Introduction

These are outtakes from the UX research and design report for a project around the service RaceClocker undertaken as part of the course UXAD in 2021.

RaceClocker is a service with which users can organize and time races in any sport.

What follows are some of the pages regarding the redesign and testing/validation of the timekeeping portion of the app, since this is where I was most heavily involved.
Page numbers and continuity will make no sense.

- David Tiemstra

UX Design

After completing Participants, it is time to share links with the Timekeepers and introduce them to the RaceClocker Timekeeping tool.
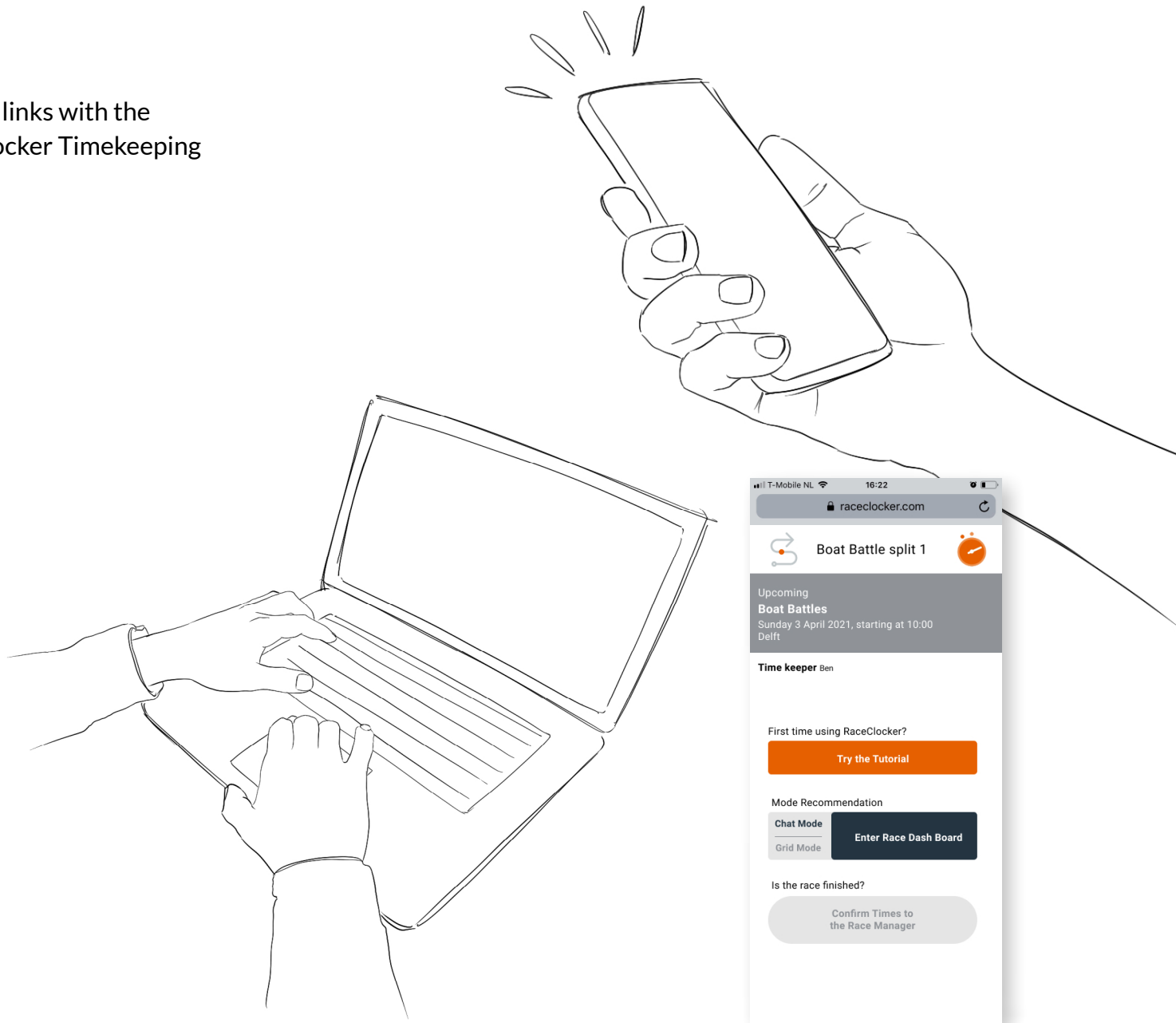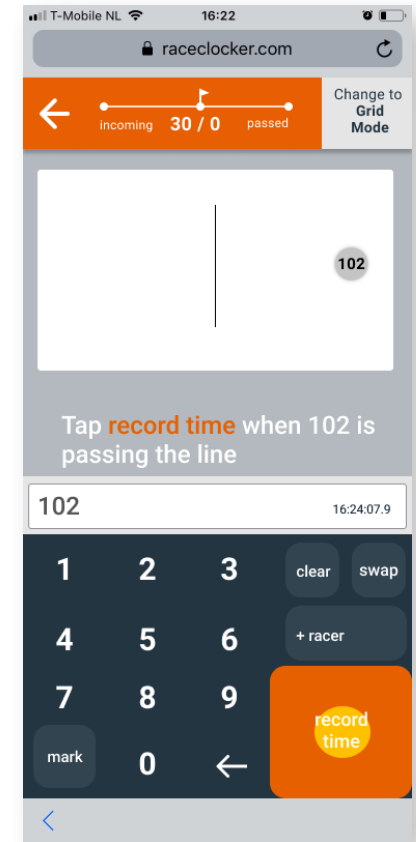
8. Timekeeper landing page:
First introduction to RaceClocker timekeeping

