much better way to eliminate conflicts is to introduce cooperative components. This allows players to group in teams and work together to reach the game goal, which leads to less conflict for each single player. Conflict can be direct or indirect, violent or nonviolent, but it remains a crucial element of all games.

2.1.2.2. Safety

Since conflict always implies the danger of being harmed, games must provide a possibility to avoid physical harm. Thus, a game is always a simulation of reality; it shows what could happen without being harmful itself. Having a look at the lion cubs again, it is easy to see that, from the lion’s point of view, it is not dangerous to make a mistake when hunting the butterfly playfully. But, if the lion had no training in hunting, such a mistake might prove fatal to him, when hunting a gazelle armed with deadly horns. A human player can play a hack’n’slay video game without the danger of losing his limbs. On the other hand, it is not the task of a game to avoid all possible negative consequences. In doing so, the game would lose touch with the real world. It is important that there is some kind of feedback if a player loses a game. This may be as simple as a “You lose”-screen. Most games employ the principle of positive reinforcement, i.e. by
2. Games and Usability

giving a positive feedback if a player solves a puzzle, and no feedback, if the player does not succeed. Hence, games are a safe way to experience reality.

2.1.2.3. Interaction

The “degree of interaction provides a useful index of ‘gaminess’.” [Cra84]. If a game offers no interaction at all, like the Rubik’s Cube, once a general strategy to solve the game is found, the game loses its attractiveness. A video game always reacts to the players’ actions, forcing them to find new solutions to solve the game. Hence, the game—players always face different challenges each time they play the game. In multiplayer games (see section 2.3), interaction does not only take place with the game, but also with other human players. Spyridou et al. [SPW03] come to the conclusion, that the more communication the users have to employ, the more immersed they will become in the virtual environment. The increased interaction will change the users’ perception of the game in a positive way, the role of the players change from the role of a spectator to participant or director.

2.1.2.4. Representation

Each game is a model of the real world. A model is a simplified, closed and formal representation of a complex system. A game world is always internally complete; there is no need to refer to agents or events outside the game, so it is a closed system. The game has explicit rules; hence it is a formal system. It is a very much simplified representation, since it is impossible to represent the real world in detail due to its complexity. Again, having a look at the lion cubs, the butterfly is the simplified representation of the defensive prey. It is a closed system, since for the lion cubs at the time of playing, nothing else is of interest. The rules are simple, hunt the butterfly, hence it also is a formal representation.

\(^3\)Of course this does not apply to gambling, which is a kind of game, too

\(^4\)http://www.rubiks.com (2008-05-01)

\(^5\)Interestingly when Crawford wrote his book, multiplayer games were not important yet: “Computer games seldom provide a human opponent[...].” Almost 25 years later, games without a multiplayer option are rare.
2. Games and Usability

2.1.3. Motivations to play games

It has already been shown that the fundamental motivation to play games is to learn. But there are other motivations to play games which are not necessarily linked to learning. In the following, some of these motivations will be reviewed in greater detail. Again, a classification by Crawford [Cra84] will be the starting point. Klug and Schell [KS06] refer to a number of types of players with different needs. These motivations will be linked to the Crawford’s classification.

2.1.3.1. Fantasy / Exploration

Similar to a story in a book or a movie, a game can lure players into a fantasy world where they forget the stresses and strains of everyday life. In section 2.1.2.3 we have learned, that a game-player is more a participant than a passive spectator, as when reading a book. The player actively interacts with the game. “The escapist tendency, the urge to fantasize, is certainly an important motivation.” [Cra84] A fantasy world needs to be explored; there are lots of things to discover which simply don’t exist in the real world. Klug and Schell refer to the player type as The Explorer. Explorers play to discover and to experience the boundaries of the fantasy world. The Storytellers instead create their own fantasy world to live in.

2.1.3.2. Nose-Thumbing

Games often offer the opportunity to assume a role such as a hit man or a mafia boss. A large number of so called killer games, such as True Crime NYC6 (figure 2.1), allow players to adopt roles that are socially unacceptable in real life. Other games allow players to instigate wars, or even to perform sexual assaults against virtual victims. Many games depict acts of violence in a highly explicit manner. They have triggered heated discussions in politics and are often regarded as responsible for youth crime or even school shootings. But current research shows a different picture. Only one in eight school shooters was actually interested in violent games; there is no significant evidence,

that playing violent games has a negative influence on players. [KO08] So a game-player “can thumb his nose at social strictures” [Cra84] and play violent games without being suspected to be a next door school shooter. The Director plays for the thrill of being in charge, he wants to be in control of the situation.

2.1.3.3. Proving Oneself

The Achiever plays to be the best player in a game, and he always tries to improve his own achievements. The Collector instead always tries to acquire the largest amount of items during the game. The Competitor plays to be better than other players. All of these player types want to prove themselves by always being the best of all players in whatever their personal game target is.

Achieving the personally set target is the main characteristic of this motivation and it is being supported by every game, sometimes with a feature as simple as a high score-list; more often, however, games offer very detailed statistics. Racing games, for example, don’t just show the round time, but also a large number of information, such as the
time spent in first place, percentages of driving the racing line or even the grade of tire abrasion. Moreover, today most video games offer the chance to compare oneself with players worldwide via the Internet.

2.1.3.4. Social Lubrication

Games are often used as social lubricants by adults as well as by kids. [KO08, For players with this kind of motivation, a game’s contents are not very important. For them, it is important to play a game together with other people, to contract and maintain friendship. A closer look at the social context will be made in section 2.1.5. The Joker is motivated by this social context. He plays for the fun alone and enjoys the social aspects of the game.

2.1.3.5. Exercise

Training cognitive or physical abilities is an important motivation for some players. Puzzle games for example train logical thinking and problem solving. Quiz games train general knowledge. There is a wide range of so called serious games, games with educational purpose, which are designed to impart special knowledge in a given domain. A fitting example is Food Force\textsuperscript{7} by the United Nations World Food Programme\textsuperscript{8}. After a major crisis has occurred in a fictitious country, the players have to take care of help deliveries and to rebuild the infrastructure of that country. The players learn about hunger and malnutrition and how these might be avoided in future.

Another kind of exercise is physical training. It has been proved, that video games improve hand-eye-coordination, spatial sense or reaction time. [GB07. Today, video games are even used in medical rehabilitation\textsuperscript{9}. This motivation is typical for The Craftsman, who loves to build, solve puzzles or to engineer constructs.

\textsuperscript{7}http://www.food-force.com/ (2008-05-01)
\textsuperscript{8}http://www.wfp.org/english/ (2008-05-01)
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2.1.3.6. Need for Acknowledgment

The last motivation to play games mentioned by Crawford, is the need for acknowledgment. Acknowledgment ranks second on Maslow’s hierarchy of needs\textsuperscript{10}. Hence, it is obvious, that it is a major motivation to play games and that interaction is crucial for games. “My opponent must look beyond the playing pieces and acknowledge my cleverness, my rashness, my deviousness, my entire personality.” [Cra84]. The Competitor as well as the Performer are motivated by the need for acknowledgment. The Performer plays because of the show he can put on; a good show ensures respect by other players the same way a good ranking does for the Competitor.

It is obvious that most players are not driven by just one motivation. The need for acknowledgment, for instance, is strongly tied to social lubrication. It is also impossible to exactly separate the player types. Most players belong to more than one type, since a player can, for instance, enjoy a puzzle game (The Craftsman), as well as beating the course record a racing game (The Competitor).

2.1.4. Criteria for selecting specific games

The reasons why people actually play games have already been discussed, but what motivates them to prefer a specific video game above others? There are many criteria that influence this decision; three of the most important criteria, multiplayer, gameplay and sensory gratification, will be reviewed in this section.

2.1.4.1. Sensory Gratification

Human beings are highly attracted by sparkling lights or good music and are naturally captivated by beautiful scenery and dazzling effects of every kind. [Evr05]. Think of a fairground without flashing lights everywhere, without the music, without the noise of the fairground rides: It would be boring. The food industry spends a lot of money every year for food designers who make our food not only visual attractive, but even try to

\textsuperscript{10}See http://www.abraham-maslow.com/m_motivation/Hierarchy_of_Needs.asp (2008-05-01) for more information
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make it sound more enticing when we eat it.\footnote{http://www.bbc.co.uk/food/tv_and_radio/perfection/experimental_kitchen_sensory.shtml (2008-05-01)} Hence, sensory gratification is important in all parts of life.

Even the earliest video games used light, colors and sound to attract and hold the players’ interest. Today video games use impressive graphics\footnote{In a modern gaming computer, the graphics card is even the most expensive part of hardware.} and feature music performed by entire symphonic orchestras\footnote{Musik in Computerspielen - Der Soundtrack zum Spielespaß; GameStar-dev 03/2007; IDG Entertainment Media GmbH}.

Inviting graphics, color, animation, and sound support the game’s fantasy world by providing sensory “proof” of the game’s reality. Hence sensory gratification generally is the deciding factor between games with the same intent. [GP04]

2.1.4.2. Gameplay

Many authors have tried to define gameplay. The result is a potpourri of definitions which shows that gameplay first and foremost is a matter of subjective perception. Rouse [RO01] defines gameplay as the degree and nature of the game’s interactivity, how the player is able to interact with the game-world and how that game-world reacts to the players’ actions. It is the component that distinguishes games from other artistic mediums. Crawford [Cra84] sees gameplay as a combination of pace and cognitive effort required by a game. Kürten and Mühl [KM00] define gameplay as the playability of a game, which manifests itself in the six criteria comprehensible coherences, equivalence of risk and gratification, adequate game pace, perceptible objectives, impartial game design and correctness. Others define gameplay as “one or more casually linked series of challenges in a simulated environment” [RA03] or as “the essential storytelling component in games” [Nov08].

Simply put, gameplay is what makes a game fun to play. More detailed, gameplay is a superset of many factors. These include interactivity, pace, story, level of difficulty as well as the players’ subjective preferences. Hence an exact definition cannot be given.
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2.1.4.3. Multiplayer

I have stated earlier, that social interaction is an important motivation to play games, which is why it is only natural that multiplayer features are also an important criteria of selection. *Anno 1503*\(^{14}\) showed the relevance of multiplayer support in 2002. The game did not support multiplayer options, when it was first released. After massive protests of the players' community *Sunflowers*\(^{15}\), the developer, announced a patch to add the missing multiplayer support. In 2004, two years after the initial game release, development of the patch\(^{16}\) was stopped, leading the players' community to take matters into their own hands and developing an unofficial multiplayer support for the game\(^{17}\).

It is obvious that for some types of players mentioned in section 2.1.3 like the *Performer*, the *Competitor* or the *Joker* multiplayer support in a game is crucial for his motivation to buy and play a video game.

2.1.5. The role of games in society

As stated in section 2.1.3.4 playing games often allows to make new friends or to cultivate existing friendships. Sorensen and Jessen [SJ00] have stated, that computer games generate friendship and social events, and that computer games can be cultivated as a common interest - an interest that often goes beyond the mere act of playing. Hence the social aspect of playing computer games is an essential reason for many children to play video games since it gives social identity. Kutner and Olson [KO08] are even going a step further. They see the act of playing games as a marker of social competence. When studying the correlation of playing violent games and getting into trouble in school, they discovered two extremes. The children that only played very violent games for more than 15 hours a week faced a greater risk for getting into trouble. On the other hand, children who didn't play video games at all showed exactly the same risk. This lead them to the conclusion that children playing video games on a regular basis are more socialized, a view that is being underlined by a large number of interviews Kutner and

\(^{14}\)http://anno.de.ubi.com/history1503.php (2008-05-01) (German)
\(^{15}\)Acquired by Ubi Soft in 2007
\(^{16}\)http://www.pcwelt.de/start/gaming_fun/archiv/38389/anno_1503_multiplayer_patch_wird_nie_erscheinen/ (2008-05-01) (German)
\(^{17}\)http://www.spieletipps.de/n_7271/ (2008-05-01) (German)
Olson conducted with parents.

We also know that playing games plays an important role in education. Kutner and Olson point out that new video game consoles like *Nintendo Wii*\(^\text{18}\) make it easier for parents to get involved. Children want to play with their parents and want to teach them, instead of constantly being taught by their parents.

Playing games enables human beings to act out another identity. This second identity is secured by the anonymity of the Internet and by the avatar\(^\text{19}\) one uses in such a game. There are various possibilities what can be done with such an identity. *Gender swapping*\(^\text{20}\) is a widely used option. Online games are the only way to see the influence of gender on other people from the opposite sex’ point of view. In 1992, Bruckman researched the phenomenon of *gender swapping* in online games. 84% of the players in the researched game were male. Hence, “*new female players are often swarmed with male players vying for their attention.*” [Bru92, *Gender swapping* is often used as a tool for enhancing personal growth and understanding. [RP01]

These are the most important roles of games in society from the author’s point of view. Socialization, education and gender swapping are covered by many researches about games. Often the results of these researches are contrary, such as the research of the influence of so-called killer games. Society is a complex structure, which is mirrored by the research. This makes it impossible to cover it in greater detail here.

### 2.2. What are Browser Games?

The Internet and its capabilities have changed massively during the first years of this millennium. Internet speed today is up to more than 1,000 times faster the speed it was just a couple of years ago. While in the late 1990s loading a web page from only 100kByte almost took a minute, today this happens in just fractions of a second. Today more than 250 million people in Europe have access to the Internet, with more than 100


\(^{19}\)Sanskrit, most commonly refers to the incarnation (bodily manifestation) of a divine being onto planet Earth. In video games, it refers to the graphic representation of the virtual alter ego

\(^{20}\)also referred to as *gender-switching*
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millions of people having a broadband Internet connection. By the end of 2007 more than 3 million Europeans subscribed to some massively multiplayer online game (MMOG), spending more than €300 million in 2007. This is a growth rate of more than 28% per year.

2.2.1. Definitions in literature

One variety of these MMOGs are browser-based games, or simply browser games. Figure 2.2 shows a screenshot of a typical browser game, Kapi Regnum. The idea of what constitutes a browser game tends to vary from author to author. In 2003 Dvork states,

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22ibid.
that: “Browser Games are also known as Java games because you must have Java enabled on your machine to play them.” [DPT03], while Lecky-Thompson claimed only a year earlier, that games that are played through a Web browser come with the key limitation that they can not contain much game-playing logic. Although browsers often support client-side scripting, such as JavaScript or a similar language, they were limited in scope [LT02]. In a similar approach in the same year Friedl says, that browser games are completely online, solely reside on one server, and are accessed by only the player’s web browser. [Fri02].

2.2.2. What is a web browser?

A web browser basically is a program to display static documents on the Internet. Today a web browser is a core program in every personal computer’s operating system. The most important browsers are Microsoft Internet Explorer, which has a 66% market share, and Mozilla Firefox, which has had a 28% market share around the end of 2007. By using a client-side scripting language like JavaScript, web documents can be enhanced with some basic application logic. With JavaScript it is possible to implement features like dynamic navigation, form validation or desktop-like user interfaces. In general, JavaScript is an integral part of modern browsers. By making use of additional plug-ins, such as Adobe Flash or Microsoft Silverlight with restrictions it is almost possible to clone the look, feel and behaviour of common desktop applications. These plug-ins are not available by default, but have to be installed by the user. Furthermore, not all plug-ins are available for all types of browsers and platforms.

Although these plug-ins support heavyweight applications, the game logic itself resides on the server. The players create an account on a game server and log into the game using their web browser. All actions the players like to perform are sent to the server as parameters, the input is calculated by the server and the result of the calculations is sent back in the form of a web page. The execution of the program code as well as the permanent storage of the game data is of servers reliability. As a matter of fact, modern browser games need more than one server for hosting a game.

26 http://www.microsoft.com/silverlight/(2008-05-01)
2.2.3. Definition of browser games

As mentioned above, browser games are considered as massively multiplayer online games. They are played together with or against a number of other players on the Internet. The length of a game round may reach from several months to several years, which is why browser games need an infrastructure to store the game data persistently. Persistent games are games which provide an environment that preserves the actions of its players. Persistent games provide living worlds that exist and evolve beyond the game’s session of any single player. [WKG+07, The players in such browser games do not need to be logged in at the same time. Often only a couple of minutes per day are enough to participate in the game.

Taking everything into account, browser games are massively multiplayer online games played over the Internet, making use only of a web browser on the client side, while the game logic itself resides on the server, which stores the game data persistently.

2.3. Key Differences between Browser Games and Video Games

Now that we have established what browser games are, it is important to have a look at the differences between browser games and video games. At first, the difference between singleplayer and multiplayer video games as well as massively multiplayer online games should be distinguished. Since some technological limitations apply, a deeper look at the technological aspects is required. Then the players’ motivation and the challenges for game developers will be looked at.

2.3.1. Singleplayer and Multiplayer Video Games

Singleplayer games are played by only one person at a time. A common example for these kind of games is the genre of adventure games. As in Jack Keane27 the player

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interacts only with the game, he is the only human being in the game world and has to master the game on his own. Multiplayer games are video games played by a number of people at the same time. Often up to four players play against each other on a single video game console. A good example is the Mario Kart-series\(^{28}\) for Nintendo video game consoles. In this game every player controls a kart and guides it through a race track while trying to beat his human and virtual opponents. Personal computer multiplayer games are slightly different nowadays. These are played against other players by using a computer network, either LAN or even the Internet. That way, more people can join the same game. One of the computers in the network needs to be a host for the other players in the game\(^{29}\). An in Germany because of its contents controversially discussed example of this kind of multiplayer game is Counter Strike\(^{30}\). In Counter Strike players group up in teams of either terrorists or counter-terrorists. Each team attempts to win the game by completing a mission objective or by eliminating the opposing team.

2.3.2. Massively Multiplayer Online Games

Massively multiplayer online games extend the principle of multiplayer games. These kind of games are played over the Internet only. One example of this group is World of Warcraft\(^{31}\). As a massively multiplayer online game, World of Warcraft enables thousands of players to come together online and battle against the game world and each other. Figure 2.3\(^{32}\) shows a scene from World of Warcraft. To be able to play World of Warcraft the player has to buy and install a software client first. With that client he connects to the game servers. In contrast to the multiplayer games mentioned above the game state is persistently stored. “A persistent world is an online game world that continues to function even when a player logs out and no longer participates in it. A player can log back in at any time and continue from where he or she left off. While a player is logged out, other players can continue to play in the virtual world.” [APS08.

\(^{28}\)http://www.mariokart.com/ (2008-05-01)
\(^{29}\)Of course there are commercial solutions where the games are hosted externally
\(^{30}\)http://www.counter-strike.net/ (2008-05-01)
\(^{32}\)source http://www.fieldsofmassaker.at (2008-05-01)
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2.3.3. Technological Aspects

In contrast to the video games mentioned above an Internet connection is required to play browser games. “Back at Atari in the late 1970s, each game cartridge for the Atari 2600 console was created by one person. […] Nowadays, […] games are normally made by teams of several dozen people, with the work done by various teams of specialists.” [Wol03] This trend today can also be seen with browser games. While the first browser games like Freeport - SOL\(^{33}\) have been developed by an individual hobby programmer, modern browser games are mostly developed by teams of specialists working for game companies. Furthermore, Wolf says that game worlds are usually 3-D in current games, not in the 2-D of yesteryear.[Wol03] This is another trend that can be seen in browser games, too. Since browser games are becoming more and more complex by means of multimedia components like graphics, audio and video, a broadband Internet connection is highly recommended. But still the web browsers have limited capabilities and performance especially in displaying multimedia content. As mentioned in section 2.2, such content can only be displayed using plugins which are not ubiquitously available.

\(^{33}\)http://www.freeport.de/Sol (2008-05-01)
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Besides, the use of multimedia requires a lot more bandwidth\(^{34}\) on the client side as well as on the server side than the use of text and still images. Unlike client-based MMOG like World of Warcraft, that send only atomic commands over the Internet, browser games require to transfer the whole web page on each single request\(^{35}\).

A huge advantage of browser games is that they do not require the player to buy and install a client program before he starts to play. Internet browsers today are available on any personal computer without further costs. The user may choose from a variety of different browser programs for each platform. If game developers follow the common web development standards, a game looks almost the same on each web browser. Since the browsers use different rendering engines like Gecko\(^{36}\), WebKit\(^{37}\) or Trident\(^{38}\), web pages are shown slightly differently in each browser. A test, that simulates extreme conditions to show the problems of the different render mechanisms is the Acid Test\(^{39}\) from the Web Standards Project. Despite the problems in rendering, that occur under specific circumstances, the ubiquitous availability of web browsers is a major advantage of browser games. Another benefit of using web browsers, are the system requirements of these kinds of programs. Web browsers need far less system resources than modern video games\(^{40}\). So browser games can still be played on older personal computers without any restrictions.

2.3.4. Players' motivation

Since a person who paid money prior to being able to install and play a game has informed himself about the game before deciding to purchase the game, it can be assumed that this person is highly motivated to deal with even complex games and to learn a complex game handling. In contrast to that, participation in free browser games often is an unplanned ad hoc decision. This results in a lower motivation to deal with complex game issues. To keep the player involved in the game, the developer needs to design the

\(^{34}\) A low-quality video requires about one to two megabytes, a medium-quality mp3 audio file requires about one megabyte of bandwidth per minute.

\(^{35}\) Client-side cache mechanisms help to save bandwidth by storing static content locally. This content then is loaded from a disc, instead from the web.

\(^{36}\) http://developer.mozilla.org/de/docs/Gecko (2008-05-01)

\(^{37}\) http://webkit.org/ (2008-05-01)


\(^{39}\) http://www.acidtests.org/ (2008-05-01)

\(^{40}\) Crysis for example requires the presence of a multi-core CPU and 512 megabytes of graphics memory
user interface of the game as intuitively as possible and to keep the access to the game as simple as possible.

### 2.3.5. Game developers

Other tasks of the game developer are provision and maintenance of game servers as well as marketing and distribution of the games. So his job description is more similar to that of a service provider than a developer.

This leads to a short track between provider and player. The game service provider can react quickly to customer inquiries. Besides, he is able to adjust or extend the game parameters at any time. Since the game completely resides on the provider’s servers it is guaranteed that the most recent version of the game is always available. The player does not have to be concerned about keeping his game up to date by downloading and installing game patches. On the other hand, the game service provider does not need to worry about pirate copies. Since AI has increasingly become one of the critical factors in a video game’s success [Rab07], the browser game developer’s challenge clearly is the balancing of the game. A massively multiplayer online game has to serve thousands of human players without favoring only one group of players. But as mentioned above, it is a huge benefit of browser games that changes to the balance can be carried out at any time, even while the game is running.

### 2.3.6. World-wide Distribution of Games

Another aspect, that hasn’t been mentioned yet, is game publishing. Since video games are sold through traditional channels of distribution, it is possible to create country-specific game versions. This option is not available for browser games, because they are available virtually worldwide.

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41 In 2004 video games have been copied more than 54 million times, in Germany only. Thus, for each copy sold regularly one illegal copy has been made. The damage to the game industry exceeded €400 million.

42 Many World War II-games for example have to be censored for the German market, since Nazi-imagery in games is prohibited by law.
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![Figure 2.4.: Example for cultural differences: Football vs. Football](image)

This could raise problems especially for browser games which are available in the universal language English. Cultural misunderstandings, such as the shape of a football (see figure 2.4) or the meaning of a color have to be taken into account as well as religious matters, such as the meaning of pork or alcohol to a Muslim.

2.4. Game Genres

“A genre is a particular type of literature, painting, music, film, or other art form which people consider as a class because it has special characteristics.” Genres in films are well defined and widely accepted. Everyone knows the difference between Eastern and Western or Science-Fiction and Action. Although Star Wars indisputable has lots of action elements no one would doubt the classification of the movie into the genre of Science-Fiction. The classification of video games on the other hand, is far more vague. Thinking of Counter Strike the first though let us see a first person shooter. But when we consider the story behind the game, it might also be regarded as a strategy and tactics game, since the player cannot win the game by mindless shooting, but has to employ a certain strategy in order to reach the game’s goal.

