Linnéuniversitetet

Project: Design of a serious game.
Chase 'n' Race

Report

Mobile Games and Entertainment, 4ME108
Social Media and Web Technologies (M.Sc.)
Linnaeus University, Växjö

submitted by: Nico Reski
Isabella Nake
Lisa Marie Ruehmann

Date: 30.05.2014
Term: Spring 2014

Main lecturer: Aris Alissandrakis

Contents

1 Introduction

This report presents the concept of the game "*Chase 'n' Race*", which was developed for the course 4ME108 "Mobile Games and Entertainment"[1]. *Chase 'n' Race* is a mobile game for amateur runners to raise their motivation to go running. The running experience is enhanced with in-game items and in-game challenges as well as the possibility to challenge other runners and thereby create competitions. Although the game does not contain a real-time interaction between runners, it makes use of a time-delayed interaction.

The runner is guided through the game with visual as well as audio feedback. To give visual feedback, a Google Glass[2] is used. With this technology, the runner gets constant feedback about the distance and the time she is running as well as notifications about other runners, in-game items and in-game challenges. In addition, the runner sees instructions about the directions. The visual feedback is presented to the runner within an Augmented Reality (AR) layer, see 4. The same feedback that the runner gets visually is also available through audio. Therefore, the runner simply has to connect headphones to the mobile device, see 5. Although the best game experience is retrieved when both, visual and audio feedback, are available, the player has the possibility to use only one of them.

At the beginning of the development of the game concept, a research regarding similar existing games as well as technologies that could possibly be used for giving the player feedback was conducted. The results of the research are presented within this report, see 2. According to the findings, Google Glass was chosen to be used within our game concept for visual feedback as well as ordinary headphones for audio feedback. After the research, the basic gameflow was defined, see 3. Therefore, in-game items and in-game challenges were determined. Based on the overall running performance as well as the accomplishment of the in-game challenges and the ability to handle the in-game items, the runner achieves rewards and raises up in the level system, see 6.

The game elements of our game concept are a collection of ideas found within the research as well as from our personal inspiration and experience. To test how the individual elements as well as their combination is accepted by the players, an evaluation in the form of a user study was conducted, see 7. Based on the results of the evaluation, some parts of the game concept need to be reconsidered, see 8. After modifications are made, another evaluation needs to be conducted to assure that the players approve the new refined version of the game concept. This and any further evaluation is beyond the scope of the presented report.

[1] Social Media and Web Technologies master program, Linnaeus University, Växjö, Sweden
[2] `http://www.google.com/glass/start/`

The remaining of this report is organized as following: Section 2 provides a brief overview of related technologies and applications. The gameflow is described in section 3. The visual design of the game is presented in section 4, whereas information regarding the audio information layer is stated in section 5. Additionally, section 6 provides an overview of the level and reward system. The user study and its results are described in section 7. Section 8 discusses the results of the evaluation. Possible future enhancements of the game concept are presented in section 9. Finally, section 10 summarizes the report by presenting our conclusions.

2 Related work

Both games as well as technologies of all kinds are evolving in a fast pace. In order to examine suitable technologies as well as proven game concepts to obtain further ideas for the game *Chase 'n' Race* we conducted two detailed researches. First, we examined the usage and suitability of technologies that support outdoor, advantageously running, activities. Second, the usage, suitability and existence of games and game elements especially for physical activities were examined. The research on both subjects is described in the following chapters.

2.1 Research: Technologies

While coming up with the overall idea for the game *Chase 'n' Race*, the main technologies involved in the game were Augmented Reality (AR) to have a visual information layer on the one hand, while using the Global Positioning System (GPS) to track the position and thus the progress of a runner on the other. In order to find out what has been done and applied using these technologies with an emphasis on mobility, we conducted a rough literature review. This section will first describe our initial research questions and then provide insights regarding the search scope and strategy. Afterwards we will analyse the publications considered relevant for our topic as well as providing conclusions, written in a narrative style.

2.1.1 Research questions

In order to define the overall aim of the research regarding relevant technologies for the mobile game, we used a perspective template according to the Goal/Question/Metric (GQM) paradigm as described by Basili [1]:

Purpose:	Examine
Issue:	the usage and suitability
Object:	of supporting technologies
Viewpoint:	for outdoor (running) activities.

According to the overall aim of the research, the following concrete research questions were derived:
RQ1: What kinds of technologies and approaches are used to support outdoor activities?
RQ2: What kinds of technologies and approaches have potential to support outdoor activities with an emphasis on moving, running respectively?

With RQ1 we want to investigate what kinds of technologies have been used to support or enhance outdoor activities. We intend to get insights of the current state of the art. RQ2 aims to have a closer look at identified technologies and approaches with an emphasis on mobility, that

No.	Result
R01	A Survey of Augmented Reality Technologies , Applications and Limitations [2]
R02	Augmented reality technologies, systems and applications [3]
R03	Augmented Reality 2.0 [4]
R04	Mobile Augmented Reality for Learning: A Case Study [5]
R05	Auditory display design for exploration in mobile audio-augmented reality [6]
R06	Current issues in handheld augmented reality [**?**]

Table 2.1: Results of the literature search regarding technologies

might be suitable for our initial game idea and thus be relevant to consider during the upcoming, more detailed game design process.

2.1.2 Search scope and strategy

We decided to use a combination of automatic and manual search strategy in order to identify relevant literature for the technology related search. The automatic search is conducted by selecting publications that seem relevant for examining the usage and suitability of supporting technologies for outdoor activities using appropriate keywords. For the automatic search we only considered literature published within the period from 2010 to 2014. The following search string has been defined and was searched for using the freely accessible web search engine Google Scholar[3]:

> (outdoor AND mobile AND technologies AND interface AND location AND "augmented reality" AND gps)

With these search results we conducted a manual search by browsing and reading the publication titles and abstracts and then deciding if a publication is relevant to be considered for answering any of the research questions. The selection of publications was roughly done using the researcher's own discretion, which is considered as a limitation of the conducted search at the same time.

2.1.3 Search results

After performing the literature search as previously described, we ended up with six papers. Table 2.1 illustrates the findings by paper title and reference.

[3] `http://scholar.google.com/`

2.1.4 Analysis and reporting

Recent developments in modern technologies, especially with respect to mobile technologies, increase the possibilities of how to use these technologies and provide not just certain added values but also entertainment to the user. By analysing the literature considered relevant, we will answer the previously defined research questions with an emphasis on the initial game idea of *Chase 'n' Race*.

RQ1: What kinds of technologies and approaches are used to support outdoor running activities?

Augmented Reality (AR) can be described as a direct or indirect view of the physical real-world environment that is enhanced or augmented by adding virtual information in real-time [3] [4]. Therefore computer-generated objects will appear to coexist in the same space as the real world [2]. By bringing virtual information, AR aims to simplify the user's life and enrich her surroundings by additional or supplemental information [2]. In a nutshell, AR 1) combines real and virtual objects in the real-world environment, 2) registers and aligns real and virtual objects with each other and 3) runs interactively in three dimensions and in real-time [2]. It is important to notice that AR is not restricted to particular display technologies and thus enhancing the vision, but can also potentially enhance other senses such as hearing, touch and smell [2].

Krevelen and Poelman examined different display technologies related to AR and claim that there are basically three ways to visually present an augmented reality: video see-through, optical see-through and projective [2]. While video see-through completely overlays and replaces the real world environment with a video feed of reality and digitised imagines, optical see through leaves the real-world perception alone, but displays only an AR overlay [2]. The projective display approach projects virtual objects as overlay onto real objects [2].

There are also three different types of displays to be differentiated in AR: head mounted displays (HMD), handheld displays and spatial displays [2] [3]. A HMD is a display device that is worn on the head, e.g. as part of a helmet or the user's glasses, and enables the user to perceive both real world environment and virtual information [3]. Handheld displays are small computing devices, which the user can hold in her hand and use as a look-through, eventually having a similar approach to the HMD [3] [4]. Handhelds, such as smartphones, usually bring the advantage of embedding several additional sensor technologies such as GPS, accelerometer or gyroscope that have potential to increase the functionalities and precision of the possible AR application [3]. Spatial Augmented Reality (SAR) makes use of tracking technologies such as video-projectors, optical elements, holograms, radio frequency tags or others to display graphical information directly onto real world objects [3]. SAR has the advantage that it does not force the user to wear or use any additional display device [3]. Consequently it has rather stationary characteristics [3].

For tracking not just the user's geolocation but also her particular field of view, tracking devices usually consist of digital cameras, optical sensors respectively, GPS, accelerometers, solid state compasses, wireless sensors and more [3] [4]. By using multiple of these technologies, the user's position can be determined more accurately through data triangulation [3]. GPS is commonly used for outdoor systems [3] and is considered the key component of an AR system [**?**]. However it has to be considered that GPS reception and accuracy can substantially deteriorate in urban environments [**?**]. An opportunity to overcome this issue can be the usage of assisted GPS (A-GPS) [2]. A-GPS consists of a worldwide network of servers and base stations that enable signal broadcast, and thus accurate tracking, within urban canyons and indoor environments [2]. Plain GPS is accurate to about 10 - 15 meters, but with more precise A-GPS approaches such as the wide area augmentation system (WAAS) location estimations with an accuracy of 3 - 4 meters can be achieved [2].

Besides the more hardware related challenges, also challenges regarding the software aspect exist, such as e.g. the user interface (UI) design. It is very important that the UI design follows some guidelines and does not overload the user with information or even distracting elements [2]. Also, it is of high importance that the UI does not prevent the user to perceive essential real world information and thus encourages the user to overly rely on the AR system [2]. So called Heads-Up displays (HUD) project information into the user's the field of view and usually create an additional layer of information [5]. This approach goes hand in hand with the optical see-through technologies related to AR [5]. The main purpose of the HUD is that the user does not need to take her eyes away from the environment to an instrument panel or something similar, but to integrate the information with the visual field of the user [5].

There are also approaches of HUD and AR applications using only audio to inform the user about the environment using a headset [5]. Recently, Vaxquez-Alvarez, Oakley and Brewster explored an auditory display design for exploration in mobile audio-augmented reality within a sound garden and provide interesting insights [6]. For their, more stationary, approach with a sound garden, they came to the conclusion that using 3D spatial audio techniques together with earcons (brief sounds that are used to represent a specific event) was the most effective auditory display [6]. Additionally, they state that capturing the user position and head orientation has been effective means considering the user's exploratory behaviour within the sound garden [6].

RQ2: What kinds of technologies and approaches have potential to support outdoor activities with an emphasis on moving, running respectively?

With the results of the analysis of RQ1, we can now have a closer look at technologies and approaches the have potential to support outdoor activities with an emphasis of a user that is moving or even running in particular. Overall it seems that AR has lots of potential to enhance the user's perception of the world in one way or the other. With respect to our initial game idea we think that AR is indeed suitable to be applied within the game design to a certain

extent and by following some approaches and guidelines. Based on the illustrated AR vision technologies, we estimate the optical see-through approach as the most applicable for the game *Chase 'n' Race*. Within the running process we do not want to fully replace the user's perceived real-world environment with a virtual one, but rather add virtual information as some kind of additional information layer. That is why the optical see-through approach is considered the best fitting one for our idea. This is most certainly implemented by a HMD, such as the recently introduced Google Glass[4], as well as applying a minimalistic HUD design approach that will eventually not distract the user from the actual activity, namely running. However the reviewed literature has not given particular insights in such a UI design. That is why this needs special consideration during the game design process and the later evaluation.

Not just AR regarding vision, but also regarding audio seems to have potential as studies have shown [6]. Although the example of the sound garden seems rather different from our game idea, we can see some insights and useful lessons that can be learned, considered respectively, during the game's design process. Overall it seems that user's are receptive for context-aware audio feedback.

Another key component to be considered and to implement our game design is using GPS as a user tracking technique. Since we aim for an overall outdoor running activity in this state of game design, GPS should be precise enough to fulfill our requirements. The overall claimed accuracy of GPS of around 10 - 15 meters needs thus to be considered within the game design. However, it is to evaluate in later case studies how precise the position determination is in urban landscapes. As technologies evolve, so will the accuracy of these services.

Additionally, through the usage of today's modern mobile technologies, a lot of different sensor technologies, such as the accelerometer, a device that measures proper acceleration, or the gyroscope, a device for measuring or maintaining orientation, may deliver additional data that can be used for data triangulation and thus lead to more precise information on the one hand or consideration to be used to implement additional game play mechanics on the other.

2.1.5 Conclusions of the technology related research

The aim of the technology related research was to identify technologies that have been proven suitable for outdoor activities as well as identifying those that have the most potential to be used considering the initial game concept of *Chase 'n' Race*. Answering RQ2 provides a glimpse of suitable technologies and approaches that will be considered during the further game design process. So it seems that both audio related as well as vision related AR can be valuable assets to implement our game idea. While user's are receptive for audio feedback from an auditory point of view, applying an optical see-through approach by using a lightweight and convenient to wear HDM such as Google Glass including a minimalistic HUD design are promising from a visionary one and consequently solid foundations to build and further develop the game's concept

[4] `http://www.google.com/glass/start/what-it-does/`

and mechanics.

2.2 Research: Games

During the brainstorming and preparation phase for *Chase 'n' Race* we were considering which game elements could be included and how the motivation of the runners could be strengthened. To gather this information research on existing games, game elements and motivation-systems had to be performed. In this chapter the conducted research to gain this knowledge is explained. First, the applied research questions are described. Afterwards, the methodology will be introduced. Finally, the research results will be shown and the research questions will be answered.

2.2.1 Research questions

The research regarding suitable games, game elements and a motivation-system relevant for *Chase 'n' Race* is based on the the Goal/Question/Metric (GQM) paradigm by Basili [1]:

Purpose:	Examine
Issue:	the usage, suitability and existence
Object:	of games and game elements
Viewpoint:	for physical activities.

Evolving from this matrix the following research questions were developed:
RQ1: Which similar games for running, workout (physical activity) or a interactive game exists?
RQ2: Which game elements have potential to be used in *Chase 'n' Race*?

The first question is aiming to find games that already exist and can be considered relevant for our game Chase 'n' Race. The second question is focused on exploring game elements that can provide interactivity within the game.

2.2.2 Search scope and strategy

The combination of automatic and manual research was chosen to perform the research. The automatic search is conducted using Google Search[5] as the main search engine. In addition, the Apple iOS App Store[6] as well as the Android Google Play Store[7] were included in the search. For the automatic search the following search strings were used:

"mobile fitness games"

"augmented reality games"

"game elements jump and run +"

[5] `http://www.google.com`
[6] `http://www.apple.com/iphone-5s/app-store/`
[7] `https://play.google.com/store`

No.	Result
R01	"10 Fitness Apps That Boost Your Stamina, Speed and Strength" on Mashable.com [7]
R02	"The 64 Best Health and Fitness Apps of 2013" on Greatist.com [8]
R03	"Best Fitness Gadgets and Tech to get you into Shape" on Digital-Trends.com [9]
R04	"Run Jump Fly" on RunJumpFly.com [10]
R05	"Platforming Games 101: Running, Jumping and more" on Racket-Boy.com [11]
R06	"Top 10 Augmented Reality Games for Android / iOS platforms" Deep-KnowHow.com [12]

Table 2.2: Results of the literature search regarding games

Zombies, Run! [13] [14]
Everest [15]
Missile Wars [16]
Gain Fitness [17]
Strava Cycling [18]
UP [19]
Charity Miles [20]
Run an Empire [21]
Fleetly Fitness [22]
Cruise Control [23]
Teemo [24]
C25K [25]

Table 2.3: Interesting games / applications

We looked through the various search results and evaluated the found games and game elements whether they could be potentially interesting and relevant for *Chase 'n' Race*.

2.2.3 Search results

We found several lists that introduced various games with a fitness aspect as well as some interesting technical gadgets to support mobile fitness applications. According to the suitability of using or applying the game mechanics, ideas respectively, for *Chase 'n' Race*, those games were noted (R01-03). Search results focusing more on game elements were considered relevant as well (R04-06).

2.2.4 Analysis and reporting

RQ1: Which similar games for running, workout (physical activity) or a interactive game exists?

To answer this research question, R01-03 were evaluated and the game descriptions were read. The games presented in table 2.3 were identified as possibly interesting for *Chase 'n' Race*.

The game Zombie, Run! was already considered interesting for our initial game idea. The focus of Zombie, Run! is to motivate the runner with audio feedback. The description provided on iTunes states the following: "They must be close. You can hear every guttural breath, every rattling groan - they're everywhere. Zombies. There's only one thing you can do: Run!" [13]

In Missile Wars the player is under attack and has to avoid missiles targeting the area she is in. If the runner does not manage to leave the area within 60 seconds she is hit. The game signals incoming missiles per push notifications and vibration of the mobile device. The target area is displayed with a red circle on a map [16].

The application Strava Running and Cycling - GPS Run and Ride Tracker can record the fitness aspect of a workout, such as burned calories, heart rate etc., but it also has a competition and community aspect that creates a game-feeling towards the workout. In addition Strava provides the possibility to browse through existing biking and running routes [18].

Another application introducing an interesting fact towards health and fitness is Charity Miles. With this application the player earns sponsorships for charity whenever the application is used while running, walking or biking. This aspect of helping and providing support for charity purposes can also be motivational. The players do not only perform fitness to make themselves feel physically better but also to help a cause [20].

Fleetly Fitness is an application within the health and fitness category and it is based on earning points for a performed workout. In addition, it has a social and competitive aspect to perform better than a friend. A big feature is the delivery of instructional videos and workout descriptions. Furthermore it features a custom workout generator, which the player can configure to create a workout personalized for herself. Also the trainings and progress log is a big part of the application system [22].

Teemo is an application that provides quick exercises that fit well in between the daily routines of the player. The exercises are embedded in an adventure game with friends, which makes Teemo novel [24].

With GainFitness the user has a personal trainer application, which can help to get into shape. Videos, descriptions and workouts are provided and the players go through them together with their (virtual) personal trainer [17].

The focus of Everest is to provide the user with challenges such as "eat to live", "lose weight in a healthy way", "discover your dream" or "get out once a week" [15][26]. Challenges can vary and include different steps to complete them. The user can see how many people are taking part in the challenge. In addition Everest is connected to Facebook, which might create a social connection.

UP is an application that interacts with a special bracelet. This bracelet records the user's sleeping times, movement such as workouts, and consumptions. The combination of the bracelet and the application makes the user more aware of her behaviour within the everyday life [19]. In addition to this bracelet [19], there are multiple other devices that are specialized fitness trackers.

collect items [5,6]
jump over mud puddles [11]
destroy enemies [11]
jump over 'hurtful' elements [11]

Table 2.4: Game elements

Other bracelets exist on the market, enhancing and cooperating with applications and devices, e.g. Garmin Vivofit. The costs for such a device vary between 100 to 130 USD and provide the user with different feedback and additional support [12].

The application Run an Empire is a game asking the players to compete with each other: "(...) maintain control of as much of their local territory as possible. To capture somewhere you have to run (or jog, or walk) around it" [21]. This idea can motivate the user to repeatedly run the same track to ensure that the capture area stays hers. It could also be a challenge to the user to try to capture more territories, which will then lead to more exercise [21].

Within Cruise Control the played music is in sync with your footfalls. This means it will resemble the runner's personal rhythm. The music is altered to match her personal pace. This can create a close connection between the runner and the music, eventually making running more enjoyable [23].

C25K is an application that aims to build the users' strength and to get them running. The target group are runners just starting to run. The application has an 8-week-plan that aims to ensure that the user gets stronger and healthier. Training sessions are 30-40 minutes long and include a warm-up as well as a cool-down phase. With this application the trainee is slowly lead towards fitness with a lot of support [25].

All described applications have elements of gameplay that can be inspirational for *Chase 'n' Race*. These game elements can be introduced to potential users during a user study in order to further investigate their acceptance towards those ideas.

RQ2: Which game elements have potential to be used in *Chase 'n' Race* game?
To answer this research question R04-06 were evaluated and the results were examined to gather interesting game elements. Table 2.4 presents found game elements.

The aim is to provide the user with game elements covering the fact that she is running. To be able to do this, the user needs to be challenged. The initial idea was to place banana skins on the track that the runner then has to avoid or she would receive a penalty [27]. Additionally, further elements should be placed on the track.