Practice time recording with the Timekeeper Tutorial

In preparation for the race, the Timekeeper practices time recording
with the Timekeeper Tutorial to get familiar with the recording times.
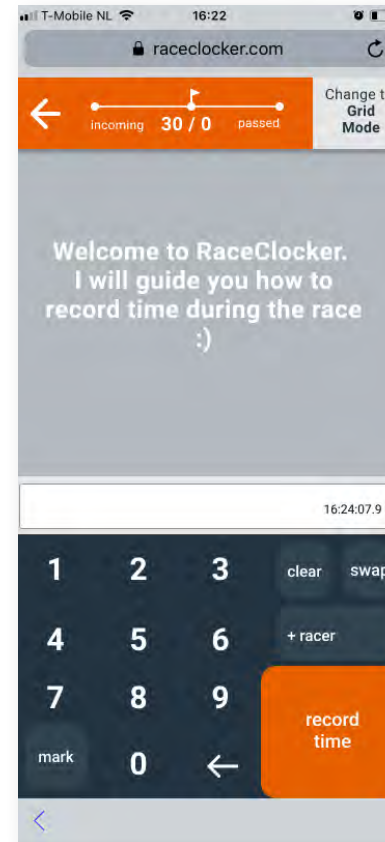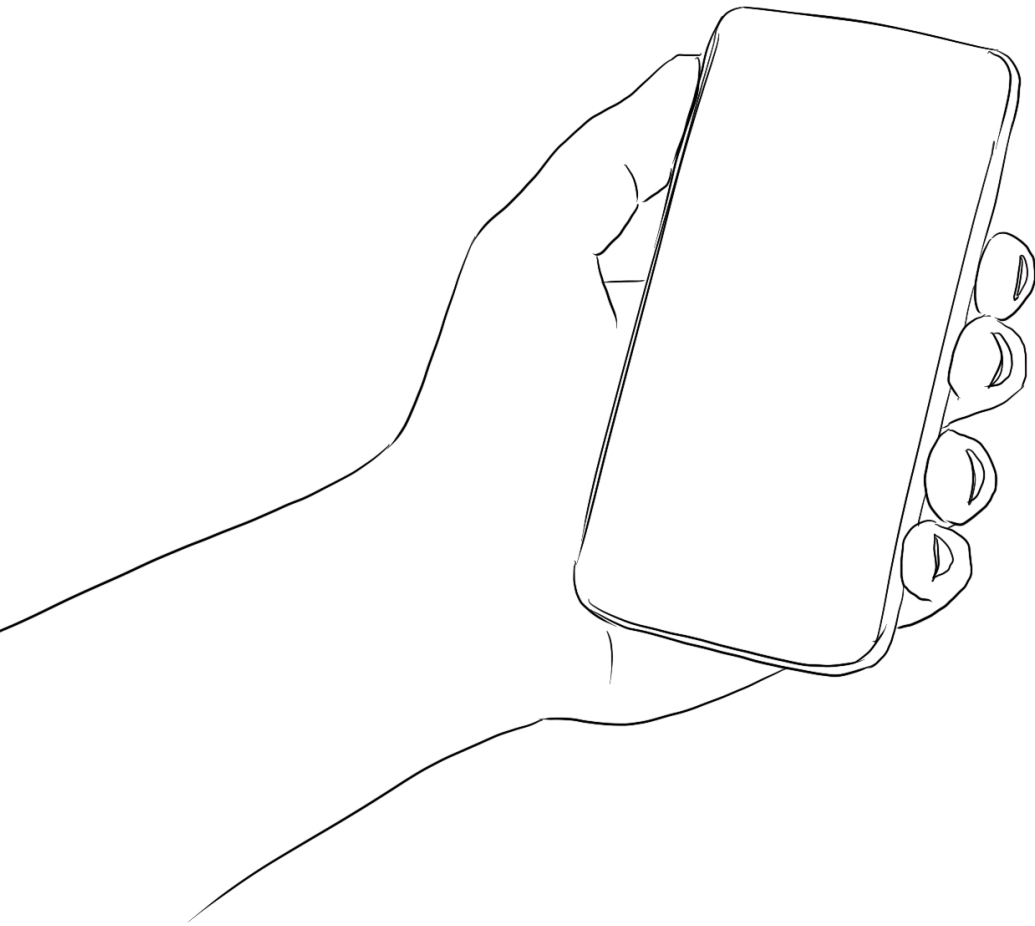
9. Timekeeper Tutorial:
Follow the step-by-step tutorial

10. Timekeeper Tutorial:
Practice timing

Time record the participants during the live race

The Timekeepers are in position and ready to time record. Depending on their preference, they can switch the timing interface between Chat Mode and Grid Mode.

Once all participants have passed and recordings are complete, the Timekeeper confirms and notifies the Race Manager.
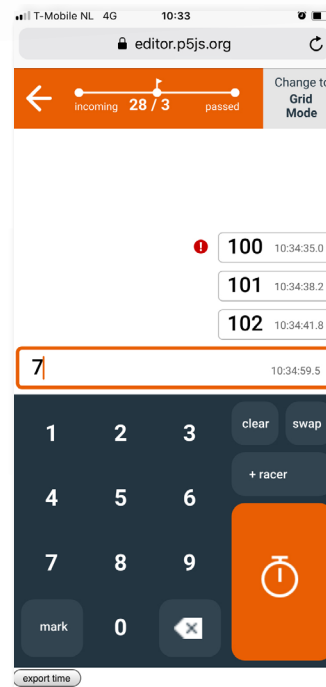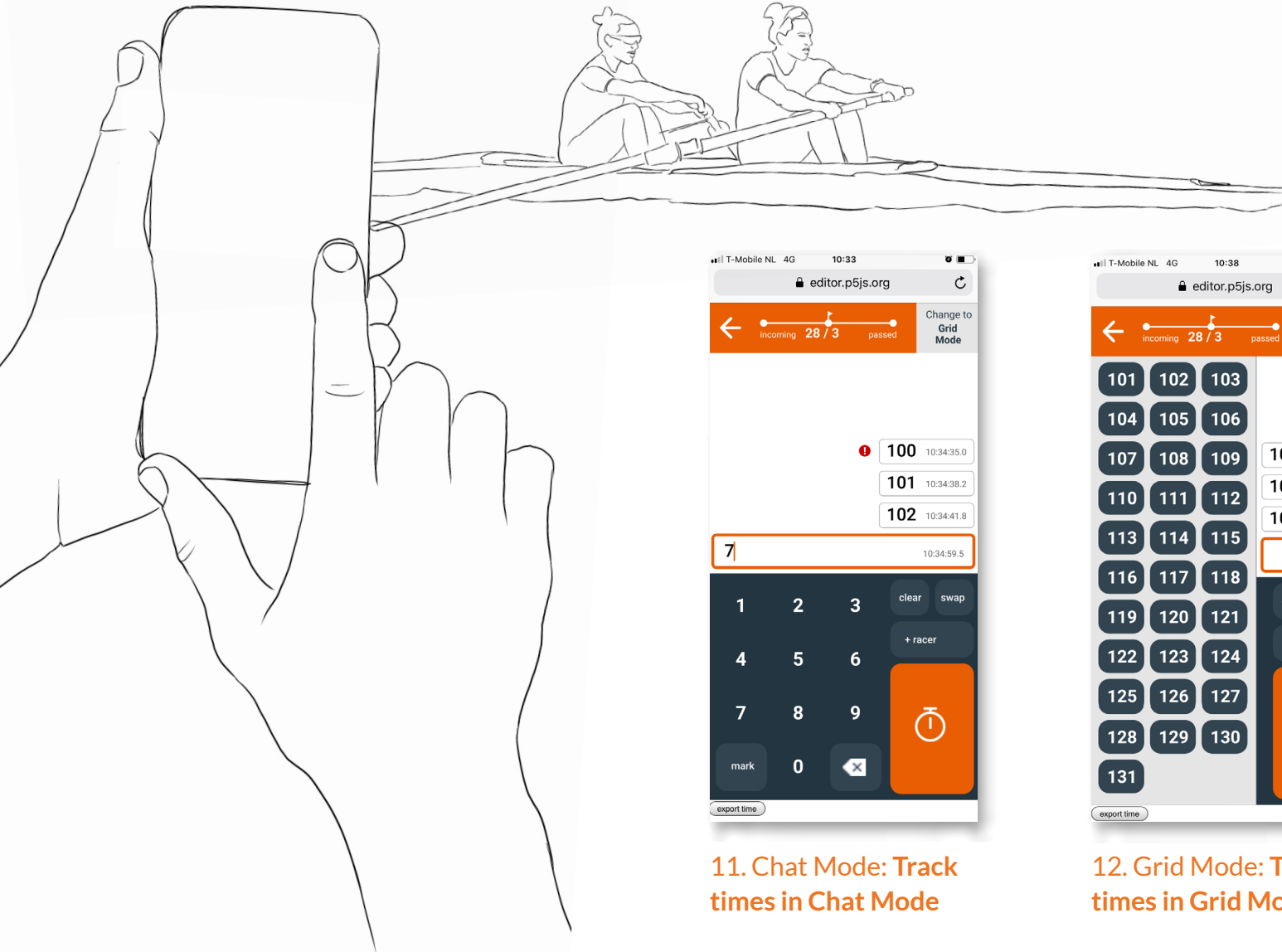
11. Chat Mode: **Track times in Chat Mode**
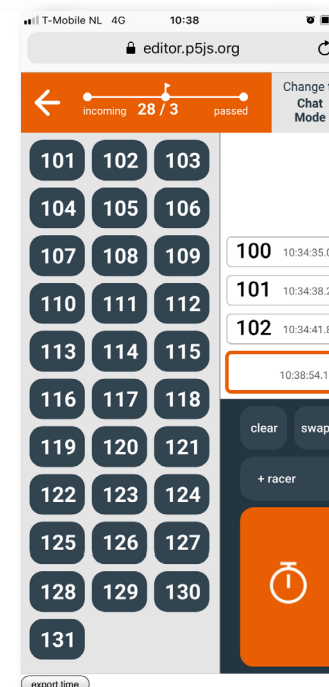
12. Grid Mode: **Track times in Grid Mode**