This simple example shows that it is not easy to classify each game according to a single genre at the first sight. Most games have elements of more than one genre. Caldwell notes in his article Theoretical frameworks for analyzing turn-based computer strategy games

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43While in Western civilization black is associated with mourning, in most Asian and African countries this role is associated with the color white

that different game genres, even different subgenres, deploy diverse representational strategies which makes general claims seem untenable. [Cal04, Wolf names 42 video game genres [Wol03, the German version of the public encyclopedia Wikipedia\footnote{http://de.wikipedia.org/wiki/Genre_(Computerspiel) (2008-05-01)} names 43 genres, the English version\footnote{http://en.wikipedia.org/wiki/Video_game_genres (2008-05-01)} names even as many as 53 different genres at the time of review. This shows how complex the classification of a game into a specific genre can be and how blurred the boundaries between two genres can be. At the moment there is no consensus about formal definitions for game genres.

During the following paragraphs, I will discuss some of the more popular game genres and evaluate these according to their relevance for browser games, in regard to the definition of browser games in section 2.2.3

### 2.4.1. Adventure Games

The genre of adventure games has already been mentioned as representative for single-player games in section 2.3.1. The game follows a more or less straightforward storyline. While the story proceeds, the player has to find items and solve puzzles. Often the player can only proceed after talking to every non-player character (NPC) in the game. There are two major subgenres. In Point-and-Click-Adventures the player sees the game world from a third persons' perspective. He controls the protagonists' figure by pointing and clicking objects with the mouse. Typical examples are the already mentioned Jack Keane or the Monkey Island-series\footnote{Developed by Lucas Arts http://www.lucasarts.com (2008-05-01), published by Electronic Arts http://www.ea.com (2008-05-01)}. In First-Person-Adventures the player sees the game world from the protagonist figures' perspective, by walking through a 3D game world. A well-known example of this subgenre is the Myst-series\footnote{Developed by Cyan Worlds http://www.cyanworlds.com/ (2008-05-01), published by Ubisoft http://www.ubisoft.com (2008-05-01)}.

Since browser games are defined as massively multiplayer online games it is easy to state that the genre of adventure games is non-applicable for browser games.
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2.4.2. Puzzle Games

These games test the players’ problem solving skills in logic, strategy, sequence solving, pattern recognition etc. Puzzle games are typical singleplayer games. Multiplayer options often are restricted to a one-on-one battle with the goal to solve the particular puzzle as first. A popular representative of this genre is *Lemmings*\(^{49}\). In the game world the Lemmings\(^{50}\) stupid little creatures heading blindly towards disaster. The player’s task is to guide the creatures by putting obstacles in their way. When meeting such an obstacle, the Lemmings will turn around and head for the opposite direction.

Puzzle games are non-applicable as browser games since, as the adventure games genre, they are not compatible with massively multiplayer environments.

2.4.3. First-Person Shooter Games

In this genre the player sees the 3D-game world from a first-person perspective. The players’ principal task is to kill his opponents, which may be either non player characters or human opponents. To fulfill this task the player has a huge arsenal of weapons at his/her disposal. Regarded as a milestone of this genre, the game *Doom*\(^{51}\) set standards in 3D-graphics when its first part was released in 1993. This genre could be regarded as the prototype of the so-called “killer-games”, (see section 2.1.5) since most of the games of this genre are extremely violent. Figure 2.5\(^{52}\) shows such a violent scene from *Doom*.

This genre is non-applicable for browser games as well. To this moment, no is no browser technology has been developed that is able to show highly detailed 3D-worlds at an acceptable speed. Apart from that fact, massively multiplayer first person shooters simply do not make sense, since the current first person shooters’ gameplay is designed for a one-on-one or team-on-team situation. Furthermore, a persistent storage of the


\(^{50}\)In the real world, lemmings are portrayed as small rodents living in tundra biomes. Their behavior, in contrasts to their virtual counterparts, is not suicidal.


game world also does not make sense in this genre, as it does not contain a game world that can evolve while a player is offline.

2.4.4. Real Time Strategy Games

The games in this genre generally are war games of some kind. The player has a top-down perspective of the game world. This may be either a 2D- or 3D-game world. In contrast to turn-based games there is no defined time limit for a move. Instead, the time is running continuously. Hence, players in multiplayer games do not have to wait until the opponent finishes his turn. Games in this genre follow the pattern of gathering resources, building a base, researching technology and fulfilling a mission objective, which in general is to completely destroy the enemies' base and troops. The Command 
& Conquer-series\textsuperscript{53} is an important example of that genre.

Up until today, available browser technologies cannot support the games’ requirements of

highly accurate synchronization needed when hundreds of units are engaged in combat. Furthermore, this type of game is not designed to support massively multiplayer matches. Often, no more than two players can join a match at the same time. As well as first person shooters, this genre is non-applicable for browser games.

2.4.5. Sporting Simulations

In this genre the player slips into the role of an athlete. The players’ perspective can be either top-down or first-person, depending on the game. Since the nature of sports presenting a one-on-one or a team-on-team situation, this genre initially is not adequate for massively multiplayer games. If the simulation is extended by a league system, the game may also support massively multiplayer games. The *EA sports-series* features a lot of different sports like American Football, Soccer, Baseball or Basketball.

![Figure 2.6.: EURO Kicker](image)

A league system of a sports simulation can be seen as the game state, so it is a persistent game world. It is also known that a sporting simulation can be supported by such a league system, what makes them massively multiplayer-compatible. The browser core technologies do not support this genre, however by using plugins such as *Flash* sports

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events may be simulated. Since the technology so far is not advanced enough to support complex realtime simulations in a web browser, such games often are round-based. One important example of this is EURO Kicker\textsuperscript{55-56}. The games uses Flash to present the playing field. Each touch of the ball stops the game, so that the player whose team is in possession of the ball can select where and how strong to shoot the ball to. In figure 2.6 the green arrow indicates the direction of the shot. The dotted white arrow indicates the direction of the goal the team targets. In the lower right corner the player can adjust the angle of the shot. The bar right next to the angle indicates the remaining round time for the move, the circle right to that bar shows the playing time. A league system supports the massively multiplayer aspect of browser games. The players meet in a chat room called “Lobby” where they arrange a match. Hence, with some restrictions, it is possible to present sporting simulations as browser games.

2.4.6. Sports Manager Simulations

In contrast to sporting simulations, the player in this genre manages a a sports club. His tasks include managing and training the team, arranging sponsorship deals, expanding the sports arena, selling fan merchandise and much more. Games of this genre are generally round-based, with one round consisting of the time between two matches of his team. Games are usually singleplayer games, but can be extended to multiplayer games when using some sort of sports manager league. Then the round time is defined by the game world, for example with one turn being one day. In the Football Manager-series\textsuperscript{57-58} the focus lies on the team management.

In Rumble Race\textsuperscript{59} the player manages a racing team. His job is to buy cars, employ drivers and mechanics, register his teams for the daily races and upgrade the cars with the trophy money won in the races. To reach the VIP license, the player has to complete 28 tasks, such as winning a race against a computer player or owning a special car. The players may organize in clans, giving them the opportunity to compete in clan races.

\textsuperscript{55}http://eurokicker.sevengames.de/ (2008-05-01)
\textsuperscript{56}Developed by ROOT9 MediaLab GmbH http://www.root9.org/ (2008-05-01)
\textsuperscript{57}In the US sold as Worldwide Soccer Manager
\textsuperscript{59}Developed by upjers GmbH http://www.rumblerace.com/ (2008-05-01)
2. Games and Usability

This example shows that the genre of sports manager simulations is suitable for browser games, since they support massively multiplayer games by organizing the players in leagues. There is no need for a real-time synchronization since the game is round-based from the start. This way, a game can completely be written to harmonize with the browsers core technologies. The players’ team as well as the game league are stored persistently.

2.4.7. Economic Simulations

As in sports manager simulations, the player’s task in this genre is to run a company. His job is to buy, produce or sell goods or services of any kind. As in Theme Park these services might be amusement. The player has to buy and build fairground rides, catering or sanitary facilities. His researches improve the rides, making them more rendering them more reliable and amusing, while his gardeners care for the parks. The player tries attain wealth by attracting as many visitors as possible.

![Figure 2.7.: Kapilands](http://www.kapilands.com)

One of the leading browser games of this genre is Kapilands. The player builds facilities

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in eight countries, such as research centers, production plants or stores. Researching a good raises the profit on sale. Each country has specific assets and drawbacks as an improved raw material production or less favorable sales figures in stores. Products may also be sold to other players. Figure 2.7 shows a factory. The top area shows the number of workers in this factory as well as its size. The center of the screen shows the products that can be produced in this facility. By entering an amount in the corresponding field the player starts producing the chosen item. This takes the indicated amount of time, which is being when the building has been expanded. Kapilands is a highly interactive massively multiplayer economic simulation with more than 100,000 players per game world. The game does not require any plugins to work, it makes solely use of HTML. Persistent storage of the game world is implied since construction, production or research could need weeks or more time.

2.4.8. Role Play Games

The player slips into the role of a fictional character in a fantasy world and controls the actions of that character. The player improves his character by acquiring new equipment or by the character’s experiences in the game world. The games in this genre focus on solving quests with distinguishable goals. Players in multiplayer games can accomplish these quests collaboratively with other players or can choose to compete against others. World of Warcraft has already been mentioned in section 2.3.2 as an example of this genre.

Renaissance Kingdoms takes place in Western Europe at the end of the Middle Ages. The player starts as a tramp that has to get rich and famous in his community. He can also choose to become a monk and enter a monastery or decide to travel through the cities of the Kingdoms to sell products on the markets. The game is played by about 160,000 players at the moment and game requires a high level of player-to-player interaction. Developing a virtual character takes weeks, hence persistent storage of the game world is implied.
2. Games and Usability

2.4.9. City Development Simulations

In 1989 *SimCity*[^63] laid the foundation for this genre, which is also known as City Building Simulations[^64]. Some games of this genre offer goal-centered and timed scenarios, but in general city building simulations do not have a specific goal. The player marks land as being zoned[^65] either as residential, commercial or industrial area; he takes care of power and water supply or builds transportation systems in order to build and manage a city, taking on the role of a mayor or city manager. Figure 2.8 shows a screenshot from *Sim City 4*[^66]. The main screen shows a part of the city with streets, housing, parks and a water tower. The left side of the screen shows the main menu with options like terraforming, zoning, transportation or power and water supply. The terraforming-menu is opened showing more options like lifting or sinking the ground. The lower part of the screen shows even more detailed options, buttons to turn the map by 180 degrees and important data, such as the current balance or the mayor’s rating. This menu-structure

[^64]: In the following, I will refer to this genre as City Building Simulation, which is more commonly used
[^65]: **Zoning** is a term used in urban planning for a system of land-use regulation
is common to most games of this genre. The SimCity-series as well as other games in this genre do not offer a multiplayer option.

There have been attempts at adapting this genre for browser games by enhancing it by a player-to-player interaction. In sv\textsuperscript{67} for example this interaction has been implemented by adding a type of war game. The player may choose from 29 different buildings, in contrast to the zoning common in games of this genre. By researching the player may improve buildings and military units. The players can group in clans called states.

On first sight, this genre is non-applicable for browser games because the games have no multiplayer option. But as our example shows it is possible to implement games of this type as browser games, if they are enhanced with some form of player-to-player interaction. In chapter 3 I will describe the design of a city building simulation and enhance it with multiplayer options in order to fit our browser games requirements.

2.5. Target Audiences

What kind of people play video games? How old are they, what social stratum do they belong to? How can the players of video games be classified into groups and what do that groups expect from games? To answer these questions, several studies made in the last years will be reviewed. These studies often refer to a specific game or group of games, but show that the results overlap in the majority of cases.

2.5.1. Player Typology

Spielplatz Deutschland\textsuperscript{68}, a study by Electronic Arts in 2006, categorizes players into five groups [Kab06]. Each of these groups will be reviewed and their relevance for browser games will be evaluated.

\textsuperscript{67}short for Space Village 2 http://www.sv-2.de/ (German only) (2008-05-01)
\textsuperscript{68}Playground Germany’, available from http://www.spielplatz-deutschland.de/ (German only) (2008-05-01)
2. Games and Usability

2.5.1.1. Casual Gamers

The group of casual gamers is by far the biggest group of all players. 54% of players belong to that group. Interestingly, this group is the exact opposite of the image of video game players drawn by the media. The average player of this group is 44 years old, only 20% being younger than 30 years. The vast majority of 83% lives in a multi-person household, 75% have an average or high income. Half of the players in this group are female.

Video games are a spare time activity like sports or reading. The decision to play happens spontaneously. Casual gamers tend to choose games of sports, fun and skill, less frequently they choose to play action, strategy or fantasy games. The casual gamer prefers simple interfaces and easy to learn games, he is looking for amusement and distraction.

A study about the casual gamer made by Real Networks shows a similar result. The proportion of women is even slightly higher. 42% of the players in this study use games also to train their memory [TS07]. Another survey from Giga-TV shows different game preferences. About two third of the respondents prefer games of skill, 44% prefer card games and 35% prefer strategy games (multiple responses possible) [TS07].

Of course this group of players is interesting for browser game developers, not only because the group is so large. Casual players tend to play only a short time per day. Browser games often require only a few minutes of activity per day to be able to compete with other players. As known from section 2.4 Sporting Simulations with some restrictions are getting popular in browser games while puzzle games are not interesting to the provider. Sports Manager Simulations or Economic Simulations require some strategic skills, hence these genres may be also of interest to this type of player.

To tap the group of casual gamers for browser games Sporting Simulations and Strategy Games rank first. Sports Manager Simulations and Economic Simulations share the second rank, since they are demanded less frequently.
2. Games and Usability

2.5.1.2. Habitual Gamers

With 24% of all players, the group of habitual gamers is the second largest group of players. Almost 50% of the people in this group are between 14 and 29 years old and about one quarter is female. Also 75% have an average or high income, with a shift to high incomes. 87% live in a multi-person household. These are 4 percentage points more than with casual players, which results from the fact that many persons in this group still live with their parents. Their life often is in a state of change, they recently finished school or started a family.

This group has grown up with video games. They are a part of their everyday life, such as books or movies. As the casual gamers, the habitual gamers prefer games of sports or fun as well as games of action or strategy. People in this group are multipliers, they convey the fun of playing to non-players. Key motivations are amusement, recreation and sociality.

Habitual gamers prefer the same types of games as the casual gamers, which is why this group is of interest to browser game developers. Games designed for this group should have an increased support for multiplayer and collaboration, since sociality is a key motivation for this group.

2.5.1.3. Thinker Gamers

This group is similar to the casual gamers. Being 38 years old, the average player in this group is slightly younger than the casual player. The other items are pretty much identical to both groups.

In contrast to the casual gamer, the thinker gamer is looking for a challenge. He is not fascinated by fast action games. For the most part he is not seeking interaction with other players.

This group of players is not very interesting to browser game developers. They do not play with or against other players, thus contradicting the requirements of browser games as massively multiplayer games.
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2.5.1.4. Fantasy Gamers

Together with power gamers this is the smallest group. Only 6% of all players are fantasy gamers. About 41% are between 14 and 29 years, 45% between 30 and 50 years old. 41% of the fantasy gamers have only a low income, about 45% have an average income, high incomes are underrepresented. Only 78% live in a multi-person household, most of them in a three or more-person household.

The fantasy gamer plays Role Play Games. He enjoys taking on a different role in these games, which let him do things that are unattainable in real life because of socio-cultural constraints.

As already mentioned in section 2.4.8 there already are some browser games in the role play game genre. Although this group of players is relatively small, it is a very interesting group for the browser games industry, as it has a very high attitude towards player-to-player communication, thus making it a perfect candidate for browser games.

2.5.1.5. Power Gamers

5% of all players are power gamers. 80% of the players in this group are male, the same number of players is less than 30 years old. 97% live in a multi-person household, which is a result of age structure. Many players still live with their parents. About half of them has an average income.

The power gamer prefers action games, especially First-Person Shooters. He rarely plays alone, but prefers to play together with friends. Of all groups, the power gamer spends the most time playing video games.

Action games like First-Person Shooters or Real Time Strategy games are non-applicable for browser games, rendering the group of power gamers unattractive to the browser games industry.
2.5.2. Results from Online Game Studies

So far, the common video gamer has been defined. Now attention will be drawn to online players. In this field, the Fantasy Player, or in general the Role Play Games player is the most observed. In chapter 4, we will have the chance to compare the studies presented here with the group of browser game players.

In 1998, Schiano and White evaluated the online-community LambdaMoo\(^69\), a so called social MUD\(^70\). Only about 18% of all participants are of the age of 28 or older. Almost 80% of the respondents are male. About 17% of the LambdaMOO-users declared to have spent more than 1,000 hours in total in the game, while the study gives no details about the period. An interesting result gives the question for the primary source of guidance for learning the use of the system. While females focus on a personal guidance, either online or in real life, males were more likely to consult written documentation. Expert users tend to prefer help from an online person followed by written documentation, while this order was reversed for novice users. Almost 60% of the time in LambdaMOO is spent for social interaction, while the rest of the time is reserved for game-related activities [SW98].

In his study of 2005, Cypra discovered that the average age of players and the proportion of women in MMORPGs varies from game to game [Cyp05]. While only 2.3% of the respondents playing World of Warcraft were female, more than 23% of the players of Ragnarok Online\(^71\) were female. One reason for this discrepancy might be the style of graphics of Ragnarok Online, which is very colorful and cute, in contrast to World of Warcraft. A definitive statement can not be given because of the lack of specific statistical data. The overall proportion of women in his study was 7.1%, the average age of all players 22.5 years. Cypra notes that some “World of Warcraft-hype” could have led to a distortion of the results. Adjusted statistical data shows an average age of 23.5 years and a proportion of women of 10.3%.

Cypra's study shows that many of the players of MMORPGs have grown up with video games. He also states that many players are in or have only just experienced a state of

\(^{69}\text{http://lambdamoo.info/ (2008-05-01)}\)
\(^{70}\text{Multi User Dungeon, often referred to as the predecessor of massively multiplayer online role play games}\)
\(^{71}\text{http://www.euro-ro.net/ (2008-05-01)}\)
change. More than 86% of the respondents state to having an average or high income. These results refer to the type of Habitual Gamers. About 5% of the players play more than 60 hours per week, which corresponds to the type of Power Gamers instead. Every fourth player of these “hardcore gamers” is unemployed.

<table>
<thead>
<tr>
<th>Study</th>
<th>average age</th>
<th>female</th>
<th>respondents total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cypra</td>
<td>21 years</td>
<td>2.3%</td>
<td>4654</td>
</tr>
<tr>
<td>Lüttmann</td>
<td>23.98 years</td>
<td>9.7%</td>
<td>1604</td>
</tr>
</tbody>
</table>

Table 2.1.: average age and gender of World of Warcraft-players

Lüttmann interviewed World of Warcraft-players for his study [Lö7]. The respondents are in average 24 years old, which is three years more than the subgroup of World of Warcraft players in Cypra’s study. In both studies women are significantly older than men. Another significant difference can be found in the proportion of women. While only 2% of the players in the corresponding subgroup of Cypra’s study are women, this value is at almost 10% in Lüttmann’s study. The numbers about the time spent for the game are almost identical in both studies.

The discrepancies in these studies may result from the method of promoting the study on online-boards and in games. Both have been held online.

All three studies reviewed show that the proportion of men is dramatically higher than the proportion of women, which ranges from 2% to 20%. The major part of respondents is between 20 and 30 years old. These studies also confirm that the proportion of Power Gamers is much smaller than described in media. The massively multiplayer online role play gamer combines several types of players from section 2.5.1. He is a Fantasy Gamer, but there are strong indications that he belongs also to the group of Habitual Gamers.

2.6. Usability

Usability is a part of the wide subject of Human-Computer Interaction. Human-Computer Interaction is concerned with the design, evaluation and implementation of interactive systems for human use and with the study of major phenomena surrounding them [Hew92]. Usability can be defined as the degree to which users can perform a set of
required tasks. It is the product of several design goals which sometimes are conflicting [BGW02]. These six usability goals will be examined in the first part of this section. Afterwards, six of Norman’s Design Principles that improve the user experience will be reviewed [Nor90].

2.6.1. Usability Goals

According to Norman, designers might consider themselves typical users. But after they having thought about the task for as long as you need to for proper design, they can no longer be regarded as typical users. They lose touch with the average users’ view, because they know too much [Rhe01]. Hence, the designers’ task is to focus on the average user. The usability goals effectiveness, efficiency, safety, utility, learnability and memorability serve the designer as guide on how not to lose this focus.

2.6.1.1. Effectivity

Effectivity expresses how good a system is at doing what it is supposed to do. The users always have a specific intention when using a software system. It is the designers’ task to support the users in solving their problems. Often the intention is obvious. Users working with a text processor normally intend to write some kind of text like a letter or a book. The intention to publish a web page is less common, although Microsoft Word and other text processors have a rough support for creating such. Going into further detail, the obviousness starts to fade away. If users indent a line of text, do they really want the text processor to automatically indent the following text? Do they really want to outline a text when they type “1.”? Microsoft Word assumes this as the users’ intention and automatically alters the style of the text.

Analyzing the users’ intention is not always easy. It is the designers’ task to find the best way to support the users’ actions. The solution to these tasks depends on the specific
2. Games and Usability

2.6.1.2. Efficiency

Efficiency describes the speed of information access, the speed of what the user wants to do and how easy it is to learn the interface. In general, procedures that are faster tend to be more efficient. Back to the text processor again, imagine a user wants to emphasize some text he wrote, maybe by changing the text style to bold. It is more efficient to permanently present a button which changes the text style instead of offering some menu such as “Edit -> Emphasize -> Bold”. While the button performs the task with a single click, the menu in the example requires three clicks. Since emphasizing text is a frequently used feature of text processing, the provision of a button increases efficiency of the system. But still there is a media disruption when the user has to switch from the keyboard to the mouse, taking time and hence decreasing efficiency. That is why especially expert users will prefer a keyboard shortcut to emphasize the text. Microsoft Word offers all of the named possibilities to serve novice users as well as expert users.

It is the designers’ job to analyze the tasks which can be performed by the specific software. For frequently used features, single-click options should be available. Less frequently used options should be hidden in a menu, so that the interface is not overloaded with buttons. A good User Interface also offers keyboard shortcuts for expert users. Sometimes it is also required to present less frequently used options in a quickly accessible place. Simply imagine a nuclear power plant where the button for emergency shutdown is hidden in some rarely used submenu.

2.6.1.3. Safety

A good User Interface protects the user from dangerous conditions and undesirable situations. A software application’s first obligation, is to correctly perform the functions the user needs. If the software does not work as expected, it is not usable. If the users of a text processor want to save their work, they expect the application to store a file that is accessible again later somewhere on the disc. If the software crashes while saving or only writes junk to the disc, the text processor is not usable. Software also needs to be
error tolerant. This is defined by how well errors are prevented and by how well errors are detected and handled if they occur.

The text processor example has already been used, this time a calculator will be used as example. The user accidentally tries to divide some number by zero, which is not defined in math. A software program would crash if a line of code tries to calculate the result of dividing a number by zero. This time it is the programmers’ task to prevent the system from such crashes. This can easily be achieved by checking the divisor before performing the operation. If the divisor is zero, the program refuses to calculate the operation. The user then should be informed about his mistake. It is not possible to filter all possible errors during designing. Hence there should be a system which prevents crashes during runtime. Most modern programming systems offer such options.

Let’s return to the text processor users. If they want to save a file and enter a file name that already exists on the disc, the system should prevent users from the undesirable situation of accidentally overwriting their tax return by giving them some feedback that a file with the same name already exists.

