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Sky Haven

A Location-Aware Mobile Serious Game for Encouraging Activity

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MASTER'S THESIS

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in

Media Informatics

by

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at the Vienna University of Technology

Advisor: Assoc. Prof.^{in} Dipl.-Ing.^{in} Dr.^{in} Hilda Tellioğlu

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Erklärung zur Verfassung der Arbeit

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Danksagung

An dieser Stelle möchte ich mich bei allen Menschen bedanken die Einfluss auf die Entstehung dieser Arbeit hatten und die mich dabei unterstützt haben sie zu einem guten Ende zu bringen.

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Abstract

Author: Peter Fikar

Technological advancement influences the course of our societies' development and has a heavy impact on our daily lives. Computation and industrialization provide us with the opportunity to control many aspects of our work and daily lives by just sitting in front of a computer screen, therefore a sufficient physical activity level, which is essential for our wellbeing and health, no longer portraits a necessity to maintain for many people in their daily routine. The relatively young field of research regarding digital games utilized in order to achieve *serious* effects is gaining importance in current scientific literature. Such games make use of the entertaining qualities of video games as a medium to achieve a variety of beneficial effects in users. Prevention, intervention and therapeutic aftercare are just a few fields of application within the health sector providing serious backgrounds for such games.

This work documents our experiences in designing a game to encourage physical activity on a scientific and user feedback-driven basis in our attempt to challenge sedentary habits. We look into existing installments of gamified applications, serious games and exergames, propagating exercising activity and sharing similar goals, such as an increase of physical activity level, analyzing their central themes and their development process. We combine defined goals for physical activity and participant's feedback, gathered throughout an iterative design process, into a fully functional mobile game in a serious context. The final digital prototype of this browser-based smart phone game will provide the vital basis for exploring our design decisions and evaluating their impact on the participating users. Through the applied scientific methods and the insights we aim to gain through exploring participant's expectations and experiences, we seek to identify motivational factors within our design which are possibly key to overcome personal barriers to physical activity. Furthermore we seek to encourage increased physical activity and to identify the relating aspects in participants responsible for triggering a possibly successful change from sedentary behavior to a more active lifestyle.

Kurzfassung

Author of translation: Michael Habiger / Author original text: Peter Fikar (see Abstract)

Der technische Fortschritt steht im wechselseitigem Einfluss mit der Gesellschaft und unserem Leben. Insbesondere Weiterentwicklungen in informatischen sowie industriellen Bereichen ermöglichen uns viele Tätigkeiten unseres Alltags sitzend, zum Beispiel vor einem Computer-Bildschirm, zu verrichten. Daher ist ein entsprechend hoher Grad an physischer Aktivität beziehungsweise Bewegung, welcher mit vorteilhaften Folgen für die Gesundheit und dem Wohlbefinden im Allgemeinen einhergeht, nicht mehr zwingend erforderlich. In diesem Zusammenhang erlangt das Forschungsfeld im Bereich von Videospielen mit ernstem Hintergrund (Serious Games) an wachsender Bedeutung. Unter Einbeziehung wesentlicher Eigenschaften von herkömmlichen Spielansätzen streben Serious Games darüber hinaus positive Effekte für die spielenden Personen an. In diesem Kontext finden Serious Games beispielsweise in relevanten Kernbereichen des Gesundheitswesens, im Speziellen in der medizinischen Prävention, Therapie und Nachsorge bestimmter Krankheitsbilder, Anwendung.

Die vorliegende Arbeit dokumentiert den benutzerzentrierten Design- und Entwicklungsprozess unseres Spieles, welches darauf abzielt, den Grad an körperlicher Aktivität zu steigern und gleichzeitig die Menge sitzender Tätigkeiten innerhalb des Alltags der Spielerinnen und Spieler zu verringern. Unter Berücksichtigung existierender Referenz-Systeme im Bereich von Exergames, Serious Games sowie Gamified Applikationen, welche ähnliche Absichten verfolgen, Nutzerfeedback im Rahmen wissenschaftlicher Methoden, sowie aus der Literatur abgeleiteten Empfehlungen bezüglich körperlicher Bewegung, wird in Folge ein digitaler Prototyp eines mobilen browser-basierten Spieles mit ernstem Hintergrund erstellt und beschrieben. Dieser Prototyp bietet dabei die Basis, um potentielle Barrieren im Zusammenhang körperlicher Aktivität zu identifizieren sowie motivierende Aspekte abzuleiten, welche geeignet sind, den Grad an Bewegung zu erhöhen. Dahingehend beabsichtigen wir eine erfolgreiche Verlagerung von sitzenden Tätigkeiten, hin zu einem gesteigertem Ausmaß körperlicher Bewegung unserer Probanden, welche durch unser Spiel hervorgerufen wird.

Contents

CHAPTER 1

Introduction

Author: Peter Fikar

This chapter gives a brief overview about the background our work is built upon. We explain how we plan to challenge activity-related issues in today's society. Furthermore we will introduce how our thesis is structured to represent efforts and outcomes.

1.1 Motivation

Author: Peter Fikar

Technology has become an integral part of today's society. New digital technologies bring forth opportunities for application throughout many different fields of everyday life. Unfortunately, technology is also an aspect when considering how work and spare time environments turn increasingly sedentary. Physical inactivity becomes a growing problem for people. This ultimately relates to obesity, diabetes and other follow-up diseases connected to sedentary habits and therefore become prominent issues. Many technologies are getting held accounted for when it comes to the discussion of possible reasons for the increase of inactive behavior. By sitting in front of a computer doing the daily work on the job, by sitting in the car when driving home or by letting the day come to an end at home watching movies on the couch or playing videogames, the course of the day becomes a less and less active routine for many people [21]. Digital entertainment technologies like video games have been linked to having people spend their day sitting in front of a screen [43].

Yet video games can also be used to promote physical activity if people are a willing audience for such a channel of entertainment. Motion-aware input devices for game consoles like the *Nintendo Wii* [67], *Microsoft XBOX 360* [65] and the *Sony PlayStation 3* [57] empower players to use body movement to interact with games and indicate a possible incentive for physical activity [32]. Such systems providing control for numerous game titles like *Move Fitness* [27], *Wii*

Sports [68] or *Kinect Dance Central* [63] have shown to be of interest to an increasing number of consumers of digital games worldwide.

Mobile technologies and especially smartphones further enable developers and designers to bring games into the pockets of people. Enabling designers of entertainment software to process user movement through the Global Positioning System (GPS) and giving them access to different sensor readings of compasses, accelerometers and gyroscopes, is opening a door to push design for mobile applications and games [2]. The integration of physical movement read by sensors of the smartphones of the users can be utilized to provide new exciting experiences for them to engage in fitness applications and games with or without goals other then sole entertainment. Digital systems have been designed by researches to explore the potential of games in such a context and have been developed, applied and evaluated within different fields of research, health aspects being one of many. Recent smartphone technology being available to a vast number of people provides not only a channel to reach out to those people but also to provide the computing power, integrated sensors, interaction and interface options necessary to present location-aware mobile serious games or exergames to a broad audience. This enables designers and developers to create game applications for the emerging mobile technologies market to conquer the increasing sedentary lifestyle in today's society. It enables them to reach people at home, at work or on their way around town and to present incentives through entertainment media to impact the physical activity habits of people everywhere [58, 60].

Within this work we present current issues within today's society regarding physical activity habits. We look into the role of technology in this matter and describe our approach to utilize or conquer motivators and barriers to physical activity by designing a prototype of a mobile location-aware exergame we named *Sky Haven*, and hence evaluating its potential. This browser-based smart phone game was developed on the basis of a user-centered design approach to keep up the inspiration user-driven input can provide us. This approach furthermore enables us to critically reflect upon our design decisions and provides us with the opportunity to develop a system of entertainment with a serious background on the fundament of potential user's creativity, needs and feedback. We investigate on and provide insights into the design of aspects supporting us in making such a game potentially attractive to serve an activity-related purpose. We analyze the outcome of our game prototype and draw conclusions about the potential of our installment of our game by reflecting on user feedback and the data they provided us throughout our deployed mixed methods approach. We highlight motivators and barriers in participants to engage in physical activity. Furthermore we make use of such factors for the creation of a digital entertainment environment to utilize its potential as a tool for prevention or intervention to conquer potentially negative lifestyle trends concerning physical inactivity in our contemporary society and therefore possibly increasing wellbeing.

1.2 Field of Interest

Author: Michael Habiger

Throughout the course of this work we explore how games approach motivators in the context of physical activity or sedentary behavior and how they might be able to overcome possible barriers through elements and mechanisms of game design.

The main questions we aim to investigate are the following:

- Which barriers and motivators to engage in physical activity are of relevance and can be identified in participants?
- To which extent is our game able to overcome barriers and make use of motivators?
- To which extent can our game change the attitude towards activity?
- To which extent can our game change self-perception regarding sedentary behavior?
- To which extent are group factors of importance in the context of gameplay, physical activity, barriers, motivators, the altering of self-perception and the attitude towards physical activity?
- To which extent can our game increase a person's activity level to counteract a sedentary lifestyle?

In this regard we design and implement a location-aware mobile game prototype to promote physical activity. By doing so we expect to challenge sedentary lifestyle patterns and physical inactivity, which may potentially lead to follow-up diseases. Furthermore we explore the general attitude of participants towards activity and sedentary lifestyle in order to observe possible changes in behavior induced by the game. In order to develop a design basis for our game prototype, we are taking into account the relevant aspects of informatics with a strong focus on games promoting health and wellbeing as well as social factors. Throughout the course of the development of our prototype we involve potential users in the design process. We integrate aspects based on the mentioned fields and insights acquired through user feedback into the design of elements, interactions and tasks made available to the player. Through the deployment and testing of our game we plan to explore its influence on the users in the context of self-perception, physical activity level, sedentary behavior as well as social factors of relevance.

1.3 Target Group

Author: Michael Habiger

Roger et al. [79] describe users as people who use the product primarily and point out various further definitions of the term *user*, basically including other stakeholders who do not necessarily interact with the product directly. Due to the prototypical nature of our game and the intention to examine its effects on immediate users, our target- and testing group consists of direct users only.

Our game prototype aims to motivate people aged 20 to 35 of both genders to engage in physical activity to counteract a sedentary lifestyle. Thus our target group consists of people maintaining sedentary behavior or a low level of physical activity. Since our prototype is a web-based application written for smartphones, people owning and using such devices on a frequent basis may bring more interest towards our gaming prototype. Considering the fantasy and role-playing-related elements our game will include, the users' attitude towards gaming in general and virtual gaming likewise may be of relevance as well.

Testing Group

Our testing group included 8 females and 8 males in total, aged 21 to 32. All of our participants possessed a smartphone themselves or had the possibility to borrow one easily. To determine the participants' self-perception of their grade of physical activity or sedentary behavior and attitude towards gaming we used premonitory surveys. All participants matched the predefined target group criteria. For consistency reasons the major part of our test users participated throughout the whole design process, including the background data collection, the prototype development, the field test of our game and the conclusive evaluation of the prototype. To protect anonymity of our participants, they chose nicknames, which were used throughout the course of the work and for the names of their virtual avatars in the game.

1.4 Approach

Author: Michael Habiger

We deploy qualitative methods to involve user feedback into the design process and to evaluate the effects of our game prototype. Starting to investigate on our user group we deploy qualitative interviews, surveys in form of questionnaires, and Cultural Probes. Afterwards we conduct a paper prototype test to evaluate initial game ideas and investigate factors relevant for game design, such as visualization, rules and interfaces through a group process. To iteratively develop our prototype we use Technology Probes to test important mechanics of our game and a digital diary to give the participants the option to provide us with direct feedback. Additionally we gather log data about the users' interaction with the game. After a field test of our game we deploy a focus group discussion to reflect upon the users' experiences within the field test.

Since the prototype ideally should support various kinds of smartphones and their respective operative systems, our game is implemented in HTML, CSS and Javascript. It furthermore incorporates a database necessary for logging user activity, saving character information etc.. This way we create a platform-independent web application working in all major mobile browsers. Our prototype integrates GPS tracking into gameplay, as location information is an important aspect. The game environment combines real locations with virtual elements, artifacts and tasks made available to the players. Those real environment interactions, elements and requirements have meaningful in-game representations.

The player's action and gameplay is embedded into a suitable theme and storyline. The background storyline and respective contents of the game originate from the genre of fantasy. Major gameplay elements bridge between real-world and in-game aspects including in-game representation of the user, feedback of player performance and features to promote social interaction.

1.5 About this Work

Author: Peter Fikar

This master thesis is structured into three parts, describing our efforts in answering defined research questions, listed in *1.2 - Field of Interest*. The following parts and chapters will provide the outline in which the process described above will take form.

1.5.1 Theoretical Part

Author: Peter Fikar

The theoretical part of this work is focused on gathering and highlighting established knowledge and facts and will contain a presentation of recent scientific approaches regarding games in a serious context. Furthermore we will describe the methods chosen to make use of the feedback of participants we recruited throughout the course of this work. This will make sure that we have lasting access to a source of information and feedback, backing our efforts throughout the different phases of this work. The insights gained through literature and participants' feedback will provide us with the basis on which a user-centered design approach will be set up serving as the foundation for the development of our prototype system.

Introduction

The introduction gives an overview about the motivation to deal with the topic we have chosen and relevant factors and aspects we further highlight throughout this work. We introduce why this theme is of growing relevance in today's society and how the work itself is presented to the reader.

Furthermore we present our research questions derived from our specific interest. We explain why we picked the topics, expecting the answering of our research questions possibly contributing additional scientific insights to the scientific community. We explain who the target group of our prototype design is as well as the constellation of the participants chosen to be our source for information gathered throughout the user-centered design process.

Related Work

The related work chapter introduces important terms regarding physical activity and sedentary behavior and how this potentially results in health issues within our society, opening up a vast field for approaches and applications for improving such conditions. Within the field of game-related concepts serving a serious purpose, there are various application possibilities regarding such conditions. Therefore we provide a more in-depth presentation of such serious games, exergames and gamification strategies closely related to our specific field and how these systems strive to challenge the central issues of sedentary behavior. We also introduce to the reader in which forms such games exist and how they can serve as a prolific medium beyond the more or less vague definitions of games we all subjectively possess. Furthermore we will discuss reference systems related to our field of interest sharing similar goals and approaches to counteract physical inactivity, sedentary behavior or promote physical activity. We will identify features and aspects of those systems and set them in relation to our development process.

Field of Interest

In this chapter we declare the specific interest we have in this field and the goals of this work as a whole. Furthermore we present our research questions derived from our specific interest. We explain why we picked the topics, expecting the answering of our research questions possibly contributing additional scientific insights to the scientific community.

Target Group

We explain who the target group of our prototype design is as well as the constellation of the participants chosen to be our source for information gathered throughout the user-centered design process.

Methods

In this chapter we will describe research methods relevant throughout the course of this work. We will furthermore underline their connection to the context of our thesis.

1.5.2 Practical Part

Author: Peter Fikar

The practical part of this work describes the design fundamentals, development, deployment and the redesign steps of our prototype.

Prototype

Throughout this chapter we will go into detail concerning the iterative process describing the evolution of our game prototype. Therein we make use of our applied research methods and utilize the data and information gathered to identify relevant aspects for establishing the initial design as well as for keeping an iterative user-driven process of ongoing redesign alive. With the description of the test phase and the final stage of our prototype game we finalize this chapter and the practical part of the work. Since the contained sections are of special interest we give a short overview about them in the following.

Preliminary Methods

Within this chapter we describe in detail how gathered data from participants provides us with insights and ideas, influencing the basis for creating our initial prototype concept. We will discuss and analyze Cultural Probes, Questionnaires and Interviews which were deployed preliminary to the first main prototype concept presented in the following chapter.

Paper Prototype - The Design Basis

We describe initial ideas and user feedback filtered through a paper prototype test session. The game concepts tested are used for setting up our guidelines established throughout the conduction of the methods providing the fundamental basis on which our further digital prototype development relies.

Digital Prototype - The Development Process

Following this, the iterative process of designing and redesigning our prototype is illustrated. Therein we describe the integration of ongoing user-feedback and how the prototype took shape throughout this process. The field test of the prototype is discussed as well.

Digital Prototype - The Final Iteration

The final iteration of our game prototype resembles the endpoint of our redesign efforts. The description of our prototype at this point in time is where the iterative development process comes to a halt. This resembles our final product and is therefore the foundation for the final analysis process following in the upcoming evaluation part of our work.

1.5.3 Evaluation Part

Author: Peter Fikar

This last part contains the evaluation of our work. The outcome of the development process and the final prototype installment, as well as the feedback of the applied methods considering the games' evaluation by the participants, undergo an in-depth discussion regarding our research goals and is concluded by answering the research questions within our field of interest.

Focus Group Discussion

Within this chapter we describe the data and insights gathered from participants during a focus group discussion referring to our final prototype installment and experiences from its field test. The outcome will undergo in-depth discussion and evaluation in order to provide us with insights about the degree of satisfaction in our participants and the prototypes' effects on them.

Discussion

This part of the work deals with the data gathered through the final evaluation and sets it in relation to central themes of this work. Therein we discuss the effects of our prototype in relation to the work as a whole. It furthermore positions the discussed factors in the larger scope of our field of interest and potential development possibilities in the future.

Conclusion

The conclusion contains the outcome of the discussion and is set in direct relation to our research questions. Furthermore it describes how the relevant aspects discovered answer our specific research questions, hence how the information gathered throughout the course of this work serves its purpose regarding the goals of this thesis. Finally the summary provides a review over the whole process of conducting this work, reflecting on what we have achieved and on our experiences throughout this work.

1.5.4 Segmentation of this Work

Author: Peter Fikar

Since two authors are responsible for this work we clarify in the following how this work is segmented into two parts. The name of the responsible author marks the beginning of the according chapter or subchapter of the work.

CHAPTER 2

Related Work

Author: Michael Habiger

This section outlines relevant background topics regarding our field of interest, including information about physical activity or inactivity respectively and sedentary behavior. Furthermore smartphones are described as potentially suitable devices for our game in the context of functionality and popularity among people. The subsequent section relates to various types of games and game mechanics with serious components, further introducing aspects of relevance in this matter. A presentation of three reference applications concludes this chapter.

2.1 Physical Activity and Sedentary Behavior

Author: Michael Habiger

Modern lifestyle becomes increasingly characterized by sedentary behavior or physical inactivity in the context of leisure time as well as at work [21]. A sedentary lifestyle basically means to engage in sedentary activities such as watching television or working with the computer, while physical inactivity refers to the absence of physical movement above a specific intensity level. Whereas such factors might not be the only reason for health-related issues, evidence exists that people are exposed to a higher risk of certain diseases, for instance overweight, heart diseases or diabetes, caused by a lack of physical activity [54, 102].

2.1.1 Physical Activity

Author: Michael Habiger

Physical activity is defined as «bodily movement produced by skeletal muscles that requires energy expenditure» [100, par.1]. Thus basically all movement types above the resting level are considered physical activities. In this context the World Health Organization (WHO) published

physical activity recommendations for different age groups. Adults aged 18 to 65 should engage in moderate intensity aerobic physical activity for at least 150 minutes per week and children aged 5 to 17 for 60 minutes each day [96, 99]. In order to raise the positive effects of physical activity, the WHO recommends extending moderate physical activity to 300 minutes per week or to 150 minutes of vigorous intensity [96]. For children, each physical activity exceeding the recommended amount of time spent has further health-related positive effects. For adults, the WHO emphasizes to engage in such activities for at least 10 minutes continuously [96]. The same applies to people aged 65 or above, with the difference that they should engage in physical activities as much as possible if the recommendations above cannot be met for some reason [98]. Maintaining the recommended activity patterns can lower the risk of specific cancers, diabetes, heart disease or overweight [96, 103].

Benefits of Being Physically Active

Engaging in moderate to vigorous intensity physical activity (MVPA) on a regular basis according to the recommended amount mentioned above may have immanent advantages on health [13, 100], including benefits related to cardiovascular disease, obesity, diabetes and cancer [17].

In general, according to the WHO, people have a significant lower risk to die of diseases caused by physical inactivity if doing physical activity at a moderate intensity for 30 minutes through and for several times a week [102]. Alongside with those major health benefits regular physical activity may further improve energy balance in general [100].

2.1.2 Physical Inactivity

Author: Michael Habiger

Physical inactivity is defined as «[...]relatively complete physical rest, which does not provide sufficient stimulus for human organs to maintain their normal structures, functions and regulations» [104, p.8] and is stated as «[...] one of the most important public health problems of the 21st century [...]» [13, p.1]. There is evidence of an increasing amount of people being physically inactive due to decreased activity in many aspects of life including work or school and leisure time likewise [21, 103]. Furthermore Dr. Ala Alwan, Assistant Director-General for Noncommunicable Diseases and Mental Health of the WHO states that 31% of the world-wide population is physically inactive [103]. While around 20% of people in low-income nations maintain a physical inactive lifestyle, around 45% of the population in high-income nations are classified as being not enough physically active [101]. This includes 50% of the people in the Americas and the Eastern Mediterranean Region not meeting adequate physical activity levels [101].

Reasons for Being Physically Inactive

«Even the simplest tasks are becoming mechanized, and people do not need to use as much energy to survive.» [21, p.2]

The decrease of physical activity within the population may be associated with increasing passive transportation using motorized vehicles and is further linked to sedentary working or school hours as well as to sedentary leisure activities, making physical activity obsolete during the daily routine [21, 72, 97].

Furthermore, there may be an association between being physically inactive and the age as well. In this regard Buckworth and Nigg [16] found that older students tend to spend an increasing amount of time especially using the computer while for instance watching TV did not correlate in such manner. Additionally, Pullman et al. [73] observed a decrease in physical activities combined with a shift away from television and night sleep to other sedentary activities like using a computer and studying.

Consequences of Being Physically Inactive

Physical inactivity is linked to several implications and according to the WHO is associated with 6% of human deaths, which are around 3.2 million people each year [100, 101]. Thus physical activity is the «fourth leading risk factor for global mortality» [100, par.1]. Blair [13] finds that low physical activity even causes 16% of all deaths and further states that normal weight men maintaining low or none physically active behavior have twice the risk factor to die of inactivity-related implication than overweight men who are physically active.

Furthermore the WHO identifies physical inactivity as a major reason for breast and colon cancers, diabetes and heart disease, with a range of 20 to 30% of affected patients being regarded as physically inactive [100].

2.1.3 Sedentary Lifestyle

Author: Michael Habiger

A distinction has to be made between physical inactivity and sedentary lifestyle, as a lack of the former is not necessarily linked to the latter [12, 45, 94]. Even where physical activity recommendations are met, there seem to be specific health implications if sedentary behavior is maintained simultaneously [45, 70]. Biddle et al. [12] state that many studies examining physical activity or inactivity among people lack the consideration of the broad diversity of being physically inactive, thus giving no actual insight on what inactive people are further doing throughout the course of the day.

While conducting a study about the correlation of young people watching TV, hence engaging in a sedentary activity, and their actual physical activity level in the context of MVPA, Biddle et al. [12] in consensus with Wong and Leatherdale [94] and Owen et al. [70] found that people can be both, sedentary and physically active likewise over a particular period of time.

Since the field of research on health effects of sedentary behavior is a relatively new one, the term sedentary is not clearly defined yet and often used varyingly depending on the specific context [88]. Tremblay [88] outlines two different definitions for 'sedentary' commonly used in the respective literature. Sedentary behavior is based on metabolic equivalents (MET) or on the amount of MVPA.

Moderate to Vigorous-Intensity Physical Activity (MVPA)

In terms of MVPA, *sedentary* is defined as the lack of any moderate to vigorous intensity physical activity [88], thus a sedentary person mainly engages in none to low intensity physical activities.

Metabolic Equivalents (MET)

One MET is defined as burning 1 kilocalorie per kg body weight in one hour [22]. Based on MET a sedentary activity refers to any physical activity with a low energy expenditure smaller or equal than 1.5 METs or with an energy expenditure at the resting level [22,71,88]. Naturally, the more a person moves or becomes physically active, the higher his energy expenditure. Table 2.1 (taken from [22]) shows common activities in relation to their equivalent MET.

Activity	**MET**
Sleeping	0.9
Sitting, watching television, reading, writing, desk work, typing, standing in line	1.3
Fidgeting when standing or sitting	1.8
Cooking, washing dishes, cleaning up, vacuum-cleaning (moderate effort)	3.3
Walking (4.8 km/h)	3.3
Tennis (doubles)	5
Bicycling (15 km/h)	5.8
Dancing	6
Swimming	7
Jogging	10
Rope skipping	12
Squash	12

Table 2.1: Common activities in relation to their MET [22].

For instance, according to the definition of MET and Table 2.1, a person weighing 80 kg burns 72 kilocalories per hour while sleeping (80 * 0.9 MET of sleeping) while the same person burns 960 kilocalories per hour while playing squash (80 * 960 MET of squash). In consequence most sitting or reclining activities, such as sleeping, reading, typing, sitting etc. can be considered sedentary activities [71, 88]. Pate et al. [71] further define light activity as part of sedentary behavior, that is any activity with an energy expenditure of 1.6 to 2.9 METs, such as cooking or cleaning up, according to Table 2.1. In this context a sedentary person spends a vast amount of time with sedentary activities [88].

According to Tremblay [88] the vague use of the term sedentary in the context of MET or MVPA and the unclear correlation between physical activity and sedentary behavior may cause uncertainty in regard of its actual meaning. Furthermore he points out that both definitions are often used alternately within the same article. Thus to avoid further confusion Tremblay [88] suggests to only use the term sedentary in the context of any physical activity with an energy expenditure of 1.5 METs or smaller while referring to the term inactive for people who do not engage in moderate to vigorous intensity physical activity.

Consequences of Being Sedentary

Maintaining a sedentary lifestyle has been reported to have negative consequences on health conditions. In this regard [89] points out various follow-up diseases linked to sedentary behavior based on several studies, including obesity, diabetes cancer, cardiovascular disease and implications with psychological health as well.

2.1.4 Connection to our Work

Author: Michael Habiger

Though sedentary lifestyle patterns may not explicitly be linked to physical activity, as described above, changing those factors likewise may nevertheless positively influence health [59]. In order to increase the physical activity level and decrease sedentary behavior we are going to integrate the WHO's recommendations described above into our prototype to combine playful elements, similar to those of conventional virtual games, and physical activity. Thus our prototype will provide game mechanics enabling our users to engage in physical activity for 150 minutes at moderate intensity or 75 minutes at vigorous activity in one week. Furthermore we will implement a functionality motivating our participants to move at least 10 minutes through based on the WHO's recommendations regarding physical activity as well. The game mechanics representing the physical activity recommendations are described in *4.4.2 - Description of Design*.

2.2 Mobile Technology

Author: Michael Habiger

A smartphone, as shown in Figure 2.1, is by definition a mobile phone with extended functionality, including telephony service, short message service, electronic mail functionality as well as features for recording and replaying audiovisual media. Furthermore smartphones are able to handle location-based services. In contrast to conventional mobile phones, smartphones run complex operating systems to support the advanced functionalities. Additionally users have the opportunity to extend the features of their smartphone by installing third party applications, making them personalized devices [2].

2.2.1 Smartphones as Personalized Devices

Author: Michael Habiger

Following the approach of combining various applications within one device and allowing a modular expandability by the user, «computing is [...] centralized in the palm of your [author's note: that is the user's] hand» [7, p.1]. In the course of a study with several mobile phone users (*iPhone* users, *Blackberry* users and miscellaneous phone users) Barkhuus and Polichar [7] found that each of the participants, despite having similar functionalities on their phones available, handled the device individually. Through the nature of smartphones, these devices allow users to create, share and obtain information at any given point of time [86] and centralize various functionalities to ultimately «adding to the smoothness of their lives» [7, p.9].

2.2.2 Popularity and Availability

Author: Michael Habiger

According to Gartner [33] smartphone sales have contributed to 47% of all mobile phone sales taken together. Till the second quarter of 2013 the total accounting of smartphone sales grew around 5% to 52% in total of mobile phones sales and up to 55% till the third quarter of 2013, which corresponds to 455.6 million devices sold to users [34, 35]. Being a «must have» [36, par.2], mobile phone sales will keep increasing in 2014 and will constitute the largest group of shipments of devices such as PCs, ultra-mobile-PCs and tablets [36] (cf. Table 2.2, adapted from [36]).

Given the increasing sales and shipments, smartphones seem to gain in popularity and availability likewise within our society.

Figure 2.1: An Apple iPhone [47]: A current example of a smartphone, including a multi-touch screen, cameras in the front and the back as well as personalized applications and a custom background.

Device Type	2012	2013	2014	2015
PC (Desk-Based and Notebook)	341,273	299,342	277,939	268,491
Tablet (Ultramobile)	119,529	179,531	263,450	324,565
Mobile Phone	1,746,177	1,804,334	1,893,425	**1,964,788**
Other Ultramobiles (Hybrid and Clamshell)	9,344	17,195	39,636	63,835
Total	2,216,322	2,300,402	2,474,451	2,621,678

Table 2.2: Mobile phones will constitute around 1.9 billion of all device shipments till 2015 [36].

2.2.3 Connection to our Work

Author: Michael Habiger

The popularity in terms of availability for potential users mentioned above and the enhanced functionality make smartphones appropriate target devices for our game prototype. The combination of features, such as Internet access, location services based on GPS and device orientation, allows various approaches of interaction with our game prototype possible. Furthermore, since the users most likely carry their smartphone along anyway, they can basically play everywhere

and anytime, which allows our game prototype to implement features of immediate nature as well.

2.3 Game-Related Concepts with a Serious Background

Author: Peter Fikar

The idea of using game-related concepts to achieve 'serious' effects in non-game-related contexts is rather old. Board games are examples of non-digital predecessors of todays' digital serious games and date back about four thousand years. Those early examples were used for training of military-related skills, meant to increase abilities for real battles [24, 87]. Old games used in such a context, mentioned by Susi et al., are for example *Chaturanga* and *Wei Hei* [87]. Business and education-related themes were explored as contexts for deployment of such games during the 20th century and with the potential of digital media like video games yet new possibilities and fields have formed regarding their use [24]. Next to the fact that military usage of such games is still a dominant area of application in digital media, such as *Americas Army* (2002), being among the first fueling discussions about serious games [87, 105], other application areas, such as the health sector, are suspected to hold significant potential for development.

In 2002 the Serious Game Initiative was founded, among its founders Ben Sawyer. Susi et al. refer to a prognosis of Sawyer within their work published in 2007, suspecting the health sector to grow most in the years to come [49, 87]. Due to the fact that our work is related to health topics and wellbeing in general we introduce this field throughout this chapter. We present related terms and categories, used to describe aspects of games, which are used in such a 'serious' matter. As we will show this is not easily done, therefore we also reflect upon relevant discussions in the following section.

2.3.1 Serious Games

Author: Peter Fikar

The term *serious games* can be found on many occasions throughout scientific literature. Connected to the use of entertainment media to achieve learning effects in late 20th century, computer games have also become of interest during that time as a potential medium for such strategies [95]. The vast variety of fields for which serious game applications can possibly be designed are widespread and the progress of computational and technological advancements have influenced potential implementation possibilities in such contexts [87, 95].

An important factor to why video games are potentially of use in these contexts comes from their controversially discussed nature itself. The medium of computer or video games is described as having the potential for invoking addictive behavior [18, 84]. According to Seah and Cairns, game-related issues are even picked up by institutions treating addictions. They have

investigated on game-related factors like high engagement through immersion in their research on video game effects [84]. But how is such a concept defined?

Definition

Throughout literature serious games have been vividly discussed in order to find a clear definition for them, but it seems that this is hard to achieve. This difficulty is addressed for example by Gekker [39], who states in his work, related to the field of health, that the term of serious games is highly contested. He points to the discussion on how serious games have been defined throughout literature and highlights the ongoing discussion by pointing to critics like Ian Bogost in his work, who is rejecting the term itself. Putting together the terms *serious* and *game* seems problematic by itself as serious and games in terms of being *fun* are contradictory terms at first glance, making this term an oxymoron [78]. A big part of the discussion regarding serious games is fueled further by the discussion about what the terms *game* or *play* mean. Those terms are also vividly discussed throughout different disciplines like design, cultural studies and anthropology [39] and are not simply defined in terms of what *game* and *play* can cover. Aside the disputes regarding those terms, definitions are mentioned regarding serious games which are also referred to throughout literature. Such a definition mentioned on several occasions [87, 91] is stated by Michael Zyda in his work [105]:

«The formal definition might read as follows: "*Serious game*: a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives."» [105, p.26]

Based on this Wassila and Tahar [91] state that any computer game going beyond the purpose of pure entertainment can be seen as a serious game.

Khaled and Ingram also underline in their work [52] the potential of the otherwise criticized factors of games to promote positive effects in form of serious games by stating:

«Whereas games have been attacked for being too influential in terms of promoting violence while also being too frivolous, serious games have managed to benefit from the intersection of these qualities, namely, the possibility to educate, inform, train, and persuade in an entertaining and compelling manner.» [52, p.69]

By highlighting the importance of entertainment in combination with serious games, Khaled and Ingram [52] point towards the aspect of using the compelling factor that goes along with playing games for other purposes than simple entertainment, as exactly this aspect can be positive for educational and health themes.

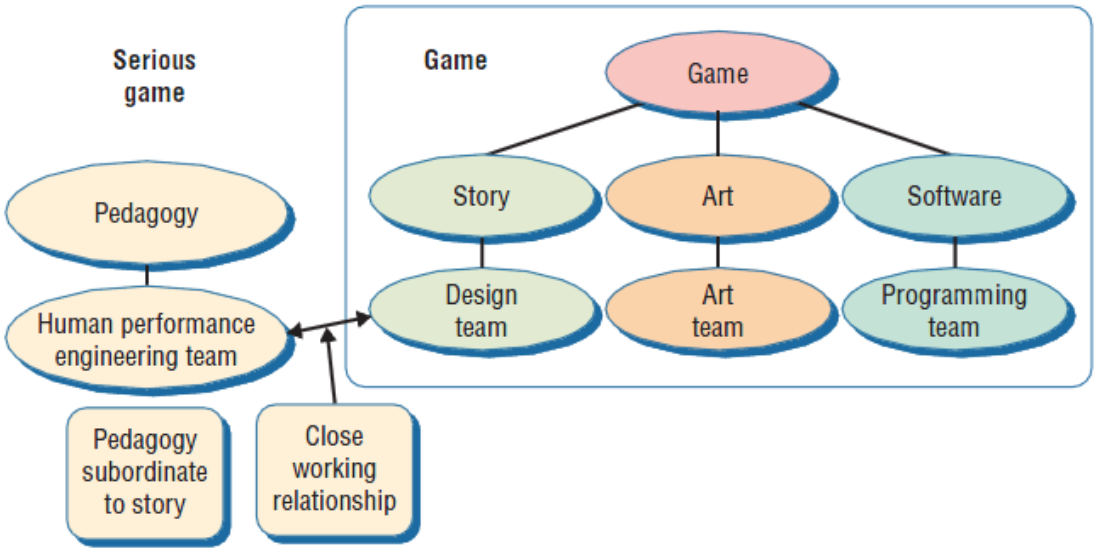

Figure 2.2: In addition to conventional game design, serious game design involves a pedagogy component [105].

Complexity of Design

Designers have to be aware of bringing together the game and the serious aspects. Therefore, according to Zyda [105], serious game design not only revolves around a traditional team of designers, who are developing the software, artwork and story of a computer game, but have to take a pedagogy component into account as well, which must closely relate to the game story development. The interweaving of entertainment of the game and the pedagogy-related part has to be done in a way that the serious game stays primarily entertaining to the user, putting the pedagogy component second but keeping up its instructional influence on the user (cf. Figure 2.2).

Khaled and Ingram [52] also point out the design challenge when bringing together the fields of game design and for example learning tool design. Combining two different fields like these requires more effort in making a design work. They further underline that there is not enough documentation in scientific literature up to this point about the diverse aspects happening within the process of creating a serious game. Even though Khaled and Ingram [52] refer to large scale projects with many stakeholders like funders, users and researchers, having inherently more complex mechanisms and communication demands than small projects like the one described in our work, we hypothesize that it holds true that the fusion of game design and the requirements of making a tool serving a distinct serious background is posing a great challenge.

Serious Games within the Context of Health

Computer games are suspected to be able to aid rehabilitation purposes, which often contain unentertaining or even unpleasant tasks for users. A potential field of use regarding rehabilitation is for example their potential to aid rehabilitation in the context of therapy for stroke patients [18]. Therapies for motor rehabilitation often consist of repetitive actions, which can be painful or possibly tedious. Serious games can be used to distract from the repetitive nature of exercises and keep the users informed about their performance. This can have a positive effect on their motivation to keep up the training [83].

Rehabilitation is just one possible target purpose in the field of healthcare. Since the term serious game is subject to discussion as mentioned above, according to Ritterfeld et al. [78] there have been attempts to put more focus on the field of application such games are dedicated to and specify the category regarding their central themes, such as health. Even the Serious Games Initiative started a more specific attempt called *Games for Health* aiming to set up a healthcare game focused community directed towards advancing this field further, providing a platform in this regard [44, 87].

There have been attempts to present potential classification within the field of health into more detailed categories. Gekker [39] points at such attempts, referring to Sawyer and Smith's taxonomy of health games. He, as well as Knöll and Moar [53], were further utilizing this categorization in their works. Gekker [39] describes Sawyers and Smiths taxonomy in his work, making use of their matrix layout, which makes up potential categories of use by combining fields such as *personal* or *professional practice* and possible *areas of application* such as *preventative* or *therapeutic* described in [82] as well (cf. Table 2.3).

Since our game is supposed to promote activity, within this taxonomy the term *exergaming* might fit best to describe our potential field to address, described as being a preventative area of application and the personal field [39, 82].

2.3.2 Exergames

Author: Peter Fikar

Recently, exercise-based concepts have become available on the console market, as console producing companies, such as Nintendo, Sony and Microsoft, have been introducing interfaces providing the players possibilities to interact with games in a motion-based way. Nintendo, in connection with its Wii console, has introduced the gesture-based *Wii Remote* in 2006, followed by Sony with the *PlayStation Move* controllers for the PlayStation 3 in 2008 and by Microsoft introducing the *Kinect* system in 2010 for the Microsoft Xbox 360 console (cf. Figure 2.3).

Fields -> / **Areas of application**	**Personal**	**Professional Practice**	**Research / Academia**	**Public Health**
Preventative	Exergaming Stress	Patient Communication	Data Collection	Public Health Messaging
Therapeutic	Rehabilitainment Disease Management	Pain Distraction Cyber Psychology Disease Management	Virtual Humans	First Responders
Assessment	Self-Ranking	Measurement	Inducement	Interface / Visualization
Educational	First Aid Medical Information	Skills / Training	Recruitment	Management Sims
Informatics	PHR (Personal Health Records)	EMR (Electronic Health Records)	Visualization	Epidemiology

Table 2.3: Different categories of health games according to Sawyer and Smith, taken from [39].

All of these input devices are capable of reading the users' physical movement to a certain degree, using different varying techniques and sensors enabling the user to use gestures or full body movement for interaction with the according video games [32].

Games making use of activity-based gameplay have also been subject to scientific research on many occasions, as for example documented by Whitehead et al. [92], who take a considerable amount of studies regarding such games into account to analyze effectiveness of exergames in their work.

Commercial console exergames like *Wii Sports* [68], *Wii Fit* [66], making use of additional input hardware, namely a balance board, *Kinect Sports* [64] and *Move Fitness* [27] have been developed and are available to players. Wii Fit has been described as being among the most prominent examples [41] and «[...]has been found to be more enjoyable than traditional exercise[...]» [58, p.360].

Figure 2.3: From left to right: A Microsoft Kinect Sensor, Sony PlayStation Move Controllers and the according PlayStation camera.

From the Indoors to the Outdoors

Görgü et al. [41] point to the fact that such exergames were produced for console systems which are usually meant to be used indoors and that the setup of screens and console peripherals and input devices are more easily set up in structured environments like homes. They suggest to bring exergames from home environments to the outdoors augmenting the real world with game-related content. Pervasive strategies could be applied to bring activity-related games to the outdoors making use of mobile technologies [5, 58]. Therefore this concept offers the opportunity to extend the playground to for example city streets. Such games can enable the user to access virtual worlds situated in real-world locations and put the player into the role of a virtual avatar in the parallel digital world [10].

An outdoor environment may enrich the possibilities for exercising in the context of such a game and may have beneficial impact regarding social aspects, as Macvean and Robertson highlight in their work [58]. Certain technologies can make this kind of gameplay possible. Notable on this account are output devices such as mobile devices with screens, headphones, furthermore sensors which are able to read relevant player data, and wireless technology enabling player communication among each other or e.g. with servers [10]. Devices providing measurements of activity in this context have been for example pedometers to measure the daily

step count [55, 58]. Modern smartphones are usually capable of providing such services, since they are able to provide visual, auditive, and vibrotactile feedback to a player while also being able to read sensor data like compass readings or e.g. location of the user utilizing GPS [60]. Also they are capable of transmitting the data between smartphones or to a server using Bluetooth or 3G protocols.

The Culture of Play

Mobile technologies have also been described as being an influential aspect when discussing the current state of technology in connection with the *ludification of culture*. We will not go into detail about discussions on what the term *ludification* means. Simply put, ludification of culture means that within today's society, and over the past decades, play has become an increasingly important theme in society and describes a phenomenon which brought forth and is fueled by the movements described above, such as serious games [15].

In connection with social networking trends and mobile technology another term has emerged over the last years, namely *gamification*. Since this term is also important regarding the theme of this work we will also provide a short overview in the next chapter.

2.3.3 Gamification

Author: Peter Fikar

Gamification is another prominent term and buzzword [15] which has been around increasingly since its first documented appearance in 2008 and has gained popularity over the following years [24]. According to Bouca [15], the prominence of this term is fueled by the phenomenon of ludification of culture, which is synergizing with the opportunities the advancements of mobile phone technologies have to offer. While we introduced the fact that the term of serious games was and still is subject to discussion, so is the term *gamification* [15, 24]. Bouca illustrates this dispute by pointing to prominent proponents such as Gabe Zicherman and critics like Ian Bogost, referring to a published comment of him on the subject, which is titled "Gamification is Bullshit" [14, 15]. Successful gamification concepts such as *Foursquare* are becoming more and more attractive and are prominent examples on how game elements can play a role in basically non-game-related contexts [24]. The mentioned application Foursquare, launched in 2009 [31], illustrates a successful mobile location-aware social network application running on a range of smartphone brands, utilizing users' locations and providing options to check-in at these locations, providing the users options to share related data with other contacts, also within other social media application networks like *Facebook* or *Twitter*. Virtual in-game rewards like points and badges are given for certain user interactions, such as checking-in at certain locations like boats, incorporating game-related concepts into this application. Other rewards are given to users for example if they are dominating a location by having the highest registered visiting count over a certain duration at a certain location, called *Mayorship* [24].

Such applications are also of interest regarding scientific research literature, which has come to investigate creative new ways users may interact with this kind of technology and also their concerns regarding privacy issues [56]. Foursquare and other location-based social networks are also seen as potential sources for research on urban social behavior and could harness potential for exploring many statistical aspects [85].

In their attempt to provide a definition for gamification, Deterding et al. [24] discuss the term in their work and attempt to position it next to serious games. According to them, «[...]"serious game" describes the design of *full-fledged* games for non-entertainment purposes, [author's note: whereas] "gamified" applications merely incorporate *elements* of games[...]» [24, p.11].