13. Timekeeper landing page: **Confirm recorded times**

2.3 Timekeeper Optimization Process

Timekeeper Redesign process

In the redesign of the Timekeeper, there are three main screens which are, the Timekeeper landing page, tutorial, and timer. Among these screens, designing the interaction of the button elements in the chat mode of the timer was the major focus. Especially, a lot of alternative decisions about improving the functional buttons were suggested. Herein, the processes are introduced.
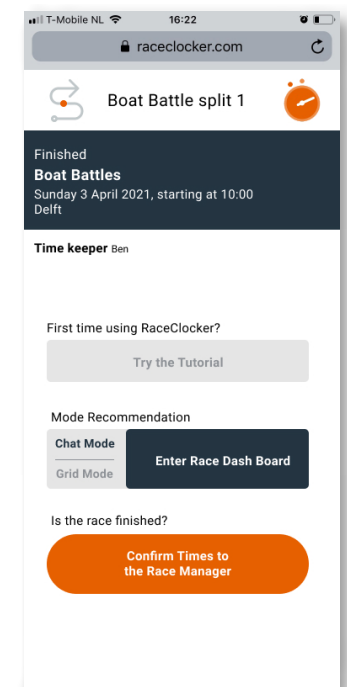
Goals 1: The performance of the Timekeeper is as accurate as possible

+Racer-button: In the earlier stage of the redesign process, the concept of the +Racer-button was to assign the same time to multiple racers(duplicate time). However, in the real race scenario, many racers passed the split line with little time difference rather than passing it all at the same time. Therefore, **for the accuracy of the time records**, it was decided that the +Racer-button should serve a two-step function with queuing the racers ahead of time.

Goal 2. The recording time should require the minimum amount of action.

Not having a confirm button: In Timer, the way for the system to recognize when the Timekeeper types the last digit of racer number was needed. For this, the alternative way was to make a Confirm button. But as a final decision, it was decided that before the race, Race Manager should set the number of digits of the racer number in the system. So that the number of actions needed in recording time could remain as minimal as possible.
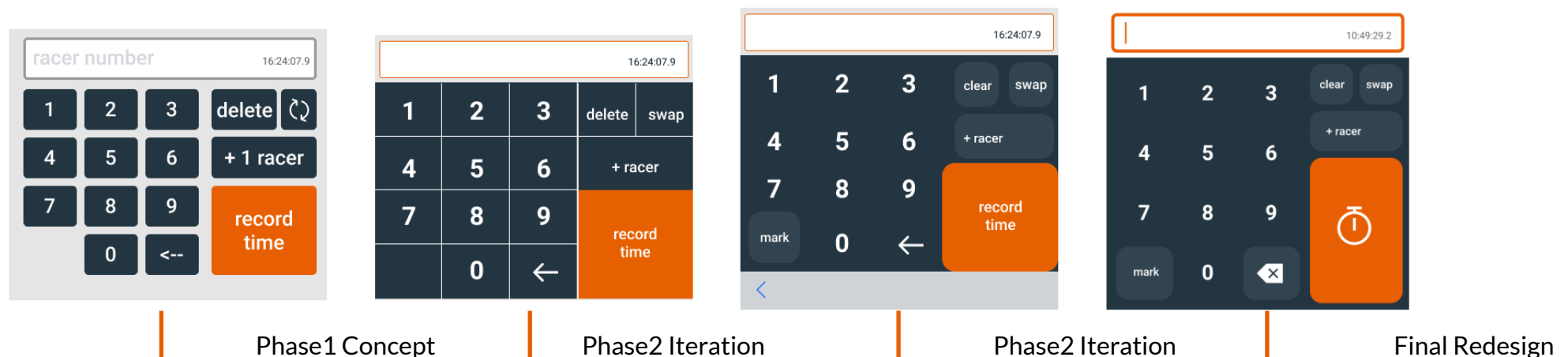

Phase1 Concept	Phase2 Iteration	Phase2 Iteration	Final Redesign

Figure 5: Timekeeper design iterations

Goals 1: The performance of the Timekeeper is as accurate as possible

+Racer-button: Being able to record multiple racers in a short intervals is an important function to improve the accuracy in timekeeping.
The + Racer button allows the Timekeeper to first queue the racers approaching to the split line and time them in succession within a short interval.