2.6.1.4. Utility

Utility simply means that the software provides the right kind of functionality. A text processor that does not support formatting the text is as useless as a spreadsheet application which cannot calculate the data the user enters. Obviously, utility alone is no indicator for usability. Although the text processor supports text formatting, it still may be badly designed, if the common features are hidden in confusing menus.

2.6.1.5. Learnability

The ten-minute-rule assesses whether a system can be mastered quickly. Rubinstein and Hersh describe the quintessence in their book “The Human Factor” in 1984: “A computer system for architects is not expected to teach architecture. Quite the reverse: The ten-minute-rule requires that what an architect already knows be helpful in learning to use the system” [RH84]. It is obvious that for complex software systems, the ten-minute-rule is inappropriate. To learn the computer systems of a new plane requires
hundreds of hours of training. Although the common features of a text processor should be learned quickly, users cannot expect to become experts within a short period of time. In general, the ten-minute-rule is inappropriate for expert users. They spend a much longer period of time to learn the system in order to become more efficient. In our example, the expert user will learn the keyboard shortcuts for the common features, which will increase his efficiency, although it takes more time to learn the system than it would take with the buttons.

The designers’ job is to develop a User Interface which suits the target user. Expert users have different requirements than novice users. If the target audience is not specified, both types of users should be supported.

2.6.1.6. Memorability

In contrast to Learnability, this describes how easily the system can be memorized. If a user returns for a later session, he doesn’t want to start all over again. For the last time the text processor example will be mentioned. If a feature like emphasizing text is hidden in a complex menu structure, it is questionable whether users will remember the place when they need the feature again. Hence, a complex User Interface is neither easy to learn nor memorable.

The designers’ task is obvious. Steve Krug puts it in a nutshell: “Don’t make me think!” [Kru06].

2.6.2. Design Principles

How can these goals be achieved? Donald Norman names several design principles which the designers need to take care of. These include visibility, feedback, constraints, mapping, consistency and affordance.
2.6.2.1. Visibility

Visibility refers to a clear communication with the user. Controls and their function should always be visible to the user. The more visible functions are, the more likely users will be able to know what to do next. If a user has the intention to emphasize a text, he will look for some button which offers that feature. The button hence should be self-explaining. Imagine there were several buttons, all looking alike. To gain more information about their actual function, you would have to touch the button with the mouse pointer, wait a second until the help pops up just to read that the button does not do what you are actually looking for. In Microsoft Word for example, the buttons to emphasize text are visible and their function is clear. Even if you might not speak Russian, it is clear which of the buttons in figure 2.9 does emphasize the text in italic letters.

Visibility enables the user to create a mental model of the system. A mental model is a representation in the mind of a real or imaginary situation. Mental models are constructed from perception, imagination or the comprehension of discourse. They help the user to predict the effect of an action.

When designing an interface, the designer should keep in mind that important elements are directly accessible. The user should be able to determine the effect of an action prior to execute it. This principle strongly coincides with the usability goal of efficiency.

74 upper left: German; upper right: Italian; lower left: English; lower right: Russian
2.6.2.2. Feedback

Sending back information on which action has been performed and what has been accomplished is the task of this design principle. Feedback often is implicit. If you emphasize a text in a text processor, you will receive the feedback implicitly as soon as the text changes its style. If an action has no visible result, like saving a file to disc, it is up to the designers to avoid user confusion by adding a message box that informs the user whether saving was successful or not. Feedback should be as detailed as possible. It is not just important to inform user that an error has occurred, they might actually want to know which error has occurred.

The form of feedback depends on the situation. Users of an office software will be satisfied if they are presented with a standard dialog box once an error occurs. The user of a nuclear power plant control center software should be informed more vividly if a core meltdown occurs. Feedback can be given in several forms like audio, tactile, verbal, visual and in combinations of these. The designers need to point out the adequate form of feedback for the given situation.

2.6.2.3. Constraints

In the context of usability, constraints describe that the designer should not reinvent the wheel. Constraints have different attributes; they can be physical, logical or cultural. Physical constraints refer to the restriction of movement of things. In general, a computer display cannot be rotated\footnote{Some flat screen displays support this feature, like some monitors of the EIZO FlexScan-series \url{http://www.eizo.com/products/comparison/index.asp} (2008-05-01)}. Hence the interface design should consider that only a minority of people will take advantage of a 90° rotated view of a text processor. The majority of users instead will be confused by such a design, although it would underline the presentation of a virtual writing paper.

Logical constraints refer to human cognitive abilities and limitations. The designers should rely on people’s common sense reasoning about actions and consequences. To show that a certain feature is not available at the moment, the designers could disable and shadow a button. A button which is visibly disabled supports the conclusion that
the specific feature is not available at the moment. This is another form of feedback. The interface sends the information that a given function is not available, in advance.

Section 2.3.6 already showed an example for cultural constraints, two kinds of footballs. This is one aspect of cultural constraints designers needs to be aware of. But they are also encouraged to exploit these learned conventions. The color red is a good example. It is universally associated with warning or danger. Hence actions that could lead to the loss of data for example should be marked or tinted red.

The designers need to keep in mind several kinds of constraints which apply to User Interface design, but they are also encouraged to exploit such constraints in order to make the interface more intuitive.

2.6.2.4. Mapping

Mapping between controls and their effects should be adequate. If a user clicks an up-arrow next to some numeric field, he expects that the value in this field will increase. The same applies to a plus-character.

![Natural vs. unnatural sequence of VCR controls](image)

The mapping of relative positions of controls is important as well. Figure 2.10 shows an example. The upper row shows the natural order of some VCR controls, while the lower row obviously shows an unnatural order. A user expects the rewind-button to be on the left side. A sequence like the lower one hence might confuse the user.

2.6.2.5. Consistency

This principle describes the consistent use of elements for similar tasks. In general, you click the left mouse button once to select an item, and you double click it to open
that item. The right mouse button in general opens a context sensitive pop-up menu. These operations are associated with those tasks and are generally accepted. Designers should not change that behavior in their interface. Similar elements should be used for similar tasks, and related operations should be placed in a common menu. Recall our emphasizing example in section 2.6.2. The most commonly used emphasizing options are grouped together. They also work alike. You can either highlight a portion of text, and then click the button to emphasize the text, or you can click the button without highlighting the text before. That will result in emphasizing the entire text you are going to type until the button is clicked again. Hence, these buttons are implemented in a consistent way. Problems may arise with very complex systems with thousands of different operations. If two elements of an interface conflict or are ambiguous, the behavior should be the one that will surprise the user least. The least surprising behavior will usually be the correct one.

2.6.2.6. Affordance

Affordance describes the attribute of an object that allows people to determine how to use it. A keyboard for example invites the user to type on it. No one would try to push the keyboard around on the desk in order to type. A keyboard’s design is self-explanatory. So should be the User Interface. If an interface offers scroll bars, it is obvious that they should allow users to move the screen’s contents. Icons and buttons should be designed to enable clicking. If they are not associated with an action, this should be made clearly visible, for instance by shadowing the corresponding button as described in section 2.6.2.3.

2.6.3. User Centered Design Approach

All of the previously mentioned principles can be summarized to a user centered design approach. The designers have got to provide a User Interface that works according to the users’ expectations. The users do not want to relearn their computer every time they install a new program. Hence the designers need to focus on the prospective users from the start and obtain actual data on their needs. The design of a system should be based on empirical data, not on imagination. Therefore it is crucial to identify the
relevant stakeholders. Stakeholders are those people who will be affected by a system and who have direct or indirect influence on the system requirements. The designers need to keep in mind that interaction is a human activity. Hence their design has to be consistent with physical and cognitive abilities and the social environment. They also have to bear in mind that some users may have special demands because of physical or mental handicaps. The Accessibility describes the degree to which a product is accessible by as many people as possible; it is not to be confused with Usability which is used to describe the extent to which a product can be used by specified users. But accessibility should always be part of the considerations for the design.

2.6.3.1. Requirement Analysis and Specification

A Requirement Analysis is crucial for a good interface design. It is already known that the relevant stakeholders or, the target audience, have to be identified. Expert users make other demands of a software product than novice users. Recall from section 2.5.2 that expert users tend to prefer help from an online user, followed by written documentation, while this order was reversed for novice users. This is one example of how the target audience influences the requirements. Another important influence on the requirements is the target platform. Not only because of the tiny screen a mobile phone has, the design of software for such a device is completely different than that of a common personal computer. Another category which requires an analysis prior to design are the features of the software product. It has to be determined which features are required and how frequent they will be used. Usability benchmarks will offer more hints on how features should be designed. Such benchmarks describe for example which tasks have to be completed in which time.

All of these specifications are established by a combination of analysis and gathering information from target users, by interviews, observation or surveys. They should also be validated by empirical studies.
2.7. Usability in the Context of the Internet

In this section the usability goals and design principles from section 2.6 to the specific requirements of the World Wide Web will be applied. The World Wide Web basically is a medium to present static documents to the user spiced up with the possibility to link to and navigate through documents. HTML is the standard markup language to create and display web documents. Since the first version of HTML was published in 1992\textsuperscript{76} HTML has made a huge development. The first version of HTML was capable of displaying plain text only. Emphasizing text or embedding images was not possible. In November 1995, such features, as well as a basic technology of interactive forms, were implemented with the first official standard, called HTML2.0\textsuperscript{77}. Today the current standard is HTML4.01, published on December 24th in 1999\textsuperscript{78} This standard has been enhanced by supporting tables, text flow around figures, cascading style sheets, client-side scripts, frames and embedded objects like Java applets. HTML5 is currently under development.

XHTML is the proposed successor of HTML. However, the W3C\textsuperscript{79} continues to recommend the use of HTML 4.01 for web publishing. Although technologies like Java Script or Adobe Flash support the creation of desktop-like interfaces, this section focuses on the basic technologies of the World Wide Web.

2.7.1. Challenges

In his article The World Wide Web, Jonathan Lazar [Laz03] points out the challenges of designing for the web environment. Distributed networks, limitations of the available languages and used protocols or incompatibilities of the available web browsers have a major influence on the Usability design for the Internet. Some of the major constraints designers today have to struggle with will be examined in this section.

\footnotesize{\textsuperscript{76}http://www.w3.org/History/19921103-hypertext/hypertext/WWW/MarkUp/MarkUp.html (2008-05-01)  
\textsuperscript{78}http://www.w3.org/TR/html401 (2008-05-01)  
\textsuperscript{79}http://www.w3.org/ (2008-05-01)  
}
2. Games and Usability

2.7.1.1. Limitations of the Network

The Internet is a computer network of millions of computers which are connected by a packet-switched network infrastructure. Some of the computers serve as dedicated servers, while others are used as client only. To transmit data over the Internet from one computer to another, the Internet Protocol (IP) is used. Via packet switching, a data packet is sent into the network without reserving any bandwidth. Some of the network components on the route from host to host may be busy because other data packets are transmitted over those components at the same time. As a result of this structure, it cannot be guaranteed that data sent from a computer reaches the target host in a given time. The higher the network load, the longer the response times. Hence response times vary from request to request.

![Figure 2.11.: Fluctuations of Server Load in 24 hours](http://www.wurzelimperium.de/)

Another major influence on the response times of course is the server load. In general, the network load and the server load depend on the time of day. Figure 2.11 shows the server load of a game server.\(^80\) The server load mirrors the daily routine of the players. There are two major peaks, in the morning around 6 am and in the evening at around 10.30 pm. Lower peaks are around morning break, around closing time and after 8 pm. According to Nielsen [Nie06], response times impact the user experience. If the delay to a request exceeds 1.0 seconds, the user will already notice the delay. If it exceeds 10 seconds, the user's attention will start to vanish. Servers should be dimensioned to handle peak demands to increase response time during times of high server load. Other factors that influence the response times are outside the scope of the web developer. These include the distance between server and client or the clients' connection speed.

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Since the clients’ connection speed cannot be determined, a web document should be as small as possible, so that users having a slow Internet connection can be satisfied as well.

### 2.7.1.2. Limitations of Web Browsers

In section 2.3.3 I have already stated that there is a huge variety of available web browser programs. I have also mentioned, that if a web developer follows the standards, the result would almost be the same in each browser. The problem is however, that browsers often do not completely support these standards. Sometimes features are missing or misinterpreted, and sometimes proprietary features are implemented that are not available elsewhere. Another problem is caused by different browser versions. Users tend to forget to upgrade their software to the newest version, forcing web developers to take care of widespread quirks when developing a web page. This gets even worse when the developer has to deal with cascading style sheets or Java Script. “The result can truly be called chaos. The same web page may appear differently in each of five different browsers.” [Laz03]

Another aspect that has to be considered, are mobile devices. Almost every mobile phone sold today comes with some kind of web browser. The limitations are obvious. The screen is very small, which requires users to frequently scroll and navigate in a web page displayed on such a screen. They often use only a traditional phone keypad which is insufficient to input form data. The bandwidth for mobile Internet access is limited too. Large pages need virtually ages to be downloaded. The economical aspect should not be forgotten. Using data services with a mobile phone often is a costly experience for the user. Hence users will tend to browse optimized pages delivering the information they seek. Optimization is to compact web pages by diminishing the use of graphics and unnecessary information.

### 2.7.2. Requirement Analysis

Before going into greater detail on how Usability can be applied to web pages, a requirement analysis (see section 2.6.3.1) should be performed. Steve Krug vividly highlights
in his book *Don't make me think!* some aspects a designer should be aware of [Kru06]. After identifying the stakeholders of a web site, these aspects will be discussed briefly.

### 2.7.2.1. Stakeholders

The target audience of web sites depends on the published content. A web site targeting kids may be more colorful than a site targeting a professional group of physicians. A site presenting products to end users has different requirements than a site targeting distributors. The stakeholders of a web site have to be reviewed for each individual case. Hence a general recommendation can not be given.

### 2.7.2.2. Scanning

People tend to scan text instead of reading it from first to last letter. In general, users reading a text have a given intention. They are searching for some kind of information. By scanning a text they can quickly decide whether the text contains the information they are looking for or not. They are looking for keywords in the text that match their targets.

Nielsen discovered that the average user does not spend more than 30 seconds reading a homepage [Nie06]. Since an adult is capable of reading 200 to 300 words per minute, this has an enormous impact on how information on the first page of a web site is presented. Nielsen concludes that the essence of the web page should be communicated in less than twenty words, since the users focuses on the navigational options of the homepage rather than on the text.

Designers can support the reader by outlining the text and emphasizing important keywords. What a user sees when he looks at a Web page depends on what he is looking for. In general he sees only fragments of what is actually presented.
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2.7.2.3. Satisficing

Like scanning a text instead of reading it, people do not want to handle unnecessary information which takes time as well as mental effort. Gathering all available information to evaluate the best option is too expensive. Hence people often choose the first reasonable option that comes to mind when making a decision. This behavior is even fortified by the fact that there usually is no penalty for a wrong guess. To use the back button of a web browser does not require as much effort as to create a plan to choose the correct option at the first time.

2.7.2.4. Muddling Through

People don’t read manuals. Hence, web pages should be designed in a manner that the user does not need instructions to use the site. They should be designed as self-explanatory as possible.

The designer can support the user by exploiting existing design conventions. They are generally accepted and understood by the majority of users. As an example many authors advise that links which have already been visited by the user should change their color. If they do, the user can see quickly whether he already visited the linked page or not, improving Usability by supporting scanning as well as satisficing.

2.7.3. Usability of Web Sites

In the preceding section some of the requirements a designer has to deal with when creating a User Interface for web sites have been reviewed. In this section some of the more common design rules to enhance the Usability of a web site will be introduced. Most of them have become conventions by now. Breaking these conventions could cause confusion, thereby decreasing the user experience. This is only a short overview, since Web Usability is a wide subject which cannot be covered in total in this thesis.
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2.7.3.1. Visited Links

Since the first graphical browser was released, it has become a convention to change the color of an already visited link. If not manually edited by the designer, every browser today follows that convention. In general, links are shown in blue, and visited links in purple. To visibly indicate a clickable link, it is underlined and changes its color to red if touched with the mouse pointer. Sometimes the mouse pointer additionally changes its shape to indicate a clickable object. Cascading Style Sheets offer the opportunity to change this behavior.

Indicating visited links supports the user in either orientation as well as navigation. The user can decide at a glance whether the link may be interesting for him or not. As known from section 2.7.2.3, users tend to click the first available and reasonable option. If there is no indication of visited links, users might visit pages they have already seen, which might be frustrating them. Hence indicating visited links strongly supports the process of decision making as well as the users’ experience of the site.

2.7.3.2. Back Button

Undoing the last action is a common feature in every application. A web browser stores the history of visited links and offers the user the possibility to go back easily if he is unsatisfied with the web page he just opened. It is proven that the Back button is the most used feature of a web browser [Kru06]. The back button exploits the fact that recognizing is easier than recalling. Hence to go back one page it is easier to click the back button instead of finding the correct back link on the web page which involves the need to remember where the user came from.

The back button could be disabled by the designer using Java Script, although it is not recommended. If a web site is entirely written in Flash for example the Back button does not work either. A Flash file is embedded into a HTML document. The Back button of a browser is limited to HTML documents. Hence, if the status of an embedded object changes, it is impossible for the browser to notice that. The Back button will still point to the last visited HTML document. The designer of such a Flash page has to take care of that situation and needs to implement an individual history support.
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“Breaking the Back button is no less than a usability catastrophe.” [Nie00]

2.7.3.3. Opening New Browser Windows

There are two kinds of new windows that could be opened by a web page. Both should be generally avoided. The first type is new browser windows, which open by clicking some link in a web page. The designers’ intention often is to keep the user on his page while the user is visiting another domain. Users instead often are vexed by this. If they don’t note that a new window has been opened, they wonder why the back button does not work anymore. In general, it is not recommended to open a new browser window if linking to another document. As already stated in the previous section, the back button is by far the most used feature of a browser. Hence if a user wants to come back to the initial page, he is likely to use the Back button. Exceptions to that convention are non-HTML documents. If a link directs to a PDF document for example, it should be opened in a new browser window. The reason for this is that many people will hit the close button instead of the back button when reading such documents. They are used to such a behavior with non-HTML documents, since in general they are opened in a specific application instead of a browser. In such applications they have to click the Close button to leave the document. Nielsen suggests to always offer non-HTML files for downloading instead of opening them in a browser window [Nie06].

Different kinds of new windows are pop-up windows. These do not even require any user action to open. These kinds of windows have often been used to present advertisement. Today most web users close such windows even before the content is completely loaded. In 2004 a study showed that 95% (sic!) of the web users have a negative image of pop-up windows [Nie04]. Browser developers have recognized that trend and today most browsers come with a pop-up blocker aboard. Hence designers are well advised to generally avoid pop-up windows.

2.7.3.4. Advertisement-like Design Elements

Today, advertisements are everywhere. Many people try to ignore them. Like zapping away TV commercials and coming back to the show just in time, people are well-trained
in ignoring advertising banners on web pages [PS01]. Within fractions of a second, users decide whether they pay attention to an element or not. Obviously, if page elements look like an advertisement, maybe because they are too colorful, animated etc., users are blind for them too. Hence, instead of attracting interest to a specific element, the result is the opposite.

2.7.3.5. Text Layout

As already stated above, people tend to scan a text instead of reading it. Hence one of the major tasks for designers is the text layout. To support the reader, emphasizing keywords and outlining text is highly recommended. In section 2.7.2.2, it has also been stated that most readers will spend only some seconds on a single web page. The conclusion was that texts need to be as short as possible.

2.7.3.6. Consistency

In contrast to the above conventions this one refers to a full web site instead of only single web pages. Each single page on a web site should have the same design elements. If navigational elements are placed in different spots on each page, it is obvious that users are irritated if they have to search and scan the navigational elements again after each click. This quickly leads to frustration and hence decreases usability and the disposition to stay on a site. This of course applies to all design elements, not only to navigation.

2.7.4. Accessibility

Accessibility describes the degree to which a product is accessible by as many people as possible. A page which is not accessible also is not usable, hence accessibility should always be part of the considerations for the design. In this section some accessibility principles will be explained. For technical background information on how accessibility can be achieved, the reader is encouraged to read a reference book like Web Accessibility: Web Standards and Regulatory Compliance by Jim Thatcher and others [Tha06, or
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Accessible XHTML and CSS Web Sites: Problem - Design - Solution: Problem, Design, Solution by Jon Duckett [Duc05].

The Web Content Accessibility Guidelines 2.0\textsuperscript{81} by W3C name four accessibility principles in their latest recommended version. These principles will be reviewed in this section. Each of the principles contains several rules which define the principle in more detail. The rules are subdivided by importance.

2.7.4.1. Perceivable

This principle means that information and User Interface components must be presentable to users in ways they can perceive. Four rules describe that principle in more detail. At first the designer should provide alternatives for any non-text content. This includes images as well as animations or audio recordings. Such texts can easily be changed into other formats like braille or speech that support users with visual impairments. The second rule describes that time-based media such as audio or video should be supported by a textual description. By strictly following that rule this even applies to live media. The third rule specifies that content should be created such that it can be presented in different ways without losing information and structure. Separation of foreground and background is the requirement specified by the last rule. Another objective of this rule is, that the use of color is not the only way to indicate elements or information. Minimal contrast ratios are defined by that rule as well as the requirement to be able to change the text size.

All the rules of that accessibility principle refer to increase the readability of the web page content for visually impaired users and to support technical equipment which is used by that group of users.

2.7.4.2. Operable

This principle also consists of four rules. It describes that User Interface components and navigation must be operable. At a glance, this looks obvious. By reviewing the rules

\textsuperscript{81}http://www.w3.org/TR/WCAG20/ (2008-05-01)
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it becomes apparent why this guideline has been included by the W3C. The first rule
specifies that all elements of a web page should also be accessible by keyboard, not only
by mouse. This improves the accessibility for people with physical impairments. The
second rule addresses time limits such as auto-updating information in a news ticker.
Some people with visual or mental impairments might not be fast enough in reading such
texts. Hence the time should be adjustable or, if possible, such time limited features
should be avoided. Although avoiding any flashing objects that could cause seizures
should be self-evident, which is stated in rule three. The last rule in this principle
refers to supporting navigation. Self-describing links should be used as well as some
kind of indicator showing the current position on the web site. Web pages should have
a descriptive title, with headings and labels used to outline the structure of the text.
Blocks which are repeated on every page, like navigation blocks, should be able to be
bypasses in some way to support users of tools like screen readers.

2.7.4.3. Understandable

The information and the operation of the User Interface must be understandable, which
is specified by three rules. To support screen readers, the first rule defines that the
language of a web page must be automatically determinable. Idioms or unusual words
as well as abbreviations have to be defined. The language used on web pages should
be as simple as possible. If the context does not allow simple language, supplemental
content that does not require reading ability more advanced than the lower secondary
education level should be available. The second rule addresses consistency. Navigational
elements should be in the same place on each web page. The context should only change
by user request, not by any automatic cause. The last rule addresses input assistance.
When user input is required, all input fields have to be labeled, so that is clear what the
input form expects of the user. If an error is detected during user input, the error has
to be described in text. If suggestions for error corrections are known, these should be
provided to the user. At last a context-sensitive help should always be available.
2.7.4.4. Robust

The last principle focuses one of the major challenges of usability. The only rule of this principle says that compatibility with current and future user agents, including assistive technologies, has to be maximized. This can be reached by strictly adhering to the web standards as already noted in the introduction to section 2.7.

2.8. Usability in the Context of Browser Games

In this chapter I have attempted to give a definition of browser games, and to delineate in which way they differ from common video games. I have stated the most common motivations to play games, and which genres are adequate to realize browser games. Furthermore, I have reviewed target audiences, as well as Usability goals and principles. Within the previous section, finally, I have reviewed the specific problems a Usability engineer has to deal with in the context of the Internet.

In this last section of chapter 2, the previous sections will be reviewed from the point of view of a browser game designer. I will attempt to show, which details the designer has to take care of and which of the previously stated requirements are obsolete in this context.