2.3.4 Connection to our Work

Author: Peter Fikar

The prototype of our game Sky Haven can be described as integrating aspects of all of the fields and categories presented above. Since we aim to design an application which qualifies in terms of being a full video game, providing a cohesive game experience, our game can be considered as a serious game in the way Deterding et al. [92] describe them as aiming to be *full-fledged games* [24]. This also stays true with Zydas Definition [105] presented in *2.3.1 - Serious Games*, also regarding the field of games for health and exercise themed games.

By aiming to provide incentives for physical activity on the basis of walking and running (and biking) through gameplay presented to the players, we share many aspects with the reference systems *iFitQuest* [58], *SmartRabbit* [60] and *Fish'n'Steps* [55]. Therefore we will give a brief overview regarding those systems in *2.4 - Reference Systems*.

Pervasive concepts extend the scope of our game by making use of mobile displays, wireless data connection and sensors like compasses and GPS [10]. Even gamification concepts may apply to certain aspects of our game by providing for example a shared leaderboard making it possible to compare own points to the ones of other players without having the ranking impacting the progression or any other content in the game. Furthermore we provide a *Travelmode* which can also be considered to provide game aspects outside of our main game context by providing feedback about distances covered by the user and can therefore also be considered an element for measuring walking-related data, hence we assume those things being gamified elements [24]. All of these aspects are making up our game as a whole by being embedded into a story-driven, fantasy-based background. This background is our attempt to establish a connection to culture and make use of prior knowledge of players which are familiar to similar stories, as discussed by Salen and Zimmerman in their work [81] regarding narrative play.

2.4 Reference Systems

Author: Peter Fikar

We start off the description of our design process by discussing three reference systems related to our goals and the kind of effects they aim to achieve to illustrate issues and directions for design. These mobile location-based systems all aim to motivate people to engage in physical activity and do so by focusing on different game aspects providing certain incentives or rewards. The systems are meant to exemplify how the subject can be approached when creating applications with such a purpose.

2.4.1 Presentation of Systems

Author: Peter Fikar

In the following, *SmartRabbit* [60], *iFitQuest* [59] and *Fish'n'Steps* [55] are being introduced as reference systems for our work, as all three combine relevant aspects for our purposes concerning our game *Sky Haven*.

SmartRabbit

Marins et al. [60] describe their game SmartRabbit in their work. It is a location-based exergame aiming to propagate running activities. The system is set up on Android devices making use of smart phone technology. The GPS is utilized to capture location data of the runner, which gets processed in order to achieve effects in the application. The game provides different game modes for the runner to choose from, providing different challenges (cf. Figure 2.4). The basic measurements relevant to proceeding in the game are distance, duration and speed of the running activity.

SmartRabbit provides a *training mode* in which the players are not competing against other human users but only against their personal limits. This mode provides the players with certain goals, which, if they are fulfilled, make other game modes available to them. This is meant to provide motivation also for experienced runners to proceed in training mode. Furthermore medals provide the rewards for achieving goals of different difficulties, which become increasingly demanding while progressing. Even though this mode is not meant to be driven primarily in a competitive way, the list of medals a player won can be displayed to others, hence hold potential for invoking competitive behavior. While medal gathering provides the main game element as incentive in training mode, the other modes facilitate player competition more directly to motivate. The *duel mode* provides runners with competitive opportunities to engage in race-like situations. To add variety to the duel modes' game options, the runners get provided with the opportunity to set the properties of a running course regarding its distance, a routes' start and finish line or country. The scores gained per race get adapted to the opponents' skill and get added to a public score list. If a player with a lower running experience can beat a player with higher experience, the lower level runner gains a higher score then the better level runner would

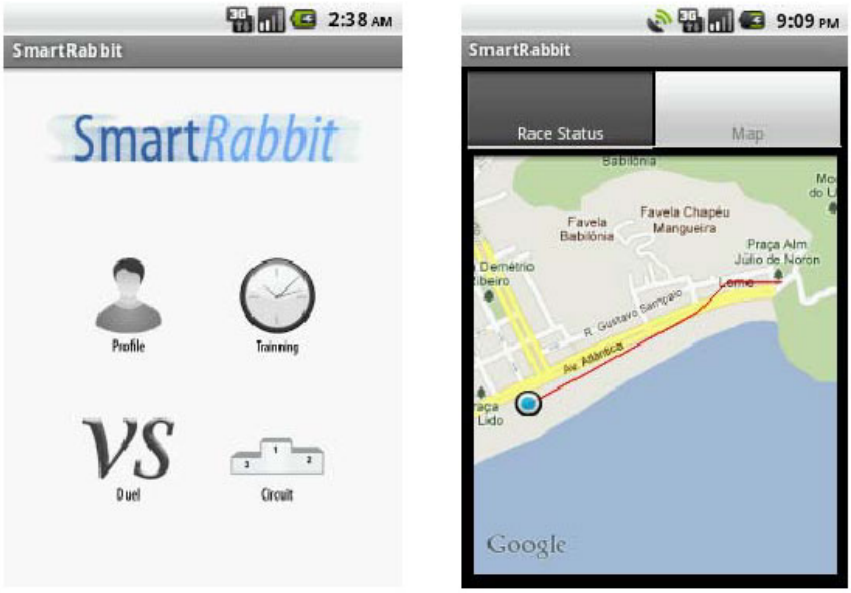

Figure 2.4: Depictions of the menu of SmartRabbit (left) and a screenshot of the application running, taken from [60].

if the lower level runner would have lost [60].

In terms of game design this could be interpreted as a kind of negative feedback system, like Salen and Zimmerman describe in their work Rules of Play [81], whereas for example the driver in a racing game catches up faster on lower ranks while the leader does not gain benefits in such a way until he possibly loses his lead.

The competition, representing the playful aspect, according to the authors of SmartRabbit [60], poses the central motivator in this game mode. The final mode is the *Circuit Mode*. In this mode the players can dominate an area, like a city or the whole country, by holding the lead for different preset distances within a certain city area. This mode aims to motivate players to excel others also in other cities than just the own hometown.

As described above the basic strategy for constructing playful aspects in the game is to provide some sort of achievement system in form of medals to collect, the competition of players against their own limits and others, and dominance over a certain area. Marins et al. [60] unfortunately do not present results of user testing but they focus on investigating theoretically on emotions invoked by this serious game which should be of importance in the process of design and make a point in creating such a game on the fundament of a game design framework and the definition of what *fun* should be which is often lacked by other serious games documented.

Figure 2.5: The selection of minigames available in iFitQuest (left) and a screenshot of a minigame in progress (right), taken from [59].

iFitQuest

Macvean and Robertson introduce iFitQuest in their work, which is an example for a location-aware exergame using mobile technology [58]. Their work from 2012 introduces the game in a pilot study, followed by a longitudinal study with the duration of seven weeks in 2013 during which they focus on school children to gain insights about behavior and motivations regarding their backgrounds and degree of self-efficacy. The information was conducted through multiple methods consisting of questionnaires, interviews as well as collected data stored in a logfile, and observations during the play sessions scheduled [59].

The game experience consisted of a collection of eight minigames in which participants were able to collect points (cf. Figure 2.5). The minigames were built upon simple game mechanics and fictional backgrounds like running away from a wolf. The basic modes of the minigame collection revolved around visiting, collecting, chasing, or running from in-game objects as well as running distances at a certain speed. The children were able to manipulate difficulty in many of the minigames and were almost free to choose from those they wanted to play. There was no greater goal connecting the minigames in a larger in-game manner. The authors reasoned that this should encourage reflective behavior and possible personal goal setting in participants. The context of the undertaken field test was school-based. The minigames themselves could be played at any location in time slots scheduled by the teacher up to three times a week for seven weeks [59].

Their game [59] has been found able to promote light intensity activity over the period of testing while it was not that successful in maintaining moderate to vigorous activity in participants, reaching a plateau effect. They investigated on how players experienced the game in terms of motivation and playing habits. They reflect upon the factors of social play and how players dealt with success, failure and their relation to goal setting. They furthermore highlight the diversity of how such aspects are perceived and how they affected participants. Social factors for example, such as competition, have been found to be affecting players in different ways. While some enjoyed competitive play, others rejected it, and some participants played in a cooperative manner even though the game itself does not provide such features.
In general Macvean and Robertson [59] point to the diverse experiences of participants regarding these factors and highlight the need to take the backgrounds of users into careful consideration when designing such exergames, underlining self-efficacy as being of central importance in their analysis. They further suggest that such studies of exergames should aim to go over an increased period of time to enable research regarding long-term effects after potential novelty effects wear off.

Fish'n'Steps

Fish'n'Steps is the implementation of a system that aims to encourage people to engage in activity, based on a goal step count over time, by Lin et al. [55]. It relies on the use of a pedometer as sensor component, which, on a side note, led to the reaction of some participants that it was seen as a part of clothing, some describing it as impractical and unstylish.

The authors defined daily step goals based on an initial step count and the personal goal of each participant. In a pre-study phase the base activity levels of the participants were determined to provide the baselines that defined the goal step counts necessary to achieve success in training. The goals calculated for the test period of six weeks got broken down into week goals and further into daily goals. If participants did better than the goal was requiring, the next week's goal was adjusted accordingly. They used discrete evaluation of the participants' daily step count regarding their individual daily goals. The steps made during one day were rated in three categories, that are sufficient, nearly sufficient and insufficient, depending on whether participants managed to reach their goal fully, halfway or below half [55].

Lin et al. [55] provided an incentive based on the visual development of a fish illustration. The visualization reflected the progress of the participant's activity investment they uploaded at a stationary device, using their pedometers on a daily basis. The fish developed in size and looks regarding the steps taken by the users, also generating new types of fish at certain step counts. The daily goal evaluation categories were represented by the visual facial expression of the fish varying between happy, angry and sad (cf. Figure 2.6).

Two versions of a fish tank for the fish were created. One version relied on one fish in one tank, only representing the individual progress of one participant, whereas the second version had four participants sharing one fish tank, each influencing the visual representation of the interior of the tank. Plus, the multiuser tanks allowed anonymous chats between the users.

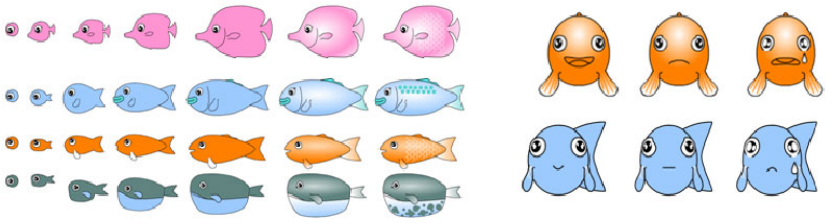

Figure 2.6: Different stages of development of the fish visualizations as well as the different emotions conveyed by the fish regarding regarding the daily goals, taken from [55].

Visualization of the fish tanks was also put on public display to facilitate competitive behavior between teams. The participants were recruited amongst employees of a research-oriented technology firm, all having graduate degrees and of adult age, all having sedentary working environments. Throughout the test phase nicknames were used, so the users did not know who the other peers using the game were, not even the ones on the own team if applicable [55].

According to Lin et al. [55], Fish'n'Steps unfortunately was unable to provide long-term sustainability, mainly because of repetitiveness and inconveniences related to the belt-worn pedometer and the upload of data. Participants forgot to put on the belt or log in and such. The authors argue however that the Fish'n'Steps game was meant to induce a change of behavior in participants rather than providing long-term excitement. Competitive elements proved to be more motivating than the fish visualization to some participants and were found to be a successful motivator overall for most users, for example users compared their fish to others on the team and were wondering about missing effort of others and reflected about the development of the own fish compared to the team and others. Others rejected the aspect of competition in general. In this regard the communication feature provided by text chat proved to be uncomfortable for some users because they did not even know who the others on their team were. According to the authors the fish visualizations were accepted and participants were found to care about them, but also occasionally showed avoiding behavior when they knew they would be confronted with a sad fish.

2.4.2 Discussion of Systems

Author: Peter Fikar

The following chapter illustrates how our prototype design can be compared to implemented examples of such games mentioned above. In the following we will discuss aspects of the presented games being present in our installment as well.

Activity

All of these systems are relying on leg-based activities. This can be set in relation with Whitehead et al. [92] who also suggest using leg-based activities as a basis for workout in classical non-mobile exergames to make them effective. Furthermore they underline that incentives are of great importance to provide long-term motivation in users and point to the possibility of including social factors.

Therefore the design of Sky Haven also relies on physical activities by foot.

Social Factors

SmartRabbit as well as Fish'n'Steps promote competitive features and in iFitQuest competitive behavior was identified to be of great importance to some users as well. Cooperative play is possible in Fish'n'Steps in a team-driven manner, and some players using iFitQuest played together even though such feature were not directly supported in-game.

Within our game we aim for integration of both, competitive and cooperative features. We furthermore provide loose player interaction in single player mode by providing interactive features promoting social play. Furthermore, since the game is mobile and in the outdoors, people are free to play in the same location at the same time.

Technology

The technologies chosen are smart phones and pedometer devices. Smart phones can provide the functionality needed to make SmartRabbit and iFitQuest work, whereas the pedometers devices were found to be not the optimal choice for some participants in Fish'n'Steps since they were found to be obtrusive.

Our platform of choice will also be smart phones. We aim to provide platform-independent play among different brands, browsers and operating systems to not exclude potential players because of their choice of smart phone technology.

Gameplay

We consider the features of SmartRabbit of having rather strong gamification tendencies, when comparing aspects like in-game ownership of running courses to things like mayorship in Foursquare explained in *2.3.3 - Gamification*. The Fish'n'Steps system also provides incentives which can be considered rather gamified than qualifying as a full game, since the visual evolution of the fish and the fish tank can be seen in a way to represent rather a scoreboard using visual illustrations enabling a visually mapped display of performance. iFitQuest promotes minigames. Each posing their own goals, the authors excluded a connection between the minigames on purpose for testing. Still we suggest that the iFitQuest system tends more in the direction of a system qualifying as a game.

Sky Haven aims to provide a variety of options regarding the style of play to be able to cover different player preferences. A part of our prototype also contains rather gamification-related aspects, such as a leaderboard, sharing experience points information, similar to SmartRabbit, or the visual evolution of a creature in relation to our implementation of training goals in form of a pet, which can be compared to Fish'n'Steps. These aspects may provide competition-based incentives. Also Sky Haven contains minigames demanding different activity tasks to be fulfilled, providing different difficulties and therefore is sharing similarities with the iFitQuest approach.

One of the main differences to all reference systems is that the main mode of Sky Haven is providing a story-driven game campaign, embedding all of these game modes and elements into a greater theme of in-game logic and game experience. Therefore we aim to provide a complete game experience, including a rich variety of possibility to play, integrating activity in many different ways regarding content and progression.

Background Story

We rely on a background story based on a world of fantasy containing creatures like orcs and goblins and making use of typical elements present in other digital role-playing games. We aim to provide a setting to which people connect.

Salen and Zimmerman [81] highlight in their work that the creation of such fictive worlds is always related to culture and the prior knowledge and expectation players have because of the familiarity with similar stories and media that sets up certain conventions.

Therefore we aim to make use of established features and elements related to the fantasy genre known from films, books and games and therefore provide the outline for all the content and interactions embedded in the game.

Meaningful Play

In their book "Rules of play" [81], Salen and Zimmerman define the term meaningful play. They highlight the relevance of this term by stating that achieving meaningful play with a game design is of uttermost importance regarding its success. Within their work, they distinguish between a descriptive and an evaluative focus on meaningful play, the latter being divided in discernable and integrated aspects.

Descriptive meaningful play is established through the relationship between player and system, relying on action and response between them in the context of the game. How successful a game achieves this communication can be reflected upon due to the evaluative aspect of meaningful play. The player must be able to understand the result of his or her actions and must be informed by the game system about it in form of discernable direct feedback. Furthermore this relationship must be integrated in the larger scope of the game, communicating the effects of actions to the player in the bigger picture of the game [81].

We argue that this term is of special relevance within the scope of this work, since we aim to provide an entertaining game experience and moreover because this term is describing the relationship between action and outcome. The actions taken in our game rely largely on physical activity and are a possibly exhausting investment. If the game fails to make clear what this investment has caused in the game and does not affect the course of the game as a whole, we hypothesize that players will lose interest in investing in the game quite fast.

In the next chapter we will describe methods and techniques we applied throughout the course of this work in detail. The methods conducted throughout the process are interwoven not only with each other but also highly connected to the participation of our test group as well as based on the related work presented above.

CHAPTER 3

Methods

Author: Michael Habiger

In the following we describe research methods and approaches suitable for our needs in the context of gathering and evaluating data of relevance. We provide the theoretical background information and outline why and how we actually use them within our work.

3.1 User-Centered Design

Author: Michael Habiger

The user-centered design process basically describes an approach to design a product under direct incorporation of future users. Thus user feedback plays the central part of the whole design process. The user-centered design process involves methods and techniques to gather data about the behavior, desires, thoughts and needs of the users to ultimately design *usable products and systems* [80] [6,9,80,90]. The participation of users takes place throughout the whole design process, including the early evaluation of the field of research, specific development steps and the prototype testing of the final product or system as well [9, 79].

Gould and Lewis [42] point out 3 principles for user-centered design:

- *Early Focus on Users and Tasks:*
  The researcher needs to get a basic understanding of the users in terms of social, cultural and personal aspects.

- *Empirical Measurement:*
  Users need to be involved in early development steps by testing product prototypes. Furthermore all kind of feedback has to be recorded and evaluated accordingly.

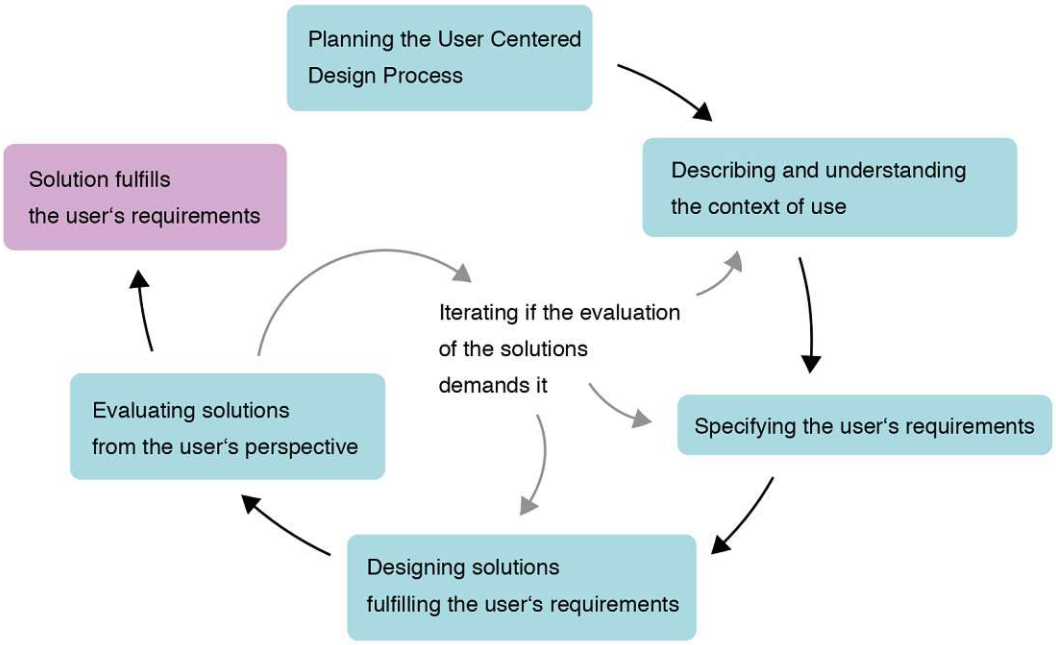

Figure 3.1: The iterative user-centered design process according to ISO 9241-210 [4] (adapted from [4] and translated by the author).

- *Iterative Design:*
  The whole process has to be iterative, meaning that the product has to be adapted continuously taking into account the feedback provided by the users.

Accordingly the ISO 9241-210 "Prozess zur Gestaltung gebrauchstauglicher Systeme" [4] defines 6 further principles for a user-centered design process:

- The design is based on users, their needs or tasks and their environment.
- Users are involved during the creation and development.
- The development and refining of the product are based on user-centered evaluation.
- The process is conducted iteratively.
- The design takes into account the whole user experience, while user experience is defined as the effects the product has on users before and after the actual usage of the product.
- The designing team works interdisciplinary.

Figure 3.1 illustrates the iterative user-centered design process according to the guidelines described above. Based on an initial plan to conduct the design process, solutions are iteratively evaluated and redesigned. This process continues till all user-related requirements are fulfilled.

Participatory Design

Participatory Design is a user-centered design approach described in dependence of the amount of user integration throughout the design process. In Participatory Design processes users are further considered as equal to the design team in terms of design decision making. Thus the users become actual partners of the researchers or designers [6, 9, 80]. In these terms two basic kinds of participatory design processes are described [6]. In weak participatory design important decisions are still made by the design team, which are strongly based on the feedback of potential users. In strong participatory design users and their feedback are involved during the whole design or development process. Baek et al. [6] further outline various levels of user participation in terms of interaction, length of involvement, scope and control regarding the design process (cf. Table 3.1, taken from [6]).

Aspect	**Weak Participation**	**Strong Participation**
Interaction	Indirect	Direct
Length	Short	Long
Scope	Small	Large
Control	Very limited	Very broad

Table 3.1: Levels of user involvement within a design process [6]. The involvement of users throughout the design process may be aligned to one of the extremes or lies somewhere in between.

In participatory design users can bring in their personal knowledge, expertise and emotions towards the project [80], thus eventually facilitating the formulation of major design decisions. Furthermore the involvement of users in early stages of the development of a product or system may minimize the risk of general usability issues with an already refined prototype [9].

Our Approach

Due to the nature of our game prototype and the purpose to evaluate its effects on our users, we choose to develop our game within a participatory design process. To do so we apply several qualitative methods to gather direct feedback on aspects related to our field of interest. The methods are generally divided according to three stages of the design and development process:

The data collection before the development of the prototype:
In order to get an understanding of our users in terms of behavior, attitude and social aspects within our field of interest we use surveys, qualitative interviews and Cultural Probes.

The iterative development process of the prototype:
To iteratively refine our game regarding design and technical implementation we apply a paper prototype test based on a Wizard of Oz approach, Technology Probes and integrate a digital diary into our game prototype. Furthermore we will gather and incorporate prototype-related feedback provided by our users throughout the field test of our game.

The final evaluation:
In order to evaluate the experiences our users made with the game prototype during the field test we conduct a group interview with four participants, chosen by specific criteria (e.g.: the player, who played most etc.).

3.2 Cultural Probes

Author: Michael Habiger

«Designing for pleasure demands a different approach from designing for utility» [38, p.53].

Since Gaver et al. [38] first deployed their Cultural Probe packages during a study concerning interaction technologies for elderly people, this approach became increasingly popular as part of user-centered design processes and has been deployed in several projects. Contrary to other user research methods Cultural Probes are not necessarily meant to be rationalized or analyzed per se [38] but rather be used as a source of inspiration and for subjective stories told by the participants [62].

Cultural Probe packages usually consist of various materials and components meant to provoke creative reflection over specific topics in the users receiving them (cf. Figure 3.2). For instance the Cultural Probe Packages Gaver et al. distributed included postcards, maps, photo cameras, photo albums and media diaries. Each of the materials was linked to a more or less specific task, like marking locations on the maps where the users have already been or writing postcards containing information about aspects related to the research topic to the researchers. Using such non-conventional mediums for communication can be a less clinical and rather more casual approach to gather qualitative information about participants. Through processing Cul-

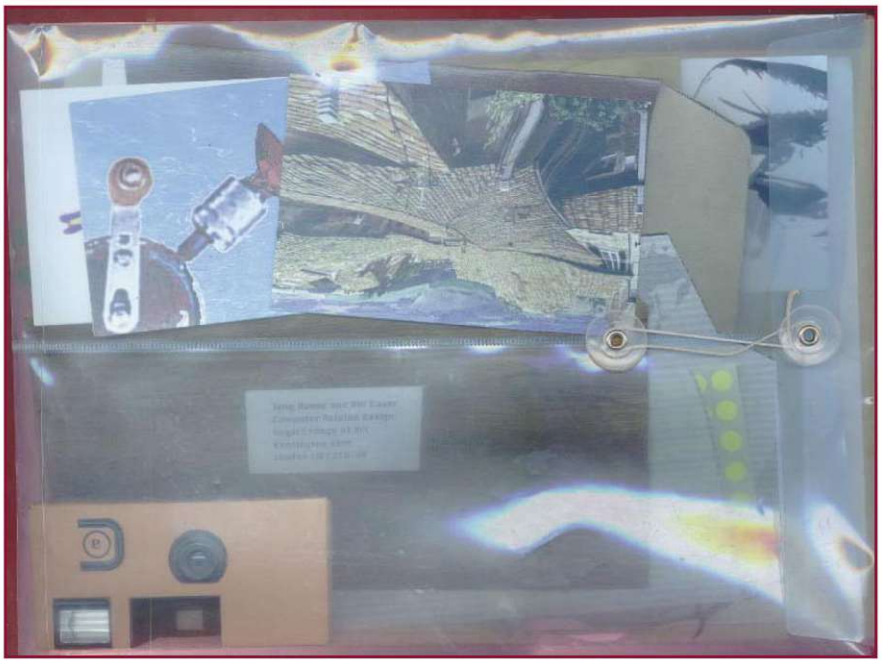

Figure 3.2: A Cultural Probe package as used by Gaver et al. [37], including various materials to invoke creative processes.

tural Probes users may express their views or opinions in a playful manner and less restricted than for instance when filling out a survey with predefined answers [37]. Thus Cultural Probes are «constantly confronting us [author's note: the researcher] with other physical, conceptual, and emotional realities» [37, p.55].

Besides the contribution of reflecting over the processed Cultural Probe packages, McDougall and Fels [62] outline four additional relevant benefits of the whole Cultural Probe deployment process:

- The creation of the Cultural Probe itself can reveal valuable insights on the research topic and allows the researchers to reflect about their own attitude towards it.
- Handing over the Cultural Probe package to the participants can create a more personal relationship to the users and vice versa.
- By processing the Cultural Probe packages the participant may get to know the general idea behind the research process, the effort put into it and the researchers themselves.
- The quantity of processed and returned Cultural Probe packages may be a hint about the amount of interest participants put towards the research project.

Our Approach

In order to approach the potentially sensible topic of sedentary lifestyle or physical activity respectively, we chose to use Cultural Probes designed to be playful in order to eventually lower the barriers our participants might have talking or reflecting about their physical activity habits and their attitude towards it.

Our Cultural Probe package consists of three main tasks and their corresponding materials, from which everyone has a different and specific focus in the context of our field of interest. The first part consists of tasks regarding physical activity in the matter of covering distances and various means of transportation. The second part covers the reflection over potential sedentary aspects within the daily routines of our participants. The third part was designed to gather inspirational feedback concerning relations between participant's real-life appearance and in-game representation.

The conduction of our Cultural Probes is further discussed in *4.1.2 - Cultural Probes*.

3.3 Technology Probes

Author: Michael Habiger

Technology Probes are an embodiment of Cultural Probes, thus aiming to provoke unexpected and inspirational results [28,46]. Compared to Cultural Probes, Technology Probes are meant to consider social aspects (how the users utilize the examined technology), technological aspects (how the technology actually performs in real-world tests) and aspects regarding the design itself (how the deployment of the Technology Probes can contribute to the project in terms of further design decisions) [46]. Hutchinson et al. [46] for instance used Technology Probes (cf. Figure 3.3, taken from [46]) not only to test the *interLiving project* [1] from the technical point of view, but also to observe how users were influenced by the technology, how their attitude towards it changed and how they dealt with it in general.

In order to successfully conduct Technology Probes the crucial functionalities of the deployed system or product have to work properly. Furthermore a technology probe has to be focused on specific aspects and should allow the participants to use them in several ways [46].

Our Approach

As part of our iterative and user-centered design process we conduct Technology Probes to evaluate one of the most important part of our game, the minigames, in the context of their technical application and the effects they have on our participants.

Figure 3.3: A Technology Probe, as conducted by Hutchinson et al. [46] for the interLiving project [1], allowing users to share pictures with family members over distances.

We apply two Technology Probe iterations. While the first one focuses on single player experiences, the second one incorporates multiplayer aspects in various configurations. Both iterations involve GPS-handling, requiring the participants to engage in physical activity in order to move their avatar representing them in the game.

The conduction of our Technology Probes is further discussed in *4.3.1 - Technology Probes*.

3.4 Interview

Author: Michael Habiger

One widely conducted and established method in user research and in particular in user-centered design approaches are interviews [23, 30, 79]. An interview is described as a «conversation with a purpose» [Kahn and Cannel 1957, in: [79, p.390]], allowing the researcher to directly ask the users about their opinions or attitudes towards the regarded field of interest.

While interviews can serve multiple purposes and therefore exist in many variations, Roger et al. [79] and Fontana [30] describe various types of interviews, the structured, the semi-structured and the unstructured interview, suitable for qualitative research depending on the given situation and the desired outcome. Those three types differ in the amount of how much the interviewer controls the interview regarding the posed questions and eventually predefined answers.

The Structured Interview

In structured interviews the questions and answers are generally predefined, thus limiting the interviewee's scope of possible answers or categories of answers. Fontana [30] describes this approach as a «theatrical script to be followed in a standardized and straightforward manner» [30, p.363]. This way the results of the interviews become standardized [79]. Structured interviews

are applicable if certain factors of a given study are already established, allowing the interviewer to formulate concrete questions and answers likewise. Another purpose for structured interviews is to try to lower the amount of falsities [30]. While the restriction to a specific set of answers allows the results to be compared effectively, it also limits the interviewee concerning bringing up new ideas or thoughts in case they are not covered up by the predefined answers [90].

The Unstructured Interview

The unstructured interview, also referred to as open-ended interview, aims to generate rich and in-depth data «given its qualitative nature» [30, p.365]. The characteristics of unstructured interviews are open questions, giving the interviewee the possibility to answer completely freely, thus generating a conversation-like atmosphere. This way both, the interviewer and the interviewee likewise, are able to control the course of the interview, making it challenging to get the desired topics addressed. Therefore some kind of agenda or interview plan helps to keep track of already covered subjects. The main advantage of open-ended interviews is that the interviewee has the possibility to address issues or to provide thoughts the interviewer has not considered beforehand, thus making detailed insights into the topic of interest possible [79].

The Semi-Structured Interview

As the name implies, semi-structured interviews are a combination of structured and unstructured interviews, thus consisting of open and predefined questions as well. As for unstructured interviews, the interviewer generally keeps an agenda covering the topics of interest to provide comparability to a certain extend among the results of several interviews. The basic process involves a predefined question as an opener and follow-up questions to further elaborate the interviewee's answers. In this regard the interviewer has to avoid suggestively formulated questions to prevent any manipulation of the interviewee. Furthermore the follow-up questions are supposed to not urge the interviewee to answer rashly [79].

Our Approach

For our interviews we chose the semi-structured approach, to allow our participants to answer freely while maintaining a certain degree of comparability among all conducted interviews. Our interview guideline contains basic questions regarding our main fields of interest and alternative questions to enable greater flexibility within the interview. Each question and its respective answer is usually followed up by further questions (e.g.: Why? In how far? etc.) in order to elaborate the given answer.

The conduction of our interviews is further discussed in *4.1.3 - Interviews*.

3.5 Focus Group Discussion

Author: Michael Habiger

In contrary to the different interview types described above, the focus group discussion, also referred to as group interview, is conducted with several people at once, in order to get them to reflect and discuss the topic of interest [29, 79]. Flick [29] states that, while conducting interviews with a single person may be unrelated to real conversation situations to some degree, group discussions foster the motivation of the participants to actually engage in natural communication with other people. He points out two basic kinds of group constellations for group interviews, the homogenous group and the heterogeneous group. While a homogenous group consists of people sharing a same or similar attitude towards the topic of interest, participants of a heterogeneous group have different opinions, backgrounds or thoughts in this regard. The intention behind a heterogeneous composition of group members is to evaluate controversial topics and aspects of agreement likewise [29, 79]. Independently of the choice of group type the recommended group size for group interviews lies around 5 members, although the concrete quantity of participants may alter [29].

Though the interviewer may refrain from guiding the group interview to encourage the development of the groups' own dynamics, it often may be required to direct the discussion into the right direction to keep the focus [29, 79]. This guidance exists on various levels. The formal guidance refers to a specific sequence of who may speak when, the thematic guidance in the context of bringing up concrete topics or in-depth questions, and the control of dynamics in order to foster further discussion by asking provocative questions or by inviting particular group members to speak [29].

Our Approach

Our Focus Group Discussion is conducted after the test phase of our game prototype. With this method we aim to elaborate the experiences our participants have made so far concerning the game prototype in a narrower and broader sense. In this regard the topics of interest are based on our research questions, including potential motivators to play our game, barriers to refrain from playing it, a possible change of attitude and self-perception in the context of physical activity and the role of social aspects within the mentioned aspects as well.

The conduction of our focus group discussion is further discussed in *4.5.1 - Focus Group Discussion*.

3.6 Written Questionnaire

Author: Peter Fikar

Surveys can take the form of questionnaires. They can be paper-based or rely on digital deployment. Therefore they can be delivered by distribution in a postal manner or via internet [11, 74]. Since these forms of questionnaires are to be filled out by the participants on their own, without the presence of an interviewer, this makes them a self-administered tool, which provides certain benefits. One benefit is that self-administered forms of questionnaires detach the influence of an interviewer from the participants. Therefore effects triggered by such a presence can be avoided. Furthermore it impacts the potential influence on how people answer questions about personal or sensitive matters, such as sexuality-related topics [11].

Unfortunately, with self-administered questionnaires researchers can never be sure that the person who answered the questions was really the person meant to do so. Furthermore one can never be sure that people understood the questions in the way they were intended by the researchers, also due to the fact that they simply cannot ask the researcher about it [11].

In general written questionnaires can share properties with oral surveys like interviews. For example the form in which a questionnaire is facilitating communication can be in a structured, semi-structured or low-structured manner. Questionnaires can serve their purpose by resembling a quantitative instrument when being highly structured, therefore enabling the collection of quantitative data; or being used in its low or semi-structured form which would enable the collection of qualitative aspects. There are many things to consider when conducting a questionnaire, such as phrasing of the questions as well as whether they are rather closed or open questions and how the questionnaire is set up as a whole [74].

Closed questions are the main form of questions in a highly structured questionnaire, the standardized questionnaire. They make use of presets of answers for the participant to choose from. Advantages of this approach are that such questions are basically more objective regarding implementation and evaluation, they are fast and easy to answer for participants and rather easy to compare for the researchers [74]. This advantage can turn to a disadvantage when it comes to participants who want to answer something else than is offered by the choices available [11].

Open questions allow the participant to answer the question in her or his own words. Disadvantages of open questions are that participants are occasionally annoyed by answering such questions and therefore tend to avoid them. Furthermore there is a problem regarding the evaluation of such answers because of the diversity of possible answers from different participants, which require analyzing the answers' contents in order to break them down into categories of characteristic attributes [74].

Closed and open question types are not excluding each other and can both be part of a survey [11]. There are also questions which are hybrids of closed and open questions in written

questionnaires, proposing questions with a preset of answers in combination with the opportunity to answer in own words [74].

Our Approach

We chose questionnaires in our work to have a fitting instrument for providing us with quantifiable data about our test users. This method seems to best suit our needs when asking for demographic background of our participants or to have them answer questions which can be sufficiently formulated in form of closed questions or closed questions with an optional open answer. We also apply open questions if the outcome is used in a more qualitative manner or required the participants to only reply in keywords. This enables us to explore the backgrounds of ten of our participants, their habits related to activity and sedentary behavior, as well as preferences regarding games.

The conduction of our questionnaires is further discussed in *4.1.1 - Questionnaire*.

3.7 Wizard of Oz

Author: Peter Fikar

In the field of human-computer interaction the Wizard of Oz technique is a common light- weight approach for involving users early on in the development process of e.g. a computer system. It allows the researcher to investigate and understand the users' expectations when interacting with the potential system designs and enables the participating users to explore possibilities even before the developers are investing time and resources to establish a functional prototype system, which then might be insufficient to fit the users' needs. Due to the fact that certain parts of the system are still missing in the testing situation, a 'wizard' is simulating the interaction with the system, which might not even be decided upon in this stage of the development process [25] (cf. Figure 3.4 taken from [77]).

Dow et al. [25] discuss Wizard of Oz simulation approaches and tool integration in connection with their system for prototyping applications in a pervasive context. They point to the possible roles of wizards throughout the development process of such a system. According to them, not only in the beginning but also further in or even late in the development process a Wizard of Oz approach might be an effective choice. The aspects of a wizards performance may vary from simulating missing system logic or technology, to observing and potentially overriding user or system data, to extending the possibilities of the current implementation and to being a helping hand for the test users.

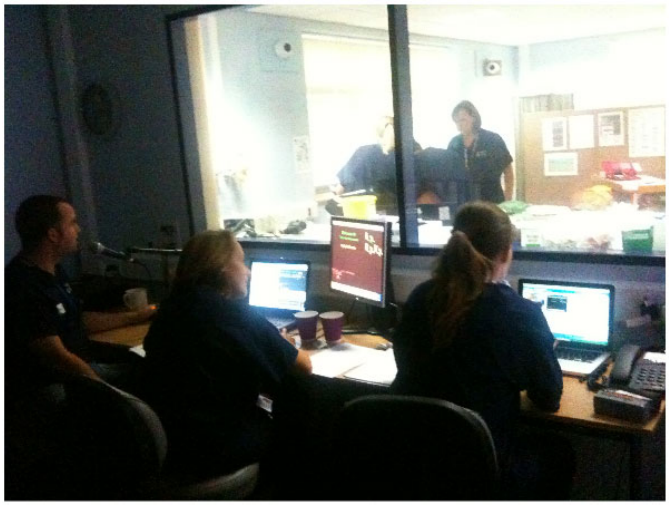

Figure 3.4: Wizard of Oz technique used to control a robot in a medical context [77].

Our Approach

We picked the Wizard of Oz approach in order to enable us to simulate non-existing hardware and software in the beginning of the design process. Due to the fact that we involve a user test early in the process we utilize this approach to simulate non-existing features in our LoFi Prototype test session.

The conduction of our Wizard of Oz approach is further discussed in *4.2.1 - Setup*.

3.8 Sketches

Author: Peter Fikar

«Explicit goals for drawing and sketching are 1. to externalize and convey the process of thinking – to transform intangible ideas to tangible information for others; 2. to review ideas/relationships, not results; and 3. to engage discussion around the subject/problem as an inclusive activity.» [8, p.29]

Sketching in the form of graphical representations, like drawings made by hand, can be a powerful method in a design process (cf. Figure 3.5 taken from [19]). It supports «thinking, reasoning and exploring opportunities» [8, p.38]. The design of interactive systems provides a vivid playground for making use of handmade sketches in any phase of the design process [61]. Low-fidelity hand-made sketches can be used to create a basis for discussion of abstract ideas and facilitate further evolution of such ideas. In a structured manner sketches can convey even more by telling a story visually, constructed by interweaving a narrative organization into draw-

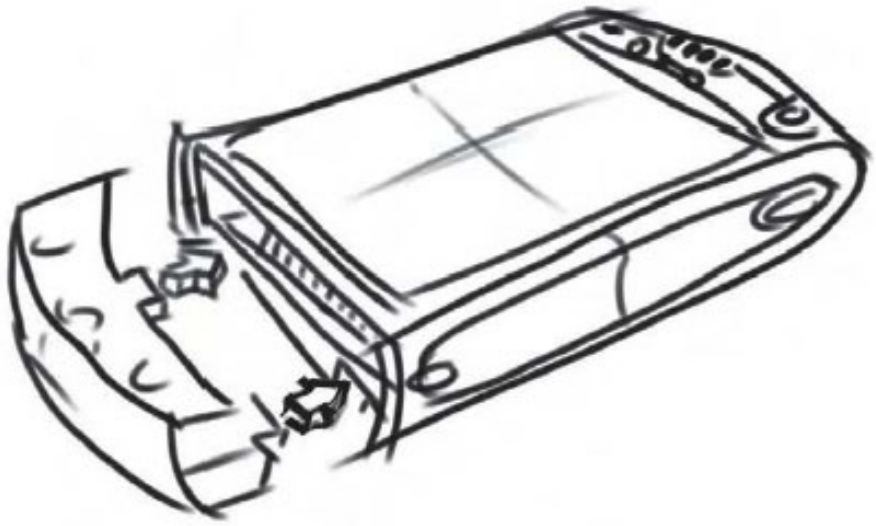

Figure 3.5: A typical sketch of a design idea [19].

ings, enabling the designer to communicate certain thoughts even better [8].

Buxton illustrates in his work [19] that sketch and mind are connected in a circular communicating manner. As the sketch is read after its creation by the designer who, in doing so, achieves further insight from the sketch, which results in the creation of a new sketch, the creating circle is closed (cf. Figure 3.6 taken from [19]. Inherent ambiguity is also what makes sketches a good basis for discussion as well as the potential discovery of new ways of seeing things in them. Next to this aspect, Buxton describes sketches to have properties which are essential to serve the mentioned purposes, such as being fast produced, low-cost, on the fly to create and of disposable nature [19].

Baskinger [8] states that many designers are not confident enough to communicate visually or even fear to do so because they feel they cannot draw. He further underlines that everyone can draw and that it is just a matter of training to increase competence and skill, like in many other disciplines.

Our Approach

Sketches are useful during design processes like the one we went through throughout this work. They proved to be the method of choice in many cases regarding the recording of ideas, communication between the authors and between the authors and the test users. Since our game also has a strong focus on visual aspects, sketches are the medium of choice when developing such illustrations to higher stages within our concept.

Our use of sketches is further discussed in *4.2.1 - Setup*.

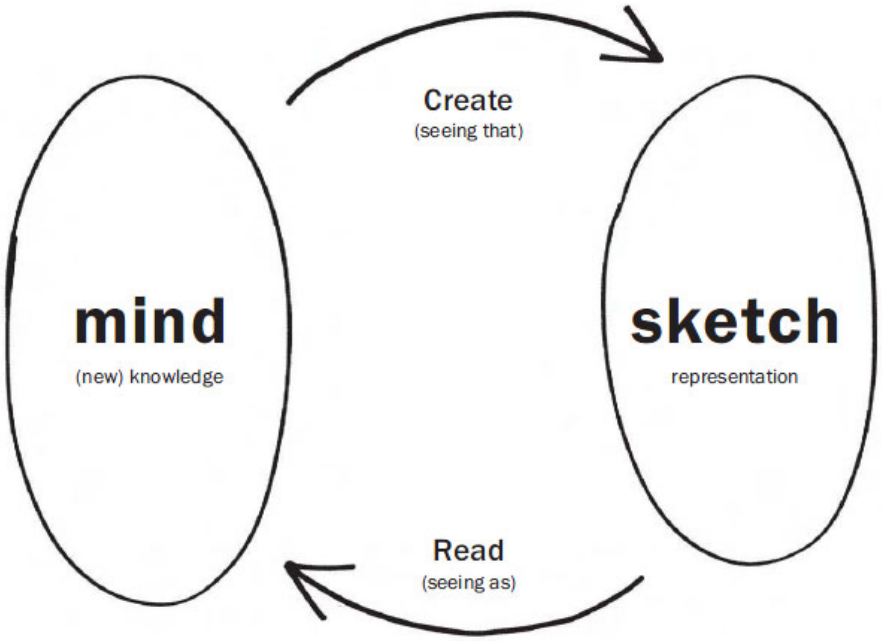

Figure 3.6: The communicational process between the designer and the sketch as described by Buxton [19], making use of Goldschmidt's *seeing that* and *seeing as*.