Key Pad(in the prototype): To be error-proof as possible when tapping the numbers, the buttons are designed in large size, and especially the 'Record time'-button became noticeable in size, so the users can always press it to record time. The proportion between the area of the number buttons and the functional buttons was set based on the decision that it should be compatible for both chat mode and grid mode when there is a mode change in between the race. Also, the naming of the buttons was improved to be more easily understandable.

Figure 6: Chat mode screens
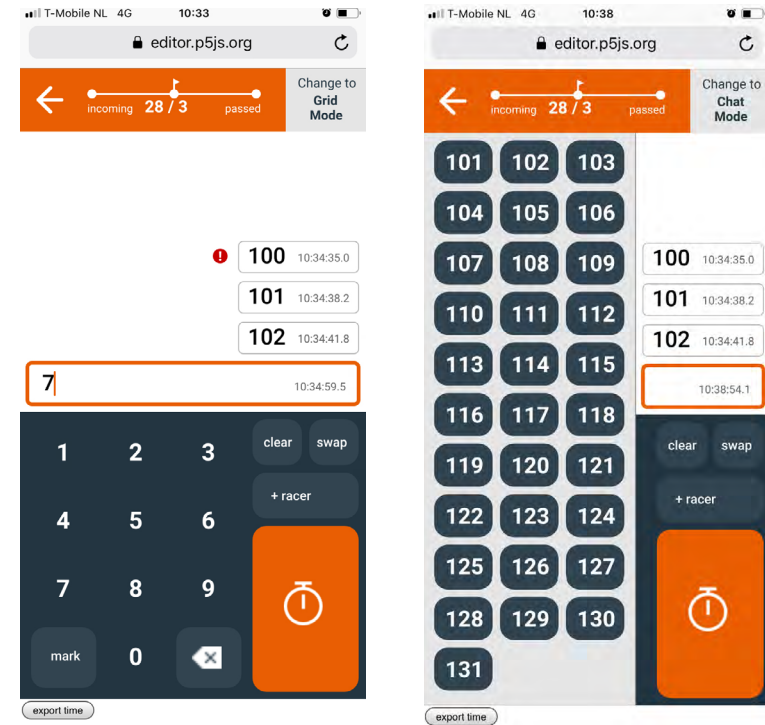
Figure 7: Keypad & Grid mode

Goals 2: The recording time should require the minimum amount of action.

To achieve the minimum amount of action in recording, the Race manager sets the number of digits of the racer number in the system ,so the system recognizes the end of the digit number.
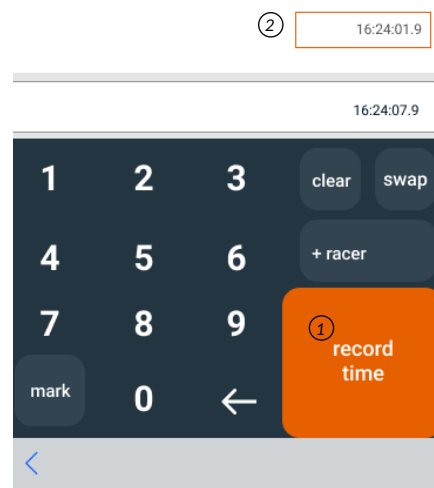
1. Record time first by pressing the 'record time' button
2. Recorded time box is made
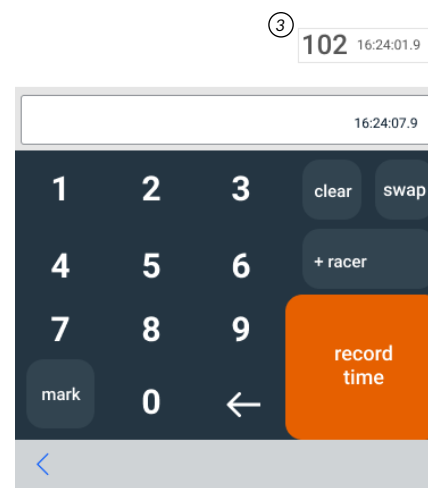
3. Type 102 in the recorded time box
/Automatically 102 is assigned to the time box

Figure 9: Time recording process

Goal 3. The Timekeeper should feel more relaxed and confident.

Making Tutorial: To make the user feel relaxed and confident, the tutorial should not only guide the user on how to use the timer but should also teach how to tackle the possible scenarios which are anticipated in a real race. Thus, it was decided that the tutorial simulates the scene where the players cross the line in short intervals or gives a situation when the Timekeeper presses the wrong numbers and teaches which buttons should be pressed in such situations.

Figure 8: Tutorial screens

15

2.3 Timekeeper Test

The goals of the Timekeeper redesign were to ensure users could time with high accuracy, choose the right timing method als to feel relaxed and confident. The goal of the user test is to evaluate whether the set targets were met and what elements caused them to be met (or not). In other words, to find out what changes are successful and where further improvements can be made. Listed below are the research questions and objectives for this study.

Research Questions
1. How effective is the redesign as a timekeeping tool:
    a. Can they time accurately?
    b. Are they able to perform their task immediately, with little explanation?
    c. Can they perform their tasks with few mistakes?
    d. Can they recover easily from errors?
2. What kind of task load does the redesign cause for users when recording times?
3. How users feel when timekeeping with the redesign?

Objectives
1. Find out if the redesigned RaceClocker allows accurate timekeeping.
    • Compare the accuracy of the time records from the user test phase one
2. How do users experience the redesigned RaceClocker? Is it relaxed and confident or complicated and difficult?
    • Compare the user experience of the user test phase one
3. Find out what causes the changes in accuracy and experience.

Participants of the Timekeeper test
Since timekeeping is done by volunteers from completely different backgrounds, like with the previous test there were very little constraints, though the aim was to get a fairly wide demographic spread that matched the previous test as closely as possible, to allow for comparable results. The aim was to recruit four participants.

Testing Set-up
Due to the circumstances a remote testing set-up was used, where three people would be in a Zoom call: a Moderator and Observer from the design team and a participant.
The participant was in the call on both their desktop (to record their face and audio) and mobile device (to share their screen).
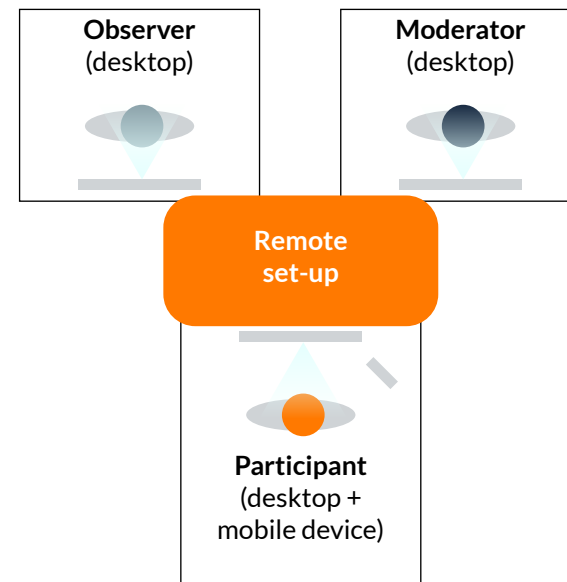They are asked to perfom the timing using a prototype made in p5.