2.8.1. Stakeholders

Much has been written about the target audience of games in the previous sections. It has been pointed out that the primary player types of interest for browser game development are Casual Gamers, Habitual Gamers and Fantasy Gamers. More than one third of the players in these groups are female. The majority of people is older than 30 years.

The players in these groups prefer games of genres like Sporting Simulations, Sports Manager Simulations, Economic Simulations, Role Play Games and games of strategy\textsuperscript{82}.

\textsuperscript{82}Genres which are not suitable for browser game development have been omitted here
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Games always target novice users as well as expert users, which must be kept in mind when designing the User Interface as well as the help system of the game. Recall from section 2.5.2, that expert users tend to prefer getting help from an online person, while novice users will prefer written documentation.

2.8.2. Requirement Analysis

In general, browser games are accessed from a common personal computer, other kinds of devices like PDAs or mobile phones are used much less frequently to access browser games. While this is the result of the costs to use data services for mobile devices, only a very small number of games actually supports them. The support of mobile devices generally requires the design of a second User Interface, which simply is too expensive in comparison to the possible benefits for the browser game company.

The question what features should be included in the game, which strongly depends on the kind of game, is the most complex task in requirement analysis. Since there is no principal in the general sense, analyzing the requirements of the potential player is relatively difficult. Hence, often features that have already proven to be successful are recombined and implemented in games. In section 2.1.4 some of the primary criteria for preferring games over other games have been defined. Particular attention should be given to these during the process of requirement analysis.

2.8.2.1. Multiplayer Support

All browser games have in common that they require a well defined multiplayer component. There are several ways in which player-to-player communication can be supported. The most common are bulletin boards and chat rooms. Such features should be available to all players. Additionally, if a feature like a clan or a guild is offered, bulletin boards and chats should also be available to support the internal communication of the guild. Depending on the game, multiplayer components might be competitive, collaborative, or both. Competitive features include high score lists and league systems as well as regular competitions. Collaborative features include the already mentioned clans as well as some sort of trading. Generally, both kinds of multiplayer components are included
in a game.

2.8.2.2. Sensory Gratification

Sensory Gratification in games relates to the use of graphics, audio, and multimedia components in general. In section 2.3.3 I have explained that the use of multimedia requires a large bandwidth. Browsers offer only a limited support for multimedia components, which also often require special plug-ins to work. The speed of users’ Internet connections varies and cannot be determined. Apparently there is a contradiction between the demand for sensory gratification and technological limitations. Audio or even video components cannot be used without neglecting the group of users who don’t have high-speed Internet access. Hence sensory gratification in browser games is often limited to still images. Sometimes it is enhanced by using basic animations, like animated GIF images, which are small in size.

2.8.2.3. Gameplay

Gameplay brings the fun into the game. It is almost impossible to be put in context with usability without quoting every single usability goal and principle. To state it simply: A game is only fun, if it has a high usability. In the following I will review some of the usability goals and principles in short and give an example how each one affects gameplay.

2.8.2.3.1. Goal of Efficiency  Efficiency describes the speed of information access. In the context of games, it describes how quickly game actions can be performed. Users tend to always be in a hurry, so a good efficiency is crucial for an interface. Increasing efficiency of a game is a good source for making financial benefits. In most browser games, so-called premium features offer the chance to play the game more efficiently. To use this features, the user has to pay a fee.

*Kapilands*[^83] is an economic simulation. Among other things, the player builds factories and produces different goods. He may have up to 60 buildings for free. Handling 60

production plants, however, is quite cumbersome and time-consuming. As a premium feature, Kapilands offers administrative buildings which enable the player to manage these production plants with a single click, thus increasing efficiency dramatically. For many players, administrative buildings are a deciding reason to pay for premium features.

This example shows that features increasing efficiency might be restricted to paying users in the final version. For many players, features that increase efficiency are the sole reason to pay for the game. Of course the game must be playable even if a user does not pay for such features.

2.8.2.3.2. Goal of Learnability  As stated in section 2.3.4 the participation in browser games often is an unplanned and vague ad hoc decision which leads to a lower motivation to deal with complex games. Therefore, a browser game has to be as simple as possible. On the other hand, games often are highly complex simulations. To support this goal, a game could start with only a few of the possible features. Once the player has more practice in handling the basic features, more and more features could be unlocked.

In *Kapi Regnum*\(^{84}\) the player starts with a very basic set of features which are required to play the game. Once he is more experienced, indicated by the virtual money he earns, more and more features are unlocked. This might even be improved by hiding even more features from the beginning. A player who just starts the game might be overwhelmed by features like research or upgrading buildings. These features could easily be hidden during the first level, without decreasing the fun of playing the game. It might even be increasing it, by reducing the complexity for beginners.

To support learnability, it is also important to offer a game manual. Whenever possible, the player should have the opportunity to jump to the corresponding section in the manual, in case he needs more information about some ingame feature. For example, if a game offers some kind of military units, details about the characteristics of these units in the manual should be directly accessible from the game rather than being hidden in an external manual.

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Figure 2.12.: Travian User Manual

Figure 2.12\textsuperscript{85} shows such a quick manual access in Travian\textsuperscript{86}. Clicking the praetorian in the barracks pops up a window which shows the unit information from the game manual.

2.8.2.3.3. Principle of Feedback Feedback should be given for every action that has been performed to inform the user what will happen next or what has just happened. Some actions in a game world are triggered by the player himself. In Kapilands, the player manages production plants. As soon as he orders a factory to produce some goods, he will receive feedback, informing him on what will be produced, how the final quality of that good has been calculated, what it will cost to produce the goods and how long it will take. This kind of feedback happens immediately after the action has been initiated. Other actions will not be performed immediately after the user has triggered them. A good which is sold on the market might be bought while the user is offline. This kind of action requires a different form of feedback, maybe some kind of message system, listing all actions that have taken place without being directly initiated by the user. Both kinds of feedback are implemented in Kapilands.

\textsuperscript{85}Screenshot has been edited to fit paper format, red line indicates the link clicked
\textsuperscript{86}Developed by Travian Games, http://www.travian.com/ (2008-05-01)
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2.8.2.3.4. Principle of Constraints  Respecting the logical constraints is very important for gameplay. Logical constraints refer to human cognitive abilities and limitations. As stated in section 2.6.2.3 the game designer should rely on common sense reasoning. Therefore, features which are not available at the moment should be clearly stated as inactive. For example, if a building is not accessible, maybe because it is being upgraded at the moment, it should be faded out in some way.

The player should however not be overburdened by too complex puzzles and strategies. If the player is unable to comprehend how the game works, it is very likely that he will leave the game soon. Games should be challenging, not overburdening. Balancing the game is one of the primary tasks a game designer has to deal with.

![Figure 2.13.: Control Icons in Molehill Empire](image)

2.8.2.3.5. Principle of Mapping  Some examples how to map controls and their effects adequately have already been given in section 2.6.2.4. Users will always try to map the real world to the game world. For example, this fact could be exploited to offer self-explaining icons. Mapping always refers to the principle of constraints, since a good mapping means exploiting logical constraints.

*Molehill Empire*\(^7\) exploits that constraints very well. Figure 2.13 shows the main control icons of the game. The flower pot represents planting, the sickle is used to represent harvesting. The watering can implies that the icon refers to watering, while the mailbox represents the message system. The briefcase represents the contract system, while the garden gnome accesses the player’s profile. The question mark of course opens the help system. Even without textual description, it is obvious what every single icon refers to.

2.8.2.3.6. Principle of Affordance  Especially when using individual icons, such as shown in the previous paragraph, they must be designed in a way that they invite the

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user to click them. In Molehill Empire, this is supported by animating the icons when touched with the mouse pointer. Additionally, the pointer changes its shape.

2.8.2.4. Layout

In this section, some of the usability examples given in section 2.7.3 will be reviewed and evaluated in consideration of browser games.

2.8.2.4.1. Text Layout Games generally have very little text, making text layout a minor priority. But of course keywords should be emphasized even in short messages. Unlike ingame texts, game manuals often are more extensive. A game manual must be laid out to enable the reader to quickly scan the text and find the desired information.

2.8.2.4.2. Visited Links As with the Back button, the handling of visited links also requires to be viewed differently in the context of browser games. Changing the color of a visited link improves usability by supporting the users' decision whether a link might be interesting or not. Since in browser games a player visits the same pages again and again, after a few hours every available link would be marked as visited. Hence, coloring visited links is not relevant for browser games.

2.8.2.4.3. Back Button As stated in section 2.7.3.2, disabling the functionality of the back button has negative effects on the usability of a web page. In the context of browser games this needs to be viewed differently. Almost every click in a browser game involves sending parameters to the server, initiating some kind of action. If a user clicks the back button the parameters will be sent a second time, carrying out the corresponding action a second time as well. This could lead to problems and frustration. For example, in Kapilands, players sometimes hit the back button, thus initiating the purchase of a building a second time. Instead of one building, the player suddenly has two buildings, having paid twice the amount of money originally intended. There are technical means available to prevent such behavior, such as a unique id that is stored in the players' session on the server, which could be associated with every page view. If the code is sent a second time, the action will not be carried out. That, however, could
have a negative effect on players who open more than one browser window per game session. The action ids in different browser windows might neutralize one another.

2.8.2.4.4. Technical Limitations In the previous section the problems of using the Back button have already been looked at. Even without using the back button, the user might initiate an action more than once. A possible cause are network problems. If the server takes more than one second to respond to a user request, the user will already notice the delay. Hence he might think that his request has not been send to the server which lets him click the same link again. Multiple requests for the same action cannot be prevented.

Finding a good solution how to handle the back button or multiple requests in general, is important for browser games. It has a great influence on the usability goal of safety.

2.8.3. Conclusion

In the context of games, gameplay and usability require the same attention. A great gameplay is useless without good usability, and as usable as a game might be, if the gameplay is bad, it won’t be played either. A bad UI is every good games’ death, no matter how good the rest is.[SB01.

While gameplay is what makes a game be fun, usability is what makes playing the game enjoyable. Both strongly correspond to each other. Generally, both should always be considered as a unit.
3. Game Design and Implementation

The first part of this chapter describes the raw game design of a city building simulation (working title: KC) as browser game. As is known from section 2.4.9, city building simulations in their strict sense are not suitable to be developed as browser game, making it necessary to extend the basic genre to fit the requirements of these games. This will be done by adding competitive as well as collaborative features to the game. In this chapter, I will describe only the basic game features. A full documentation of a game’s design generally encompasses much more than 100 pages. The game’s user interface will be designed in consideration of the goals and principles named in chapter 2, as well as the specific requirements of web pages and browser games.

The game will be designed to use the browser’s core technologies only. These include XHTML, CSS and JavaScript. Technologies that require the user to download and install plug-ins, will be omitted. The game will be kept compatible with Firefox, version 2.0 and higher, Opera 9.0 and higher, as well as Internet Explorer 6.0 and higher, whereas some light restrictions will apply to version 6 of Internet Explorer. Support for Safari will be added at a later stage of development. On the server side, PHP and MySQL will be used to run the game. In the second part of this chapter, I will explain some of the technologies in greater detail and give an example on how they are implemented.

3.1. Recalling City Building Simulations

The object of City Building Simulations is to build a city, attract people to live and work there, and to generate income in monetary form which then can be used to improve
the city. The player begins to build his city by zoning land into either residential, commercial or industrial areas. Once areas have been zoned, they are claimed by virtual inhabitants who then will resume building their homes or industrial buildings. Once they actually inhabit the city, they pay taxes, thus offering the players the opportunity to increase the city’s attractiveness. They might build parks, sports arenas or recreational areas in general. Of course they also need to take care of the city’s water and power supply or public transportation. As the city grows, people will demand more room for development, pleasure and lifestyle, as well as public safety or infrastructure. The virtual inhabitants’ satisfaction is influenced by a variety of different factors. Air pollution due to industry, traffic problems due to missing public transport system, or crime are potential problems the player has to take care of. In general, these games have no specific objective; the players’ task simply is to run the city and to satisfy the inhabitants’ demands.

In *Andrew Rollings and Ernest Adams on Game Design* [RA03], the authors list some common elements of the genre, which they call Construction and Management Simulations. Since some of these are of major importance for the City Building Simulation that will be designed in this chapter, these elements will be reviewed in short.

### 3.1.1. Resources

An economy is built of resources which are produced, consumed and exchanged. These resources might be either tangible or intangible. A tangible resource is an item that must be transported or stored in some way. Generally, tangible resources are goods like food, raw materials, building materials and of course the final goods, which are result of some manufacturing process. In contrast, intangible resources do not need a storage space. The most obvious example is the resource of money. In some games, resources are both tangible and intangible. Goods need to be transported from a mine to the storehouse for example. Once they are transported to the storehouse, they are immediately available for further processing, thereby changing their status from tangible to intangible resources.
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3.1.2. Sources

Every resource needs a source, a way in which it enters the game. Money is often generated by taxes or by selling goods, while raw materials need sources like a mine or a well to be produced. Final goods instead will be produced in some production plant. Each source has a production rate, that is, how many resources of a given kind can be produced per time unit and size of source. Complex and expensive goods should have a lower production rate than raw materials. The production rate can be fixed or variable, for example, virtual weather conditions could influence the yield of a corn field. Sources can be either limited or unlimited. If they are limited in output, it is implied that the game must have a predefined end scenario. Of course it is possible as well, that all kinds of resources may be bought from some marketplace.

3.1.3. Drains

A resource must be consumed in some way. This activity is called a drain. There are several ways a resource can be consumed, the most common drains named by Rollings and Adams being construction and maintenance. Construction obviously refers to buildings and infrastructure. Constructing costs money as well as building materials. Sometimes buildings can be upgraded which belongs to this type of drain as well. Maintenance costs incur on a regular basis. They are paid to maintain buildings, infrastructure or to pay the employees' wages. While construction only happens when initiated by the player, maintenance costs are paid on an ongoing basis.

3.1.4. Converters

Converters are entities that transform one resource into another. The most obvious converters are production plants which transform raw materials into final goods. Another example of less obvious converters are all kinds of sale. Sales transform goods into the resource money. When goods are sold to virtual consumers, it is more likely that they are consumed over a longer period of time. Hence, the sale to virtual customers often happens on an ongoing basis. If a good is sold to another human player instead, the supply is sold immediately.
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3.1.5. Deadlocks

Deadlock refers to a specific condition in which two processes constrict each other. In the context of games, this may occur if during the production of a certain good, that same good is required for the production process. Hence, to produce a product, the product itself is required\(^1\), which is also called a circular reference. If unhandled, in the majority of cases circular references sooner or later will lead to a deadlock situation.

For example, in *Kapi Regnum* such a circular reference exists. To construct a building, some building materials like wood are needed. If the players have no lumberjack building, at some point they will not be able to purchase new buildings. To avoid this deadlock situation the market offers an unlimited supply of all building materials. A deadlock situation could also occur if the player has no money left, since delivering goods to a store costs money (*tolls*). In general, the player cannot have a negative balance. The balance check is omitted if the player wants to deliver goods to the market.

3.1.6. Equilibria

Equilibria can be either static or dynamic. An equilibrium can occur if a player does not interact with the game for some time. A static equilibrium refers to a situation of constancy. Everything remains as it was when the player stopped interacting; input and output are in a state of balance. In a dynamic equilibrium, input and output vary over a period of time, but the system will always return to the same state after a while. It's a cyclic process.

Static equilibria are easy to discover for the players. They change something in the production process and can determine the effects. This makes it easy to learn and play the game. Dynamic equilibria are more complex. If a system does not return to its initial state for a long time, effects of changing the premises are not comprehensible to the player. Equilibria take the pressure off the player. The game runs without interaction. This often is not a desirable state, since interaction is one of the fundamental characteristics of a game (see section 2.1.2.3).

\(^1\)Often referred to as the chicken-and-egg problem, [http://en.wikipedia.org/wiki/The_chicken_or_the_egg](http://en.wikipedia.org/wiki/The_chicken_or_the_egg) (2008-05-01)
3.1.7. Construction

There are two types of construction mechanisms in a game. On the one hand, players can buy a building. The resources for that action are removed from the storehouse and the building is immediately available. The other type is called design-and-build. This type of construction is often found in games where the player “does a little construction, then some management, then more construction, and so on.” [RA03] The player chooses a building site. In contrast to buying a building, this process will take some time. Resources can be paid immediately, but they can also be deducted unit by unit from the storehouse while the building is being constructed.

3.1.8. Demolition

In City Building Simulations, the players should be offered the opportunity to rethink their strategy and hence to demolish buildings. There are three ways to implement demolition of buildings into the game. Demolishing a building can cost money, which forces the player to plan more carefully in the future. Demolishing a building can also be free of charge. The players will only lose the resources which they paid for to actually construct the building. The third option is to return building resources or money to the user when demolishing a building, as it has been sold instead of demolished.

Of course a developer needs to take care of not overpaying the player when selling a building. If players receive more money for demolishing a building than they originally paid to construct it, most likely they will exploit this by buying and selling buildings all the time to gain a huge fortune. If players are offered to sell buildings to other players, this restriction should of course not apply.

3.1.9. Analysis Tools

When playing a city building or management game, a player generally wants to explore and understand the model behind the economic system. To support this, the game has to offer analysis tools that grant player access to the key variables of the system. So the players need to know how much money they have, what their stock supplies are and so
3. Game Design and Implementation

Information about supply and demand is very important for these kinds of games. Since they simulate virtual inhabitants, it is also of interest to know how satisfied these are and what they desire most at the moment. Information on how these variables change over time might also be important in order to see how actions can influence the system. Such information is shown in tables, lists and diagrams. A city building simulation is often based on a map that simulates a natural terrain. Some areas of this terrain might be good for mining raw materials, while others may have fertile grounds. Fertility can be measured in binary variables, such as fertile and not fertile, or it can be measured in a gradual system as very fertile, normal fertility, less fertile and so on. An analytical tool should show the degree of fertility of the different areas. Such tools overlay the map with different colors to indicate fertility. Figure 3.1 shows a screenshot\(^2\) from *Tropico 2: Pirate Cove*\(^3\) shows the degree of fertility for corn. The colored areas red are infertile; the dark green areas around the wood in the upper right corner are very fertile. The shades of yellow correspond to a medium fertility.

\(^2\)Source: Pirates & Privateers \url{http://www.pirates-privateers.com/} (2008-05-01)

\(^3\)Developed by Frog City Software, subsidiary of Take-Two Interactive \url{http://www.take2games.com/} (2008-05-01), published by Gathering of Developers, subsidiary of Take-Two Interactive
3.2. Enhancing Multiplayer

Since classic city building simulations do not support multiplayer gaming, some elements need to be developed to make the game suitable for browser games. Some of these features require the resulting game to refrain from city building simulations in a strict sense. The resulting game therefore will consist of elements from different genres, like city building simulations and economic simulations. Before describing the game design in greater detail, I will show some possible multiplayer elements.

3.2.1. Collaboration

Collaboration is a process where a group of at least two people jointly work together towards a common goal. In Kapi Regnum players can come together in guilds to collaboratively build a world wonder. Since a world wonder is very expensive, single players cannot build it. After the world wonder has been built, the players concerned will receive an valuable award for their commitment in the project.

In a later stage of the game, players in KC will have the chance to apply for the Olympic Games. To hold the Olympic Games, players will have to work together to build Olympic sports facilities, hotels and a public transport network. In detail, as soon as a player reaches a certain level, he will be offered the opportunity to join the Local Olympic Committee. Each Local Olympic Committee will consist of five to ten players. To hold the Olympic Games, the Committee will have to have a certain amount of different resources, such as building material, food or money in stock. Each member of the Committee can contribute resources in order to fulfil the objective. As soon as all requested resources are delivered, the players will receive a new building, the Olympic Stadium. Once the building has been constructed, the Olympic Games will take place. This will increase the virtual inhabitants’ satisfaction, as well as the sales to the virtual community for a given period of time. Additionally, the players will be awarded a badge, that will indicate the successful holding of the Olympic Games in all rankings.

Another collaborative feature will be the wonder of the world. Players of trade communities can contribute to construct the wonder of the world. As soon as all required resources are delivered, each player of that trade community will receive a new building.
Once it has been constructed in the player’s city, it will increase the city’s reputation as well as the satisfaction of its virtual inhabitants. In contrast to the Olympic Games, this effect will remain permanently.

This type of multiplayer element is less common in games.

3.2.2. Cooperation

In contrast to collaboration, cooperation does not mean to working together towards a common goal. Cooperative players work together, while still preserving their individual goals. In Kapi Regnum, guild members have different benefits. For example, they are relieved from customs duty, when trading with each other. The main purpose for players to join guilds is to find trustworthy trading partners. Players often demand less money for delivering a good to another member of the guild. So while players buy and sell cheaper, they are still trying to reach their own goals of either getting rich or respectable in the game world. To communicate with the guild members, each guild can use their own ingame board.

In KC, the already mentioned trade communities will be a major multiplayer component. As soon as players have reached a certain level, they will be allowed to open a new trade community. Players of all levels may join that community. The leaders of the trade communities will be able to choose, whether they accept new members or not. All members of a trade community will receive a benefit in producing a specified resource, which may be chosen by the community leader. Some resources, like building materials, will be excluded. Each trade community will be offered a chat room called Community Center and a forum, called Billboard, which may contain public as well as private sections. Private sections will be available to the community members only. For example, they can discuss their competition strategy or post their permanent offers to other members. The public section will be accessible by every player and can be used to post membership applications.

Another kind of community will be the county. Players will be randomly assigned to a county when they register for the game. Each county will encompass a maximum of 500 players. As in Kapi Regnum, members of a county will be relieved from customs duty; they will only have to pay transportation costs. Each county will have a Local
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Stock Market, where businesses can be conducted. The Local Stock Market is basically a chat room available to all members of a county. Of course each county will also have its own board. A county will offer some collaborative elements as well. One task will be to provide and run a homeless shelter. Players will constantly have to provide food, money or building material to succeed in this task. The larger the county’s virtual population becomes, the more homeless people will have to be fed. If a player does not participate in these charitable donations, the satisfaction level of his city’s inhabitants will decrease.

The element of cooperation is included in almost any browser game by some form of guild, clan or alliance.

3.2.3. Competition

![Figure 3.2.: Kapi Regnum: Allo’d Ranking](image)

Most games have a competitive element of some kind. This may sometimes be as simple as a high score list. Kapi Regnum for example offers several types of rankings. Players can compete in either having the largest number of fixed assets (“allo’d”), the most cash or the highest number of reputation points. Figure 3.2 shows a partial screenshot of
3. Game Design and Implementation

the allod-ranking\(^4\) in *Kapi Regnum*. In many browser games, like *Travian*, war is the central element of competition. Players erect fortified villages, arrange troops of different military units and fight each other to steal resources or villages.

In *KC*, such violent measures will not be possible. *KC* will be a game of friendly and peaceful coexistence. A player of *KC* should not be punished for not being able to play for a while, and players should not be forced to join the game on a regularly basis.

Of course the game will offer plenty of different rankings. These will include the cash value, fixed assets, the overall satisfaction of a city's virtual inhabitants, reputation points etc. As in *Kapi Regnum*, these rankings will list every player. There will however also be specific rankings for counties and trade communities which, in general, will include the same statistics as above. This way, a player can try to beat the high score in either the trade community, the county or the game world. To strengthen the collaborative elements of trade communities, some rankings will allow comparing these communities as well.

Regular contests will be another competitive element. Such contests will be announced in an ingame newspaper. In general, the player's task and that of the members of a trade community or a county will be to send in as many resources of a specific type as possible, in a given period of time. Once the contest is over, the winners will be awarded with reputation points.

3.3. Game Description

In this section, I will describe some of the game's core elements. The complete game design documentation has more than 150 pages, which is why only some excerpts can be presented here. These include a short overview of the game, a closer look at the economic system, the purposes of the game world map and the creation of infrastructure. I will close this section with a description of the virtual inhabitants' satisfaction and the influencing variables.