3.9 LoFi and HiFi Prototypes

Author: Peter Fikar

Prototypes are «[. . .] models that partially embody a vision of the final product[...]» [76, p.139]. Hence they can be utilized for user testing, focusing on different aspects in different stages of the development process. Basically one can differentiate between low-fidelity prototypes and high fidelity prototypes. The fidelity of such prototypes indicates how far their level of implementation is from a final product [76].

Low-fidelity prototypes, or LoFi prototypes, can also be called paper prototypes [75] and they can be tinkered quickly using easy to get and easy to process materials [76]. The materials can also be of inspirational nature when designing such a prototype [75]. Users get to test the potential behavior of e.g. interfaces which are controlled by a human being instead of a computer system that might not be existing yet, simulating reactions of the paper-built interface in accordance to the action of participants of the test. [75, 76] (cf. Figure 3.7 taken from [76]). While their low-fidelity nature enables developers to test designs early on in the process and are of much use in this early development stage, issues regarding usability, test of possible changes and follow-up features and developments are better investigated using HiFi prototypes [75, 76].

Figure 3.7: A LoFi prototype, as used by Rick et al. [76] to evaluate various shapes of puzzle parts for the development of their application *TransTime*.

Referring largely to interface design in his work on prototyping, Rettig [75] sets LoFi Prototyping in relation with formative evaluation, undertaken in stages of the development process where the product is still taking shape.

Testing a Paper Prototype

Rettig [75] suggests in his work how to setup a paper prototype user interface test, starting with assembling traditional crafting materials such as pens, brushes, glue, paper sheets, cards and so on. There should be a deadline to prepare for such a user test session, even if some things are not yet thought over completely, because there is always something new coming along to think about. Furthermore it should be kept easy for the researchers to play the computer in the test situation by providing flexible materials and props to represent interface functionality in a creative way. Prepared scenarios and practice runs can help to make such a test successful. He further suggests roles for the researchers by proposing there should be someone to greet and welcome the users and get e.g. some preliminary data from them, someone playing the computer, simulating the system reactions when users interact with the setting, someone who leads the test for the users and talks to them directly and the rest of the team should write down notes regarding their observations in terms of issues and possible solutions.

Our Approach

Since our research approach is based on a high degree of user involvement, we are utilizing different prototype stages for testing throughout our development process. We expect this to be a rewarding method for our purposes. We make use of the concept of paper prototypes early on in the design process to generate ideas and make changes to the concept. Throughout the development process we make use of more and more sophisticated digital prototypes in order to refine our concept.

The application of our LoFi prototype is further discussed in *4.2 - Paper Prototype – The Design Basis*.

On Note-Taking

Taking notes in a scientific matter is for example an integral part of ethnographical research in the field. Wolfinger [93] points to the complexity underneath this technique, which is, simply put, the writings of a researcher made during an observation in a site of interest. He highlights several things to consider and points to different ways of approaching ethnographic note-taking in the field. Within his work he aims to raise awareness for the role of the tacit knowledge and assumptions researchers have and its impact on the gathered data. He introduces two different approaches of taking field notes. One way to approach taking notes is for example to just take notes of things that are found to be noteworthy by the researcher. The researcher subjectively decides on what needs to be written down and therefore the researchers' background influences what is found to be salient. Another way to take notes is in a comprehensive manner, suggesting taking systematic notes, for example of everything observed within a given timeframe.

We picked note-taking because we find it an attractive and sufficient technique when collecting data about user behavior during test of playful test situations, like we provided early on in the design process and it enabled us to make good use of data records about defined points of interest.

3.10 Behavior Log Data

Author: Peter Fikar

«Behavioral logs are traces of human behavior seen through the lenses of sensors that capture and record user activity.» [26, p.349]

In the field of human-computer interaction there is a vast variety of possibilities to make use of such recordings. Data of interest might be gathered from user interactions with computer systems, applications, websites, or social networks [26]. Kelders and van Gemert-Pijnen [51] make use of log data in their work regarding the use of such files to improve e-health intervention technology. The related log-files contain data regarding different users, their actions type, lesson-related information and a time stamp. From this data they extracted information in

connection with user behavior regarding number of logins, number of logins regarding different lessons, and so on. This illustrates that the collection of log data while a user interaction is in progress is an important quality of this technique. Another strength of this technique is that the user of an interactive system may interact with it in an unaffected way because the situation of use is detached from the influence of the presence of observers or artificial test environments.

Such log data can be collected by software on the client side or on the server side by e.g. search engine providers and can be used in a way to collect large amounts of behavior data from users all over the world. Even though this is a powerful method to gain much data there is a problem with knowledge about the backgrounds of the ones who get observed as well as when it comes to answering the reasons for user behavior the way it has been saved in the logs. The analysis of such data may lack motivations of users or other qualitative aspects and is therefore more effective in providing better insights when used in combination with additional techniques [26].

Our Approach

We made use of log data as a recording method to provide us with numbers regarding user behavior in the field. Since we conduct a field test of our prototype, this is our approach to gain insight into factors like duration and kinds of use, error reports, activity statistics and in-game progress of the players.

3.11 Diaries

Author: Michael Habiger

Diaries can be a straightforward and subtle way to gather user feedback. By using diaries users have the possibility to directly log their experiences with a product or system right after using it, thus making diaries an immediate way to capture various aspects of the user's interactions [20]. This includes the specific interaction taken, the time when the interaction happened, the reaction of the user and their actual thoughts about it [79]. Furthermore diaries enable the researcher to continuously gather user feedback over a long period of time, for instance to record data about the users' interaction with a product or system in their daily routine [20].

According to Goodman et al. [40] diaries can be primarily used at the beginning of the design process to collect preparatory data and information for further research or during the actual deployment and testing of a prototype as a channel of ongoing user feedback [40]. Furthermore diaries may be an inexpensive way to reach scattered users and gather feedback over large distances [40, 79].

Our Approach

We use digital diaries as part of the testing phase of our game prototype. The diary-functionality is directly integrated into the game prototype itself and is accessible through the respective but-

ton in the main menu. This way we aim to give the users an opportunity to immediately or also reflectively record and communicate their currently experienced interactions with the system and the game in a broader sense. The participants are not obliged to use the diary, thus giving them the freedom of whether and how they want to use this functionality.

The application of our digital diary is further discussed in *4.3.1 - Diary*.

Having provided the methodic basis on which we planned the process of deploying our prototype, we illustrate the development of our game in detail in the next chapter.

CHAPTER 4

Prototype

Author: Peter Fikar

We start off this chapter describing our design process by presenting how applied methods impact the design and how they influence the basis of a paper prototype which got tested out with participants. The outcome of this paper prototype test refines basic ideas and concepts and provides initial user driven guidance for establishing the design fundamentals for our digital prototype development process.

Due to the iterative nature of our design process we describe how further methods applied throughout the course of development enabled us to evaluate certain aspects of our design and provoke user reactions to provide us with further feedback. We go into detail on how the process of development was accompanied by a phased release of the prototype for field testing. Finally, we end this chapter with the description of our final prototype which is also the end of the practical part of this work.

4.1 Preliminary Methods

Author: Peter Fikar

To get an insight regarding our users' behavior, attitude and social aspects, in the following we introduce our application of preliminary methods meant to gather feedback relevant for our prototype design decisions.

We describe the conduction of each method, consisting of questionnaires, interviews and Cultural Probes and the outcome relevant for our prototype derived from the data gathered throughout the process.

4.1.1 Questionnaire

Author: Peter Fikar

Questionnaires were conducted to collect data about our participants in the early stages of our research. The questions conducted were closely related or equal to the background topics and themes of the interviews. We aimed for having a comparable basis for the evaluation of the questionnaire data and the interview data.

We chose to make use of a traditional paper-based form, which was meant to be filled out with a pen. The questionnaires were given out to the participants to be filled out on their own without further guidance and were picked up afterwards.

The goal of the survey was to explore the participants' backgrounds regarding physical activity, sedentary behavior, and game-related topics, thus to characterize our test group. Factors of interest were participants' estimates on how much time they spend on related activities, what their interests are and how satisfied they are regarding their appearance and physical activity level. By doing so we aimed to gain a data basis about our participants and possible indicators for designing an activity-based system regarding their interests, expectations and daily routine.

The questions of the user-habit questionnaire are based on certain topics they are each assigned to. The topics and themes used to define the questionnaire are closely related to the guide of the interviews. This combination should enable us to investigate on certain topics more in-depth and therefore provides us with richer information about certain aspects of both methods.

Data

In the following we present the data we collected through the deployed questionnaires. The data is presented in a compressed manner and is structured regarding the topics of the questions. The topics used are the ones defined in the guide describing the questionnaire and interview. This guide describing the conducted questionnaire can be found in *B - Guides*. The categories, starting after the demographic part, are labeled alphabetically from A to E.

Note: In case participants provided an interval instead of a single number answering a survey question, the described average is split up in a minimum and maximum average, taking only the lowest given numbers as well as the highest given numbers into account. The term *games* without further description means digital and traditional games unless explicitly stated otherwise.

The survey was handed out to ten people, who made up our core group for development of the prototype. The ratio between female and male participants in this group was equally distributed, consisting of five female and five male individuals. Their age varied between 22 and 32 at the time of deployment with an average of 28.1. The participants filled out the form using their chosen nickname.

Duration and Kind of Physical Activity per Week (A)

Q1: The average number given when asking for the count of physical activities per week taking longer than 10 minutes in participants was 5.7 times. The related kinds of activities listed were walking, being the most mentioned one having a count of 5, followed by biking, having a count of 3. Other named activities included cleaning, sports, yoga, transition from home to university, jogging, squash and swimming. The provided answers regarding the total durations of such physical activities varied between 10 and 120 minutes. The minimum average of durations is 16 minutes, whereas the maximum average is 52.5 minutes.

Q2: 6 participants stated to prefer or rather prefer physical activity in a group while 3 participants stated that they are undecided and one rejected activity in a group. In participants who prefer group activity, the preferred group sizes vary between 2 and 8 people. Taking all the minimum group sizes into account provides an average group size of 3.2 people, whereas the maximum group sizes provide an average of 4.7 persons. The mentioned kinds of preferred people making up such groups were characterized as friends, family and unknown people. The most popular type was friends with 6 mentions. The two most mentioned kind of group activities were walking and swimming, having a count of 2 each. Other mentioned activities were biking, tennis, squash and other outdoor sports.

Duration and Kind of Sedentary Activity per Week (B)

Q3: Numbers about perceived sedentary behavior in participants per day varied between 5 and 15 hours. Taking all the minimum durations into account provides a minimum average of 9.4 hours, whereas the maximum duration average provides an average of 9.7 hours per day. The average of days per week when such behavior applies is given by a minimum average of 6.3 and a maximum average of 6.4 days per week.

Q4: Eight participants stated that they are sedentary while working and during their spare time as well. Two stated that they are only sedentary on the job.

Duration and Kind of Gaming Activity per Week (C)

Q5: All of the participants stated to play computer games as well as traditional games, PC being the dominant choice for digital games with 8 mentions, next to console and smart phone mentions.

Q6: The duration of game-related activities per week varied between 0.5 and 25 hours per week. Durations of sessions of gaming activities were described between 0.25 and 4 hours. Taking all the minimum durations given into account provides an average of 1.8 hours, whereas the maximum durations provide an average of 1.9 hours per week.

Q7: The participants provided the percentage of gaming activities during spare time, with values varying between less than 1 and 60 percent with an average of 20.9 percent gaming activity

measured against spare time.

Q8: Genres of interest regarding games were dominated by role-playing games with 6 mentions. Further genres mentioned were strategy, card, adventure (*tell-tale* games), jump n' run, tower-defense, rail-shooter, open-world and local-cooperative games. Traditional game choices were dominated by card games with 8 mentions followed by 7 mentions of board games, other mentions referred to social, dice, role-playing and pen-and-paper games.

Q9: Eight participants expressed interest in games related to physical activity by stating yes or rather yes. Two participants were undecided. No participant gave a negative answer.

Q10: All of the participants stated to prefer or rather prefer gaming activities in a group. Cooperative play or related forms are the most mentioned game modes of social gaming with 9 mentions, including answers like coop-against-others and casual-coop. Competitive gaming and related forms were mentioned on 4 occasions including also the coop-against-others answer. One participant did not answer the question. The related preferred group sizes vary between 2 and 10 persons. Taking all the minimum group sizes into account provides a minimum average group size of 3.7 people, whereas the maximum given group sizes provide an average of 4.8 people.

Satisfaction with Physical Activity Routine (D)

Q11: Participants stated that being physically active is of importance or rather of importance to them in 7 cases; two participants stated they are undecided and one participant stated to have rather no interest in being physically active.

Q12: Participants estimated their degree of activity being low, which was the dominant answer with 7 replies, next to 2 answers stating medium degree of activity and one answer claiming high degree of activity.

Satisfaction with Physical Appearance (E)

Q13: The satisfaction with the own degree of fitness was mainly negative, with 6 answers in the no or rather no field. 2 participants stated to be satisfied with their own fitness level and 2 remained undecided.

Q14: The question regarding participants' satisfaction with their own physical appearance was mainly negative with 5 no or rather no, closely followed by 4 yes answers and one undecided participant.

Interpretation

The interpretation of the data of the questionnaire is done in accordance to the related topics A-E and contains basic design decisions, indicators for integration of activity and game aspects as well as potential indicators for design. We further highlight data underlining our choice regarding the participants and their qualification regarding the target group.

Duration and Kind of Physical Activity per Week (A)

Leg-based activities like walking and biking were stated to be the most dominant kinds of practiced physical activity more than 10 minutes at a time, which also complies with the World Health Organizations' recommendations for minimum workout duration (as described in *2.1.1 - Physical Activity*) and also got underlined by data regarding activities usually done in groups. Hence it can be said that this aspect highlights that leg-based activities could provide a possible basis for workout, which also does not require special environments or additional equipment like swimming or squash would.

Transition between locations and cleaning were mentioned in connection with such activities, underlining that that such activities are often necessities rather than choices. We will therefore take transition-related concepts into consideration. Since group-based activities were generally received positively, this will also be taken further into account.

Duration and Kind of Sedentary Activity per Week (B)

The overall data in this section indicates that many participants perceive themselves to be sedentary around 9 to 10 hours per day, mostly on the job and in their spare time alike, almost every day of the week. Since sleep was excluded from this estimate, we hypothesize that this shows potential for propagating a more active behavior during the spare time of our participants.

Duration and Kind of Gaming Activity per Week (C)

As all of our participants stated to play games, digital and traditional games alike, which also take up a considerable amount of spare time, among certain participants up to 60%, it can be said that games provide a possible channel for reaching out to them. We further take into account the average duration of game sessions of around 2 hours. We aim to provide enough game content to provide 2 or more hours of gameplay. Group play was an overall interesting aspect, more specifically on a cooperative basis. Competitive elements were also mentioned and might be of interest to them.

Data regarding the participants' interest in physical activity-related game concepts indicates that such a game concept will not be generally rejected by them. The most mentioned traditional game types were card and board games, while the most popular genre in video games was found Role-Playing-Games, hence we will take these forms of games into consideration regarding method design and game design.

Satisfaction with Physical Activity Routine (D)

Even though physical activity is of great importance to them they estimate their degree of activity being generally low. Because of this discrepancy, we hypothesize that they will not fundamentally reject a new way for being physically more active like we aim to provide throughout the course of our prototypes deployment.

Satisfaction with Physical Appearance (E)

Since most participants are not satisfied with their fitness level and their physical appearance, this further highlights that our prototype could possibly be a way for participants to address these aspects.

Influence on our Work

The following aspects, derived from the questionnaire, are being considered when designing our prototype:

- Participants' awareness of own activity level makes them potentially welcome new options for being physically active.
- Digital games are a potentially attractive way to invoke engagement in our participants.
- Role-playing game-related concepts are potentially attractive to participants.
- Digital games requiring physical activity are a potentially attractive way to invoke engagement in our participants.
- Paper prototype design elements will make use of potentially attractive board and card game-related aspects.
- Game design aspects should take leg-based activities like walking, running or jogging into account, as they are potentially attractive to our participants.
- Game design aspects should take spare time and travel-related transition times into account.
- Game design aspects should provide group-based activity and gameplay based on mainly cooperative gameplay factors but can also contain competitive gameplay factors.
- Game design aspects should provide content for more than 2 hours of gameplay.

4.1.2 Cultural Probes

Author: Michael Habiger

We conducted Cultural Probes to gather inspirational feedback from our participants. The contained tasks focused on relevant topics in regard of the research topics. The Cultural Probes further served as an initial establishment of contact between our participants and us, such as to introduce our participants to our research project in a casual manner and to lower potential barriers they might have, communicating their attitude and habits in the context of physical activity.

Our Cultural Probe packages consisted of three different tasks while the first one was divided in two subparts. Alongside with the instructions for the particular tasks our participants received various additional materials for processing the Cultural Probe packages (cf. Figure 4.1). The packages included:

- An info sheet covering facts and information about our work and the Cultural Probe packages itself
- Detailed instruction sheets for each task
- An association table for different means of transportation
- An illustration of three imaginary ways to different locations of interest and corresponding patches of various means of transportation
- A blank illustration of a shape of a male or female body. The gender of the body shape depended on the actual gender of the participant
- An instant camera
- Miscellaneous materials to fill out the Cultural Probe packages, such as different pens, glue, a scissor etc.

As mentioned above, in order to process the Cultural Probe packages our participants had to complete three different tasks, from which one was subdivided into two smaller parts.

Hit the Road Part 1
In the first task the participants were given an association sheet showing symbols of different means of transportation, for instance of a car, a bus, a train, a bicycle, for walking etc.. The participants had to write down spontaneous associations for each symbol right after receiving the Cultural Probe package. By doing so we wanted to make sure to catch the participants' very first thoughts of the shown means of transportation.

Hit the Road Part 2
For the second task the participants had to imaginarily get to various locations of interest and choose their preferential means of transportation. The locations of interest and the tasks related

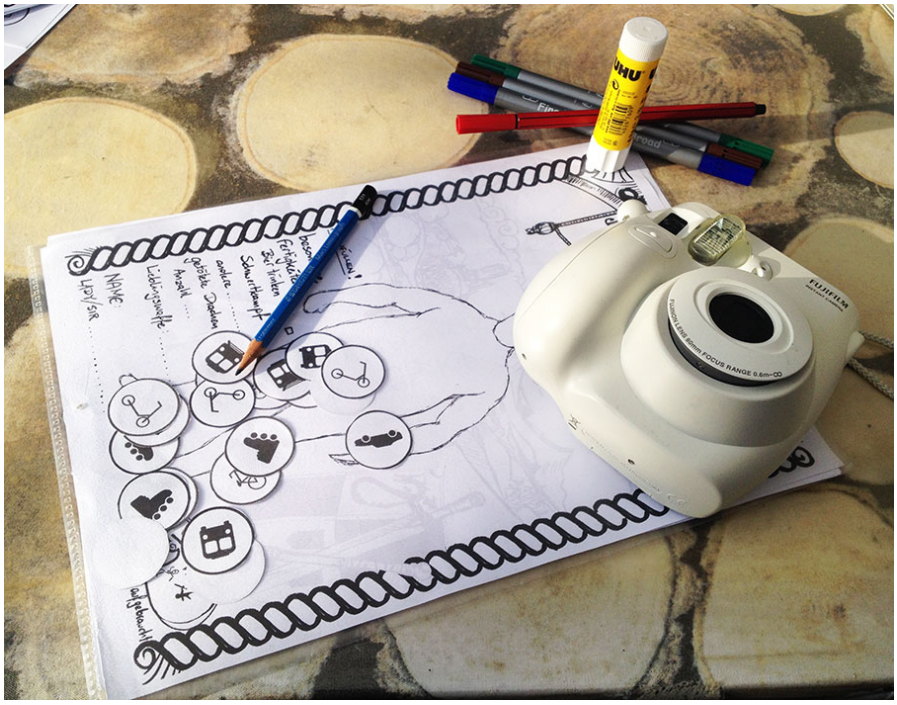

Figure 4.1: The contents of our Cultural Probe package.

to them were the ground-floor of a two-floor high building to get the mail, a supermarket to buy milk 200 meters away and to get to a cinema 3 kilometers away. The participants were provided an illustration of those locations alongside with cut-out patches showing the same symbols of the task Hit the Road Part 1 and were asked to glue these symbols representing their preferential means of transportation for the given situation on the corresponding area of the sheet. For getting the mail, only using the stairways or the elevator was available (cf. Figure 4.2).

Photo Shooting
For the task Photo Shooting our participants had to use instant cameras to capture five things of importance and relevance in their life, in specific in their daily routine excluding other people. The importance was not only measured in regard of emotional factors but also on how much time the participants spend with the corresponding subjects. Even things that were not necessarily of enjoyable nature yet of relevance were asked to be photographed. Furthermore the participants were asked to add short captions to each picture to describe its content.

Heroes Wanted
Before the participants received their Cultural Probe packages they had to choose from four illustrations showing blank human bodies of different body types each. Though the blanks did not imply any valuation nor were further described, the four body types included a slim, a chubby, a muscular and an average body form. The participants had to spontaneously pick their favorite

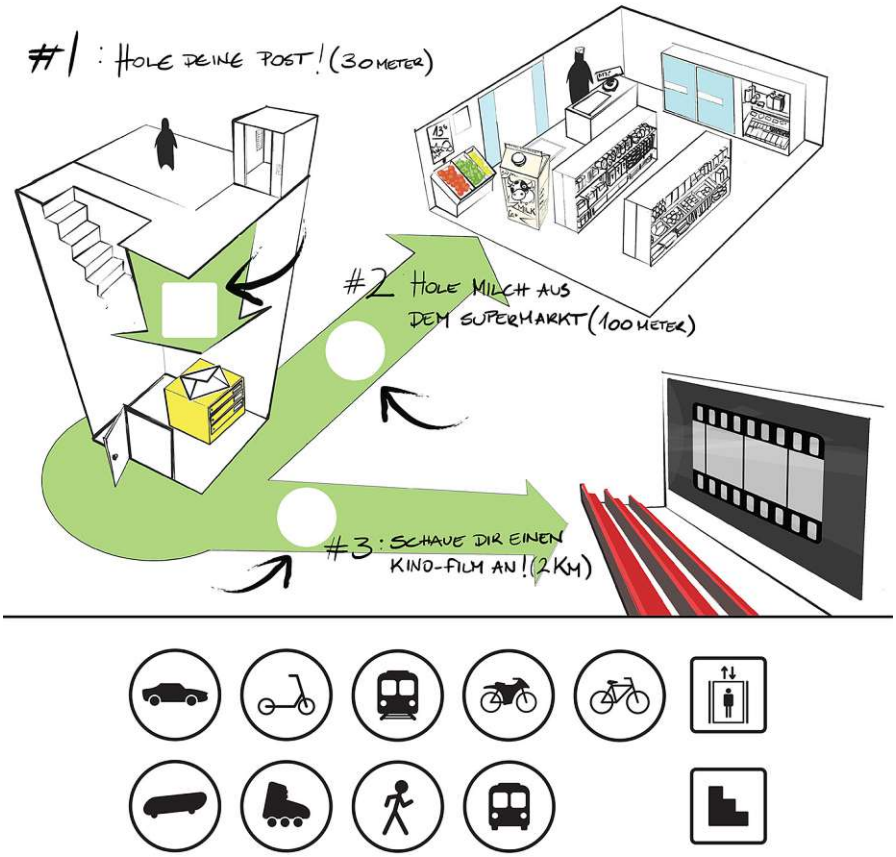

Figure 4.2: An illustration showing distances to various places of interest and the symbols of several means of transportation, as used for Hit the Road Part 2.

body type in the context of how they would prefer to look like in a fantasy world, regardless of their actual appearance. The illustrations were gender specific, meaning that the female participants were restricted to female body type templates and the males to male body type templates respectively (cf. Figure 4.3). In a next step the participants had to extend the body templates with features or details like facial features, haircuts, clothing and armor by drawing or describing them in order to further develop their custom alter ego. Ultimately the participants were asked to name their character created this way.

The first part of the first task served as a preparation for the follow-up task to give us a basic idea of how the participants perceive various means of transportation and whether their attitude towards them may influence the way they actually use them. In the second part we wanted to get a clue on how physical activity is affected by various distances the participants have to overcome in their daily routine and vice versa. Moreover we aimed to gather inspiration about possible features and aspects our game prototype might implement regarding those distances and the

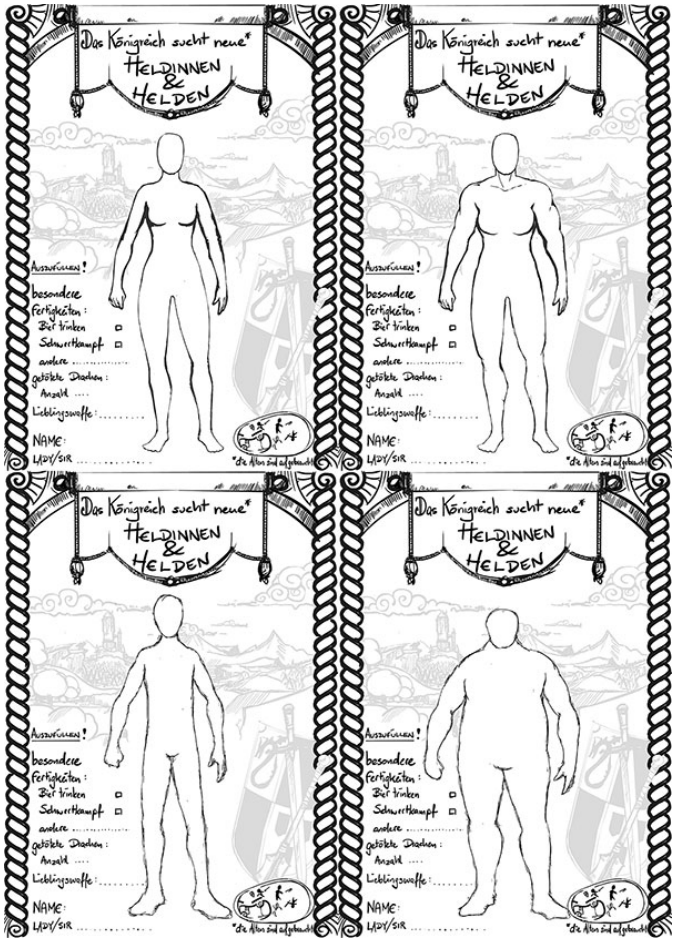

Figure 4.3: Examples of the blank body shapes our participants had to choose from: A muscular and average female body shape, as well as a thin and obese male body shape.

means of transportation used by our participants.

With the second task we aimed to gather insights on the lifestyle of our participants and whether the most present things of their daily routines may be linked to sedentary behavior. By using an instant camera we intended to foster a kind of novelty factor as a motivator to perform the task. Since the result of the photography could be reviewed instantly after the picture was taken, thus making additional equipment obsolete for this process, we intended to further lower the barriers to engage in this task. Furthermore we aimed to maximize the reliability of the things photographed by our users. While digital photographies can be easily reconsidered and deleted, analogous pictures are more or less fixed the moment they are taken.

The intention behind the last task was to draw connections between the participants' real body shape and the chosen blank body shape in the context of a possible desire to change their

physical appearance. To make this task more appealing and to foster identification with the various body shapes our participants were asked to complete the blanks in order to create their favored fantasy avatar.

Data

In the following we describe the processed Cultural Probe Packages we received from our participants in the chronological order of the different tasks.

Hit the Road Part 1
Walking was associated with terms like healthy, fit and relaxing but also with being slow and making time and endurance necessary. *Climbing the stairs* was associated with physical exertion or fitness throughout. The attitude towards the *scooter* and the *skateboard* was rather mixed. While some participants relate such means of transportation with practical, fun or stylish, three of them associate especially the scooter with businessmen. *Rollerblades* were generally perceived as vintage and childhood-like but also as being fun and for recreational purposes like playing inline-hockey or to rollerblade on the Donauinsel. Nevertheless two participants find rollerblades a rather impractical way to travel. *Bicycles* were associated with being practical, suitable for recreational purposes and a quick way to get from one point to another. They were also linked to be boring or the term 'ouch [author's note: translated from the german term 'Autsch']'. The consensus regarding *motorbikes* was that this means of transportation is quite dangerous and in this context is linked to accidents. *Driving by car* and *using the train* were both perceived mixed by the participants. While cars were associated with fun, comfort and independency, they were also linked to stress, traffic and noise. Though trains were described as being convenient, relaxing and economical, one participant wrote that they are not as stressless as they used to be. Furthermore two people associate trains with delays. *Using the bus* was mainly associated with negative terms like being inconvenient, pressing, shaky, sickening and as being a necessary evil. One participant described using the bus as economical. The *elevator* was often linked with laziness, while one participant referred to it as something that is there not to be used.

Hit the Road Part 2
Four participants chose the elevator to get their mail from the basement and further four claimed they would use the stairs. One participant attached both symbols and provided additional hand written information, that she would use the stairs when she gets down to the basement and the elevator to get up to her apartment in the 2nd floor again. To buy milk from a supermarket, which is 200 meters away, all participants would walk; except one who would use her bicycle to get there. To cover the distance of 3 kilometer to watch a movie in the cinema nearly all participants would use some kind of motorized vehicle to get there. Four of them would use a car, while the other four attached the bus or train symbol to the distance). Similar to the mailbox task the same participant chose several means of transportation and provided additional information. Depending on the specific situation and city she currently is in, she would use the train or bicycle to get to the cinema or she would walk there if appropriate.

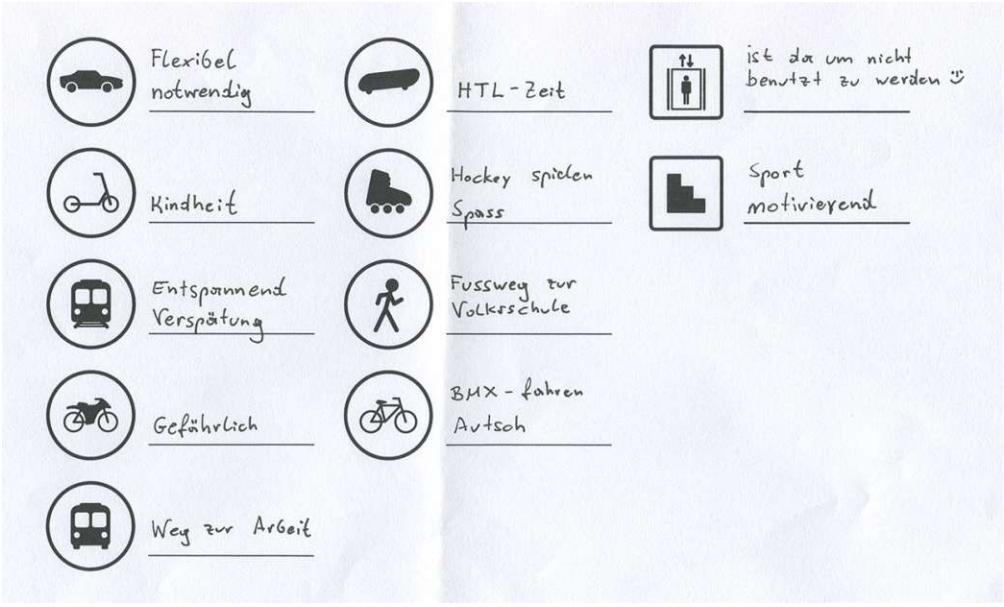

Figure 4.4: A processed association table of *Hit the Road Part 1*, including the association 'Autsch' with bicycle.

Photo Shooting
The two most common things our participants took pictures of were their personal computer or notebook and their devices for watching movies or television, including TVs and a beamer. In this context one participant photographed his DVD-collection. The description of the PCs and notebooks were often linked to work and leisure time likewise.

Four participants returned pictures of their beds to us, while two of them described the pictures quite emotionally. One participant included a small heart next to the description, while another one referred to the bed as 'sleeping' followed by two exclamation marks (cf. Figure 4.6). Three participants took pictures of their couches, while one of them described his couch as being a place where he 'chills' in his apartment.

In terms of means of transportation two participants returned photographies of their bicycles to us, from whom one described it as her 'means of transportation number 1'. The same participant took a picture of her shoes and her backpack describing it with 'everytime with bag and baggage'. Three other participants included pictures of their car and one photographed a subway train. The remaining pictures showed miscellaneous subjects like a coffee machine, a handbag, pencils, a freezer or a stove.

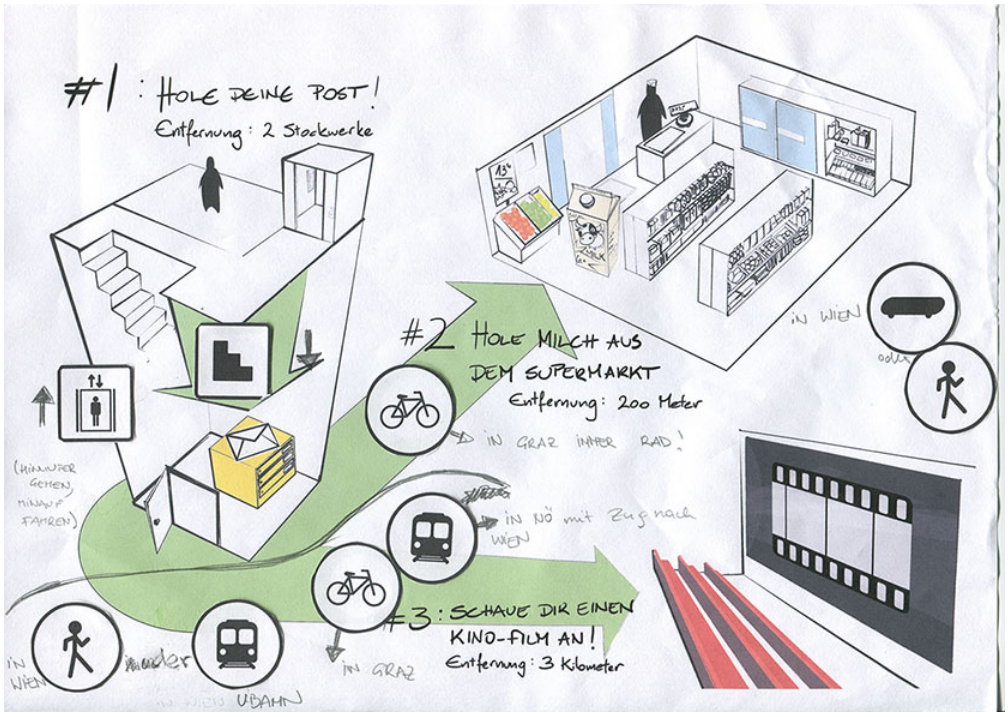

Figure 4.5: A filled out *Hit the Road Part 2* - sheet, with attached patches and detailed descriptions for each distance to cover.

Heroes Wanted

Two of the female participants chose the slim body form while one of them simultaneously pointed at the average female body type and stated that she knows she looks more like this (the average female body type) but if she had been given the choice she rather looked like the slim one). One participant chose the average body type, another one the muscular body type and one participant decided to pick the obese one commenting her choice that it would be funny to play such a character, despite of being rather slim in real life. In the course of processing the last task of our Cultural Probe Package the same participant further expanded the outlines of her obese female blank to make her look even thicker.

Concerning our male participants, two of them chose the average male body form, two the slim type, one picked the muscular body type and one the obese blank (similar to the female participant who chose the obese female body type, the male who chose the obese male body type is rather slim and athletic in real life).

The blanks were completed with rich details ranging from simple drawings to extensive descriptions provided besides the drawn features (cf. Figure 4.7). Some participants added separate detailed views of specific armor parts, weapons or accessories and explanations of how specific objects work. One participant for instance created a samurai-like avatar wielding a speargun

Figure 4.6: Various photographies received from one of our participants. The picture of her bed is additionally marked with a small heart next to the description.

and provided further textual information of the functionality of the gun. A female participant supplemented the features of her character with textual descriptions of special attributes linked to the corresponding body or clothing part (for instance that she can hear foes quickly or that her clothes change color according to the background). Another participant furthermore wrote a little background story for his character on his character sheet. Things that were not visible because of the abstractness of the drawing or were possibly overlaid by other objects were also mentioned textually. For instance one participant wrote that she has a crossbow attached to her back while another one described the skin of her character as tanned. All blanks contained weapons of some kind. Those which had no explicit weapons, such as axes or swords, included descriptions that the character was for instance able to fight with her hair or in another case could battle with his bare hands. Overall, as mentioned above, basically all body type blanks were returned with quite a high grade of detail.

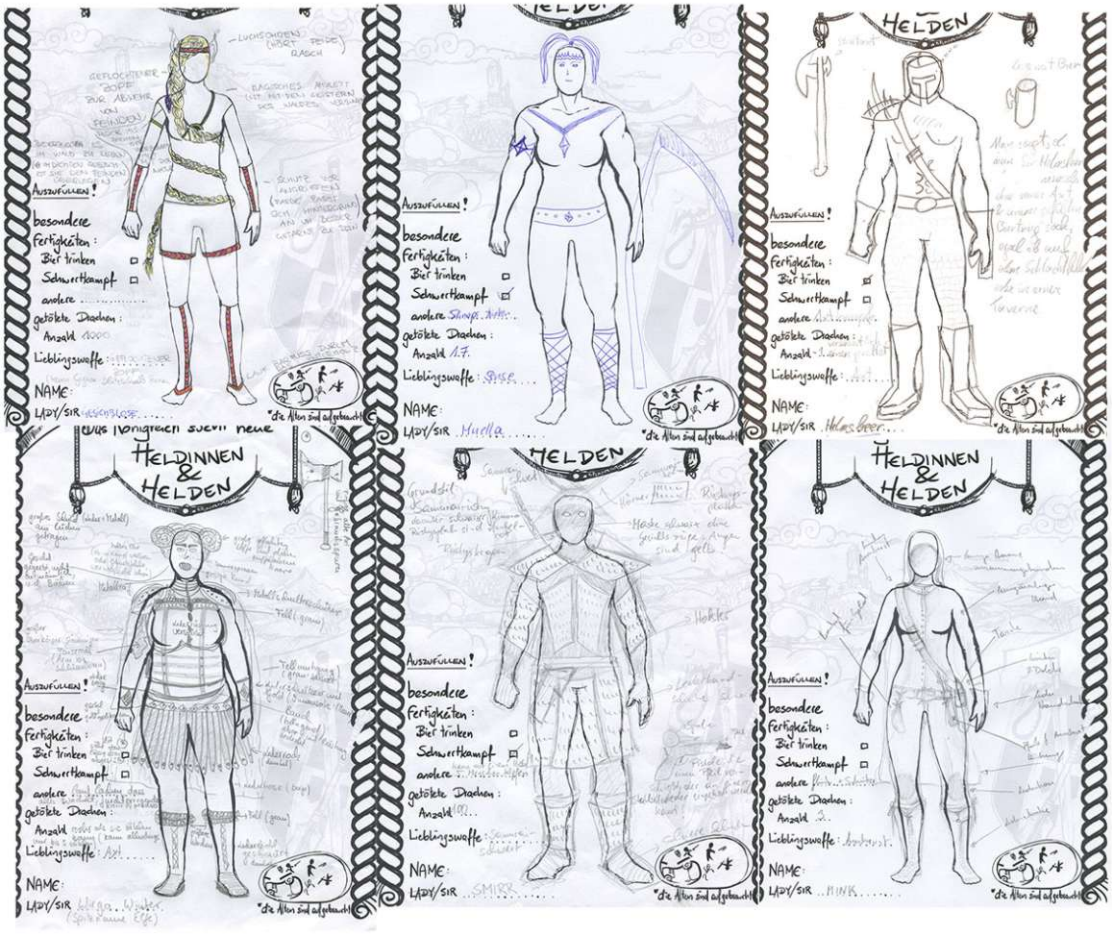

Figure 4.7: Samples of the processed blank body shapes, populated with rich details and descriptions of various features of the created characters by our participants.

Interpretation

According to Gaver et al. [38] our processed Cultural Probe Packages were not over-categorized or over-rationalized but rather used as inspirational source for our further work. We processed each part of the Cultural Probes Packages in regard to derive possible guidelines and ideas for further design decisions.

Hit the Road

Walking was in general described as being healthy or relaxing and further associated with fitness. Moreover all participants prefer this kind of movement over any other means of transportation at least for short distances. Since this kind of movement seemed to be perceived quite positively and is common among our participants, leg-based activities will be taken into account for the development of our game prototype (as discussed throughout *4.1.1 - Questionnaire*). Further-

more other means of transportation, such as bicycles and rollerblades were also associated with common routes in daily routines, being fun or for recreational purposes. Therefore such physical activities may also be of interest for future design decisions regarding our game prototype.

Photo Shooting
A major part of the photographies we received from our participants contains subjects which may be linked to sedentary activities. This included computers, televisions, beds and couches. The descriptions provided alongside with the pictures hint towards PCs or notebooks being used for work and leisure time likewise, while couch or sleeping activities were often described emotionally by adding signs like a drawn heart or exclamation marks next to the writings. The photographies may further confirm that our participants engage major parts of their daily routines in sedentary activities. Furthermore the common use of computers for recreational purposes may imply a certain acceptance of the combination of physical activities and virtual gaming.

Heroes Wanted
Regarding the third task it was hard to observe specific connections between the body shape blanks chosen by our participants and their real physical appearance. While one participant stated that she would rather look like the slim body blank, other participants chose the thick body shape despite of being slim in real life. Therefore we refrained from drawing conclusions regarding possible desires to change the own body shape derived from the chosen body blanks. Nevertheless our participants seemed to put a great amount of commitment in the completion of their body shape blanks. Alongside with drawn features they often provided textual descriptions indicating a certain intention to express themselves through their custom avatars. Therefore we decided to integrate the characters created by our participants into our game prototype as their actual avatars alongside with their chosen nickname. To make the characters provided by our participants fit the overall visual style of our game prototype they will be redesigned accordingly. By doing so we might raise the grade of identification of participants with their personalized avatars by ultimately making them part of the provided virtual world of the game prototype.

Influence on our Work

The impact the outcome of this method had on our prototype is as follows:

- The game prototype should include virtual game elements as a channel to engage in physical activity.
- Leg-based activities should constitute a major part of the gameplay.
- Furthermore physical activities implying the use of a bicycle or rollerblades might be taken into. consideration for further design decisions regarding the integration of physical activities into the game prototype.
- The personalized avatars created by our participants throughout the procession of their Cultural Probe Packages and their chosen name should be integrated into the game prototype as their personal avatars representing them.

4.1.3 Interviews

Author: Michael Habiger

We used interviews to collect qualitative data about our participants in our field of interest. Specifically, we questioned our participants about their attitude towards physical activity, their physical activity behavior patterns, their gaming behavior and their satisfaction with their fitness level and physical appearance.