This could be, e.g. the collection of hoops or gold coins to gain additional points [11], which is used in games such as Sonic the Hedgehog [28] and RunJumpFly [10]. In addition to the banana skins on the track, mud puddles or virtual spikes could be part of the track. These could be either placed by fellow runners or randomly by the system [11]. To create more interactivity,

it could also be possible to include enemies within the game, which the user has to defeat with jumping on or kicking them [11].

Instead of collecting coins the user could also collect puzzle pieces. These pieces could unlock items in the reward system or they could be displayed as batches on the avatar [10].

A big additional game element is the Augmented Reality layer. To gather some insight on how current applications use this feature a research was also included. The outcome was rather disappointing: The AR layer is only displayed on the mobile device [12]. This is a approach that cannot be used for a running application due to the fact that holding the device while running will interrupt the running activity.

2.2.5 Conclusions of the game related research

During the research, game elements were found that could be interesting and useful for the development of *Chase 'n' Race*. There are a lot of different applications available that pursue various aspects, approaches and themes to motivate players to keep them in physical shape. Nevertheless no application was identified that combined running, motivation and the game-factor in a similar way to our game idea. The combination of AR, in-game elements such as avoiding banana skins, challenging others and the simple act of running does not exist yet.

3 Game flow

This sections describes the game flow, including two different modes which the player can choose. Furthermore, in-game items and in-game challenges are presented. A short overview of the data that is going to be collected regarding both the players as well as the routes is also given.

3.1 Overview

When the player starts the game, she has the possibility to select one of two available options. She can either select one of the existing routes and run against those, who completed the route already before, being confronted with in-game items and in-game challenges, or she can decide to create a new route, which will afterwards be available for other players. An overview of both modes is shown in figure 3.1. Furthermore, they are explained in detail in the following.

3.1.1 Mode I: Select a route

When the player selects this mode, she can choose a route that already exists in the system. The player can be located via the GPS functionality of her mobile device and thereby retrieve a list of routes within a certain distance around her. The distance can be chosen by the player. Furthermore, the player can enter an arbitrary location to get all routes within a certain distance of that location. Getting a list with several routes gives the player the possibility to explore new routes created by other players in the community. The player gets detailed information about each route to be able to select the one that fits her requirements best. That information contains the distance of the route to the runner, or the entered location, respectively, the length of the route, the estimated time based on the runner's average speed and, if the runner ran the route already before, the best time in which she managed to complete the route. Furthermore, the best time of the route in general is shown, how many different players ran the route already and how often it was run in total. Especially if the player does not know the route yet, showing the route on a map should give the information where the player will have to run. The player does not have to memorize the path, but will be directed via guidance through the application.

After the player selected a route, she proceeds to the start point. During the run, the GPS functionality of the mobile device needs to be enabled to be able to track the runner and give information about the directions. Furthermore, it needs to be tracked if the runner is really following the route. For getting feedback, the runner needs either a Google Glass, in this case she gets visual feedback, or headphones for audio feedback. For an optimal game experience, it is advised to use both tools. In the settings section of the application, the players can choose which type of feedback they want to get. Additionally, they can turn off the feedback about the directions, which might be annoying if a player ran a route already several times and thus, knows exactly where to run.

Before the run starts, the player gets the overview of the route on a map one more time. Then,

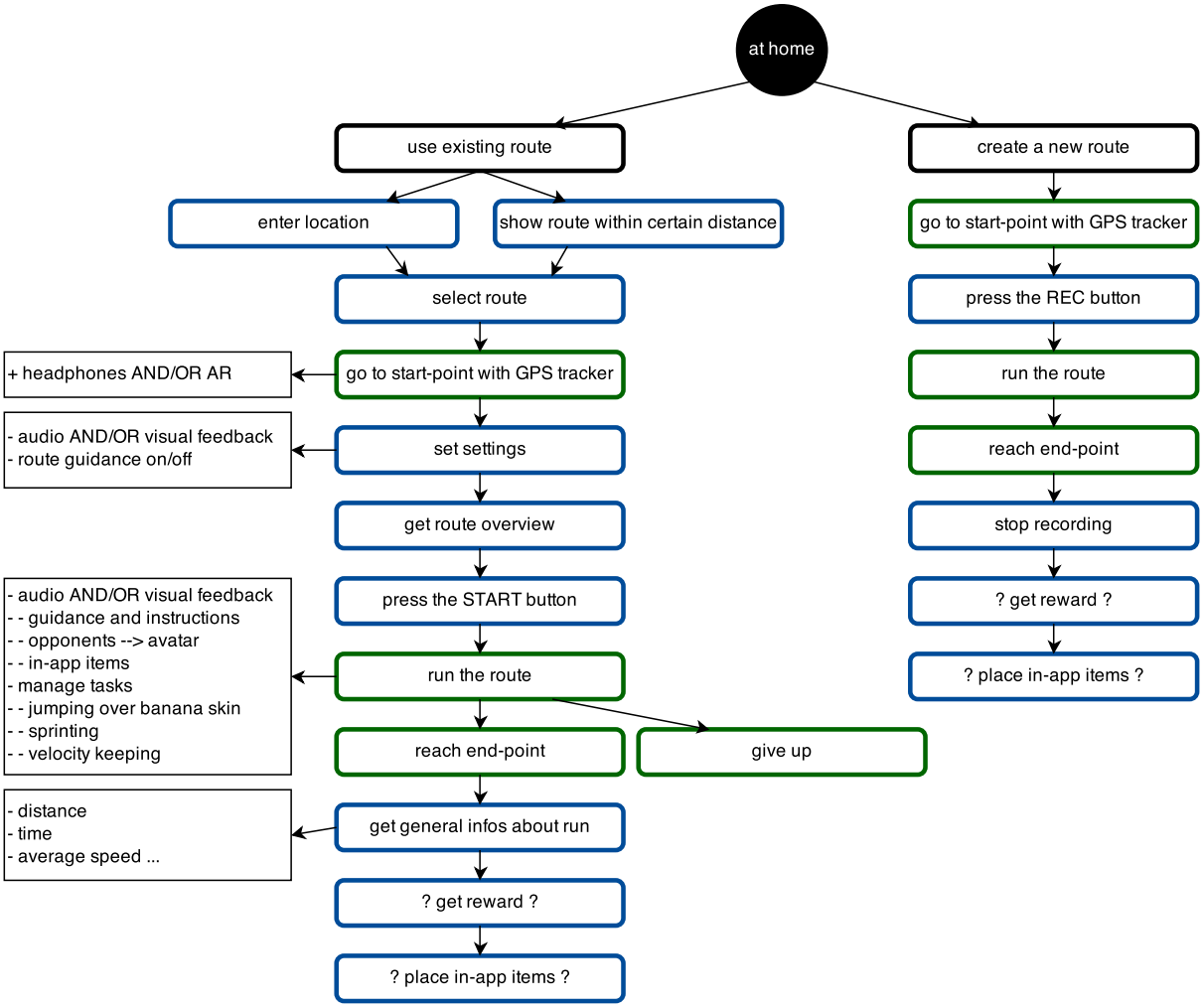


Figure 3.1: Game flow

the player presses the start button and begins to run. The player should follow the instructions regarding the directions. If the runner leaves the actual track, she is informed about the fault. The shortest way back to the route, without having to run back the same route as the runner came from if possible, is calculated and leads the runner back to the right track. This feature should give the player the possibility to finish the run even in case of unexpected obstacles on the actual route, e.g. a street that for some reason can not be passed anymore. If the runner gets too far away from the right track, the runner is disqualified. Runners should not have the possibility to take shortcuts or to avoid in-game items. The feedback regarding the leaving of the track as well as the directions back to the actual route is given even if the player turned off the feedback for directions. If a runner is disqualified, she does not get any points or rewards.

Since the run is a competition between the runner and other players who ran the route already before, the runner gets feedback about their performance. If the runner comes close to another player, she is informed about this and can thereby take actions to actually pass the other player. In the same line, the runner gets feedback if another player behind her comes close, so that the

runner can try to avoid the other player passing her.

Another element of the game are the in-game items. Those are "imaginary" banana skins, which lie on the track and have to be sidestepped by the runner. If the player uses a Google Glass while running, she can actually see the banana skin in the AR layer. Through the headphones, the player gets audio comments about when to sidestep the banana skin. If the player does not sidestep the banana skin, she "slips", which means that she is getting a time penalty. For each completed route, the player gets one fourth of a four-leaf clover. If the player has a whole four-leaf clover and does not sidestep the banana skin, she has enough luck to not slip, meaning she does not retrieve any time penalty but she loses the four-leaf clover.

Additionally, the game contains in-game challenges. Two different types of those challenges exist: sprinting and velocity-keeping. For the sprinting challenge, the player tries to run a certain short part of the route faster than a given time. For the velocity-keeping challenge, the runner has to hold a certain velocity, which will be around her average velocity, over a predefined distance. After the runner passed the challenge, she will get appropriate feedback. For each sprinting challenge, a Top 10 ranking exists, containing the times of the ten fastest sprinters for that challenge. If a runner finishes the challenge with a time within the Top 10, she gets also feedback about her rank. Otherwise, the runner can see her rank in the application after she completed the route.

At any time, the runner has the possibility to abort the run and give up. Although the runner does not complete the route, she still gets some points for the parts she ran and the passed in-game challenges. In comparison to that, someone who is disqualified does not receive any points.

Finally, when the player reaches the end point of the route, the run is finished. On the mobile device, different information regarding the run are shown. The runner gets general information such as the time the runner needed as well as the distance she ran and her average velocity. In addition, the number of successfully passed in-game items and used four-leaf clovers, if they were needed, is presented. Also the number of successfully passed in-game challenges and the rank for each sprinting challenge is shown. If the run does not have already three whole four-leaf clovers and she completed the entire route, she gets one fourth of a four-leaf clover. Furthermore, if the run enables any new achievements, the player will be notified about them. Also, the current amount of points the player collected as well as the current level and how many points are missing to reach the next level will be presented. As a last point, the player places in-game items on the route as obstacles for future runners. Each player can put up to three in-game items on the track.

3.1.2 Mode II: Create a route

If the player decides to create a new route and selects this mode, she first needs to proceed to the start point with a GPS enabled device. There, she presses a button to start the recording.

During her run, the route is tracked via GPS. At the end point of the route, the player presses the button to stop the recording. She directly gets feedback about the distance she ran, the time she needed and her average velocity. She can name the route and save it to make it accessible for other runners. Afterwards, if the player gets any new awards with the creation of the route, she is informed about them. In addition, her current point and her current level as well as how many points she needs to reach the next level is shown. The player can place three in-game items on the track. At this point, the creation of the route is done and the route is now available for other runners. At least 40 % of the created route need to differ from already existing ones in order to get accepted as new route in the system.

3.2 In-game items

As already stated in the game flow overview 3.1, the in-game items are banana skins. Those banana skins are not real, thus, they can only be seen within the AR layer when a Google Glass is used. If the game is played with audio feedback, the player gets the information about where the banana skins lays as audio comments. The player needs to sidestep the banana skins to successfully pass them and avoid "slipping". Slipping on a banana skin means to get a time penalty. A whole four-leaf clover, which the player can collect by completing four routes successfully, can prevent the player from slipping. This means, if the player does not sidestep the banana skin but has a four-leaf clover, the player has luck to not slip. No time penalty is retrieved, but the player loses the four-leaf clover.

After completing a route, the player can place up to three banana skins on the track, depending on the length of the route. If another player selects the route, the route is divided into different sections, each one has approximately a length of 500 meters. For each section, a banana skin is selected from the pool of all banana skins placed by other runners. If for a section no banana skin is available, a randomly generated one is used. If a player slips on the banana skin of another runner, the player gets a time penalty, while the player who placed the banana gets points as a reward, cf. figure 3.2. A player is never confronted with a banana skin placed by herself. Regardless if the banana skin was passed successfully or not, it is removed from the pool of placed banana skins and thus, cannot be selected another time.

3.3 In-game challenges

Two different types of in-game challenges exist: sprinting and velocity-keeping. For the sprinting challenge, the runner tries to be faster than a given time over a certain distance. The given time is rather small, so that the players cannot just easily run, but have to sprint to pass the challenge. The velocity-keeping challenge requires the runner to hold a certain velocity, which is around the runner's average speed, over a predefined distance. During the first meters, the runner will get feedback if she is too slow or too fast, to get some feeling for the demanded velocity.

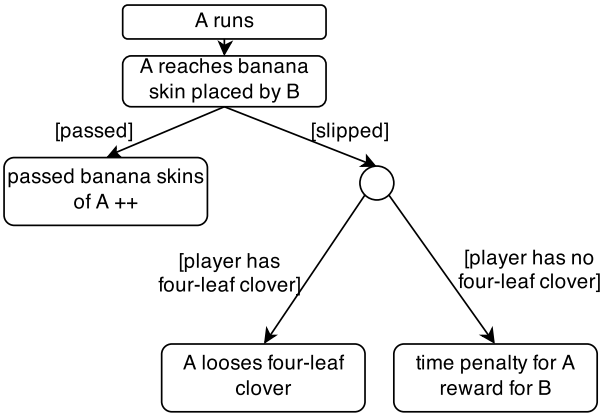


Figure 3.2: Flow of handling banana skins

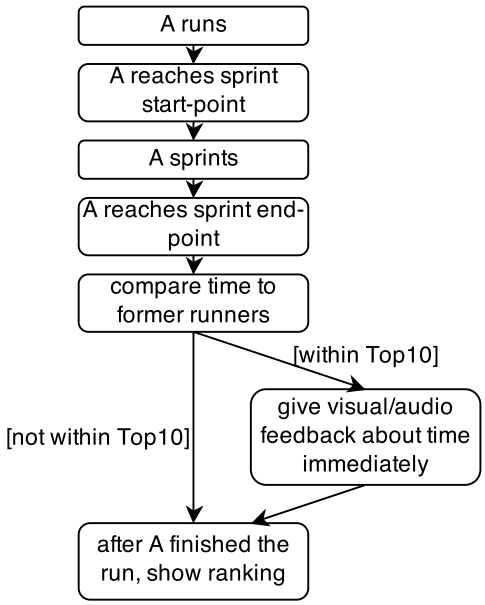


Figure 3.3: Flow of sprinting challenge

The route is divided into different sections, each with a length of approximately 500 meters, similar as for the in-game items. Each section contains randomly selected either a sprinting or a velocity-keeping challenge. At the end of the challenge, the runner will get feedback about if she passed the challenge or not. The runner gets points and awards for passing challenges, but no penalties if she fails. For each sprinting challenge, a ranking with the actual times of the runners exists. If a runner manages to be within the ten fastest, she gets a notification immediately at the end of the challenge (cf. figure 3.3: Flow of sprinting challenge).

3.4 Collected Data

The application needs to store various data regarding the player as well as the routes. See A.1 to get an overview about the data that will be collected. Some of the data will be used for statistical analyses, for example to calculate a runner's average speed.

4 Design

While running the user can be presented with visual as well as audio feedback. The audio feedback will be described in the following section 5. The user has to use Google Glass to experience an AR layer with a head-up display (HUD) while running. This layer will transport virtual information during the game play. This includes various game elements as well as directions. Additionally, the user interface (UI) of the mobile application was designed. The head-up display will focus on the, in comparison, relatively static elements of the game play such as the display of distance, time and instruction elements, while the AR will display dynamic elements including challengers, challenges and banana skins.

4.1 Mobile Application

The mobile application is a dedicated software for *Chase 'n' Race*. While the runner is performing the run, it will not be actively used but serves as a node to connect the different components as well as establish the connection with the server to log and save the users progress. Furthermore the mobile application enables the user to login as well as choose the mode she wants to play or browse through previous statistics. Additionally the mobile application provides logging information once the user finished a run. This display includes general statistics about how the user performed on the track compared to others as well as a personal feedback.

When accessing the application the user will be presented with a login-screen, see figure 4.1. This login-screen displays valuable information towards either a current user or a new user. A new user can take a closer look into the application when accessing the FAQ's or information about the application provider. She can also register to become part of the *Chase 'n' Race* community.

Once logged in, the user is directed to a screen where she can start a new run choosing either from existing routes or creating a new route (see figure 4.2). She can browse through existing routes either close to her current location or in another town. When browsing through the routes, the shown information includes values such as the name of the route, the distance to her current location, the distance of the track as well as her best time and the overall best time performed by a runner.

Once a track is chosen a more detailed route profile is displayed. This will include the track displayed on a map as well as previously mentioned values (distance of the track, the runner's best time and overall best time). Furthermore the amount of placed banana skins and the number of competitors for this track is included, as figure X.3 illustrates. From this screen the runner can choose whether she wants to run this track or not. A start-button is included to provide this functionality.

Having finished a run, the user is directed to a route profile with the map and track as well as the personal log for the performed run. This will include a detailed feedback for the actual

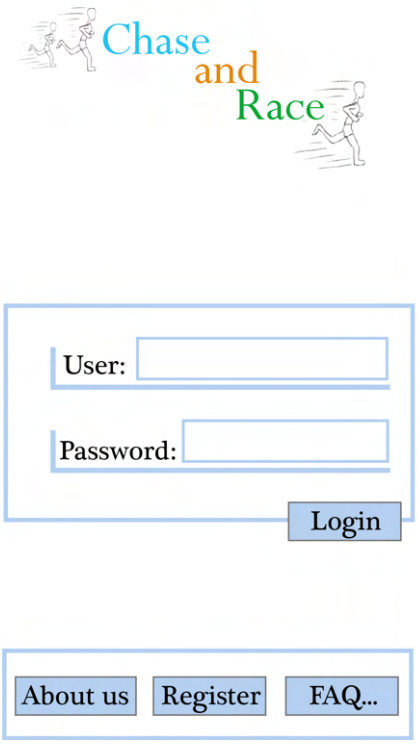


Figure 4.1: Mockup: *Chase 'n' Race* Login

ranking in the different challenges whether she earned a new lucky-charm (a part of the four-leaf clover), how many banana skins she successfully passed and on how many banana skins she slipped. These different values add up to a amount of points which are added to the user profile (see figure 4.4a). Following this screen, the user is presented with her current level and statistics for all the runs she performed (see figure 4.4b).

These different mockups aim to provide a possible visualization of the various scenarios and situations a user could be confronted with. In addition, this also roughly shaped the game flow and the accessibility the user can have towards the game. When the interaction and transition between different screens is not properly adjusted the user could become lost or confused while using the application. If that should happen the user might stop using the application, which would mean that the community does not grow and *Chase 'n' Race* would lose its appeal due to missing challengers as well as the aspect of having a community.

4.2 Visuals during the run

The visuals the user is provided with during the actual run have to make sure that the view is neither cluttered nor that the elements distract the runner too much. A cluttered or irritating view could be dangerous while interacting with traffic, pedestrians and cyclists. To ensure this

Number		Distance to you	Distance	Your Time	Best Time
1.	Forest Path	2.1 km	10.5 km	1.07 hr	55 min
2.	Lake Path	2.15 km	6.25 km	30 min	15 min
3.	Lake Path 2	2.15 km	6.25 km	30 min	15 min
4.	Lake Path 3	2.15 km	6.25 km	30 min	15 min
5.	Lake Path 4	2.15 km	6.25 km	30 min	15 min
6.	Running Path	6 km	7 km	30 min	15 min
7.	Lake Path 5	2.15 km	6.25 km	30 min	15 min

Figure 4.2: Mockup: Start-Screen for logged in user

would not happen the visuals were created semi-transparent. For the HUD and AR various versions were designed so they could be evaluated and tested during the user study. In the user study the different versions are going to be shown and the feedback is going to be considered for further development (see 7).

4.2.1 Head-up display (HUD)

The HUD is referring to the parts of the UI visible through the Google Glass that have a static position. This includes information regarding distance and time as well as instructions and guidance (see figure 4.5).

An important element in the HUD is the feedback displayed to the user. This feedback has to be placed somewhere within the available space without cluttering the view. To test this, four views were created displaying the following combinations: left, right, left and right as well as right and top (see figures, 4.6a, 4.6b, 4.6c and 4.6d).