Figure 14: Race Manager Test Setup

Data Collection Methods

Data was collected from the test through four channels (figure 26), each resulting in a different kind of data that served to answer a different research question.

To find out about the participants' performance the prototype creates a spreadsheet with all the recorded times and to find out more about the participants' experience and why they took certain actions, questions were asked in a short interview and they were asked to fill in a survey after completing the test.

Limitations

Since the test was designed to compare the Chat Mode to the Grid Mode, participants were not allowed to swap modes in while timing. Meaning the second target (if they would choose the correct method) could not be assessed directly.

A limitation of the prototype was that scrolling was not possible, though this is a rarely needed feature while timing.

	observation	interview	Form	Timing Data
data type	**qualitative** facial expression notes video recording	**qualitative** notes video recording	**quantitative** rate experience pick-a-mood	**quantitative** recorded times
objectives	1. performance 2. experience 3. causes	2. experience 3. causes	2. experience 3. causes	1. performance
R. questions	1b. immediately 1d. error recovery 2. task load 3. feeling	3. feeling	3. feeling	1a. accuracy 1c. few mistakes

Figure 15: Data collection methods

Protocol

The test consisted of three parts: first the participant completes the tutorial, then they watch a simulated race (figure 16) and try to time it using Chat Mode and after that they watch it again but this time they record the times in Grid Mode. Throughout this they are not asked to think out loud so they can focus fully on timing as accurately as possible.

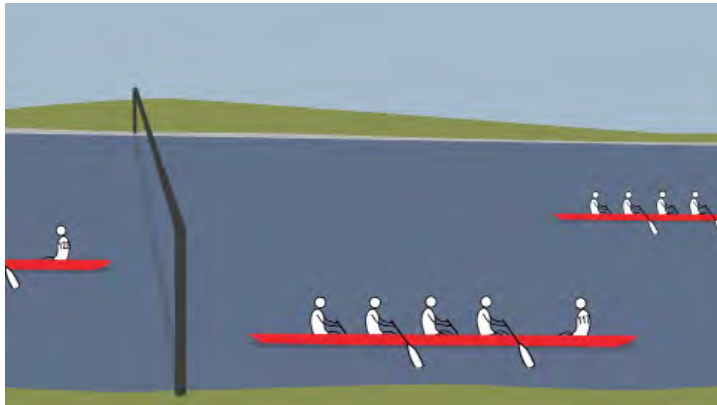*Figure 16: the race simulation used was the same as during phase one. View here.*
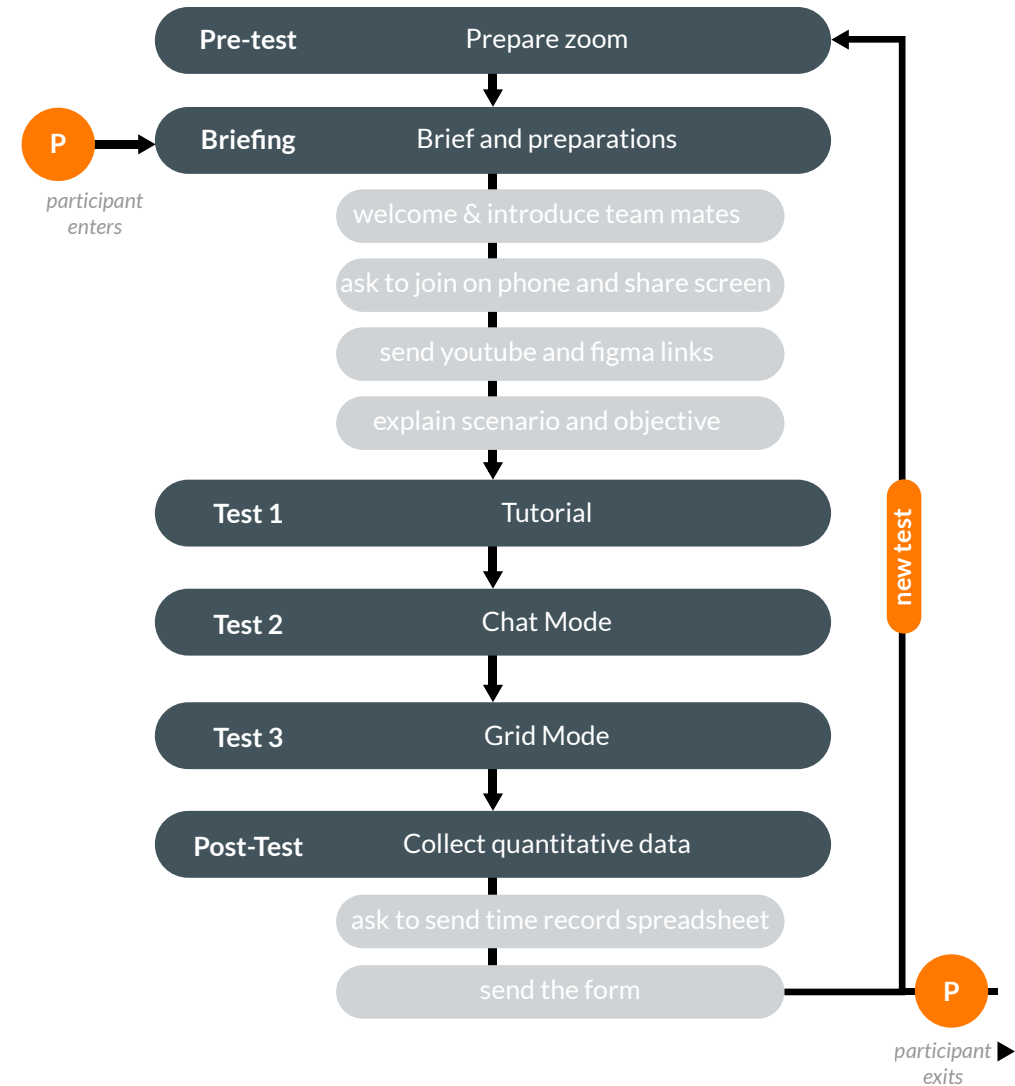
Figure 17: Timekeeper test protocol