We conducted semi-structured interviews and thus used an interview guide containing questions categorized by our relevant topics. The interview guide consisted of basic questions and related sub questions. Furthermore it contained alternative questions for some topics to allow us to react to specific situations or an unexpected flow within the interviews. The answers of our participants were generally further elaborated by inquiring on specific aspects of the given response. To keep up the flow of the interview the question blocks assigned to our topics of interest could be asked in any non-specific order if necessary.

The main topics of interest our interviews focused to cover were:

- The participants attitude towards activity
- Barriers and motivators for physical activity
- The participants gaming behavior including physical activity games
- The satisfaction with the fitness level and physical appearance

By conducting semi-structured interviews we aimed to investigate the mentioned aspects in our participants and to gain qualitative data as a basis for further design decisions for our game prototype.

Data

The data of our interviews was processed and summarized by loosely assigning the participants' statements to the appropriate topics of interest as described above. Considering the nature of the free answers of our participants various statements may fit two or more categories as well. Therefore the presented data has to be considered appropriately.

Attitude towards Physical Activity

Throughout the conduction of the interviews the term *physical activity* was emotionally perceived quite mixed, though it is frequently associated with physical effort or exertion. Two of the participants mainly comprehend physical activity as a necessary factor to travel from one location to another, for instance to get from home to the working place and vice versa. Another interviewee described this kind of necessary activity as stressful especially when she is under

the pressure to catch a train or the bus. She generally distinguishes between the mentioned necessary activity and activity which is meant to be fun like for instance sports. In this regard she stated that she has the desire choose the quality of her physical activities in a more conscious manner, because from her point of view the amount of stressful activity as described above is too high.

Two participants perceive physical activity as a potential strategy for relaxation and recreation. One of them stated that he rather enjoys walking for a certain amount of time than spending this time waiting for the bus. Another interviewee appreciates physical activity as a thing that just belongs to his life and as an important factor for recreation.

Basically all interviewees think that they engage in a sedentary lifestyle in means of spending too much time sitting or lying at work and during their leisure time. Only one participant stated that he is sedentary only at home or during his leisure time respectively because he needs to mainly stand or walk at work. Five of the participants stated that they spend their time sitting using their computers for gaming and Internet surfing or the television at home, while two of them read books as well.

Barriers towards Physical Activity

As stated above, there exist various circumstances that the participants perceive as possible reasons for being physically inactive. Three of the interviewees think that the lack of time is crucial in this regard. While one of them stated that she is not quite sure which the actual reason for her physical inactivity is but would spend more time doing for instance sports if she had more time at hand. For some of the participants not only the lack of time but also exhaustion is mainly caused by their work or their studies, preventing further physical activity. Although there might be enough time sometimes, three of the interviewees feel to not have the sufficient amount of energy to actually be physically active when arriving at home after their work or studies especially when the day was outstandingly stressful or exhausting. For one participant in this regard the weather plays an additional role as a potential barrier to engage in physical activity, as he stated that he has not the intention to 'torture [author's note: translated from the german term 'quälen']' himself by doing sports in bad weather. For the same interviewee a further reason for physical inactivity might be problems related to private and working live, as he stated that he worries to much about complications regarding that matter and therefore just is not in the right mood to do sports sometimes.

Another barrier to engage in physical activity is the missing fun factor of certain activities. Two of the participants gave the example of jogging being too monotonous. For one of them sports somehow has to include entertaining aspects in order to motivate him.

For the same person not only the lack of amusement but also to overcome his own 'weaker self' might discourage him to be more physically active. He stated that it is far more easy to turn on his computer or television than actually get up and exercise. Another interviewee pointed out similar aspects, as he relates the whole process of getting up, dressing for sports, getting

out and actually to start running as a demotivating factor per se sometimes. In this regard two participants identify their current state of fitness and body shape as a potential reason for not being physically active. One interviewee described his physical fitness by now catastrophic and thinks that it gets harder to bring oneself to be more physically active the longer one remains inactive.

For one participant social factors play a further role as a barrier to engage in activity. While she stated that she never played digital games in the past, she now spends a large amount of time playing with her boyfriend, whom she describes as being physically inactive as well. Despite the fact she shows interest in playing basketball she revealed that her boyfriend refuses to play with her because of his idleness.

Motivators towards Physical Activity

In the course of conducting the interviews the participants were also asked about potential motivators for them to be physical active. While one of the participants nevertheless is physically inactive he is quite aware that being physical active might increase his health conditions. Therefore he can imagine this fact as a possible motivator to engage in physical activity. The same applies to his perception of getting into a better body shape by doing exercises. In this context three of the participants stated that they do physical activities not explicitly for a better body shape or health but for the sake of doing something good to oneself. For instance one interviewee feels better after doing yoga exercises despite the fact that she has to bring herself to perform them. The other participant described the fact of feeling good after physical activity as some kind of feeling of success. She thinks the reason for this is because she plans to be physically active beforehand, takes the necessary time for it and actually puts her plan into action. For one interviewee doing sports, especially in natural surroundings, triggers feelings of inner balance for him as well as the knowledge of doing something good to himself as described above. Furthermore he stated that sometimes a monotonous activity like for instance jogging is doing just fine for recreational purposes as such kind of activity does not overwhelm him.

Another often addressed motivational factor to engage in physical activity during the interviews are social aspects. One participant stated that meeting his friends is a very important factor for him and he therefore perceives doing physical activities as an effective opportunity to do so and to socialize with them. In this regard another interviewee thinks that doing sports in a group feels less exhausting and annoying based on ‘a sorrow shared is a sorrow halved [author’s note: translated from german ‘geteiltes Leid ist halbes Leid’]’. A further motivational aspect of importance to two participants in the context of social aspects are competitive factors. For one of them trying to outmatch another person automatically sets a distinctive objective to achieve, especially when playing games like inline-hockey or squash. The same applies to the other interviewee who finds the fusion between physical activities and game elements, like in his case football, and the competitive as well as cooperative factors arising therein a suitable way to motivate himself to do sports. For one participant observing how friends become fitter and better shaped by doing sports can be a motivational factor to engage in activity as well.

For two participants preserving the fitness level itself can be further motivational. One of them stated that he basically wants to be ready and flexible enough for everything related to physical activities coming up to him. He would not want to take a pass on certain activities just because of his possibly poor level of fitness. He furthermore tries to outmatch himself in order to motivate himself to be physically active. Along with the other interviewee he pointed out that the thought of getting exhausted by just taking the steps or generally doing minor task in terms of physical activity feels quite unpleasant.

Motivators towards Gaming

In order to point out potential motivators for gaming and digital games in specific our participants where asked about their gaming behaviors in general and the reasons why they play games. All of our participants play digital games on a regular basis. Five of them think that social factors have a crucial impact on their gaming behavior and act as an important motivator for gaming. In this regard our interviewees distinguish between cooperative and competitive games. One participant stated that he likes the possibility to compete against other players and to outmatch them, while the game does not have to have only competitive but cooperative elements as well. For instance he enjoys to team up with other players to compete against another team. From his point of view the right mixture of competitive and cooperative elements depends on the game and the current mood. Nevertheless he and another participant furthermore stated that they started to play a digital game because their friends played it as well. A similar aspect is true for two other participants, who mainly play computer games because of their boyfriends and with them. For one of them playing games is something intimate therefore it is of great importance for her whom she shares her playing time with. In this context she said that winning is secondary for her as she rather plays together cooperatively than against each other. The other participant who mainly plays with her boyfriend stated that she never really played digital games or even showed interest in them before and that her boyfriend is the main reason she does so. She prefers cooperative games because this way she actually spends qualitative time with her boyfriend and enjoys accomplishing objectives together with him while playing them. Nevertheless she furthermore stated that she likes to play traditional games, for instance tabletop or card games, as well. In this context she pointed out that the social aspects are much more promoted with traditional games than in digital games as one can have direct eye-contact or conversations with the other players. Another motivator to play cooperative digital games for one of the participants is the fact that he has the feeling to share his experiences and successes with other players. In his opinion the reason why he enjoys such features is simply his attitude towards other people and friends especially.

Three of the participants find it motivating when digital games are not too realistic but rather have some kind of fantasy-driven genre or elements. While one of those participants stated that she is ok with similarities to the real world in games she would not want to play games which are too life-like or which addresses scenarios of the real world like for instance war games. In this context one interviewee can imagine that it is important or motivating for people to have the possibility to fade out of reality completely and immerse into the game while playing.

One reason why one of the interviewee prefers playing digital games over watching television is the interactive character of a digital game. He appreciates to have some kind of influence on how the adventure he is playing takes place. This kind of freedom of choices feels more exciting to him than just watching television. He stated that the influence the digital game provides leads to a certain strategical depth as well. Along with another participant he finds these given strategical opportunities quite motivating to play certain games. Both participants prefer strategically-driven games over games where the player has to rely on fast reactions or luck to progress.

For one of the participants the design of the game is explicitly important. She sated that the design not only means visual, aesthetical or graphical aspects to her but also aspects regarding the design of the game mechanics and that those factors have to be made in a 'beautiful [author's note: translated from the german term 'schön']' and well thought way. She furthermore pointed out that the design of the game mechanics is even of more importance to her than the way a game looks.

Another motivator for one interviewee is the achievement of specific targets. For him it is motivating to try for instance one level over and over again when he fails at it repeatedly. Another factor in this regard is to continuously do the same in an online role-playing game, like farming resources for a new armor or ability. This way of playing digital games allows him to emotionally switch to a 'standby' mode by fulfilling certain tasks.

Two of our participants emphasized that a game must not be too complex. While one of them referenced a platform game which has to be relatively straight forward in order to be motivational, the other one stated that he prefers traditional games like *UNO*. He described this game as simple and intuitive so basically everyone can start to play right away.

One further reason for one of the interviewees to play digital games and to chose them over physical activity sometimes is the simulation of physical activity within the game. She enjoys playing games in which she can move her avatar fast and likes the fact that she can accomplish this movement by just triggering some buttons.

Activity-Related Games

Five of our participants perceive activity-related games, for instance games for the *Wii*, *Kinect* or *PlayStation Move*, as a funny way to combine physical activity with game elements. While one participant was skeptical at first he enjoys especially sport games from time to time by now. The reason for his change of mind was the astonishingly precise body and movement tracker. For him this factor raised the fun factor and motivation to play such games. While for another participant, though he has not tested sports games yet, an interactive workout game involving physical activity might be of interest, two other interviewees do not see activity-related games as a replacement for real physical activity or sport. One of them stated that although one actually move, those movements are just very short and quick and in the end one just stands in the same place the whole time. In this context one participant prefers games which are not explicitly

movement games but rather games which involve movement for the sake of the gameplay. She would not want to play a game in which you have to for instance raise your arm several times to move your avatar forward. As an example of a good activity-related game she mentioned *Raven Rabbits* where the player has to fulfill small tasks by taking appropriate physical actions. One of the interviewee would only play activity-related games in company of friends.

Satisfaction with the Fitness Level and Physical Appearance
All participants stated that they either want to be more physically active, but can not for various reasons or are dissatisfied with their daily routine in means of physical activity. One participant also mentioned that he actually knows that he should increase his degree of physical activity for reasons of his health. In general all interviewees see reasons for change of their grade of physical activity.

In the context of the satisfaction level regarding the own physical appearance one participant stated that she is basically content but also aware that there are specific regions of her body which she would like to change. For another interviewee it is of importance to not look too chubby and to not having a posture which may be perceived as too 'broken' in the context of being unhealthy. For two of our participants beauty arises from feeling fit. Though one of those interviewees is not satisfied with her physical appearance she further explained that she would be content if she simply had a good feeling about herself and her fitness level. She rather wants to 'feel good from the inside [author's note: translated from german 'sich von innen heraus wohlfühlen']' than aim to equal some kind of common ideal of beauty. In this context one participant stated that it would be nice to be thoroughly fit and buff like the beau ideal is conveyed via media but thinks that this does not seem to motivate him quite enough to engage in physical activity.

Interpretation

The data of our interviews was analyzed in order to elaborate potential factors and indicators for future design decisions. Furthermore we derived guidelines from the relevant aspects revealed by our interviews for the continuative development of our game prototype.

Since several participants perceive that transitions from one location to another location solemnly as a necessity and one of them as quite stressful it might stand for reason to give those travel distances some kind of purpose by taking them into account for further design decisions. One participant further states that he rather enjoys to walk instead of spending his time waiting for the bus. This further emphasizes the idea of integrating such leg-based transitions into the game prototype in a meaningful way. These insights correlate with similar findings during the evaluation of our processed surveys (see *4.1.1 - Questionnaire*) hence this topic might be of vast relevance.

A major part of our interviewees perceive a lack of time as a potential barrier to engage in physical activity. Since many participants further stated that they spend great periods of time using their computers for internet surfing and gaming or watching TV, an approach to combine physical activity with gaming elements might overcome the mentioned lack of time to engage

in physical activity. Such an approach might be further sustained by corresponding results of our surveys, showing that despite of stating a lack of time for physical activity, all participants spend up to more than half of their spare time playing digital or traditional games (see *4.1.1 - Questionnaire*). Additionally two participants generally perceive physical activity as being too monotonous and miss entertaining aspects in this regard. Therefore a fusion of playful elements and physical activity might further act as a potential motivator for people to be more physically active. Since all participants are not completely content with their current level of fitness or their physical appearance and would appreciate a change in this regard, integration of physical activity requirements into our game prototype seems obvious and is further promoted.

One participant emphasized that movement in virtual games incorporating physical activity needs to be meaningful for her. Hence the integration of physical activity into our game prototype aims to be comprehensible and actually related to the events happening in the game and vice versa (e.g.: if the player walks in real life, the player's avatar should walk as well).

Of further importance for one interviewee were strategical depth and the possibility to make decisions in virtual games as well. Thus similar features to allow some kind of freedom of choice will be taken into consideration for further design decisions.

A participant mentioned that achieving targets (for instance reaching a new level in the game) are a motivational factor for him to play virtual games. In this regard a proper rewarding system might be a beneficial feature to integrate into our game prototype.

For most interviewees social factors are an important aspect in the context of physical activity and traditional or virtual games as well. The preference for competition and cooperation with other people might suggest to take multiplayer features into consideration. Such an approach might moreover be established since some of our participants enjoy to share their accomplishments or exhaustion – 'a sorrow shared is a sorrow halved' – with other people. Additionally, for one participants seeing the progress other people achieve constitutes a further motivator to engage in physical activity.

In the context of social aspects one participant thinks that one major advantage of traditional games towards virtual games is that the players can see each others mimics and gestures and can actually talk to each other directly. Therefore features to enable direct and real contact between players are taken into account for our game prototype.

Regarding the setting of the game prototype three of our participants favor a fantasy-related genre over too realistic ones. Hence a genre including a fantasy-driven story line and fantasy elements might satisfy such preferences and may therefore contribute to a positive acceptance of our game prototype.

For one interviewee the aesthetics in the context of game mechanics and visual appearance of a game are of great relevance to her. Though well-thought game mechanics matter more

to her, the visual style of a game has to be harmonious as well. Hence to create a consistent atmosphere within our game prototype a proper visual presentation aims to fit the chosen genre and game mechanics.

Influence on our Work

The following thoughts derived from the interviews were taken into account when designing our prototype:

- An approach to combine physical activity with gaming elements in a meaningful way might act as a motivator to engage in physical activity.
- As discussed in *4.1.1 - Questionnaire* and *4.1.2 - Cultural Probes* it is further emphasized that the game prototype should implement leg-based activities including walking, jogging and running.
- Our game prototype should enable the player to take decisions and give him freedom of choice in many aspects of the game.
- The game prototype should support multiplayer features, including competitive and cooperative mechanics.
- A mechanic to visualize other players' progress within the game might be motivational as well.
- The game prototype should foster direct contact between the players.
- The game should be embedded in a fantasy-driven world.
- The visual representation of the game and its elements should be consistent and visually appealing.

4.2 Paper Prototype – The Design Basis

Author: Peter Fikar

The low-fidelity prototype, also referred to as *paper prototype*, was the first method directly connected with our initial game ideas and creative development approach. Whereas other preliminary deployed methods and the literature review were meant to explore the possible design space and participants' backgrounds, habits and expectations, the paper prototype test session was the first milestone in terms of testing out our creative approaches and ideas. The test session should provide us with participants' feedback about the presented materials, props and their visual representations and should stimulate ideas and reactions in them to give our development and creative attempts an initial direction. We aimed that test to be a generator and filter for ideas to shape our concepts into a more concrete form. The basis for testing this paper prototype was a game-oriented session, in which participants played the game, moderated by the authors, and

provided feedback, opinions and ideas regarding situations they encountered during the progress of the game session.

The basis on which the paper-based prototype test was conduct consisted of the things we learned through the Cultural Probes, the user-habit questionnaire and the interviews, all of which have been carried out preliminarily. During this test we made use of the Wizard of Oz technique on the basis of early concepts of visual designs and sketches as well as of note-taking to gather important feedback.

In this chapter we explain how the testing of the paper prototype was undertaken and which techniques we adapted to best fit our needs regarding the goals of our research, the themes it sought to explore and how it was applied to answer questions and give indications relevant to the fields of interest of this work.

First we describe the setup and the materials, such as sketchy illustrations and carefully crafted props, used to communicate our ideas to the participants and meant to enable a flow of conversation about the proposed visual elements and aspects of our design. We proceed by presenting the detailed feedback gathered regarding the concepts and materials we introduced to the participants. In order to enable interpretation of the feedback gathered we define topics and criteria for analyzing the provided data. The interpretation will then grant us with indications of possible design decisions and concrete directions. Finally we conclude the presentation of the paper prototype with guidelines for development for our further digital iterations and therefore present the basis for our digital development process.

4.2.1 Setup

Author: Peter Fikar

The user test session was set up around the idea of providing a game-like experience to the four participants and took place at the home of one of the authors. The atmosphere was meant to be relaxed and informal since the goal was to apply the test under the premise of a social board game evening. The participants of the test were set up as being the players and were meant to navigate a token on the map representing their character in the game world. The situations within the game-experience presented to them were prepared beforehand. The flow of the interactions and the corresponding reactions of the system were simulated by the moderators. The moderators provided guidance, discussion incentives, questions, explanations, narrative elements and interaction effect simulations. To initiate discussion and provoke qualified feedback in participants, we prepared a printed paper map as the visual basis for gameplay, much like a game board, and objects for representations of elements and interactions put together in a consistent storyline narrated by the moderators.

In this context we applied the Wizard of Oz approach when simulating non-implemented interactivity. Users should be able to learn about our ideas without using technology. This way we ensured that game-related aspects were communicated to the players. We applied it less in

the way of playing a silently reacting computer, but in a more verbose manner and therefore provoking feedback from participants, making them try different approaches in different game situations and encourage the generation of alternative ideas in them. This way we aimed to provoke expression of expectations, wishes, satisfaction and opinions on planned features, interactions and visualizations of the planned game software.

We applied note-taking as technique to record data during the test of the paper prototype. One of the authors was writing down notes, while the other one moderated the test session. The notes written down were meant to capture important sayings or reactions of participants, but should also reflect the overall discussion going on about features and functions of the tested subject matter. Even though the notes in ethnography are taken in the field, as we discussed in *3.9 - LoFi and HiFi Prototypes*, we hypothesize that the notes we took can be seen in a similar way because we aimed to simulate a board game evening, which could be considered an in-situ event with participants enacting as players of a game, which was exactly the kind of role we wanted to explore. This approach not only synergizes with the paper prototype testing session but is also an integral part of it.

The paper prototype's imaginative background was based on a fantasy-related setting on which the prepared illustrations were oriented. Potential connections between physical activity and gameplay were also suggested to the participants to explore opinions and ideas regarding them.

To enhance immersion in the fantasy-related setting of the game, we applied sketches and throw-away paper designs throughout the paper-based prototype play session to communicate ideas and suggestions to participants. This enabled us to mature designs and open our minds to the different aspects of importance when evolving aspects of the game. It also helped us to think out of the box to come up with alternative approaches to certain issues and discuss new ideas and refined concepts with participants.

Throughout the process the participants were encouraged to reflect actively and speak freely about game experiences and elements they like, dislike or miss in the game. Furthermore they should also come up with alternative ideas while playing or ideas which are remotely connected to the flow and concept of the game. We developed the session along a short game story, which embedded the provided interactions and elements to put all those elements into relation and into a greater game-like context also aiming to set up an enjoyable background for playing.

To keep moderation of the paper prototype test straightforward and simple and to provide a richer basis for a reflection processes we teamed up the four participants of the user test in order to play. They formed two teams, represented by one player character each. Hence they had to agree on decisions they made in the game and therefore eventually provide additional information about their decision making process. The participants had to decide whom to team up with on their own.

Figure 4.8: The paper prototype test session was meant to create an atmosphere of a board game evening.

The duration of the play session was planned to span around two hours to investigate on concepts explained above.

Materials

Even though the users' experiences and receptions of a digital version of the game would be impossible to reproduce accurately within the paper prototype test session, simply due to the fact that the final installment of the game prototype requires physical activity and in-situ interaction with the game's tasks and interaction elements in the outdoors, we found that a gaming session based on a board game paradigm, containing the basic elements and interactions as well as the mentioned narrative, would provide a rich basis for feedback and would help to improve our knowledge about motivational factors of the game. In order to do so, materials for setting up the gameplay for the participants were produced to simulate the game experience. The materials were representing potential major game elements. The list of provided game materials was put together as follows:

A Paper-Based Map of the Game Environment
The printed map of the game was a concept for a map overlay tailored to fit the real-world location in the Donauinsel area. It was produced in an appropriate size to fulfill the requirements of the test session and provide the space needed for the planned test interactions and required elements (cf. Figure 4.8).

A Paper-Based Set of Icons
Those icons provided access points for interactions on the map. The icons represented different kind of elements put into the game world (cf. Figure 4.9). They were meant to embody e.g. interactive elements for the players and access points to certain features that were placed on the map for the players to explore. Their symbolic depictions were intended to represent the following in-game functionalities and effects:

Figure 4.9: From left to right starting at the top: Enemy character icon, chest icon, 'exclamation mark in a speech bubble' icon, rock icon, place of interest icon, graveyard icon.

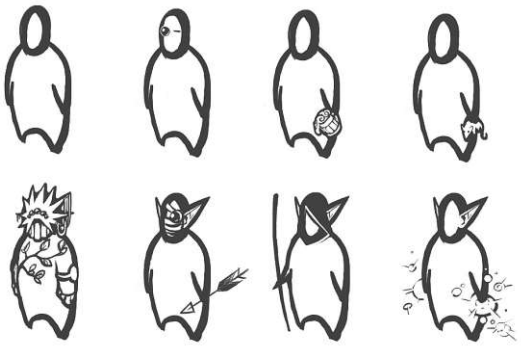

Figure 4.10: From left to right starting at the top: NPC icon in its neutral form, three detailed NPC icons depicting humans, one detailed NPC icon depicting the golem, three detailed NPC icons depicting elves.

- *Non-Player Character Icon*
  These icons represented virtual persons in the test session, which reacted neutral or friendly to the players' characters. The according interactions and behaviors were simulated by the moderators. There were different versions of Non-player character (NPC) representations present in the game session, namely a unified or neutral one and more detailed ones, depicting different aspects regarding the represented in-game character (cf. Figure 4.10).
- *'Exclamation Mark in a Speech Bubble' Icon*
  This icon represented possible dialog options and the respective interactive access points on the map to engage into a conversation with the connected NPC icons mentioned above (cf. Figure 4.9).

· *Enemy Character Icons*
These icons on the map represented unfriendly or hostile characters. Other than NPCs, enemy characters were not meant to be interacted with on a dialog basis, neither did they possess additional icons like the dialog-initiation icon mentioned above. They were designed to provide the access point for engaging into combat with the according enemy character (cf. Figure 4.9).

· *Chest Icons*
They represented the access points to closed containers holding different kind of items (cf. Figure 4.9).

· *Rock Icons*
The rock icons were blocking the paths to certain places on the map in the game scenario. They could not be broken in the beginning but are meant to be broken as the game proceeded, providing a connection to the abilities the player develops during the game, also in relation to invested physical activity (cf. Figure 4.9).

· *Place of Interest Icon*
This icon was meant to mark special locations or areas, for example the target area of a player task regarding the storyline. The design contains an exclamation mark and a star (cf. Figure 4.9).

· *A Graveyard Icon*
The icon depicted a sarcophagus and was meant to represent a graveyard (cf. Figure 4.9).

Furthermore we provided close-up view versions of most of the icons discussed above resembling playing card-sized pieces of paper depicting game elements in more detail (cf. Figure 4.11). Hence they were graphically more advanced and were not used for depicting generalized categories of interaction objects like the map icons usually did. They were differing in style to provoke responses about the looks and feel of the type of design. After interaction with an icon was initiated by the players, the following close-up view cards were shown, representing, as already mentioned, the detailed versions of the symbolic elements.

· *Non-Player Character Portraits*
The portraits of the NPCs the players could interact with were designed as rendered depictions of the upper body using grayscale paintings as representational basis. Other than the rest of the card designs in the paper prototype board game, these pictures were not created in line-art style. Furthermore the pictures featured certain elements unique to the specific character they portrayed to suggest his or her function (cf. Figure 4.11).

· *Dialog Card*
One card was designed to represent a placeholder for text, related to a dialog. The actual content of the conversation was part of the moderation and was told to the participants verbally (cf. Figure 4.11).

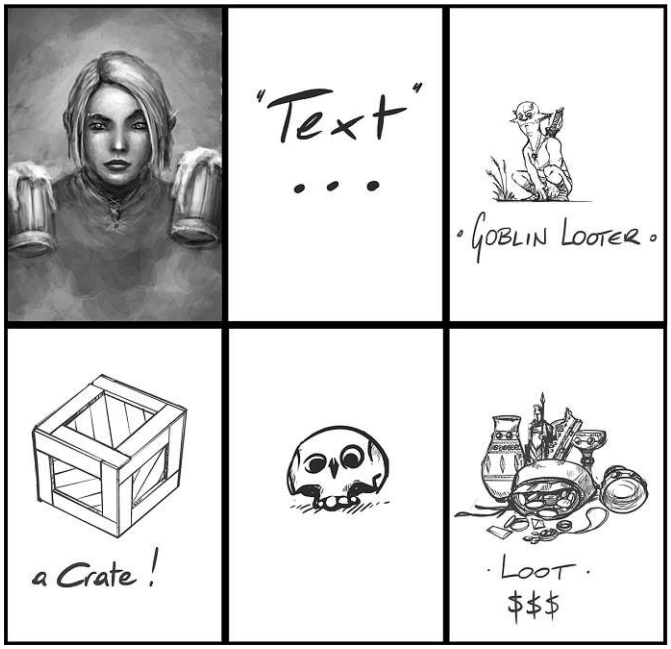

Figure 4.11: From left to right starting at the top: A NPC close-up, placeholder for dialog, enemy close-up including its name, chest close-up, corpse close-up in its general form, treasure/loot close-up.

- *Enemy Character Portraits*
  In contrast to the NPC close-ups, the portraits of the enemy characters were designed making use of the mentioned line-art style without any shading or rendering. There were two different types of enemy creature illustrations present in the game (cf. Figure 4.11).

- *Chest Close-Up*
  This picture showed a detailed view of the chest icon introduced above. The detailed view did not match the form of the icon itself as it was depicting a crate rather than a chest. The visual style utilized was again based on line-art (cf. Figure 4.11).

- *Corpse Close-Ups*
  Two different detailed views, which were again held in line-art, depicted a symbolized view representing death in general respectively a corpse. Both versions contained a skull with one containing an arrow and a dagger sticking out of the skull (cf. Figure 4.11).

- *Treasure Close-Up*
  This close-up contained a line-art illustration depicting a detailed view of a pile of gold and treasure (cf. Figure 4.11).

The players were provided with generic playing figurines to be put on the map representing their character on the map and character-sheets giving them information about their equipment

Figure 4.12: Different kind of items presented to the participants during the paper prototype test lying on top of two character sheets. Equipment items for the character to wear (to the left), gold coins representing in-game money (at the top), quest-related items such as the pet creature, the depiction of beer including a flavor text description and a goblin head as well as other miscellaneous items below (lower right corner).

and appearance (cf. Figure 4.12). The character sheet contained a placeholder, indicating the missing depiction of the player characters' looks and symbolic representations of items, namely a helm, chest armor and a hammer symbol, which were more faded than the other parts of the sheet. Those symbols represented categories of possible equipment for the player, such as clothing and items collected in the game, represented by item cards containing drawings of the specific object.

The items were designed in line-art fashion only. Different items, which could be picked up throughout the game session, were provided in form of illustration on cards, resembling the close-up views, and were shown to the players throughout the gaming session. The pictures were meant to show the following list of items:

Figure 4.13: The setup of the game depicted in more detail, including the game board in form of a map and player figurines, a blue player figurine shown on top of the pet icon (center), printed interface elements such as bars and text labels (upper right corner) and sketched cards of multiplayer ideas(lower right corner).

- *Money*
  Represented by drawings of three coins (cf. Figure 4.12).
- *Player Equipment*
  The players were able to collect illustrations of a helmet, a chest-armor, a spiked club and a hammer, which could be worn or equipped by the player's characters (cf. Figure 4.12).
- *Other Items*
  A picture of a magical potion containing a toe and pet-food packages (cf. Figure 4.12).
- *Quest Items*
  Two items were crucial for the players to gain throughout the gaming session as the story of the game progressed. These item cards depicted the head of a goblin and a tankard of beer (cf. Figure 4.12).

We furthermore introduced a pet companion for the players to collect and use. We created visual game elements representing a pet icon, a close-up and an ability interface:

- *Pet Icon*
  This icon was shown on the map when the player's character was in possession of a familiar. It is shown as part of the character's representation and is locked to his or her respective location symbolizing its special status (cf. Figure 4.13).

- *Pet Portrait*
  The close-up view of the pet was represented in the same line-art style as e.g. the items and the mechanics of picking it up in the play-through followed this scheme as well (cf. Figure 4.12).

- *Interface Elements*
  Different kinds of interface elements were introduced to the players. These sketched materials were meant to provide visual feedback to the participants about their pets' abilities. A related visual element was produced to depict different fill levels of a bar colored in a reddish tone (cf. Figure 4.13).

We furthermore integrated textual elements in the game. Text was present beneath each line-art picture no matter the category explaining what item it should represent. Words on small-sized pieces of paper contained textual descriptions of simulated button functionality. They contained different functionalities available like *loot*, *accept*, *cancel*, *try to escape* and *talk*, which could be executed by the players in a simulated manner (cf. Figure 4.13). The players were introduced to the prepared props in the order in which they encountered them as the game proceeded. We aimed to provoke feedback in participants about their interpretations and understandings of the presented materials, moderated interactions, events and the looks and feel of the visualizations.

We divided the data gathered in topics and questions derived from them, being potentially relevant for the further development of our digital prototype. The questions we asked during the session were supposed to provide direction for us to cover factors that could provide potential output relevant for the further development, acting as a guideline to cover all issues important to us. Certain aspects may fall into more than one of the categories introduced below. In such cases the regarding aspect was assigned to the topic which seemed to fit best. The term *aesthetics* in the context of the following description is meant to describe the emotional and taste-driven opinions of the participants, extending the rational interpretation of possible meaning of the materials in terms of subjective appreciation.

Topics of Relevance

The following catalogue of topics was of relevance throughout the course of moderating and further on for the interpretation of the paper prototype test session:

The Aesthetics of the Game

- *Aesthetics Fitting Context*
  We investigated on how the perception of aesthetics of the presented visuals is fitting the context of the game.

- *Picture Understanding*
  We explored on how participants understand the visual representation of the presented depictions and what they are associating with it.

- *Emotional Response Regarding Aesthetics*
  Furthermore we laid focus on how the visual elements are emotionally perceived regarding their looks and feel.

Rules of Game Interaction

- *Interactions Fitting Context*
  We investigated on how the interactions presented to the users are fitting the context of the game.

- *Interaction Understanding*
  We aimed to explore on how participants understand the presented interaction possibilities during the play session.

- *Emotional Response Regarding Interactions*
  We considered how the interactions are emotionally perceived in terms of being interesting or enjoyable.

- *Perception and Acceptance of Interactive Flow*
  We considered how the participants perceive the flow of interaction, connecting certain presented game elements.

Social Game Features

- *Multiplayer Reception*
  We investigated on whether social play in the game is a feature of interest.

- *Multiplayer Features*
  We furthermore explored which requirements such social features should fulfill to be of interest to our participants e.g. competitive of cooperative factors.

· *Multiplayer Embedding*
We also explored how social game features are best integrated in relation to other parts of the game, including possible rewards.

The Pet Systematic

Since we found the concept of a creature evolving visually regarding physical activity goals to be an interesting feature, such as presented in the Fish'n'Steps reference system introduced in *2.4.1 - Fish'n'Steps*, we included such an approach in the user test. Our approach goes beyond pure visual development of an animal and aims for a more interwoven approach for integration of feedback as well as in-game features, interactions and effects.

Therefore we investigated on the potential of such a companion or pet system during the paper prototype session, including potential integration options and possible in-game effects. Furthermore we gathered feedback about how users wish to interact with such a companion and in which ways the pet can be integrated to act as a channel of feedback regarding physical activity in the real world. Finally we also investigated on how such a companion system can be made use of to incorporate a reward system e.g. in form of providing a collecting incentive when more than one pet is present in the game.

4.2.2 Data

Author: Peter Fikar

The gathered feedback is presented in structured paragraphs according to categories that seemed to best resemble key game materials, concepts and relevant factors mentioned above. Hence it provides the basis for interpretation towards guidelines for the design of a digital version of our prototype.

The Player Character

A character-sheet was handed to the player teams before the game started. Two female participants and the two male participants formed a team because the two male participants chose their teammate instantly leaving both of the female participants with no other choice. The female team chose the character sheet with the male placeholder character and the male team vice-versa. The sheets held information about the characters representing the players in the game and were received positively. The participants understood that it showed a placeholder picture of their in-game character and several options to provide the character with different pieces of equipment for head, body and weaponry, depicted by grey pictures of example equipment. The body-related equipment slot was criticized for depicting only a piece of chest armor, which was described as being misleading because it should rather show pieces of full body armor including boots and pants, since the slot was meant to be for this type of equipment. The participants stated their desire to evolve the abilities of the character while proceeding in the game. The suggestion

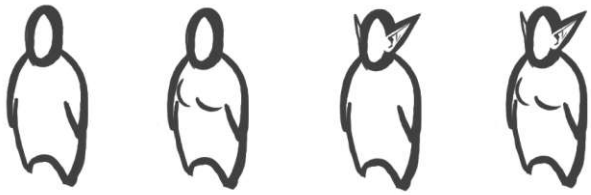

Figure 4.14: The versions of icons depicting gendered representation were rejected by our participants.

to make their increasing abilities relevant for fighting scenarios in the game was supported by the players.

The Non-Player Characters

Since Non-Player-Characters are of importance regarding the gameplay, the participants were confronted with the following features:

NPC Icons
The symbolism used for depicting the NPCs on the map was correctly understood as the representation of a person and was of enough interest that participants tried instantly to move their player-figurines towards that icon when first encountering it, even though their function was not yet revealed. The other NPCs encountered throughout the paper prototype play session have all been discussed and seemed to fit the background story and the expectations of the players.

We offered two different versions of icons representing NPCs. The icons depicting an additional detail regarding the characters function, such as representations including a rat or a tankard of beer representing a pet trader or the landlady of the tavern, were found to be slightly more interesting than the neutral versions, that is NPC icons without further features. Players stated that this would be especially useful if there was more than one NPC in one place of the map.

We also offered a female version of the icon when the players encountered a female NPC. The female representation was not received well because the participants did not expect the icons to give indication about the gender of the depicted in-game character by their distinct design (cf. Figure 4.14). The version of the NPCs not featuring female attributes have been understood as being neutral, not male, hence not symbolizing any gender.

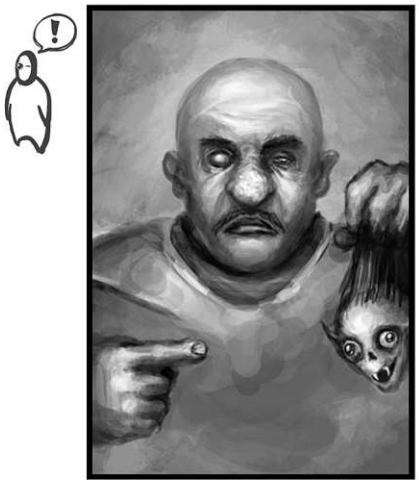

Figure 4.15: Clicking the NPC icon on the map triggers a more detailed depiction of the NPC, in this case the mercenary Brock.

NPC Portraits
After the participants initiated the planned interaction with the first NPC they were presented with the close-up views of the corresponding in-game character.

The connection between the iconographic representation and its more detailed close-up imagery was well-received and the transition between the two stages was understood as different representations of the same in-game character (cf. Figure 4.15). The portrait version of the NPC was of special interest because of the different mood and details conveyed by the fleshed-out rendered illustration. It was characterized by participants to be darker and shadier but it was also understood to convey the characters function, for example selling things or being in possession of desired items, because of the representation of choice.

This aspect showed when the close-up view of the mercenary NPC got encountered by the participants without the moderators providing any additional hint about who the in-game character might be. It was first interpreted as being the person looked for according to the expectations set by the narrative of the game storyline (the players were meant to look for the missing assistant of the pet trader). On second thought the participants considered that the portrait did not look like the person they are searching for and stated that the visual representation of him, holding the head of a creature which does not look like a pet, made them think twice about their initial interpretation, as the features depicted were not the one's they were expecting when thinking about an assistant of a pet trader. Actually, the presented close-up view illustrated a goblin-hunting mercenary (cf. Figure 4.15).

The attitude of the NPCs were questioned on several occasions because participants were characterizing them as insane-looking or unfriendly at times but it was also stated that these

factors added depth to the characters as well as triggering curiosity about the potentially wider range of reactions these characters have to offer when interacting with them. It was also of interest to the players that the NPCs could turn out to be untrustworthy, hence adding additional depth to the narrative aspects of the game.

Also the in-game importance of the character was associated with its way of representation. The participants discussed that the rendered digital paintings of the NPCs seemed to be more important than the enemy's line-art focused portraits because of the used style of illustration.

The Dialog Mechanics
When the characters of the players came closer to an NPC, an exclamation mark inside a speech bubble icon was put on the map next to the NPC and was identified by the participants as possibility to talk to this character. They also expressed their desire to click the icon to see what would happen. The icon was associated with the dialog-related interactions only, not with other kinds of interactions with different kinds of icons, for example characters interacting with the rock-depicting icon. After the participants initiated the interaction with the NPC by clicking the exclamation mark icon they were guided to the close-up representation of this specific NPC, as discussed above, followed by the simulated conversation. The text placeholder card was placed on the board to symbolize the dialog narrated by the moderators. The players expressed their wish that the conversation should contain more than just one block of text and should provide the possibility to find out more about the character by giving them choices within the dialog. The players accepted the mission by clicking a paper button representation labeled 'Accept' beneath the dialog field the NPC provided.

Quest Target Markers
The presented narrative storyline included tasks in form of quests provided by the NPCs, depending on certain map locations. A quest demanded the players to find a specific place relevant for continuing the storyline. They were provided with textual information regarding the location as well as a visual feature on the map marking the relevant spot. The place of interest icon was understood well and was connected automatically with being of high importance because of its visual representation containing an exclamation mark and a star symbol. In general the opinions on how the target location information should be provided were mixed. Some preferred textual information while others wished for direct visual indication about the location of the target.

Furthermore the participants were interested in having more than one option to complete a quest and get an extra reward for fulfilling those options even though the moderated game scenario only demanded the completion of either one of two tasks.

Marker Icons for Special Elements or Events
Some map icons for special occurrences would demand very specific representations, consisting of detailed features to give indication about their purpose. The players agreed that a unified icon representing special events or elements in a generalized way would be sufficient. This discussion originated from a possible representation of a dead NPC who was target of a player task.

Figure 4.16: Clicking the enemy icon on the map triggers a more detailed depiction of the enemy, in this case an orc.

Enemy Characters

Since one task included finding and fighting a goblin, an enemy character, enemy icons were presented to the players and placed on the map. *Enemy Icons*
At first these icons were interpreted as depicting evil rodents or something similar, since the players presumably expected a goblin-like icon. This encounter was early in the game so that the transition between icon and close-up view had not been encountered very often in the play session up to this point. After the moderators explained that this encounter works similar to the NPC interaction, the participants decided to get their character in range of the enemy icon and tried to click it.

Enemy Close-Up
After the players started to interact with the icon representing the enemy, the moderators showed them the portrait view card of the corresponding enemy character (cf. Figure 4.16). The name of the character was hidden and the participants guessed that the illustration showed the goblin they were looking for. After revealing to them that this is not the goblin but a different enemy, an orc, instead, they stated that they were not confident that their guess was right all along.

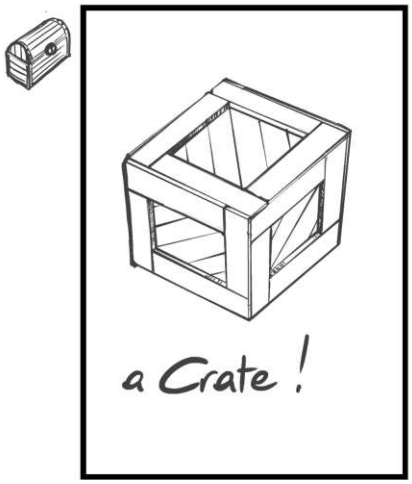

Figure 4.17: Clicking the chest icon on the map triggers a more detailed depiction of the container, in this case a crate.

Similar Interaction Objects

The following objects were introduced under the same premises as the other icons and close-ups presented above.

The Rock Icon
A house, being part of the map illustration, was a spot of interest early on during the play session. One team instantly declared this house, a tavern, to be the travel destination of choice in the very beginning of the game session. It was also stated that taverns would be of special importance because in role-playing games they are often serving as *quest-hubs* providing many possibilities to interact with NPCs and getting involved in quests. The paths to the house were marked with icons representing rocks, which were also understood as such. Furthermore it was instantly assumed that the rocks are obstacles and are not meant to be passable right away. One participant stated that if some element was standing out from the rest, it could be interacted with in his opinion. He furthermore stated that he would try out what he can do with the object by running around it and clicking it from all sides and if nothing happens he would conclude that he cannot do anything with it right now.

The Chest
The chest icon was instantly attracting the attention of the players when it came into play. They attempted to open the chest to check on its content. The moderators presented the close-up view card of the chest element, which was not directly in line with the depiction of the icon because it showed the illustration of a crate opposing the icon depicting a typical treasure chest (cf. Figure 4.17). At first the transition between the iconographic representation and detailed view was partly misinterpreted. The players assumed that the crate was the content of the treasure chest icon they just clicked on. A discussion of this issue led to the conclusion amongst participants

that the close-up of the container that showed after the icon was clicked would be definitely understood as representing the same in-game object if transitions between map icons and close-up views were consistent throughout the whole game even if the close-up picture was different in terms of appearance.

The Pet System

As the pet system was meant to provide a possible way for integrating physical activity-related aspects and feedback it is discussed here. After the participants opened the crate discussed above they were provided with a card depicting a crab. The crab was identified as possible pet or food.

Pet Icon
We provided an icon of the crab accompanying the player characters. The intention of making the pet a companion was understood correctly. There was instant curiosity about the functionality of the pet and the participants demanded information about it. They assumed to get such information by clicking it.