According to the results the layouts should be adapted and further enhanced 7.2. The directions are going to be displayed both as a written guidance and a symbolic reference. Such an element could be an arrow that points straight ahead (see figure 4.7a) or an arrow that points to the right (see figure 4.7b). These symbols were included in the user tests to see how a player

Figure 4.3: Mockup: Route Profile for a certain track

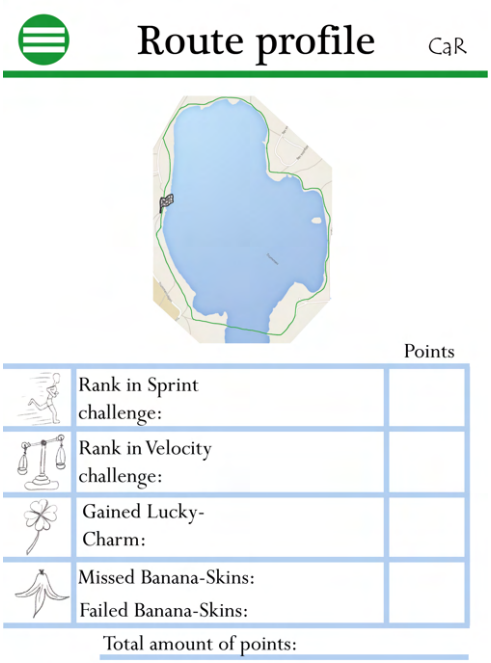
would react to this form of data representation.

4.2.2 Augmented Reality layer (AR)

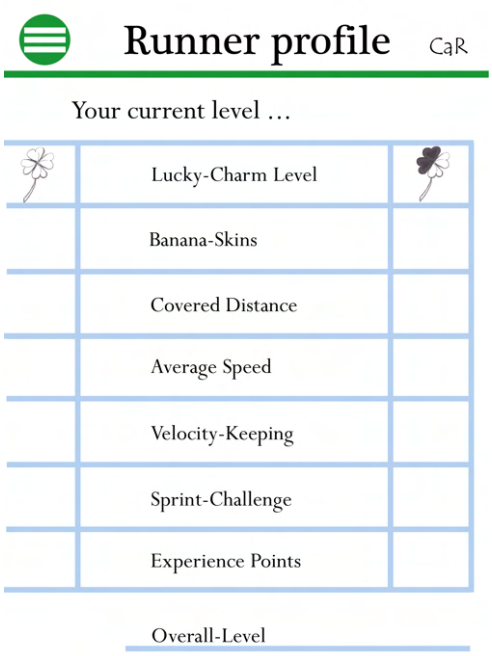
The AR layer shows in-game items as well as in-game challenges and other runners. In-game elements are banana skins (see 3.2) that are going to appear within the screen as well as the challenges (velocity-keeping and sprinting challenge, see 3.3). These elements are going to be displayed in the field of vision for the runner. Therefore we need to ensure that the elements are neither too realistic or too dense nor too cluttering for the run. To provide the possibility of evaluating these elements, three possible display variations were created. These elements focus on different aspects such as ensuring a distinction between the game and the actual surroundings as well as keeping the game fun.

For displaying another challenger on the track the following three display variations were created: an avatar version (see figure 4.8a), a realistic version (see figure 4.8b) and a point (or dot) version (see figure 4.8c).

For creating these dynamic elements we considered the circumstance that the track will not always be displayed in the same perspective. Therefore the elements cannot always be displayed attached on the ground properly. To ensure that this, possibly irritating, display of elements



(a) Mockup: Finished Track - User Feedback 1



(b) Mockup: Finished Track - User Feedback 2

Figure 4.4: Finished Track - User Feedback

Figure 4.5: HUD 1: Border and Start in the display

is not happening randomly, we decided to place the elements floating on the screen instead of trying to align them completely with the ground.

In addition to the challengers there are also the banana skins the runner has to react to. Also for this element, three display variations were created: a cartoon version (see figure 4.9a), a realistic version (see figure 4.9b) and a point (or dot) version (see figure 4.9c).

Depending on either the success or the fail of passing the banana skin an alternative HUD color theme was created. This theme transports the information that something went wrong with using the signal color red as figure 4.10 illustrates.

(a) HUD: Information displayed - Position as a block left bottom corner

(b) HUD: Information displayed - Position as a block right bottom corner

(c) HUD: Information displayed - Position bottom left and right bottom corner

(d) HUD: Information displayed - Position center top and right bottom corner

Figure 4.6: Finished Track - User Feedback

(a) HUD: Guidance displayed - Straight arrow

(b) HUD 7: Guidance displayed - Arrow pointing to the right

Figure 4.7: HUD: Guidance displayed

To display the other game elements such as a symbol for the velocity-keeping challenge, sprinting challenge and the end of the track, a draft for each symbol was integrated as an overlay. These symbols (see figures 4.11a, 4.11b and 4.11c) were chosen to transport an initial meaning towards testers and to provide a form of visual feedback.

These AR layers are necessary to transport mandatory information towards the user, in case she decides to use only visual and no audio feedback. The created mockups are supposed to create an impression, which elements need to be included while displaying valuable information

(a) AR: Variation 1 - Passing Challenger, Avatar

(b) AR: Variation 2 - Passing Challenger, Realistic

(c) AR: Variation 3 - Passing Challenger, Abstract (Dot)

Figure 4.8: AR: Challenger

to the user. While performing a run that only relies on visual feedback, the user needs to have detailed information at all times. One reason is to ensure that the runner does not get lost or is being endangered due to an image that is displayed opaque or view-demanding.

(a) AR: Variation 1 - Banana Skin on track, Cartoon

(b) AR: Variation 2 - Banana Skin on track, Realistic

(c) AR: Variation 3 - Banana Skin on track, Abstract (Dot)

Figure 4.9: AR: Banana skin

Figure 4.10: AR: HUD display for a failed banana skin

(a) AR: Symbol for Velocity challenge

(b) AR: Symbol for Sprinting challenge

(c) AR: Symbol for Finish line

Figure 4.11: AR: Different symbols

5 Audio

During the game, while the player is running, she can receive visual feedback as well as audio feedback. While the former one was described in the previous section 4, the latter one is presented in this section. The runner has the possibility to play the game with audio feedback only. Thus, the game needs to give the same information as audio comments, the player would get with visual feedback. To make use of the audio feedback, the player has to attach headphones to the mobile device.

Three different types of audio feedback exist: game instructions, sounds and directions, which are presented in the following. An overview of all different comments and sounds used during the game can be find in the appendix A.3. For each comment, two versions exist. The first version talks about the player, applying a third-person narrative. The comments do not address player directly, but give the feeling of a narrator who tells a story about the player. In the second version, the player is directly addressed, applying a second-person narrative. This means, the voice tells the player what to do next. Which of those two types of comments the users prefer, is tested during the user study (see 7.1). The game will allow the players to choose between at least one male and one female voice to give all players the chance to find a for them agreeable voice.

5.1 Game instructions

The game instructions inform the player about what is happening in the game, such as in-game items, in-game challenges and other runners who come close to the player. Even without seeing those game elements, the player should be able to handle them.

5.2 Sounds

Sounds should support the game instructions. If possible, events are signalized only with a sound to avoid to overload the players with comments. For some parts, it needs to be tested whether the players prefer a comment or a sound. An example is the situation when another player comes close to the runner. The runner can be notified about this situation either with a comment or by a sound that gets louder the nearer the other player comes to the runner and quieter when the distance between runner and other player increases.

5.3 Directions

The directions give the player the information about where to run. Since one part of the game is to give the players the possibility to experience new routes, the players do not always know the route they are running and thus, need to be navigated. If the runner leaves the actual track, the game looks for a new route which leads the runner back to the right track. Since some routes can have the need of a lot of directions and thus, need a lot of comments which can get annoying for

players who already know the route, the possibility to turn off comments regarding the directions exists. Only the comments that should bring the runner back to the right track in case she left it, can not be turned off.

6 Level and reward system

To represent the runner's progress and to provide additional motivation to the runner to keep going and playing the game, *Chase 'n' Race* features a basic level system. For actions and events within the game, the runners are collecting experience points and thus leveling up in their personal levels. Additionally, a reward system is applied in *Chase 'n' Race*, which consists of classical achievements and both positive rewards and negative ones (penalties). This chapter will first present the level system and then provide insights in the reward system.

6.1 Level system

The developed level system of *Chase 'n' Race* is an essential part of the runner's profile. Throughout actions and events in the game, the runner will earn experience points to raise their runner level. Experience points are hereby the unit for measuring the progress, and activity respectively, of the runner. The usage of experience points is a widely known and broadly applied concept to fulfill this purpose. The level system for *Chase 'n' Race* is aimed to make it easy to level up in the beginning in order to stimulate early success feelings of the runners, while leveling up in the higher levels need consistently more initiative and actions. The process of overall adjusting and deciding how many experience points are granted for certain events and how many are needed for the different level up tiers was a very iterative and experimental one.

The level system should scale dynamically and thus benefit runners who are making good progress. For this reason, a efforts factor was introduced, which represents the performance of the runner based on the run distance and the average speed of the runner. 100 % efforts mean that the runner completed a route of x kilometers by consistently running in her average speed. The concrete formula to calculate the runners efforts is shown below:

*runners effort = 100 + (100 - (Time for route in h / (Distance in km / average speed) * 100))*

However, when calculating experience points dynamically, there also had to be a lower limit in order to grant the user a minimum of experience points in case the performance was not good. Overall, events were identified that should make runners able to earn experience points. The amount of experience points runners earn is hereby calculated dynamically, e.g. when a round is completed based on the previous explained efforts factor, or set to a flat amount of generic experience points, e.g. when a challenge was completed or a banana skin was avoided. The level system is in general a positively rewarding one, adding more experience points to the runner's collected pool of points. However, one event was also applied that has the character of a negative reward system, subtracting collected experience points of the runner. This happens when the runner gets overtaken by a challenger with the same or a lower level as the runner herself. Table 6.1 provides a detailed overview about all the events within *Chase 'n' Race* that

Events	Dependencies	Formula	Notes
1 round completed	route distance, runner time	= 10 exp flat + (10 exp * x km) for 100 % effort 100 % effort = time for distance based on average speed	
1 round failed	completed percentage of route	= 10 exp flat + completion in % * 25	25 = 1/2 * 50 basic exp
Sprint challenge completed	none	= 3 exp flat	
Velocity-keeping challenge completed	none	= 3 exp flat	
Banana skin side-stepped	none	= 2 exp flat	
Challenger slipped on banana skin placed by Runner	Level of challenger	= 1 exp * level of challenger	
Challenger overtaken	Level of challenger, level of runner	= 1 exp flat + max(level challenger - level runner, 0)	
Runner overtaken	Level of challenger, level of runner	= - min((level runner - level challenger) + 1, 0)	only if level runner >= level challenge
1 route created	none	= 20 exp flat	

Table 6.1: Level system: Experience points earning overview

Experience point Experience point for Level up	1
1 - 2	500
2 - 3	1000
3 - 4	1500
4 - 5	2500
5 - 6	4000
6 - 7	6500
7 - 8	10500
8 - 9	17000
9 - 10	27500

Table 6.2: Level system: Level up matrix

grant runners experience points.

Based on the experience points allocation stated in Table 6.1, the game designers defined the amounts of experience points needed to gain one level up. These amounts are calculated based on summarizing the amounts of experience points needed to gain the previous two level ups. It is to notice, that once a runner gains a level up, her experience points are set to zero. Table 6.2 states the level up matrix.

Furthermore in order to properly test the designed level system, an experience point calculator was created A.2. Developing the calculator helped to get a feeling and overall understanding of the numbers behind the level system and an impression if they seem reasonable and appropriate. Of course, in order to provide a proper balancing, this system would need to be further tested and specifically evaluated during future user studies, alpha and beta tests respectively.

6.2 Reward system

The reward system of *Chase 'n' Race* can be divided into three parts, namely rewards, penalties and achievements. At this stage of development, the rewards and penalties are in line with each other. Slipping on a banana skin is punished with a time penalty. Concretely, for each slipped banana skin, five seconds are added to the runners round time in the end. However, for each completed round, the runner collects one quarter of a four-leaf clover. The four-leaf clover is automatically used when a runner slips on a banana skin, eventually preventing her from a time penalty. The four-leaf clover is an object of consumption and thus usable only once.

Achievement	Incrementer	Tier			
		Bronze	Silver	Gold	Platinum
Banana	successfully passed banana skins	10	50	300	1800
Measuring tape	covered distance	20 km	100 km	500 km	1000 km
Speedometer	successful velocity-keeping	5	30	180	1000
Running shoe	successful sprint challenge	5	30	180	1000
Protective helmet	amount of created routes	1	5	10	20
Ribbon	successfully completed/finished routes	5	50	200	450
World map	run unique routes	3	10	25	50

Penalties	Description	Impact	Notes
Time penaltiy	slipped on a banana skin	= round time + 5 seconds	

Reward	Description	Impact	Notes
1/4 four-leaf clover	runner completes 1 round	= current	Four-leaf clover storage: max 3

Table 6.3: Reward system: Achievements, penalties and rewards.

Since runners get a quarter of a four-leaf clover for each completed round, they need to complete four rounds to get a whole one. Also, the amount of collectable four-leaf clovers was limited to a maximum of three at a time. This should prevent runners to pile, or "farm" in the gamer's ordinary language, this item.

Additionally to the level system as described in 6.1, the game designers choose to introduce an achievement system to furthermore differentiate between runners to make them more comparable, and eventually rise a certain competitive behaviour due to the fact that they might want to earn achievements their friends already have. Achievements are granted for different reasons, such as successfully avoiding banana skins, running a certain amount of distance, successfully completing challenges or running unique routes. These achievements are granted within a four tier system, consisting of a bronze, silver, gold and platinum tier, which gets unlocked once the runner completed a certain sum of them. Table 6.3 provides a detailed overview of *Chase 'n' Race*'s reward system including achievements, penalties and rewards.

7 Evaluation of the game idea

After the first game design iteration, a user study was conducted to gather insights and to evaluate the overall game idea up to this point. These insights and the captured first impressions will eventually help to further refine the game design before *Chase 'n' Race* is going to be implemented. This section will provide information about the setup and conduction of the user study and present the results.

7.1 User study

In order to collect data to examine the concept of *Chase 'n' Race*, the overall idea was presented to potential users in the target group, namely amateur or occasional runners. To gain knowledge and impressions from the participants at first hand, the presentation included a walkthrough of the game design. The whole study was constructed around the demonstration of a possible flow of playing the game. Besides giving explanations of what the game is about, how it is intended to work and what technologies are involved, the study moderators lead semi-structured interviews with the participants to ask for detailed feedback and their opinions about certain game elements. Furthermore, the participants had to fill in an online questionnaire to give further feedback on the idea and their impressions of *Chase 'n' Race*.

The main part of the study was a walkthrough of the game design and concept. Therefore the researchers recorded two versions of the same outdoor running route. These recordings were then further processed in order to present the walkthrough to the participants step by step. Still images were extracted and overlaid using the AR mockups to illustrate the AR information layer while running. Additionally, audio feedback was recorded beforehand in two versions (once directly speaking to the runner and once talking about the runner in the third person) and embedded in the presentation as well in order to examine the audio information channel during the user study. The game design walkthrough featured all important elements and mechanics of the game including playful elements, such as virtual banana skins to avoid as well as challenges like sprinting and velocity-keeping challenges. Hereby, the moderators asked the participants to choose whether they wanted to accept a challenge or whether they wanted to successfully pass, slip respectively, a banana skin. This is the reason why the walkthrough was recorded in two versions as previously mentioned. The complete presentation can be found in the appendix A.4.

7.1.1 Aim of the user study

The general aim of the user study was to get general insights and first impressions of people within the target group of amateur and occasional runners. Besides impressions concerning the overall concept and idea of the game, the study also addressed more specific design questions, such as which layout and positioning of the AR overlay seems most convenient for the participants, which audio feedback version is appropriate or what in-game graphic styles (abstract, cartoon,

realistic) are best accepted. Up to this point, these decisions were made based on the game designers researches and preferences. Since the opinions may vary, the user study presents a great opportunity to further refine these game decisions and address them in the further development of the game. Additionally, the user study aims to address essential questions, such as whether participants think that the game would motivate them to go running more often, whether they think the combination of audio and visual feedback is a mandatory part of the game or whether they could imagine to be an active part in the game's community. Finally, a user study is always a great opportunity to gather improvement recommendations and other suggestions. All those insights should represent informative feedback, which will provide a solid foundation including considerations and recommendations for the future work and thus the next iteration of the game design.

7.1.2 Data collection

For the data collection and evaluation of the insights received by conducting the user study, the following methods were applied:

- **Self-constructed questionnaire**: For investigating the defined aims (see 7.1.1) a custom questionnaire was constructed A.5.
- **Semi-structured interview**: According to the recommendations by Grey [29], a semi-structured interview was conducted to address certain questions, while keeping the freedom to pursue conversations with the participants when appropriate. For this purpose, an internal questionnaire to take notes and move through the walkthrough was created (see A.8).
- **Audio recording while performing the user study**: In order to have the opportunity to rehear the interviews and thus the thoughts and arguments of the participants, the happenings during the user study were audio recorded.
- **Think aloud protocol**: While the user study was conducted, the participants were encouraged to ask questions to the moderator as well as to give their thoughts full scope and comment on the concepts and ideas they were presented to.

7.1.3 Setup of the user study environment

To conduct a single session of the user study, the following persons and technical equipment were used:

- **Persons:**
  - 1 moderator: Responsible for giving an introduction and leading the interview.
  - 1 participant (each session)

- **Technical equipment:**
  - 1 notebook: Used by the moderator in order to give the introduction and to present the overall walkthrough of the game design to the participant. Additionally, the notebook was used to audio record the conversation between moderator and participant.
  - 1 Apple iPad: An Apple iPad tablet device was used to audio record the conversation between moderator and participant (in case the notebook was not used for this purpose).
  - Pen and Paper: Used by the moderator to take notes during the semi-structured interview and the conversation with the participant in general.

7.1.4 Conduction of the user study

A general invitation with the request for participation including overall details concerning the game design project and the user study was sent to potential users in the time before the actual conduction. The targeted users were able to point out their interest in participating by scheduling their preferred attendance time using a poll hosted using the Doodle[8] platform. In the following days, a final schedule of 9 user studies with 1 participant each was created and the participants were notified accordingly.

At the beginning of each user study, the participants had to fill out a participation consent, stating that they are aware of general points such as the data collection, the audio recording of the user study as well as their ability to withdraw the study at any time (see A.6). Additionally, a preliminary questionnaire had to be completed, stating overall demographic information as well as the participants running habits (see A.7). Once the study started, the moderator gave a brief introduction about herself, himself respectively, as well as providing some introducing details to the game design project and the user study. After this introduction, the moderator started presenting a possible walkthrough of the designed *Chase 'n' Race* game. At this point, the moderator also started with the semi-structured interview in order to gain insights, impressions and opinions of the participants. After the walkthrough, the participants answered the general online questionnaire to finished their participation in the user study.

7.2 Results of the user study

This section will provide insights in the results of the user study as described in 7.1. Through the nature of the conducted user study and the chosen data collection methods (see 7.1.2), we will provide a mixture of quantitative and qualitative evaluation of the participants' impressions and feedback [29]. Through the relatively small amount of participants it is however not possible to address accurate conclusions. Therefore the following conclusions would have to be examined

[8] `https://doodle.com/`

in further large-scaled user studies. Nevertheless, the scope of the conducted study let the game designers evaluate and apply impressions and opinions of the participants' early on in the process of designing *Chase 'n' Race* and thus represents an important stage in the design development of the game.

7.2.1 Demographics and prior experiences

In the beginning of the user study the participants were asked for their gender, their age as well as their prior experience in exercising physical activities, concretely running. Figure 7.1 shows that 4 male and 5 female users participated in the user study, which makes a total of 9 participants. Furthermore, the participants were aged between 22 and 27 years, as figure 7.2 illustrates. Figure 7.3 presents the answers of the participants' prior experiences regarding exercising physical activities and running in particular. It is to notice that the participants could check multiple answers, thus those which were fitting to their profile and exercising habits. 5 of the 9 participants are exercising physical activities, e.g. going to the gym or playing in a sports club, on a regular basis. Furthermore, 5 participants are going running occasionally on an irregular basis. This is very interesting, since here the designed game *Chase 'n' Race* could make a difference, eventually aiming to motivate these participants to go running on a regular basis. 2 participants are even going running on a regular basis. Furthermore, also other physical activities are practised, e.g. riding a longboard (1 of the participants). Interestingly, all participants of the user study are exercising physical activities in the one way or the other.