27

Chapter 4

User Test Results

This chapter presents the results from the Race Manager and Timekeeper user tests. Since both tests collected different kinds of data they will be presented seperately, but following the same structure.
Both tests collected qualitative data in the form of observations made during the test, dialogue with the participants and comments made in the survey, as well as quantitative data showing how well the participants performed (for Race Managers this is their task completion rate, for Timekeepers their timing performance) and the way they rated their experience in the survey.
First the observations will be presented to show what happened during the test, then the performance data followed by the experiences to show how this affected the participants' timing performance and experience.
Finally, conclusions are drawn in the form of main usage issues for both redesigns.
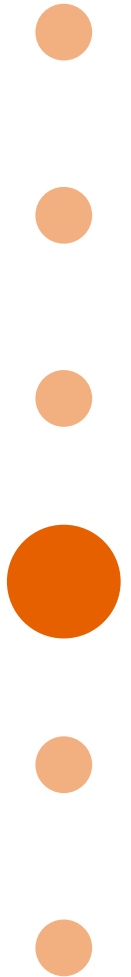
4.2 Timekeeper

An overview of the Timekeeper results can be seen on the right. Here the most important findings from each part are shown and the next three subchapters will go into further detail.

Reflections on test execution
The tests went down mostly as excepted, but two things occured that should be kept in mind when looking at the results:
1. The test setup took longer for the fourth participant, which meant they could only complete the test in Chat Mode.
2. Due to a bug in the prototype, users were unable to enter the same time twice in Grid Mode, even if they had deleted the original entry, only the third participant suffered from this.

Participants

Number	Age Group	Gender	Digital Literacy	Sports Experience
#1	20s	Female	High	None
#2	20s	Female	Medium	None
#3	20s	Male	High	High
#4	50s	Female	Low	None

Race Manager Results Overview

1. Observations

"Having a more realistic scenario would make the tutorial more memorable."

"I need three taps per boat instead of just the one, which is more of a hassle when multiple boats pass."

Some participants were having a hard time finding the right number in Grid Mode

2. Timing performance

average mistakes

PHASE 1
5.6

PHASE 2
1.3

average inaccuracy

PHASE 1
1.63 S

PHASE 2
0.95 S

3. User Experience


PHASE 1

PHASE 2

4.2.1 Test Observations

Here notable observations are presented along with the corresponding screen elements. These were used to compose a list of issues that can be found in section 4.3.

"Having a more realistic scenario would make the tutorial more memorable." ●

Immediately forgot the instructions from the tutorial. ● ●

Tap **record time** when 102 is passing the line
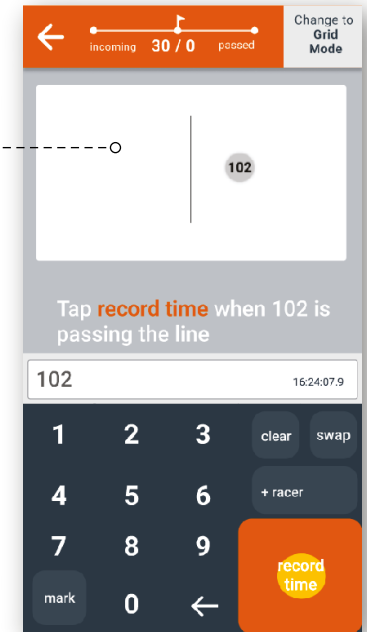
Chat Mode

● "I like that it is not filled with numbers"

The participant records too soon and writes the number as ● the boat passes

"I need three taps per boat instead of just the one, which is ● ● ● more of a hassle when multiple boats pass."

● Recording the time when the boat is still approaching
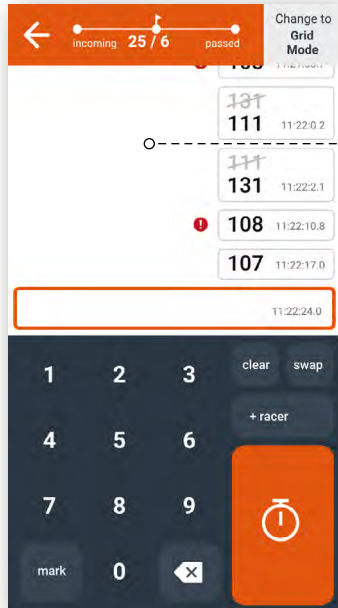
Grid Mode

Having a hard time finding the right number. ● ●

"This mode is less prone to typos than Chat Mode." ●

Some users did not look down to press record ● ●

"Maybe in Gridmode, you should use more contrast between pressed and unpressed buttons." ●

Observation	
1st participant	●
2nd participant	●
3rd participant	●
4th participant	●

4.2.2 Timing performance

Here it is shown how the redesign impacted how well the participants were able to time all the incoming racers in the test.

Figure 19 (on the next page) compare the amount of mistakes and the timing accuracy between the two modes of the new prototype and the results from phase one (using the actual RaceClocker).
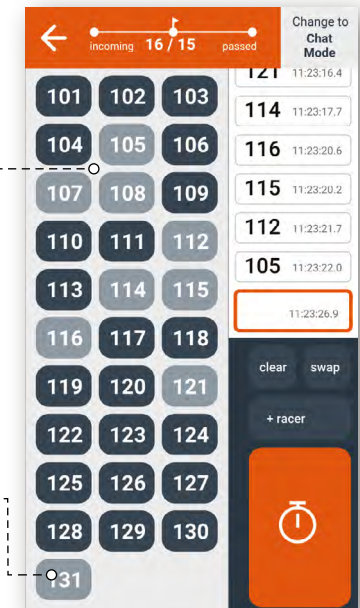Raw data can be found in appendix C.
Note that the participant numbers for the phase 2 participants correspond with each other (i.e. Chat Mode participant 3 is also Grid Mode