Pet Close-Up
We provided them with the pet's current abilities. In case of the crab the ability was supposed to be breaking rocks. Hence the players were provided with the ability to break the rocks blocking the path to the house on the map mentioned above.

Pet Leveling and Abilities
In general the players welcomed a companion system and the visual representation was interpreted as being funny. They stated that they would enjoy collecting them if there were more than one of a kind. It was further stated that only one pet should accompany the player at a time and it should not perform critical in-game actions without the player's permission or direct command.

Since our initial concept included the implementation of a direct feedback component to provide a bridge between in-game representation and physical activity performance in the real world, we introduced an additional user interface element after the players' acquisition of the companion crab. As the pet moves along with the player we simulated that a bar was filled with a reddish color. This was not received well and was interpreted by the players as being *something bad*, such as fatigue of the pet. They stated that another color would be interpreted in a different way. Green or blue for example were stated to provide a positive feeling about the raising bar. When reaching a fully filled state we announced that the status is now *charged* and asked the participants to formulate ideas regarding this situation. The players wanted to use this charge for fighting or for breaking certain items like special chests or the rocks blocking the path and should also be usable per direct command of the players.

One participant who stated to have much experience playing computer games and role-playing games in particular articulated that he finds the integration of activity feedback into a pet companion to be an interesting concept.

Items

Several items were shown to the players throughout the course of the game. The objects presented were supposed to be quest relevant items, weapons, equipment and such. The visual representations of the items presented to the players were mostly understood. Particular items provoked interesting reactions.

Hammer
One player said that the provided hammer item, which was supposed to resemble a weapon, could also be understood as being a tool to possibly break the rocks in the game's storyline.

Beer
The beer item's textual description initiated a discussion about its in-game effects. The name description of the illustrated beer jug was containing the phrase *badly tapped* which made some of the players suspicious if the item would fulfill its planned storyline purpose. The players decided that they wanted additional information text describing the items in more detail but it should be separated from the name of the object and be colored differently. This concept resembles *flavor text* present in games like *World Of Warcraft* [48] or the card game *Magic - The Gathering* [69].

Money
Some participants perceived the representation of coin illustrations as misleading. We provided a representation containing three coins on one little piece of paper representing golden coins. The number of the coins was randomly picked. The participants were interpreting the symbols differently and were confused if the three pieces of gold would represent three pieces of gold or just one piece of gold, mainly because they were provided with more than one piece of paper showing the picture. The conclusion of the participants was that one icon and a counter beneath it should represent gold so it does not lead to confusion.

Items of Special Importance
Furthermore some players stated that special items needed for in-game progress like narrative or quest-related items should have an indicator showing their importance, like a colored outline or something similar to indicate their value for in-game mechanics. This should prevent the players from giving away items needed later on. Also the items the players possess should be stored and displayed in an inventory-like structure, having each slot holding one item at a time.

The players also discussed that it would be a fresh and interesting concept if certain rewards, provided by NPCs who have hidden bad intentions, had negative consequences.

Participants also discussed special items for the pet companion, influencing its behavior or abilities, which should be gained in single player as well as multiplayer game mode. For example it was suggested that a *pet-food* reward could influence how often a pet can perform a certain action.

Combat

We offered combat-related choices to the players while the close-up view of an enemy got displayed to them. Paper buttons labeled *fight* or *try to escape* were placed on the illustration of an enemy to suggest initial options. The participants appreciated this idea. They also asked instantly if there was an opportunity to see how strong the enemy is and if the player's character can die in the game. The outcome of the discussion was that there should be indicators in the game giving vague information about the difficulty of an enemy. The icons on the map should be color-coded to give indication about their general difficulty in comparison to the player. The close-up view should furthermore give more detailed information about the abilities of the enemy in combat. The players also expressed the wish that there should be the option not only to flee before but also during a fight. We suggested that this option should include some risk for the player character, which was appreciated. The pet was also involved into the discussion regarding the combat scenario to explore the opportunities the participants would come up with. The players expressed that the pet should be able to influence the fight by a varying degree. The suggestions ranged from the companion should be influencing the strength of abilities of the character or enemy up to being directly involved into the combat as a character fighting on its own. A vivid discussion evolved how the pet and the player's abilities could influence such a combat system. Statistics regarding player level and equipment usage were discussed and gave indications for developing a combat system based on three simple statistical variables, namely life, attack power and armor. The participants agreed on turn-based fighting, making use of those variables and also including the pet's abilities in combat. Once again the charging ability of the pet, mentioned before, was taken into consideration. It should be fully controlled by the player. Pet actions triggering automatically by chance and overall passive effects, like e.g. an aura weakening the enemy characters, were also supported by participants. The fighting system should also include a randomized component, so that even weak enemies still have a chance to hurt the player and the outcome of a fight is not fully predetermined.

Player Death

The storyline of the paper prototype included the virtual death of a player's character to induce discussion about how this situation should be handled in the game. We suggested a mechanic where players lose their abilities to interact with the environment and have to run to a graveyard icon on the map to resurrect their character there. This option was received negatively mainly because it was connected with movement in the real world, hence investing time into a potentially long walk to the graveyard and back to the initial location of dying. The participants suggested other mechanisms such as other players being involved in a cooperative manner, as they should be able to get other players back to life, as well as possible items being able to do the same. Also the options to pay virtual in-game money instead or involve the pet into this mechanic were brought up. There should also be immunity to damage for a certain duration after the player's character comes back to life.

Dead Creatures and Characters

We included a dead character in the storyline and a dead creature. Since the players won a fight against an enemy leaving only its corpse behind, we introduced detailed view representations

of both of those elements. Each of the depictions contained a skull, one showing a dagger and an arrow in addition, meant to represent the defeated enemy. The cards with these illustrations consisted also of a button enabling the player to loot the corpses. The button was shown in the same manner as the buttons regarding combat or dialog already introduced before. The skull, pictured with weapons, was interpreted as resembling a *violent death* in contrast to the normal skull, which was interpreted as *natural death*. The loot button was also understood correctly.

Game Modes

Players expressed their wish to be able to choose between different modes of the game regarding when and where to play. Also they stated their wish to be able to play with others as well as against them.

Passive Travelmode vs. Active Storymode
The participants stated that it would be nice to be able to include activity in the real world, which is not performed directly in a fixed real-world location of a gaming-area, in our case the Donauinsel area. The game's physical activity measurements should also take everyday-movement into account, like the way to work or walking around the city with the Smartphone in the pocket. Such a *Travelmode* (see *4.4.2 - Description of Design*) should not provide crucial benefits for the story-driven game progress nor should such benefits be of fundamental importance to the *Storymode* (see *4.4.2 - Description of Design*). One participant mentioned that the rewards for this could work in a 'nice-to-have' manner such as small bonuses or slightly increased item attributes.

Singleplayer vs. Multiplayer
The suggestion of making it possible to play in groups was appreciated and the suggestion to have cooperative and competitive gameplay elements was supported by the participants. A multiplayer component should not be crucial to proceed in the Storymode, so that players are not forced to play together. Special multiplayer rewards should not have a heavy impact on the main storyline, similar to the effects of the Travelmode feature described above.

The players came up with the idea to set an encountered multiplayer task in the game to be either a cooperative or competitive event prior starting the game. This was a result of their wish to be able to choose how to solve a multiplayer task according to the present mood. One player mentioned also the possibility to set those multiplayer events up in form of minigames, which do not have to be necessarily connected to the Storymode at all.

Modalities of the Game
The players expressed their wish to be able to play the game without any sounds. They stated it would be nice to have but should not be of crucial nature, since they did not want to play with headphones all the time.

4.2.3 Interpretation

Author: Peter Fikar

In this section the user input and feedback described above will be interpreted in a structured manner. The outcome concerning these criteria, described in *4.2.1 - Topics of Relevance*, has direct influence on our design decisions for the digital prototype.

The Player Character

Concerning the interpretation of aesthetics it can be said that the aesthetics of the character sheet seemed to fit the context of the game, since the players showed a positive reaction towards the characters' representation and the design of its elements consisting of the character and the symbolically marked item slots.

Furthermore the participants' interpretation of the meaning of the visual content of the sheet's placeholder and the slots for equipment were partly as we intended. The depicted chest armor for the body-related equipment was criticized for being misleading, therefore we take into consideration that the symbol will depict full body equipment pieces in the prototype concept.

Taking the emotional aspect into account, the positive reaction towards the character sheet as a whole and the discussion resulting from its probable relevance for altering abilities of the character and possible combat functionality seemed to have attracted special interest in participants, hence it can be said that the sheet's simulated elements and their functionality are possibly an incentive.

The Non-Player Characters

In the following section the impact the NPCs had on the participants is discussed.

NPC Icons
The aesthetics of the icons were received positively regarding the story context and seemed also to fit the narrative information about the characters depicted by the storyline in case of the more detailed versions of the icons. These icons containing features of the NPCs functionality were highly appreciated.

The NPC icons were understood as being symbolic representations of humanoid characters, as intended, as well as the icons consisting feature being especially useful to distinguish between different NPCs if more of them were put together in one place. Overall the NPC icons' design was interpreted correctly and the detailed versions seem to best fit the background aesthetically. Furthermore the players rejected the version of NPC icons consisting of female attributes quite emotionally, hence gendered version of the icons will be avoided.

NPC Portraits
The aesthetics of the portrait versions of the characters were perceived very positively and the mood transported by the rendered portraits seemed to add to the enjoyment of exploring the corresponding narrative factors and triggered rich conversations about their story-related functionality. Hence it can be said that the renderings of the characters were fitting the context of the game's background. They were also interpreted as representing increased importance to the players because of the way of representation. The participants understood the illustrations in a correct manner and identified the features depicted as being part of the functionality of the in-game character.

The NPC close-ups provoked emotional responses associated with their depiction. Although the illustrations were perceived as depicting possibly unfriendly or insane people, the participants found this to be a good thing because it added depth to the characters and made them curious about their intentions. Such features seemed to invoke curiosity in the players about the character's intentions and story.

The Dialog Mechanics
The aesthetics of the dialog icon and its placement seemed to fit the context of the game as people instantly understood that the icons' proximity to the NPC icon could provide a possible access point for initiating a conversation with the corresponding NPC. Also the dialog card was understood well in the context of the dialog-related chain of events. The participants stated that they not only want a display of text but also be provided options for getting more information about the characters and their purpose in the game's context.

The participants understood the icon in a way that it is only connected to dialog options and not to be used as access points to other kinds of interactions. The text placeholder card was interpreted as the spoken words of the corresponding NPC as intended. The players' showed immediate interest in clicking the dialog icon and stated the wish to be able to find out more about the NPC in the dialog. This seemed to invoke emotional involvement of the players.

Quest Target Markers
The quest marker icons seemed to fit the context of the game's narrative because of the interpretation regarding their popup-like appearance and the player's understanding about their quest-related purpose. Furthermore the icon's appearance was interpreted to convey special importance because the symbols of the exclamation mark and the star were both connected with features of special purpose. While some players showed clear preference towards the representation of quest locations marked by the icon, others preferred the textual description.

Quest-Related Interactions
The interactions necessary for picking up a quest were understood well regarding the accept-button's simulated interactive functionality. Similarly, the labeled buttons were understood in holding the textual information regarding the buttons' purposes. Furthermore it was understood by the players that the textual description was part of a task that was accepted by clicking the

button. So it can be said that the design of the button and the placement was sufficient for understanding the range of interactions possible regarding the use case of accepting a quest.

The interaction options regarding the quests attracted much attention and caused a discussion about additional possibilities to fulfill such quests in multiple ways, hence it can be said that there was a positive emotional response in participants regarding this matter.

Marker Icons for Special Elements or Events
The players agreed on a unified icon being a sufficient representation in the context of the game.

Enemy Characters

In the following section the impact the enemy characters had on the participants is discussed.

Enemy Icons
The icons representing hostile characters were understood in the context of the game but the initial understanding of the depiction was discussed vividly. The icons caused some controversy in the beginning. The participants argued that their understanding of the icons would depend on their consistent use on the map and throughout the game. On the one hand this would contradict the decision that icons of NPCs should consist of personal features because of the more individual character of the designs.

On the other hand it can be justified to make use of unified icons for enemies and more personalized icons for NPCs because NPCs were also interpreted to be of more importance to the players since they will be potentially revisited throughout the progression of the game.

Enemy Close-Up
The players had developed expectations regarding the enemy illustrations shown to them because of their ongoing experiences in the game session. Therefore we consider them to fit the context of the fantasy-driven story of the game.

This gets underlined by the fact that participants expressed certain expectations regarding the looks of the named creatures, when they encountered their first enemy in the game - the orc. On the one hand they were expecting a goblin because of the quest they were supposed to fulfill but on the other hand they doubted their first interpretation of the picture because on their prior knowledge of these common fantasy creatures, since orcs and goblins are typical fantasy media-related creatures and also part of popular movie productions such as *The Lord of the Rings*. This indicates that the features of the illustrations were in consensus with the prior knowledge about the looks of such creatures. Also the line-art types of drawings have provoked positive reactions in participants.

Similar Interaction Objects

Objects resembling other icons on the map had the following impact on our participants.

The Rock Icon
The rock items were understood as depicting obstacles in the game and that the items seemed to possess interaction possibilities when standing out from the rest. The paper material possibly reinforced this impression, since the paper icons were cut out and placed on the map. Furthermore the players suspected that the rocks, which were blocking the way to the tavern and were not breakable in the beginning, would become removable later on in the game. Hence it was understood that there are objects that require certain happenings throughout the course of the game's progression.

Also the rocks' depiction provoked interest in players to interact with the obstacle, under the premise that the rocks act as obstacles. They provoked the players to click it from all sides to see if something happens. Hence it can be said that the rock icon had an inviting character for interaction.

The Tavern
The tavern seemed to fit the game background because it was connected automatically with a place of communication and interaction opportunities. This fitted the context of the game, as even though only one NPC was there to provide interaction it was associated correctly. The tavern instantly attracted the interest of the players, hence it can be said the emotional response it provoked is desirable.

The Chest
The aesthetics concerning the chest icon were received positively. Also the chest's depiction was interpreted correctly. It instantly attracted the players and triggered curiosity about its content.

Transition Between Icons and more Detailed Depictions

A discussion evolved among the players about the meaning of the presented detailed version of the container and the form of transition between map icons and close-up views in general. It was unclear to participants whether the detailed line-art of the crate was depicting the content or the close-up view of the chest icon. The illustration of the crate was meant to represent the close-up view of the chest. The participants agreed on that if interactions carried out on icons on the map are always resulting in display of a detailed version of the corresponding icon, it would certainly be understood to resemble the same game element. Therefore using this procedure consistently for all transitions between map icons and close-up views seems beneficial.

The Pet

The icon representation of the crab pet on the map was instantly recognized as being a companion, hence the form of representation was understood because it was fitting the context of its use.

The portrait view of the pet was provoking positive response, curiosity and the wish was uttered by the participants to be able to collect more of those pets, hence the game will include more than one pet and will be held in a less serious drawing style than for example the NPCs close-up views. The interface element depicting the charge level of the pet will not be of red color, as player interpreted it as having possible negative consequences, like fatigue.

The transition between the icon and the portrait view was understood and the players stated that they want to find out more about their pet when clicking on it. Also the participants stated that the pet should be able to make use of the abilities it holds for example in combat or to access special chests to fit the game experience.

Furthermore players expressed the wish that the interactions made possible by the pet should be partly under their command and that the companions should not act uncontrollably on their own. Also the real-world physical activity needed to charge the pet was perceived positively.

Items

The participants expressed their wishes concerning the following aspects relevant for design: the name description of items should fit the requirements of their effects or quest they are meant to fulfill. Additional background information or funny descriptions on the items should be presented in separated texts and not be part of the item's name. Furthermore it was discussed that items which are crucial for the storyline itself should not be drop-able carelessly but rather be either stored in an own part of the inventory, one item per slot, or be marked as important items. The players further stated that there should be items that influence the pet's abilities.

None of the illustrations were provoking a negative emotional response. An interesting debate evolved among participants about the reward items for fulfilled quests. It was discussed if reward items could have unfavorable effects, which can be set in connection with the emotional interpretation of certain NPCs described as being untrustworthy by some players.

Combat

The way the buttons were displayed in the context of being part of the close-up illustrations of the enemy character was understood correctly. The form of display was consistent with the display of buttons regarding the options for dialog when the players were interacting with NPCs. Furthermore the context of the combat situation provoked the idea of including indicators regarding the threat an enemy poses to the player.

The interactions provided by the buttons were interpreted correctly because they fit the context of a combat situation. The possible interactions attached to the presented buttons were understood correctly and the players uttered the wish to have the additional opportunity to flee during an ongoing fight, not only before. Also the attempt to flee combat should also bear the risk of failing. Since the game is based on real locations, running in the real world is a viable option for this. Furthermore the combat situation provoked many suggestions and ideas in par-

ticipants, hence it can be said that the factors were perceived positively.

Interpretation Regarding Entering Combat
The players stated that they want to decide when to continue playing. They introduced the idea of enemies, or other hazardous game elements, being unable to attack the player while the game is not played actively since this could lead to players losing a fight without even noticing it just because their smartphones are in their pockets.

Player Death
The interaction of resurrecting at a graveyard seemed understandable to the players, yet was emotionally rejected. They understood the basic concept of resurrection, but were unsure about how this could be implemented. The players suggested that the other players' interactions could be involved in a certain manner to resurrect a dead player character. Also the spending of virtual money was suggested or involving an ability of the pet companion. As already mentioned, the emotional response to perform a run to a graveyard or similar, was mostly negative.

Dead Creatures and Characters
The visual representation of dead creatures and characters seemed to fit players' expectations regarding the context of in-game death. The button containing a 'loot' label again seemed to be fitting the context as it was understood intuitively, as it was again representing the interaction possibilities regarding the represented item, accessed from a close-up view. Also the depictions of the different skulls were understood as intended and not provoking any negative emotional response among the players.

Game Modes

This section describes the participants' attitude towards several possible game modes.

Travelmode vs. Storymode
Certain factors were emerging during the paper prototype test regarding when and where to play. The participants discussed the initial concept of gameplay, being bound to the location of a certain area getting extended by a Travelmode that can be used while travelling outside of the Donauinsel area. Furthermore the game's story should be extended to fit the requirements for a full field test providing sufficient content regarding activity-related goals.

Singleplayer vs. Multiplayer
Since participants showed a high interest in playing together, the game should feature multiplayer next to single player gameplay. This enables the players to interact with each other in the game and also provides them with the opportunity to play alone if they wish. The participants stated to be interested in both, cooperative and competitive mode. One participant suggested that seperate minigames should be present in the game, which could be combined with multiplayer features.

Modalities of the Game
Participants rejected the idea of including audio to the modalities of the gameplay, as they were not fond of the thought of wearing earplugs throughout the game while playing on the Donauinsel area.

4.2.4 Influence on our Work

Author: Peter Fikar

This section describes the influential aspects the gathered feedback from the paper prototype session had on our further development oft the game. Since the output from this method was crucial for our design development of the digital prototype, we derived a vast number of guidelines from this method. Following we present an overview containing basic design decisions derived from the analysis process described above, regarding the feedback basis provided by the participants during the paper prototype session. To get further insight on the results the complete sheet of guidelines can be looked up in *E - Guidelines*.

Visualizations

The designs presented to the users during the prototype test acted as models for the digital prototype's design in the form they appeared satisfying to the participants. Which elements are of interest in detail, such as the character menu, the appearances of the game board, the icon-based elements as well as the close-up depictions and the different styles of illustrations, can be looked up in the interpretation part of the paper prototype user-test and in the derived guidelines in *E - Guidelines*.

The structure of interactions available to the users will be strongly focused on a simple and consistent interaction paradigm, which should therefore be easy to learn and to understand. We aim to provide such consistent concepts of interaction throughout every aspect of the game.

Pets

According to the feedback gathered in the paper prototype test it can be said that pets are a desirable feature for such a game and it was discussed on many occasions which abilities it should possess and how they should be influencing the game's content. Critical abilities of the pets will be under full control of the player and will also influence a combat system.

The pets will represent a direct feedback system of the physical activity performed by the player in the real world and in accordance to the training goals, set by the WHO standards (as described in *2.1.1 - Physical Activity*), considering different levels of workout intensity. Player movement will directly influence the evolution of the pet and its in-game effects.

Game Modes

There will be different game modes available in the digital implementation of the game. The game modes available to the players will be a storyline-based mode, a travel-based mode and a minigame type of mode. The game will contain single player and multiplayer parts in a cooperative and competitive manner.

The minigame idea provides us with the opportunity to introduce a multiplayer option for the players that is not interfering with the storyline or Travelmode. We furthermore aim to provide ways to interact with other players, also in parts of the game that are not inherently of multiplayer nature.

Furthermore we will provide a Travelmode, which allows engaging in a game experience while being on the way and having the smartphone in the pocket. This mode also aims to provide a way to make use of movement information when traveling between two locations by foot.

The Storymode, driven by a fantasy-like storyline, will be bound to specific locations. The Donauinsel area in Vienna, a recreational site with low to no car traffic was chosen by us. This should ensure minimized risk for the players regarding cars and environmental hazards and provides sufficiently large open space containing meadows, trees and small paved walk and bike ways, therefore providing a good playground to augment with a digital map overlay, which again suits the playground for our Storymode gameplay. The Storymode provides the nexus for gameplay effects of the other game modes.

Activity Integration

Physical activity will be measured utilizing GPS data. Location data will be facilitated to provide distance, time and speed between points of measurements for each user as long as the user is logged into the game application. This data will be mapped into different gameplay aspects to represent the players' efforts and to provide feedback to her or him, depending on the game mode the user is currently using. We will furthermore make use of compass readings to provide different modes of control in different game modes.

We aim to provide variety of in-game utilization of movement data and the utilization of detailed aspects of the WHO recommendations, integrating the mentioned different intensities of light, moderate and vigorous workout (as described in *2.1.1 - Physical Activity*). Furthermore we will integrate recommended training durations and per week workout requirements into game aspects aside. The design of game elements will be wrapped around the mapping of the recommendations and is therefore also part of the design basis for shaping in-game events, effects and interactions.

Consistency

We aim for presenting all interface interactions and transitions between in-game views in a consistent manner. Participants highlighted on many occasions that such a consistency is necessary

to understand fundamental interaction options throughout the course of the game.

Cheat

We do not aim for a high degree of cheat safety. By doing so we expect participants to find creative ways of using our system, showing us possibilities to improve game content and refine gameplay concepts.

4.3 Digital Prototype – Development

Author: Michael Habiger

The following chapter will describe our user-centered iterative development of the digital game prototype. Our game was developed under steady integration of our participants and their provided feedback. The prototype was iteratively adjusted and underwent specific changes based on three different sources of feedback, namely method-driven, user-driven and developer-driven changes as described below.

After the deployment of the Technology Probes and the incorporation of the feedback gathered this way, we successively made the digital prototype available to our participants, rolling out contents of the game in basically two phases. The field test started by releasing the Travelmode and minigames giving the participants about 4 weeks time to get familiar to the game mechanics and already gather experience points and items for the Storymode. With the Storymode added, the game provided all initially planned features and game modes. The field test was open to use till the conduction of the conclusive focus group discussion, about 4 weeks after the Storymode had launched.

4.3.1 Method-Driven Changes

Author: Michael Habiger

Method-driven changes derived from feedback our participants provided while conducting user-centered design methods. This included technology probes and our digital diary. In this context the mentioned methods changed existing design rather than generating new one, for instance like the interviews, cultural probes or the surveys did.

Technology Probes

As part of our iterative and user-centered design process we conducted Technology Probes to test one of the most important parts, the GPS handling, and the screen rotation according to the faced direction. We tested these aspects in the context of the technical application as well as the effects these game mechanics have on our participants.

Our Technology Probes were applied iteratively while the second one built on the first one. This enabled us to include feedback we gathered through the application of the first Technology Probe into the second iteration. For both iterations the participants were asked to fill out a short survey containing structured and open questions after playing the minigames.

The first iteration of our Technology Probes contained single player aspects in various configurations. The basic task was to catch a green dot displayed on the user's smartphone screen by actually moving towards it in real life. The participant was represented by a black dot in the middle of the screen. To indicate the orientation of the user, the virtual representation on the screen rotated according to the direction the player was facing. Throughout the conduction of the Technology Probe adding more green dots, adding a time limit and furthermore adding hostile red dots, which were meant to be avoided, enhanced the task (cf. Figure 4.18).

Task 1 - Catch the Green Dot!
In the first task the user had to catch one green dot to successfully finish the minigame. There was no time limit nor were hostile dots present.

Task 2 - Catch the Green Dot in Time!
The second task was similar to the first task with the difference that the player only had a limited timeframe to catch the green dot.

Task 3 - Catch all the Green Dots!
For the third task the player had to pass a series of green dots in different locations. All of them had a time limit in which they had to be reached.

Task 4 - Catch the Moving Green Dot!
In the fourth task the participant had to catch a moving dot. The movement was random and straight in any direction. After each step the dot changed it's direction.

Task 5 - Catch the Green Dot & Evade the Red Dots! (1)
The fifth task included two moving red dots which the player had to evade while trying to catch the green dot.

Task 6 - Catch the Green Dot & Evade the Red Dots! (2)
For the sixth task the user had to catch the green dot which was surrounded by red dots. Differently from the red dots of task five, they were idle but changed their size continuously by expanding to a specific extend and then shrinking again.

The second iteration of our Technology Probes involved multiplayer features and tasks. On the contrary to the first Technology Probe two users had to play simultaneously. The first task was to catch as many green dots in a row cooperatively in a specific period of time, meaning that two players shared their accomplishments. In the second task the two players had to compete against each other, trying to catch more green dots than the other player. After a defined period

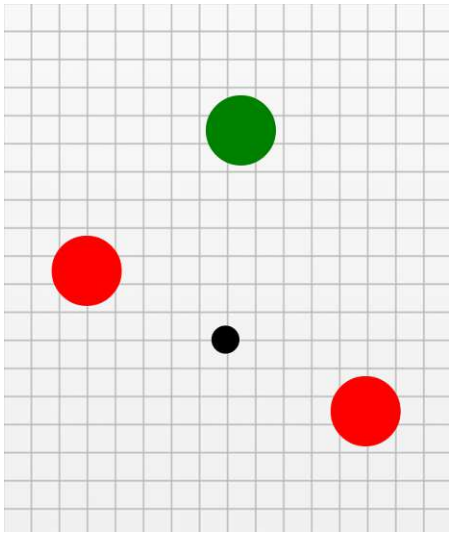

Figure 4.18: A task of the Technology Probes as shown on-screen. The player is represented by the black circle and has to catch the green dots while avoiding the red ones.

of time the player who reached more green dots won the competition.

Cooperative Task!
In this task the users had to catch green dots each to gather as many points as possible together. The total and shared score was visualized accordingly.

Competitive Task!
For the competitive task the users battled against each other, trying to gather more green dots than the opponent. The points of each player were visualized on-screen to make a clear overview over the score possible.

Through the conduction of our Technology Probes we focused on gathering feedback about the interactions within the game incorporating body movement and real-world locations and how our participants perceive and handle those mechanics. Furthermore we aimed to test our technical setup and the GPS-related functionality in more authentic conditions. By doing so we were able to directly integrate user feedback into the further development of our game prototype on the technical level.

Data

The data described in the following is in the chronological order of the tasks the participants had to execute in the course of both Technology Probe iterations. Additional feedback provided by our users is further presented available.

Technology Probe 1
According to the processed short surveys which the participants had to fill out after each task of the Technology Probes, the task description was basically well understood. One participant faced issues regarding the correct display of the instructions stating that the displayed font was cut off. A major feedback provided by our participants was the slow GPS-update rate. In this context the users experienced ever moving or jumping dots and wobbly movement of the players' representational dot on the screen caused by GPS lags or fluctuations from time to time.

One participant mistakenly assumed that she is not the black dot at first and wrote that she has the impression that the dot to catch (in her conception the black dot) moved into the wrong direction and therefore had difficulties to complete the tasks. During the fourth task she realized that she was actually represented by the black dot. In consequence she noted that she basically had no further problems completing the remaining tasks successfully. Two participants experienced issues regarding green dots to be unreachable. One participant wrote that a green dot he had to catch spawned in his pond while a wall blocked another participant.

Regarding the increasing difficulty level of the tasks three participants related the challenge to simultaneously catching green dots and avoiding red dots with a higher fun factor. Nevertheless the last stage, in which the red dots furthermore changed their size by repeatedly expanding and shrinking, was rated as too hard by one participant making it impossible for her to complete this task. Another participant found the expanding and shrinking interval as being too fast.

One participant furthermore sees potential of this approach for adolescents which 'perceive classic sport as too uncool [author's note: translated from german 'klassischen Sport als uncool findet']'. In this context another user stated that he can imagine attempts to integrate physical activity into virtual gameplay to be entertaining rather for children. In general four users experienced the provided interaction and game mechanics as being fun and joyful.

Technology Probe 2
All participants found the instructions for the two tasks of the second iteration of our Technology Probes comprehensible. Furthermore all users were able to accomplish the task with little or without major complications, except one participant who experienced slow GPS updates. In this context another participant perceived the GPS mapping as inaccurate but nevertheless had no significant problems to catch the green dots.

The most common issue addressed by five participants was the missing feedback, in case a dot lying outside the area visible rendered on the screen. In consequence two of those participants wished for some kind of indicator where to go next to prevent random searching for the dots. One user furthermore drew a sketch of how such a mechanic might look like (cf. Figure 4.19).

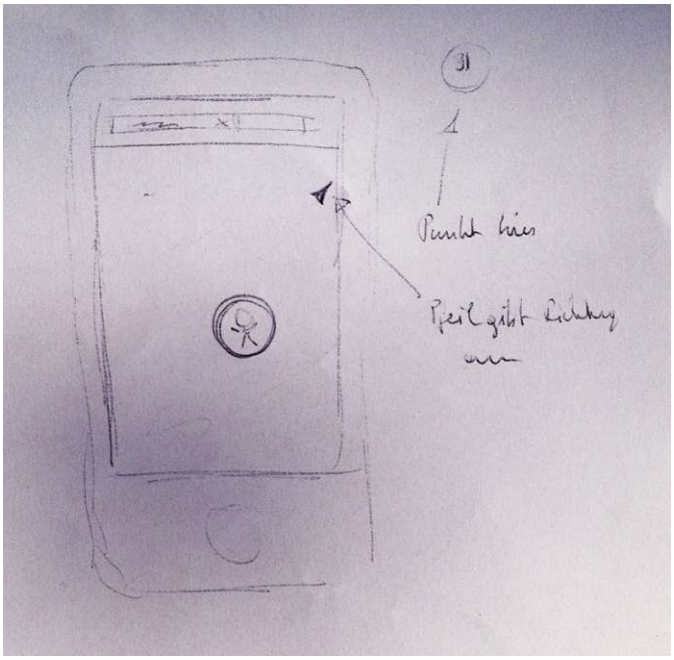

Figure 4.19: A sketch provided by one of our participants to communicate an idea of a possible indicator for green dots which may be outside the screen.

Interpretation

In the following we analyze the feedback provided by our participants regarding the positive and negative aspects within the introduced mechanics. We further describe the impact of those aspects on further design decisions and development iterations.:

Technology Probe 1
Since many of our participants experienced issues regarding inaccurate GPS-signals, slow update rates or random movement, we implemented absolute positioning in addition to only move the map when the client receives a valid GPS-signal. By doing so an accumulation of any GPS-related errors was prevented in further consequence since every new position of the map was calculated independently from previous states.

Furthermore we added a timer to each dot meant to catch. If time ran out the dot automatically changed its position, allowing the user to reach it in case it was previously blocked by any obstacles. An opportunity that the user himself can relocate the dot if it was unreachable was declined, as this mechanic eventually would be exploited to move the dots even if not necessary.

As more complex movement, such as expanding dots, was too hard to catch or to dodge, further iterations of our minigames implemented simpler mechanics (e.g: idle dots and moving dots). Furthermore the animation speed of the dots was narrowed down to buffer potential

GPS-related instabilities, giving the user proper time to react accordingly. In the context of any misconceptions and confusions regarding the visualization of the dots, they were replaced with according illustrations, such as the player's avatar, instead of the black dot in the final version of the game including the minigames.

Technology Probe 2
Several participants experienced issues regarding the orientation and the positions of the dots if not visible in the first place. To facilitate the orientation on the map and guide the player to the next dot, a feature which connected the player with his targets by using dashed lines was implemented for further iterations. Only dots the user had to catch were connected to the player to avoid any confusion whether a hostile dot is meant to be caught or not.

Diary

The diary was used to gather ongoing feedback from our participants. The feedback gathered this way was not meant to have a specific focus, but rather could consist of any game prototype-related topics in the narrower and broader sense. Furthermore the entries of our digital diary were meant to be observed throughout the testing phase to eventually integrate it into our game prototype if possible and appropriate.

The game prototype contained a digital diary-functionality, which was accessible anytime via the main menu of the application. The participants had the free choice whether they would use the diary or not. The diary-view consisted of a simple text field in which the users could write their feedback and a button to save the content of the text field to the database, as seen in Figure 4.20.

By providing such a feature our test users had the possibility to record immediate or reflective feedback after and during playing the game. Such feedback could basically include any occurrences and thoughts related to the game prototype, like how the game is perceived in general, the in-game progress, suggestions for improvements, bug reports etc..

Data

Four users recorded one entry each with two of them writing random phrases not connected to the game. One participant used the diary to commend the prototype. Another user suggested an integration of the Travelmode into the Storymode as well and bonus experience points gained by the player's character in case of inclement weather.

Interpretation

Throughout the whole test phase the digital diary seemed to have been broadly declined among our participants, as few entries were made. Since the suggestions of a Travelmode for the Storymode and the bonus experience points for inclement weather were submitted in a late phase of the field test they were not implemented into the game prototype itself but noted for future work.

Figure 4.20: The diary view as shown in-game, consisting of a textfield and a button to save its content.

4.3.2 User-Driven Changes

Author: Michael Habiger

User-driven changes derived from feedback gathered through other communication channels apart from our conducted methods and the diaries. In this context several participants used direct ways to express their experiences with the game prototype gathered during the test phase. Some of them called us or wrote short text messages in case of any uncertainties or regarding technical subjects. One participant provided detailed feedback by sending us text files containing any encountered issues or suggestions of improvement via email on a regular basis.

One user reported that she would like to use the Travelmode for distances she covers with her bike too. Since the Travelmode automatically caps the speed and therefore the experience points, the results of the Travelmode were distorted when not used with walking only. We therefore implemented a modified version of the Travelmode, namely the Bike Travelmode alongside with speed and distance thresholds suitable for faster movement. In consequence, after selecting the Travelmode from the main menu, the user had the possibility to choose between walking or biking.

Figure 4.21: The in-game leaderboard, which displays the players ranked according to their experience points.

Another participant addressed that she would appreciate a possibility to compare her performance to those of other players and that such a feature would eventually motivate her to play more often. Since the analysis of the interview also revealed that some kind of visualization of other peoples' progress might be a potential impetus to engage in physical activity, we added a leaderboard to our game prototype. The leaderboard automatically ranked all players according to their in-game experience revealing who is the best, the second best etc. (cf. Figure 4.21). The leaderboard was accessible via the main menu at any time.

Our user interface mainly relied on touch gestures to interact with the game prototype rather than buttons due to the limited space available on the touch screen. For instance when the user wanted to browse through his in-game items in the inventory he or she had to swipe left or right respectively. One user perceived this way of interaction as too implicit and furthermore experienced technical issues regarding the touch recognition on his Windows Phone rendering him impossible to view his whole inventory. In consequence we implemented hidden areas on each side of the inventory screen, allowing the user to tap the left side of the screen to switch to the next item to the left and vice versa.

The two first participants to reach the first in-game boss had difficulties to win the battle

against him. In a specific stage of the battle the boss continuously threw hostile projectiles towards the player, which he had to dodge by quickly moving to another location in reality. Simultaneously the player had to reach the boss to end the stage. Both users reported that the timeframe between two projectile firings of the boss was too short making the outcome of the battle a matter of luck. For a better balance within the fight the fire rate of the enemy was slowed down and the speed of the projectiles reduced as well. Concerning the second in-game boss one of the users further faced difficulties. In this case the player had to reach four points, represented as levers, within a specific timeframe to get to the next stage. This stage also incorporated real movement to the according locations. The user reported that the overall time limit to reach all the levers was too short and that even a small delay in movement, possibly caused by a missing GPS-signal, resulted in failure. In order to buffer such delays we reduced the amount of levers from four to three. By lowering the grade of difficulty of the boss fights we aimed to heighten the game flow for our participants.

A participant reported that she lacked proper feedback when her charge level reached 100% and therefore missed the fact that she got the power bar item as a reward. To enhance the feedback in this regard we added a prominent textual information to the middle of the screen in case the player achieved 100% charge level and therefore received the power bar item supplementing the permanent charge level indicator in the bottom right area of the screen. The textual information persisted for three seconds before it started to slowly fade out.

Throughout the testing phase of our game prototype some participants asked us if the may invite other people, such as family members or friends, to play along. Hence we created a generic character for female and male 'guest' players each, including the according database entries and the visual components being copied for every new test user. This way the new users met the same requirements as our primary participants with the difference that they had custom avatars, which they customized during the conduction of the Cultural Probe Packages (as described in *4.1.2 - Cultural Probes*). The visual appearance of the 'guest' players is shown in Figure 4.22

Furthermore the participants' constant feedback allowed us to continuously patch bugs and correct minor textual issues, for instance formatting errors or typos.

4.3.3 Developer-Driven Changes

Author: Michael Habiger

Throughout the design and development phase of the game the prototype was iteratively extended and tested by ourselves as well. Alongside with patching minor bugs, the game further underwent major changes. Those changes affected technical and game design-related aspects likewise.

In order to facilitate the orientation within the minigames and the higher zoom factor within them, we implemented a camera rotation in dependence to device orientation. This functionality allowed the map to rotate around the player in a manner that objects which were virtually in

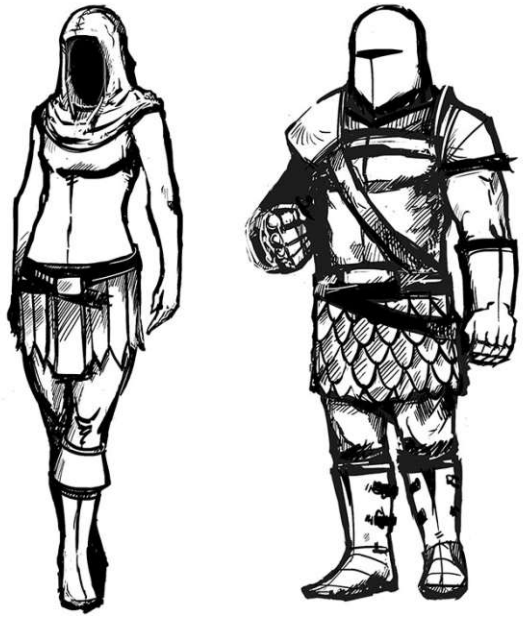

Figure 4.22: The generic female and male characters provided for ‘guest’ players.

front of the player in real life were also visualized accordingly on the screen. Since our game prototype was written web-based, our prototype was not able to access the functionalities of all smartphones, in this case the device orientation, likewise. While the rotation worked accurately for iOS, we experienced unstable and jittering signals on Android and Windows Phone. Therefore we implemented an alternative control mechanic to allow manual rotation of the maps in minigames for those operating systems. During a minigame two arrow symbols were shown on the screen, from which one was placed on the left side pointing left and vice versa. One tap on one of the symbols caused the map to rotate in the according direction whereas a second tap stopped the animation (cf. Figure 4.30). This way we were able to ‚fake‘ the device rotation and made minigames playable for Android and Windows Phone users as well. To also give iOS-users the possibility to manually rotate the minigame map, the user was allowed to choose the control mechanic he or she intended to use for the current game session each time the game was started.

Our game prototype included in-game pets, which accompany the player’s avatar within the Storymode and gain experience points as the user moves in real life to grow stronger. Since both available pets can be only obtained by progressing within the Storymode, we needed a mechanic which allowed temporary storage of experience points for pets, even if the player did not posses one yet (e.g: if he had only played the Travelmode or minigames so far). Consequently we implemented some kind of an interim pet called *Blob*, which every player possessed right from the start and was able to save experience points. While this pet did not grow stronger itself, the experience points could be transferred from the Blob to another pet as soon as the player

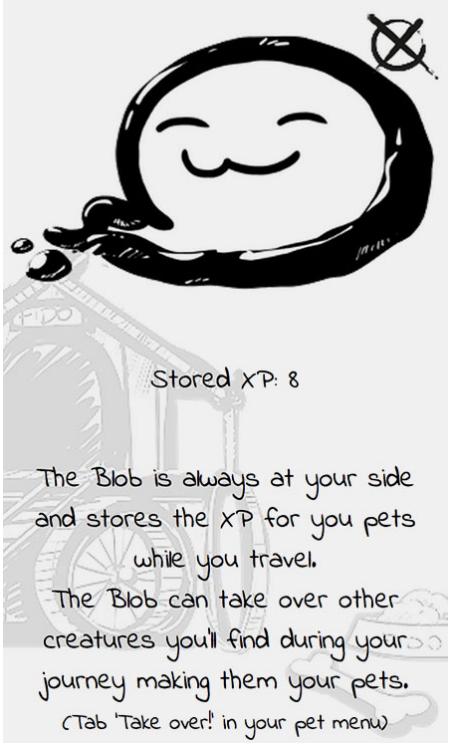

Figure 4.23: The special Blob pet, which served as an interim pet till the players received other ones.

obtained one by using a specific item which he was rewarded upon completion of minigames (cf. Figure 4.23). In the context of in-game pets we further implemented a visualization of pets in the Storymode. This way the current pet was represented next to the player's avatar as an indicator which pet is equipped at the moment.

To allow our participants to keep track about their progress in the real world regarding movement and physical activity we integrated travel statistics into our game prototype which were accessible via the character sheet. Though the player's level was an indicator for the player's grade of physical activity, it did not break down how much and in which mode the player actually moved. Therefore the statistics contained information about the total distances and average speeds of the player for every game mode separately. This information was only visible to the player himself and not used for the leaderboard as described above.

A major change regarding the Storymode of our game was the integration of a simple barter system which enabled our participants to trade healing potions and special equipment for in-game money which they could loot from various containers and defeated enemies. This change was due balancing reasons since health did not regenerate without the use of a healing potion. Furthermore we aimed to heighten the motivation to attack enemies, which required physical

activity, and to explore the area by providing a reason to gather in-game gold.

Concerning the combat system within the Storymode we narrowed the complexity down to three variables, including health, attack and armor. By doing so we aimed to make the combat system more predictable and intuitive. Furthermore we integrated a *leap-into-battle*–mechanic, similar to the *run-away*-mechanic. On the contrary to the *run-away*-mechanic the player was enabled to acquire a bonus for the battle against an enemy by engaging in physical activity before the combat. To do so he had to run as fast as possible right before the battle started. In dependence to his speed the player raised his chance to attack the enemy first. Battles against in-game bosses, which were special enemies with different combat procedures, were designed similar to the procedures inherent in the minigames mentioned above.

Due to technical restrictions caused by the resolution of smartphone screens we had to overhaul the concept concerning the virtual map representing the test area of the Storymode. While the map was initially planned to cover the whole test area, the therefore necessary image file was rendered blurry and incorrect by several mobile browsers caused by its big dimensions and the close zoom factor. In consequence we divided the virtual map into smaller locations of interest, further referred to as zones, which were connected by a zoomed out overview map. If a player entered such a zone the view zoomed in and rendered the now smaller image file accordingly. The zones were accessible from all directions and could be entered by tapping it while standing in the according area in the real world.