7.2.2 Evaluation of the semi-structured interview

As the moderators lead the participants of the user study through a possible walkthrough of the game design, they asked for some concrete feedback. The complete internal questionnaire that the moderators used to conduct the semi-structured interview can be found in A.8.

One of the first concrete questions to examine was the layout of the HUD elements in the AR layer. Hereby, the participants were presented with 4 different layout versions (see 4.2.1. Left placed all elements on the left side of the HUD, while right placed them on the right side. Furthermore, left and right as well as right and top were versions of the layout intended to separate information from each other and place it in different positions of the screen. Figure 7.4 illustrates that the participants did not like having all the information on one place of the screen but rather separated. During the conversations, most of the participants stated that they need to concentrate while running and thus it is easier for them to look into a certain area of the HUD and immediately find the information they are interested in. Thus a separation of information eases this procedure. While 5 participants preferred the HUD layout right and top, 3 found the left and right version more appropriate.

The participants were also presented with 3 different versions of visually presenting a banana

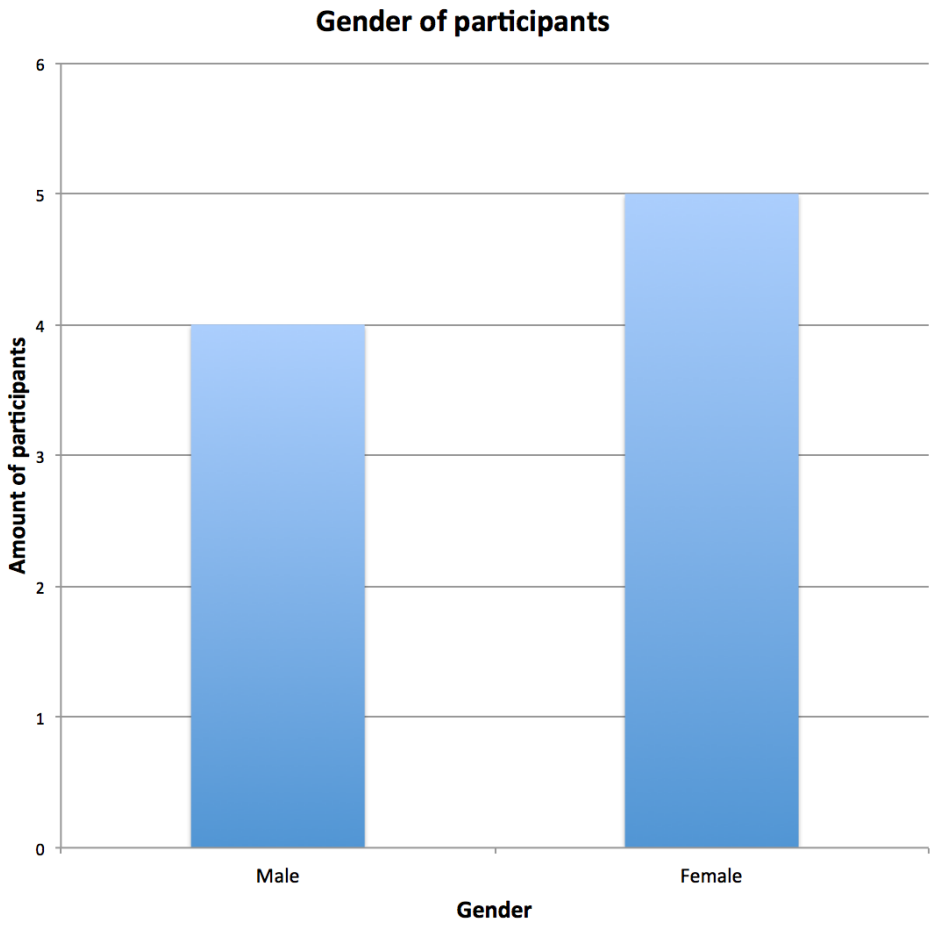


Figure 7.1: Gender of the participants

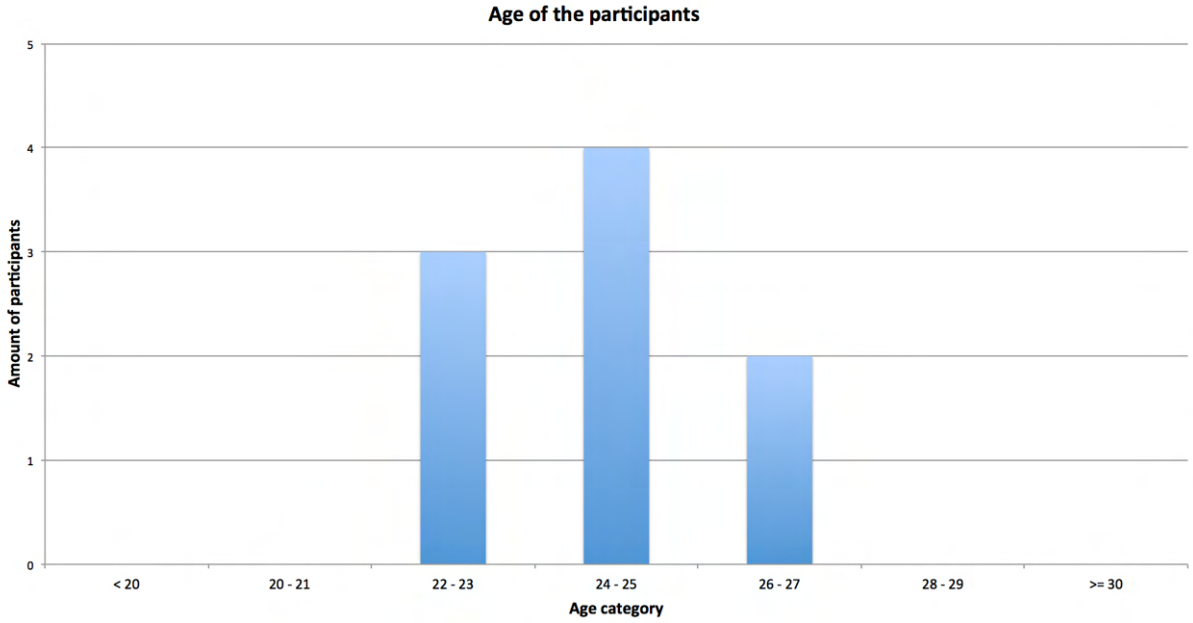


Figure 7.2: Age of the participants

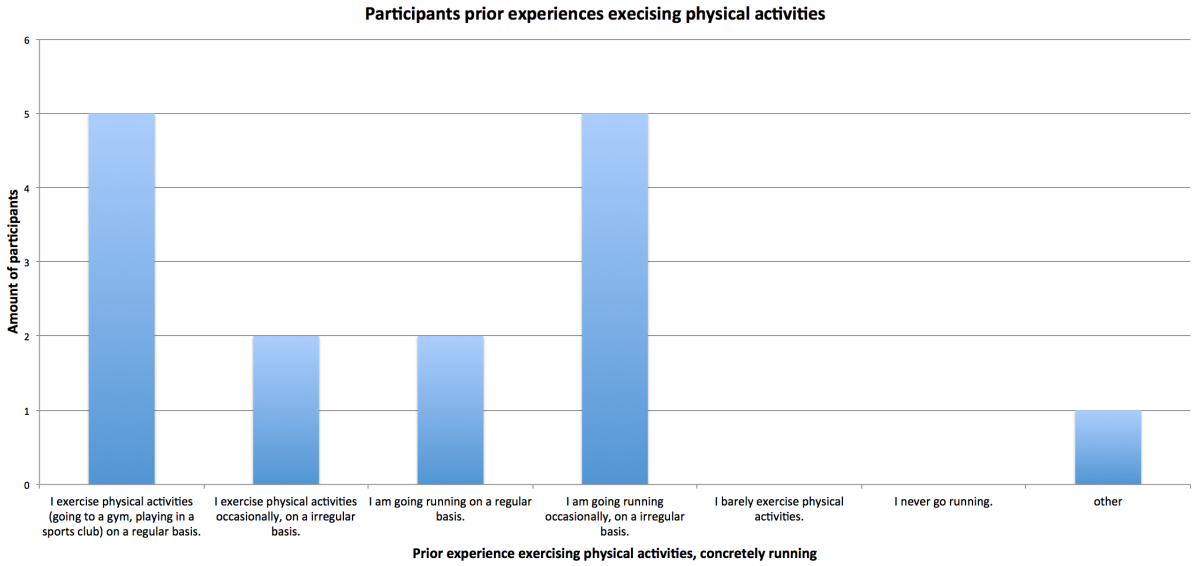


Figure 7.3: Prior experiences of the participants

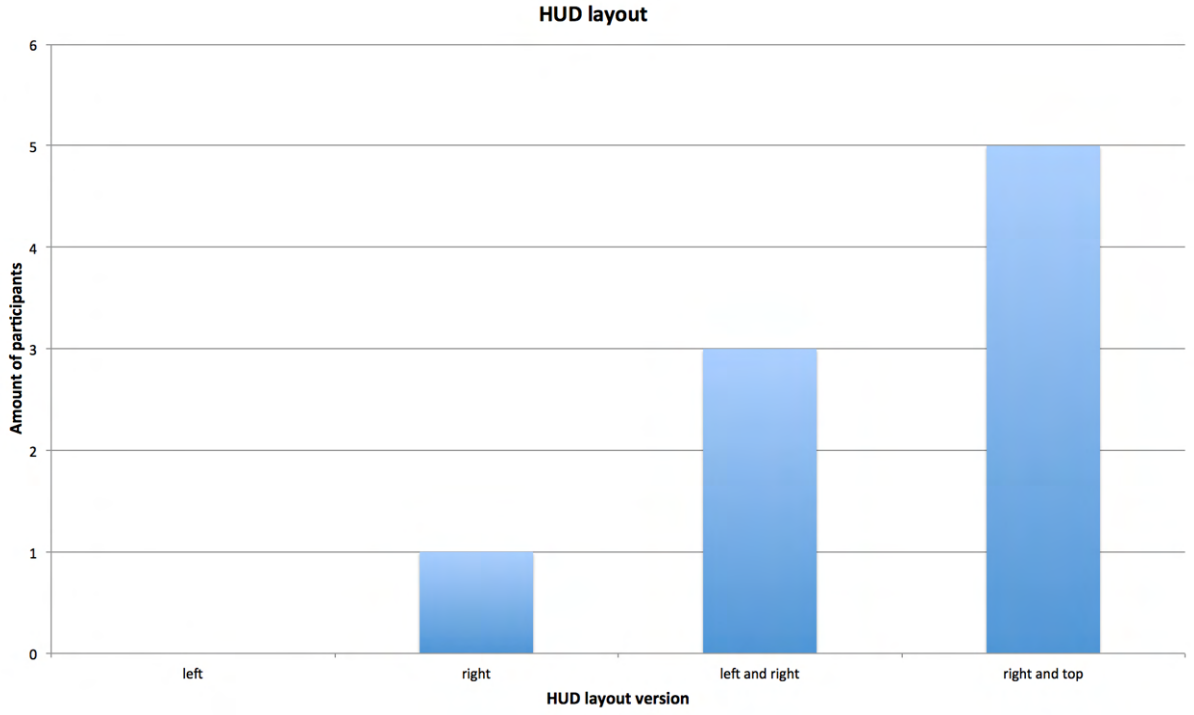


Figure 7.4: Results: Preferred HUD layout

skin on the route within the AR layer. The participants could choose if they prefer a realistic or a cartoon banana or whether they just want to see a point (or dot) on the track, representing the banana skin (see 4.2.2). The majority of 4 participants preferred the realistic themed banana skin, while 3 choose the cartoon version with the argumentation, that this one rather represents the playful character of *Chase 'n' Race*. Only 2 participants wanted to get informed of a banana skin on track as a point, with the comment that there could even be a banana icon within the

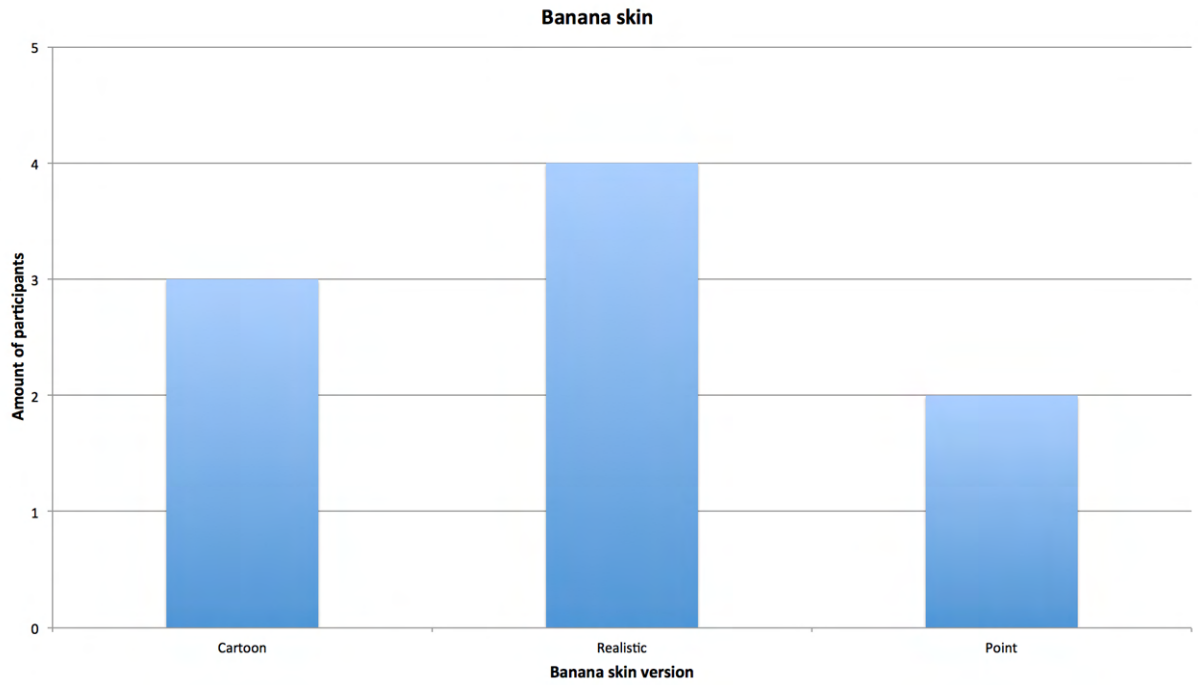


Figure 7.5: Results: Preferred banana skin version

point. This is an interesting idea and can be considered in the future. Figure 7.5 outlines these results. Since the participants' preferences between realistic and cartoon banana are rather close, we suggest to investigate these preferences in further user studies. Alternatively, it could even be thought of the option to include all versions in the game and let the user decide how to theme and skin the graphical representation of *Chase 'n' Race*.

Additionally there are several occasions in the game when the runner is confronted with other virtual ones. During the walkthrough of the designed game we also asked the participants how they would prefer other runners to be visualized. They were presented with an avatar and a realistic version as well as with a point (or dot) as described in 4.2.2. Most of the participants, concretely 5, preferred the realistic version of the runner, which represents rather an outline or shape of a realistic one (see figure 7.6). Participants felt attached to this version, commenting that they are able to build a better connection to the realistic runner since it represents indirectly the running progress of another real runner. Thus it might be more motivating since they are able to identify themselves rather with the realistic representation than with the avatar one. Furthermore, participants noticed that it would be great to provide and display additional information to these other virtual runners, like distance between the runners or even the name and a profile picture. However, it was additionally stated that the two latter ones should only be shown when the runners are actually friends in real life or have some other connection. This thought is an interesting one too and should be further considered in the future development of the game.

The audio information channel was also evaluated during the user study. Therefore the

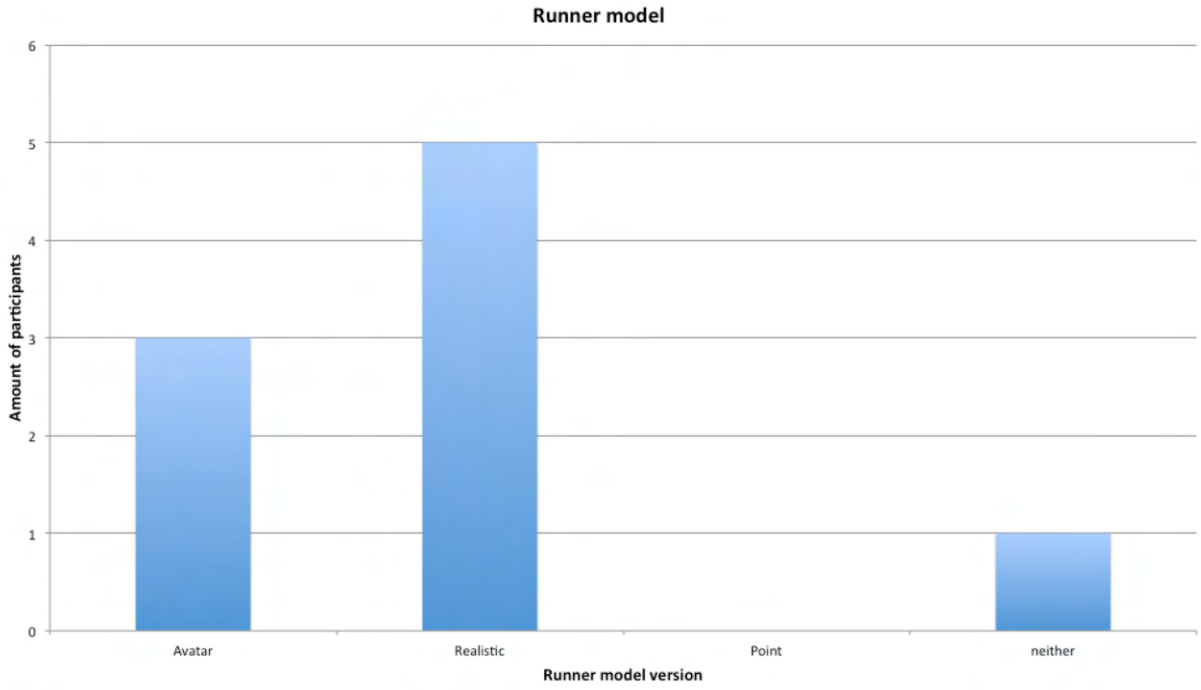


Figure 7.6: Results: Preferred runner model

audio guidance and instructions were presented to the participants in two versions, randomly. One version was addressing the runner using the second-person narrative and thus referring to the runner with "you". The alternative version addressed the runner using third-person narrative. Several audio commentaries were presented to the participants, not just once but multiple times during the walkthrough. Figure 7.7 shows a rather clear result: All participants preferred the second-person narrative version. The participants argued that the second-person narrative is more clear. Eventually they feel to get instructed, which is appreciated. The third-person narrative produced the feeling that they would not run alone but with another person, which even caused confusion by some participants. Consequently, in some cases the moderators had to explain the difference between the two audio versions and what they intended to achieve. Still, the second-person narrative was in the end the preferred one.

7.2.3 Evaluation of the post-study questionnaire

After the moderators finished the presentation as well as the interview during the *Chase 'n' Race* walkthrough, the participants were asked to complete a general questionnaire (see A.5). This section states some of the feedback gathered from the self-constructed questionnaire. Unfortunately, 1 participant did not complete the post-study questionnaire, which is why the following results are based on the feedback of 8 rather than 9 participants.