participant 3) but not with the phase 1 participants. Phase 2 participant 4 could only complete the test in Chat Mode so their entry is missing from Grid Mode.
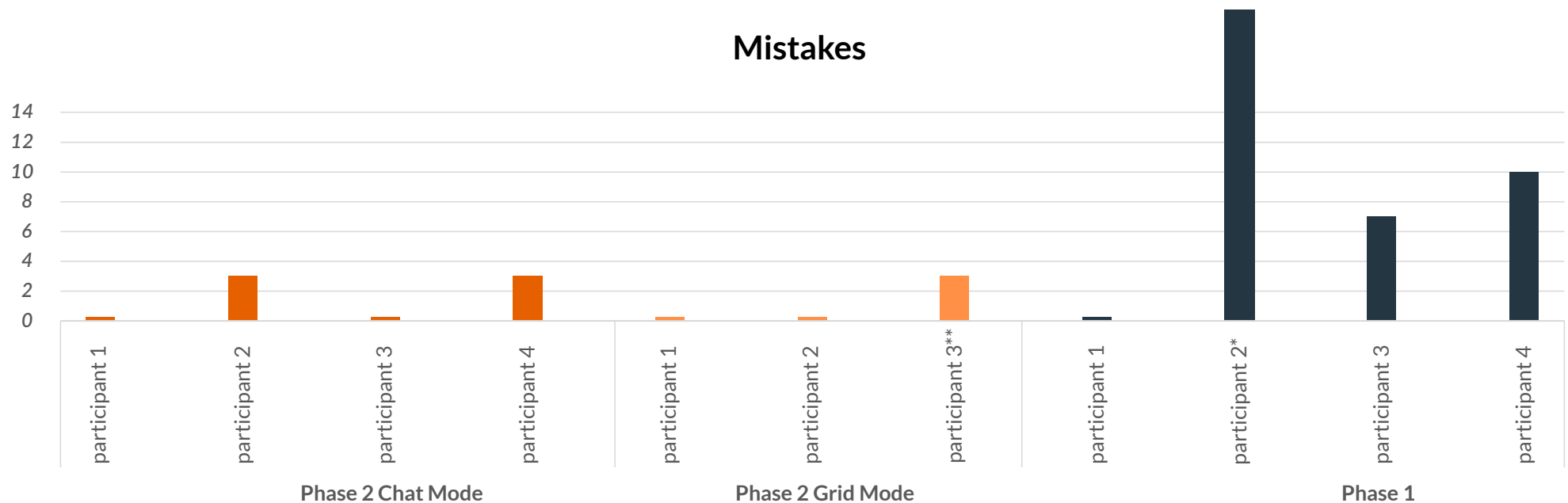

Figure 18: The amount of racers that were either missed or timed in the wrong order.
* Phase 1 participant 2 got all 31 participants in the wrong order because they misunderstood the objective and timed everyone in order of Bib number.
** Phase 2 Grid Mode participant 3 tried to undo their mistakes but was unable to do so due to a bug in the prototype

Average deviation in seconds

03.02	
02.59	
02.16	
01.73	
01.30	
00.86	
00.43	
00.00	

participant 1 · participant 2 · participant 3 · participant 4 — **Phase 2 Chat Mode**

participant 1 · participant 2 · participant 3 — **Phase 2 Grid Mode**

participant 1 · participant 2* · participant 3 · participant 4 — **Phase 1**
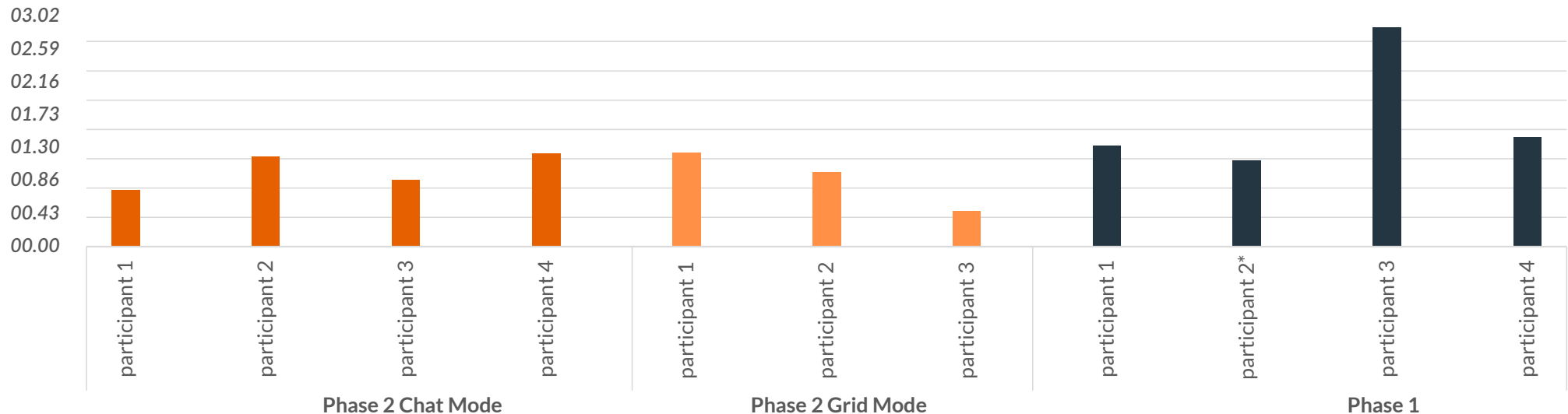
Figure 19: The average deviation from the actual time for all correctly timed racers
*Since Phase 1 participant 2 had no correct times their records were measured against the racers in the order in which they timed them, meaning the devia-
tion may have been larger had they looked for the right participant every time.

It should be noted here that the Phase 2 Grid Mode participant 3, the participant with the lowest average deviation (as well as Phase 2 participant 2) usually timed by first recording a time and later assigning the corresponding number, while Phase 2 participant 1 timed by tapping the numbers directly and timed much less accurately than they did in Chat Mode.
Also the mistakes and deviation were quite evenly spread out over the boats, meaning **performance was similar for multiple boats coming at a time as for boats with a lot of time in between them**. This goes for both the phase one and phase two results.

Be aware that for both all tests, some minor inaccuracy may have been introduced by testing online since t=0 may not exactly correspond with the moment the user started the video.
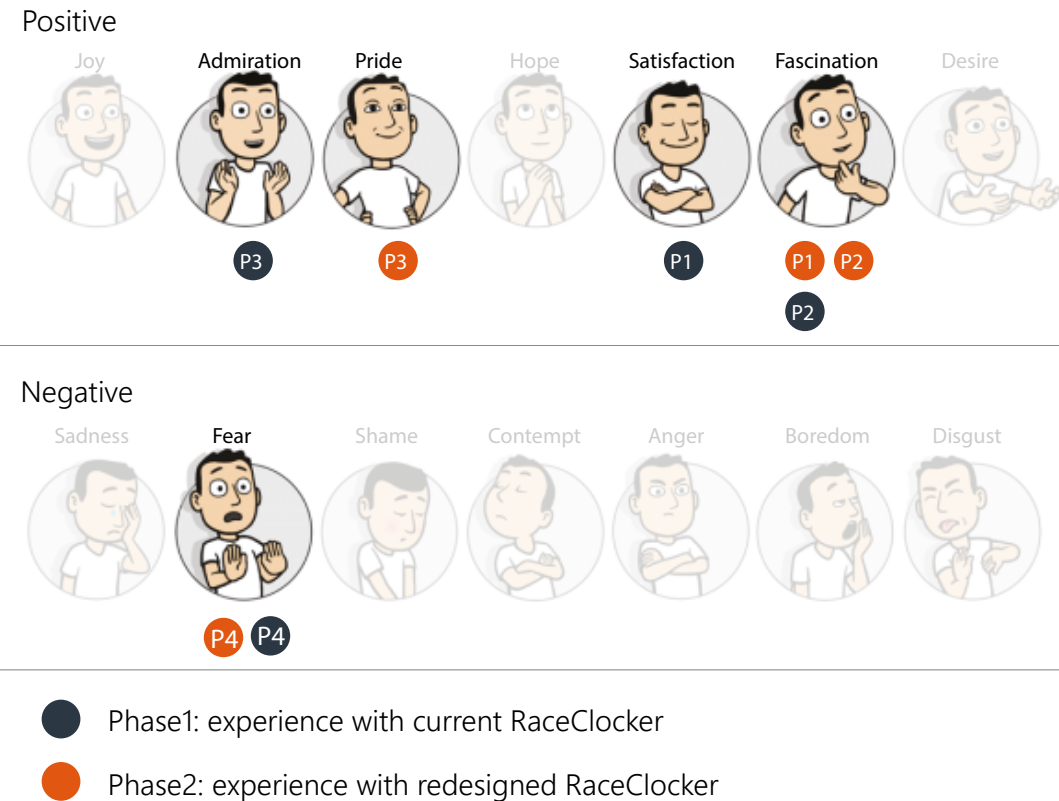
4.2.3 User Experience