Regarding further visualization aspects of our game prototype we integrated a color coding scheme for the symbols representing enemies within the game. The enemy symbols were henceforth colored green, yellow or red. The color of an enemy symbol depended on its grade of threat compared to the player's strength. If the enemy was weaker than the player the symbol was rendered green, in case of equal strength the symbol was colored yellow and a stronger foe was represented by a red symbol. Furthermore boss enemies were visualized by special enemy symbols containing a crown as an indicator of being important. The bosses' symbols were always rendered red no matter what the player's strength was.

4.4 Digital Prototype – The Final Iteration

Author: Michael Habiger

The following chapter describes the technical aspects and components our digital game prototype was built on and how the applied technologies intertwined with each other. It further outlines the design of our digital game prototype regarding fundamentals, such as the integration of the WHO's recommendations described in *2.1.1 - Physical Activity*, as well as gameplay, giving an overview of included features and game modes likewise.

4.4.1 Technical Choices

Author: Michael Habiger

Our game prototype was written in HTML (Hyper Text Markup Language), CSS (Cascadian Style Sheet), PHP (Hypertext Preprocessor) and Javascript/jQuery [50] and used SQL (Structured Query Language) to communicate with a MySQL database. A web-based approach allowed us to build our game prototype platform-independently so it could be executed on iOS, Android and Windows Phone likewise.

HTML
The structure or markup of all in the prototype existing elements was defined in HTML, including in-game objects like enemies, chests or the players' avatars, the user interface elements and textual descriptions as well. If applicable, the markup was altered dynamically by removing or adding specific elements using Javascript.

CSS
The visualization of the structures was defined using CSS. This included the positioning of all elements within the screen of the smartphone, the visual appearance in general and the nesting of image files. The style of the elements was adjusted dynamically using Javascript.

Javascript
All script-related functionalities were written in Javascript using the JavaScript library jQuery, including the game logic, the alteration of elements in the context of removing or adding them to the markup, the animation of elements and the GPS-handling. Furthermore Javascript was used to handle all asynchronous calls to communicate with the server via AJAX (Asynchronous JavaScript and XML). Listing 4.1 shows a short Javascript code block, which calculated the in-game experience according to a specific intensity level of physical activity (light, moderate or vigorous intensity).

PHP
PHP was used to handle all incoming AJAX calls. Depending on the specific call the PHP script established a connection to the database, executing according SQL statements. Furthermore in response to the received results the data was processed and returned if necessary.

SQL
SQL served as the interface between the server sided PHP-script and the database and was used to insert relevant data into the database, or to retrieve it.

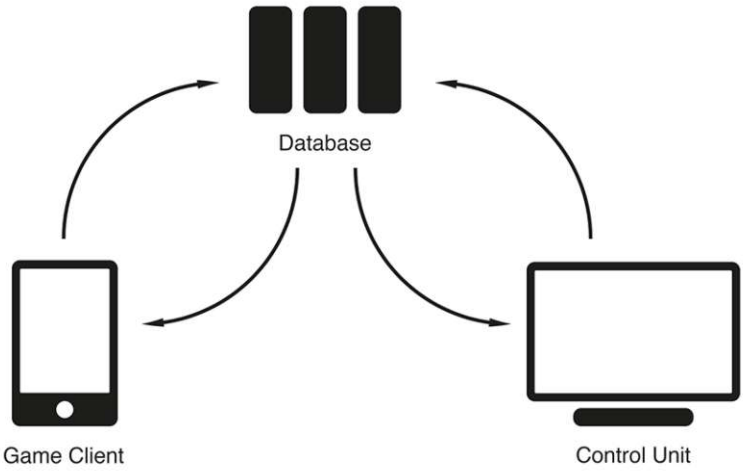

Figure 4.24: The communication process of the prototype components, including the game client, a control unit and a database.

Components

Our game prototype consisted of three major components including the game client, a control unit and a server sided database. Both the game client and the control unit communicated with the database using AJAX calls. The database was further used to exchange information between two components (e.g. two clients or a client and the control unit). The process of communication among the components is illustrated in Figure 4.24.

Game Client
The game client was the actual gaming application and contained the major parts of the game logic. It was accessible using a login form via all major mobile browsers (Firefox, Chrome, Internet Explorer, Safari) running on a suitable smartphone. The game client automatically checked whether the user attempted to login using a mobile browser or any other browser. For causes of integrity and consistency regarding log data and geolocation information our participants were only allowed to login from smartphones. In any other case the game client blocked the login and displayed proper information to the user. After a successful login the game client requested all relevant information including the character-related data like the gathered experience, equipment, the current progress in the Storymode etc. from the database. Each alteration of such values in the course of playing the game was saved to the database.

In the context of the Storymode the game client furthermore kept a list of visible and invisible enemies. If an enemy was defeated by the player it was set to invisible on the client and marked accordingly in the database. In regular intervals the game client checked whether an enemy is ready to respawn (getting visible again) or remains invisible.

Furthermore the game client handled geolocation information based on received longitudinal and latitudinal values via GPS. This information was used to calculate the distance, the speed, the direction and the activity level of the participants between every last two known positions. Based on the particular game mode the user was currently playing and the calculated values the user gained appropriate experience and moved his avatar through the virtual world (cf. Listing 4.1). Furthermore the geolocation information of other players was used to display their avatars if they were close enough. Any change of geolocation-related values was updated in the database as well.

```
var buffer_intensity_passive = 'none';
if(interval_speed < lightmin){
    intensity = 0;
    add_xp = 0;
}
else if (interval_speed < modmin && interval_speed >= lightmin){
    intensity = 1; // light workout
    buffer_intensity_passive = 'slow';
}
else if (interval_speed < vigmin && interval_speed >= modmin){
    intensity = 2; // moderate workout
    buffer_intensity_passive = 'semi';
}
else if (interval_speed >= vigmin){
    intensity = 4; // vigorous workout
  buffer_intensity_passive = 'fast';
}
// xp awarded the during last measurement
add_xp = interval_duration*intensity;
player_xp += add_xp;
```

Listing 4.1: Experience Calculation

Control Unit
The control unit constituted a special kind of client and was used to monitor the current state of all players and enemies displayed in the virtual world in the Storymode. In regular intervals the control unit checked whether an enemy is ready to respawn by calculating the duration from the point the enemy was set to invisible by a game client to the current time. If the specified threshold of 12 minutes was reached the enemy was flagged as visible again.

A similar mechanic applied to the player handling. In case a player remained inactive (this may occur if the player simply turns off his or her smartphone while playing the Storymode) for a specific amount of time he or she was logged out automatically. To determine the inactivity the control unit compared the current game mode and the alteration of the geolocation information of the players. If the last game mode of the player was the Storymode and the geolocation of this player had not changed for 2 minutes the control unit marked him or her as inactive in the

database. By doing so the inactive players were not rendered incorrectly by the other players' game clients on their display.

Database
The MySQL database served to save all player-related information consisting of character information, in-game possessions and visible or invisible elements. It was further used to forward information from one client to another (e.g. during multiplayer minigames) by letting one client periodically write to the database, while the 'receiving' component continuously read the data.

In specific cases the data was processed before the insertion or returning of data using according procedures. This included for instance the handling of the player's equipment, in which a procedure automatically detected whether an item needs to be marked as detached or equipped within the database. By doing so the client just had to send the name of the item that had to be altered independently of its actual state in the database.

Additionally the database was used to gather log data of the playing behavior of our test users. This included the game mode, the timeframe, the average speed of the players and the distance travelled by them for each game session. A procedure processed the input data to calculate distances and speed restricted to realistic values dependent on the current game mode in case of any measurement errors of the client. Furthermore the procedure automatically terminated game sessions and created new ones if appropriate conditions were met.

4.4.2 Description of Design

Author: Michael Habiger

The digital game prototype included various game modes and a character sheet, containing in-game information of the avatar as well as statistics about the participant's movement in reality. Based on their performance in reality, players were able to gather in-game experience points which were calculated based on specific thresholds regarding the movement speed. Furthermore the game contained a pet system as a mechanic for various feedback channels. In the following the mentioned aspects of the digital game prototype are described in more detail.

Fundamentals

The required types of movement in the game were mainly based on walking activities. The Travelmode furthermore supported bicycling as described below. The user's walking speed influenced various in-game effects and was categorized by three intensity levels, derived from [3], also discussed in *2.1 - Physical Activity and Sedentary Behavior*:

- Light or Slow - Walking with 2 to 4.8 km/h
- Moderate or Medium - Fast walking or jogging with 4.8 to 8.04 km/h
- Vigorous or Fast - Jogging or running with 8.04 km/h or faster

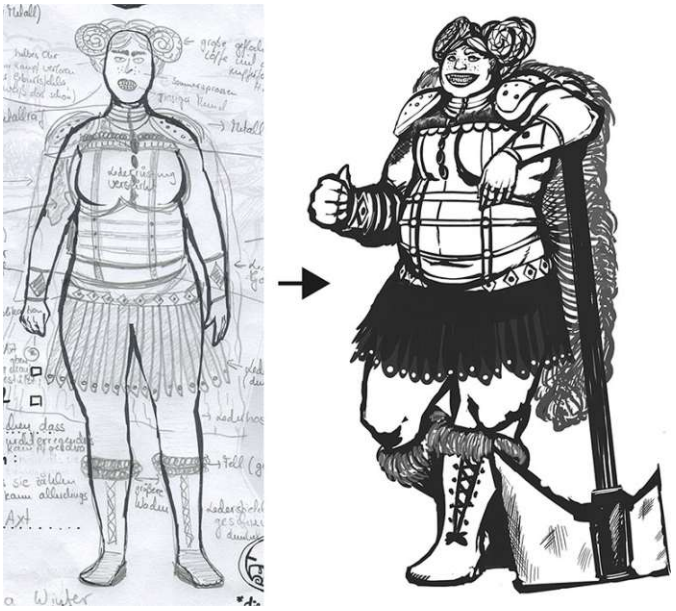

Figure 4.25: A redesigned in-game avatar of one of our participants. The left illustration shows the original character created by the participant during the conduction of the Cultural Probes. The right illustration shows the redesigned character to fit the visual style of the game.

The Player's In-Game Representation

The players were represented in-game via a symbol of their respective character. The characters were adapted and redesigned to fit the overall style of the game, maintaining major features and characteristics of the original personalized avatars (cf. Figure 4.25). The player's symbol, showing the head and part of the upper body of the respective avatar, was positioned to the middle of the screen. To express in-game movement while the player moved in real, not the in-game avatar was animated, but the map beneath him was shifted accordingly. The same applied for rotational animations in minigames. All avatar-related information could be viewed in the character sheet, including in-game attributes and travel statistics (cf. Figure 4.26).

Experience Points

The player's avatar gained experience points while the player walked during the various game modes including the Storymode, the Travelmode and the minigames. The exact amount of experience points gained was determined by the specified levels of intensity as described above and further influenced by the duration and the resulting speed of the player's movement. In case of moderate intensity the gathered experience points were multiplied by 2 and by 4 if the player moved at a vigorous intensity level.

The experience points influenced the player's avatar's level, allowing to equip stronger items, thus increasing his or her power in-game. Each player's character started at level 1 and needed

Figure 4.26: The character sheet, containing all information about the player's avatar, as shown in the game.

in sum 6000 experience points to to reach level 2. To hit the maximum level of 3 the player had to gather 18000 experience points. The maximum level possible was scaled in a way that the player could only reach it if certain recommendations by the WHO were met, meaning that the user needed to engage 150 minutes in moderate or 75 minutes in vigorous intensity physical activity.

Besides the player's avatar's experience the player furthermore gathered experience for the in-game pets. The currently equipped pet gained the same amount of experience as the player's avatar did. If no pet was equipped or the participant engaged in the Travelmode or played minigames, the player's Blob (as described in *4.3.3 - Developer-Driven Changes*) saved the gathered experience for future distribution among the other pets.

The Pet System

Within the game the participants were able to obtain various in-game pets by progressing within the Storymode, who accompanied the player's character, giving him or her special abilities and boosting his or her battle-related abilities. The pets incorporated various channels of feedback regarding the player's physical activity level including a direct, a semi-direct and an indirect effect.

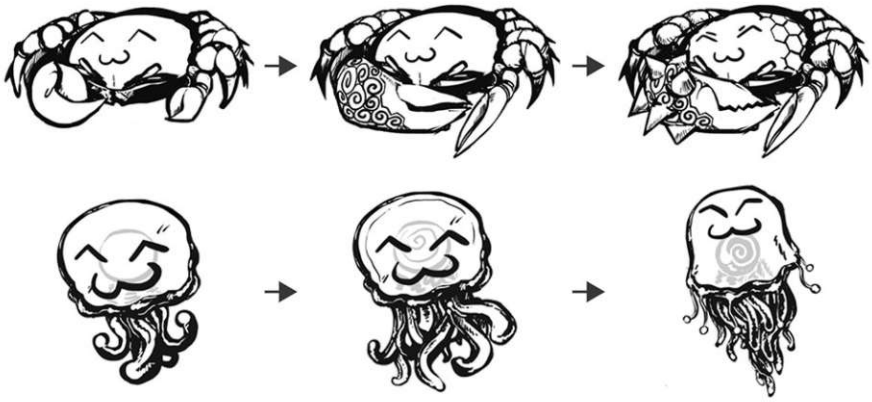

Figure 4.27: The visual evolution of the in-game pets in accordance to their increasing level as an indicator for their strength.

Direct Effect
The player's avatar had a skill called charge which served as an indicator for moving continuously. The charge level increased by walking at at least moderate intensity and could be fully charged to 100% by moving 10 minutes through. The charge mechanic was derived from the WHO's recommendation to engage at least for 10 minutes at once in moderate to vigorous activity. Once the charge was fully loaded the player's avatar got the power bar item, which could be used to strengthen his or her pet for the next combat against an enemy. To indicate that the user is walking at a sufficient high speed to increase the charge, the respective visualization on the screen was colored green.

Semi-direct Effect
As a semi-direct feedback for physical activity the pet's experience directly influenced the chance to gain certain bonuses for the duration of a battle against in-game enemies. This chance increased with every experience point the pet gained by real movement of the player.

Indirect Effect
The indirect effect provided long-term feedback about physical performance. It was influenced by the pet level, which in turn was determined by its experience points and had an impact on discrete additions to the pet skill pool available to the player. Such skills included the abilities to enter certain areas or to open special chests containing useful items during the Storymode. The higher the level of the pet was the more skills the pet was able to learn. Furthermore the pet changed its appearance as an indicator for its growing strength, as shown in Figure 4.27.

Game Modes

Our game prototype included various game modes, each supporting a different style of play. All game modes integrated physical activity into the gameplay and relied on the GPS - functionality of the smartphone.

Storymode
The Storymode was the major game mode and contained the main content regarding gameplay and the fantasy-driven storyline. The story as well as the narrative backgrounds of the game were mainly told by non-player characters within the test area and were interwoven with a series of story-driven tasks or quests. The player was provided with an in-game quest log, describing the current task, to help keeping track of the storyline and relevant tasks.

In the Storymode the player had the possibility to travel around on an altered overview map of a certain area of the Donauinsel. The altered map was visualized on-screen in regard to the actual position of the user within this area. To virtually get to a specific location the player had to move to the according area in the real world.

Within the test area the map was further divided into zones representing more detailed locations containing interactive elements, such as non-player characters, enemies or chests. To give the player an indication about certain locations of interest during quests, the relevant zones were marked by a special symbol indicating its importance: The quest marker. The symbol was visible to the player in case he was close to the regarding zones. To enter a zone the player had to tab the symbol representing it on the overview map while the in-game avatar stood within it (cf. Figure 4.28).

Inside a zone the player had the opportunity to fight against enemies, among other activities. According to their strength the enemies were colored green, yellow or red (cf. Figure 4.28) and could be attacked by tapping their according pop-up icon next to them. To gain a head start on attacking the enemy, the player had the possibility to *leap-into-battle*. In this case the user had to run as fast as possible to increase the chance to attack first. The player further had the the choice to leave the combat with an enemy. To do so the user had to tap the *run-away* button during the battle and run away into any direction for five seconds. In case the player covered a sufficiently large distance the attempt to flee was successful.

By implementing such game mechanics we intended to incorporate motivators to engage in physical activity at vigorous intensity. Furthermore we aimed to create a more intense immersion of the player into the events within the game by making his real-world movements affect in-game elements in an immediate manner.

A player could be defeated by in-game enemies, resulting in the player's avatar's death, which left him or her incapable of interacting with certain objects within the virtual world. Furthermore the appearance of the avatar changed, indicating the 'dead' state (cf. Figure 4.29). We used this feature to incorporate social aspects into the Storymode, giving users the possibility to

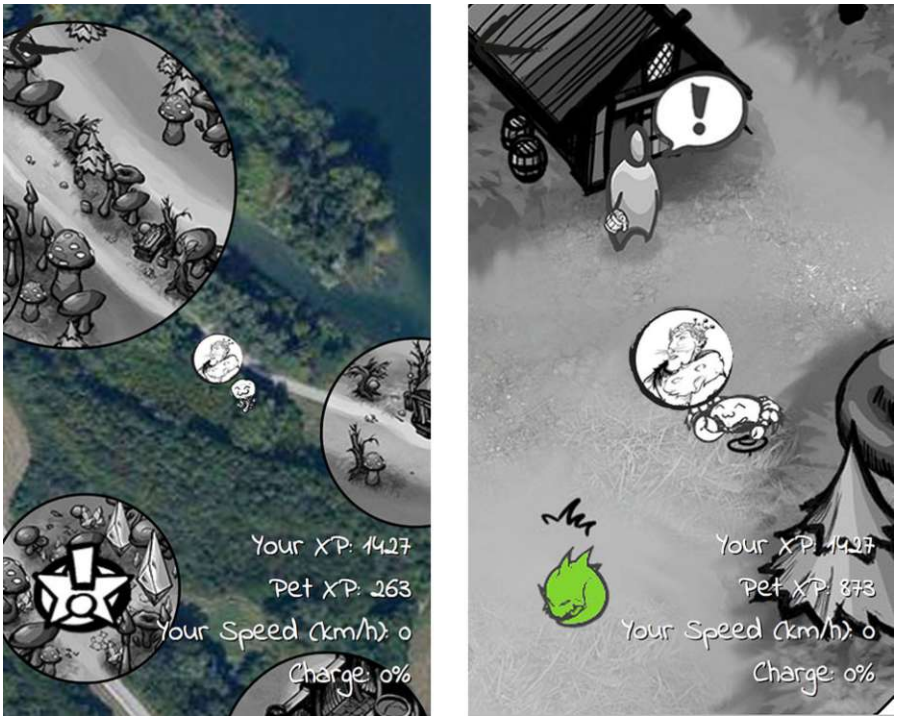

Figure 4.28: The overview map (left) and the view from within a zone (right) including the player's representation in the middle of the screen with the pet, a quest marker symbol in the bottom left of the overview map and a NPC with the according interaction symbol as well as a green enemy symbol in the zone view.

revive each other's character. To revive a 'dead' player, another user had to approach him and tab the according symbol.

The scope of the Storymode was designed to provide at least 3-4 hours of gameplay, so the physical activity guidelines recommended by the WHO could be met and even exceeded in case the player engaged in activities apart from the storyline, such as leveling all pets, exploring the area, collecting items etc..

Minigames

The player had the opportunity to play minigames anytime and anywhere, which constituted short game entities for moderate to vigorous intensity movement. Within the minigames the player had to chase items which were represented by green illustrations. To catch an item, the player had to move towards it in the real world. To facilitate the orientation the visualized map on the screen rotated in dependence to the direction the player was heading. For technical reasons Android and Windows Phone users had the possibility to rotate the map manually using arrow buttons projected on the left and right area of the screen (cf. Figure 4.30).

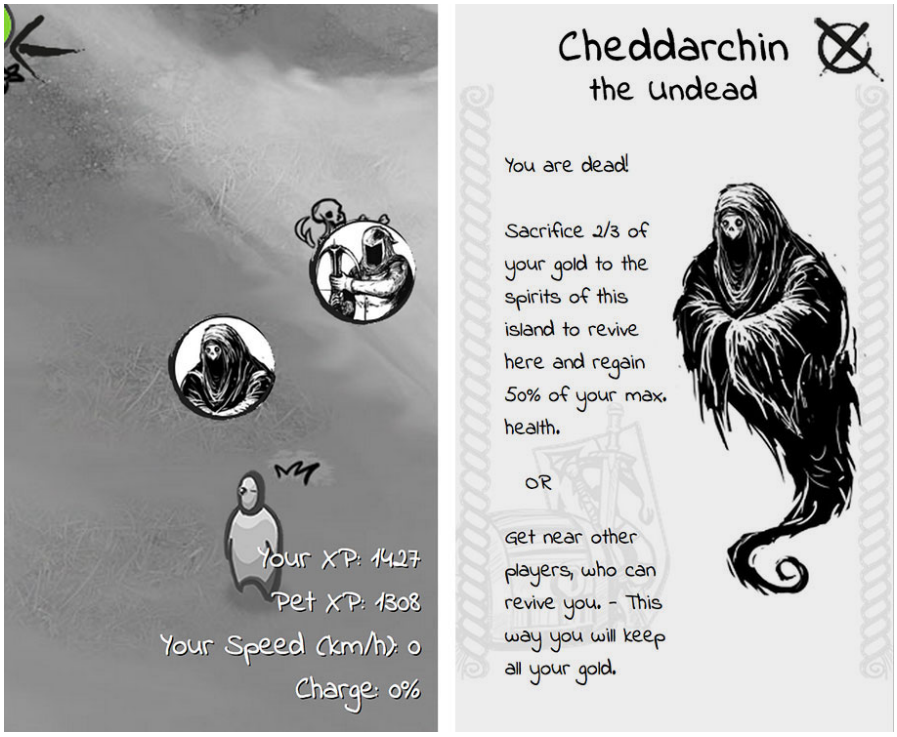

Figure 4.29: A 'dead' player's character as represented in a zone (left) and within an altered character sheet (right).

Since other people seemed to be a possible motivator for playing, we furthermore implemented multiplayer-minigames including cooperative of competitive aspects, which allowed two players to play together or against each other. If both users chose to play cooperatively they had to catch green items together and shared the same score pool. After the current minigame finished both players were rewarded likewise. Within the competitive version of the minigames two players battled against each other and tried to catch more green items than his or her competitor. At the end of the minigame only the winner received the reward.

Travelmode

Using the Travelmode the player was able to gain experience points while covering distances by walking within his or her daily routine. To start the Travelmode the player had to tap the according button in the main menu of the game prototype. By doing so the first checkpoint of the route got set automatically. Since the Travelmode measured the distance between two real-world points in a straight line and summed up all sub-distances for the current session, the player had to set a checkpoint for each big change of direction. For each sub-section the player was provided information about the last section including the timeframe, the covered distance, the average speed, the intensity level and the gained in-game experience (cf. Figure 4.31). The user furthermore had the possibility to delete the last section in case he forgot to turn off the

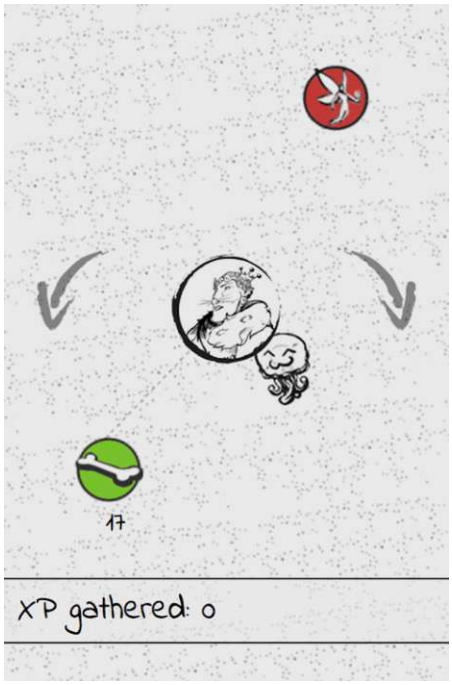

Figure 4.30: A scene taken from a minigame showing the player's avatar and the pet in the middle of the screen, the green pet food icon to catch and a red enemy the player had to evade. The pet food icon was connected to the player with a dashed line as an indicator of its location. Furthermore the scene shows the arrows to rotate the screen for Android and Windows Phone users.

Travelmode and travelled e.g. by bus after the last checkpoint was set. Like this errors regarding the speed and distance could be avoided. The speed and distance was capped by a database-sided procedure in dependence of the passed time in between two checkpoints to buffer possible GPS-measurement errors. In case of any distortions resulting in too high average speed, it was capped above the threshold of vigorous intensity movement speed at 14 km/h. By doing so we aimed to sanitize the movement data of the players for our log.

The Travelmode furthermore supported bicycling, which included higher thresholds regarding the maximum and minimum speed as well as the resulting experience gain. The thresholds were based on the following limits derived from [3]:

- Light or Slow - Bicycling with 4.8 to 8.04 km/h
- Moderate or Medium - Bicycling with 8.04 to 16.09 km/h
- Vigorous or Fast - Bicycling with 16.09 km/h or faster
- Capped Threshold for the log - 30 km/h

Figure 4.31: The view of the Travelmode displaying information from in between two checkpoints, including the distance, the duration, the speed, the resulting intensity as well as the gained in-game experience.

To choose from the different Travelmodes, the player had to tap the according button in the Travelmode menu of the game.

4.5 Digital Prototype – Evaluation

Author: Michael Habiger

This chapter describes the final evaluation of our digital game prototype. To do so we used the method of a focus group discussion.

4.5.1 Focus Group Discussion

Author: Michael Habiger

After the field test of our prototype we conducted a focus group discussion with four of our participants. We chose this method because we aimed to create an amicable environment inviting to engage in reflection on the game. The topics discussed not only included experiences with the game itself but also aspects related to it in a broader sense and were focused on our research questions in this regard.

For our discussion group we invited four of our participants, chosen by specific criteria:

- The participant who played most and tried every game mode at least once.
- Two participants who put an average amount of time into the game but played every game mode at least once likewise.
- One participant who played the game rarely.

To determine the defined patterns we used the log data recorded during the field test. Our participants were encouraged to talk freely about their experiences with the game prototype among themselves. We intervened as little as possible and only to lead the discussion into specific directions regarding topics related to our research questions or to elaborate specific aspects more in depth. As during the paper prototype session we chose note-taking as technique to collect the data.

We aimed to gather concluding feedback regarding the participants' experiences with the game itself as well as aspects being considered motivators to play the game and barriers, which kept them from playing. Furthermore we intended to initiate a reflective discussion concerning the participants' attitude towards their grade of physical activity, their self-perception regarding this topic and the role of social aspects in this context. Ultimately we aimed to analyze the feedback gathered throughout the conduction of the focus group discussion within the context of the insights we have gained so far.

Data

The content discussed by our participants was categorized by topics derived from our research questions. Due to the nature of several statements during the focus group discussion being suitable for more than one of those categories the data presented in the following has to be viewed in a broader and overlapping sense.

Motivators to Engage in Physical Activity

Regarding potential motivators to engage in playing our game prototype two participants stated that being outside is a beneficial factor. One of them compared our game to a conventional online role-playing game with the difference of simultaneously walking through nature and referred to it as being 'cool'. The other user further noted that she found the feature of being outside and moving interesting, especially when thinking about all the time she previously spent at home sitting when playing computer games.

In the context of being outside three of our participants perceived the incorporation of real locations as being well implemented, while one of them referred to the Donauinsel specifically, which she found very suitable for the according game situations or quests taking place there. One participant explained that the combination of real locations and a virtual game made him swing off the conventional paths of the Donauinsel to explore the surroundings several times

despite the fact that some terrain was not accessible conveniently.

Regarding the fusion of the real and virtual world, the same participant stated that this approach made him feel like being an actual part of the game. This effect was further intensified by the fact that he had to actually cover distances to get from one point to another, instead of just pushing a button like he normally does in virtual games. Moreover game mechanics demanding immediate physical activity further support immersion into the game for him. In this context he referred to the *leap-into-battle* mechanic and the *run-away* mechanic for being kind of more direct. He further stated that the exertion caused by the game was also rewarding when he finally accomplished a goal he was reaching for.

For one participant the leap-into-battle mechanic was motivational in another context. She explained that this was a cool and funny feature, which she made use of every time she got the possibility to. She found it motivational to engage into an virtual battle with an enemy at sight, run into the battle using the leap-into-battle mechanic and to ultimately win and gather rewards.

Another participant stated that he knew that the leap-into-battle mechanic was meant to run by foot, but nevertheless used his bike to get the beneficial effects of the high speed for the following battle more comfortably. Although he stated that he basically did not know which enemy he fought, the battle marks next to the enemies' visualizations encouraged him to attack. He further mentioned that he enjoyed 'cheating' by using his bike to gather experience faster because he was able to cover distances more quickly.

In a similar context another user had fun to exploit certain bugs (looting the same chests repeatedly by leaving and re-entering a zone), giving her a basically unlimited amount of specific items. She further explained that she intentionally started as early as possible to cheat and found it motivational to outwit the game and the developers.

The same participant stated that she perceived the strategical elements of the game as being encouraging and compared them to classic paper-chase games, which require curiosity and reflection over the given tasks. Regarding curiosity she further mentioned that she was very interested in the background story of the adventure provided by our game prototype, the upcoming plots and the written texts telling them. She rated this aspect of the game as being the most motivational part to play it. For one participant further role-playing game elements besides the story were also motivational. He explained that the characters' level mechanic was appealing for him and that he enjoyed building a strong in-game character.

Basically all participants perceived the visuals of the game, especially the pictures, as appealing. Two users further stated that they had to grin several times when reading the partly sarcastic descriptions of in-game items. One of them explained that she found it encouraging to gather those items.

Regarding improvement in the context of motivational factors to play the game our users suggested to reduce the amount of buttons especially for the Travelmode and to provide a faster opportunity to log in. Furthermore one participant could imagine that the incorporation of real items might be an interesting feature for future work. Another user would like to see a possibility to regenerate in-game health in specific locations like taverns or bars to keep up the game flow and to get greater rewards for superior in-game performance.

Barriers to Engage in Physical Activity

Much-addressed barriers to play our game prototype were technical issues. Three of our participants experienced problems when logging in and found the typing of their password tedious. In this regard one user mentioned that a possibility of some kind of auto completion would have been beneficial. Especially when intending to use the Travelmode on the fly the manual login felt obstructive for her. In this regard the participant further stated that she was annoyed by having to tap the screen to save her position every time she changed her direction. Another user explained that she rather missed some experience points by tapping the screen less, for instance only twice per route than pulling her smartphone out at every corner. Another user further noted that especially the Travelmode afforded too many interaction steps to effectively use it and wished for some kind of shortcut. He and another user were further annoyed by GPS-related inaccuracies, resulting in measuring errors (for instance getting a too short distance credited) using the Travelmode.

One participant faced issues regarding the auto-rotating map. He mentioned that while playing minigames he was blocked by real-world obstacles frequently, such as bushes or walls when trying to catch a virtual target on-screen. Another user stated that she often died battling a boss because of the confusing control with manual rotation at first and the casually slow update rate of the GPS-signal resulting in unexpected movement of her avatar. Furthermore the non-rotating map in the Storymode irritated her and she sometimes had problems to find her way around or follow cardinal directions as required for certain tasks.

Regarding the user interface, one participant mentioned that his fiancée he had invited to play one time had problems with the back button. She was frustrated by accidentally pushing it too often sometimes, which resulted in the necessity to load the game again requiring a new login process. Three other participants experienced similar issues at first, though one of them stated that such problems only happened in the beginning when she was still unfamiliar with the user interface.

A further potential technical barrier discouraging one of our participants to play the game was the high energy consumption of our prototype. To save her smartphone's energy level she often turned it off between two points of interest despite being aware that she will miss out experience points this way.

Though one user mentioned he had miscellaneous technical issues using various mobile browsers, reaching from unlucky login attempts to GPs-Problems, another user stated that he

was not bothered too much by such things knowing that the played game was a prototype. In this regard one participant often forgot about the prototypical state of our game and therefore expected a smoothly functional game.

Concerning the balancing of the level mechanics and the difficulty level one participant mentioned that fighting with the virtual enemies sometimes felt random. Despite having the feeling of having a strong avatar, he nevertheless lost several fights, giving him the impression that combat was purely luck-based sometimes. Two other participants perceived the first boss battle as too hard.

Two users stated that particularly in NPC-conversation the amount of in-game text, telling the background story of the Storymode, was too high. Especially one of them had difficulties to read the text because of reflection of the sunlight when the display was directly hit by it. Nevertheless the other one felt a need to read the whole text to make sure she did not miss out any important information for the further gameplay.

For one participant the Storymode was too linear by leading the player from one location to the other, giving her no real choice what she was going to do next. Although she stated that she knew she could basically engage in various activities, she further explained that she would have appreciated several quest-related targets as beneficial.

Attitude towards Physical Activity

Regarding the attitude of our participants towards activity, one participant pointed out that our game mode includes a certain fun factor in contrary to jogging, to which he referred to as being monotonous. Another user mentioned that she had the feeling that she would have been more physical challenged if she had engaged in other activities, such as walking quickly, bicycling or swimming instead of playing the game. For her especially the walking transitions between the different zones in the Storymode were tiresome though she also stated that she walked very slowly when playing the game. She furthermore avoided every enemy encounter if possible and only fought when necessary for the progress in the Storymode. One participant noted that playing the game was probably less exhausting because of the frequent interactions with the smartphones and the breaks correlating with them.

Though one user mentioned that she did not play the game to make sports, she nevertheless engaged in every battle with enemies possible, feeling physically challenged by the leap-into-battle mechanic. Another participant conceived the game as physically challenging likewise. Though not engaging in any sports on a regular basis, he perceived it as pleasant to walk for instance three hours while playing the game. He further perceived the transitions between the various zones as being ‘OK’. Getting in-game experience by walking distances gave him the feeling that he did not waste his time when moving around the test area.

In the majority of cases the same user deliberately chose to play our game prototype instead of playing computer games at home. He considered our game as an alternative to conventional

computer games because he can spend time outside and engage in physical activity. In this context another user would choose a game like our prototype over other computer games for the same reasons. She explained that such a game could act as substitute because of the additional beneficial aspects of movement and being outside while maintaining the same fun factor as other computer games for her. Two participants perceived the game prototype as being supplemental for physical activity.

Self-Perception Regarding Sedentary Behavior and Physical Activity Level

Throughout the testing phase of the game prototype two participants became aware of how much they actually sit and in how far they engage in physical activity, or inactivity. While one of them noticed that she actually moved more than she thought, the other user realized that she spends vast amounts of time sitting. She stated that she began to intentionally stand more often during working hours or at the university instead of sitting down and walked more consciously.

Another participant was surprised of the distance he covered throughout the testing phase of the game prototype and stated that he had not thought he walked so far. One participant was already aware of his physical inactivity before playing our game prototype.

Social Aspects

Regarding social aspects int the context of being constituting motivational factors all participants perceived the approach to play together with other people as a main driving force to play our game prototype. One participant stated that she appreciated a number of things when playing our game, specifically spending time with her boyfriend by playing a computer game and being physically active as well.

Three of our users mentioned that they wished for more in-depth cooperative features for the game. While one of them regularly revived other players' avatars she suggested features like a trading system or the possibility to fight an enemy together. One participant felt that playing with other people nearby was more like playing in parallel rather than playing together. For him this factor was expressed by the necessity that all players had to do the same things likewise. He stated that some kind of multiplayer mode incorporating collaboration and task sharing would be more interesting for him. Two users perceived the Leaderboard as motivational. One of them explained that he always wanted to be ahead and was willing to play more in case any other player had caught up.

In terms of long-time motivation to play our game prototype two participants would find coop features beneficial to keep playing. Another user addressed community generated content as a potential motivational factor. He further explained that quests could be created by all players and in consequence played by everyone. For him this would be furthermore beneficial, since he would not have to travel to a specific area to complete tasks but rather go outside and experience adventures provided by the game in the direct neighborhood.

Regarding barriers related to social aspects, one user experienced energy consumption issues while waiting for other players playing with her to catch up with her. When all players had reached the same stage of the story her smartphone's battery had already died, making it impossible for her to play along. Another participant further stated that she felt annoyed while waiting for other players who faced technical problems. For one user playing together was practically impossible for such reasons.

Two participants mentioned that other uninvolved people in the test area started to observe them. For one this was especially problematic since some important locations were occupied by celebrating or bathing people and perceived their presence as being embarrassing for him at first. Nevertheless he further stated that he overcame that initial embarrassment and kept playing anyway.

Increase of Physical Activity Level

One participant stated that the Travelmode motivated her to walk more often instead of taking the subway to get from one location to another.

Miscellaneous Feedback

For one participant the prototype was better than he initially thought it would be. He further mentioned that he would have kept playing if the battery of his smartphone had lasted longer. For another user battery issues were the same reason why she quit her gaming session.

Two users played mainly after university or work on the fly home and in some cases as well if they felt motivated enough. The other two participants intentionally planned to play the Storymode at a weekend together.

Interpretation

Since our participants perceived being outside as well as the incorporation of role-playing elements as quite positive, the combination of these aspects may be beneficial in terms of a major motivator to start and keep playing. This may be due to the fitting environment of the test area for the background story and the general genre of the game. In specific an area with meadows, trees etc. seemed to be an appropriate choice for the context of our game, as the real-world environment resembled the virtual world represented on-screen. In this regard, one participant stated that he enjoyed scouting the area while playing. According to his statement the choice of the real-world location, not only concerning the overall setting, but also direct incorporations of real-world objects as well as interesting and cherished places (for instance a way, a crossroad or a distinctive tree) into the virtual world may invite for exploring the area to discover hidden elements. Therefore a strong relation between real-world locations and in-game places of interest might have constituted an important motivator to engage in playing our game.

Under the paradigm of using real-world locations one participant suggested the integration of places like cafés or bars into the game represented by taverns, which allows in-game health regeneration or provides resting bonuses. Thus playing the game obviously inspired the participant to make connections between game factors and potential incorporation of his environment.

For one participant embedding our game into an actual existing area seemed to further increase the immersion into the virtual world, resulting from the necessity of real movement to take action within the game (for instance to travel from one area of interest to another) instead of using conventional input devices such as keyboards. In this context the feeling of being part of the game further got emphasized by features like the leap-into-battle or run-away mechanics due to their analogous connection to real-world actions. If the player performed well and *powerful* in reality, he was rewarded with *power* in-game as well. Hence by giving the player proper feedback of his investment of physical efforts, the physical activity within the game seems rewarding itself.

In terms of real movement within the game the lack of cheat prevention seemed to foster creativity concerning the use of physical activity for the provided game mechanics. In this regard one participant chose to ride his bicycle over walking (despite of officially not being allowed to), which suggests to integrate further means of transportation requiring physical activity into the gameplay. Another user exploited a bug allowing her to harvest a chest multiple times by repeatedly leaving and entering a zone, which again made real movement necessary (a zone could only be left by leaving the appropriate location in reality). Hence by giving the players the feeling that they could trick the system and allowing them rogue-like gameplay, though not intentional in first place, might have been a further incentive to engage in physical activity within the game.

In the context of using fantasy-driven role-playing elements one participant perceived the background story, possibly triggering curiosity, as a driving factor to keep playing. One user enjoyed collecting in-game items, such as armors and weapons for her avatar, while another player appreciated the in-game level mechanics and aimed to build a strong character. Given those aspects choosing a fantasy-driven roleplaying setting seemed to make the players emotionally connected to their in-game characters in a natural manner.

The visuals and in specific the humorous allusions connected were broadly accepted by our participants, implying that such aspects may have been well suited as a comic relief factor during gameplay.

Barriers to engage in playing our game mentioned by our participants were mainly technical issues and linked to shortcomings of the web-based implementation as well as to the prototypical nature of our game. While a platform-independent approach was appropriate to test the concept of the game on many different devices, native applications might have provided more sophisticated support of features such as GPS, compass readings, standby functionalities, as well as a more efficient energy management. Furthermore some users perceived some aspects of the game as too hard or inconvenient (e.g. boss fights or encountering physical obstacles while playing

minigames). Other difficulties encountered were specific elements of the user interface (e.g. the back button or the rotation buttons for the minigames), a flatter learning curve, presumably by implementing in-game tutorials or more hints.

Regarding gameplay itself certain issues, in particular the unpredictable outcomes of battles as well as the too linear storyline, were perceived negatively. This may be due to high user expectations and the therefore lowered tolerance level regarding such aspects. Since one participant further stated that she sometimes forgot that she played a prototype, such high user expectations may be derived from the general presentation of the game, giving the impression of a fully functioning and formed game concerning the visual appearance and the broad spectrum of already existing features (e.g. different game modes).

In the course of the focus group discussion our participants outlined very individual attitude towards physical activity, which seemed to affect how they actually played the game. For example one participant enjoyed attacking enemies and therefore 'leaped' into battle at vigorous intensity, while another user more or less ambled slowly during playing the Storymode. Hence, given the variety of different approaches to engage in playing, it seemed that the game was able to provide prototypical implementations for different preferred activities in participants. In this regard one users was astonished about the amount of kilometers he had covered playing the Storymode, and another participant stated that she frequently chose walking over traveling with the subway to gather experience using the Travelmode. Thus the provided game modes further appeared to fulfill individual preferences regarding physical activity. Overall the attitude towards in-game activity seemed to be well perceived, as some of our participants considered it as an alternative for sports (for instance as jogging is perceived as too monotonous by one user) or for playing virtual games at home, while others used the game in an extending manner regarding movement.

A well-discussed and recurring topic within our focus group discussion were social aspects. Since the majority of the participants wished for more in-depth cooperative features, including a system to trade or to do cooperative tasks such as fighting enemies together and splitting tasks among other players, the integration of such extended features could have been a further motivator to engage in playing the game. While most users did not explicitly use multiplayer minigames, they nevertheless played the Storymode alongside each other, which further suggests that social factors played a central role for the participants. In a similar context the leaderboard seemed to constitute an appropriate choice to incorporate and visualize the progress of the players in order to motivate them to keep playing.

As the focus group discussion provided feedback regarding the field test, in the following chapters the outcome will be discussed in the context of the entire work. Thereby the focus is set on the process as a whole in form of an overall discussion of the work. This is followed by a conclusion regarding our field of interest including the answering of our research questions and finalized by a summary to give a brief overview on this thesis and its derived outcome.

CHAPTER 5

Discussion

Author: Peter Fikar

In the following we discuss important factors of our work in relation to our prototype and its evaluation. We will reflect upon our prototype's influence on participants and the effects of the user-centered development process relevant to the basic themes of our work.

Throughout the course of this work we set ourselves certain goals. We aimed to create a system potentially able to impact and possibly improve activity-related lifestyle features. Therefore we encouraged our chosen participants to grant us valuable insights and feedback to provide us with the information necessary to set up an initial design, improving it during development and reflect upon its potential.

Real-World Factors in the Game

Overall it can be said that participants received the designed prototype system positively. Motivational aspects emerged from of the applied mobile and pervasive concept itself. According to the focus group discussion results, the game managed to combine outdoor environments and a digital game world in a beneficial manner, because the users highlighted positively that they could make use of the game in natural surroundings, which was also a motivator for physical activity mentioned during the preliminary interviews.