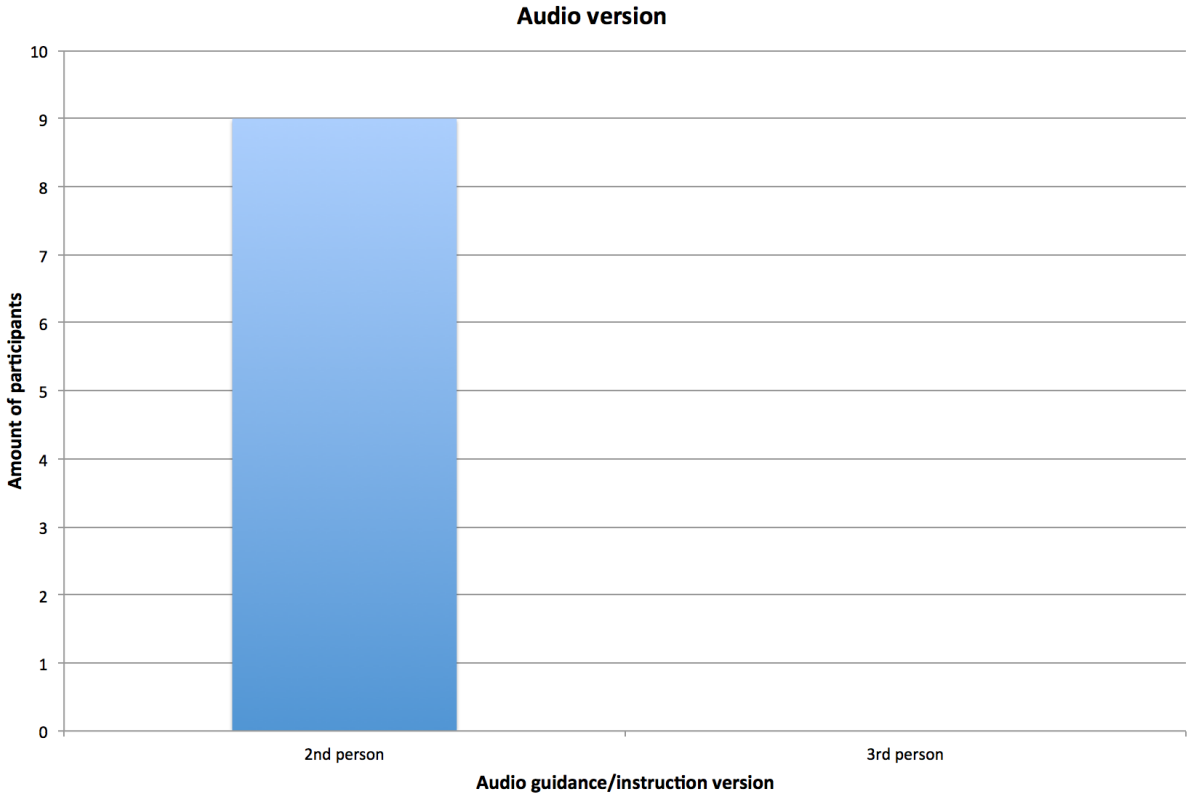


Figure 7.7: Results: Preferred audio narrative version

What is your overall impression of the presented game design concept?
Generally, the participants thought that the concept behind *Chase 'n' Race* is a very good idea. They stated that it is really motivating for people who love challenges on the one hand, and need additional motivation to get running on the other. Especially the combination of running and challenges was considered positively. The participants agreed that the overall concept makes running more interesting and less boring. Thus they could imagine to exercise running more frequently with the usage of such a game. The visual and audio guidance was furthermore considered good. However, participants also noticed that the UI could be enhanced, most certainly through conducting more research targeted especially towards racing games. As previously stated, running challenges were noticed positively, although some participants expressed their opinion that all challenges should be optional and the runner should not be forced to do them. Additionally, one of the participants mentioned that the banana skins seem to be too "gimmicky" and not beneficial to the concept.

Do you think the game would motivate you to go running more often?
Figure 7.8 illustrates the participants answer regarding the questions if they think, the game would motivate them to go running more often.

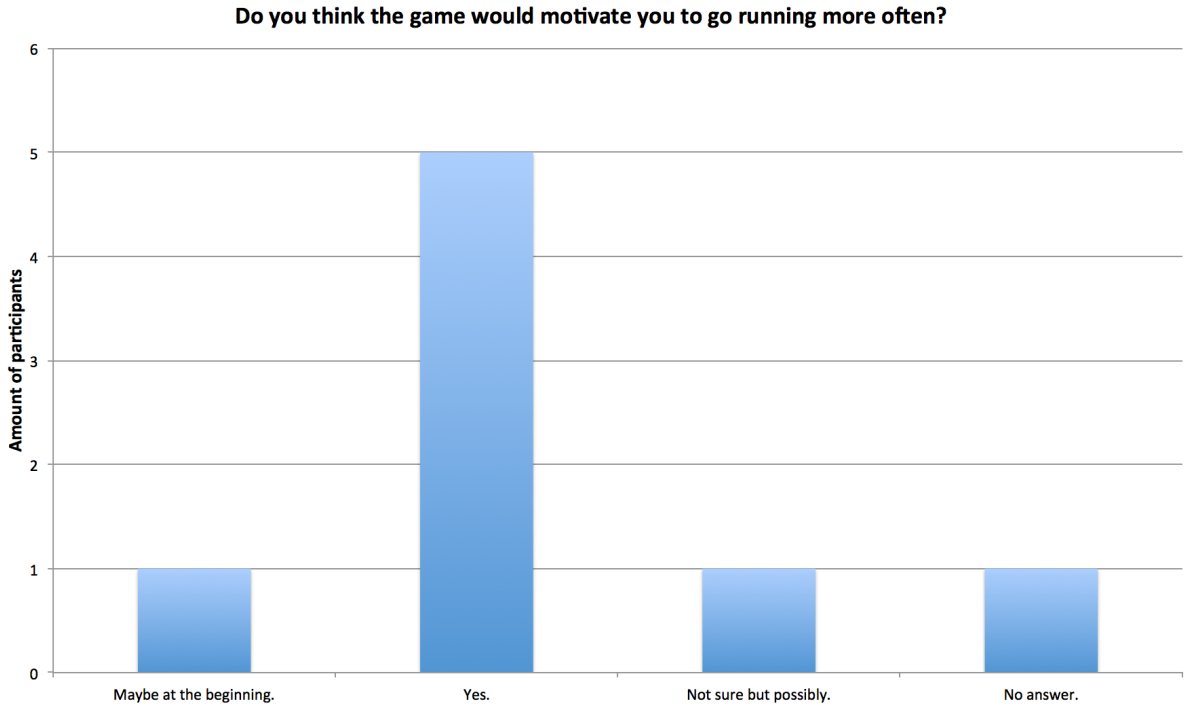


Figure 7.8: Results: Do you think the game would motivate you to go running more often?

Do you think you would be an active part of the community including recording and sharing new running routes?

Participants can imagine to be active part in the community build around *Chase 'n' Race* including recording and sharing new running routes, some on occasion, some rather frequently, as figure 7.9 illustrates.

Do you think the recording and sharing of running routes is a crucial part of the game?

Almost all participants think that recording and sharing running routes is a crucial part of the game. Eventually, this will help runners to discover new routes, as the results show in figure 7.10.

Do you think the combination of audio and visual feedback is a mandatory part of the game?

Figure 7.11 presents the results regarding the question whether the participants thought the combination of audio and visual feedback is a mandatory part of the game or if they can imagine to play the game in an audio-only, video-only respectively, version.

What do you think about the visual presentation of the game?

The opinions regarding the visual presentation of *Chase 'n' Race* are divided. Some of the participants thought that the visual information layer was okay, nice respectively, as well as

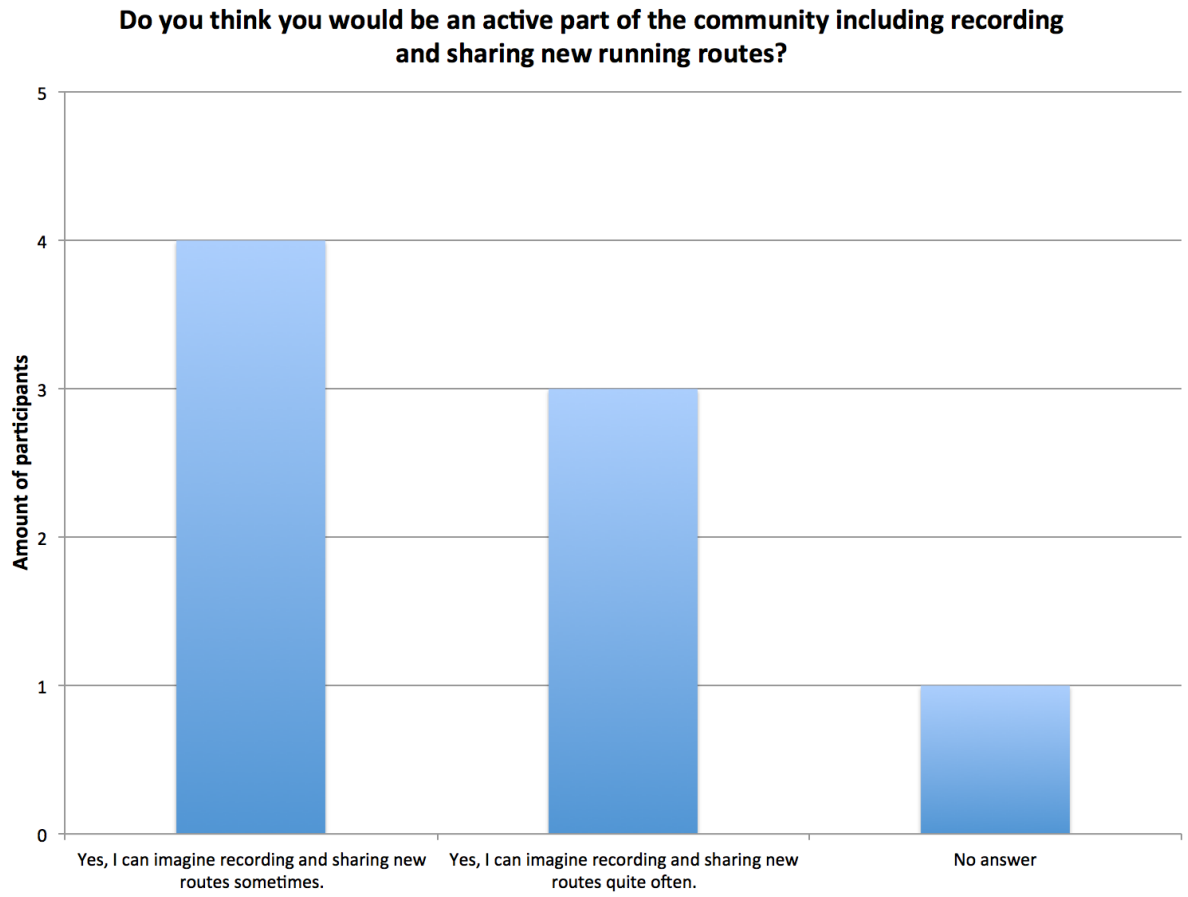


Figure 7.9: Results: Do you think you would be an active part of the community including recording and sharing new running routes?

appropriate, featuring all information needed. The different color themes (blue in normal state, while having a rather red theme on negative events, such as banana slips) were noticed positively. Other participants however thought that the graphics could be better and thus the UI should be further developed in the future. Also one participant mentioned that it would be nice to display statistics periodically, e.g. the average speed during the last run kilometer. Participants also mentioned once more that it would be nice if the runners could arrange the different HUD elements as they would like on the screen, giving them the freedom to customize their personal HUD. This is certainly an interesting thought and should be considering during the next design stages.

What do you think about the aesthetics of the game?

Overall, the first design draft of the games graphics and thus aesthetics seems to be fine and appropriate. The participants noticed that the simplicity of the design is good, focusing eventually on the essential parts and game elements. However, the participants' opinions are divided regarding the realistic versus the cartoon style of the game. Some participants have the opinion,

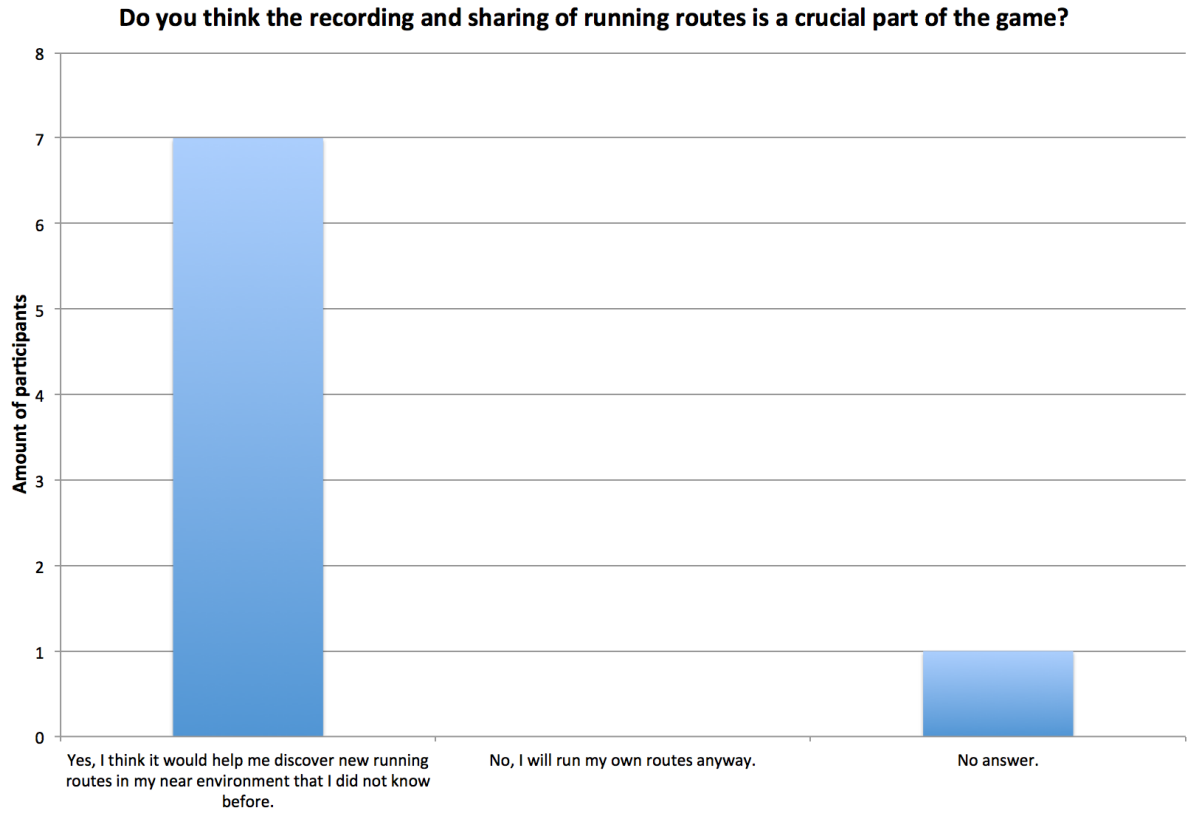


Figure 7.10: Results: Do you think the recording and sharing of running routes is a crucial part of the game?

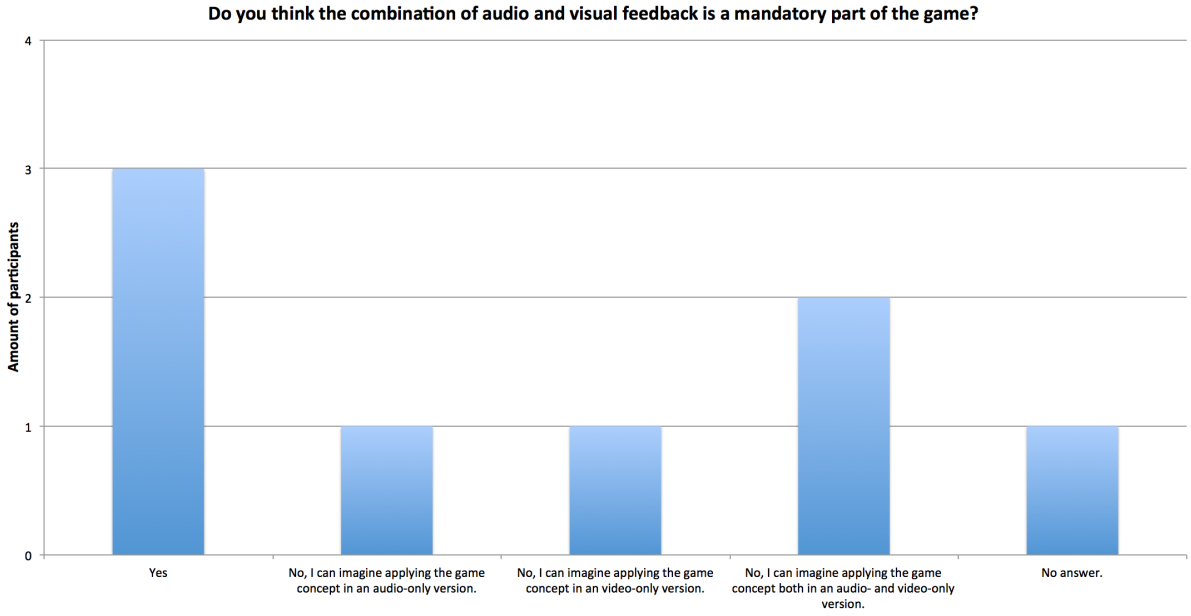


Figure 7.11: Results: Do you think the combination of audio and visual feedback is a mandatory part of the game?

that the mixture of reality with more fiction and cartoon-like elements is nice and somehow funnier, which might distract the runner from the fact that she is actually exercising. On the other hand, some participants thought that the design should be even more realistic, suggesting even options to display different kinds of runners such as females and males, young ones and matures. These results are in line with the feedback gathered through the interviews and shows, that different runners have different preferences. Therefore, providing the runners with the option to choose one of several themes or styles might be considered in the future.

What do you think about the audio feedback of the game?
The audio feedback of *Chase 'n' Race* was received very well. First of all it is to mention that the participants agreed on preferring the second-person narrative for the audio guidance and instructions. Overall, the provided audio feedback in the game was a good idea. The guidance and additional instructions are considered important by the participants. However, some of the participants thought that there was too much spoken audio feedback, e.g. a usual presented event in the game such as a banana skin had two audio comments (one warning 25 meters in front and one after passing, slipping respectively, the banana skin). The participants suggested to have a simple audio effect to replace one of the two spoken audio comments, such as a cheering when a banana skin was successfully passed. Also, some participants voiced misgivings towards the fact that the audio comments might get redundant once the runner knows the game and plays it often. This seems to be an individual preference though. Therefore, the interplay between both audio and video feedback needs to be further examined in the future to make sure that audio-only, video-only respectively, versions of the game are applicable. Since the game design already had this in mind, a proper balancing between visual and audio feedback might be the key to the solution when runners chose to be presented with both information channels at the same time.

Do you think the involvement of other runners is a mandatory part of the game?
Participants agree on the mandatory involvement of other runners in the game, eventually strengthen their desire for competition when playing *Chase 'n' Race*. Figure 7.12 illustrates this result.

What do you think about the playful game elements?
The playful elements of *Chase 'n' Race* were both received positively on the one hand, but also sceptical on the other. Participants thought that they are a really good idea, essentially bringing fun into the activity of running, which is considered important when exercising sports. At the same time, some participants have the opinion that the challenges should be more promoted, setting the real focus on the running habits of the player. Therefore these participants suggested to make these playful game elements optional. This needs further investigation, since the playful game elements are considered an essential part of the game *Chase 'n' Race*.

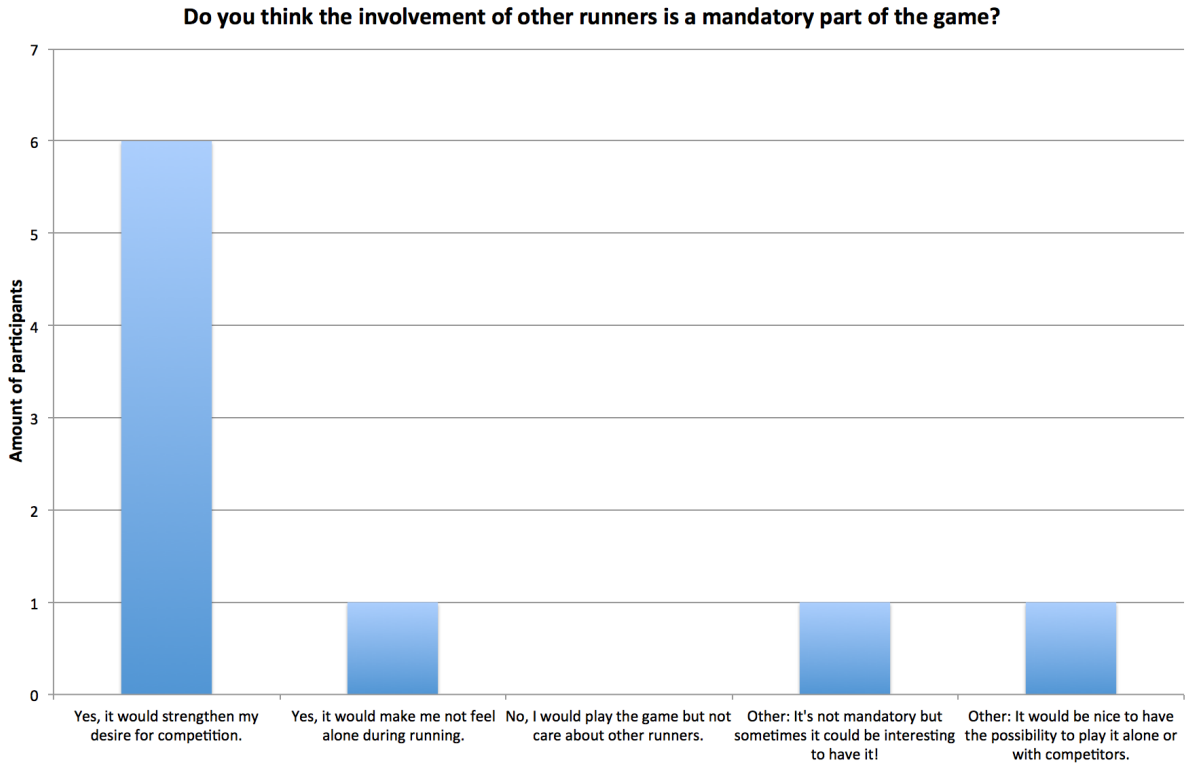


Figure 7.12: Result: Do you think the involvement of other runners is a mandatory part of the game?