\(^4\)Screenshot taken on 2008-05-20
3. Game Design and Implementation

3.3.1. Subject of the Game

*KC* is a massively multiplayer online browser city building simulation with strategic and economic elements. *KC* has no predefined goal. In principle, the game is open-ended; it will be shut down when there are not enough players anymore, or the economic system is exhausted. This, however, is not foreseeable. *Kapitalism*\(^5\), an open-ended economic simulation which launched in mid 2003, five years after the initial release, is still played by several thousand players today. When players register for the first time, they need to name their future city. They will be allowed to change their city name of three times, until the name will become permanent. Some players of *Kapi Regnum* used the renaming option several times a day, which made other players furious and disturbed the sense of community.

On the first login, the players will be forced to play a tutorial. This tutorial will introduce the primary functions of the game, such as the analysis tools (see section 3.3.4.3) and the construction menu. To have the players directly involved in the game, they will be asked by their virtual *Mentor* to construct the *City Hall*, the center of their new city. As a positive feedback, they will be awarded a *Building License*, allowing them to construct residential buildings. To do that, the players will have to buy some building material from the *Local Stock Market*. As soon as the first residential building has been constructed, the players will be informed by their virtual Mentor, that the first inhabitants of their town are not satisfied at all. The Mentor will guide the player to the residential building and ask them to lower the tax.

Throughout the game, the virtual Mentor will explain a new feature as soon as it is available. The Mentor will be the interface of the ingame help system. Once the Mentor menu is opened, the players may either browse through the help document or ask a question. As soon as the players have passed the first tutorial-tasks, they will be awarded a *Mayor License*, advancing them to level one and allowing them to fully access all features of that level.

Once the players have left the tutorial mode and reach level one, they will be able to build their city. Several types of buildings are available: Residential buildings for the virtual inhabitants to live in, industrial buildings, where resources are produced and sold.

\(^5\)developed by upjers GmbH, http://www.kapitalism.de/ (German only) (2008-05-01)
as well as infrastructure buildings, which include power, water and recreation facilities. The player will have to cater for the virtual inhabitants who need jobs, food, recreation and other resources. The needs depend on the players' level. On level one, inhabitants only have very fundamental needs. They need water, electric power, basic nourishment and a job. Jobs will be offered by constructing industrial buildings. To provide the inhabitants with basic nourishment, the player could for example build a farm to grow corn, and a bakery to produce and sell bread. Both buildings will offer job opportunities. Working inhabitants will increase tax revenue. Among this autonomous form of supply, the players may also choose to buy food from other players and construct a Shopping Center, where the food will be sold to the inhabitants. Both options will satisfy the need for basic nourishment, as well as the need for work. When starting the game, the player will not have enough funds to construct a power plant or a waterworks. These resources must be bought either from other players or from a Non-Player Character, which stores an unlimited amount of basic resources. Each time unit, called a tick, the required resources will be taken from the storehouse, while the produced resources are transported to the storehouse. As soon as the supply is depleted, the virtual inhabitants' satisfaction level will decrease. If the satisfaction level has sunk below a certain value over a long period of time, inhabitants either will degrade a level or will stop working and thus stop paying taxes.

Oversupply produced by industrial buildings can be sold on the ingame markets. Hence it's the players' choice to either try to satisfy the inhabitants' demands on their own or by cooperating with other players. For example, they might concentrate on producing only a few resources, sell the oversupply and buy resources which they don't produce from other players.

On the later levels, virtual inhabitants' demands of the will increase. Each level will unlock new buildings, so that these demands can be satisfied. With their demands, the virtual inhabitants' gratitude will also increase. They will upgrade the City Hall so that it will glow in new splendor. They might even erect a monument to honor the Mayor (i.e. the player) of the city.

The general goal is to satisfy the virtual inhabitants. Without caring for the inhabitants, the player will not be able to advance beyond a certain point. There is a wide range of potential individual goals the player may choose. Some of them have already been described in section 3.2.2. The players may try to outperform other players and reach
the top of some of the many ranking lists. They may also play just for fun without a specific goal.

3.3.2. Economic System

“Creating and balancing an economy is one of the most complex and difficult jobs a game designer can do, and you can be sure that no matter how carefully you have worked it out, there will be consequences and relationships that you never considered.” [RA03]

Developing a working economic system is very difficult and time consuming. Many things have to be considered. As known from section 3.1, some of the key elements of an economy are resources, sources, drains and converters. In KC, sources and converters will appear in the form of buildings. Some drains will consist of buildings as well, while others will have the form of contests and quests. In this section, I will describe some of these elements briefly.

3.3.2.1. Resources

Some resources like food, water or electric power have already been mentioned above. For example, basic nourishment is a group of resources. It contains several goods like bread, milk or eggs. To satisfy the need for basic nourishment, at least one of those resources has to be available. If the players have more than one resource of a group in stock, both resources will be used equally. Some resources will have quantifiers. Bread might for instance have a quantifier of two, while milk has a quantifier of one. In other words, two units of milk are worth one unit of bread. Virtual inhabitants’ demands will also be quantified. On level one for example, the demand for basic food has a quantifier of four per tick. So to satisfy the demand, the player will need four points worth of resources. This might be either two units of bread, four units of milk, or a mixture of both. To enable the virtual population to grow, the players will need more resources on stock than only the basic requirements. To attract new inhabitants, they will need at least 10% oversupply.

With each level the players advance, the demand for goods will raise. While an inhabitant
3. Game Design and Implementation

at level one needs resources worth four points of basic food, on level two the inhabitant will need resources worth six points. Hence to advance a level, a player will need even more than 10% oversupply of basic food resources.

Other groups are food and luxury food. While the group food contains resources like fruits, vegetables, meat or chocolate bars, luxury food contains caviar, champagne or cream tart. Obviously the inhabitants of the city will demand such food on later levels only. Altogether the game has more than 25 groups of goods, containing more than 100 products.

Other resources like water, power or building material will not be organized into groups.

3.3.2.2. Sources & Converters

All resources can be produced in a corresponding building. Some basic resources, like power, water or basic food, will also be available from a Non-Player Character, called Country (see section 3.3.2.4 for more details).

Figure 3.3 shows a partial screenshot of an early test version of KC. The screenshot
3. Game Design and Implementation

shows a detail page of a bakery, a converter building. In the middle of the screen there are three sliders. These sliders manipulate the percentage output of the bakery. In this example, the bakery produces 300 loaves of bread (first slider), 600 buns (middle slider) and 200 units of a not yet named product (lower slider) per time unit. These are experimental values, since the bakery employs only five people (upper right corner). At each tick, the produced goods are automatically transferred to the storehouse. To produce goods this building requires some raw materials. In this example, the bakery requires 100 units of power and 100 units of water per tick (upper left corner). These raw materials are taken from storehouse each tick. If there are not enough raw materials left, the building will decrease or stop output. Actually almost every source needs some raw materials. Most buildings will require water and power at least. The more complex the output of a building, the more different raw materials will be needed. Since a bakery requires raw materials to produce goods it is a converter building.

Another type of converter buildings that hasn’t been mentioned yet, are residential buildings. These buildings require resources on a regular basis to satisfy their inhabitants. With each tick a specified amount of resources, which depends either on the players’ as well as on the buildings’ level, will be used. Since they are generating an output, i.e. money due to tax payments, they are converter buildings instead of drains.

Other converter buildings include a butcher, a farm, a clothing factory or a car factory, to name only a few. Altogether there will be more than 40 converter buildings. Source buildings, which do not require raw materials to generate output, will include a nuclear power plant or a waterworks.

3.3.2.3. Drains

A drain is an activity which consumes resources. In section 3.1.3, different types of drains have been named. Construction is the first drain. In KC constructing buildings require different resources, such as building materials like wood and stone, as well as money. These resources are consumed during the construction process, they vanish from the game. Aside from constructing new buildings, upgrading already existing buildings is another kind of drain. Upgrading also needs building materials as well as money. Each building will require a different amount of building materials and money. The bakery for example costs 1,000 units of wood and 1,000 units of stone as well as 75,000 money
units (a name for the currency has not been chosen yet) on level one. Costs will rise with the players’ as well as with the buildings’ level.

The second drain named in section 3.1.3 is maintenance. Maintenance costs incur on a regular basis. Although in KC resources which are needed to satisfy the virtual inhabitants incur on a regular basis, these are no maintenance costs according to the definition in section 3.1.3. Such resources are converted to money. In KC there will be no maintenance costs. Otherwise, players that don’t play the game for a while could go bankrupt, if the maintenance costs summed up to a financial burden that exceeded the players’ funds.

In KC, contests and quests will be a major drain. Contests are arranged by the in-game newspaper on a regular basis, about twice a month. Each contest asks the player to send as much of a specified resource as he can to a city named Salvation Army City. Sent resources will vanish from the system. The top senders will be awarded with reputation points. Quests are a similar approach. From time to time players will receive a quest; for example they are asked to send relief supplies to a city that has been struck by a disaster. Once the players have sent all required resources, they will also be awarded with reputation points. Resources sent in the context of such quests will vanish from the system.

The last drain in KC are transportation costs. Resources which are sold at a player-to-player market require the buying player to pay transportation costs. That money will vanish from the system.

3.3.2.4. Deadlocks

A deadlock is a specific condition in which two processes constrict each other. In KC, two possible conditions for such a deadlock have been identified. Since some basic resources like power or water are frequently required, but cannot be produced by players who have just started to play, a deadlock situation may happen if there are not enough resources of this kind available to cover the demand. To avoid that, a Non-Player Character called Country will have an unlimited supply of basic resources available to buy. Another deadlock situation to be mentioned, is a very rare one. If a player has no funds left, does not have any working inhabitants who pay taxes and has neither resources, nor industrial
buildings to sell, then he is trapped in a deadlock. Since in the common course of this game, this is unlikely to happen, it will not be prevented by the game. The afflicted player will have to reset his city and start over.

### 3.3.2.5. Equilibria

If players do not interact with the game for a longer period of time, it is important to know how the economic system will react. In KC, this is easy to determine. Production and consumption are constant over time. Hence, if production is higher than consumption, the stocks will fill. If consumption is higher than production, the stocks will deplete, and if consumption and production are equal, the stocks will remain unchanged. Hence only a static equilibrium may happen, if production and consumption are equal. In any other situation, there will be no equilibrium. Without interaction, the players' cities will not grow.

### 3.3.3. The Map

![Figure 3.4.: KC: The Map](image)

Each player will start with his own empty game map. There will be only one form of map in the game, so that all players have the same starting conditions. Figure 3.4 shows a partial screenshot of the map. The display detail shows a river mouth, surrounded by green and fertile land and a few trees. The details' size is about 8 acres long and 16 acres wide. A map in total is 60 acres wide and 60 acres long, which results in a
map size of 3,600 acres in total. The map has acres of varying fertility for different kinds of resources. In the north of the map, for example, you can find a huge forest which provides wood. In the northwest you can find the sea, which allows fishing as well as international trading. Each natural resource will have acres with a high degree of fertility. Not all acres can be covered with buildings. In the screenshot above, acres touching the rivers are not suitable for buildings in general. An exception will be the Hydroelectric Power Plant, which needs to be built on a river. How the player will be able to identify which areas are suitable for what kind of buildings will be shown in section 3.3.4.3 If a building is constructed in an inappropriate place, it will not produce any output.

The map presents a top-down, slightly oblique angle view of the city. The map detail shown in the browser can be moved by clicking and holding the mouse button while moving the mouse. The players will generally see only a fraction of the map, unless they possess large screens. To help the players orient themselves, a mini-map will always show the current map detail in relation to the complete map.

3.3.4. Creating Infrastructure

In this section I will explain in short how the infrastructure of traffic and logistics works and how the best locations for specific buildings can be found.

3.3.4.1. Traffic

The players do not need to construct roads. Such traffic routes are implicitly existent. On the later levels, the players will have to construct a Railway Station, to be able to transport more resources at once to the markets (i.e. sell more goods at once). The railway line itself will also be implicitly existent. Air pollution will be a topic on the later levels, so the players are encouraged to also construct Bus Stations or maybe even a Metro. A Harbor at the sea will allow international trading of goods, which at first is limited to players in the same county only. At last, virtual inhabitants will also demand an Airport, once the city's population has reached a certain number.
As soon as the buildings have been constructed, the corresponding traffic routes will be existent implicitly. Allowing the players to build the traffic routes on their own is not possible because of the web browsers’ restrictions. At the moment, the minimum size of an acre is a square of 80 pixels, which represents one fourth of a residential estate. To preserve the measures when supporting roads, an acre of a map would have to be very small in size. Most browsers are not capable of handling thousands of map elements.

3.3.4.2. Logistics

Immediate availability of resources decreases the level of complexity. As soon as a resource is produced, it will be transported to the storehouse immediately, at no further cost. Resources which are consumed by virtual inhabitants or needed by construction sites will be removed from stock immediately at no cost. When trading with other human players, goods will be transported immediately, but costs incur. The prices on the different markets will be noted as EXW\textsuperscript{6}. This means, the buyer will have to pay transportation costs, depending on the distance between the two cities and the desired amount of the good.

3.3.4.3. Analysis Tools

The game map will consist of many acres with different degrees of fertility, ore concentration and so on. To enable the players to identify acres which are suitable for the building they want to construct, several analysis tools will be offered. All of these tools are based on the same system. Some values are of a binary nature, like “acre has iron ore” and “acre has no iron ore”, others are graduated in some way, like “acre is highly fertile for corn”, “acre is of average fertility for corn”, “acre is of less fertility for corn” and “acre is not fertile”. For each group of resource, a specific analysis tool will be offered. As soon as the players choose to construct a building, the corresponding analysis tool will be started. Of course the players may choose to manually use the analysis tools whenever they want.

If an acre is not suitable for the specified building, the acre will be overlaid with field

\textsuperscript{6}EXW is an Incoterm meaning Ex Works. Hence, the seller makes the goods available at his premises.
that is tinged red. The color dark green will correspond to the best value of either binary or graduated allocation. The average value will correspond with the color yellow; the rest will be shades of either green to yellow or yellow to red.

### 3.3.5. Satisfaction of Inhabitants

Satisfying the needs of the virtual inhabitants of a city is a central element of KC. Satisfaction is influenced by many factors. The higher the level of the player and the inhabitants, the more factors will influence satisfaction. In the beginning, the inhabitants’ satisfaction is calculated rather easily. They only have a few basic requirements, such as basic nourishment, electric power and water. Other influences are work and tax. Each of the many influencing factors has a weighting. Not having basic nourishment for example will have a much greater negative influence on the level of satisfaction than unemployment. Once the players proceed, not only resources, work and tax will have influence on the level of satisfaction, but also things like recreational facilities and sports, social security, personal safety, which is ensured by a Police Station or a Fire Department and chances for self-fulfillment like traveling or arts. Each of these needs can be satisfied by a corresponding building, like a Museum, an Airport or a Football Arena.

The players will not have direct access to the values describing the level of satisfaction. When looking at the details of a residential building, the players will see an icon indicating the level of satisfaction of that building’s inhabitants. There are ten of these icons, representing percentage values from 0% to 10%, from 10% to 20% and so on. These icons are shown in figure 3.5. Although the level of satisfaction is not indicated by a precise number, it is likely that the player will easily determine how satisfied the virtual inhabitants of his city are.
3.3.6. Conclusion

KC will be a fairly complex game. Players can develop individual strategies to succeed in reaching their own goal, which they can choose from a large range of competitive elements. To satisfy the needs of their virtual inhabitants, players are required to cooperate to some degree. Aside from all this complexity, the challenge is to keep the game as simple and understandable as possible. Some ideas how this can be achieved, have already been shown above. An omniscient Mentor which supports the player or analysis tools which reduce the complexity of exploring the map are available. Complexity has been dramatically reduced by avoiding the construction of traffic routes or by an immediate update of the stocks. Deadlocks have been analyzed and handled. All these measures increase the game’s usability. For example, the Mentor supports Learnability as well as Efficiency. Safety is increased by pre-analyzing possible deadlocks. Next to the elements mentioned in this section, the User Interface of a game determines whether a game is enjoyable and usable or not. Hence in the following section, I will focus on the User Interface of the game.

3.4. User Interface

In the previous section I already described how playability and usability can be improved by proper game design. In this section I will describe how the User Interface of KC is designed to improve usability even more. Different aspects of the interface will be highlighted exploiting the knowledge about usability from chapter 2. These aspects include the main screen of the game, the system of modal view, the game icons and buttons and the ingame manual system, which is called Mentor.

3.4.1. Main Screen

Figure 3.6 shows the prototype of the KC main screen. In the lower left corner the Mentor can be seen. The Mentor is fixed to that position. In the lower right corner a text box gives an immediate overview of the acre the mouse pointer points at. At the moment the mouse points at the nuclear power plant (“Atomkraftwerk”). Since the map
itself is quite huge, a mini map in the upper left corner (surrounded by a red border) helps the user to navigate on the map. A black-bordered rectangle on this mini map indicates the current position. Residential areas are colored red, infrastructural buildings are colored yellow. Industrial buildings will be colored blue. The player can use the mini map to quick navigate through the map by moving the black-bordered rectangle. The map on the main screen will automatically jump to the corresponding area. Both, the mini map as well as the quick information box, are partially transparent, so that they do not block the view onto the map. Also both elements are movable. The player can decide which position he wants to have the elements at by simply clicking them, holding the mouse button and moving them around. Of course he can also decide not to show that elements at all. Such options are available in the player profile’s menu.

In the upper part of the main screen, some important information as well as the main menu are shown. The left info box shows basic information like the city’s name (“Bamburgensis”), the reputation points (“123 points”), the current balance and the number of new messages or contracts. The box and its contents are fixed. The information box on the right side of the menu shows information about the current supply of selected resources. By default, this box will show the current stocks of the basic resources wood, electric energy and the group of basic foods. The player has the chance to change the items shown in that box when visiting the storehouse.
Between the two information boxes the main menu is shown. These items are fixed in position, they will be always visible. More about this menu can be found in section 3.4.3.

Buildings can be accessed by clicking them on the map. A detail window will pop up giving context sensitive information about the selected building. To follow the rule not to open new browser windows (see section 2.7.3.3), the game uses CSS to simulate pop up windows. If the user clicks a free acre instead of a building, the construction menu will automatically be opened.

If the player selects a new building to construct on the map, the corresponding analysis tool will automatically be started to show which acres of the map are suitable for that building. All free acres will be colored according to the specifications of section 3.3.4.3. As soon as the player has selected a place for the new building the analysis tool is deactivated and the original view of the map is restored.

The view of the main screen is consistent. Although some elements are customizable, the arrangement of the core elements is always the same. The most important information and links are always visible. Some elements exploit constraints, like the meaning of colors. The analysis tool for example uses a traffic light logic to indicate whether an acre is suitable for the selected building or not. The main screen also adapts its size according to the browser window size. If the player changes the size of his browser window, the game will immediately adapt the new size by rearranging the relative position of the screen elements to best fit screen. The browser window size is a physical constraint.

3.4.2. Modal View / Feedback

In KC there are different forms of feedback. One form of motivating feedback has already been described in the subject of the game (see section 3.3.1). If the player advances one level or passes a certain task he will be awarded with a degree, reputation points or other valuable things, which include new buildings and game features. This is a form of positive reinforcement. Another form of feedback which has also been described in section 3.3.1 is the Mentor. The Mentor is not only access to the help-system, but he also will inform the player about newly unlocked features or troubles in his city like undersupply of resources. This is a discreet form of feedback without interrupting the
3. Game Design and Implementation

Generally the introduced forms of feedback do not require interaction of the user. Other forms of feedback require user interaction. For example, if the player wants to upgrade a building, he will be asked to confirm the action, since upgrading has pervasive consequences for the player. It costs money as well as other resources, and it will take some time until the building is finished. During this time the building will not produce any goods. Hence an explicit confirmation should be asked for. To show clearly that interaction is required, such feedback makes use of the principle of modal views. A modal view specifies a dialog which has to be finished in order to continue the game. To indicate this, the main screen will be shaded until the dialog is finished, which is shown in figure 3.7 (The message in the dialog reads: “confirmation prompt” - “Upgrade building to level x? This lasts x hours and costs x money units”. The buttons are labeled “yes” and “no”).

Such dialogs support the safety of the game. As soon as the player initiates an action which will have serious consequences for further play, he is asked to confirm this action. Shading the main screen and disabling all links and buttons exploits logical constraints.

3.4.3. Icons / Mapping

There are several groups of icons in the game. One of them has already been shown in figure 3.5, the icons indicating the satisfaction of the virtual inhabitants. These
icons exploit two constraints at once. On the one hand they use traffic light logic to indicate the level of satisfaction, where red corresponds with the worst satisfaction and dark green with the best satisfaction level. They also use human facial expressions to indicate virtual inhabitants satisfaction which can easily be mapped to real world mood of people.

The traffic light system will be used in other areas as well. Colored buttons indicate stock movement. Red buttons indicate that the production rate is too low to satisfy the demands of the inhabitants, while green buttons indicate that the demands can be handled. Yellow buttons indicate that there is just enough for the inhabitants to survive. The traffic light system is consistently used in the game whenever an appraisal of some kind has to be done.

Another group of icons are the building action-icons. This icons represent four operations only: demolishing, upgrading, selling and closing a building. They have been designed to be easily mapped with real world actions. The demolish icon shows a wrecking ball, while the selling-icon shows bankrolls. To further support the identification of the related action, the icons have been named, too. Figure 3.8 shows these icons including their text links. The screenshot has been altered to better fit the paper format. Originally they are placed on the right side of the buildings detail-window where they are always visible. It doesn’t matter which of the almost 100 different buildings the user looks at, the details-window and the building action-icons will always look alike.

The icons representing the main actions of the game like construction, statistics or
messages are also designed such that they can easily be mapped with the real world. For example, the construction icon shows a construction site, while the statistics menu is represented by a pie chart. As figure 3.9 illustrates, the main menu icons are emphasized when touched with the mouse pointer, they become bigger. This effect is called “fisheye”. In the context of this thesis its main purpose is to simulate dynamic animations which are not common for browser games, to enhance the sensory gratification, which was defined in section 2.1.4.1 as a criteria for selecting games.

The icons of KC are designed to support the usability goal of memorability. The icons are always visible, and they all look alike. They are grouped together by the means of their context and can always be found in the same position, regardless of which detail window was opened. A design related to the real world should support learnability of the interface.

3.4.4. Manual / Support

The Mentor is the interface to the help system. The manual of the game consists mainly of written text, only few graphics will illustrate the manual when needed. From the previous chapter is known that the presentation of text has to follow some guidelines to enhance usability. Texts should be short and precise, they should support scanning of the text by emphasizing keywords. Unnecessary information should be omitted. Hence supporting text like a background story of the game should be separated from the manual.

The Mentor will also offer the player the possibility to ask questions. Such a question could be “How can I produce cars?”. The system will try to extract the subjects of the input and present the correct answer by presenting the corresponding page from the manual. This system has different challenges to face. Especially spelling mistakes could decrease the effectiveness of the system. Implementation of this system will be rather complex and is not subject of this thesis.

The manual will support the usability goal of efficiency. The Mentor will always open the page of the manual corresponding to the current action. Hence if the player opened the Car Factory-dialog, the Mentor will automatically present the manual page for the Car Factory if requested. It also supports learnability, since the manual guides the
player through the different options and actions of the game.

3.5. Further Challenges

In this section I will, in context of KC, review in short some further aspects of usability and browser games which have been mentioned in chapter 2.

The game KC makes extensive use of JavaScript technology. JavaScript is executed on the players’ computer. It cannot be determined how fast that computer is. If it is an older model, it might be that the JavaScript environment cannot execute time critical components just in time. On the other hand, although JavaScript is standardized as ECMAScript, browsers have proprietary elements in their JavaScript engine, which might conflict with code that runs problem-free on other browsers.