Here is displayed how users in phase two responded to questions about their experience on a Google Form compared to during phase one.

The same questions were asked during both phases. Here a visual overview is shown, and the raw responses can be found in appendix C.

1. Can you choose one face from the image below about your overall experience of timekeeping in RaceClocker?

(Single select multiple choice question)

Positive

Joy	Admiration	Pride	Hope	Satisfaction	Fascination	Desire
	P3	P3		P1	P1 P2	
					P2	

Negative

Sadness	Fear	Shame	Contempt	Anger	Boredom	Disgust
	P4 P4					

● Phase1: experience with current RaceClocker

● Phase2: experience with redesigned RaceClocker

Phase 1

P1 "It works but doesn't feel sophisticated. I would think there are **more possibilities**"

P2 "**curious** and a bit **stressed**"

P3 "I think it's **interesting** and **not that hard** for me to use"

P4 "**Too much going on** at the same time for my limited senses. The system was OK though."

Phase 2

P1 "**satisfied**"

P2 "I feel that if it has the voice recognition recording function, it would be faster to record the numbers."

P3 "I was curious to see how well this prototype would work, compared to timing rowing boats with old-fashioned methods."

P4 "I felt **stressed** clocking on time when boats arrived shortly after one another"

2. How would you rate your timekeeping experience with RaceClocker?

(Multi select multiple choice question)

1. I found the system very cumbersome to use

2. I needed to learn a lot of things before I could get going with this system.

3. would need the support of a technical person to be able to use this system.

1(25%)

4. I would imagine that most people would learn to use this system very quickly.

2(50%)

3(75%)

5. I thought the system was easy to use.

3(75%)

1(25%)

6. Others: I should have to practise more

1(25%)

Phase1: experience with current RaceClocker

Phase2: experience with redesigned RaceClocker

In the answers of question 2, compared to the phase 1 answers, more participants said the system is quick to adapt and easy, and no one said they need support to use the system. One participant added that she needs more practise to use the system. It is assumed that the participant could not process too much information in the tutorial which made her leave this comment.
Question 3 and 4 are added to identify the experience of two modes.

In the user test participants were asked twice to keep the time for the same simulated race , first in Chat Mode, second in Grid Mode. Therefore, the test did not allow participants to switch between modes during the race.

4.3 Overall Test Conclusions

For both the Race Manager and the Timekeeper, much of the findings from the user tests can be summarized as a set of issues. Issue severity was determined based on frequency and consequences.

These issues capture where the biggest room for improvement is within the redesign and they will be used as entry points for the Discussion and Recommendations.

Timekeeper

1.1	***The tutorial is not memorable enough.***	*Tutorial*
2.1	***Writing numbers in Chat Mode takes too long.***	
2.2	***It is unclear when times are recorded in Chat Mode.***	*Chat Mode*
2.3	*Chat Mode is stressful.*	
3.1	***Finding numbers in Grid Mode takes too long.***	*Grid Mode*
4.1	*The redesign was not experienced any less stressful than the original.*	*Overall*

● ***Severe issue***

● *Notable issue*

TIMEKEEPER TARGET 1

The majority of users should be able to time all participants in the correct order with a low margin of error on their first attempt.

Related issues:

2.1   **Writing numbers in Chat Mode takes too long.**

Chat Mode

2.2   **It is unclear when times are recorded in Chat Mode.**

3.1   **Finding numbers in Grid Mode takes too long.**   *Grid Mode*

The timing performance results suggest that the Timekeeper redesign achieved its primary target, since **it scored considerably better on both accuracy and mistakes** than the original application. Especially not having to scroll or look up and down from the screen as much appear to have contributed to users making less mistakes in stressful situations.

It should of course be taken into account that the test was done at a very small sample size so results should be taken with a grain of salt.

TIMEKEEPER TARGET 2

The majority of users do not have to switch recording methods during a race or mess up because of this.

To be able to compare results between grid and Chat Mode we did not allow users to switch modes mid-test, so **it is unknown if switching would cause them to make mistakes**. What we did find was that mistakes and accuracy for a 30-man race were slightly in favor of Grid Mode, which suggests that **they would not have to switch mid-race** as long as they are recommended the correct mode.

TIMEKEEPER TARGET 3

The majority of users should report that they felt relaxed and confident in their time-keeping.

Related issues:

2.3   **Chat Mode is stressful.**   *Chat Mode*

4.1   **The redesign was not rated any less stressful than the original.**   *Overall*

From the answers of the survey, **the overall experience hasn't changed dramatically**. It was expected that they would feel relaxed and confident because of responsive chat mode, and the functions that allow error recovery and queueing multiple racers.

However, it may be that some participants experienced a cognitive overload from the many features introduced in the tutorial, causing them to stress out while trying to remember all the features.

TIMEKEEPER OTHER ISSUES

Important issues that do not relate directly to the targets

1.1   **The tutorial is not memorable enough.**   *Tutorial*

other   **Users cannot time by name**   *Overall*

Two participants forgot the instructions from the tutorial almost immediately. It is possible this is because the shown example may be too abstract, users do not think about how to apply it in a real world scenario. Or that it holds your hand too much: users are presented with very clear instructions and highlighted buttons, causing them to go through it "on autopilot".

Another limitation of our setup and prototype is that it only allows timing with three-digit Bib/Bow numbers, while in reality races may occur that require timing by name or longer/shorter numbers.