The chosen fantasy background and the roleplaying context, also relating to the participants' preferences uttered in the questionnaires, were highlighted by participants in combination with the Donauinsel location choice. The choice of environment and the game-related concept synergized, supporting each other in a natural manner. Therefore we consider our fitting choice of location to be a potential motivator.

Furthermore the location bound Storymode can also be considered to be a major motivational force when it comes to keep the users playing, potentially prolonging play sessions, since the story was described as being of high interest. People wanted to play on to see what happens next. Hence this supports our design choice to provide a proper fantasy-driven story in the game. This background sets the stage for embedding the dialogues, bringing the personality of the characters to life and framing all the elements of the game. The elements designed in this matter, such as items and pets, were a major point of interest to the players. The humorous flavortexts, also discussed during the LoFi prototype test were highlighted as well as the pleasing visual representation of game items that can be considered potentially entertaining factors. In general we consider the looks and feel of the illustrations as a success because participants stated their appreciation on several occasions throughout the user-centered design process.

We further suspect that the extensive storyline may support efforts to keep up the motivation over an extended time period since it showed potential to drag people into playing on. Thus, releasing ever new game content extending the story and in-game content to the players could potentially keep the game interesting even after initial novelty effects wear off. This also underlines our decision to provide a concept based on a full-fledged game approach rather than relying on gamification-related concepts only.

Physical Activity in the Game

The choice to provide different modes of the game in order to support individual preferences of users regarding their gaming and activity habits was supported by the results of the focus group discussion. Participants vividly discussed their experiences regarding the effects on their physical activity. The forms of physical activity the Storymode provided during the field test were perceived in varying ways. Traveling between locations in the game was perceived less engaging than more direct forms of activity such as the "Leap-into-battle" functionality, which was highlighted on several occasions to be of special interest to participants. We hypothesize that the prominence of this feature may result from the fact that the investment of physical activity results in a perceived strong impact in-game and therefore resemble such exhausting efforts in a more rewarding way. This can be seen in connection to our goal to provide meaningful play [81] especially in connection with physical activity investment as discussed in *2.4.2 - Meaningful Play*.

Participants showed an emotional connection to their character. It was stated that it is enjoyable to build a strong character making use of the provided role-playing game-related level mechanics. Unfortunately this was somewhat compromised by the fact that combat with in-game enemies was also considered unpredictable on occasion. If one cannot predict whether the character is strong or not this beneficial factor might be lost. This also underlines again the importance of meaningful play, by making in-game actions predictable to the player. We argue that this can be regarded an issue of balancing in-game factors, which was not our primary concern during this stage of the prototype.

Exploitation as Incentive and Design Indicator

Since we also did not actively enforce any form of cheating prevention, participants showed creativity in interpreting our suggestions of rules to use the game, such as using the bike instead of walking or exploiting bugs in the game. Even though the use of a bike was making the game for the regarding participant more convenient and less exhaustive it highlights that the integration of other forms of activity are potentially interesting, further supporting the bike-option regarding the Travelmode. Another exploit made a user benefit from additional in-game resources when leaving and entering a zone in the Storymode. This resulted in an increase of physical activity, hence can be seen as an additional motivational factor which emerged from the interest in making use of unintentional system behavior. This emergent concept could be explored in possible future work.

Technical Issues

The main barriers to an enjoyable game experience in connection with physical activity can be characterized as technical inconveniences. One major issue in this context was the inaccuracy of sensors regarding GPS and compass readings. Participants criticized early on in the design process the insufficiency of the GPS signal for controlling the minigames in an appropriate manner, the Technology Probes results clearly indicate this as well (see *4.3.1 - Technology Probes*) Relating to the field test, concerning the usage of compass-driven rotations, or, if chosen, the manual controls, both were received as being too complicated to handle if encountered the first time during a boss fight. Even though we provided the minigames, including the same handling of the controls, before the Storymode was even rolled out during the field test, the learning curve was considered as being too high. .

Another major trade off was the tedious login, which was also criticized on several occasions throughout the design process starting with the Technology Probes. Overall the technical issues reported by participants can be classified as being related to the browser-based approach we followed. Most, if not all, barriers regarding technical issues would be positively affected by a native approach implementing apps for each smartphone brand. This would also enable the design of features running while the smartphone is on standby and opportunities to reduce touch screen input by opening up possibilities for more natural input e.g. through other accessible smartphone sensors. This would also potentially decrease energy consumption of the smartphones, prolonging battery life, impacting the possible duration of playing sessions in the field.

Gameplay-Related Barriers

Even though participants regarding its motivational influence cherished the provided story, they also criticized that reading through the story text was potentially interrupting. Even though audio was initially rejected as a possible channel of output for players, as results of the paper prototype show, additional modalities of in- and output could prove to be a viable option for conveying potentially longer story parts while moving on. This would also support features

making use of continuous movement like the charge functionality of the pet, which was almost never used by participants during the field test of the Storymode.

The Unfinished Nature of the Prototype

Several effects of the prototype can be set in relation to the still incomplete nature of our game, due to the fact that even the last iteration of our prototype still does not resemble a finalized product but rather a beta version.

One issue regarding game imbalance was already mentioned above, discussing the perceived randomness of combat encounters. Even though participants' statements referred to the prototype as being better than expected, it should be mentioned that expectations of participants regarding the prototype seemed to be high, which they also reflected upon during the focus group discussion. We consider this to be in connection with the degree of user involvement during the design process, which we hypothesize invoked a certain view on our development process and the quality of our prototype. We also suspect that the cherished quality of the presented visualization is playing a role in this matter, because the visuals may convey a more finished product than it really is. This may have led to increased expectations and an increased frustration level regarding technical issues. Another reason might be that we never explicitly made clear that the Storymode field test is a prototype test but rather presented the users with the game as if it was in a final stage of development.

Social Factors

Group factors showed to be of great importance, as expected regarding the results of our preliminary methods, and were also discussed as potentially being a main incentive to play the game in relation to our prototype. Participants stated that they would prefer playing together in a more connected way than the game was able to provide in its prototype state. Even though we implemented multiplayer features in form of minigames and some cooperative elements within the Storymode, such as reviving other players, participants stated that they want to share tasks and quests and would prefer a more group-based approach to playing the game.

Participants stated on several occasions throughout the course of the design process that they would feel uncomfortable regarding actions necessary to interact with the game that could be noticeable by other people in public. Statements underlined this during the focus group discussion but it was also stated that these effects were mitigated while playing. This suggests that there is a process of familiarization with playing the game in public, which takes time to adept to. Also we hypothesize that this does not have to be a weakness of our game, but can also be seen as strength to recruit new players due to their interest in observing the doings of the others. Furthermore we suspect these effects to diminish drastically if such games were as popular as other apps and smartphones features requiring publicly visible interactions.

Attitude

Even though the focus group discussion laid its spotlight on reflecting about the prototype field test, participants vividly discussed alternative approaches and new ideas, such as involving physical items connected to in-game items or approaches providing the option to play in the direct neighborhood of their homes. This indicates that the form of game experience offered by our prototype triggered creative impulses in our participants reflecting about possibilities of activity-based gameplay. Hence we suggest that this also had beneficial effects on the attitudes of our participants regarding such games as a whole and the activities integrated into them, which is also supported by the results of the preliminary applied methods regarding the attractiveness of the concepts connecting digital games and physical activity.

The creative processes triggered in participants could also be utilized to promote new kinds of design approaches for further development of the game. We hypothesize that integrating features to utilize this creative attitude could also be used to extend the game experience by making the players designers of game content, which then again can be played by others.

Derived from the results of our focus group discussion it can be said that the attitude of our participants towards the physical activity integration within our game was positive, underlined by statements cherishing that the activity is of less monotone nature than traditional forms of physical activity. This also points to the diversity of perceived incentives to play the game. Some replaced gaming in a home environment by playing our game outside, being a prominent motivator in participants as discussed above, while others extended their classical activity habits by playing the game and therefore add additional physical activity to their daily routine. In any case it can be said that the game has the potential to impact the lifestyles of the participants in individual ways by potentially decreasing sedentary behavior as well as promoting additional activities next to traditional ones.

Therefore we consider that the attitudes towards activity in a game differ from the attitude towards traditional sports like jogging and hence opens up a new field of possible activity adding a new potentially fruitful approach to activity for certain people.

Self-Perception

The perception of the own activity level can be set in connection with the different ways in which physical activity was promoted in the game and the attitudes discussed above. Some participants stated that they moved more than expected in the game, hence it can be said our game covered up a certain degree of exhaustion by providing a distraction. Other participants preferred features related to the leaderboard, which makes physical activity more explicit and was described to be a competitive incentive. An explicit case even describes that the prototype managed to increase awareness about sedentary behavior beyond the scope of the game, resulting in less sedentary behavior at work.

Furthermore we consider that the game showed potential to increase reflection about the own activity level by invoking the described creative thinking in participants regarding the connection between activity and game content, as discussed above, and hence may be able to further raise awareness about the own activity level in this regard.

Not only game-related factors induced a reflection process in participants but also the user-centered design process. Some participants uttered their frustration with their own activity level and sedentary behaviors after they handed in the questionnaires, stating that answering such questions made them think about the role of sedentary behavior and physical inactivity in their lives. Unfortunately this also might impact the perceptions regarding the test of our prototype, since our group of participants was involved from the beginning. Future work might include further field tests with users who did not take part in the development process, to provide us with different points of view.

Our Game in Relation to Motivators and Barriers in Participants

We hypothesize that our game has the potential to overcome barriers to activity explicitly mentioned by participants during the preliminary interviews. One of those main barriers was the lack of time to engage in physical activity. Since our game was used in ways extending activity habits or replacing sedentary spare time behavior at home, we argue that our game was able to promote an alternative way of spending time and potentially supports individual ways by its' varying gameplay features.

Another barrier was the missing fun factors regarding traditional physical activity approaches such as jogging. As the focus group discussion showed, participants were reflecting upon many features in a vivid and excited way and highlighted their individual approaches towards in-game features. It was furthermore explicitly stated that the game managed to provide a less monotone way to approach physical activity than traditional ways do.

Furthermore the game managed to support some motivators identified through the applied preliminary interviews by integration of an approach to physical activity in a natural outside environment. The choice of the Donauinsel area can be set in relation to be more supportive regarding recreational factors since it is basically a recreational area supporting the in-game fictional world.

We hypothesize that the incentives which were discussed and perceived well by participants could potentially provide additional ways for the users to overcome their 'weaker self' regarding physical activity and could furthermore motivate to maintain being physically active by supporting the feeling of success regarding the in-game storyline progression or the challenge to stay on top of the leaderboard.

Overall it can be said that the Storymode as well as the Travelmode and the according leaderboard were broadly accepted and perceived well among participants. The minigames were of less interest. We argue that this is connected to the lack of control in connection with impreci-

sions of the GPS and other technical features. The Travelmode could have been more successful if it was supported in a more subtle way, for example by running automatically in the background instead of requiring user input for every checkpoint.

In the following chapter we discuss the outcome of this work concerning our field of interest. Furthermore we aim to provide answers to our research questions.

CHAPTER 6

Conclusion

Author: Michael Habiger

The concluding part of our work aims to answer our questions of interest regarding movement patterns and sedentary lifestyle behavior of participants. To do so we are taking into account the insights we gained by conducting an iterative user-centered design process to build a digital game prototype called *Sky Haven* for encouraging in physical activity, as well as the feedback received from our test users during and after the field test. The following section provides concluding answers concerning our questions of interest in the context of physical activity as well as a summary of our work.

Which barriers and motivators to engage in physical activity are of relevance and can be identified in participants?

Within the conduction of our preliminary methods to deduce possible barriers to engage in physical activity we found that a lack of time constituted a major reason to maintain a sufficient high grade of bodily movement. Although some of our participants know that being physical active can be linked to beneficial effects regarding health, the process of overcoming one's 'weaker self' and engage in activity is perceived as obstructive, especially when available time for recreation is further restricted as a result of work or studies. In this context such factors cause some of our participants to be already too exhausted when for instance arriving at home, leaving them in an unmotivated state concerning physical activity.

A further important barrier identified in our participants were missing fun factors in conventional sports, as for example one participant referred to jogging as being too monotonous and therefore boring. In this regard sedentary leisure activities such as watching television or playing computer games are additionally hindering to engage in bodily movement.

A potential motivator regarding physical activity was the awareness in participants about doing something good to oneself in terms of health and wellbeing. Furthermore achievements linked to bodily movement were often associated with feelings of success, giving physical activity a rewarding character. Especially being outside in the nature while being physically active was perceived positively. Other potential motivational factors are constituted by social aspects as described below by answering the research question regarding social factors within our field of interest.

To which extent is our game able to overcome barriers and make use of motivators?

Our game prototype incorporates physical activity combined with fantasy-driven role-playing game elements embedded into a suitable genre and background story. By doing so we intended to give our game an appealing setting and since such role-playing game elements are derived from conventional digital games, we aimed to challenge the sedentary activity of playing computer games with and next to others. In this regard participants reported that, given the choice whether to play virtual games at home or to engage in playing our game prototype, they rather chose to play *Sky Haven*.

A crucial factor in matter of designing the game was mobility, thus building the game for smartphones. This way the users could play anytime and basically everywhere depending on the game mode in which they engaged in. In this regard a participant stated that she walked specific routes more often instead of using public transport using the Travelmode in order to gather in-game experience.

Since several participants perceived being outside in the nature in relation with physical activity as a potential incentive, the Storymode was embedded into a specific location within the Donauinsel area, including meadows, trees and a natural environment in general, mainly used for recreational purposes. This area further provided a fitting context to incorporate role-playing game elements and a fantasy-driven background story, meaning that the locations of interest in-game had a strong connection to their real-world correspondences in terms of appearance and ambience. In this regard players stated that such a combination fostered their immersion into the game and invited exploring the area within the game. Furthermore the storyline triggered curiosity as a motivator to play the game.

Physical activity especially induced by the certain elements of the Storymode, namely the *leap-into-battle*-mechanic, was perceived positively among our participants, since the direct mapping of physical effort to an immediate outcome linked to this effort seemed to be rewarding, giving the users a feeling of accomplishment and immersion. In a broader context of the term rewarding, players reported that they enjoyed to strengthen their character by being physically active thus gathering in-game experience or to collect various provided in-game objects, such as armor or weapons.

To which extent can our game change the attitude towards activity?

The participants chose various approaches of being physically active within the game in terms of the game mode (e.g. Travelmode or Storymode), the favored means of movement (e.g. walking or biking) and the modality (e.g. the focus on vigorous, moderate or light intensity activity), suggesting individual attitudes towards bodily movement. Nevertheless, since most users perceived their preferred kind of physical activity as fun or motivating, it seemed that the attitude towards in-game physical activity was quite positive. This assumption may be emphasized by the fact that, among other beneficial effects, some users preferred playing our game due to being outside and physically active instead of playing computer games at home.

Especially during the course of the focus group discussion, the participants suggested further integration of various kinds of physical activity, real-world objects or locations into the game. Thus our game seemed to encourage creative reflection over physical activity and how it can be implemented in a playful manner. Hence it can be said that the interest towards physical activity combined with elements of conventional virtual games was rather high.

To which extent can our game change self-perception regarding sedentary behavior?

Due to the direct involvement of our users into the development process as co-designers of the game itself, it is hard to argue in how far the game or the whole process might have changed the self-perception regarding sedentary behavior in our participants. Several participants stated that they realized how much they actually sit during the day just by filling out the preliminary questionnaires. Nevertheless one participant was astonished about the amount of physical activity he engaged in while playing the game as he stated that his grade of bodily movement is usually not that high. Another user participant reported that the game motivated her to choose standing over sitting while at work or at university. Therefore we hypothesize that our game has the potential to change self-perception regarding sedentary behavior or physical inactivity likewise, though this aspect has to be exposed under consideration of the direct relation of our participants to the topic caused by the strong involvement into the design process itself.

To which extent are group factors of importance in the context of gameplay, physical activity, barriers, motivators, the altering of self-perception and the attitude towards physical activity?

As mentioned above, social aspects, including cooperative and competitive aspects likewise, made up a major incentive to overcome barriers to engage in physical activity. In this regard participants pointed out that physical activity might also be a chance to meet friends or other people in general. Additionally the opportunity to outmatch others makes up a further motivator to be physically active. In this regard a participant reported that seeing other people's progress (for instance, if they are getting into a better body shape) might further constitute a major incentive for her.

To make use of those motivators related to social aspects, our game prototype provided features for multiplayer and social gameplay as well. Several of our participants, while not using the provided multiplayer mechanics directly, played together by planning trips to the test area at the Donauinsel together in order to progress alongside each other within the Storymode. Furthermore some of our users were motivated to keep playing because of the provided leaderboard, showing the total experience points of all players, and the feeling of competition arousing from it.

Throughout the final evaluation of our game prototype, our participants extensively discussed social aspects within the game. This included further possibilities and ideas on how cooperative features might be implemented and how those features could possibly contribute a major motivator to play the game. Also social aspects in a broader sense were brought up during our focus group discussion, as one participant suggested community-driven features, allowing users to generate content by themselves, which again could be played by other people.

Considering our findings in terms of social aspects, they seem to play a significant role within physical activity and further need to be considered as highly valuable when combining bodily movement with playful elements in order to support social gameplay in a narrower and broader scope likewise.

To which extent can our game increase a person's activity level to counteract a sedentary lifestyle?

Given the widely positive attitude our participants seem to have towards physical activity within the game, we hypothesize that our approach to combine real-world bodily movement with virtual gaming elements in a mobile setting including the outdoors has the potential to increase a person's activity level and in consequence may contribute to the decrease of sedentary lifestyle behavior in users. This assumption may be further emphasized taking into account that participants seemed to be more aware about their activity patterns as well as to be more engaged in physical activity induced by the game. By using the provided functionality of our game the users substituted other leisure time activities, such as playing computer games, or extended their existing grade of physical activity. Since our participants reflected upon possible enhancements of the game regarding further integration of bodily movement as well as other real-world factors likewise, it can be said that users appeared to appreciate the approach of incorporating physical activity and playful elements in a mobile game such as ours to ultimately increase their level of physical activity and counteract sedentary lifestyle patterns.

6.1 Summary

Author: Peter Fikar

Within this work we introduced issues of increasing relevance within today's society, namely the decrease of physical activity and the increase of sedentary behavior and potential follow-up medical conditions. We investigated and described how current technological advancements affect these problems and how digital entertainment media may be part of the problem on the one hand, but can also be part of the solution on the other hand.

As we showed throughout this work, video games can be a medium of choice in order to provide a motivational basis for being physically more active. We introduced game-related concepts possibly useful in contributing to the topics described in our work, making up our main goals of research. By making use of different concepts, such as serious games, exergames, pervasive gaming in a mobile context and recent concepts like gamification, we established the basis for the development of our own game, Sky Haven, in order to answer those research questions.

This game was developed utilizing a user-centered approach in order to optimize our efforts to create an appealing game experience. We advanced the design throughout iterative steps enabling us to undertake continuous refinement and the integration of feedback gained through the deployment of scientific methods. This concept enabled us to make sure our decisions are not dominated by our own bias and are more likely to be beneficial for potential user needs.

We investigated on potentially motivating game aspects and elements and the integration of physical activity to best fit our requirements to provide an attractive way to exercise within our participants. Among other methods an extensive paper prototype test was conducted to explore the fundamentals on which the digital system was built upon.

The development of the digital prototype was accompanied by a field test introducing our prototype system to the participants. The web-based approach we took for deployment enabled us not only to provide our game experience throughout a wide range of Smartphone brands but also to update and improve the game without major inconveniences for the participants according to their ongoing feedback.

The final iteration of the prototype system was discussed with selected users, identifying strengths and weaknesses of our game. The results of this final evaluation step were further set in relation to knowledge and insights we gained throughout the course of this work in order to provide us with the information needed to answer the questions we set us as goals regarding our field of interest.

We concluded this work by setting our findings in relation to our research questions. Therein we point out the potential of our game to provide incentives for engaging in physical activity such as the appreciated integration of real-world environment in a fictional fantasy world, making use

of role-play elements. With this we set the stage for a cherished extensive storyline able to keep players potentially interested to prolong interaction with the game, possibly increasing playtime and therefore training time. Our game managed to provide a variety of features supporting different attitudes and preferences towards game-related physical activity of participants. The prototype enabled us to identify crucial features that should be reinforced to increase its incentive aspects, such as advanced cooperative features to facilitate social aspects in a more in-depth manner.

Throughout the course of this work test users became more aware of their physical activity level which may impact their lifestyle becoming more physically active.

We also investigated on shortcomings, potential improvements and extensive new features to open up possible future work, such as changes to less attractive game features, additional game modes and a more native implementation approach to conquer technical issues.

Overall it can be said that the iterative user-centered approach was the right choice in order to build a full-fledged game which we consider having the potential to act as an incentive to promote physical activity in users by extending existing physical activity habits or replace sedentary gaming habits by bringing such an experience to the outdoors in a social way.

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APPENDIX A

Consent Form

Projekt Arbeitstitel – Sky Haven

"Ein Serious Game zur Förderung von Bewegung" (in weiterer Folge „Studie" genannt)

Die Studie wird im Rahmen der Diplomarbeit von Michael Habiger und Peter Fikar, betreut von Assoc. Prof. Dipl. Ing. Dr. Hilda Tellioglu, durchgeführt.
Geschätzter Zeitraum der Studie: Juni 2013 – Juni 2014
Technische Universität Wien - Karlsplatz 13, 1040 Wien

Forscher
Die folgenden Personen, in weiterer Folge "Forscher" genannt, sind für die Studie verantwortlich:
Forscher : BSc. Michael Habiger (e0409732@student.tuwien.ac.at)
Forscher : Bakk techn. Peter Fikar (e0051804@student.tuwien.ac.at)
Betreuung : Assoc. Prof. Dipl. Ing. Dr. Hilda Tellioglu (hilda.tellioglu@tuwien.ac.at)

Einverständniserklärung:
Die unterschreibende Person erklärt sich hiermit bereit, die Informationen, welche im Rahmen ihrer Teilnahme an den durchgeführten wissenschaftlichen Methoden erhoben wurden, den Forschenden zur weiteren Verarbeitung und Verwendung innerhalb ihrer Diplomarbeit sowie für weiterführende wissenschaftliche Publikationen zur Verfügung zu stellen. Die gesammelten Daten werden anonymisiert gehandhabt und verarbeitet. Die wahre Identität der Teilnehmer wird im Rahmen der Veröffentlichung der fertigen Diplomarbeit und/oder den wissenschaftlichen Publikationen nicht einsehbar sein und ist für Dritte aus den veröffentlichten Informationen nicht ableitbar. Die personenbezogenen Daten werden ausschließlich im Rahmen der Studie inklusive Diplomarbeit und daraus folgenden Publikationen gehandhabt und verarbeitet.

Diese Vereinbarung gilt für alle Methoden, an denen die unterschreibende Person teilgenommen hat. Folgende Methoden treffen auf die unterschreibende Person zu:

Cultural Probes, Fragebögen, qualitative Interviews, LoFi Prototyp Testsession, Technology Probes 1 und Technology Probes 2, Prototyp Feldtest und Fokusgruppendiskussion.

Des weiteren behalten wir uns das Recht vor, auch Aussagen dem Wortlaut und dem Sinn nach, welche nicht im Rahmen der Anwendung dieser Methoden veräussert wurden und auf unser Forschungsprojekt Bezug nehmen, als Feedback im Rahmen der Arbeit sowie eventueller weiterführender Publikationen zu verwenden.

Mit meiner Unterschrift gestatte ich den Forschern, die von mir bereitgestellten oder daraus abgeleiteten Daten im Rahmen der Diplomarbeit und folgenden wissenschaftlichen Publikationen zu verwenden.

_____
Datum und Unterschrift

Danke für Ihre Mühen und Ihre hilfsbereite Teilnahme an der Studie.

APPENDIX B

Guides

Fragenkataloge

Michael Habiger & Peter Fikar

Betreffend Survey und Interviews vor Applikation der Testphase des Prototypen in Verbindung mit Cultural Probes und Workshop

Survey : Fragebogen

Einleitungsfragen – personenbezogene Daten

Geschlecht (m/ w/anderes)

Alter (in Jahren / kein präzises Datum notwendig)

Nickname (eindeutig einer Testperson zugeordnet – eindeutiger Identifikator für die Projektdauer)

Themenblöcke

A. Zeit und Art körperlicher Bewegung pro Woche

Wie oft pro Woche betreiben Sie Aktivitäten, die Sie mehr als 10 Minuten am Stück in Bewegung halten? (In allen Lebensbereichen z.B.: Arbeit, Freizeit, tägliche Wege, etc.)

Wie lange bewegen Sie sich dabei am Stück?

Welcher Art sind die Aktivitäten die Sie länger als 10 Minuten in Bewegung halten?

Bevorzugen sie Bewegung in der Gruppe?

Wenn ja:

Welche Gruppengröße bevorzugen Sie hierbei?

Welche Art von Bewegung betreiben Sie in dieser Gruppe?

Welche Menschen sind, Ihrem Wunsch nach, Teil dieser Gruppe?

B. Zeit und Art sitzender Tätigkeit pro Woche

Wie viele Minuten/Stunden verbringen sie pro Tag sitzend bzw. in einer inaktiven Haltung (Nachtschlaf ausgenommen)?

Wie oft pro Woche trifft dies zu?

Betrifft Sie solch körperliche Inaktivität in Beruf und in der Freizeit gleichermaßen?

C. Zeitaufwand und Art des Spielverhaltens pro Woche

Welche Art von Spielen spielen Sie?

Digital - Wenn ja :

Welche? (Computer/ Konsolen/ Smartphone/ andere ...)

Analog - Wenn ja :

Welche? (Brett/Karten/Table-top/ andere ...)

Wie lange spielen Sie durchschnittlich am Stück wenn Sie spielen?

Wie viele Stunden verbringen Sie pro Woche mit Spielen?

Wie viel Zeit ihrer gesamten Freizeit verbringen Sie mit Spielen? [in %]

Welche Art (Genre) von Spiel erweckt Ihr Interesse am meisten?

Wie interessant sind für Sie Spiele die mit körperlicher Aktivität verbunden sind? (digital - z.B.: Microsoft Kinect, PS Move, Wii Controller, andere; analog - klassische Bewegungsorientiere Spiele (z.b.: Boccia, Fangen, Fussball, andere))

Bevorzugen Sie spielen in Gruppen?

Wenn ja:

Welche Gruppengröße bevorzugen Sie hierbei?

Welche Art sind diese Spiele [Kooperativ, Kompetitiv,...]

D. Zufriedenheit mit der Bewegungsroutine

Wie wichtig ist es Ihnen körperlich aktiv zu sein?

Wie schätzen Sie Ihren Grad an körperlicher Aktivität für sich ein?

E. Zufriedenheit mit Erscheinungsbild

Wie zufrieden sind Sie mit Ihrem Grad an Sportlichkeit?

Wie zufrieden sind Sie mit Ihrem körperlichen Erscheinungsbild?

Interview

Die Nummerierung bezieht sich nicht auf die Reihenfolge. Die Blöcke entsprechen den gewählten Themengebieten orientiert an den Forschungsfragen im Abstract.

Legende:

{alt. = alternative Fragestellung in Abhängigkeit vom Interviewverlauf}

{add = nachfragende Fragestellung in Abhängigkeit vom Interviewverlauf}

CP. = Cultural Probes bezogene Frage - meist als Einstieg in einen Fragenblock gedacht (Stage-setting)

X. Survey Themenbezugsreferenz

Einleitungsteil: Anonymisierungsinformation und Informationshandhabung (Geschlecht, Alter, Nickname)

Themenblöcke

1. Motivatoren & Barrieren für Bewegung

A. Zeit und Art körperlicher Bewegung pro Woche

CP. Warum haben Sie genau die Fortbewegungsmittel gewählt, die Sie angegeben haben?

Was bedeutet für Sie Bewegung?

Welchen Stellenwert hat Bewegung in Ihrem Alltag?

Was macht Ihnen an Bewegung besonderen Spaß? {alt.} Was ist Ihr Antrieb Bewegung zu machen?

Was empfinden Sie an Bewegung als unangenehm? {alt.} Was hindert sie daran Bewegung zu machen?

B. Zeit und Art sitzender Tätigkeit pro Woche

Was bedeutet für Sie der Begriff "sitzender Lebensstil"?

Welche Aspekte betreffen Sie in Bezug auf diesen Lebensstil Ihrer Meinung nach?

Welche Lebensbereiche verbinden sie in Ihrem Alltag mit sitzender Haltung?

Welche Rolle spielen Unterhaltungsmedien für Sie in diesem Zusammenhang?

2. Motivatoren & Barrieren für Bewegung integriert in ein Spiel

C. Zeitaufwand und Art des Spielverhaltens pro Woche

Welche Aspekte interessieren sie an Spielen besonders?

Welche Faktoren machen digitale Spiele auf Computer, Konsolen, Smartphones, etc. für sie interessant?

Gibt es andere, analoge, traditionelle bzw. klassische Spiele (z.B.: Sportspiele, Gesellschaftsspiele, Kartenspiele, etc.) die sie ausüben?

Wenn ja, welche Faktoren sind hier für Sie von Interesse?

3. Einstellung zu Bewegung

D. Zufriedenheit mit der Bewegungsroutine

CP. Warum haben sie genau diese Assoziationen für die Fortbewegungsarten gewählt?

Was löst körperliche Bewegung bei Ihnen aus?

add.{Währenddessen?; Davor?; Danach?; Regelmäßigkeit?}

Welchen Stellenwert hat körperliche Fitness in Ihrem Leben?

add {Welchen Einfluss hat die Art der Bewegung wie zum Beispiel Sport/Spiel/etc. in Bezug darauf?}

4. Eigengewichtswahrnehmung

E. Zufriedenheit mit Erscheinungsbild

CP. Warum haben Sie genau diesen Körpertyp für die Gestaltung Ihres Charakters gewählt?

Was ist Ihnen an Ihrem Erscheinungsbild wichtig?

Was bedeutet für Sie der Begriff "Schönheitsideal"?

Eingeschobene Fragen für Interview ODER Teil der Workshopmoderation

5. Soziale Faktoren

add Themenblock 1: Welche Aspekte sind für Sie wichtig, wenn Sie Sport in der Gruppe betreiben?

add Themenblock 2: Was bedeutet es für Sie gemeinsam zu spielen?

6. Bewegungsaspekte von Spielen

add Themenblock 2: Was verbinden Sie mit bewegungsorientierten Spielen unter Verwendung von PS3 Move/Wii/Microsoft Kinect?

APPENDIX C

Survey

Bitte geben Sie uns die folgenden Daten über ihre Person bekannt :

Geschlecht ____

Alter ____

Nickname _____

1) **Zirka wie oft pro Woche betreiben Sie Aktivitäten, die Sie mehr als 10 Minuten am Stück in Bewegung halten?** ca. ____ mal

   ❖ *Zusatz) Falls: "öfter als 0 mal"*

   1a-z) Welcher Art sind die Aktivitäten, die Sie länger als 10 Minuten in Bewegung halten?

   _____

   1b-z) Wie lange bewegen Sie sich dabei am Stück?

   _____

2) **Bevorzugen Sie Bewegung in der Gruppe?**

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

   ❖ *Zusatz) Falls: "ja" oder "eher ja"*

   2a-z) Welche Art von Bewegung betreiben Sie in dieser Gruppe?

   _____

   2b-z) Welche Gruppengröße bevorzugen Sie hierbei?

   Anzahl ca. ____ Personen

   2c-z) Welche Menschen sind, Ihrem Wunsch nach, Teil dieser Gruppe?

   Freunde ☐

   Familie ☐

   Unbekannte ☐

   andere _____

3) Wie viele Stunden verbringen Sie zirka pro Tag sitzend bzw. in einer inaktiven Haltung (Nachtschlaf ausgenommen)? ca. ____ Stunde(n)

3a) Wie oft pro Woche trifft dies zu? durchschnittlich ____ mal

4) Körperliche Inaktivität betrifft Sie (Bitte zutreffendes ankreuzen)

eher in der Freizeit ☐

eher im Beruf ☐

in Beruf und Freizeit gleichermaßen ☐

5) Welche Art von Spielen spielen Sie? (Bitte zutreffendes ankreuzen)

digital ☐

- *Zusatz) Falls "angekreuzt"*

5a-z) Welcher Kategorie sind diese Spiele zuordenbar?

PC ☐

Konsolen ☐

Smartphones ☐

andere _____

analog ☐

- *Zusatz) Falls "angekreuzt"*

5b-z) Welcher Kategorie sind diese Spiele zuordenbar?

Brettspiele ☐

Kartenspiele ☐

Soziale Spiele ☐

andere _____

6) Wie viele Stunden verbringen Sie pro Woche mit Spielen? ca.____ Stunde(n)

6a) Wie lange spielen Sie dabei durchschnittlich am Stück? ca.____ Stunde(n)

7) Wie viel Zeit Ihrer gesamten Freizeit verbringen Sie mit Spielen? ca.____ %

8) Welche Art (Genre) von Spiel erweckt Ihr Interesse am meisten? (z.B.: Ego-Shooter, Strategie, Rollenspiele, etc.)_____

9) **Erwecken digitale/analoge Spiele, die mit körperlicher Aktivität verbunden sind, Ihr Interesse?** (digital z.B.: Microsoft Kinect, PS Move, Wii Controller, andere; analog z.B.: klassische bewegungsorientiere Spiele z.B.: Bowling, Fangen, Fußball, Boccia, andere))

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

10) **Bevorzugen Sie spielen in einer Gruppe?**

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

❖ *Zusatz) Falls : "Ja" oder "eher ja":*

10a-z) Welcher Art sind diese Spiele (z.B.: Kooperativ, Kompetitiv,...)

_____

10b-z) Welche Gruppengröße bevorzugen Sie hierbei? ca.____ Personen

11) **Ist es Ihnen wichtig, körperlich aktiv zu sein?**

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

12) **Wie schätzen Sie Ihren Grad an körperlicher Aktivität für sich selbst ein?**

Hoch	Mittel	Niedrig
☐	☐	☐

13) **Sind Sie mit Ihrem Grad an Fitness zufrieden?**

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

14) **Sind Sie mit Ihrem körperlichen Erscheinungsbild zufrieden?**

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

Vielen Dank, dass Sie sich die Zeit genommen haben, uns bei unserem Vorhaben zu unterstützen und diesen Fragebogen ausgefüllt haben.

APPENDIX D

Cultural Probes

Sky Haven
Cultural Probe-Kit

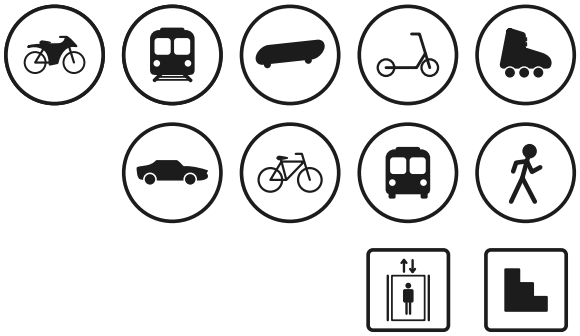
1. Mache dich auf den Weg

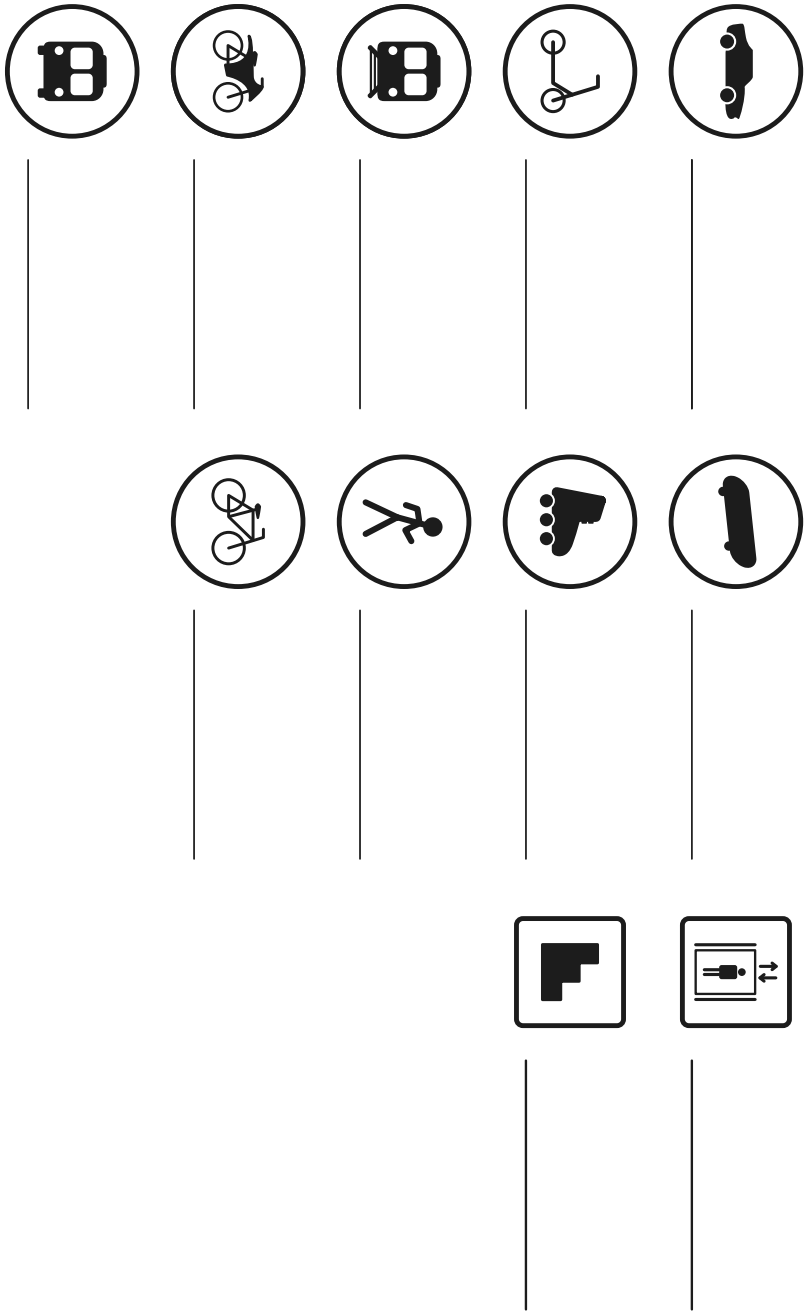
a.)
Schreibe bitte zu jedem Symbol eine spontane Assoziation.

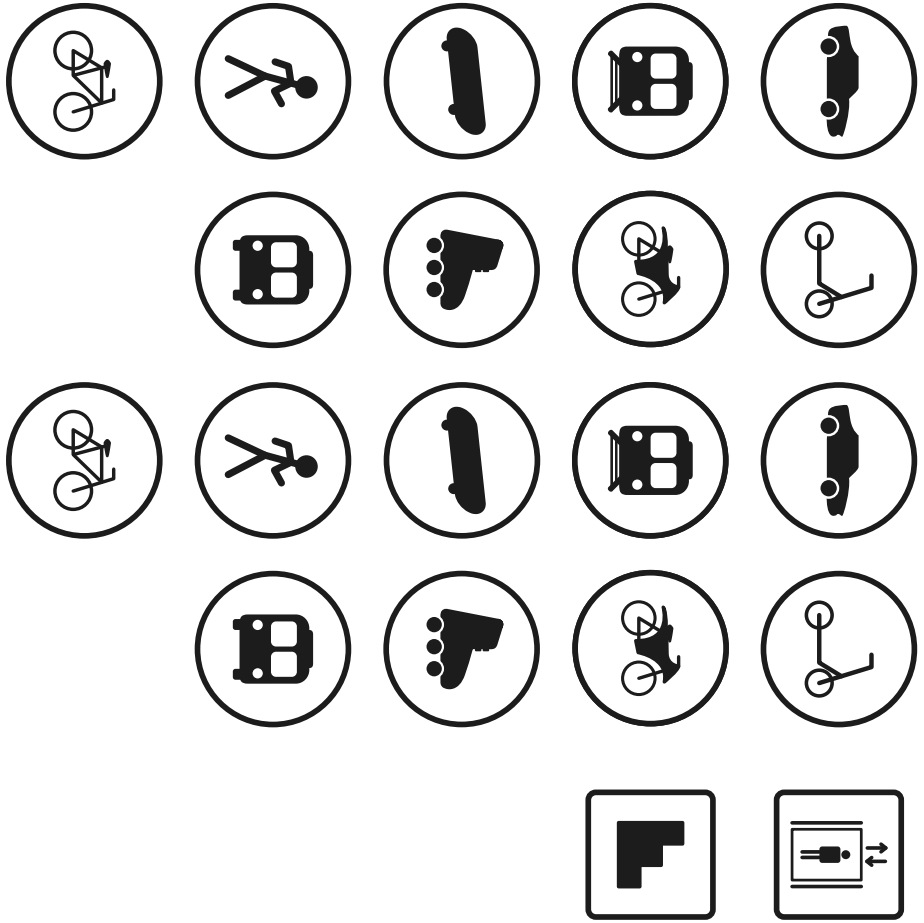
b.)
Mache dich in Gedanken auf den Weg zu unterschiedlichen Orten.
Klebe dabei bitte jeweils ein Symbol in den dafür vorgesehenen Bereich.
Das Symbol entspricht dabei dem von dir verwendeten Fortbewegungsmittel.

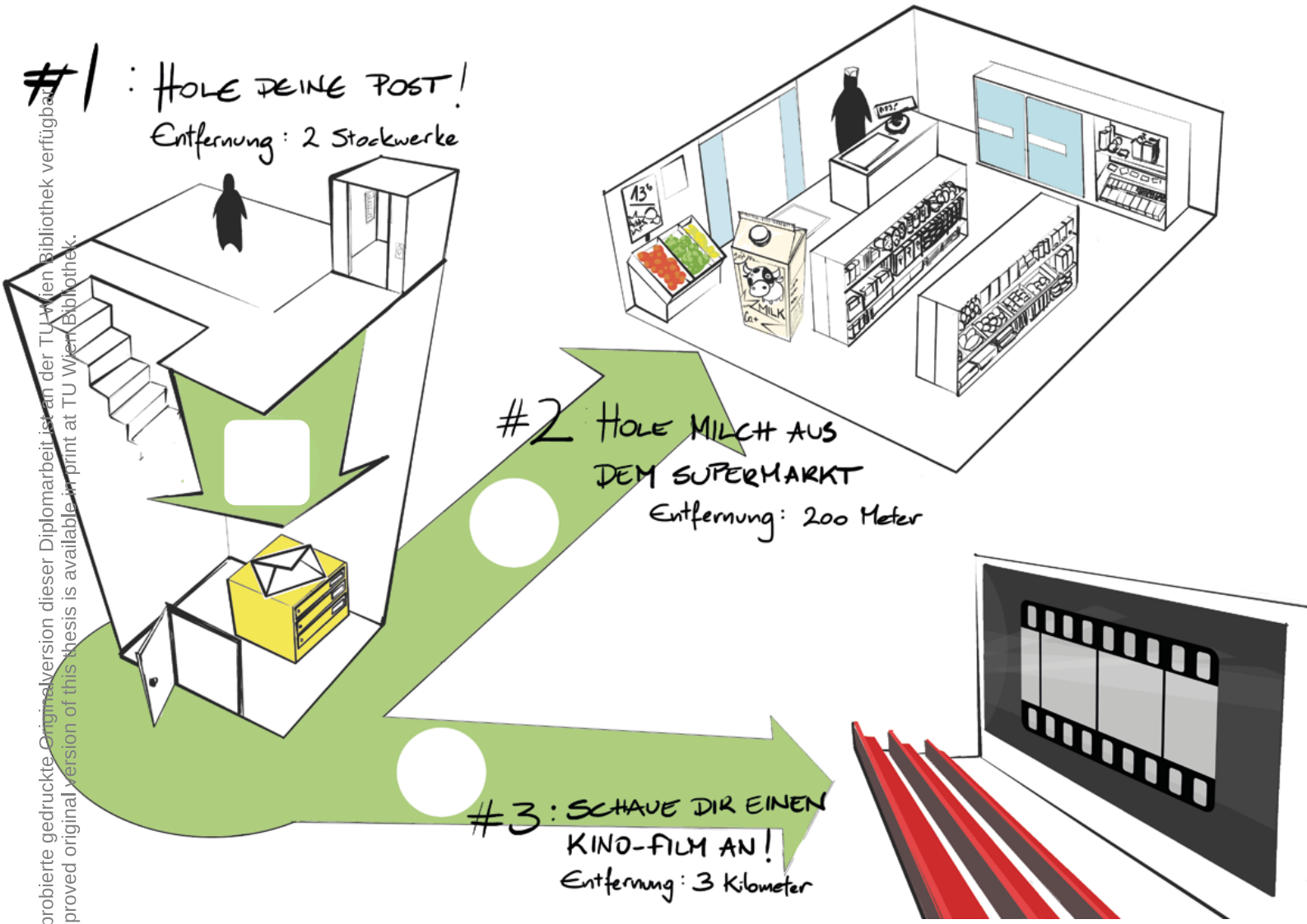
Die eckigen Symbole sind für die ersten Aufgabe (Post holen) vorgesehen.