Changing the color of visited links does not apply to the game. On the one hand, mostly icons and buttons initiate actions, instead of textual links, on the other hand in a game people will trigger the same actions again and again.

Handling the Back button is not possible. Since all actions take place within the same HTML document, the Back button would always bring the player back to the login page. Personally I think, this will not be as much a problem as Nielsen described it. [Nie00] The design of the game is more like the design of a classic video game, rather than a web page. We also know from a study by Nielsen [Nie06] that users who open a PDF document in a browser window often accidentally close that window, because they are used to that behavior from the standard PDF viewer program. Hence I think if the design of the game is more like a classic video game, players will tend to follow the behavior they are used to from such games. A Back button-like functionality is not common for video games.

Nielsen advised to omit opening new browser windows. [Nie06] In KC techniques like JavaScript and CSS are used to present content in the same browser windows as the game is. New windows are presented in a modal view mode, so the user has to close the windows before he can continue playing. An exception from this rule is the help window. It will be opened as new window so that the user can continue playing while
3. Game Design and Implementation

reading the manual.

Accessibility is a rather complex topic for such a game like KC. Due to the design of the map accessibility for visually impaired is not guaranteed. Supporting external tools like screen readers would require a complete different design of the game, since such tools today cannot handle the extensive use of JavaScript and CSS. Supporting screen readers would require the use of a more textual design.

3.6. Implementation

In this section I will describe very briefly the technologies which are used to develop KC. I will differentiate between server-side and client-side technologies and will give a short example for each of these.

3.6.1. Server-Side

The server-side basis of KC is a classic LAMP infrastructure. The term LAMP is an acronym and refers to Linux, Apache\textsuperscript{7}, MySQL\textsuperscript{8} and PHP\textsuperscript{9}. Linux is the server operating system. The KC development environment is based on the Debian\textsuperscript{10} GNU/Linux distribution. The web server software is called Apache. KC uses the current version of Apache 2.x. The database server uses MySQL as database software. Version 5.x of MySQL is required to be able to use Stored Procedures and Transactions. PHP is the server-side programming language used to develop KC. KC requires to use the most recent version of PHP (currently 5.2.x), which offers a basic object-oriented programming support as well as built-in PDO\textsuperscript{11} support. The presence of the Alternative PHP Cache-module\textsuperscript{12} for Apache is required. Due to this requirement, PHP needs to be run in module-mode instead of CGI-mode.

\textsuperscript{7}http://httpd.apache.org/ (2008-05-01)
\textsuperscript{8}http://www.mysql.com/ (2008-05-01)
\textsuperscript{9}http://www.php.net/ (2008-05-01)
\textsuperscript{10}http://www.debian.org/ (2008-05-01)
\textsuperscript{12}http://pecl.php.net/package/APC (2008-05-01)
The use of a server-side cache is crucial for high performance. This will be demonstrated by an example from a production server of *Wurzelimperium*.

Listing 3.1: Benchmarking of including an external file

```php
$start = microtime(true);
include('langfile_'.$SPEE.'.php');
$end = microtime(true);
$timeused = $end - $start;
```

Listing 3.1 demonstrates the benchmarking of loading and executing an external source file. On the tested production server, this step took an average of 2.7 milliseconds. At about 2,200,000 page views per day, this amounts to a total of 99 minutes. Hence in average 99 minutes per day the tested machine was busy with opening and executing a simple language file. Using a memory-based cache system, the time was reduced by a factor of 1,000, which dramatically increased the users’ experience.

Use of database transactions increases the safety of the game.

A database transaction is an atomic operation and may therefore be successful or not. Since stock entries generally require more than one database query, one to check the amount of a specific resource on stock, one to either update existing or creating new stock, transactions are required to improve safety of database queries. *KC* addresses database transactions by using the PHP Data Objects-interface (PDO). Listing 3.2 demonstrates the use of transactions and PDO.

Line four initiates the database transaction. Any query on the database object (line two), which is made from now on, will be part of the transaction, unless the transaction is either commit or rolled back. On line 6, a query to check the current supply of a specified product is executed. Depending on whether the product is available or not, either an update-query or an insert-query is executed. On line 18, the transaction is committed. If an exception occurs, the transaction is rolled back on line 21. Transactions ensure that, if more than one stock query is executed at the same time, both queries will be executed so that no updates to the database will be lost.
3. Game Design and Implementation

Listing 3.2: Using PDO and transactions to update stock

```php
function stockEntry($product, $amount, $quality = 0) {
    global $dbh;
    try {
        $dbh->beginTransaction();
        $sql = $dbh->query('SELECT amount FROM kc_store WHERE user=\''.$_SESSION[\'USER\']\' AND product = \''.\$product\' AND quality=\''.\$quality\');
        $result = $sql->fetchAll(PDO::FETCH_OBJ);
        if (count($result) == 1) {
            # supply present!
            $newamount = $amount + $result[0]->amount;
            $dbh->exec('UPDATE kc_store SET amount = \''.\$newamount\' WHERE user=\''.$_SESSION[\'USER\']\' AND product = \''.\$product\' AND quality=\''.\$quality\');
        } else {
            # No supply!
            $newamount = $amount;
            $dbh->exec('INSERT INTO kc_store (amount, user, product, quality) VALUES (''.\$amount\', ''.\$_SESSION[\'USER\']\', ''.\$product\', ''.\$quality\'));
        }
        $dbh->commit();
    } catch (Exception $e) {
        $dbh->rollBack();
        throw new Exception(lang('error', 'cannotupdatedb'));
    }
    return $newamount;
}
```

3.6.2. Client-Side

On the client side, several widely accepted standards will be used. XHTML is the client-side basis of the game, while CSS is used for all style elements. JavaScript enhances the interactivity of the game, which is supported by the Dojo Framework.\(^\text{13}\) Each of these technologies will be introduced in brief, for some of them an example on how it is implemented will be given.

\(^\text{13}\)http://www.dojotoolkit.org/ (2008-05-01)
3.6.2.1. XHTML

The game solely uses XHTML as markup language. This allows creating easy to read source files, by keeping the maximum compatibility with any modern browser. Since validity of the source code is enforced by this format, integration of JavaScript is simplified. More about XHTML 1.0 can be found on the Internet: http://www.w3.org/TR/xhtml1/

3.6.2.2. CSS

Cascading Style Sheets (CSS) are a stylesheet definition used to present a document written in a markup language. In KC, this is extensively used. Listing 3.3 shows the CSS which is used to define the presentation of the mini map. Actually, the mini map consists of three nested div-tags, one being the map area itself (“mappreview”), one being the mini map image (“mappreview_img”) and one being the current visibly detail-indicator (“mappreview_border”). The style of these div-elements is defined by CSS.

3.6.2.3. JavaScript

Even without using the Dojo Framework the proportion of Java Script-code outnumbers the lines of code written in PHP for the prototype of KC. JavaScript is used to simulate the dynamics of a classic video game in the browser. For example, moving the map would not be possible without JavaScript. To give a quick example, Listing 3.4 shows a function which updates our mini map. Please remember from the previous section, that the mini map consists of three nested div-elements.

When called, the function calculates from the current map position (stored in “downLeft” and “downTop”) and the current browser window size (returned by functions “getWindowHeight()” and “getWindowsWidth()”) the new size and position of the black rectangle, which indicates the currently visible detail from the map. If a user has constructed or demolished a building, the code in line 8 will update the map.
3. Game Design and Implementation

Listing 3.3: CSS of mini map

```html
<!-- Map-Preview -->
<div style=""

top:100px;
left:50px;
width:120px;
height:120px;
z-index:4;
position:absolute;
border:3px solid red;
background-color:rgb(255,255,255);
filter:alpha(opacity=80);opacity:.80;" id="mappreview">
</div>
</div>

3.6.2.3.1. Dojo Framework  The Dojo Framework is a JavaScript Framework, designed to ease the rapid development of JavaScript- or Ajax-based applications. Dojo offers many functionalities which are needed in KC. For example, Dojo supports Drag’n’Drop behavior, needing only a single line of code to implement it. Dojo offers support for modal views and dialogs as well as support for the fisheye-menu. It offers a great support for all Ajax-related tasks. The lines of code to be written to implement all of these features dramatically decrease by using Dojo. The licensing is extremely liberal, allows for commercial use and enables sub-licensing\textsuperscript{14}

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Listing 3.4: Updating the mini map using JavaScript