Can you think about other playful game elements?

The participants turned out to be very creative regarding the question of whether they can think of other playful elements. The following list represents a selection of the participants' suggestions:

- Puddles, squirrels, branches on the way.
- Mushroom picking.
- Different terrain types, such as a slippery or dangerous road, for not running fast over a certain distance.
- Following an avatar that is running (keeping the same speed as the avatar).
- "Getting chased by Donkey Kong. Extra points for escaping him."
- Catching extra points, e.g. stars, around the route.

What do you think about the challenges in the game?

The presented challenges of *Chase 'n' Race* received incredible positive feedback. They were considered the most important feature and main part in the game, providing more motivation and more fun to the runner, while strengthen the runner's condition through sprinting and velocity-keeping. Thus, they are good for the training. Some participants even suggested to have them more frequently in the game, consequently allowing the runners to test themselves. At the same

time the challenges make the game more diversified and interesting compared to other existing games. One participant mentioned though that the UI needs to be altered to make clear that they are optional, which could not be recognised by the participant.

Can you think about other challenges in the game?
The participants were not as creative thinking about other challenges as they were with thinking about other playful elements. However, the following list presents a selection of interesting thoughts and ideas to consider in the future design and development:

- Hurdle race.
- Run with, against respectively, your own ghost to improve your own performance.
- Side route challenges (leading the runner off the usual route, needs further clarification).
- Off road challenges (challenges on off road territory, such as in the woods or mountain areas, needs further explanation).
- Swimming challenges.
- Checkpoint challenges, to reach checkpoints within a certain time frame.
- Providing runners with the option to choose the amount of challenges they are confronted with.

Do you have any suggestions for improvements or other thoughts?
Finally, the participants were asked for any other suggestions for improvements or thoughts on the presented game that were not covered within other sections of the evaluation. Jumping over obstacles rather than avoiding them was a comment of one participant, arguing that this would ensure that the runner does not collide with other pedestrians, such as cyclists, on the road. Also it was suggested to have overall different game modes, such as one with many sprinting (or other) challenges. Especially the competitive layer seems to work great with the concept and idea of *Chase 'n' Race* and should be further extended. Additionally, it was suggested to have a closer look at existing racing games and their UI design to further develop the one of *Chase 'n' Race*. Integrating background music or even the music of the runner within the game seems also of importance to the participants. In general, the idea of *Chase 'n' Race* was considered "well presented" as well as assessed "innovative", "great" and with "a lot of potential".

8 Discussion

Based on the results of the conducted user study (see 7.1) we can conclude that the overall concept and idea of *Chase 'n' Race* was fairly accepted by all participants. The initial motivation to create a concept around an outdoor running game that should motivate people to exercise running more frequently, while having fun through different kinds of interactions such as playful elements and challenges, could be accomplished. Throughout all interviews the moderators could feel the participants' enthusiasm and curiosity about the present game idea as well as their immediate interest to provide the moderator, game designers respectively, with detailed feedback.

The best reception of the game can be assigned to the in-game challenges and thus the overall competitive character of *Chase 'n' Race*. The participants appreciated the idea of the challenges, indirectly providing a proper training and thus long-time performance increase. Essentially, this was also mentioned by some participants themselves, these challenges can be based on a self-adapting system, meaning that the challenges are based on the overall performance of the runner and making them harder as the runner progresses. Since this would still be covered within the overall game elements, the runner would automatically increase her performance over time through a personal trainer-like intelligence running behind the scenes of the game. The idea of such a self-adaptive challenge system seems to have lots of potential and should definitely be further investigated in the future design of the game.

The banana skins, introducing more playful elements to the game, were received positively and sceptical at the same time. Some participants considered them fun elements that would eventually distract the runner from the running process itself, while others argued with the same reasoning but in a more negative tone, preventing the runner from the running process. This needs further evaluation in the future. The playful elements were intended to distract the runners from exercising in a positive way, but not in a negative one. Resulting from the participants' feedback, we conclude that the acceptance of these playful elements strongly depends on the runners' personal preferences. Providing the players with an option of enable or disable these elements might be a solution to the problem. However it is important to not make too many compromises at the same time but to address one target group properly. Therefore a user study with more participants and a special focus on playful elements on the one hand, and challenges on the other, in order to compare the acceptance of both within the game, should be conducted. Curiously enough, at the same time the participants showed quite some creativity when it came to the question whether the can think about other playful elements for the game (see 7.2.3).

The first version of the graphics and thus visual information layer was accepted by the participants on the one hand, representing a good and solid start. Overall, the HUD design and AR layer need further work and finetuning in their elements. While participants preferred partly a more cartoonish look, partly a more realistic one for the banana skins, they preferred in general a more realistic look for virtual runners. The argumentation of having a more realistic theme

so that the runners could identify themselves easier is understandable. Furthermore the results show that the participants prefer to have the displayed information rather separated than all in one place, which supports their user experience since they e.g. have to look for the current time to the right side of the HUD, while the currently run distance can be found on the left side.

The second-person narrative clearly won against the third-person narrative regarding the presented audio guidance and instruction versions. The participants could not identify themselves with the approach of speaking about them in the third person. Actually, in some cases this even raised confusion. Speaking to and instructing them more directly using the second person ("you") was much more appreciated and clear. Therefore, we can conclude that the third-person narrative should not be pursued in the future, but rather the quality of the audio comments in the second-person narrative can be improved. Also, some participants argued that the spoken audio comments might be or get too much in the future once the runners are more familiar with the game. In the further development and within the first prototype versions, a proper balancing of audio guidance and instructions should be examined in more detail.

Furthermore, there is also the need for an appropriate balance between the audio and visual information layer, especially when the game features three different modi: audio-only, visual-only as well as audio and visual combined. The game designers have to be aware of these challenges in the future. Eventually, this needs further testing using a working prototype and more user studies.

In general, we as both game designers and moderators in the user study are very satisfied with the received feedback and results of the first user study, targeting to examine our initial game idea and concept. While we have proven that we are on the right path to design and develop a game that can eventually motivate amateur and occasional runners, we got lots of constructive and valuable feedback from the conducted user study. These results provide a solid foundation for the future design of the game, consequently providing an even more refined and advanced game experience.

9 Future enhancements

In this report, the concept of *Chase 'n' Race* was presented. Additional ideas, which may be possibly realized in the future to enhance the game, are described in this section. The presented ideas are based on the thoughts of the game designers and would need to be evaluated in the scope of further user studies before they are actually integrated into the game.

9.1 Route profiles and ratings

One possibility to enhance the game is to extend the information about the routes. The players can then specify the characteristics of routes. Those characteristics can contain information if the route is going up hill and down dale or if it is rather flat as well as if it contains lots of streets or if the player runs mainly through a forest. In addition, potential danger zones can be pointed out, e.g. if the route contains sections which are especially dark during evenings. Furthermore, players should be able to add comments regarding temporary obstacles, which make it hard or impossible to follow the route, e.g. road works or construction sites.

Players can also get the possibility to rate a route using a 5-points scale. Thus, players who are browsing through the list of available routes to find a new one can see which routes have a high rating and thus are favored by other users. Together with the rating, players can add a comment to reason the rating.

9.2 Additional in-game elements

Currently, the game contains one in-game item and two in-game challenges. To provide the player with a more varying game experience, more in-game items and in-game challenges could be included.

9.3 Live-challenges

Another way of enhancing the game would be to offer live-challenges to the players. This means, that one player can state a date and a time as well as select a route and invite other players to have a face-to-face race. Guests can have the possibility to invite more players. All invited participants of the live-challenge need to state if they join or not, at the latest three hours before the start time of the race. Players who said they would participate in the event but do not show up should get some kind of penalty.

During the live-challenges, the runners would get the feedback about in-game items and in-game challenges as well as the directions as usual. However, no feedback about other runners who ran the route before, is given, since the challengers of this race are the other participants who run the route at the same time.

9.4 Cycle races and more

The current game is only addressed to runners. In the future, various other types of sport could be included, e.g. cycling, inline skating and more. This would require to define appropriate in-game items and in-game challenges, suitable for each sport.

10 Conclusion

The overall task for the work in this project was to create and design a serious game. Early on we decided to create a game that is set within the context of health and fitness. The aim of the game was to motivate people who usually have difficulties getting themselves started exercising physical activities. For this purpose, we introduced *Chase 'n' Race*, a mobile game for amateur and occasional runners. *Chase 'n' Race* should entertain and thus motivate runners by featuring playful game elements such as virtual banana skins, which need to be avoided, and in-game challenges to test the runner's performance. During the running activity, the player is presented with visual feedback by using Google Glass and an AR information layer on the one hand, as well as audio guidance and instructions through the usage of headphones on the other. At the beginning of the design process, we examined existing games and technologies that could be relevant for the later design of *Chase 'n' Race*. Then we started to create the overall game flow including game elements and challenges, basically creating the game's main mechanics. With the first draft of the game flow we made the visual as well as the audio information layer more concrete, providing first design drafts for both of them. Additionally, a level and reward system was created, presenting the progress of the individual runners. Eventually, in order to get a proof of concept and first feedback concerning *Chase 'n' Race*, we prepared and conducted a user study with nine participants of the initial target group. During the user study we presented a possible walkthrough of the designed game to the participants and collected feedback with both semi-structured interviews as well as a post-study questionnaire. The results show that we are on the right path with designing *Chase 'n' Race*, since the game idea got thoroughly positive and constructive feedback. All participants can imagine to get motivated and eventually go running more often with an application that features the presented game concept and idea. The gathered feedback and collected data provides an excellent foundation for the future design iterations of *Chase 'n' Race*, an outdoor mobile running game.

References

[1] V. R. Basili, "Software modeling and measurement: the Goal/Question/Metric paradigm," p. 24, 1992. [Online]. Available: http://portal.acm.org/citation.cfm?id=137076

[2] D. W. F. Krevelen and R. Poelman, "A Survey of Augmented Reality Technologies , Applications and Limitations," *The International Journal of Virtual Reality*, vol. 9, pp. 1–20, 2010. [Online]. Available: http://www.hindawi.com/journals/jia/2011/721827/

[3] J. Carmigniani, B. Furht, M. Anisetti, P. Ceravolo, E. Damiani, and M. Ivkovic, "Augmented reality technologies, systems and applications," pp. 341–377, 2011.

[4] D. Schmalstieg, T. Langlotz, and M. Billinghurst, "Augmented Reality 2.0," *Virtual Realities*, pp. 13–38, 2011. [Online]. Available: http://link.springer.com/10.1007/978-3-211-99178-7

[5] M. Specht, S. Ternier, and W. Greller, "Mobile Augmented Reality for Learning: A Case Study," pp. 117–127, 2011.

[6] Y. Vazquez-Alvarez, I. Oakley, and S. A. Brewster, "Auditory display design for exploration in mobile audio-augmented reality," *Personal and Ubiquitous Computing*, vol. 16, no. 8, pp. 987–999, Sep. 2011. [Online]. Available: http://link.springer.com/10.1007/s00779-011-0459-0

[7] Mashable.com, *10 Fitness Apps That Boost Your Stamina, Speed and Strength.* Web page, May 29, 2014. [Online]. Available: http://mashable.com/2012/07/26/fitness-apps/

[8] Greatist, *The 64 Best Health and Fitness Apps of 2013.* Web page, May 29, 2014.

[9] DigitalTrends.com, *Best Fitness Gadgets and Tech to get you into Shape.* Web page, May 29, 2014. [Online]. Available: http://www.digitaltrends.com/mobile/best-fitness-trackers-devices-gadgets/#!F0QYQ

[10] RunJumpFly, *Run Jump Fly.* Web page, May 29, 2014. [Online]. Available: http://runjumpfly.ezone.com/

[11] RacketBoy.com, *Platforming Games 101: Running, Jumping and more.* Web page, May 29, 2014. [Online]. Available: http://www.racketboy.com/retro/platformers/platforming-games-101-all-you-need-to-know

[12] DeepKnowHow.com, *Top 10 Augmented Reality Games for Android / iOS platforms.* Web page, May 29, 2014. [Online]. Available: http://deepknowhow.com/2013/12/11/augmented-reality-games-android-iphone/

[13] SixToStart, *Zombies, Run!* iOS App Store, May 29, 2014. [Online]. Available: https://itunes.apple.com/us/app/zombies-run!/id503519713?mt=8

[14] ——, *ZOMBIES, RUN! Running game & audio adventure for iOS/Android.* Web page, May 29, 2014. [Online]. Available: https://www.kickstarter.com/projects/sixtostart/zombies-run-a-running-game-and-audio-adventure-for

[15] Everest, *Everest.* Web page, May 29, 2014. [Online]. Available: http://www.everest.com/

[16] AcrossThePondSoftware, *Missile Wars.* iOS App Store, May 29, 2014. [Online]. Available: https://itunes.apple.com/us/app/missile-wars/id415376172?mt=8

[17] GAINFitness, *GAIN Fitness.* Web page, May 29, 2014. [Online]. Available: http://gainfitness.com/

[18] Strava, *Strava Running and Cycling - GPS Run and Ride Tracker.* iOS App Store, May 29, 2014. [Online]. Available: https://itunes.apple.com/app/strava-cycling/id426826309?mt=8

[19] Jawbone, *Jawbone UP.* Web page, May 29, 2014. [Online]. Available: https://jawbone.com/up

[20] CharityMiles, *Charity Miles.* iOS App Store, May 29, 2014. [Online]. Available: https://itunes.apple.com/us/app/charity-miles/id505253234

[21] PanStudio, *Run An Empire - The Real-World Territory Control Game.* Web page, May 29, 2014. [Online]. Available: https://www.kickstarter.com/projects/panstudio/run-an-empire-the-real-world-territory-control-gam

[22] FleetyCorporation, *Fleetly Fitness*. iOS App Store, May 29, 2014. [Online]. Available: https://itunes.apple.com/en/app/fleetly/id400220868?mt=8

[23] CruiseControl, *Cruise Control*. Web page, May 29, 2014. [Online]. Available: http://www.cruisecontrolrun.com/

[24] Teemo, *Teemo*. Twitter, May 29, 2014. [Online]. Available: https://twitter.com/goteemo

[25] ZenLabs, "C25K," in *2014*. Web page, May 29. [Online]. Available: http://c25kfree.com/

[26] Everest, *Everest Challenges*. Web page, May 29, 2014. [Online]. Available: http://www.everest.com/challenges

[27] Nintendo.com, *Mario Kart 64*. Web page, May 29, 2014. [Online]. Available: http://www.nintendo.com/games/detail/ypYFdZloLpIo5g7mvh9xXj0gLcT7KGSy

[28] SEGA, *Sonic The Hedgehog*. Web page, May 29, 2014. [Online]. Available: http://www.sonicthehedgehog.com/

[29] D. E. Grey, *Doing Research in the Real World*, 2nd ed. SAGE Publications Ltd, 2009. [Online]. Available: http://www.uk.sagepub.com/books/Book232627

List of Figures

List of Tables

A Appendix

A.1 Collected Data

The following data will be collected by the application:

Player

- username
- avatar
- age
- level
- player statistics
  - created routes
  - started routes
  - finished routes
  - placed in-app items
  - four-leaf clovers
  - completed tasks
    - sprints
    - velocity-keeping
    - banana skins
      - slipped
      - passed
  - run statistics
    - distance
    - time
    - average speed

Route

- location data
- distance
- in-app items
- tasks

Figure A.1: Collected data of the runner

A.2 Level system: Experience point calculator

The experience point calculator can be accessed online: `http://bit.ly/1poHCPw`

A.3 Audio versions

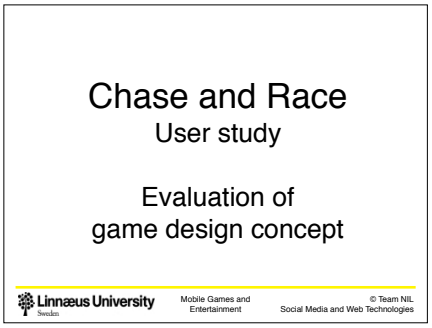
Situation	Comment 1	Comment 2	Sound
Start – sunny	Welcome to the running challenge today with wonderful sunshine! All participants are already getting excited – who will win todays challenge?	Welcome to the running challenge today with wonderful sunshine! All participants are already getting excited – who will win todays challenge?	
Start – cloudy	Welcome to the running challenge! Today the weather is cloudy, but all participants are already getting excited – who will win todays challenge?	Welcome to the running challenge! Today the weather is cloudy, but all participants are already getting excited – who will win todays challenge?	
Start – rainy	Welcome to the running challenge today! Even the rain cannot stop the participants from this race. Everyone is already getting excited – who will win todays challenge?	Welcome to the running challenge today! Even the rain cannot stop the participants from this race. Everyone is already getting excited – who will win todays challenge?	
Start – day	Welcome to the running challenge today! All participants are already getting excited – who will win todays challenge?	Welcome to the running challenge today! All participants are already getting excited – who will win todays challenge?	
Start – night, clear	Welcome to the running challenge! It is a beautiful, clear night. All participants are already getting excited – who will win todays challenge?	Welcome to the running challenge! It is a beautiful, clear night. All participants are already getting excited – who will win todays challenge?	
Start – night	Welcome to the running challenge tonight! All participants are already getting excited – who	Welcome to the running challenge tonight! All participants are already getting excited – who	

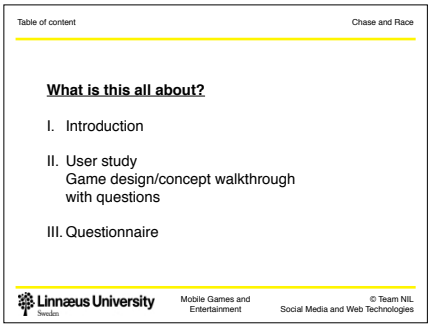
Tasks – velocity challenge x meters in front of runner	Velocity challenge in x meters. The runner is getting prepared.	Velocity challenge in x meters. Get prepared!	
Tasks – Sprinting challenge directly in front of runner	Sprinting challenge in front of the runner. The runner is getting ready.	Sprinting challenge in front of you. Get ready!	
Tasks – velocity challenge directly in front of runner	Velocity challenge in front of the runner. The runner is getting ready.	Velocity challenge in front of you. Get ready!	
Tasks – start signal			Whistling 1x
Tasks – end signal			Whistling 3x
Tasks – velocity challenge – first ten steps			“Heart beat” (different sounds for ‘too fast’ and ‘too slow’
Tasks – after finishing rank y (within Top 10)	Congratulations to the runner for getting the y-th rank in this challenge!	Congratulations! You got the y-th rank in this challenge!	Applause
Banana skin x meters in front of runner	Attention! There is a banana skin x meters in front of the runner. The runner should better sidestep or jump over it than slipping…	Attention! There is a banana skin x meters in front of you! Sidestep it to avoid slipping!	
Banana skin directly in front of runner	The runner tries to sidestep or jump over the banana skin!	Sidestep the banana skin now!	
Banana skin – player passed	Well done! The runner passed the banana skin without any problems.	Well done! You successfully passed the banana skin!	Applause
Banana skin – player slipped	Oh no! The runner slipped on the banana skin!	Oh no! You slipped on the banana skin!	Slipping and hitting the ground
Banana skin – player uses four-leaf clover	The player stepped on the banana skin but apparently he/she had an extra portion of luck	You stepped on the banana skin but the four-leaf clover in your	Magically sound

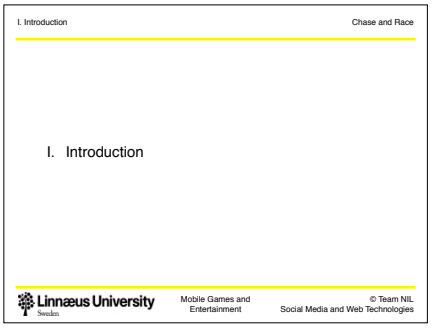
	will win todays challenge?	will win todays challenge?	
Start – last 5 seconds	Start in 5 seconds. 5 – 4 - 3 – 2 – 1 – go!	Start in 5 seconds. 5 – 4 - 3 – 2 – 1 – go!	Start-gun
Finish in x meters	The runner will reach the finish line in x meters.	You will reach the finish line in x meters!	
Finish			Whistle (2x ?), Applause
Information about distance (x kilometers)	The runner managed already x kilometers	You ran already x kilometers!	
Challenger x Meter in front of runner – runner is getting closer to challenger	The runner is getting closer to the challenger in front of him! Now approximately x meters are between those two.	You are getting closer to the runner in front of you! You are only x meter behind him!	High beeping, getting louder
Challenger x Meter in front of runner – runner is falling behind challenger	The runner is falling slightly behind the challenger in front of him! Now approximately x meters are between those two.	You are falling slightly behind the challenger in front of you. Now approximately x meters are between you two.	High beeping, getting quieter
Challenger x Meter behind runner – challenger is getting closer to runner	The challenger behind the runner is getting closer to him! Now approximately x meters are between those two.	The challenger behind you is getting closer! He is only x meters behind you!	Low beeping, getting louder
Challenger x Meter behind of runner – challenger is falling behind runner	The challenger behind the runner is falling more behind! Now approximately x meters separate those two.	The challenger behind you is falling more behind! Now approximately x meters separate you two.	Low beeping, getting more quiet
Challenger - runner	The runner passed the challenger!	You passed the challenger!	
Tasks – Sprinting challenge x meters in front of runner	Sprinting challenge in x meters. The runner is getting prepared.	Sprinting challenge in x meters. Get prepared!	