Ist dein bevorzugtes Verkehrsmittel nicht vorhanden, schreibe es bitte
in den entsprechenden Platzhalter.









2. Foto-Session

Mache 5 Fotografien von verschiedenen
Gegenständen, Möbel etc., mit denen du viel Zeit verbringst.

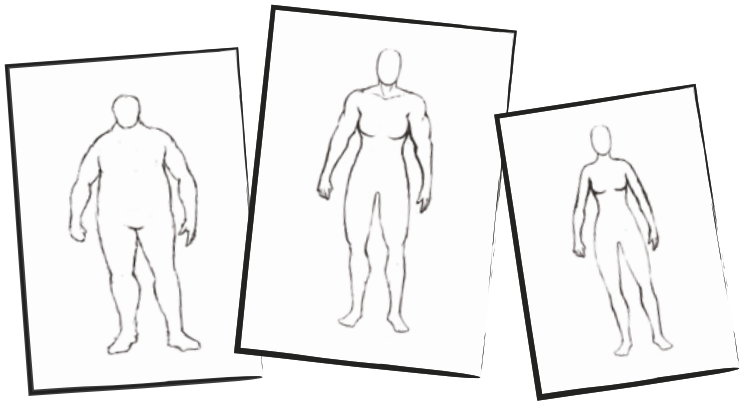
Beschreibe das Foto mit einem oder wenigen Worten
und klebe die Fotos mit Klebestreifen auf diesen Zettel.

3. Heldinnen und Helden gesucht!

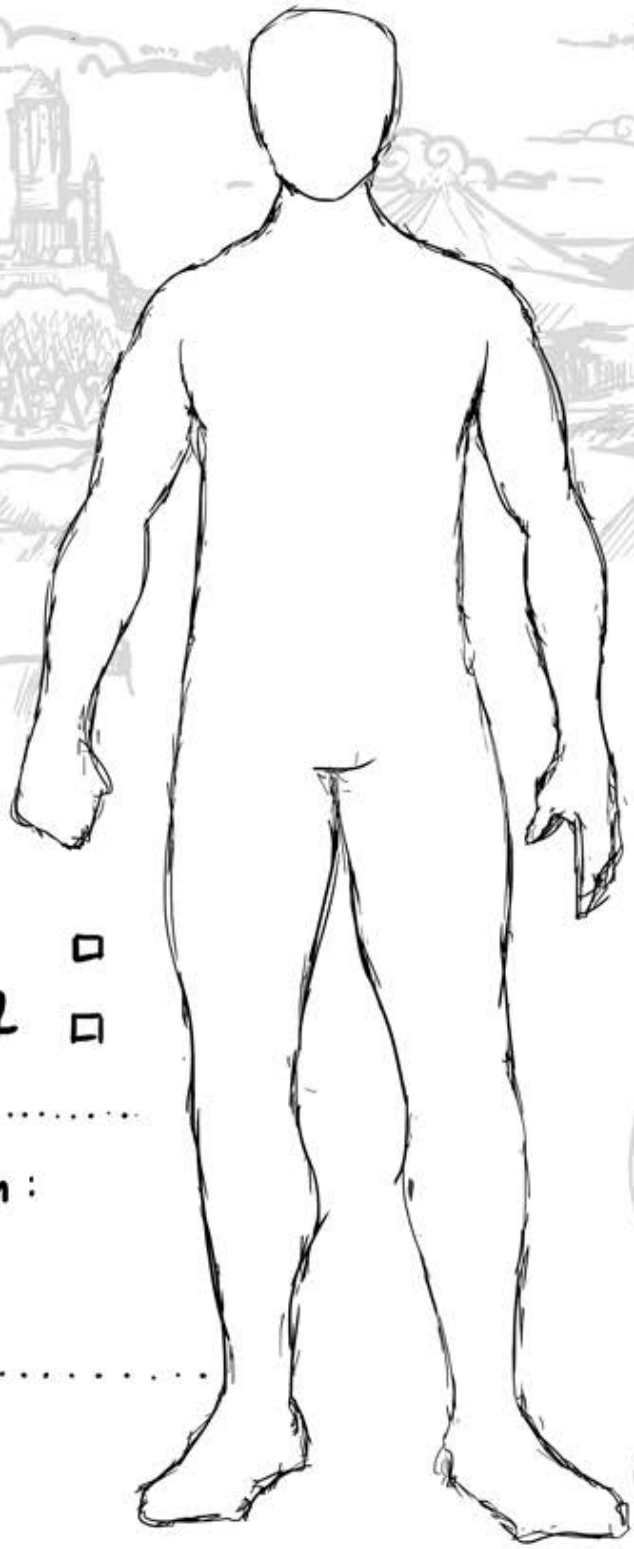
Dein König sucht nach frischen Heldinnen und Helden, um dem immer hungrigen Blob entgegen zu treten. Es wird ersucht, ein Bild von dir in voller Montur an den königlichen Hof zu schicken, damit der König seinen Günstling erwählen kann.

Man benutze das vorgefertigte königliche Formular.

Gestalte deine Heldin oder deinen Helden nach deinen Vorstellungen.
Verwende dazu Stifte, Bilder oder Fotos, um ihr oder ihn mit Details, Kleidung, Frisuren, Accessoires und ähnliches zu komplettieren.
(Geht ein Versuch schief, stehen dir mehrere Schablonen zur Verfügung)



Das Königreich sucht neue* HELDINNEN & HELDEN



AUSZUFÜLLEN!

besondere Fertigkeiten:

- Bier trinken ☐
- Schwertkampf ☐
- andere .....

getötete Drachen:

Anzahl ....

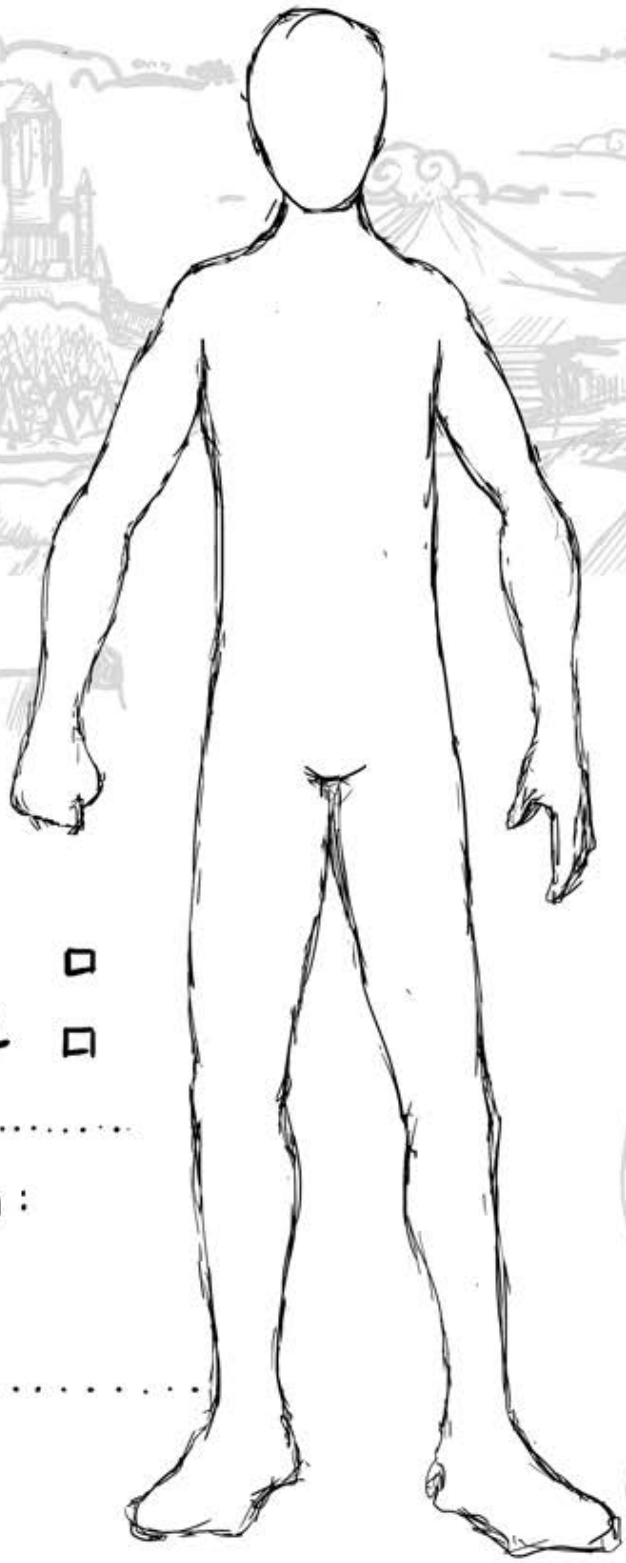
Lieblingswaffe: .....

NAME:

LADY/SIR .....

*die Alten sind aufgebraucht

Das Königreich sucht neue* HELDINNEN & HELDEN



AUSZUFÜLLEN!

besondere Fertigkeiten:

- Bier trinken ☐
- Schwertkampf ☐
- andere .....

getötete Drachen:

Anzahl ....

Lieblingswaffe: .....

NAME:

LADY/SIR .....

*die Alten sind aufgebraucht

Das Königreich sucht neue* HELDINNEN & HELDEN

AUSZUFÜLLEN!

besondere Fertigkeiten:

- Bier trinken ☐
- Schwertkampf ☐
- andere .....

getötete Drachen:

Anzahl ....

Lieblingswaffe: .....

NAME:

LADY/SIR .....

*die Alten sind aufgebraucht

Das Königreich sucht neue* HELDINNEN & HELDEN

AUSZUFÜLLEN!

besondere Fertigkeiten:

- Bier trinken ☐
- Schwertkampf ☐
- andere .....

getötete Drachen:

Anzahl ....

Lieblingswaffe: .....

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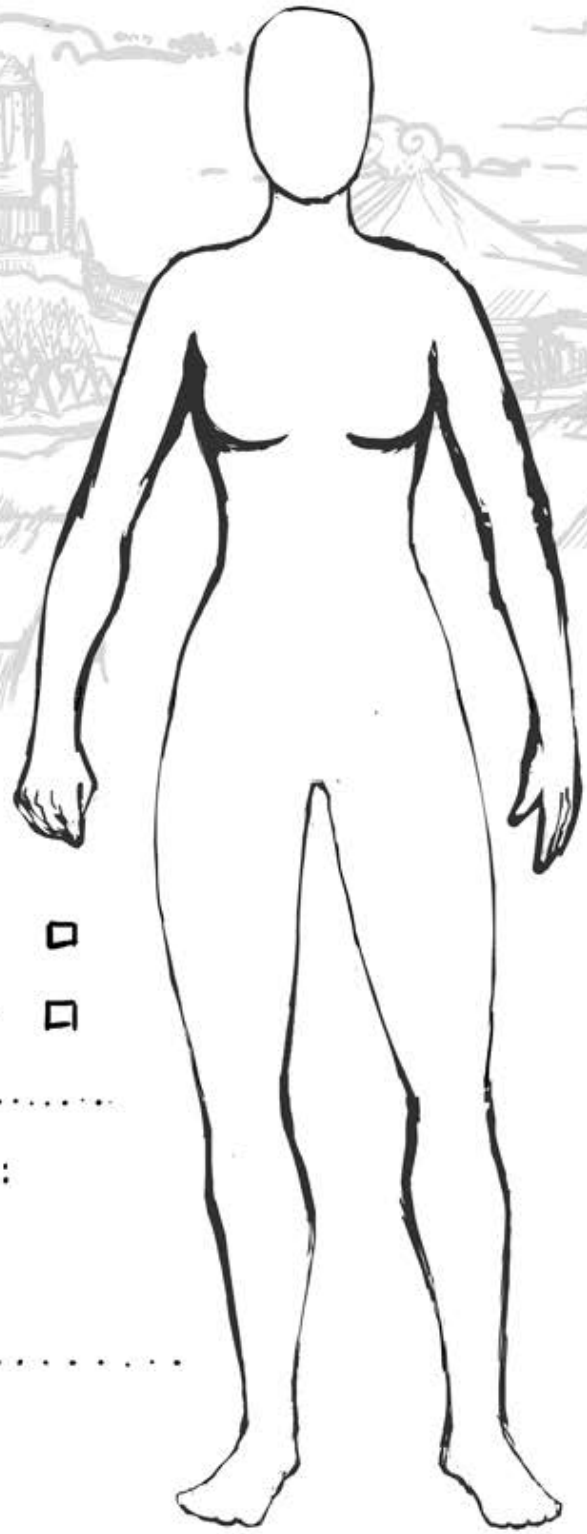
Das Königreich sucht neue* HELDINNEN & HELDEN



AUSZUFÜLLEN!

besondere Fertigkeiten:

- Bier trinken ☐
- Schwertkampf ☐
- andere .....

getötete Drachen:

Anzahl ....

Lieblingswaffe: .....

NAME:

LADY/SIR .....

*die Alten sind aufgebraucht

Das Königreich sucht neue* HELDINNEN & HELDEN

AUSZUFÜLLEN!

besondere Fertigkeiten:

- Bier trinken ☐
- Schwertkampf ☐
- andere .....

getötete Drachen:

Anzahl ....

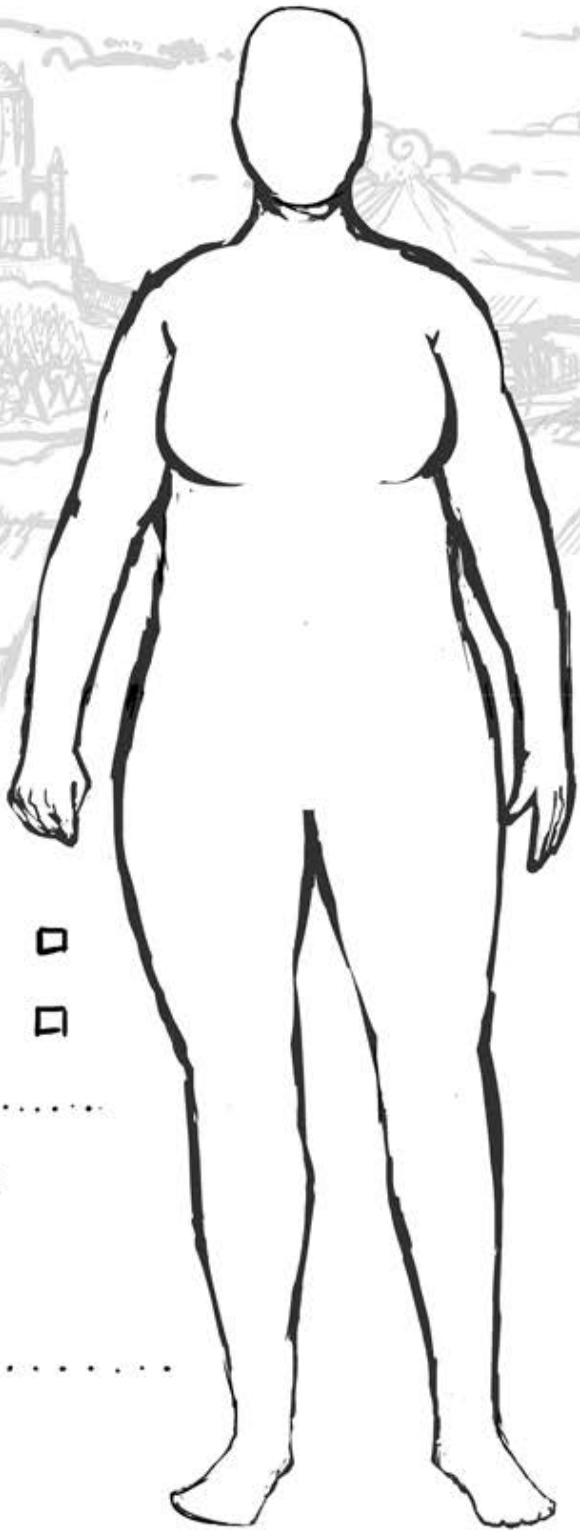
Lieblingswaffe: .....

NAME:

LADY/SIR .....

*die Alten sind aufgebraucht

Das Königreich sucht neue* HELDINNEN & HELDEN



AUSZUFÜLLEN!

besondere Fertigkeiten:

- Bier trinken ☐
- Schwertkampf ☐
- andere .....

getötete Drachen:

Anzahl ....

Lieblingswaffe: .....

NAME:

LADY/SIR .....

*die Alten sind aufgebraucht

Das Königreich sucht neue* HELDINNEN & HELDEN

AUSZUFÜLLEN!

besondere Fertigkeiten:

- Bier trinken ☐
- Schwertkampf ☐
- andere .....

getötete Drachen:

Anzahl ....

Lieblingswaffe: .....

NAME:

LADY/SIR .....

*die Alten sind aufgebraucht

APPENDIX E

Guidelines

Paper Prototype

GUIDELINES - DESIGN FACTORS FOR PROTOTYPE

Player representation

- Slot illustrations depict representative items
- Slots attributes influence statistics, influencing game factors
- Character sheet design will be maintained

Map Icons in general

- Icons will be designed in a way that they are standing out from the rest
- Icons will be access-points on the map + interaction leads to close-up view
- Interactions with icons can be carried out by clicking/tapping marks (dialog, battle, check out)
- Transitions between icons and close-up views will all work in the same manner

Interactive elements and objects

- Interaction buttons are part of close-up views + contain a label indicating function (loot options, dialog options, combat option, check out options)
- Dialog Text will support non linear interaction (various dialog options and/or decisions e.g. “accept quest”)
- Icons (and related interactions) are related to events in the game + will become active in form of pop-up like animations as soon as they come in range of the player
- Special events or elements will be represented by a special icon/mark describing their special “character”

NPCs

- NPC icons’ basic design and functionality is maintained
- NPC icons will contain detailed features
- NPC icons will not contain gender indicators
- NPC portrait's basic design will be maintained ("job"-features are illustrated)
- NPC portrait will contain renderings
- NPC portrait will remain "moody"
- NPC portrait will contain dialog options
- Dialog icons will be maintained
- Dialog icons will only be used for this purpose
- Quest locations/areas/elements will marked and described textually
- Quest can involve multiple ways to fulfill (non exclusive incl. rewards/consequences)

Enemies

- Enemy icons' basic design and functionality will be maintained
- Enemy icon design will not contain features but will be represented by a unified type of icon
- Enemy icons will contain a color coded indicator regarding difficulty of combat
- Consistency requires: Battle icons will only be used for this purpose
- Enemy portrait will contain line-art
- Enemy portrait will contain combat options
- Enemy portrait will contain combat relevant information about itself

Combat

- A battle option should be "fleeing"
- The player's character should be able to flee during fight including risk
- The risk should be influenced by pet and/or character skills and the corresponding abilities of the enemy
- Combat relevant factors regarding in-game movement will require physical activity in the real world (fleeing, minigames (boss), battle)
- The combat will take place in a turn-based manner (fast paced)
- The combat system should include an element of chance
- The combat system should include pet abilities
- The combat system is based on the characters and enemies abilities, based on simple stats, influenced by items and character level

Death

- There will be no "corpse-run"
- Characters can be resurrected
- Resurrection depends on factors (pets, other player characters, items)
- Resurrection includes a period of time in which the player cannot be hurt (implicitly given by the fact that you need to engage actively into combat by clicking the battle mark)
- Close-up view of dead characters or enemies will be maintained
- Close-up views of dead characters or enemies will include the looting options (button)

Other map interaction objects

- Chest design will be maintained
- Rock design will be maintained
- There will be close-up views of these items
- The interaction options will be shown in this close-up view
- The tavern will contain more than one interaction possibility

Pet

- Pet icon will be depicted as being part of the player
- Pet close-up will be accessible through the character menu of the player
- Pet close-up design will be maintained
- Pet close-up will contain pet ability information
- The pet will provide the element for the feedback system and in-game representation of physical activity
- The pets' abilities will be structured according to the training goals (charge, passive effects, level - short term, long term, intensities WHO)
- The pet will influence combat, narrative progress (e.g. breaking rocks)
- There will be more than one pet
- There will be only one pet active at a time (also in terms of leveling)
- The charge bar will not contain red color (blue, green)

Interactive elements of objects

- Interaction buttons - part of close-up view AND containing label indicating function (loot options, dialog options, combat option, check (out) options)
- Dialog Text will support non linear interaction (various dialog options and/or decisions - accept quest)
- Icons (and related interactions) related to events in the game will become active in form of a pop-up like animation as soon as they become relevant

- Special events or elements will be represented by a special icon/mark describing their special character

Items

- Weapons will also be possible tools
- Items will contain flavor texts separated from the item's name
- An inventory will hold the items, one item per slot
- Special items, in terms of importance regarding narrative context, will be marked and/or stored separately
- There will be items influencing abilities or in-game effects of the pet
- Money will be symbolized by an item not stored in the inventory including the numeric value of it
- Items which have a negative effect on the player's character (possibly rewards for quests by questionable NPCs)

Gamemode

- There will be a localized game mode containing the narrative structure including the game's storyline related content (active mode)
- This playground will be divided into zones, connected through passive mode
- There will be a delocalized game mode (passive mode)
- Passive mode rewards/effects will not have heavy impact on the active mode of the game
- The active mode will contain single-player features and multiplayer minigames.

APPENDIX F

Manual

ISLANDER – Manual

BASICS

Movement Requirements and Types

The required types of movement in the game are mainly based on walking activities (except for Travelmode in which you may choose a "Travelmode Bike"). Your walking speed influences various in-game effects. There are 3 intensities by which the speed is categorized:

Light or Slow - "normal" walking speed,

Moderate or Medium - fast walking speed/Jogging speed,

Vigorous/Fast – Jogging speed or running speed

Menu Options

- In case of: "I can't do anything in the game! / There are no buttons! / What do I have to do? / What the… ??? " -

"TAP THE SCREEN FOR MORE OPTIONS!"

Since the game-screen is very small in most of the cases, potential menu options are hidden by default. To gain access to the interface option in a certain view tap somewhere on the screen and a menu will pop-up (if available in this view).

- In case of: "The Minigames are UNPLAYABLE!!!" -

"CHOOSE DIFFERENT CONTROL OPTIONS!"

If you have trouble with playing minigames, check out the "Techsheet" document for help. There are also different options for controlling movement in the Minigames (if you have an IPhone).

GAME MODES

Travel mode (Singleplayer)

In Travel Mode you can gain experience points (XP) for your pets! Just tap the Travelmode button and your first checkpoint gets set automatically. Now just set checkpoints while you walk outdoors and gain experience as an in-game reward! The linear distance between the checkpoints, and the speed at which you have travelled influence your XP gain. Your first pet "Blob" saves your gathered experience points until you transfer the XP into a storyline pet of your choice. If you want to set the last checkpoint of your Travel Mode session, tap the "Place (last) Checkpoint and exit Travel Mode" - button. If you made a mistake and want the last section not to be measured (e.g. in case you forgot to finish Travel Mode and travelled e.g. by bus after the last checkpoint was set), tap the "Don't place Checkpoint and exit Travel Mode" - button. This ensures that the last section of your way gets cancelled and won't count towards your XP-Gain.
You may also use your bike for gathering XP in Travelmode, which works in the same way as Travelmode for walking. The main difference for Travelmode Bike is that the XP gain differs because of a higher speed requirement.

Minigames (Singleplayer)

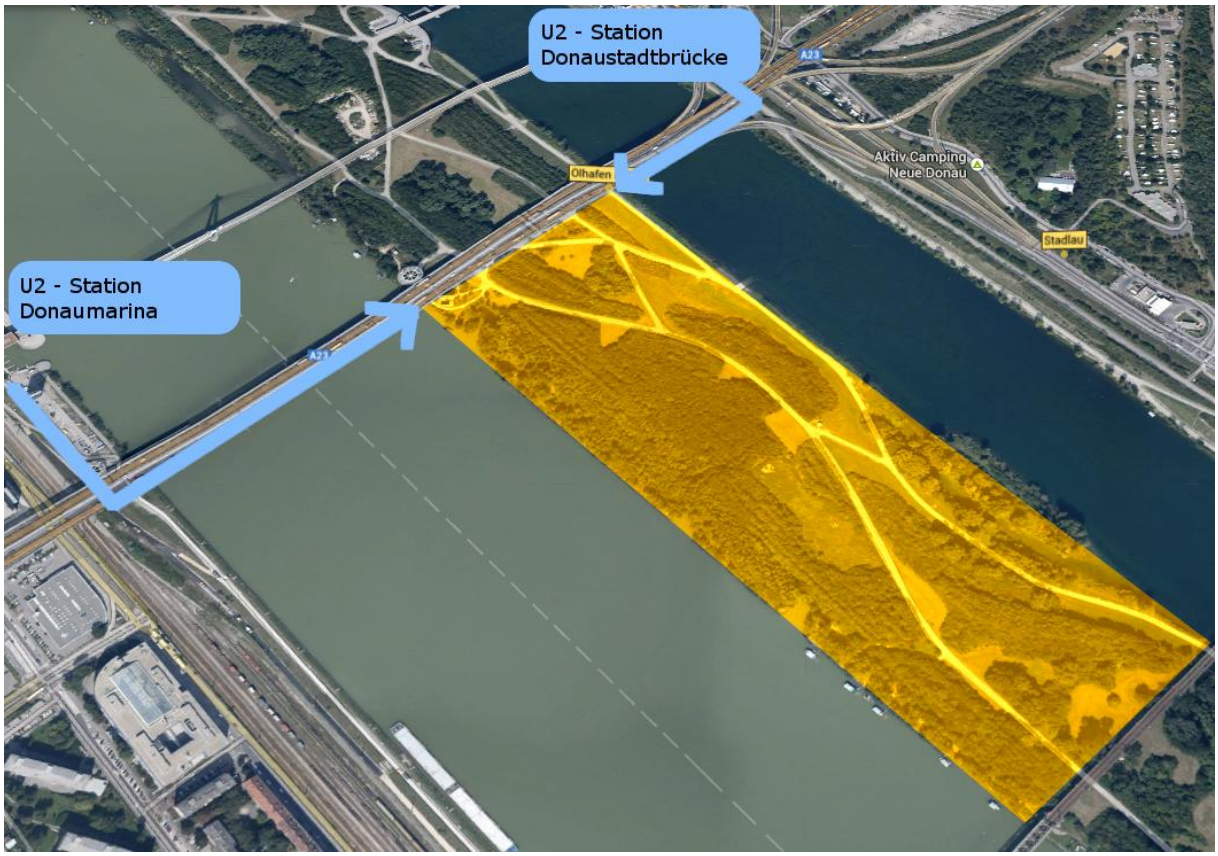
You can play a minigame with "Blob"! If you win, you will get rewarded with pet biscuits! You can use them to transfer the XP from "Blob" to a pet you found in the Story Mode! Each transfer will use up one of your biscuits! To start a minigame, tap on your character in the main menu, tap the screen and choose "Your Blob". (further reading in the chapter “Experience points” and “Pets of the Character”)

Minigames (Multiplayer)

The multiplayer minigames can be accessed in the main menu. Choose a gametype and have a friend nearby choosing the same gamemode and the game will start. You battle for rewards like gold and potions in a cooperative or competitive manner.

Storymode (Singleplayer)

The Storymode is the major game-mode of the game and contains the main content regarding gameplay and storyline. You travel around an altered map of the “Donauinsel”-Area. The yellowish-area represents the playground, near the subway stations Donaustadtbrücke or Donaumarina. (checkout the image below)



Zones

Within the playground the map is further divided into zones. You can enter such a zone by tapping on it on the screen while your in-game character stands in this zone.

Zone Markers

To give you indication about certain locations of interest during a quest, relevant zones get marked by a special symbol indicating its importance. You can see them when you are close to the zone.

Interactions on the map

Interactions with interactive map elements on the map all work similar. If your character comes close to an interactive map element, an icon will pop up. Possible interactions may include talking to a Non-Player Character (speech bubble icon), interacting with chests (hand icon), attacking enemies (crossed swords icon) etc.

THE CHARACTER SHEET

The character sheet holds crucial information about your character, its equipped items, experience points and statistics. You access the sheet by tapping your character's icon. The character sheet is also the access point for the inventory, your two pet menus (Blob and other pets) and the Quest log, keeping record of your current tasks.

EXPERIENCE POINTS

Character Sheet

Your character gains experience points (XP) while you move, depending on speed and duration of your movement during active mode (also in Travelmode and Minigames).

Your experience gain is determined by "intensity". There are 3 stages of activity intensity (light (2 - 4.8 km/h), moderate (4.8 - 8.04 km/h), vigorous activities (+8.04 km/h)) which are used to categorize your walking speed. Player Character Experience Points (XP) influence your character level which again influences your ability to wear equipment of different qualities.

Pet Experience

Besides Player XP you also gather Pet XP in the different game-modes, depending on the game-mode you are currently in and/or your equipped pet. The currently equipped pet (or the "Blob" – in case you have no additional pets) gains the same amount of experience as you do. The Pet XP is bound to the respective Storymode pet and cannot be shifted between them (only exception is your "Blob").

Level

Levels are gained by gathering a certain amount of XP points, for pets and player character alike. You start off being level 1. To gain level 2 you will need to gather 6000 XP points and for level 3 you will need 18000 XP.

PETS OF THE CHARACTER

'The Blob'

"The Blob ": Blob is not a conventional pet, it is more or less your default companion and best friend and gains Pet XP during Travelmode and the Minigames you are able to access in your blob menu.

The blob has no special skills but can take over any creature you picked up in storymode and that got stored in your pet-menu, making the creature your equipped pet. In this case the gathered Pet XP gets fed directly into the equipped pet as long as the Blob possesses the creature. Blob further provides a repository for Pet XP gathered when you haven't got another creature equipped.

Since the Blob doesn’t have any Pet XP based skills you may want to transfer the Pet XP gathered by the Blob into another pet of your choice. To do so, you have to use a Pet Biscuit you can gather in the blob related Minigames mentioned above each time you want to transfer Pet XP. Each transfer uses up one of the Pet Biscuits.

Other Pets

At the beginning of combat the Pet XP count of the equipped pet directly influences your chance to gain a bonus on certain stats for the duration of the fight.

Pet XP influences the level of the pet creature, which influences its set of skills available to you, depending on the kind of creature you have in your possession.

Basic Skills: Your pet has a basic ability which enables the player to access certain areas in the storymode playgound.

Level 1 Skills: Your pet has the ability to open certain special chests in the zones of the playground. The chests can be found somewhere on the map.

Level 2 Skills: At level 2 your pet gains the ability to get enchanted by fairy items. If you have a fairy in your inventory you can use it to provide the pet with a pet depended skill helping you in combat. Fairies can be found in chests all over the map.

Level 3 Skills: Your pet has now optimized awesomeness in looks.

Charge & Pet Power Bars

Moving continuously for 10 minutes to gain charge up to 100% at a speed faster than ~5kmh (walking with moderate speed).(If you are too slow or stand still for too long the charge gets reset to 0)

Effect: If the charge reaches 100% you automatically receive a consumable item (power bar).

In combat, you can consume a bar each round to feed your equipped pet. It will gain an effect (depending on the pet) for exactly this round of combat.

ITEMS

You can gain items during your adventure. You can pick them up, e.g. after you opened a chest. Usually you pick up all available items at once by tapping on the “Take all” Button while looting an object. Items can be inspected in your inventory, which can be accessed through your Character Sheet.

Gear

Some items can be equipped and are directly influencing your characters’ attributes. These items can be equipped into gear-slots (head: helmets, body: armor, hands: weapons, neck: amulets). Only one item can be equipped at a time in one distinct slot. To be able to equip certain items you may need a higher character level. You can equip items using the equip button in your inventory.

Consumable Items

Healing Potions: Healing potions can be found on many occasions during your adventure. They are stacked in your inventory. Using up one healing potion will fully recover your hit-points. This effect can be activated in your inventory by tapping on the item.

Fairies: Fairies can be used to enchant your pet, making it stronger for one whole battle (if your pet's level is sufficient - pet level 2). This effect can be activated in your inventory by tapping on the item.

Pet Biscuits: Pet Biscuits can be used to transfer the pet XP from your “Blob” to another pet of your choice. This effect can be activated in your inventory by tapping on the item.

Pet Power Bar: Pet Power Bars can be used to increase your pets abilities in battle (pet level independent), for one round. This effect can be activated directly in combat, each round, by tapping "use powerbar" in the combat menu.

COMBAT

Enemies

Enemies are color coded regarding their rough difficulty level in comparison to your stats on entering a zone. (Green: easy, Yellow: medium, Red: hard)

Entering Combat

You enter combat by clicking the pop-up icon next to the enemy-symbol on the playground-map (crossed swords icon)

Fleeing

You may run from battle to avoid it, by tapping “Run Away” in the menu. You may do this every round to escape possible defeat. Prepare to run (in any direction) as fast as you can to escape. If you fail to escape your character dies.

First strike chance and how to increase it

Striking first in combat is a big advantage, because you get a head start on doing damage to the opponent. Your chance to strike first on entering a battle is 50%. You can increase your chance to strike first if you choose to “leap into battle” in the combat menu. If you choose to click “leap into battle” you have to run as fast as you can towards the enemy (in reality you may run into any direction of your choice, run in a straight line).

Bosses

Bosses differ in combat procedure. They may also contain more phases of combat including minigames next to normal combat rounds. Losing one of the Boss battle phases results in player death.

Player Death

Death is not permanent in the world of “Islander”. You can instantly revive on spot if you die, losing a certain amount of gold. You can also seek the assistance of another player avoiding the loss of gold. To revive another player you have to tap his icon on your phone and chose “revive”. Both players have to be in the same zone.

APPENDIX G

Technology Probes

TECHPROBE 1

Danke, dass Sie am Test der "Techprobe 1" teilnehmen!

Anleitung

1) Stellen Sie vor Beginn des Tests sicher, dass Sie einen Bereich aufsuchen, in dem Sie sich in einem Umkreis von 20 Metern frei bewegen können und in dem sich keine Gefahrenquellen (Straßen, Autos, Baustellen, etc.) befinden.

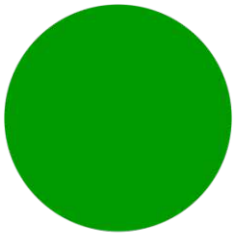
2) Halten Sie ihr Smartphone vor ihren Körper. Um eine Drehung im Spiel zu erwirken, drehen Sie sich mitsamt ihrem Handy in die entsprechende Richtung.

3) Sollte die Orientierung der Drehung mangelhaft funktionieren, können sie den Kompass ihres Smartphones durch mehrfache anhaltende kreisende "8er" Bewegung um das Handgelenk korrigieren.

4) Android-Benutzer können, falls notwendig, die Drehung durch den Button „Revert Rotation“ umkehren.

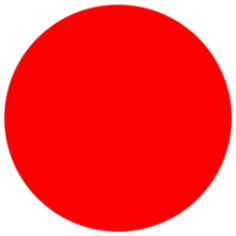
Symbolik

Schwarz : Sie, der/die Spieler/in



Grün : Diese Punkte gilt es zu erreichen.

Grün(Zahl): Countdown - Diese Punkte gilt es zu erreichen bevor die Zahl im Punkt 0 erreicht.



Rot : Diesen Punkten gilt es auszuweichen.

TASK #1 *Catch the Green Dot!*

1. War die zu erfüllende Aufgabe klar verständlich ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

2. War der Task umsetzbar ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

3. Wie fühlte sich die Interaktion an ? (max. 1 Satz)

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TASK #2 *Catch the Green Dot in Time!*

1. War die zu erfüllende Aufgabe klar verständlich ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

2. War der Task umsetzbar ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

3. Wie fühlte sich die Interaktion an ? (max. 1 Satz)

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TASK #3 *Catch all the Green Dots!*

1. War die zu erfüllende Aufgabe klar verständlich ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

2. War der Task umsetzbar ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

3. Wie fühlte sich die Interaktion an ? (max. 1 Satz)

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TASK #4 *Catch the moving Green Dot!*

1. War die zu erfüllende Aufgabe klar verständlich ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

2. War der Task umsetzbar ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

3. Wie fühlte sich die Interaktion an ? (max. 1 Satz)

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TASK #5 *Catch the Green Dot & Evade the Red Dots!(1)*

1. War die zu erfüllende Aufgabe klar verständlich ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

2. War der Task umsetzbar ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

3. Wie fühlte sich die Interaktion an ? (max. 1 Satz)

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TASK #6 *Catch the Green Dot & Evade the Red Dots!(2)*

1. War die zu erfüllende Aufgabe klar verständlich ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

2. War der Task umsetzbar ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

3. Wie fühlte sich die Interaktion an ? (max. 1 Satz)

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Hier ist Platz für ergänzende Kommentare :

TECHPROBE 2 - Multiplayer

Danke, dass Sie am Test der "Techprobe 2" teilnehmen!

Anleitung

1) Stellen Sie vor Beginn des Tests sicher, dass Sie einen Bereich aufsuchen, in dem Sie sich in einem Umkreis von 20 Metern frei bewegen können und in dem sich keine Gefahrenquellen (Straßen, Autos, Baustellen, etc.) befinden.

2) Halten Sie ihr Smartphone vor ihren Körper. Um eine Drehung im Spiel zu erwirken, drehen Sie sich mitsamt ihrem Handy in die entsprechende Richtung.

3) Sollte die Orientierung der Drehung mangelhaft funktionieren, können sie den Kompass ihres Smartphones durch mehrfache anhaltende kreisende "8er" Bewegung um das Handgelenk korrigieren.

4) Android-Benutzer können, falls notwendig, die Drehung durch den Button „Revert Rotation“ umkehren.

Symbolik

Schwarz : Sie, der/die Spieler/in

Blau : Der/Die Mitspieler/in

Grün : Diese Punkte gilt es zu fangen.

Beschreibung

Jedes Minigame hat eine eingestellte Dauer (Countdown)

Comp (competitivie mode) : Die beiden Spieler spielen gegeneinander. Der Spieler der innerhalb der begrenzten Spielzeit mehr Punkte sammelt, gewinnt. Nur ein Spieler gewinnt hierbei die, an den Punkten bemessenen, Belohnung.

coop (cooperative mode): Die beiden Spieler spielen gemeinsam. Beide spieler sammeln soviele Punkte wie sie können in der Zeit. Die gemeinsamen Punkte bilden die Grundlage für die Belohnung, welche beide Spieler jeweils erhalten.

TASK #1 *Cooperative Task!*

1. War die zu erfüllende Aufgabe klar verständlich ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

2. War der Task umsetzbar ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

3. Wie fühlte sich die Interaktion an ? (max. 1 Satz)

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TASK #2 *Competitive Task!*

1. War die zu erfüllende Aufgabe klar verständlich ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

2. War der Task umsetzbar ?

Ja	Eher ja	Ich weiß nicht	Eher nein	Nein
☐	☐	☐	☐	☐

3. Wie fühlte sich die Interaktion an ? (max. 1 Satz)

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Hier ist Platz für ergänzende Kommentare :

Focus Group Discussion

Einleitung
- Diskussion
- untereinander, nicht mit uns
- ihr könnt euch auch gegenseitig Fragen stellen
- Konversation liegt bei euch
- Thema Spiel und alles was im weitesten Sinne zu tun hat (also nicht nur Dinge im Spiel -> sondern auch Dinge die neben oder durch das Spiel passiert sind)

- ab und zu mischen wir uns vielleicht ein, um eventuell in eine bestimmte Richtung zu lenken

Motivatoren

Barrieren

Einstellung

Bewusstsein

Soziale Aspekte

Erhöhung des Grades an körperlicher Bewegung

Generell der Ansatz von Bewegung in unserem Spiel gegenüber „traditioneller“ Bewegung oder anderer Aktivitäten

MOTIVATOREN / AMBITION
Was war der motivierenste Faktor für euch am Spiel?
Was waren für euch Faktoren mit dem Spielen zu beginnen? bzw. weiter zu spielen? bzw. wieder zu spielen?
Was am Spiel war für euch am lohnensten?
Was am Spiel hat euch gefesselt?
Was war die treibende Kraft dahinter, das Spiel zu spielen (zu beginnen und weiterzuspielen)
Bei welchem Spielerlebnis glaubt ihr wart ihr am ambitioniertesten?

EINSTELLUNG
Haben solche Spiele das Potenzial eure Einstellung gegenüber Bewegung ändern?
Wird dadurch, dass Bewegung in ein Spiel integriert wird, die Einstellung gegenüber dieser Bewegung geändert? Jogging - oder das Spiel spielen?
Wie seht ihr das in unserem Spiel?

BEWUSSTSEIN
Hat das Spiel in irgendeiner Form euer Bewusstsein gegenüber eurer Bewegungsroutinen oder Nichtbewegungsroutinen im Alltag beeinflusst? Inwiefern?
Auf welche Art das Spiel eure Selbstwahrnehmung beeinflusst?
Kann das Spiel den gefühlten Grad an körperlicher beeinflussen?
Wie seht ihr das in unserem Spiel?

SOZIALE ASPEKTE
Welche Rolle spielten für euch andere Spieler im Rahmen des Spiels?
Motivatoren?
Barrieren?
Welche Spielfeatures?
Auch im Bezug auf Bewusstsein gegenüber eigenen der Bewegungsroutinen?
Und im Bezug auf die Einstellung gegenüber körperlicher Aktivität?

ERHÖHUNG DER AKTIVITÄT
Inwiefern habt ihr das Gefühl, dass das Spiel euch dazu verleiten kann, mehr Bewegung zu machen / gemacht zu haben? Ersatz / Ergänzung
Welcher Teil des Spiels hat dabei Potential euch dazu bringen kurzfristig / längerfristig Bewegung zu machen?
Langzeitmotivatoren?