```javascript
function updateMapPreview() {
    div_mappreview_border.style.left = (Math.ceil(Math.abs(downLeft) / 80) - 1 * 2) + "px";
    div_mappreview_border.style.top = (Math.ceil(Math.abs(downTop) / 80) - 1 * 2) + "px";
    div_mappreview_border.style.height = (Math.ceil(getWindowHeight() / 80) * 2) + "px";
    div_mappreview_border.style.width = (Math.ceil(getWindowWidth() / 80) * 2) + "px";
    div_mappreview_img.innerHTML = '<img src="http://server/services/m' + _USER + '.map" style="width:120;height:120;border:0px;" />';
}
```
4. Empirical Study

In this section, I will evaluate a study about browser games and compare the results to the studies which have been reviewed in chapter 2. At first I will describe the motivation for the study. Then, I will introduce the study’s design and method. I will explain the hypothesis for each of the researched items, give the results, and then discuss them in relation to the hypothesis, as well as in relation to the studies introduced earlier.

In the second part of this chapter, I will briefly explain the results of a user experiment which was performed to evaluate the game.

4.1. Introduction

In the previous chapters, I have reviewed several studies about the demography of video game players, types of players and usability. The result of these studies has constituted the foundation for a city building simulation, as described in the last chapter. In this chapter, which consists of two main parts, the demography of browser game players as well as the usability of browser games in general will be reviewed. Additionally in the same study, among other games, **KC** will be evaluated. The results of these studies will be compared with the already mentioned studies. One of the key questions is, whether the studies about the demography of video game players and online game players can be applied to browser game players as well. Another question is, which types of players actually form the group of browser game players. The second key question is, whether general usability rules can be transferred to browser games. Study participants will evaluate screenshots of different browser and video games. Based on their answer, we’ll be able to deduce how general usability is experienced by the players. A screenshot of **KC** has been entered among the series of games, in order to evaluate the game without
4. Empirical Study

distorting the results by highlighting a single screenshot.

The results of such a study are of course of special interest to browser game developers. Are they developing for the right target audience? Are the current games of good usability, or are players less content with the current games? Which game features are important for players, and which features are of lesser importance? The answers to these questions are of special economic relevance for the mostly small browser game companies in a market, that experiences a growth of almost 30% per year\textsuperscript{1}. A long-term survival of browser game companies on the market and a continuation of the current growth trend can only be achieved, if their future projects will be target group specific and good enough to reach the discriminating majority of users.

4.2. Study

At first I will introduce the questionnaire, as well as the procedure how the study was conducted. For each examined case, I will briefly explain the hypothesis, present the results of the study and discuss them. The section will be finished by a review of the discussions and conclusions, and further questions that might arise from them.

4.2.1. Method

4.2.1.1. Participants

The study was conducted in April and May 2008. The questionnaire was published on the Internet in German and English. It has been announced in several browser game bulletin boards, such as the German and English versions of Kapilands, Kapi Regnum, Rumble Race, Caribic Islands and Molehill Empire. Additionally, it has been posted by players in other game boards like World of Dungeons. Furthermore, the questionnaire has been announced on browser game news sites as, for example, Galaxy News. A total of 1,771 participants has completed at least the first page of the questionnaire. 12 subjects were excluded from the analysis, because they entered invalid data. Four subjects were

\textsuperscript{1}see section 2.2
4. Empirical Study

excluded, because they entered an invalid age (accepted range from 10 years to 100 years), eight subjects were excluded because they declared to play more than 140 hours per week (20 hours per day). Since only two returns were answered in English, they have been omitted. Hence, a total of 1,747 returns can be evaluated.

4.2.1.2. Material

The online questionnaire (see appendix A) consisted of 20 forms, each of these forms consisting of a single page. A basic validation was conducted after the participant sent a form. After each step, the obtained data was stored in a MySQL database.

The first form asked for some basic demographic data, as well as the participants’ preferred browser and video game genres. The respondents were able to check up to three favorite game genres of each kind. The purpose of the second form was to learn about the players’ computer equipment, while the third form asked about the most and least important features of browser games. In a free-text field, participants had the option to additionally name features not listed. Browser games known by the participant were the subject of form four. Again, participants had the chance to name additional games which were not listed. The following six forms presented game icons, which the participant had to evaluate. Participants were offered a list of five pairs of bipolar rating scales. The order of these pairs was randomly chosen on each form. The participants also had to guess, which game menu the icon might belong to. The 10th form presented six icons from a construction menu of KC. The participants were asked to assign each icon to its appropriate action. The following nine forms evaluated screenshots from different browser and video games. Each form presented a screenshot of a game as well as ten bipolar rating scale pairs, which were shown in random order on each page. The participants were also asked, whether they did find their way around easily and if they could imagine playing the corresponding game. At last, participants were asked to assign each game to a game genre. The last page asked for the participants’ email address, to enable them to take part in a sweepstake.
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4.2.1.3. Procedure

After introducing the subject of the questionnaire, the participants were immediately presented the first form. If they bookmarked the page, participants could pause filling in the questionnaire and return later. After sending a form, the acquired data was immediately stored in a database. Throughout the questionnaire, the participant was tracked with a unique id to be able, to assign the data from each form to a specific record.

4.2.2. Hypothesis, Results and Discussions

4.2.2.1. Players’ Demography

<table>
<thead>
<tr>
<th>Player Type</th>
<th>men</th>
<th>women</th>
<th>&lt; 30</th>
<th>&gt; 30, &lt; 50</th>
<th>&gt; 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casual Gamer</td>
<td>50%</td>
<td>50%</td>
<td>20%</td>
<td>46%</td>
<td>34%</td>
</tr>
<tr>
<td>Habitual Gamer</td>
<td>75%</td>
<td>25%</td>
<td>48%</td>
<td>40%</td>
<td>10%*</td>
</tr>
<tr>
<td>Fantasy Gamer</td>
<td>n/a</td>
<td>n/a</td>
<td>41%</td>
<td>45%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Table 4.1.: Former Studies: Player Demography

4.2.2.1.1. Hypothesis  In section 2.5, I have reviewed some studies about player typology and named three groups, which are of interest for browser game companies, the Casual Gamers, the Habitual Gamers and the Fantasy Gamers. These were analyzed by means of age and gender distribution. The results of those studies are shown in table 4.1\(^2\). If browser game players really belong to one of these groups, the demography should be similar. The percentage of women should be between 25% and 50%, and about 40% should be between 30 and 50 years old. As proven by Cypra \cite{Cyp05} and Lüttmann \cite{L07}, female players in general are significantly older than male players. Hence, the same result is expected to be found in this study as well.

4.2.2.1.2. Result  The vast majority of 88.4% participants was German, 5% of the participants was Austrian, while 3.7% came from Switzerland. The rest of the participants was from 21 different countries.

\(^{2}\) missing two percentage points are not listed in the referred study
4. Empirical Study

<table>
<thead>
<tr>
<th>Native Country</th>
<th>percentage</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>88.4%</td>
<td>1,544</td>
</tr>
<tr>
<td>Austria</td>
<td>5.0%</td>
<td>88</td>
</tr>
<tr>
<td>Switzerland</td>
<td>3.7%</td>
<td>64</td>
</tr>
<tr>
<td>others</td>
<td>2.9%</td>
<td>51</td>
</tr>
</tbody>
</table>

Table 4.2.: Native Country of Questionnaire Participants

About 28.2% (total 493) of the participants were female, 71.8% (total 1,254) were male. Overall, 69.5% is younger than 30 years, 27.5% is between 30 and 50 years old and 3.0% is older than 50 years. The average age is 23.96 years for men, with a standard deviation of 9.452, and 31.08 years for women, standard deviation 10.041. In the referenced study of Kabel, the minimum age of participants was 14 years. Leaving out answers from participants aged younger than 14 (n = 81), the average age of men is 24.75 years (+ 0.79 years), standard deviation 9.240 (- 0.212), the average age of women is 31.16 years (+ 0.08), standard deviation 9.982 (- 0.059). Overall values are now: 68% is younger than 30 years, 28.9% between 30 and 50 years, and 3.1% older than 50 years. Figure 4.1 shows the distribution of age in relation to gender in a bar chart.

![Figure 4.1.: Age Distribution in relation to Gender](image)

4.2.2.1.3. Discussion  The proportion of women was estimated to be between 25 and 50 percent. With 28.2 percent it lies within the bounds of this estimation. It was also assumed that women are significantly older than men. With an age difference of about 7.1 years, this is also proven to be correct. However, only about 29% of the participants claimed to be aged between 30 and 50, more than 11 percentage points
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less than originally predicted. This can have various reasons. Since the study has been published primarily on bulletin boards, it is possible that certain groups of people have not been reached. It is possible that younger Internet users visit these boards more frequently. In Cypra’s and Lüttmann’s studies, participants also have been noticeably younger than in the reference study of Kabel, which might indicate that online gamers in general are younger than video gamers. Young people have grown up with the Internet, so they might be more interested in online games than older gamers.

4.2.2.2. Game Habits

4.2.2.2.1. Hypothesis In his study, Cypra states that the average online gamer plays 24.6 hours per week, with the median being at 20 hours. He also categorizes three groups of game habits: normal-, frequent- and hardcore-gamers. The first group plays less than 30 hours per week, which is true for about 65 percent of all gamers. While frequent-gamers play between 30 and 60 hours per week (30 percent), hardcore gamers play even more than 60 hours per week (5 percent). The game habits of browser game players should be similar to the game habits of other online gamers.

<table>
<thead>
<tr>
<th>hours per week</th>
<th>percentage</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>67.9%</td>
<td>1,187</td>
</tr>
<tr>
<td>30-59</td>
<td>24.7%</td>
<td>432</td>
</tr>
<tr>
<td>&gt;59</td>
<td>7.3%</td>
<td>128</td>
</tr>
</tbody>
</table>

Table 4.3.: Game Habits of Browser Game Players

4.2.2.2.2. Result The general playing time of browser game players is 25.13 hours per week, with the median being 20 hours. About two third of the gamers play less than 30 hours per week, about one quarter plays between 30 and 60 hours per week. 7.3 percent claim to play more than 60 hours per week. Table 4.3 shows the exact values.

4.2.2.3. Discussion The results are as expected.
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4.2.2.3. Preferred Genres

4.2.2.3.1. Hypothesis

In reference to the gamer types some genres have been named in section 2.5, that are likely to be preferred by browser gamers. These were: Sporting Simulations, Manager Simulations, Economic Simulations, Role Play Games and Strategy Games. So these genres should be favored by players over other genres.

4.2.2.3.2. Result

The participants were allowed to give multiple answers (max. 3). At least one of 12 options had to be checked.

<table>
<thead>
<tr>
<th>genre</th>
<th>percentage</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adventure</td>
<td>5.2%</td>
<td>196</td>
</tr>
<tr>
<td>Action</td>
<td>2.1%</td>
<td>80</td>
</tr>
<tr>
<td>Shooter</td>
<td>0.7%</td>
<td>28</td>
</tr>
<tr>
<td>Puzzles</td>
<td>5.9%</td>
<td>224</td>
</tr>
<tr>
<td>Jump &amp; Run</td>
<td>1.0%</td>
<td>39</td>
</tr>
<tr>
<td>(Sports) Manager</td>
<td>12.5%</td>
<td>473</td>
</tr>
<tr>
<td>Role Playing Games</td>
<td>13.6%</td>
<td>511</td>
</tr>
<tr>
<td>Sports</td>
<td>1.8%</td>
<td>68</td>
</tr>
<tr>
<td>Simulations (Flight...)</td>
<td>5.3%</td>
<td>201</td>
</tr>
<tr>
<td>Strategy</td>
<td>20.9%</td>
<td>786</td>
</tr>
<tr>
<td>Economic Simulations</td>
<td>30.4%</td>
<td>1,146</td>
</tr>
<tr>
<td>none of them</td>
<td>0.5%</td>
<td>17</td>
</tr>
<tr>
<td>total</td>
<td>100.0%</td>
<td>3,769</td>
</tr>
</tbody>
</table>

Table 4.4.: Preferred Browser Game Genres

4.2.2.3.3. Discussion

Four out of five genres are favored as predicted. Manager Simulations, Economic Simulations, Role Play Games and Strategy Games together are preferred by 77.4 percent of the players. In contrast, Sporting Simulations are almost of no interest to browser game players. This might be a direct result of technical limitations, which apply when sports games are being developed for web browsers. It is possible, that games like EURO Kicker (see section 2.4.5) are too new to be known by a broader range of users. Another possibility is, that Sporting Simulations are not interesting at all to the tested group, since only 4.3 percent named Sporting Simulations as preferred genre for video games. While in the category of video games, Role Playing Games and Strategy Games are of equal interest to players, they are much less interested
in playing Economic Simulations as video games (see table 4.5). This might indicate that players prefer to trade with human opponents instead of a computer. Economic systems might be perceived as being much more realistic when they are influenced by thousands of players.

### 4.2.2.4. Game Elements

#### 4.2.2.4.1. Hypothesis

As is known from chapter 2, people often play online games for the sake of playing with and against others. That is why we should expect cooperative and competitive elements to be listed especially frequently. Although this contradicts the requirement for Sensory Gratification, multimedia components will be less important, due to the technical limitations of browser games. High transmission rates will also be very important, since long response times have a dramatic impact on user experience.

#### 4.2.2.4.2. Result

The participants were allowed to give multiple answers (max. 3). At least one of 22 options had to be checked. Results are shown in table 4.6. Percentage values refer to the number of participants. The free-text option was used by about 10 percent of the participants, most participants however using this option to justify their answer, rather than to make suggestions, which is why this text field has not been

<table>
<thead>
<tr>
<th>genre</th>
<th>percentage</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adventure</td>
<td>8.4%</td>
<td>385</td>
</tr>
<tr>
<td>Action</td>
<td>6.1%</td>
<td>278</td>
</tr>
<tr>
<td>Shooter</td>
<td>7.5%</td>
<td>342</td>
</tr>
<tr>
<td>Puzzles</td>
<td>7.6%</td>
<td>347</td>
</tr>
<tr>
<td>Jump &amp; Run</td>
<td>3.6%</td>
<td>163</td>
</tr>
<tr>
<td>(Sports) Manager</td>
<td>8.0%</td>
<td>369</td>
</tr>
<tr>
<td>Role Playing Games</td>
<td>13.9%</td>
<td>639</td>
</tr>
<tr>
<td>Sports</td>
<td>4.3%</td>
<td>199</td>
</tr>
<tr>
<td>Simulations (Flight...)</td>
<td>4.8%</td>
<td>219</td>
</tr>
<tr>
<td>Strategy</td>
<td>19.7%</td>
<td>905</td>
</tr>
<tr>
<td>Economic Simulations</td>
<td>15.1%</td>
<td>695</td>
</tr>
<tr>
<td>none of them</td>
<td>1.0%</td>
<td>48</td>
</tr>
<tr>
<td>total</td>
<td>100.0%</td>
<td>4,588</td>
</tr>
</tbody>
</table>

Table 4.5.: Preferred Video Game Genres
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evaluated in this study. 1,682 participants answered this part of the survey.

<table>
<thead>
<tr>
<th>element</th>
<th>must have</th>
<th>less important</th>
</tr>
</thead>
<tbody>
<tr>
<td>high transmission speed</td>
<td>53.4%</td>
<td>2.9%</td>
</tr>
<tr>
<td>extensive graphics</td>
<td>9.7%</td>
<td>43.9%</td>
</tr>
<tr>
<td>few graphics</td>
<td>0.8%</td>
<td>9.8%</td>
</tr>
<tr>
<td>tutorial</td>
<td>12.5%</td>
<td>10.5%</td>
</tr>
<tr>
<td>ingame help</td>
<td>5.5%</td>
<td>4.7%</td>
</tr>
<tr>
<td>forum and chat</td>
<td>15.4%</td>
<td>9.1%</td>
</tr>
<tr>
<td>free game</td>
<td>58.7%</td>
<td>2.6%</td>
</tr>
<tr>
<td>accessibility</td>
<td>1.8%</td>
<td>4.8%</td>
</tr>
<tr>
<td>no use of JavaScript</td>
<td>1.4%</td>
<td>9.0%</td>
</tr>
<tr>
<td>no use of Flash</td>
<td>2.6%</td>
<td>11.2%</td>
</tr>
<tr>
<td>lots of quests</td>
<td>18.5%</td>
<td>4.4%</td>
</tr>
<tr>
<td>confirmation dialogs</td>
<td>1.1%</td>
<td>32.3%</td>
</tr>
<tr>
<td>profound story</td>
<td>29.5%</td>
<td>2.9%</td>
</tr>
<tr>
<td>simple game</td>
<td>4.2%</td>
<td>14.8%</td>
</tr>
<tr>
<td>long game turns</td>
<td>9.0%</td>
<td>9.5%</td>
</tr>
<tr>
<td>short game turns</td>
<td>1.7%</td>
<td>10.8%</td>
</tr>
<tr>
<td>guilds / clans / alliances</td>
<td>14.3%</td>
<td>12.6%</td>
</tr>
<tr>
<td>individual strategies</td>
<td>27.1%</td>
<td>0.8%</td>
</tr>
<tr>
<td>individual user interface</td>
<td>2.1%</td>
<td>23.4%</td>
</tr>
<tr>
<td>self-explaining interface</td>
<td>15.7%</td>
<td>2.5%</td>
</tr>
<tr>
<td>multimedia components</td>
<td>1.0%</td>
<td>46.1%</td>
</tr>
<tr>
<td>rankings</td>
<td>9.6%</td>
<td>12.7%</td>
</tr>
<tr>
<td>total</td>
<td>295.8%</td>
<td>281.0%</td>
</tr>
</tbody>
</table>

Table 4.6.: Game Elements

4.2.2.4.3. Discussion  More than 53 percent of the participants regard transmission speed as a crucial game element, outnumbered only by the demand for a free game. This might be the result of an “everything on the Internet is for free-mentality”, which is the result of the first years of the Internet, when content providers lived on advertisements. After the burst of the dot-com bubble in 2001\(^3\), content providers had to rethink their strategy.

Surprisingly, on ranks three, four and five, players demanded game elements, which can be summarized as game depth. This is a strong reference to the motivation Fantasy /

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Exploration, which has been defined in section 2.1.3.1. The players want to leave the stress and strain of everyday life behind, by actively interacting with a game. They want to be participant, not spectator, so they prefer game elements which support this motivation. Players prefer to find their own way in a game, they do not want to read manuals and long tutorials explaining how to play a game, but prefer a self-explaining interface. This was defined in section 2.7.2.4 and has been supported by this ranking. Participants demand a self-explaining user interface on rank 6. Only 15.4 percent of the participants are looking for a forum or chat. 14.3 percent want classic multiplayer features. No more than one out of ten participants is interested in rankings. Since browser games are classic massively multiplayer games, this result is very surprising.

As predicted, multimedia components as well as bandwidth-consuming extensive graphics are named as least important features.

4.2.2.5. Icons

4.2.2.5.1. Hypothesis Utilizing logical constraints and a good mapping of controls and their underlying effects, helps support usability. If users can determine in advance what the effect of clicking a button will be, both possible confusion and frustration can be avoided. In the following, six different icons, four from current games, two from KC, will be examined. Participants were asked to evaluate the presented icon in five categories and identify the corresponding game element. It is likely that an icon with a good mapping will be categorized as being pleasant, attractive and simple. Persons who know the game the icon is taken from, are more likely to rate an icon better than people who don’t know that game at all, as they have become used to the icon and its meaning. Please refer to appendix A for the icons.

4.2.2.5.2. Result Icon one (Kapilands, Construction Menu) has been evaluated by 1,636 participants, icon two (KC, Bank Menu) by 1,627 participants, icon three (KC, Construction Menu) by 1,612 participants, icon four (Kapilands, Selling Booth Menu) by 1,604 participants, icon five (Kapi Regnum, Construction Menu) by 1,599 participants and icon six (Kapi Regnum, Market Menu) by 1,591 participants. The overall ratings are shown in table 4.7. In table 4.9 only ratings by participants who know the corresponding game are shown. Ratings which outnumber other ratings in the corresponding
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group by at least ten percentage points and those that are higher than 50 percent are emphasized. Deviations of the sum 100% are a result of the statement “I don’t know”. 1,261 participants claimed to know the game Kapilands and 974 participants claimed to know the game Kapi Regnum.

<table>
<thead>
<tr>
<th>icon #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>repulsive</td>
<td>14.2</td>
<td>4.9</td>
<td>13.7</td>
<td>24.8</td>
<td>31.1</td>
<td>46.3%</td>
</tr>
<tr>
<td>attractive</td>
<td>37.3</td>
<td>75.7%</td>
<td>52.4%</td>
<td>30.8</td>
<td>26.1</td>
<td>12.7%</td>
</tr>
<tr>
<td>neither</td>
<td>41.7%</td>
<td>16.2%</td>
<td>29.6%</td>
<td>39.2%</td>
<td>35.3%</td>
<td>26.6%</td>
</tr>
<tr>
<td>ornate</td>
<td>7.9%</td>
<td>21.2%</td>
<td>42.8%</td>
<td>3.9%</td>
<td>7.1%</td>
<td>11.8%</td>
</tr>
<tr>
<td>minimalistic</td>
<td>45.3%</td>
<td>15.9%</td>
<td>10.4%</td>
<td>76.1%</td>
<td>54.3%</td>
<td>48.5%</td>
</tr>
<tr>
<td>neither</td>
<td>39.9%</td>
<td>57.3%</td>
<td>41.9%</td>
<td>15.5%</td>
<td>29.1%</td>
<td>23.6%</td>
</tr>
<tr>
<td>complex</td>
<td>10.3%</td>
<td>36.7%</td>
<td>67.5%</td>
<td>4.6%</td>
<td>16.4%</td>
<td>13.7%</td>
</tr>
<tr>
<td>simple</td>
<td>77.0%</td>
<td>48.3%</td>
<td>19.0%</td>
<td>84.4%</td>
<td>60.4%</td>
<td>52.0%</td>
</tr>
<tr>
<td>neither</td>
<td>9.5%</td>
<td>12.6%</td>
<td>10.7%</td>
<td>7.5%</td>
<td>16.7%</td>
<td>17.9%</td>
</tr>
<tr>
<td>pleasant</td>
<td>44.5%</td>
<td>72.7%</td>
<td>49.2%</td>
<td>33.9%</td>
<td>28.0%</td>
<td>13.9%</td>
</tr>
<tr>
<td>unpleasant</td>
<td>18.3%</td>
<td>8.4%</td>
<td>21.2%</td>
<td>31.2%</td>
<td>37.9%</td>
<td>50.5%</td>
</tr>
<tr>
<td>neither</td>
<td>31.3%</td>
<td>16.3%</td>
<td>25.9%</td>
<td>29.9%</td>
<td>27.2%</td>
<td>22.8%</td>
</tr>
<tr>
<td>objective</td>
<td>45.1%</td>
<td>39.9%</td>
<td>23.3%</td>
<td>55.7%</td>
<td>50.4%</td>
<td>34.4%</td>
</tr>
<tr>
<td>playful</td>
<td>29.2%</td>
<td>24.6%</td>
<td>41.2%</td>
<td>16.2%</td>
<td>11.4%</td>
<td>15.8%</td>
</tr>
<tr>
<td>neither</td>
<td>21.0%</td>
<td>30.9%</td>
<td>30.8%</td>
<td>21.7%</td>
<td>29.6%</td>
<td>31.0%</td>
</tr>
</tbody>
</table>

Table 4.7.: Evaluation of Game Icons: Overall Values

Overall, participants related the icons to the following actions:

<table>
<thead>
<tr>
<th>icon #</th>
<th>menu</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction Menu</td>
<td>92.8%</td>
</tr>
<tr>
<td>2</td>
<td>Bank Menu</td>
<td>91.8%</td>
</tr>
<tr>
<td>3</td>
<td>Construction Menu</td>
<td>90.0%</td>
</tr>
<tr>
<td>4</td>
<td>Market Menu</td>
<td>85.4%</td>
</tr>
<tr>
<td>5</td>
<td>“do not know”</td>
<td>38.6%</td>
</tr>
<tr>
<td>5</td>
<td>Bank Menu</td>
<td>15.8%</td>
</tr>
<tr>
<td>5</td>
<td>Alliance Menu</td>
<td>12.8%</td>
</tr>
<tr>
<td>6</td>
<td>“do not know”</td>
<td>57.1%</td>
</tr>
<tr>
<td>6</td>
<td>Bank Menu</td>
<td>19.7%</td>
</tr>
</tbody>
</table>

Table 4.8.: Assumed action: Overall Values

Participants knowing the corresponding game related the icons to the following actions:
4.3.5.3. Discussion  The overall ranking for Kapilands icons (icon 1, icon 4) is nearly identical for both icons. The majority of participants name them to be minimalistic, simple, pleasant and objective. For both icons a majority could not decide whether the icons are repulsive or attractive. More than 85 percent of the participants were able to determine the associated menu. The overall ranking for Kapi Regnum (icons 5 and 6) shows a different image. Participants also name these icons to be simple and minimalist, but they also clearly regard them as repulsive and unpleasant. The mapping of icon and menu was unsuccessful as well. A majority of participants was unable to determine the associated menu both icons referred to. Less than 10 percent of the participants were able to determine the corresponding menu. Interestingly, even the participants...
who claimed to know the game failed to name the correct game menu, although both icons can be found on every page of the game in the main menu. Furthermore, 21 percent of the Kapi Regnum players identified the last icon as bank menu, when a bank does not even exist in the game. The icons of KC (icon 2, icon 3) are named to be attractive and pleasant. The icons are evaluated oppositional for the item pairs complex / simple and objective / playful.

In the group of players positive items are rated more often, while the number of undecided participants decreases. Negative items are not affected at all. This supports the hypothesis that players get attuned to game icons. Kapi Regnum icons, which have not been assigned to the correct game menu, are regarded as repulsive and unpleasant, while Kapilands icons, which were identified correctly, are regarded as attractive and pleasant. This also underlines this section's hypothesis. It is difficult to tell why even Kapi Regnum players failed to identify the icons. It is possible, that they are blinded by routine, since they use these icons on a daily basis. Maybe they orient themselves by the textual menu links, instead of the icons when navigating through the game. This needs to be studied in detail.

4.2.2.6. Interfaces

4.2.2.6.1. Hypothesis  Participants of the study were asked to evaluate nine screenshots of the interfaces of different browser and video games. The evaluation results of four of these screenshots will be examined in this section. KC is defined as city building simulation with strategic and economic elements. The results of KC will be compared with an economic simulation (Kapilands), a strategy and war game (Travian) and a classic city building simulation (Sim City 4).

In earlier chapters we have learned that people do not want to have to deal with unnecessary information, because it is time-consuming and involves mental effort. The less information is on the screen, the more satisfied users are. We have also learned that interfaces should be designed as self-explanatory as possible, since users do not want to read instructions and manuals. Hence, interfaces with less text and icons will be regarded as easy to read, tidy, not confusing or attractive. On the other hand, interfaces with a lot of text and different icons will be rated as being complex, confusing, cluttered or hard to read. Persons who know the game are more likely to give the interface a
better rating than people who don’t know that game at all; as with icons, they have become attuned to the interface. Please refer to appendix A to review the screenshots.

4.2.2.6.2. Result Interface one (Kapilands) has been evaluated by 1,547 participants, interface two (Travian) by 1,431 participants, interface three (KC) by 1,456 participants and interface four (Sim City) by 1,427 participants. The overall ratings are shown in table 4.11. The table also shows ratings by participants who know the corresponding game. Ratings which outnumber other ratings in the corresponding group by at least ten percentage points and those that are higher than 50 percent are emphasized. Deviations of the sum 100% are a result of the statement “I don’t know”. 1,189 participants claimed to know the game Kapilands and 727 participants claimed to know the game Travian.

4.2.2.6.3. Discussion As it was the case with the icons, participants who already know a game rated the positive items higher, while the number of undecided participants was almost the same. This time, negative items are also affected. They often decrease by about the same amount as the positive items increase. For example, while the item clear increases by 8.9 percentage points, the opposite item unclear decreases by 9.8 percentage points, when only participants who know the game are considered.

Kapilands is a game with many different icons. The screenshot shows no less than 30 icons. It also has a lot of text, the fax. According to the hypothesis, this game should be evaluated as being complex, confusing or cluttered. All three items are named by at least 40% of overall participants. On the other hand, Travian has 5 icons only. Text is sparsely used to indicate the current supply, some links, the city name or information about ongoing construction of buildings. Hence it is expected that participants will consider the interface to be not confusing, attractive or tidy. Again this was confirmed by at least 40% of overall participants. It is noticeable that Travian is the only game which has mostly been regarded as looking playful. This might be the result of the game’s cartoon-like style.
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### Table 4.11: Evaluation of Interfaces

<table>
<thead>
<tr>
<th></th>
<th>Kapilands all players</th>
<th>Travian all players</th>
<th>KC all players</th>
<th>Sim City 4 all players</th>
</tr>
</thead>
<tbody>
<tr>
<td>tidy</td>
<td>45.2%</td>
<td>61.0%</td>
<td>70.7%</td>
<td>61.8%</td>
</tr>
<tr>
<td>cluttered</td>
<td>44.5%</td>
<td>69.1%</td>
<td>14.2%</td>
<td>20.2%</td>
</tr>
<tr>
<td>neither</td>
<td>8.9%</td>
<td>9.8%</td>
<td>10.4%</td>
<td>12.5%</td>
</tr>
<tr>
<td>confusing</td>
<td>41.1%</td>
<td>29.7%</td>
<td>24.2%</td>
<td>37.4%</td>
</tr>
<tr>
<td>clear</td>
<td>31.4%</td>
<td>41.0%</td>
<td>47.2%</td>
<td>38.8%</td>
</tr>
<tr>
<td>neither</td>
<td>14.0%</td>
<td>22.6%</td>
<td>23.3%</td>
<td>18.0%</td>
</tr>
<tr>
<td>repulsive</td>
<td>25.3%</td>
<td>28.1%</td>
<td>23.9%</td>
<td>16.1%</td>
</tr>
<tr>
<td>attractive</td>
<td>42.0%</td>
<td>40.8%</td>
<td>44.2%</td>
<td>55.5%</td>
</tr>
<tr>
<td>neither</td>
<td>29.8%</td>
<td>26.0%</td>
<td>26.6%</td>
<td>23.2%</td>
</tr>
<tr>
<td>ornate</td>
<td>51.6%</td>
<td>16.7%</td>
<td>18.5%</td>
<td>38.8%</td>
</tr>
<tr>
<td>minimalistic</td>
<td>14.9%</td>
<td>31.2%</td>
<td>32.8%</td>
<td>11.0%</td>
</tr>
<tr>
<td>neither</td>
<td>30.9%</td>
<td>31.2%</td>
<td>20.9%</td>
<td>9.7%</td>
</tr>
<tr>
<td>contrasty</td>
<td>39.8%</td>
<td>38.7%</td>
<td>50.5%</td>
<td>65.2%</td>
</tr>
<tr>
<td>flat</td>
<td>34.1%</td>
<td>36.1%</td>
<td>20.9%</td>
<td>9.7%</td>
</tr>
<tr>
<td>neither</td>
<td>20.7%</td>
<td>17.7%</td>
<td>21.7%</td>
<td>18.1%</td>
</tr>
<tr>
<td>easy to read</td>
<td>56.6%</td>
<td>70.4%</td>
<td>76.6%</td>
<td>57.7%</td>
</tr>
<tr>
<td>difficult</td>
<td>34.2%</td>
<td>14.0%</td>
<td>10.6%</td>
<td>25.2%</td>
</tr>
<tr>
<td>neither</td>
<td>8.2%</td>
<td>10.3%</td>
<td>8.7%</td>
<td>12.0%</td>
</tr>
<tr>
<td>clear</td>
<td>43.7%</td>
<td>59.8%</td>
<td>66.6%</td>
<td>51.6%</td>
</tr>
<tr>
<td>unclear</td>
<td>47.2%</td>
<td>25.9%</td>
<td>19.1%</td>
<td>33.6%</td>
</tr>
<tr>
<td>neither</td>
<td>7.7%</td>
<td>9.3%</td>
<td>8.8%</td>
<td>10.2%</td>
</tr>
<tr>
<td>complex</td>
<td>59.0%</td>
<td>20.1%</td>
<td>38.3%</td>
<td>75.1%</td>
</tr>
<tr>
<td>simple</td>
<td>28.9%</td>
<td>25.9%</td>
<td>41.1%</td>
<td>11.7%</td>
</tr>
<tr>
<td>neither</td>
<td>10.4%</td>
<td>11.9%</td>
<td>14.7%</td>
<td>8.1%</td>
</tr>
<tr>
<td>pleasant</td>
<td>43.0%</td>
<td>46.4%</td>
<td>48.9%</td>
<td>57.7%</td>
</tr>
<tr>
<td>unpleasant</td>
<td>36.3%</td>
<td>29.8%</td>
<td>26.8%</td>
<td>11.7%</td>
</tr>
<tr>
<td>neither</td>
<td>18.7%</td>
<td>18.6%</td>
<td>19.8%</td>
<td>8.1%</td>
</tr>
<tr>
<td>objective</td>
<td>33.5%</td>
<td>30.6%</td>
<td>28.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>playful</td>
<td>32.8%</td>
<td>51.9%</td>
<td>24.0%</td>
<td>38.8%</td>
</tr>
<tr>
<td>neither</td>
<td>29.4%</td>
<td>12.5%</td>
<td>25.6%</td>
<td>27.8%</td>
</tr>
</tbody>
</table>

Table 4.11: Evaluation of Interfaces
4. Empirical Study

4.2.3. Discussion

The previous study offers more than one key message. Browser game players seem to be younger than video game players. The majority of browser game players spends less than 30 hours per week playing games and prefers games with a great game depth. Players love Economic and Manager Simulations as well as Strategy Games and Role Play Games. Action games are of no interest to them.

Having been attuned to a game leads players to have a more positive attitude towards the game. So it is important to pick up people and guide them through the first critical days, thus increasing their willingness to stay in the game for a longer period of time. Once the first hurdles are taken, players might be offered access to more complex features. To support that, a good mapping from real world to game world is important. As the last part of the study showed, less is often more.