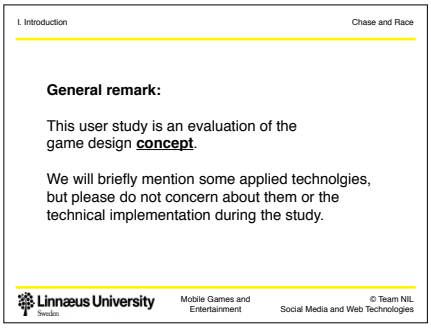
	in his/her pocket so that he/she did not slip!	pocket protected you from falling down!	
Guidance - turn right in x meters	The runner will need to turn right in x meters.	You need to turn right in x meters!	
Guidance - turn left in x meters	The runner will need to turn left in x meters.	You need to turn left in x meters!	
Guidance - turn right	The runner turns to the right.	Turn right now!	
Guidance - turn left	The runner turns to the left.	Turn left now!	
Guidance - run straight in x meters	The runner will need to continue running straight ahead in x meters.	You need to continue running straight ahead in x meters!	
Guidance - run straight	The runner continues running straight ahead.	Run straight ahead now!	

A.4 User study: Presentation









I. Introduction Chase and Race

What is Chase and Race ?

- mobile game
- main activity: running
- targeted at amateur runners
- audio and visual feedback
- time-displaced interaction with other runners
- personal profile with level- and reward-system

Linnæus University Sweden Mobile Games and Entertainment © Team NIL Social Media and Web Technologies

I. Introduction Chase and Race

Audio and visual feedback:

- audio: via headphones
  - instructions and guidance
- visual: using Augmented Reality (AR)
  - e.g. Google Glass
- feedback and guidance
  - route
  - game elements (obstacles, challenges)
  - other runners

Linnæus University Sweden Mobile Games and Entertainment © Team NIL Social Media and Web Technologies

I. Introduction Chase and Race

Google Glass
Source: http://www.google.com/glass/

Linnæus University Sweden Mobile Games and Entertainment © Team NIL Social Media and Web Technologies

I. Introduction Chase and Race

Augmented Reality (AR) - User view
Source: http://kenlonseth.blogspot.se/2013/02/augmented-reality-hud.html

Linnæus University Sweden Mobile Games and Entertainment © Team NIL Social Media and Web Technologies

II. User study Chase and Race

II. User study

Game design/concept walkthrough
with questions

Linnæus University Sweden Mobile Games and Entertainment © Team NIL Social Media and Web Technologies

II. User study Chase and Race

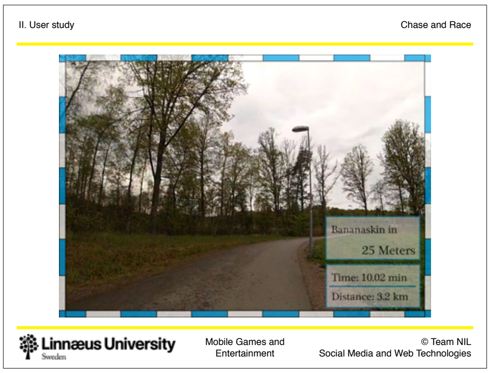
Linnæus University Sweden Mobile Games and Entertainment © Team NIL Social Media and Web Technologies

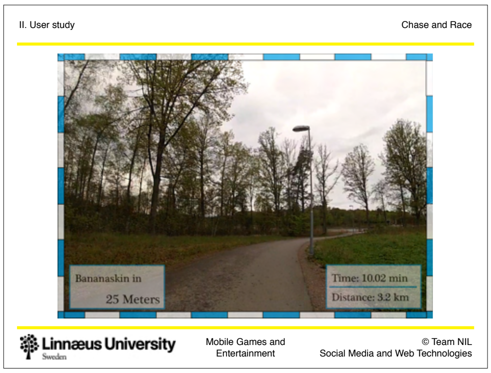
II. User study Chase and Race

Linnæus University Sweden Mobile Games and Entertainment © Team NIL Social Media and Web Technologies

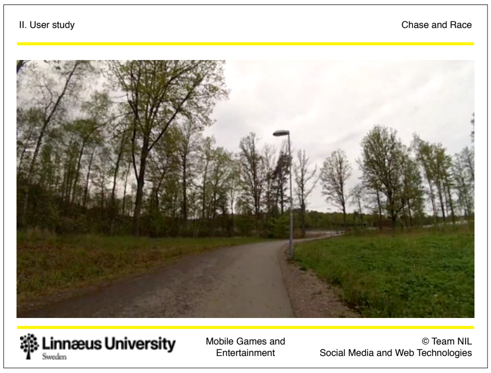
II. User study Chase and Race

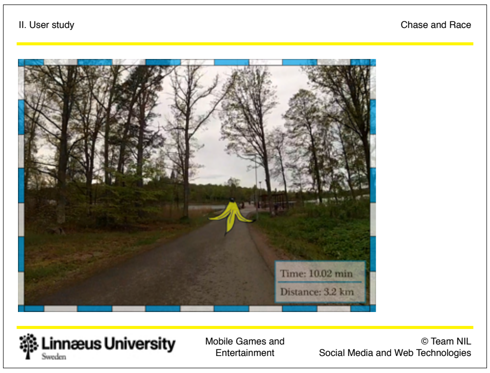
Linnæus University Sweden Mobile Games and Entertainment © Team NIL Social Media and Web Technologies

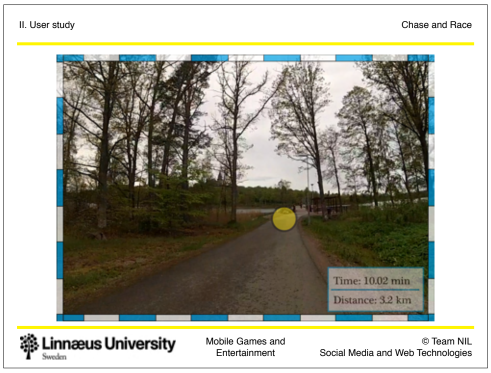

II. User study
Chase and Race
Bananaskin in
25 Meters
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and
Entertainment
© Team NIL
Social Media and Web Technologies

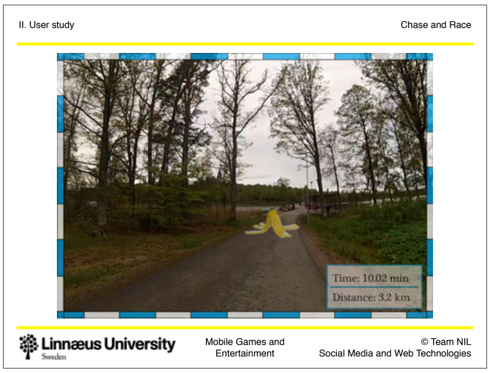

II. User study
Chase and Race
Bananaskin in
25 Meters
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and
Entertainment
© Team NIL
Social Media and Web Technologies

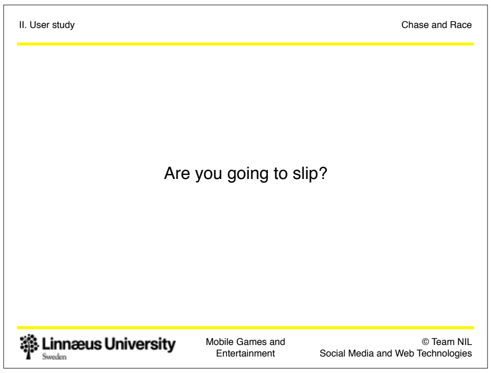

II. User study
Chase and Race
in 25 Meters
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and
Entertainment
© Team NIL
Social Media and Web Technologies

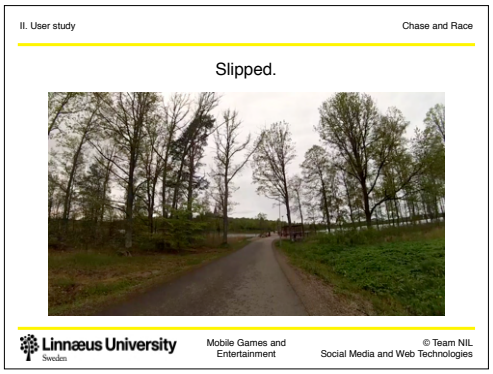

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and
Entertainment
© Team NIL
Social Media and Web Technologies

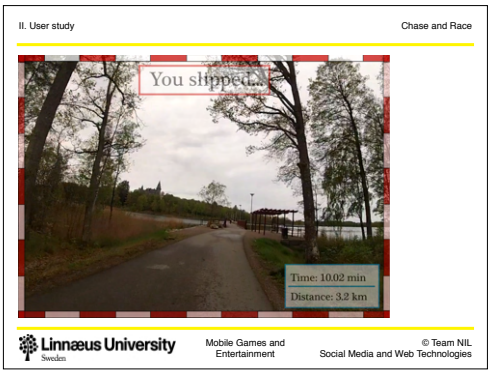

II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and
Entertainment
© Team NIL
Social Media and Web Technologies

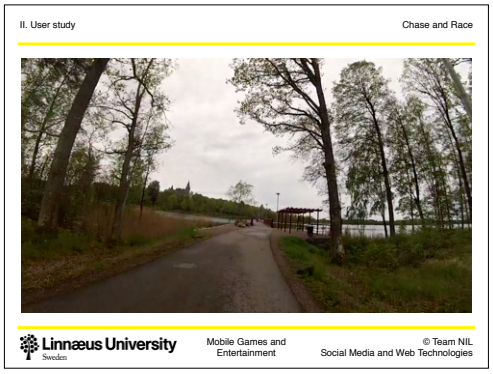

II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and
Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and
Entertainment
© Team NIL
Social Media and Web Technologies

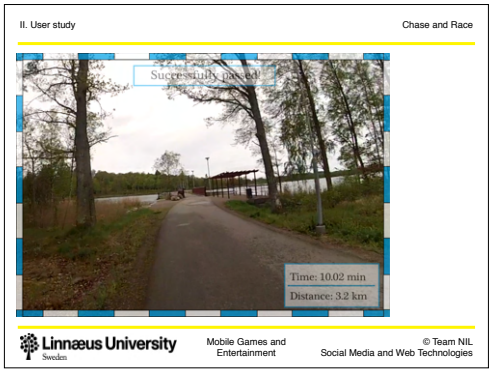

II. User study
Chase and Race
Are you going to slip?
Linnæus University
Sweden
Mobile Games and
Entertainment
© Team NIL
Social Media and Web Technologies

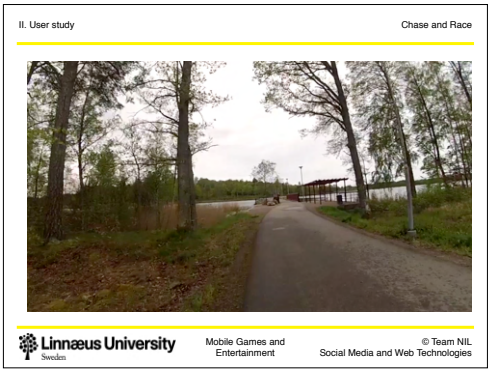

II. User study
Chase and Race
Slipped.
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

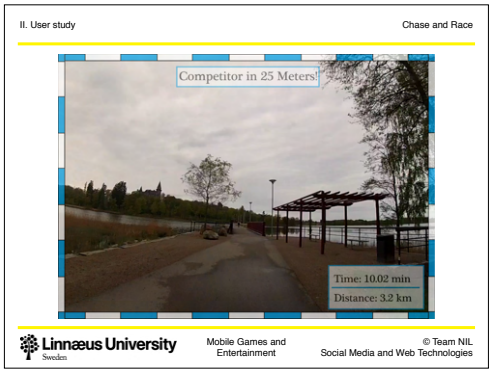

II. User study
Chase and Race
You slipped...
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

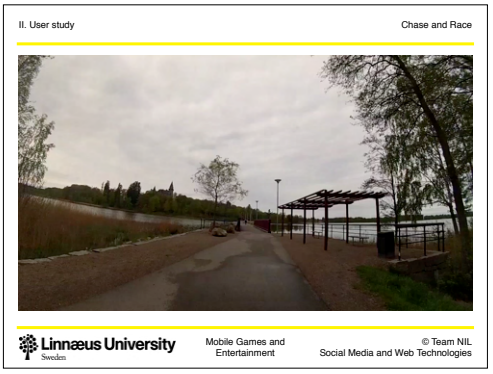

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

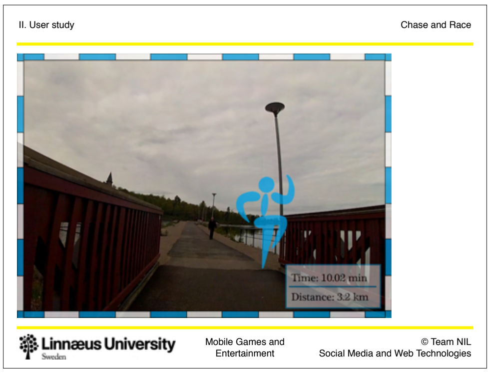

II. User study
Chase and Race
Not slipped.
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

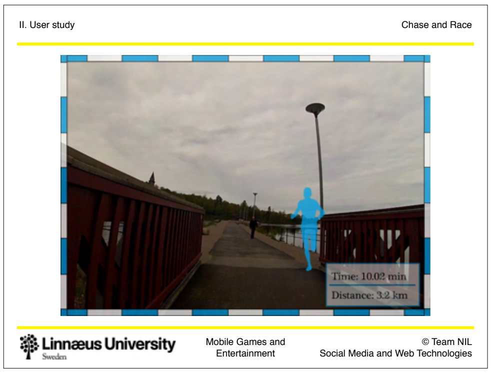

II. User study
Chase and Race
Successfully passed!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

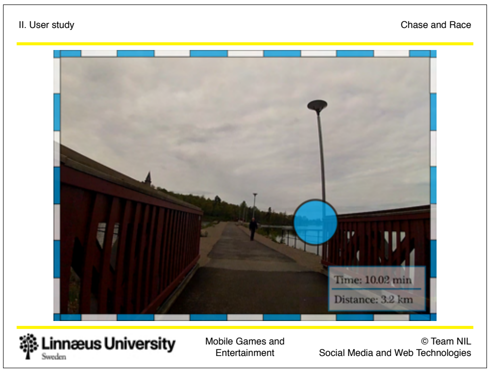

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

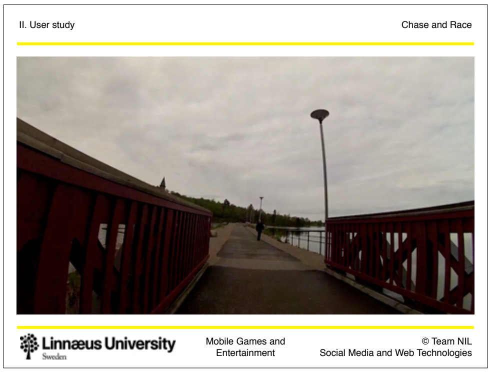

II. User study
Chase and Race
Competitor in 25 Meters!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

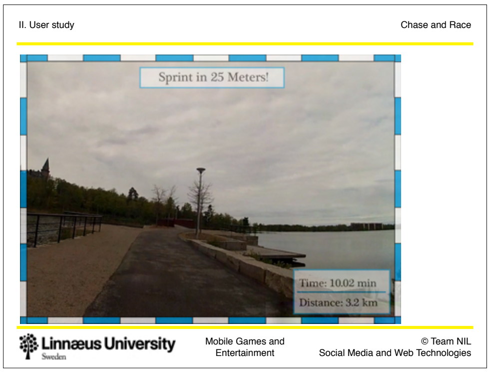

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

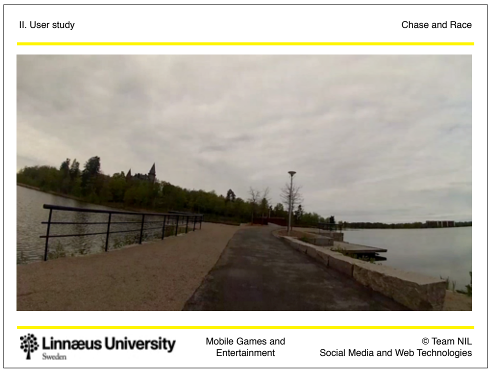

II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

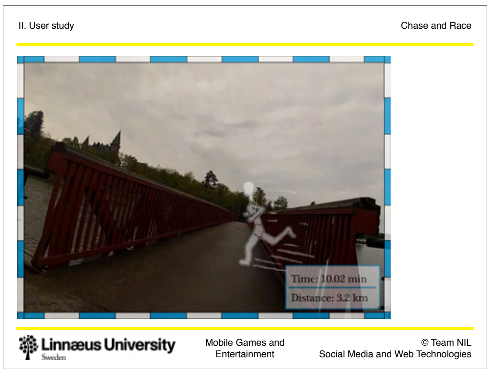

II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

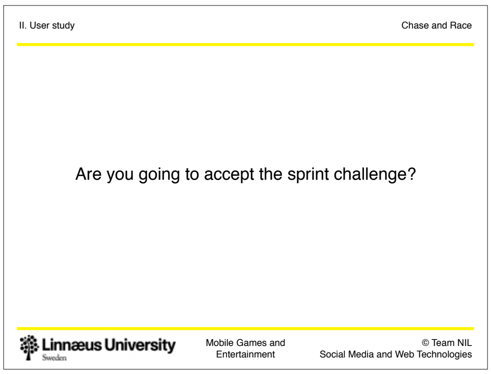

II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

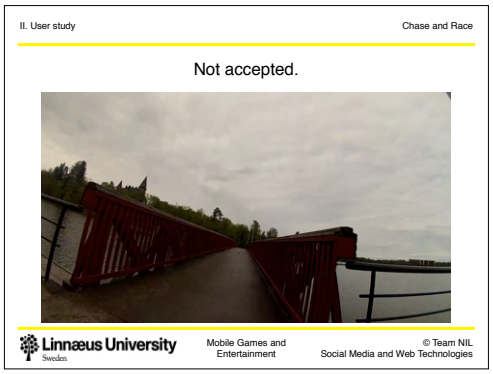

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

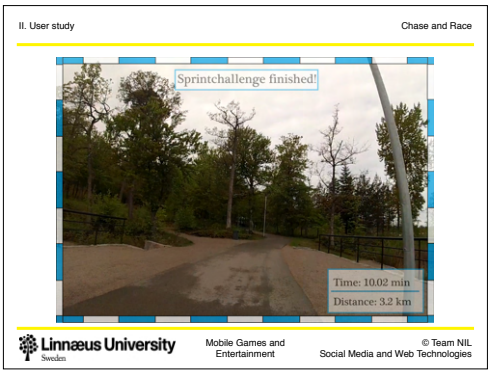

II. User study
Chase and Race
Sprint in 25 Meters!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

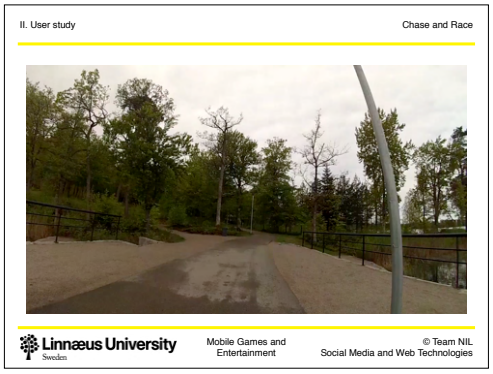

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

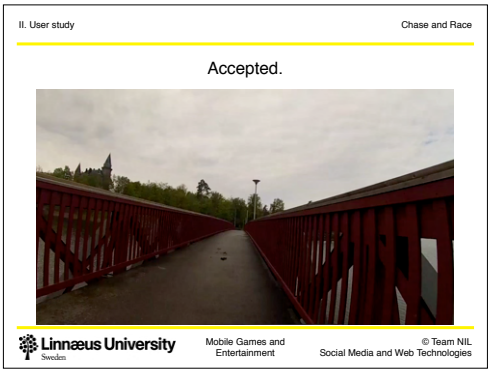

II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Are you going to accept the sprint challenge?
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