4.3. Experiment

According to Nielsen, user testing with real users is the most fundamental usability method. It is essential, since it provides direct information about how people use computers and what their exact problems are with the concrete interface. [Nie06] The prototype of KC will be tested with real users and the results and implications will be described.

4.3.1. Method

4.3.1.1. Participants

This experiment was conducted in May 2008. Two subjects were chosen, both male and 26 years old. Both had no experience in playing browser games, but were used to playing classic video games. The experiment took place at the participants’ homes, using their own computers. While five subjects are enough to determine at least 80% of all usability
4. Empirical Study

problems according Nielsen, the possible test cases of the early prototype of KC were very limited, so that no more than two subjects could be tested.

4.3.1.2. Material

The experiment was conducted with a working partial system of KC. Not all functions are implemented in such a prototype. The first task was to find the City Hall on the game map. The City Hall was the only building on the map. At the beginning, subjects had to scroll the map to find the building. The second task was more complex. Subjects were asked to construct a residential building and to satisfy the virtual inhabitants, so their satisfaction indicator would at least be colored in green. Construction of a new building, as well as any other effect of an action, took place immediately, there was no active time delay. To fulfill this task, subjects had to find out how to construct a building, how to identify the needs of the virtual inhabitants and how to satisfy them. This objective required to construct a bakery and to buy water from the market. It was also required to lower taxes at least about 2 percentage points. The help system was not functional.

4.3.1.3. Procedure

The experiment was an inductive test. With inductive tests, prototypes are analyzed and flaws are uncovered, suggestions for improvement and design are gained. Both subjects were tested individually. One experimental session took about fifteen minutes. Each session had two tasks. First, subjects were instructed with one task. After passing the first task, they were instructed with the second task. While conducting a task, subjects were asked to verbalize their thoughts, which were digitally recorded.

4.3.2. Results

Both subjects successfully conducted both tasks. Subject A immediately tried to drag the map around. After recognizing that the mini map has changed its state after the first move of the map, the subject noticed a yellow spot on the mini map and clicked it, which
completed the first task. Subject B tried to scroll the map by using the browser scroll bars. The subject was confused that this had no effect on the map. After a while, the subject tried to drag the map. Once the subject recognized that the mini map changes its state when the main map is being dragged, the subject clicked the yellow spot on the mini map. The subject expressed his astonishment that such a dragging technology was realizable with a web browser.

Both subjects began the second task with opening the construction menu. Both immediately recognized the residential buildings and constructed such a building on the map. Both subjects clicked on the building after it was constructed. While subject B immediately lowered the taxes, subject A first realized that food and water are missing. The subject opened the construction menu again and built a bakery. Then the subject searched the construction menu for a waterworks. When realizing that there no waterworks was available, the subject opened the market menu and bought enough water. Afterwards, the subject lowered the taxes, which completed the task. After realizing that lower taxes are not enough to fulfill the task, subject B started constructing and buying the same way as subject A did.

4.3.3. Discussion

Both subjects were able to solve the tasks within a short period of time without additional help. The handling of the map by subject B revealed a design problem. Dragging techniques are not yet very common on web pages. Hence, a less experienced user might not recognize that the map can be dragged. This has a major impact on the interface design. An additional navigational control will be implemented in the next version of the prototype, which allows users to move the map acre by acre by clicking the corresponding arrow buttons on the control.

In an interview after the test, both subjects mentioned that the details window, which is shown permanently, distrubs the view on the map. This is another result of the experiment. The details window will be removed. With the redesign required for the navigational element, a semi-transparent bar on the bottom of the game map will be implemented, which then will hold the information of the details-window.
5. Final Discussion

When regarding games, usability and gameplay must be seen as a unit. A game designer is always more or less a usability engineer, too. Browser games have special requirements on game designers, such as multiplayer elements, as well as technical limitations. Browser game players are often less motivated when exploring a new game for the first time. In contrast to classic video games, players often don’t arrive with the intention of playing a specific game, they just happened to arrive on this website. It has been shown that users, who have never seen a specific interface before, generally have a lower opinion of that interface. It is likely that both effects, a lower opinion as well as a lower motivation, intensify one another. So the game designer has to design the game so that it neither asks too much of beginners, nor underchallenges experienced players. There are various possibilities on how this can achieved. Personally, I think, the best way is to reduce complexity for beginners. Removing each game element a new player has no use for in early stages of the game, reduces complexity and makes the interface appear tidy, less confusing and more pleasant. It has been shown that the perception of interfaces can be influenced positively if the content can be mapped to a real world object.

Achieving to “pick up” players when they enter the game for the first time, and guide them through the game world, and to enhance their interest and motivation for the game so that they will return to the game, is the Holy Grail of game design. Only players who play a browser game on a regular basis will be willing to pay a regular fee for using the normally free game. Only then the browser game companies’ efforts will pay off.

A good gameplay and a good usability will, quite literally, determine victory or defeat.
A. The Questionnaire

The following pages show a print out of the original questionnaire, as it was presented to the survey’s participants. The options of the combo boxes are as follows:
### A. The Questionnaire

**Form 1: About you**

<table>
<thead>
<tr>
<th>Item</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>gender</td>
<td>male, female</td>
</tr>
<tr>
<td>native country</td>
<td>list of all countries worldwide</td>
</tr>
<tr>
<td>school education</td>
<td>Primary School (not completed (yet)), Primary School (successfully completed), Junior High (not completed (yet)), Junior High (successfully completed), Senior High (not completed (yet)), Senior High (successfully completed), College (not completed (yet)), College (successfully completed), other, not applicable</td>
</tr>
<tr>
<td>your profession</td>
<td>Student, House Wife / House Husband, Unemployed, Office-Employee, Worker, Self-Employed, Freelancer, Civil Servant, part-time employee, not applicable</td>
</tr>
<tr>
<td>How long have you been playing video games?</td>
<td>I don’t play these kind of games, less than one year, one to two years, two to five years, more than five years, not applicable</td>
</tr>
<tr>
<td>How long have you been playing browser games?</td>
<td>I don’t play these kind of games, less than one year, one to two years, two to five years, more than five years, not applicable</td>
</tr>
<tr>
<td>computer skills</td>
<td>Beginner without basic knowledge, Beginner with basic knowledge, Comfortable using standard applications, Advanced user, professional user, not applicable</td>
</tr>
</tbody>
</table>

Table A.1.: Combo Box Options Form 1
## Form 2: computer equipment

<table>
<thead>
<tr>
<th>item</th>
<th>options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which Operation System do you use?</td>
<td>Windows 98&lt;br&gt;Windows 2000&lt;br&gt;Windows XP&lt;br&gt;Windows Vista&lt;br&gt;Linux&lt;br&gt;MacOS X&lt;br&gt;other&lt;br&gt;I don’t know</td>
</tr>
<tr>
<td>Which is your favorite browser?</td>
<td>Firefox 1.5x&lt;br&gt;Firefox 2.x&lt;br&gt;Internet Explorer 6.x&lt;br&gt;Internet Explorer 7.x&lt;br&gt;Safari&lt;br&gt;Opera 8.x&lt;br&gt;Opera 9.x&lt;br&gt;Konqueror&lt;br&gt;other&lt;br&gt;I don’t know</td>
</tr>
<tr>
<td>Do you allow JavaScript in your browser?</td>
<td>yes&lt;br&gt;no&lt;br&gt;I don’t know</td>
</tr>
<tr>
<td>How fast is your internet connection?</td>
<td>less than 1 MBit&lt;br&gt;1 Mbit&lt;br&gt;2 Mbit&lt;br&gt;6 Mbit&lt;br&gt;16 Mbit&lt;br&gt;faster than 16 MBit&lt;br&gt;I don’t know</td>
</tr>
<tr>
<td>Do you have a flat rate connection?</td>
<td>yes&lt;br&gt;no&lt;br&gt;I don’t know</td>
</tr>
</tbody>
</table>

Table A.2.: Combo Box Options Form 2, 1 / 2
## A. The Questionnaire

### Form 2: computer equipment

<table>
<thead>
<tr>
<th>item</th>
<th>options</th>
</tr>
</thead>
<tbody>
<tr>
<td>How fast is the CPU of your computer?</td>
<td>less than 1 Ghz</td>
</tr>
<tr>
<td></td>
<td>1 to 2 Ghz</td>
</tr>
<tr>
<td></td>
<td>more than 2 Ghz</td>
</tr>
<tr>
<td></td>
<td>I don’t know</td>
</tr>
<tr>
<td>How many cores does your CPU have?</td>
<td>Single Core (PCs older than two years)</td>
</tr>
<tr>
<td></td>
<td>Dual Core</td>
</tr>
<tr>
<td></td>
<td>Quad Core</td>
</tr>
<tr>
<td></td>
<td>I don’t know</td>
</tr>
<tr>
<td>How much memory does your computer have?</td>
<td>&lt; 512 MB</td>
</tr>
<tr>
<td></td>
<td>512 MB - 1024 MB</td>
</tr>
<tr>
<td></td>
<td>1 GB - 2 GB</td>
</tr>
<tr>
<td></td>
<td>&gt; 2 GB</td>
</tr>
<tr>
<td></td>
<td>I don’t know</td>
</tr>
<tr>
<td>What is the size of your monitor?</td>
<td>&lt; 13 Inch</td>
</tr>
<tr>
<td></td>
<td>13 Inch</td>
</tr>
<tr>
<td></td>
<td>15 Inch</td>
</tr>
<tr>
<td></td>
<td>17 Inch</td>
</tr>
<tr>
<td></td>
<td>19 Inch</td>
</tr>
<tr>
<td></td>
<td>22 Inch</td>
</tr>
<tr>
<td></td>
<td>&gt; 22 Inch</td>
</tr>
<tr>
<td></td>
<td>I don’t know</td>
</tr>
<tr>
<td>Which resolution do you use?</td>
<td>&lt; 1024*768</td>
</tr>
<tr>
<td></td>
<td>1024*768</td>
</tr>
<tr>
<td></td>
<td>1280*1024</td>
</tr>
<tr>
<td></td>
<td>1600*1200</td>
</tr>
<tr>
<td></td>
<td>1600*1050</td>
</tr>
<tr>
<td></td>
<td>&gt; 1600*1050</td>
</tr>
<tr>
<td></td>
<td>I don’t know</td>
</tr>
</tbody>
</table>

Table A.3.: Combo Box Options Form 2, 2 / 2
### A. The Questionnaire

#### Forms 5 - 10: Icons

<table>
<thead>
<tr>
<th>item</th>
<th>options</th>
</tr>
</thead>
<tbody>
<tr>
<td>This icon represents the ... menu</td>
<td>Alliance/Clan, Bank, Construction, Research, Help, Inventory, Market, Statistics, Military, Newspaper, I don’t know</td>
</tr>
</tbody>
</table>

**Table A.4.: Combo Box Options Forms 5 - 10**

#### Form 11: Construction Menu

<table>
<thead>
<tr>
<th>item</th>
<th>options</th>
</tr>
</thead>
<tbody>
<tr>
<td>guess which specific type of buildings this icons stand for</td>
<td>Mining (e.g. Iron mine), Education (e.g. University), Research (e.g. Research Centre), public health (e.g. Hospital), Industry (e.g. Chemical Plant), Infrastructure (e.g. Water Supply), Cultural (e.g. Theatre), Sports (e.g. Soccer Stadium), Commerce (e.g. Toy Store), Living (e.g. Villa), I don’t know</td>
</tr>
</tbody>
</table>

**Table A.5.: Combo Box Options Form 11**
Usability in Browser Games

About you

First of all we like to know something about you. How old are you, what is your experience in gaming? All of these take influence on the individual perception of games. Don't worry, your data will be kept in confidence and will be stored in a manner which allows no inference about you. More details about how privacy is guaranteed you will find behind the link “about privacy” on bottom of this page.

Please enter your age

[ ] years

gender

[ ]

native country

[ ]

school education

[ ]

your profession

[ ]

How long have you been playing computer-/video games?

[ ]

How long have you been playing browser games?

[ ]

computer skills?

[ ]

Where do you play browser games?

Please select no more than three options!

[ ]

at home

[ ]

at work

[ ]

at school

[ ]

at friends

[ ]

at hotels, on vacations

[ ]

I don't play these kind of games

[ ]

not applicable

[ ]

How much time do you spend
playing computer-/video games per week?

[ ]

How much time do you spend
playing browser games per week?

[ ]

What are your favorite computer / video game genres?

[ ]

Adventure

[ ]

Action

[ ]

Shooter

[ ]

Brain Teasers & Puzzles

[ ]

Jump & Run

[ ]

(Sports) Manager

[ ]

Role Playing Games

[ ]

Sports

[ ]

Simulations (Flight-, Space-...)

[ ]

Strategy

[ ]

Economy Simulation

[ ]

none of them

[ ]

What are your favorite browser game genres?

[ ]

Adventure

[ ]

Action

[ ]

Shooter
Brain Teasers & Puzzles
Jump & Run
(Sports) Manager
Role Playing Games
Sports
Simulations (Flight-, Space-...)
Strategy
Economy Simulation
none of them

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Usability in Browser Games

computer equipment

Now we like to know something about your computer equipment. If you have access to more than one personal computer, please answer the questions for the computer you prefer playing browser games with. Don't worry, these will be the most complicated questions of this questionnaire ;)

Which Operation System do you use?
Which is your favorite browser?
Do you allow JavaScript in your browser?
How fast is your internet connection?
Do you have a flat rate connection?
How fast is the CPU of your computer?
How many cores does your CPU have?
How much memory does your computer have?
What is the size of your monitor?
Which resolution do you use?

submit

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Marcus Schwarz (http://www.marcus-schwarz.eu)
Usability in Browser Games

most / least important features of browser games

Now we like to know which are "must have" features of browser games, and which are not so important for you. Please select no more than three options for each of the questions! If you like to give a more detailed answer, or if the features you are looking for are not listed here, you may use the textarea below.

Which three of the following are "must have"-features?

- High data transmission speed
- Extensive graphics
- Few graphics
- Tutorial
- Ingame-Help
- Forum / Chat
- free game
- Accessibility
- No use of JavaScript
- No use of Flash
- Lots of quests
- confirmation dialogs for each action
- profound story
- simple game
- Long game turns (> 12 month)
- Short game turns (< 6 month)
- Ingame organization possibilities (Alliances, Clans...)
- Individual strategies
- Individualization of the User Interface (colors, menus...)
- simple, self-explaining user interface
- multimedia components (Sound, Video, Voice)
- Rankings

Which three of the following are least important?

- High data transmission speed
- Extensive graphics
- Few graphics
- Tutorial
- Ingame-Help
- Forum / Chat
- free game
- Accessibility
- No use of JavaScript
- No use of Flash
- Lots of quests
- confirmation dialogs for each action
- profound story
- simple game
- Long game turns (> 12 month)
- Short game turns (< 6 month)
- Ingame organization possibilities (Alliances, Clans...)
Individual strategies
Individualization of the User Interface (colors, menus...)
simple, self-explaining user interface
multimedia components (Sound, Video, Voice)
Rankings
Usability in Browser Games

Known Browser Games

Now you will find a list of more or less well-known browser games. Please note for each game whether you know it or not and whether you (still) play it or not.

- Kapilands (?)
  - I know this game
  - I play this game
  - I do not know this game
  - I do not play this game anymore

- Kapi Regnum (?)
  - I know this game
  - I play this game
  - I do not know this game
  - I do not play this game anymore

- RumbleRace (?)
  - I know this game
  - I play this game
  - I do not know this game
  - I do not play this game anymore

- OGame (?)
  - I know this game
  - I play this game
  - I do not know this game
  - I do not play this game anymore

- Molehill Empire (?)
  - I know this game
  - I play this game
  - I do not know this game
  - I do not play this game anymore

- The Renaissance Kingdoms (?)
  - I know this game
  - I play this game
  - I do not know this game
  - I do not play this game anymore

- Travian (?)
  - I know this game
  - I play this game
  - I do not know this game
  - I do not play this game anymore

- Power of Politics (?)
  - I know this game
  - I play this game
  - I do not know this game
  - I do not play this game anymore

- Tribal Wars (?)
  - I know this game
  - I play this game
  - I do not know this game
Oil Imperium
- I do not play this game anymore
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

Battle Knight
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

Popomundo
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

Hattrick
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

X-Wars
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

The Guildmaster
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

Ikariam
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

Seafight
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

Mafia 1930
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

Knights Divine
- I know this game
- I play this game
- I do not know this game
- I do not play this game anymore

Gladiatus
Jennifer Government: NationStates

Do you play browser games which are not mentioned above? Then please enter them here! Please enter a couple of reasons why you enjoy playing one of the above-mentioned games!

(optional)

submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
**Usability in Browser Games**

Now we will show you some icons used in browser games. Please try to rate these icons as spontaneously as possible!

<table>
<thead>
<tr>
<th>repulsive</th>
<th>attractive</th>
<th>neither</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>complex</td>
<td>simple</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>ornate</td>
<td>minimalistic</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>pleasant</td>
<td>unpleasant</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>objective</td>
<td>playful</td>
<td>neither</td>
<td>I don't know</td>
</tr>
</tbody>
</table>

This icon represents the ... menu (2)

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Usability in Browser Games

Icons (2/6)

Now we will show you some icons used in browser games. Please try to rate these icons as spontaneously as possible!

<table>
<thead>
<tr>
<th>Ornate</th>
<th>Minimalistic</th>
<th>Neither</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Playful</td>
<td>Neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>Pleasant</td>
<td>Unpleasant</td>
<td>Neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>Repulsive</td>
<td>Attractive</td>
<td>Neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>Complex</td>
<td>Simple</td>
<td>Neither</td>
<td>I don't know</td>
</tr>
</tbody>
</table>

This icon represents the ... menu (?)  6

Submit

about privacy

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Icons (3/6)

Now we will show you some icons used in browser games. Please try to rate these icons as spontaneously as possible!

<table>
<thead>
<tr>
<th></th>
<th>objective</th>
<th>playful</th>
<th>neither</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>repulsive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>complex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pleasant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ornate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This icon represents the ... menu (?)

submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Now we will show you some icons used in browser games. Please try to rate these icons as spontaneously as possible!

complex ○ simple ○ neither ○ I don't know ○
repulsive ○ attractive ○ neither ○ I don't know ○
ornate ○ minimalist ○ neither ○ I don't know ○
pleasant ○ unpleasant ○ neither ○ I don't know ○
objective ○ playful ○ neither ○ I don't know ○

This icon represents the ... menu (?)  

Submit

about privacy
Marcus Schwarz (http://www.marcus-schwarz.eu)
Usability in Browser Games

progress: 38%

Icons (5/6)

Now we will show you some icons used in browser games. Please try to rate these icons as spontaneously as possible!

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ornate</td>
<td></td>
<td>minimalistic</td>
<td></td>
<td>neither</td>
</tr>
<tr>
<td>pleasant</td>
<td></td>
<td>unpleasant</td>
<td></td>
<td>neither</td>
</tr>
<tr>
<td>repulsive</td>
<td></td>
<td>attractive</td>
<td></td>
<td>neither</td>
</tr>
<tr>
<td>complex</td>
<td></td>
<td>simple</td>
<td></td>
<td>neither</td>
</tr>
<tr>
<td>objective</td>
<td></td>
<td>playful</td>
<td></td>
<td>neither</td>
</tr>
</tbody>
</table>

This icon represents the ... menu (2)  

submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Usability in Browser Games

Icons (6/6)

Now we will show you some icons used in browser games. Please try to rate these icons as spontaneously as possible!

- pleasant
- unpleasant
- neither
- I don't know

- objective
- playful
- neither
- I don't know

- complex
- simple
- neither
- I don't know

- repulsive
- attractive
- neither
- I don't know

- ornate
- minimalistic
- neither
- I don't know

This icon represents the ... menu (?) 6

submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Construction Menu

In many browser games one of the main tasks is the construction of buildings. Below we will present some icons from such a construction menu. Your task is to guess which specific type of buildings these icons stand for! Have a look at the icons and select the option that came to your mind at first!

submit
Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!

ornate ☐ minimalistic ☐ neither ☐ I don’t know ☐

confusing ☐ clear ☐ neither ☐ I don’t know ☐

complex ☐ simple ☐ neither ☐ I don’t know ☐

tidy ☐ cluttered ☐ neither ☐ I don’t know ☐

pleasant ☐ unpleasant ☐ neither ☐ I don’t know ☐

easy to read ☐ difficult to read ☐ neither ☐ I don’t know ☐

repulsive ☐ attractive ☐ neither ☐ I don’t know ☐

objective ☐ playful ☐ neither ☐ I don’t know ☐

clear ☐ unclear ☐ neither ☐ I don’t know ☐

contrasty ☐ flat ☐ neither ☐ I don’t know ☐
I would easily find my way around:

- definitely
- rather yes
- rather not
- absolutely not

I would play this game:

- definitely
- rather yes
- rather not
- absolutely not

This game belongs to the genre:

Submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Browser games (2/9)

Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!

- objective
- tidy
- ornate
- pleasant
- easy to read
- contrasty
- clear
- confusing
- repulsive
- complex

- playful
- cluttered
- minimalistic
- unpleasant
- difficult to read
- flat
- unclear
- clear
- attractive
- simple

- neither
- I don't know
I would easily find my way around
- definitely
- rather yes
- rather not
- absolutely not

I would play this game
- definitely
- rather yes
- rather not
- absolutely not

This game belongs to the genre

Submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!
I would easily find my way around
- definitely
- rather yes
- rather not
- absolutely not

I would play this game
- definitely
- rather yes
- rather not
- absolutely not

This game belongs to the genre

submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Usability in Browser Games

Browser games (4/9)

Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!

<table>
<thead>
<tr>
<th>objective</th>
<th>playful</th>
<th>neither</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>confusing</td>
<td>clear</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
<tr>
<td>contrasty</td>
<td>flat</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
<tr>
<td>clear</td>
<td>unclear</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
<tr>
<td>repulsive</td>
<td>attractive</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
<tr>
<td>ornate</td>
<td>minimalistic</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
<tr>
<td>pleasant</td>
<td>unpleasing</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
<tr>
<td>tidy</td>
<td>cluttered</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
<tr>
<td>complex</td>
<td>simple</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
<tr>
<td>easy to read</td>
<td>difficult to read</td>
<td>neither</td>
<td>I don’t know</td>
</tr>
</tbody>
</table>
I would easily find my way around

- definitely
- rather yes
- rather not
- absolutely not

I would play this game

- definitely
- rather yes
- rather not
- absolutely not

This game belongs to the genre

Submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!
I would easily find my way around
- definitely
- rather yes
- rather not
- absolutely not

I would play this game
- definitely
- rather yes
- rather not
- absolutely not

This game belongs to the genre

[Submit button]

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Usability in Browser Games

progress: 76%

Browser games (6/9)

Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!

<table>
<thead>
<tr>
<th>Term</th>
<th>☐ ornament</th>
<th>☐ minimalist</th>
<th>☐ neither</th>
<th>☐ I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>pleasant</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>repulsive</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>objective</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>complex</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>confusing</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>clear</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>contrasty</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>tidy</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>easy to read</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
I would easily find my way around
- definitely
- rather yes
- rather not
- absolutely not

I would play this game
- definitely
- rather yes
- rather not
- absolutely not

This game belongs to the genre

Submit

about privacy
Marcus Schwarz (http://www.marcus-schwarz.eu)
Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!

<table>
<thead>
<tr>
<th>characteristic</th>
<th>playful</th>
<th>neither</th>
<th>repulsive</th>
<th>attractive</th>
<th>neither</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>objective</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>repulsive</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>complex</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tidy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>contrasty</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>easy to read</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confusing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pleasant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ornate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>clear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I would easily find my way around
○ definitely
○ rather yes
○ rather not
○ absolutely not

I would play this game
○ definitely
○ rather yes
○ rather not
○ absolutely not

This game belongs to the genre 6

submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Usability in Browser Games

progress: 86%

Browser games (8/9)

Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!

(* please check your answers, at least one row is not filled)
I would easily find my way around
- definitely
- rather yes
- rather not
- absolutely not
(* please check your answers)

I would play this game
- definitely
- rather yes
- rather not
- absolutely not
(* please check your answers)

This game belongs to the genre
(* please check your answers)

Submit

about privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Usability in Browser Games

Browser games (9/9)

Your last task will be to rate some screenshots of games. As we did with the icons, we’d like to ask you to answer as spontaneously as possible!

<table>
<thead>
<tr>
<th>repulsive</th>
<th>attractive</th>
<th>neither</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>objective</td>
<td>playful</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>confusing</td>
<td>clear</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>easy to read</td>
<td>difficult to read</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>tidy</td>
<td>cluttered</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>clear</td>
<td>unclear</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>complex</td>
<td>simple</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>ornate</td>
<td>minimalistic</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>contrasty</td>
<td>flat</td>
<td>neither</td>
<td>I don't know</td>
</tr>
<tr>
<td>pleasant</td>
<td>unpleasant</td>
<td>neither</td>
<td>I don't know</td>
</tr>
</tbody>
</table>
I would easily find my way around

- definitely
- rather yes
- rather not
- absolutely not

I would play this game

- definitely
- rather yes
- rather not
- absolutely not

This game belongs to the genre

Submit

About privacy

Marcus Schwarz (http://www.marcus-schwarz.eu)
Thank you!

Thank you for taking part in this survey. Please finish the survey clicking the "send" button below.

If you like to enter the sweepstake (remember you can win one of five half-year premium accounts (max 20 EUR) for a browser game of your choice) please fill in your email address.
If you do not want to enter the sweepstake, please leave the address field empty an click "send".

about privacy
Marcus Schwarz (http://www.marcus-schwarz.eu)
Thank you!

Thank you for answering all of the questions in this survey :) Now that you have finished you should have some fun with your favorite browser game!

about privacy
Marcus Schwarz (http://www.marcus-schwarz.eu)
privacy statement

When you enter this site, a so called hash code (md5), containing of 32 characters, will be generated using some random values like time, browsercode etc. This randomly generated code will be used throughout the session to identify the participant. It is not possible to use this hash code to gain information about the identity of the participant. All answers to the questions in this survey will be stored in an encrypted database. The hash code will be used to map the answers to a specific data record. If the survey has been completely answered the participant may enter his email address to enter a sweepstake. This email addresses will be stored in a separate table in the encrypted database, without reference to the hash code. The hash code will be transmitted solely to assure that one cannot enter more than one email address per survey.

After the survey has been finished all hash codes will be removed from the database. After the winners have been drawn all email addresses will be removed from the database. Email addresses will not be sold or given away to third parties.

If you have further questions, please contact: datenschutz.bg2008@marcus-schwarz.eu

Marcus Schwarz (http://www.marcus-schwarz.eu)
### Forms 12-20: Screenshots

<table>
<thead>
<tr>
<th>item</th>
<th>options</th>
</tr>
</thead>
<tbody>
<tr>
<td>This game belongs to the genre</td>
<td>Adventure, Action, Shooter, Brain Teasers &amp; Puzzles, Jump &amp; Run, (Sports) Manager, Role Playing Games, Sports, Simulations (Flight-, Space-...), Strategy, Economy Simulation, none of them</td>
</tr>
</tbody>
</table>

Table A.6.: Combo Box Options Forms 12-20
Bibliography


Bibliography


<table>
<thead>
<tr>
<th>Reference</th>
<th>Author(s)</th>
<th>Title</th>
<th>Publisher</th>
<th>Year</th>
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<tr>
<td>[L07]</td>
<td>Lars Lüttermann</td>
<td>Spielergesellschaft Deutschland: Computerspiele als Spiegel gesellschaftlicher Trends am Beispiel World of Warcraft</td>
<td>Oldenburg</td>
<td>2007</td>
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<td>[Nie04]</td>
<td>Jakob Nielsen</td>
<td>The most hated advertising techniques</td>
<td></td>
<td>2004</td>
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<td>[Nor90]</td>
<td>Donald A. Norman</td>
<td>Psychology of Everyday Things</td>
<td>Basic Books</td>
<td>1990</td>
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<td>[RA03]</td>
<td>Andrew Rollings and Ernest Adams</td>
<td>Andrew Rollings and Ernest Adams on game design</td>
<td>NRG. New Riders, Indianapolis, Ind.,</td>
<td>2003</td>
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<td>[Rab07]</td>
<td>Steve Rabin</td>
<td>AI game programming wisdom</td>
<td>Charles River Media, Hingham, Mass.,</td>
<td>2007</td>
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<td>[Rhe01]</td>
<td>Howard Rheingold</td>
<td>An Interview with Don Norman</td>
<td>In Brenda Laurel, editor, The art of human–computer interface design, pages 5–10</td>
<td></td>
</tr>
</tbody>
</table>


Bibliography


Erklärung

Ich erkläre hiermit gemäß § 27 Abs. 2 APO, dass ich die vorstehende Diplomarbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe.

Unterschrift