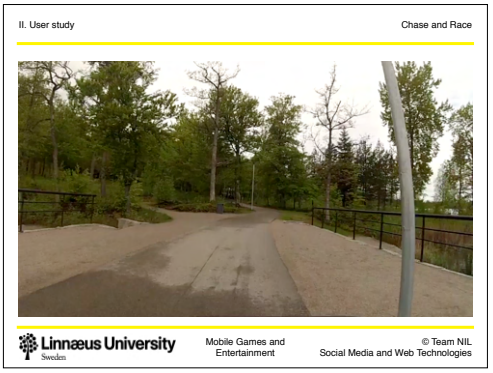

II. User study
Chase and Race
Not accepted.
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Sprintchallenge finished!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

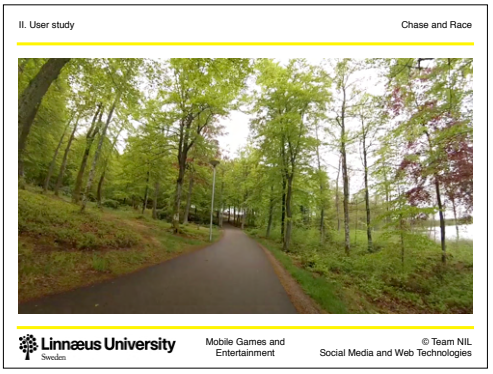

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Accepted.
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

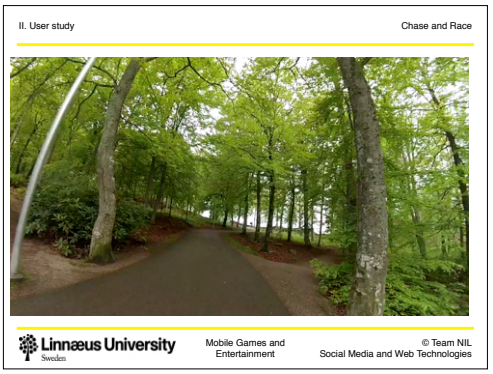

II. User study
Chase and Race
Sprintchallenge finished!
Sprinting Rank:
5th Rank
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

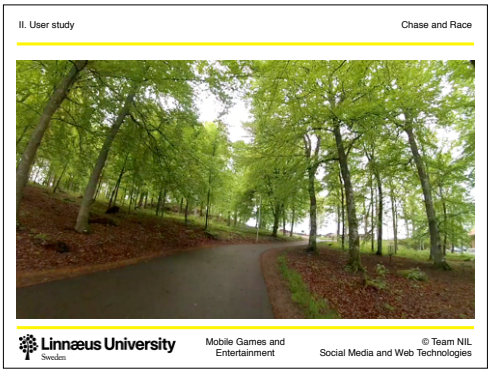

II. User study
Chase and Race
Guidance in 25 Meters!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

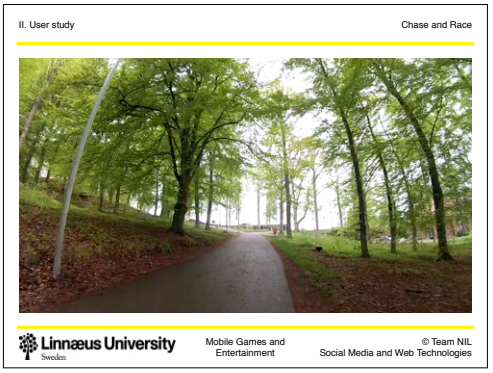

II. User study
Chase and Race
Run straight ahead!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

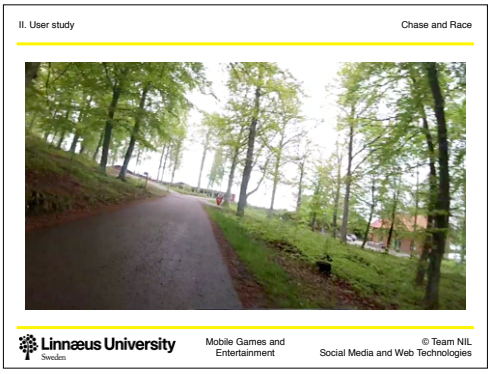

II. User study
Chase and Race
Guidance in
25 Meters
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

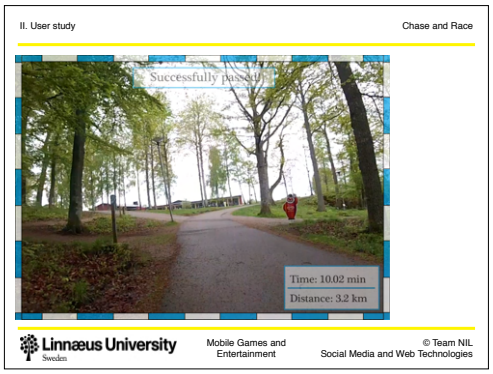

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

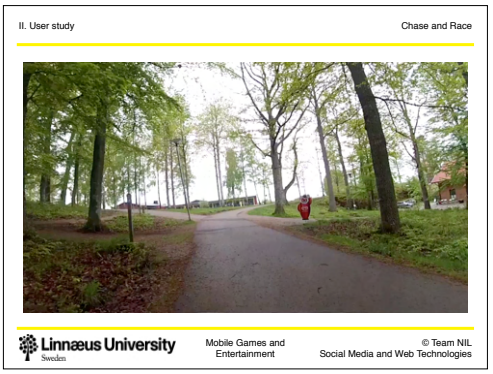

II. User study
Chase and Race
Guidance in 25 Meters
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Successfully passed!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

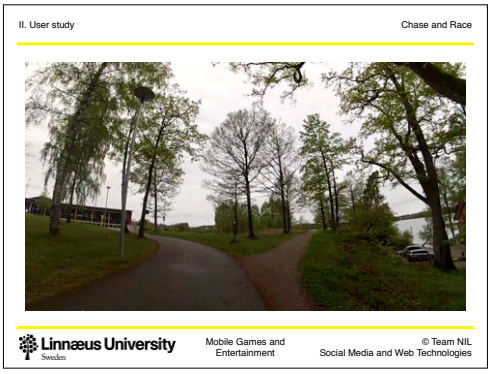

II. User study
Chase and Race
Run straight ahead!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

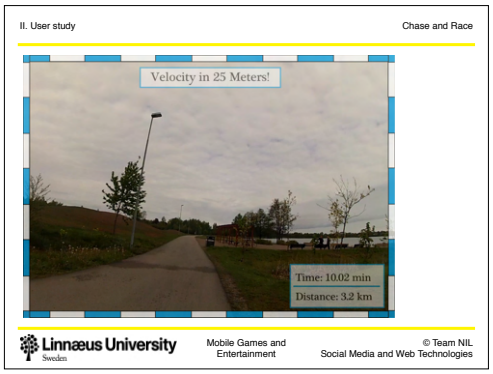

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

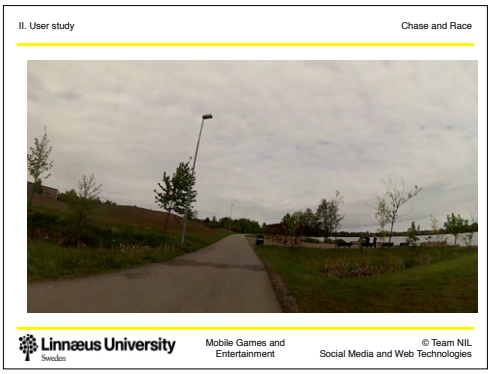

II. User study
Chase and Race
Guidance in 25 Meters!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

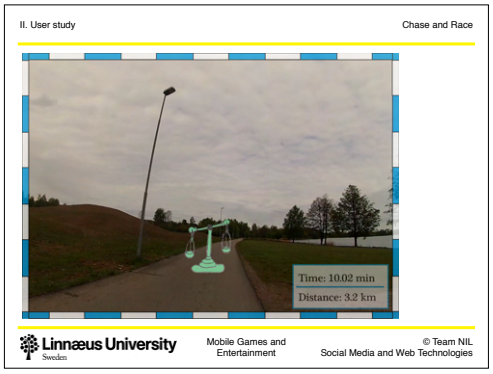

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Turn right!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

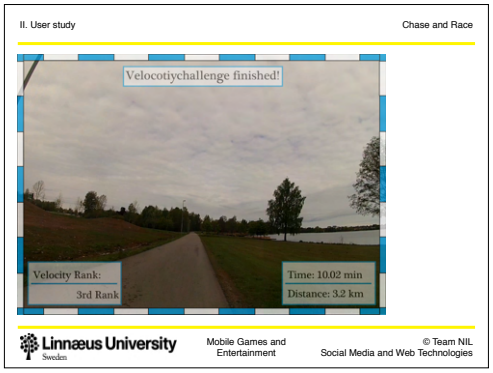

II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

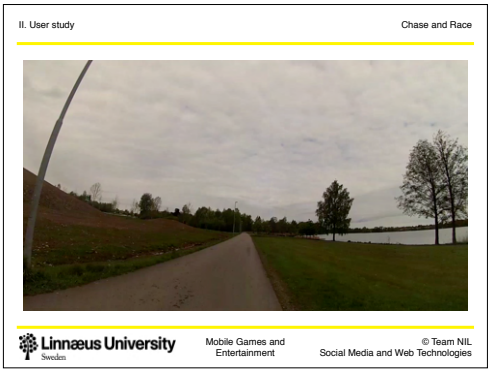

II. User study
Chase and Race
Velocity in 25 Meters!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

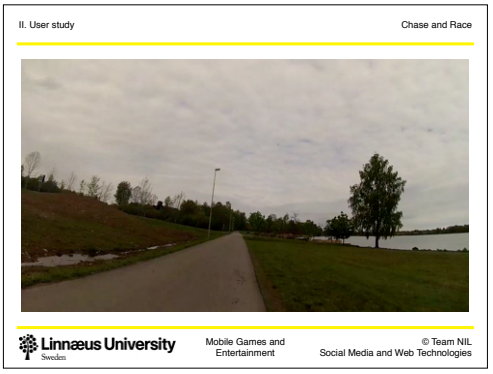

II. User study
Chase and Race
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Velocotiychallenge finished!
Velocity Rank:
3rd Rank
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Finishline in 25 Meters!
Time: 10.02 min
Distance: 3.2 km
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies


II. User study
Chase and Race
Linnæus University
Sweden
Mobile Games and Entertainment
© Team NIL
Social Media and Web Technologies

III. Questionnaire

We prepared a questionnaire in order to collect some data.

Please fill out the **Google Forms questionnaire** based on the impressions you collected through today's session.

http://bit.ly/1sOjhA4

Thank you very much for your participation!

Chase and Race - Game design concept evaluation

This questionnaire is part of our evaluation of the game design concept for the game “Chase and Race”. The work on this project is conducted within the course “Mobile Games and Entertainment” in the master program “Social Media and Web Technologies” at the Linnaeus University, Växjö, Sweden. Please complete the questions honest and as detailed as possible. Your answers are an essential part of our work and would strongly enhance its results.

Project leaders:
Lisa M. Ruehmann - lr222gu@student.lnu.se
Isabella Nake - in222cu@student.lnu.se
Nico Reski - nico.reski@lnu.se

1. **What is your overall impression of the presented game design concept?**
   Please describe your impressions in a few sentences.

   .....

   .....

   .....

   .....

   .....

2. **Do you think the game would motivate you to go running more often?**
   Mark only one oval.

   ◯ Yes
   ◯ No
   ◯ Not sure
   ◯ Other: .....

3. **Do you think you would be an active part of the community including recording and sharing new running routes?**
   Mark only one oval.

   ◯ Yes, I can imagine recording and sharing new routes quite often.
   ◯ Yes, I can imagine recording and sharing new routes sometimes.
   ◯ No, I would just use routes that other community members created.
   ◯ Other: .....

4. **Do you think the recording and sharing of running routes is a crucial part of the game?**
   Mark only one oval.

   ◯ Yes, I think it would help me discover new running routes in my near environment that I did not know before.
   ◯ No, I will run my own routes anyway.
   ◯ Other: .....

A.5 User study: Self-constructed questionnaire

5. **Do you think the combination of audio and visual feedback is a mandatory part of the game?**
   Mark only one oval.

   - ◯ Yes
   - ◯ No, I can imagine applying the game concept in an audio-only version.
   - ◯ No, I can imagine applying the game concept in an video-only version.
   - ◯ No, I can imagine applying the game concept both in an audio- and video-only version.
   - ◯ Other: .....

6. **What do you think about the visual presentation of the game?**
   Please state your thoughts about the visual presented information. Were they too much or too few? Do you think important information were missing?

   .....
   .....
   .....
   .....
   .....

7. **What do you think about the aesthetics of the game?**
   Please state your thoughts about the presented aesthetics of the game.

   .....
   .....
   .....
   .....
   .....

8. **What do you think about the audio feedback of the game?**
   Please state your thoughts about the audio instructions and guidances.

   .....
   .....
   .....
   .....
   .....

9. **Do you think the involvement of other runners is a mandatory part of the game?**
   Tick all that apply.

   - ☐ Yes, it would strengthen my desire for competition.
   - ☐ Yes, it would make me not feel alone during running.
   - ☐ No, I would play the game but not care about other runners.
   - ☐ Other: .....

10. **What do you think about the playful game elements?**
    Please state your opinion about the playful game elements (like banana skins, four-clover leaf protections ...) in the game.

    .....
    .....
    .....
    .....
    .....

11. **Can you think about other playful game elements?**
    Please tell us your ideas for additional game elements you can imagine.

    .....
    .....
    .....
    .....
    .....

12. **What do you think about the challenges in the game?**
    Please state your opinion about the challenges (sprint, velocity keeping) in the game.

    .....
    .....
    .....
    .....
    .....

13. **Can you think about other challenges in the game?**
    Please tell us your ideas for additional game elements in the game.

    .....
    .....
    .....
    .....
    .....

14. **Do you have any suggestions for improvements or other thoughts?**

    .....
    .....
    .....
    .....
    .....

Powered by

A.6 User study: Participation consent

User study: Chase and Race

This questionnaire is part of our evaluation of the game design concept for the game *"Chase and Race"*. The work on this project is conducted within the course *"Mobile Games and Entertainment"* in the master program *"Social Media and Web Technologies"* at the Linnaeus University, Växjö, Sweden. Please complete the questions honest and as detailed as possible. Your answers are an essential part of our work and would strongly enhance its results.

Project leaders:	Lisa M. Ruehmann	lr222gu@student.lnu.se
	Isabella Nake	in222cu@student.lnu.se
	Nico Reski	nico.reski@lnu.se

User constent

- ☐ I am aware that the participation in this study is voluntary and that I can withdraw at any point in time.
- ☐ I agree that the data I provide during the study is beeing processed within the boundaries of the presented project, and the presented project only.
- ☐ I agree that the presentation and my participation is being audio-recorded. Only the project leaders will have access to these recordings.
- ☐ I agree that my identity remains anonysmously and only cursory information (such as age, gender) are collected and processed.
- ☐ I agree that the data I provide during the study is being presented publicly within the format of a project report.

Participants's name

Participants's signature

1

A.7 User study: Preliminary questionnaire

Overall personal information

Date of participation:

Age:	< 20	20 - 21	22 - 23	24 - 25	25 - 26	27 - 28	28 - 29	>= 30
	☐	☐	☐	☐	☐	☐	☐	☐

Gender:	Male	Female
	☐	☐

Prior experience exercising physical activities, concretly running:
How much experiences do you have exercising physical activities, concretly running? (multiple answers possible)

- ☐ I exercise physical activities (going to a gym, playing in a sports club) on a regular basis.
- ☐ I exercise physical activities occasionally, on a irregular basis.
- ☐ I am going running on a regular basis.
- ☐ I am going running occasionally, on a irregular basis.
- ☐ I barely exercise physical activities.
- ☐ I never go running.
- ☐ other:

A.8 User study: Internal questionnaire

Start:
Banana skin in 25 Meters:
Explain concept of Banana skin

Which HUD is prefered?
0 left 0 right 0 left & right 0 right & top

Banana skin:
Order of shown banana skins (write numbers from 1-3)
___ Real Banana ___ Cartoon Banana ___ Point

Which Banana skin is prefered?
0 Real Banana 0 Cartoon Banana 0 Point

Does the runner slip or sidestep the banana?
0 Slip 0 Sidestep

Banana skin slipped:
Comment: 2nd or 3rd person played first?
0 2nd person 0 3rd person

Comment: 2nd or 3rd person prefered?
0 2nd person 0 3rd person

Banana skin passed:
Comment: 2nd or 3rd person played first?
0 2nd person 0 3rd person

Comment: 2nd or 3rd person prefered?
0 2nd person 0 3rd person

Challenger 25 m in front:
Challenger: Which one was shown first?
0 Avatar 0 Point

Which challenger is prefered?
0 Avatar 0 Point

Challenger directly in front:
Which challenger is prefered?
0 Avatar 0 Point

Sprinting challenge in 25m:
Explain Sprinting challenge

Sprinting challenge:
Comment: 2nd or 3rd person played first?
0 2nd person 0 3rd person

Comment: 2nd or 3rd person prefered?
0 2nd person 0 3rd person

Does the runner accept the challenge?
0 No sprinting 0 Sprinting

Sprinting challenge over:

Sprinting challenge Top10:
We tell the runner if he/she is within the Top10 - should the range be changed? (write number of prefered ranks)

0 ___ ranks would be better 0 10 is a good choice

Guidance in 25 m - straight ahead:
Guidance run straight:
Banana skin in 25 meters:
Guidance in 25m - straight ahead:
Banana skin:
Banana skin passed:
Guidance run straight:

Guidance in 25m - turn right:
Comment: 2nd or 3rd person played first?
0 2nd person 0 3rd person

Comment: 2nd or 3rd person prefered?
0 2nd person 0 3rd person

Guidance turn right:
After the runner turned right, the video is fast forwarded to the velocity challenge

Velocity Challenge in 25m:
Explain velocity challenge

Velocity Challenge:

Velocity challenge over:

Velocity challenge Top10:
If not answered before: We tell the runner if he/she is within the Top10 - should the range be changed? (write number of prefered ranks)

0 ___ ranks would be better 0 10 is a good choice

Finish Line in 25m:
Finish: