

# RACELOCKER

## REPORT PHASE 3

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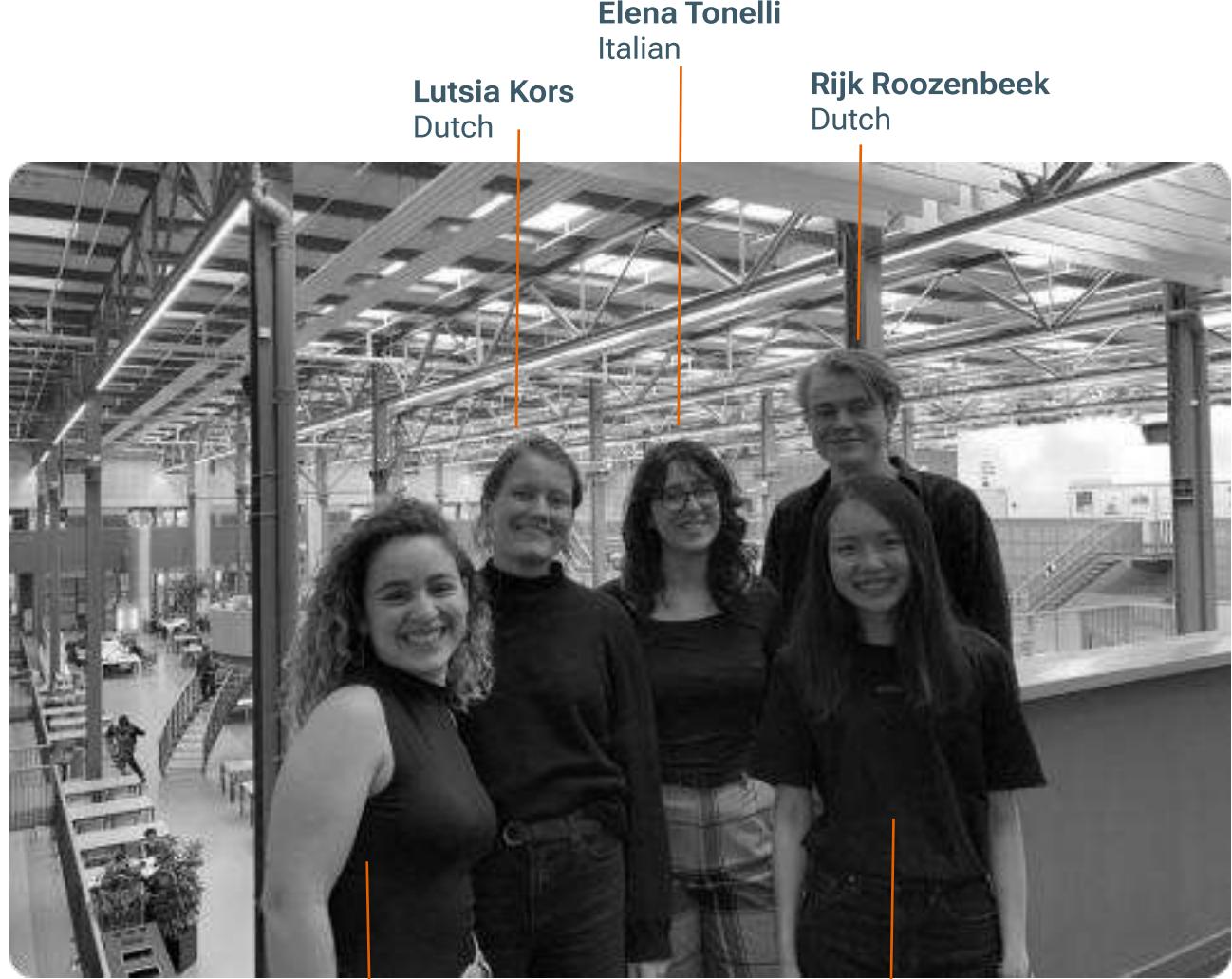
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# Executive summary

*RaceClocker is a web-based application designed for live race management, time tracking, and result sharing. In this report, a redesign is created with the goal to "Enable timekeepers to be aware of the status of the race by making them feel connected to each other and confirmed about their tasks". This design goal established in previous reports. Through several iterations, improvements were made to the timekeeper's user experience by implementing changes in color, size, priority ranking and functionality. The focus was on eliminating unnecessary information and highlighting essential features. The redesign is tested with the intended user ( $n=5$ ) and data is collected by observation, a PrEmo card set, a questionnaire and a System Usability Scale (SUS). The redesigned application showed an 18.8-point increase in SUS score compared to the original version, most of the functions are understood and easy to use and 8 out of 10 testable targets are reached. This indicates significant usability improvement. The report concludes with quick fixes and final recommendations on how to proceed with the proposed redesigns.*

# Team UNO

We are team UNO, five Design For Interaction master's students from the faculty of Industrial Design Engineering.



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# Preface

This report describes the third phase of the redesign of the web app RaceClocker.

RaceClocker is a web-based application for live race management, time tracking, and result sharing. It provides an all-in-one manual timing solution compared to traditional methods involving stopwatches, paper sheets and Excel spreadsheets.

The design challenges that were addressed during this process concern the communication aspect and the organization of the layout of the timing interface. The team's goal is to redesign the app in a way that enables timekeepers to feel confident in their tasks, to communicate easily with one another, and to feel autonomous using an intuitive and well-organized interface.

This last report is based on the previous two reports. The first report focused on the analysis of the app's functions, its usability based on user tests and it concluded with the design brief. The second report was mainly about the concept generation. After evaluating the three concepts, a redesign was proposed to conclude the report.

This report starts from phase 2 redesign and the first iterations based on peer and coach feedback, usability inspection and inputs from an experienced UI designer. The redesign that came from these iteration has been tested with five participants. The conclusions of all the process present quick fixes and recommendations for the future.

# CHAPTER 1

## REDESIGN

*In this chapter the progress following from the phase 2 concept towards the testable redesign is shown. In this chapter the iterations are quickly recapped, the redesign and its functions are explained in detail and the changes in user experience are shown through a drawn scenario.*

- 1.1 Iterations
- 1.2 Redesign
- 1.3 Conclusion

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# 1.1 Iterations

## 1.1.1 Introduction

Continuing from phase 2, several changes were made to the concept. A “first” iteration step was made using feedback on phase 2 by the coaches and the client, input from a feedback session with fellow IDE students and input from an experienced UI-designer. A second iteration step was done using insights gathered from a pilot test (Appendix A.1) and a cognitive walkthrough done within the team (Appendix A.2). See figure 1 for an overview of the 2 iterations.

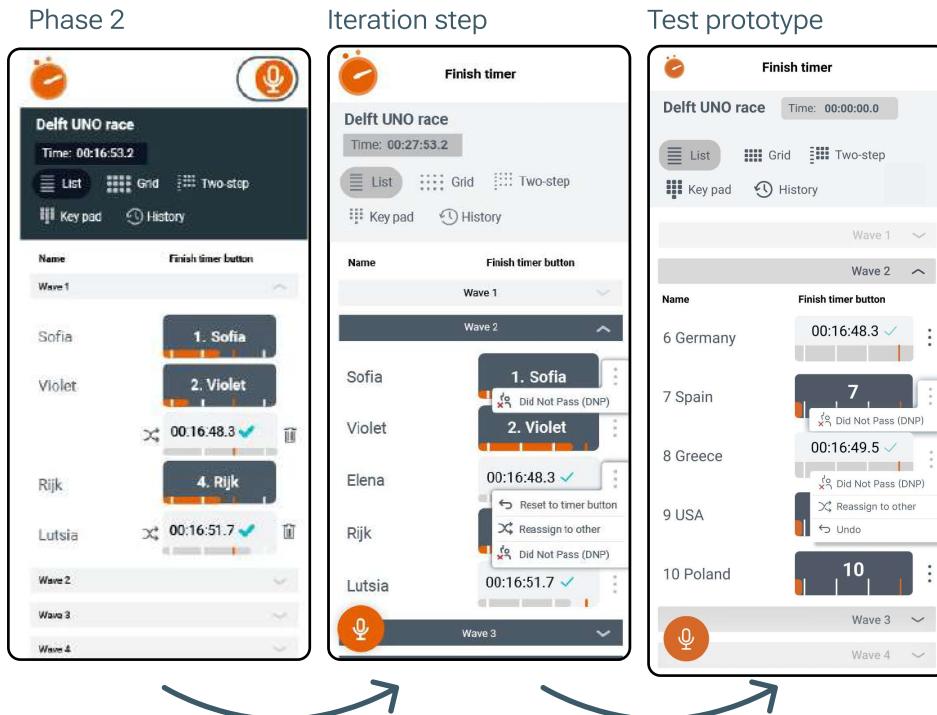


Figure 1. The 3 iteration steps

## 1.1.2 Main changes

The changes can in general be described in 3 groups:

1. A general change in colors.
2. A clean-up of the screen.
3. Improvements on the walkie talkie.

The general changes made during the iteration steps can be seen in figure 1. A more detailed description of the changes made can be found in Appendix A.3 and the iteration options can be found in Appendix A.4.

### Change in colors

The dark blue color in the top bar attracted a lot of attention. By selecting a less hard color less attention is drawn by this and more attention goes towards the timing buttons. It overall calms down the app interface and focuses the attention towards the functions mostly used by the timekeeper.

### Cleaning up the screen

In the phase 2 concept, a lot was happening on the interface: a lot of functions and options were directly visible and distracted the timekeeper from their task. To combat this, two main parts have changed. First, the top bar has reduced in size and its icons have become smaller, including the relocation of the running timer to the top part of this menu. Secondly, less commonly used functions (did not pass, undo and reassign) have moved behind an error menu, which can be opened using the three dots icon next to the timing buttons.

### Walkie talkie

The walkie talkie function is a dominant addition in the redesign. Several iterations have been made after phase 2 to improve ease of use and general user experience. The button has moved to the bottom left corner which makes it easily reachable and it is separated from other buttons to avoid tapping buttons by accident.

# 1.2 Redesign

## 1.2.1 Introduction

After the iterations shown on the previous page, a redesign and a testable prototype were made taking into account the inputs from the user, peers, the client, and coaches. The following subchapter starts with a comparison between the scenarios of use of the current app and the prototype to illustrate how the interaction changed. Then, the prototype is shown with the new features and the ones that were kept from the current app.

An overview of how the app looks like in a phone can be found in figure 2.

This subchapter explains the following functions:

- Timing button
- Walkie talkie
- Progress bar
- Error menu
- Waves menus
- Timer
- Fixed header
- Confirmation screen

The following pages show a legend on the top right that indicates if the feature characteristic that is being talked about was kept from the current app or if it was introduced in the redesign (chapter 1.2.3 - 1.2.10).



Figure 2: The Redesign shown in hand

# 1.2 Redesign

## 1.2.2 Scenario of use

The scenario of use (figure 3) shows the old and new experiences of the timekeeper when timing a race with RaceClocker. In the scenario, the qualities of the design goal (aware, connected and confirmed) are differently experienced with the redesign.

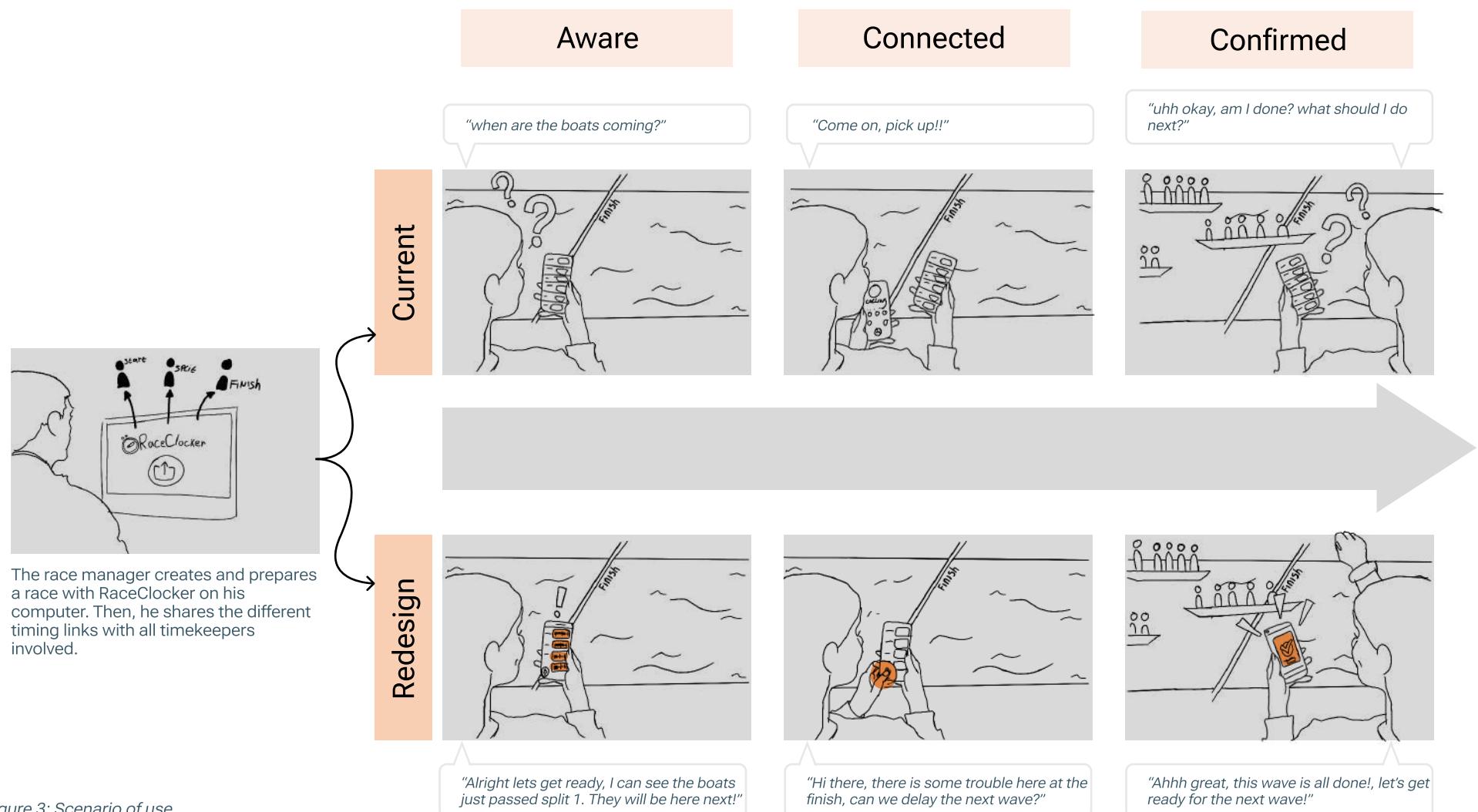
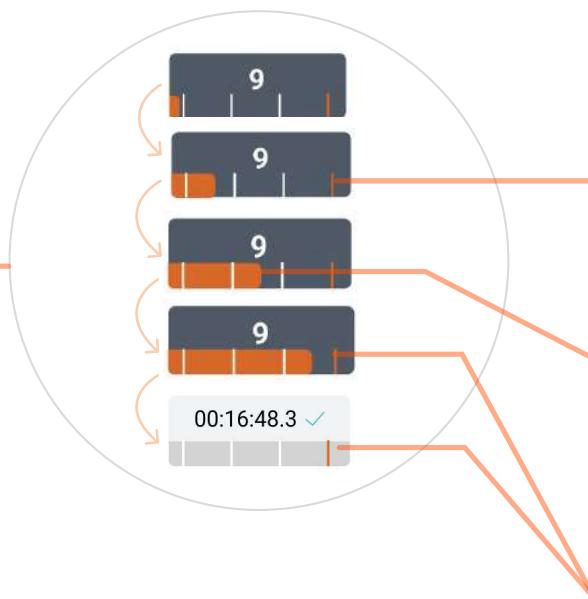
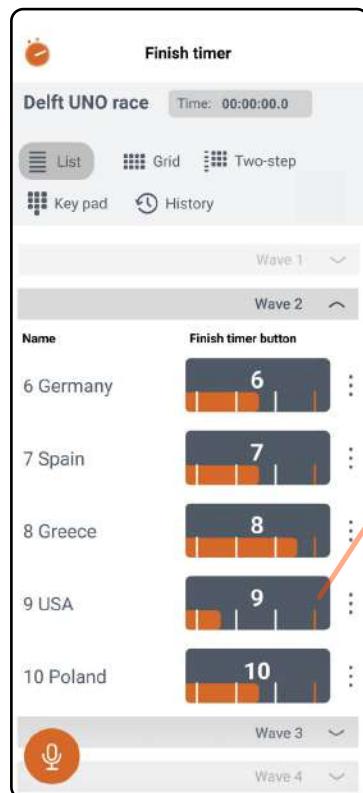


Figure 3: Scenario of use.

# 1.2 Redesign

- Features added/changed in redesign
- Features kept from current design



The four stripes represent a race with one starting point, one finish point and two split points in the middle. The stripe in orange represents your own location, while the white ones represent the others checkpoints. The amount of stripes is defined by how the race manager sets up the race.

The bar shows the progress of the boat by jumping in between the checkpoints. This makes it more clear for the user that a boat has passed a split point and is approaching to the next.

The third progress bar shows what the finish timekeeper sees when the boats are coming to its finish line.  
After tapping on the button to finish the boat, this immediately turns grey (see next page for further information on the button).

Figure 4: App interface showing five boats in different states of the race. The bubble on the right show a zoomed-in feature.

# 1.2 Redesign

- Features added/changed in redesign
- Features kept from current design

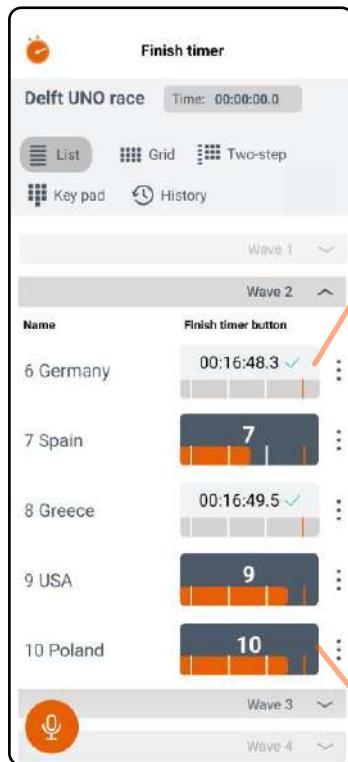
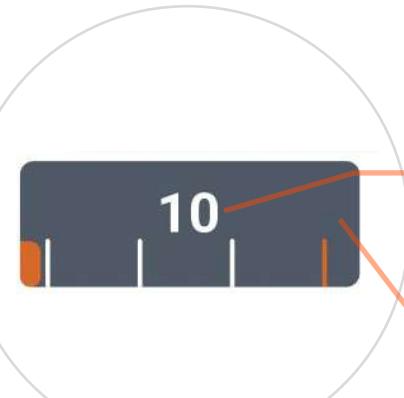


Figure 5: App interface with two timed boats (6 and 8) and the other three still to be timed. The bubbles on the right show two zoomed-in features.



The tapped button displays the boat's racing time and immediately provides confirmation feedback indicating that the boat has finished. The light blue check icon also indicates to the user that the information is synchronized with the server and other timekeepers.

When the boat has been timed, the button now shows the progress bar in light grey. Moreover, the time displayed on the button was increased in size to make it more readable for the user and to make it consistent with the non-timed button.



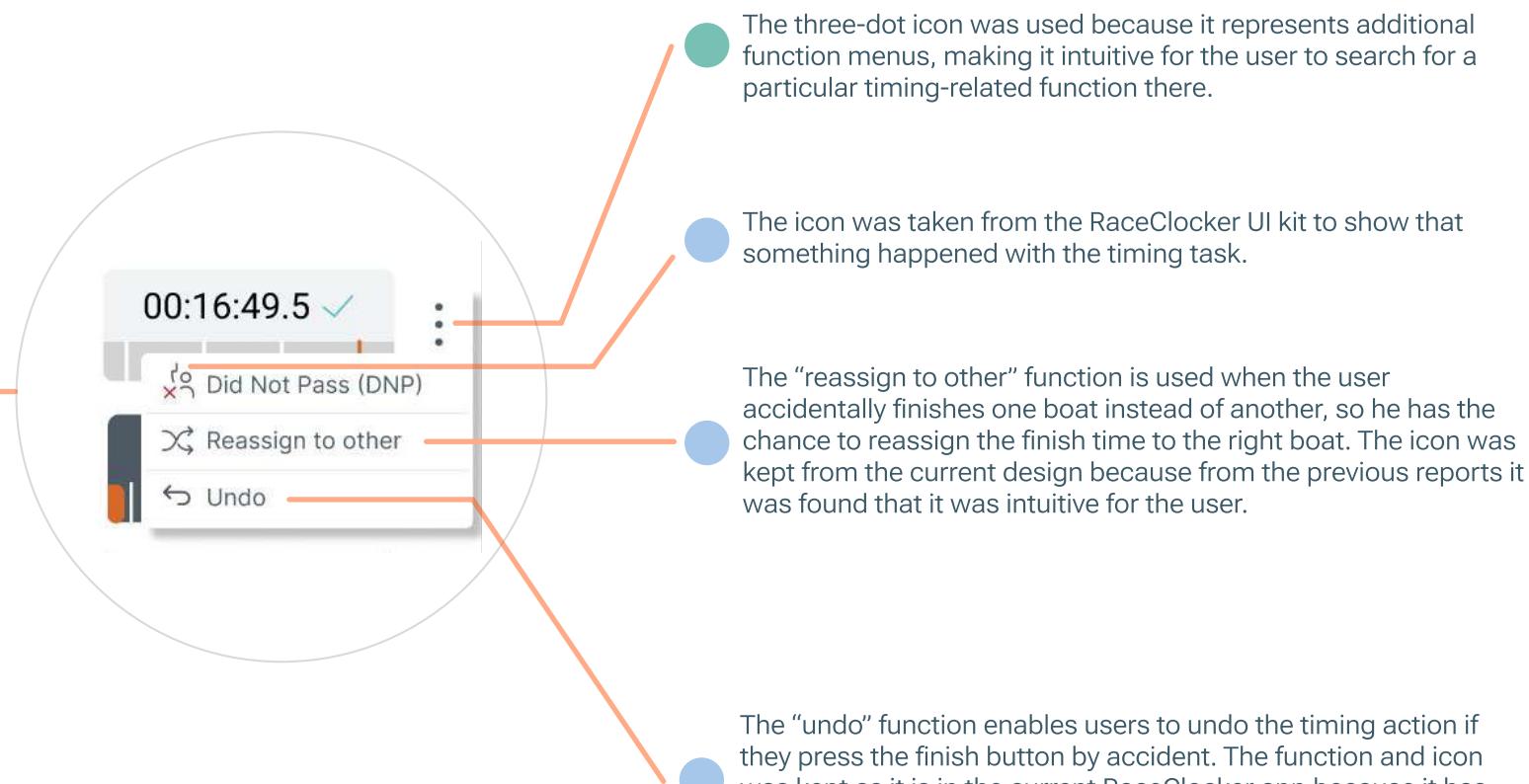
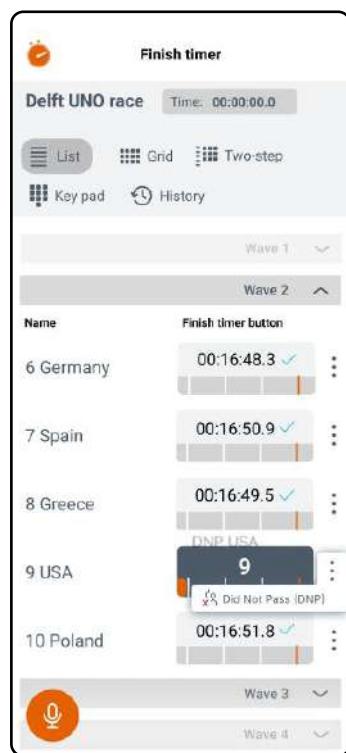
The button shows a large number to help users identify the boats more easily as they approach the finish line. This is especially helpful if the boats are about to finish close to one another. Also, to help the timekeeper to know when his task is about to begin, the progress bar is displayed.

The dark color of the button creates a strong contrast with the white background, making it easier to detect in direct sunlight.

# 1.2 Redesign

## 1.2.5 The error menu

The error menu was created to cluster all the functions that are usually needed only in special occasion. In this way the interface appears cleaner and more organized. The error menu as it is shown in *figure 6* contains the following functions: did not pass, reassign to other and undo. The functions “reassign to other” and “undo” are already part of the current app, while the “did not pass” function was added so that timekeepers have the possibility to assign boats that did not cross the line and the wave can still be finished.



*Figure 6: App interface with one error menu opened when the boat has not been timed. The bubble on the right shows the zoomed-in feature when the boat has been timed.*

- Features added/changed in redesign
- Features kept from current design

# 1.2 Redesign

- Features added/changed in redesign
- Features kept from current design

## 1.2.6 The walkie talkie

The walkie talkie function enables quick communication between timekeepers, ending the need for them to use other phones or communication devices. They can easily communicate by pressing down the walkie talkie button without changing interfaces. The walkie talkie allows only one person to communicate at a time, ensuring that communication is clear and does not become overwhelming to the timekeeper (see figure 7).

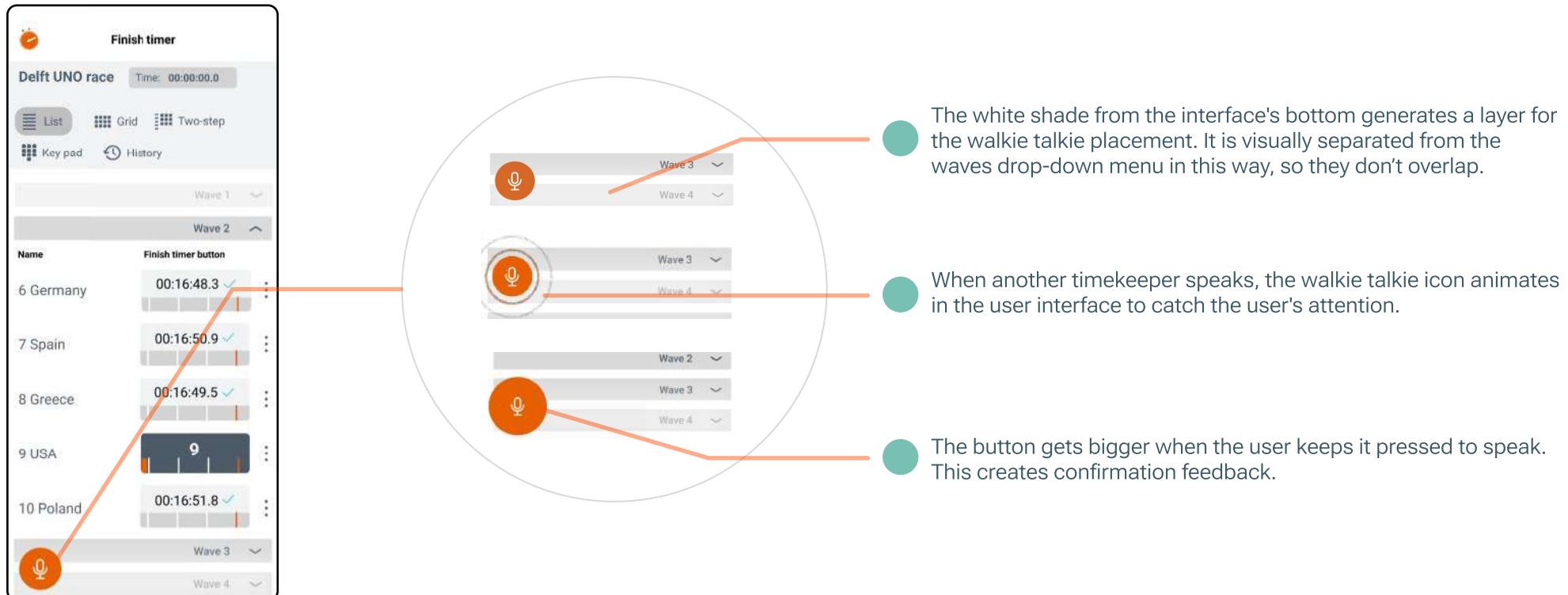


Figure 7: App interface that shows the finish timer interface. The bubble on the right shows the zoomed-in states of the walkie talkie.

# 1.2 Redesign

- Features added/changed in redesign
- Features kept from current design

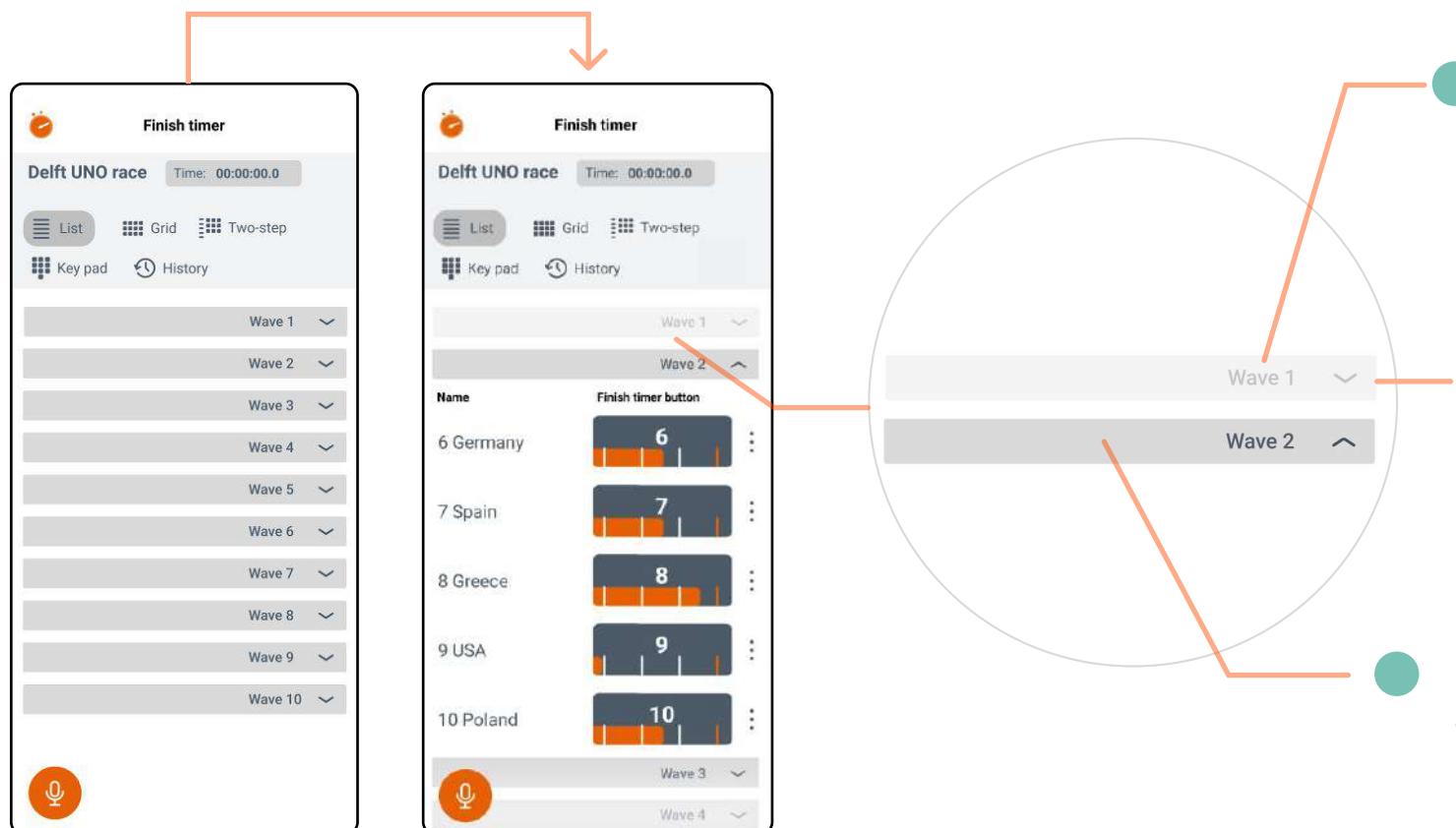


Figure 8: App interface. In the left all the waves are closed and in the right the first wave is done and the second wave is open. The bubble on the right shows the zoomed-in states of the menu.

The title of each wave is relocated to the right of the interface in order to have both, the title and the arrow, on the opposite side of the walkie talkie. This makes sure that their functions do not overlap. Moreover, the user can either press on the title or the arrow to open or close a wave; when they do so, the arrow changes orientation to give the user feedback.

The already timed waves are shown in a lighter color so that it has contrast with the waves that are still to be timed. Furthermore, this light shade was chosen to not overwhelm the user with information that is no longer needed.

The waves that still need to be timed have a darker shade of grey so that they stand out. They are clearly buttons that the user can press to open the wave menu.

# 1.2 Redesign

## 1.2.8 Running timer

During a race, a timekeeper only sees what is in front of him. In most races the distance between split points is big and nothing really happens for big periods of time. The idea behind the running timer is that the user can relate the screen to an analog stopwatch so that he knows the race is going on and that he has to be alert (see figure 9).

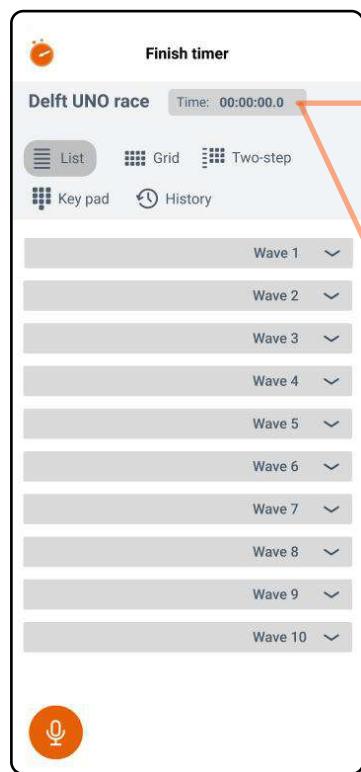
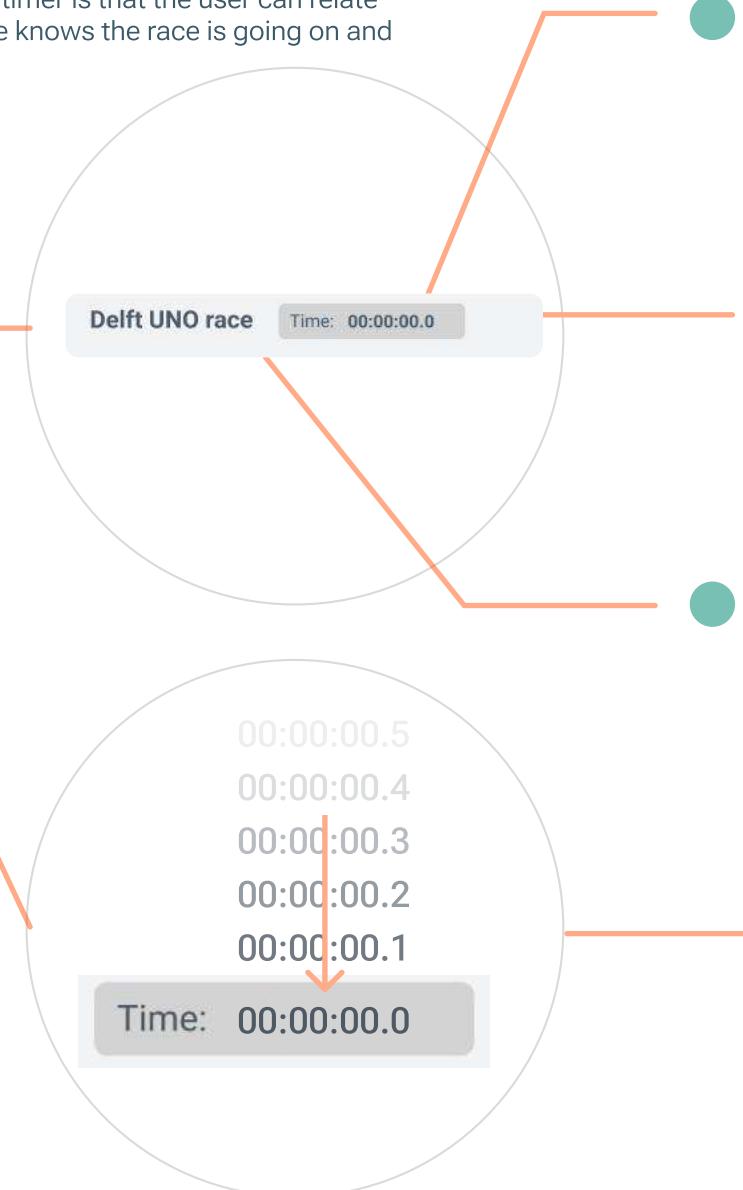


Figure 9: App interface when it is first opened. The bubbles on the right show two zoomed-in features.



The size and light color of the timer allows the user to see it if he needs it without it drawing too much attention and overwhelming him. Furthermore, now it does not compete in importance with the other buttons and titles, respecting the hierarchy within the menu.

The timer is placed on a darker rectangle to highlight its importance and to show that there is something happening there as it is the only dynamic element in the grey menu.

The timer is placed on the right of the title to save vertical space. This way, the grey menu is shorter and more space is given to the waves and participants list.

The timer is always running so that the timekeeper can make the connection between the app and the stopwatch, which is the analog alternative and predecessor to RaceClocker.

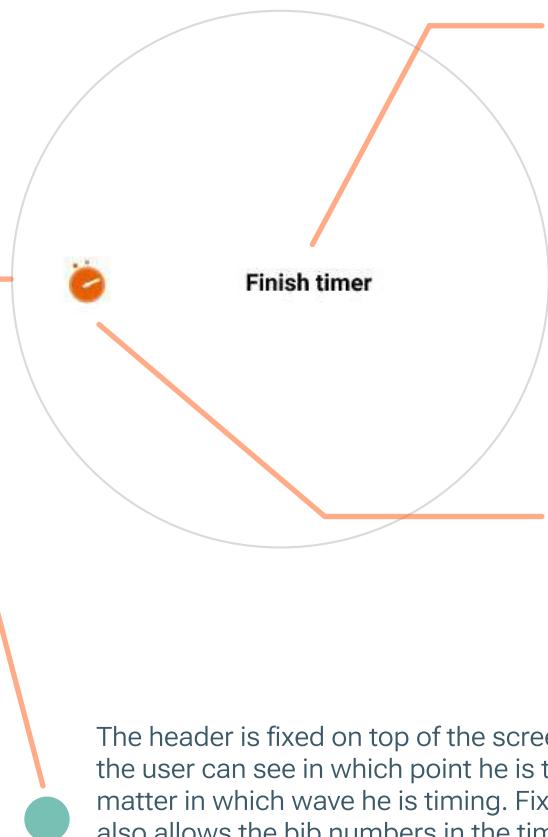
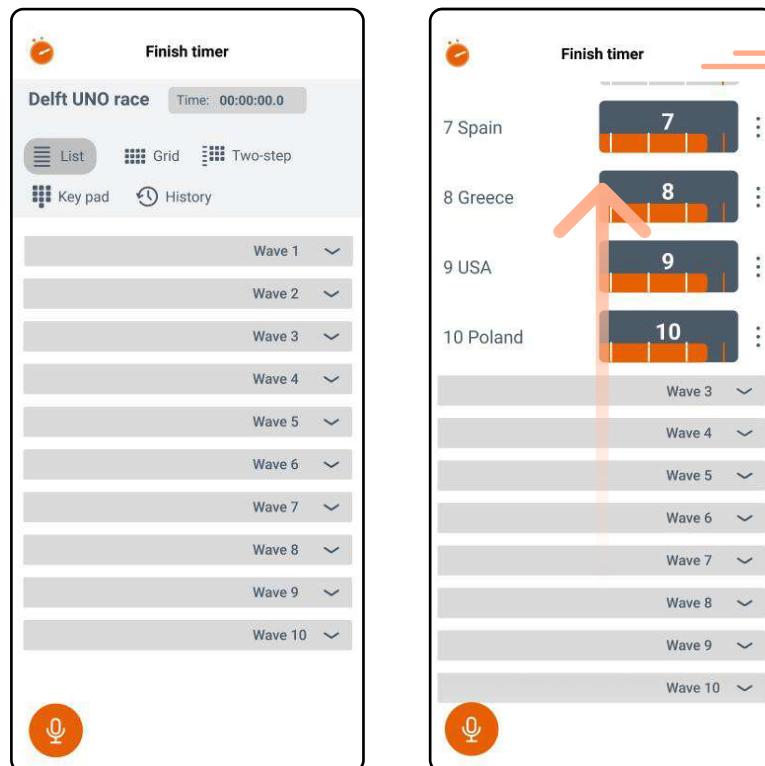
The timer starting time is 0 and starts running when the race starts (instead of displaying the real world time) so that the timekeeper can see how long the race has been going on.

- Features added/changed in redesign
- Features kept from current design

# 1.2 Redesign

## 1.2.9 Fixed header

Each split point in a race has a different timing link from the race manager. This means that the start timekeeper sees a different interface than the finish timekeeper. With the fixed header, the timekeeper is always aware in what timing interface he is timing (see figure 10).



The title shows in which timing interface the timekeeper is at all times.

The RaceClocker logo is always displayed on the screen of the user.

The size of the logo has reduced. This way, the user can not mistake the logo for the walkie talkie button.

The header is fixed on top of the screen. This way, the user can see in which point he is timing, no matter in which wave he is timing. Fixing the header also allows the bib numbers in the timing buttons to be bigger as now the timekeeper location name does not have to be repeated elsewhere in the interface.

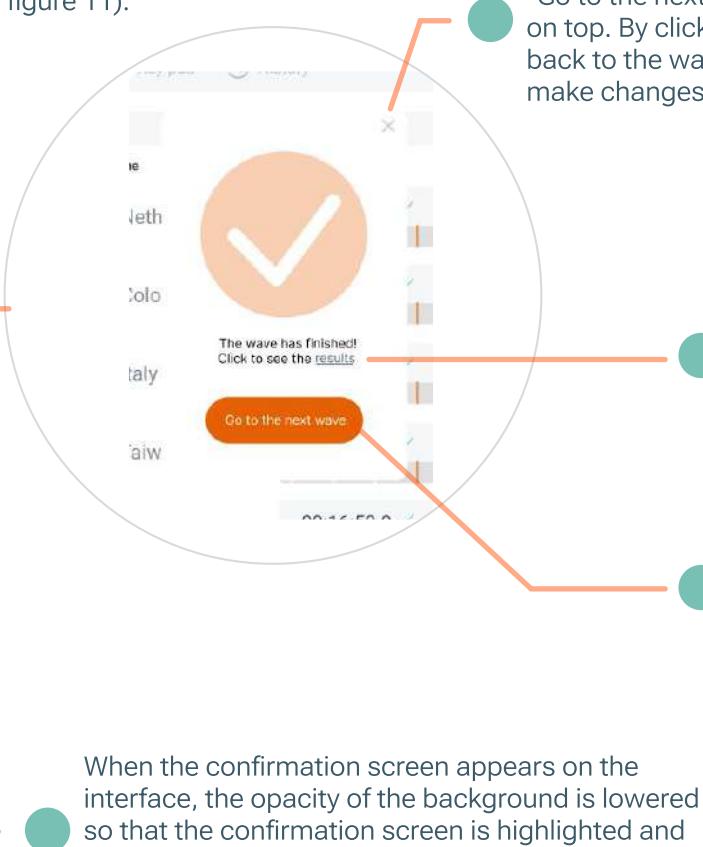
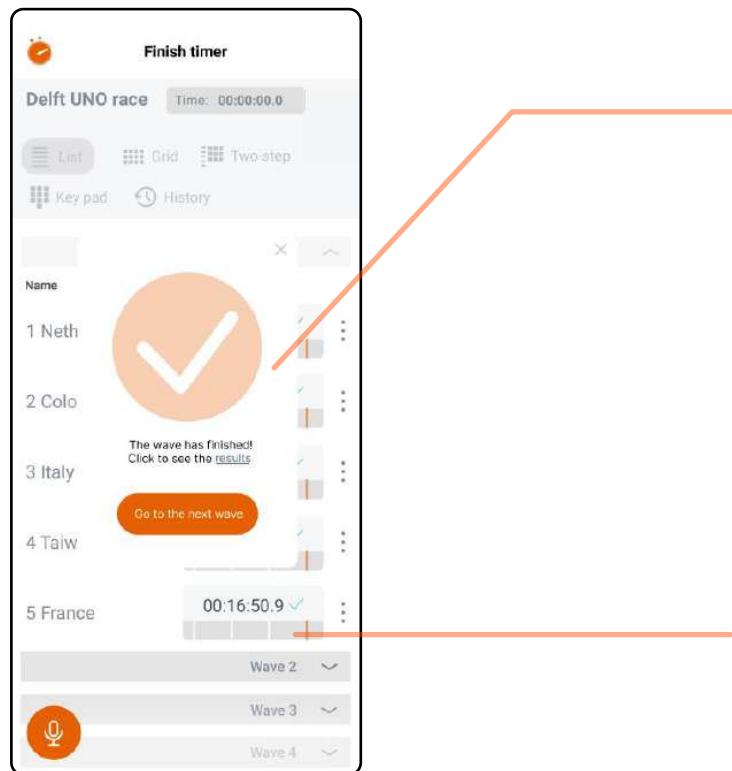
Figure 10: App interface. In the left all the waves are closed and in the right the interface is shown after scrolling down having one wave open. The bubble on the right shows the zoomed-in feature.

- Features added/changed in redesign
- Features kept from current design

# 1.2 Redesign

## 1.2.10 Confirmation screen

The timekeeper usually times multiple waves in a race. The redesign gives positive feedback every time a wave is finished so the user knows he is one step closer to finishing his overall task. Moreover, every time the user gets the confirmation pop-up he also gets a audio feedback (see figure 11).



The confirmation pop-up can be closed using the "Go to the next wave" button but also with the "X" on top. By clicking on this button, the user goes back to the wave he just finishes; there, he can make changes and open the new wave manually.

By clicking on "results", the user jumps to a results page to see how the finished boats have performed. As the results are shown in a different webpage, the button to get there is shown as a link.

The "Go to the next wave"-button allows the user to automatically close the confirmation pop-up and open the next wave. This way, moving from one wave to another is made easy and effortless. Furthermore, this option is highlighted and bigger than the results button as it is the logic step in the timekeeping sequence. The color and button appearance allow the user to spot it easily.

When the confirmation screen appears on the interface, the opacity of the background is lowered so that the confirmation screen is highlighted and the user knows the next action has to be performed within the confirmation screen.

Figure 11: App interface when a wave is finished. The bubble on the right shows the zoomed-in feature.

- Features added/changed in redesign
- Features kept from current design

# 1.3 Conclusion

Phase 2 ended with a concept for the app. During phase 3, it was improved as far as possible through usability inspection, peer- and coach feedback and experienced UI designer input.

In this chapter, the different iterations from phase 2 concept to the redesign, which will be tested in the next chapter, were shown. The chapter is the result of insights and iterations that took place in order to get to a redesign that could be used in user tests in the next chapter. Both the features kept of the current app and features that are completely new are explained.

# DESIGN VALIDATION

# CHAPTER 2

*In this chapter the redesign showed in the previous chapter is tested and validated. Firstly, the test plan and the data collection methods are explained. These are followed by the results and findings gathered during the user tests. Finally, both the quantitative and qualitative results and findings are analyzed per function and validated using the testable targets.*

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# 2.1 User test

## 2.1.1 Introduction

The main goal of the test is to validate if the redesigned app solves the design problem, using the design criteria as a guideline. Furthermore, the test will evaluate the combined new functions within a simulated context.

## 2.1.2 Test set-up

Important details of the user test plan will be shown here, but the full user test plan can be found in Appendix B.1. The user test was optimized by conducting a pilot test (Appendix A.1).

Five participants individually performed the user test. All were familiar with the context of rowing and have timed boats before (it differs to what extend, some do it daily, others have done it once). A short introduction (appendix B.2) was given to explain information required before testing (see figure 13).

The user test consists of three tasks to be performed:

1. Communicating a delay to pre-recorded walkie talkie messages.
  2. Timing 5 boats in wave 1.
  3. Timing 4 boats in wave 2 and communicate a sunken boat to the app.
- Afterwards a discussion takes place in which the test and the app will be discussed. The test takes a total of  $\pm$  45 minutes per test to complete.

To step into the role of a timekeeper, the participant was asked to put on a timekeeper T-shirt of a rowing race. To furthermore simulate the racing scenario context, a p5.js model (appendix B.3) with crossing boats is created and displayed on a big screen. Also, a smartphone prototype in Figma enabled the participant to interact with our redesign.

The roles within our design team were distributed in a way that allowed a lot of observation, while moderating the test and support the participant if and when needed (figure 12).

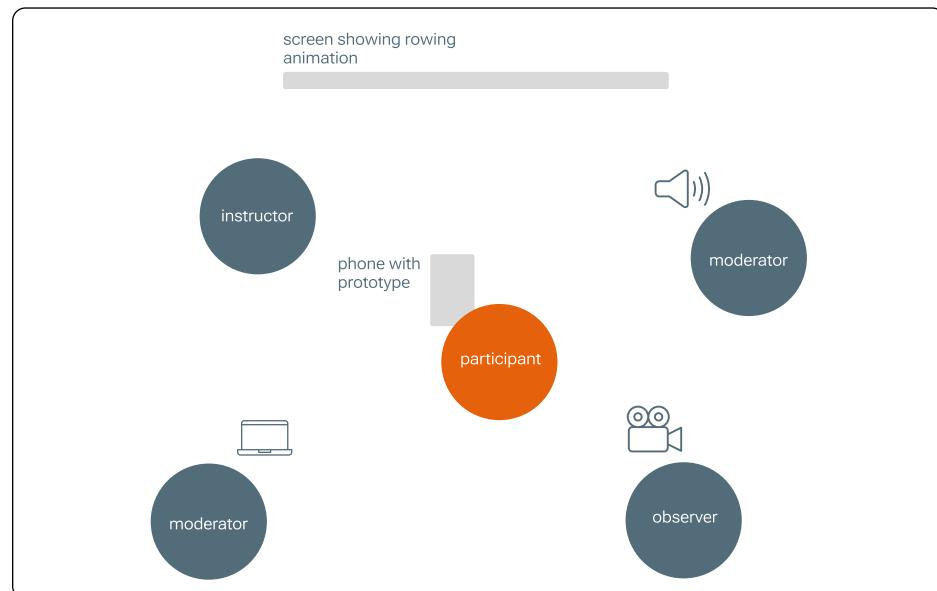


Figure 12. User test set-up.

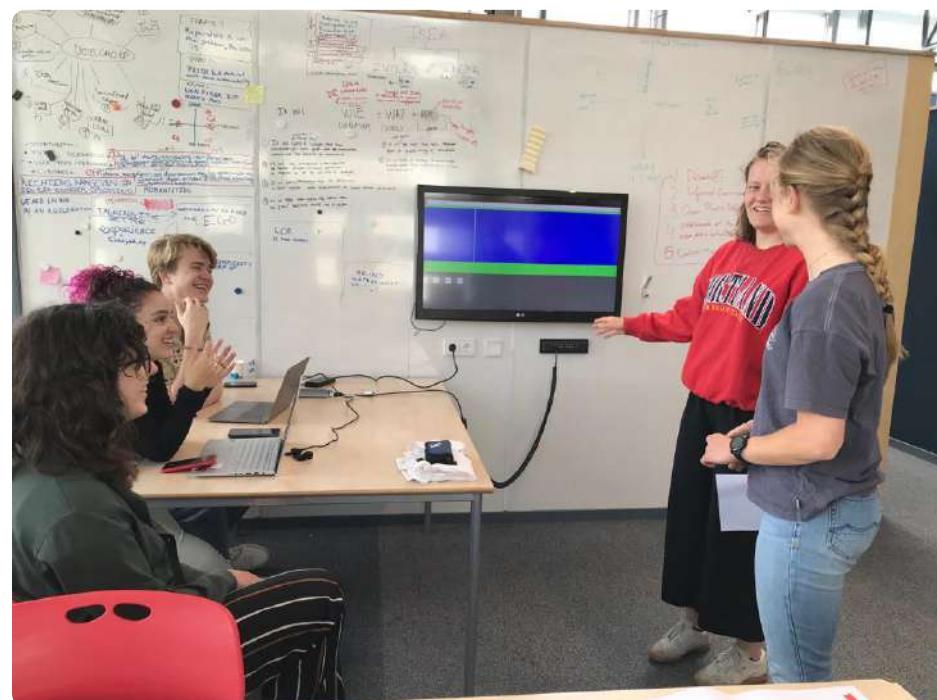


Figure 13. User test introduction.

# 2.1 User test

## 2.1.3 Methods of collecting data

To observe and discuss the tasks of the user test, 4 methods of collecting data were used.



### Observation during test

During the user test, the participant will be observed by a video recording, taking pictures and note-taking. The participant is not asked to think out loud, to focus on the audiovisual tasks during the test.

Figure 14. Explanation of the user test.



### PrEmo

The PrEmo card set (Desmet, 2019) is used directly after the tasks, to stay close to the participants' emotions. The cards are displayed on a timeline with the three tasks on the horizontal axis and positive/negative on the vertical axis (Appendix B.4). This method is used as a conversation starter. From now on, the participant is expected to think out loud.

Figure 15. PrEmo card set and timeline.



### RaceClocker Questionnaire

The Redesign Questionnaire (Appendix B.5) includes questions to specific functions and to test our testable targets. The participant rates to what extend they agree/disagree with the statements on a Likert scale (reference XX). Printed screenshots of the interfaces (Appendix XX) are provided to let the user explain their choice and support a short discussion afterwards.

Figure 16. Redesign questionnaire and interface screenshots.



### System Usability Scale

The System Usability Scale (SUS) (J. Brooke, 1995) consists of a Likert scale questionnaire with fixed statements to test the usability of practically any kind of system (Appendix B.6). The participant rates to what extend they agree to the statements.

Figure 17. System Usability Scale questionnaire.

# 2.2 Results

## 2.2.1 Introduction

By testing the RaceClocker redesign, both qualitative and quantitative data was collected. The results are collected using the SUS questionnaire (see appendix B.7), the RaceClocker questionnaire (see appendix B.8) and observation.

## 2.2.2 The SUS score

A desired minimum outcome of a SUS is a score 68. Scoring below this number means the system has major issues, scoring above is sufficient. The SUS method does not point out specific problems but gives an indication whether the general system is good. We used the SUS questionnaire to test both the current RaceClocker during the first phase, and the redesign during the user tests. Figure 18 shows the results per participant from the user tests and the averages (of the current design and redesign) per question. This shows on which topics the redesign scores least and best. The overall SUS scores are shown in figure 19. This shows the redesign has improved the overall usability of RaceClocker. For detailed results see Appendix B.7.

## 2.2.3 RaceClocker questionnaire

During the test, participants were asked to fill in a questionnaire designed by ourselves and rate the redesign on certain topics. The responses on the questionnaire can be found in Appendix B.8. Overall, the redesign scored well, all answers averaged a 3.7 or higher out of 5. To go into the more insightful qualitative details concerning this questionnaire in relation to observations done during the test, both are analyzed in conjunction. This analysis can be found on the next pages (chapter 2.2.4).

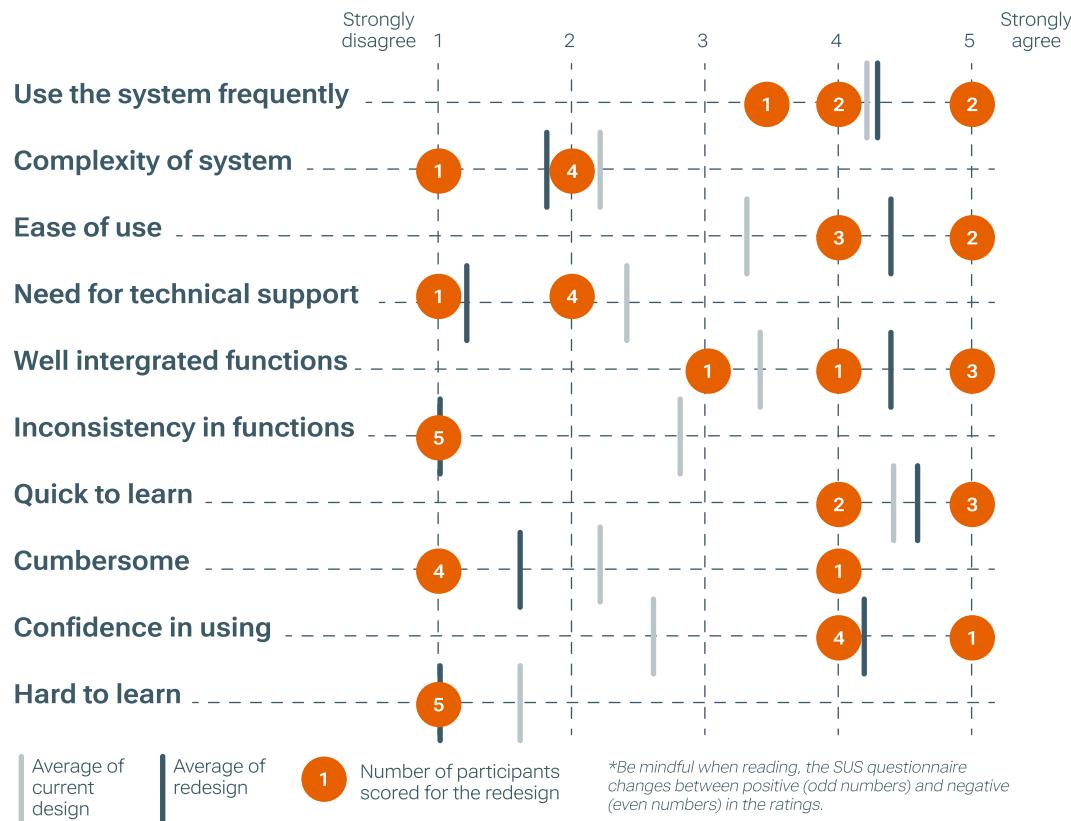
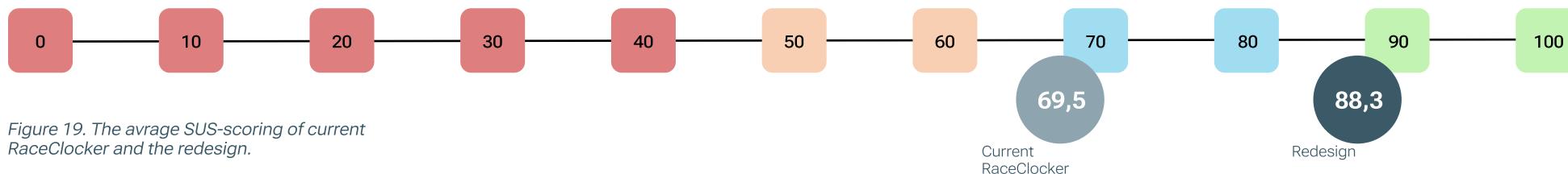


Figure 18. SUS answers per participant and average

# 2.3 Analysis of results

## 2.3.1 Findings per function

During the user test, various new and changed functions were evaluated. The results are based on the questionnaires, PrEmo and observation. Some general quotes said during the test but not fitting with one of the functions are shown below. Notes taken can be found in appendix B.9. The results of the questionnaires are mapped out in figures 20 to 26.

P1: "I felt a bit insecure because I kind of already had to start without knowing the system yet but I was also curious.... But then I looked at the screen and it was quite intuitive"

P4: "I used it once and I feel I can use it again without new help"

P1: "I think that anybody could do this, also if you are not a rower or if you are a first year or something"

P3: "you have to do a lot by yourself, it would be nice if the tasks are divided over more people "

P4: ""it was the first time so it was a bit scary, but quickly felt confident""

### Progress bar

The progress bar was not perceived clear immediately. It was confused as an indicator for the speed of the boats because during the test, due to time limitation, it was moving unrealistically fast. One participant did not notice it at first because she was looking at the screen to spot the boats and not to the app interface. However, after the test, the function was understood and considered useful as feedback about the state of the boats during the race. It was also suggested that it was helpful to reduce the communication load to the other timekeepers through the walkie talkie (See figure 20 for the overview of the results).

P5: "When I saw it move past the checkpoints it was really nice, I could see where the boats were even though I did not see them in the screen yet"

P4: "It's convenient in the progress bar to see where boats are at and when I have to be ready"

P3: "At first I thought the bar showed the speed of the boats but I realized this does not make sense and I got that it showed which point they pass"

P4: "It's nice for the walkie talkie if it reduces to only communicate for issues or important stuff"

Q10: In the app, it's clear to me if I am a start, split or finish timekeeper.

Q12: I understand what the progress bar in each button represents.

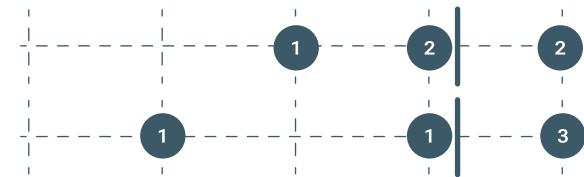


Figure 20. Score given on questionnaire by participants on questions related to progress bar function

1  
Amount of participants

Average of redesign

# 2.3 Analysis of results

## Walkie talkie

The walkie talkie function was perceived clear and familiar. The placement was found intuitive and clever since it was positioned far away from the other features of the interface, so that it could not be tapped by accident. The only issues regarding the function were found when the participant tapped the button instead of keeping it pressed while speaking, mostly because their finger was covering the button while it was becoming bigger. The pulse animation made the participants aware that another timekeeper was using the walkie talkie to communicate but not knowing who was talking made them feel lost (see figure 21 for the overview of the results).

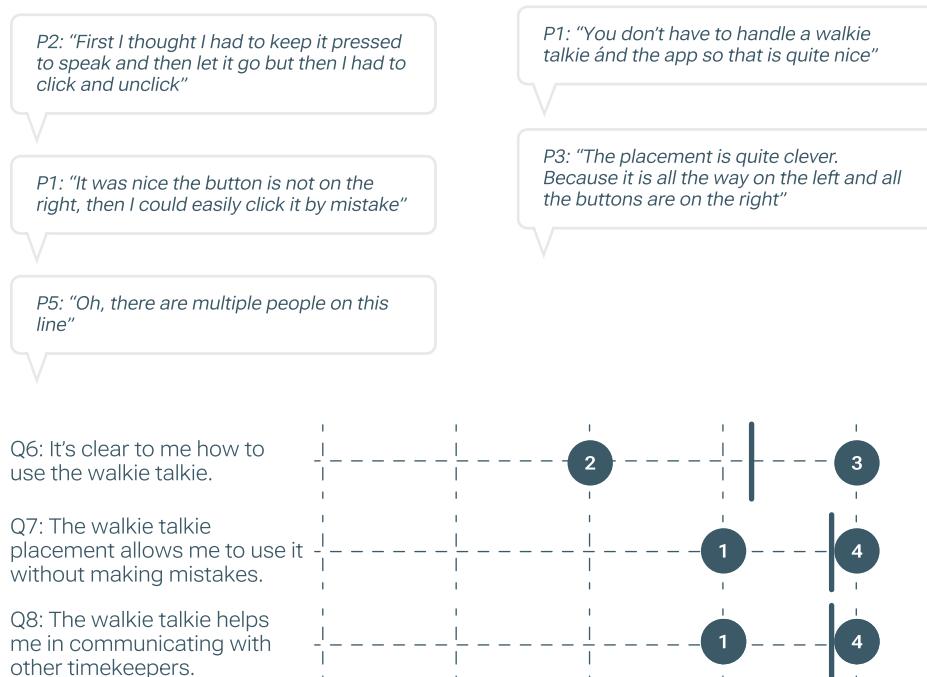


Figure 21. Score given on questionnaire by participants on questions related to walkie talkie function

## Confirmation feedback

The confirmation feedback was shown through a few features: sounds, change of colors in buttons and a pop-up screen to show that the user finished timing a wave.

The overall score in this group of features was 4.9. All five participants scored 5 points on knowing when a wave has finished. Specifically about how clear the user could hear the sound confirmation, four of the participants scored 5 and the other tester scored 4 because it did not catch his attention. Furthermore, the confirmation after each wave caused excitement on the faces of the participants. However, after the test they did not remember the confirmation sounds. This was mainly because, thanks to its intuitiveness, they reacted to it subconsciously. (see figure 22 for an overview of the results).



Figure 22. Score given on questionnaire by participants on questions related to confirmation feedback functions

1 Amount of participants  
Average of redesign

# 2.3 Analysis of results

## Error menu

The error menu was perceived intuitive by the participants because the DNP button could be found easily when it was asked to mark a boat as "did not pass". The participants reported that they liked how that the functions "delete, reassign and DNP" were all clustered in one menu because they are meant to be used only in special occasions. (see figure 23 for the overview of the results).



Q5: It's easy to communicate that a boat has not passed the finish line.

Figure 23. Score given on questionnaire by participants on question related to "error menu" function

## Big buttons

The participants found that the big numbers displayed on the buttons helped them match the boats on the screen with the buttons on the interface. This made them time boats accurately. Despite this, they still felt afraid to tap on the wrong button when the boats were approaching the finish line close to each others. For this reason, it was recommended to place the buttons more apart from each other. (see figure 24 for the overview of the results).

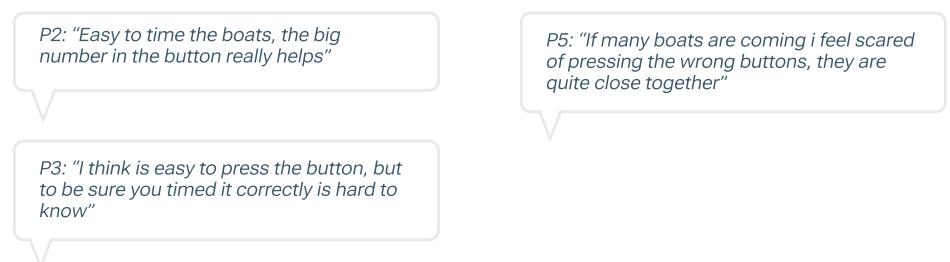


Figure 24. Score given on questionnaire by participants on question related to error "big button" function

1  
Amount of participants

Average of redesign

# 2.3 Analysis of results

## Running timer

The running timer is a feature that does not need to be used and checked constantly during a race. It made the users feel good to have the option to check the time of the race if they needed to. This feature was mostly ignored as it was not dominant in the interface but it was easy to find if the user wanted to. On average, it was graded with a 4 because the purpose of the timer was clear. Nevertheless, two participants scored it with a 3 because they did not understand the timer right away (see figure 25 for a overview of the results).

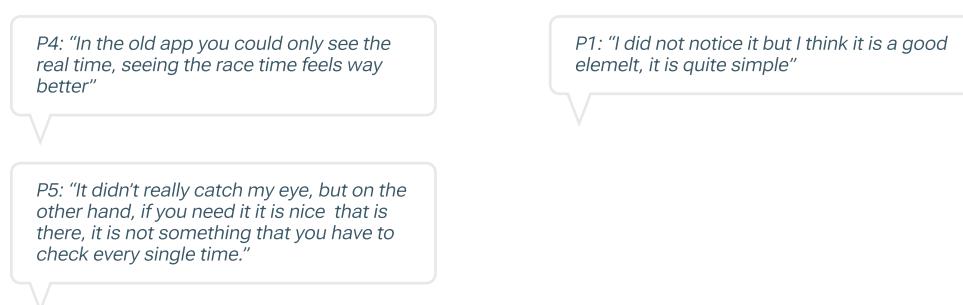


Figure 25. Score given on questionnaire by participants on question related to error "running timer" function

## Waves structure

During the test, the wave structure was well received and understood by the participants. It helped them handle their tasks in order without having to see all the participants all at once in a long list. Having the boats visible per wave helps participants in finding the right boats, making their task more clear. The participants liked the wave menus as it made their timing experience feel more at ease and structured (see figure 26 for an overview of the results).

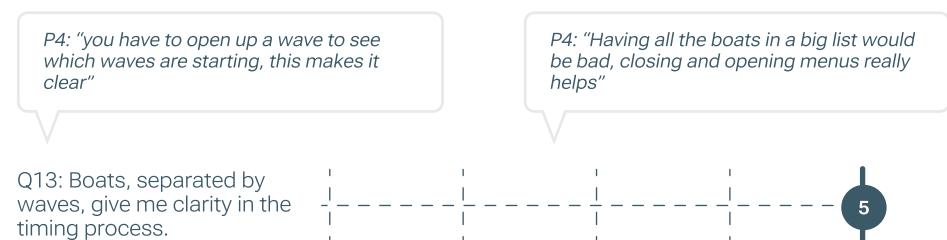


Figure 26. Score given on questionnaire by participants on question related to error "wave structure" function

1 Amount of participants

Average of redesign

# 2.3 Analysis of results

## 2.3.3 Testable targets

The design criteria and testable targets are created in previous reports and evaluate the three design goal qualities: aware, connected (figure 27), and confirmed (figure 28). In addition, the "user experience" category (figure 28) was created to evaluate the qualities of the interaction vision: autonomous, communicative, and supported.

The testable targets are evaluated based on the results of the questionnaires and observation during the test. The targets with a check icon are reached and the targets with the cross icon were not fully reached or understood. They need to be addressed for recommendations.

	Design criteria	Testable target	
Aware	<ul style="list-style-type: none"> <li>The timekeeper is aware about the race progress.</li> <li>The timekeeper can easily understand all functions.</li> <li>The timekeeper is aware of the connection between the real world context and the app when boats cross the finish line.</li> </ul>	<ul style="list-style-type: none"> <li>The participant knows at all time where boats are located during the race.</li> <li>After the test, no participants respond that they did not understand the tasks to be performed.</li> <li>The participant is able to accurately time a boat in less than 1 second.</li> </ul>	The overall score of the question "It's clear to me in which part of the race each boat is" in the questionnaire is 4 out of 5. Observations showed that 3 out of 5 participants needed suggestion from the design team to use the walkie talkie as they wanted to tap it instead of keeping it pressed. Observation showed that all of the participants accurately timed boats in a range from 0.1 - 0.4 seconds.
	<ul style="list-style-type: none"> <li>The timekeeper is able to easily communicate with other timekeepers.</li> </ul>	<ul style="list-style-type: none"> <li>The participant is able to communicate information to other timekeepers within <math>\leq 2</math> taps.</li> <li>The participant can easily communicate information to other timekeepers within 5 seconds.</li> </ul>	Observation showed that all participants were able to find the walkie talkie button in 1 tap. Observation showed that participants were able to find the walkie talkie button in 0.5 seconds.
Connected			Testable target was reached Testable target was not completely reached

Figure 27. Testable targets: Aware and connected

# 2.3 Analysis of results

	Design criteria	Testable target	
Confirmed	<ul style="list-style-type: none"> <li>The timekeeper is able to feel when their task finishes.</li> </ul>	<ul style="list-style-type: none"> <li>The participant is able to notice the audio confirmation feedback.</li> <li>The participant is able to notice the visual confirmation feedback.</li> </ul>	The participants score an average of 5 out 5 for the question "In the app, I can see when a wave has finished" in the questionnaire. The participants score an average of 4.8 out 5 for the question "I can clearly hear the feedback sounds made by the app" in the questionnaire.
user experience	<ul style="list-style-type: none"> <li>The timekeeper feels autonomous when using the app.</li> <li>The timekeeper feels supported in using the app.</li> <li>The timekeeper feels communicative in using the app.</li> </ul>	<ul style="list-style-type: none"> <li>The participant gives a score of <math>\geq 80\%</math> on feeling autonomous.</li> <li>The participant scores <math>\geq 80\%</math> on feeling supported.</li> <li>The participant gives a score of <math>\geq 80\%</math> on feeling communicative.</li> </ul>	The participants score an average of 3.8 out 5 for the question "Using this app, makes me feel autonomous" in the questionnaire. This was because some participants felt overwhelmed by the novelty of RaceClocker and felt they needed help from a second timekeeper in this "list" timing mode. The participants score an average of 4.6 out 5 for the question "Using this app, makes me feel supported" in the questionnaire. The participants score an average of 4.6 out 5 for the question "Using this app, makes me feel communicative" in the questionnaire.

Figure 28. Testable targets: confirmed and user experience

Testable target was reached

Testable target was not completely reached

# 2.4 Conclusion

In this chapter, the design was validated by testing with different users in a scenario that mimicked the context of a rowing race. With the data collected after the user tests, analyses verified the testable targets and understandability of the new or changed functions.

Overall, the results of the tests showed a good welcome of the redesign. The new design's SUS score is significantly better than that of the previous design, indicating enhanced usability of the RaceClocker app. Furthermore, most of the goals set for the user experience and interaction have been reached when evaluating the testable targets. The user now feels more connected, aware, and confirmed by the app; this means that, overall, the design goal for RaceClocker has been accomplished. While there are a few areas where further iterations can be made, these quick fixes and recommendations are discussed in detail in the following chapter.

## Limitations

Even though all the tests were carried out in a way in which no important characteristic of a rowing race context was left behind, there are some limitations about the tests and the results:

### 1. Limited sample size and familiarity with the context

The test involved only five young participants who were already familiar with the context. This small sample size restricts the generalization of the results. To obtain more significant and representative outcomes, a larger and more diverse sample should be included in future testing.

### 2. Testing environment mismatch

Although RaceClocker is designed for outdoor use, the tests were conducted indoors due to the test's objectives, time constraints and space limitations. While efforts were made to mimic real-life characteristics as much as possible, the indoor setting may not fully capture the app's performance and usability in its intended outdoor environment.

### 3. Lack of real-time race conditions

RaceClocker is primarily used during live races where numerous unpredictable factors can influence its functionality. However, for the tests, a prototype of the app was utilized in a prearranged scenario. This controlled setting may not fully encompass the challenges and complexities encountered during actual races, potentially limiting the evaluation of the app's performance under real-time conditions.

### 4. Integration in the real app environment

Because a prototype was made in Figma, not all features were implemented as they would be in reality. The biggest feature being the synchronous updates among timekeepers. Within the prototype we were unable to connect multiple timekeepers together which affected multiple functions. The functions being: the walkie talkie, the progress bar, the running timer and the did not pass button. All these functions would change depending on the actions of another timekeeper and are mimicked to the best of our abilities.

# FINAL IMPROVEMENTS

# CHAPTER 3

*This chapter concludes the entire design project and adds final improvements to the redesign. With the analysis done and insights gathered from the user tests, final quick fixes are done to make last improvements to the redesign. In addition, recommendations are given on how to proceed and show which functions still need change and/or more attention.*

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3.2 Recommendations	32
3.3 Conclusion	33

# 3.1 Quick fixes

## 3.1.1 Introduction

The quick fixes presented on this page are derived from the analysis of the user tests and have the purpose to address current issues with simple improvements (see figures 29, 30, and 31). However, the opportunities for design exploration that require further research and experimentation will be discussed in the recommendations section on the next page.

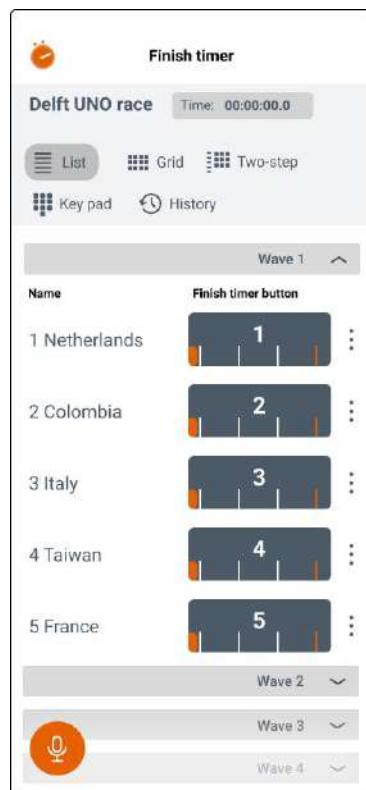


Figure 29: Before testing



Figure 30: After testing - suggested bigger Walkie talkie button and space between timing button

## 3.1.2 Main changes

### 1 The walkie talkie

During the user testing, it was observed that some participants needed clarification about how to interact with the walkie talkie feature. Some users attempted to long-press the conversation, while others opted to tap it. The design team addressed this issue and provided more explicit guidance. The icon of the walkie talkie was made bigger when it is long-pressed for conversation. This visual feedback effectively resolves the confusion and encourages users to hold it instead of tapping, ensuring a consistent and intuitive interaction with the walkie talkie feature.

### 2 The timing buttons

Additional space has been allocated between the timing buttons to prevent users from feeling cramped or accidentally tapping a wrong button.

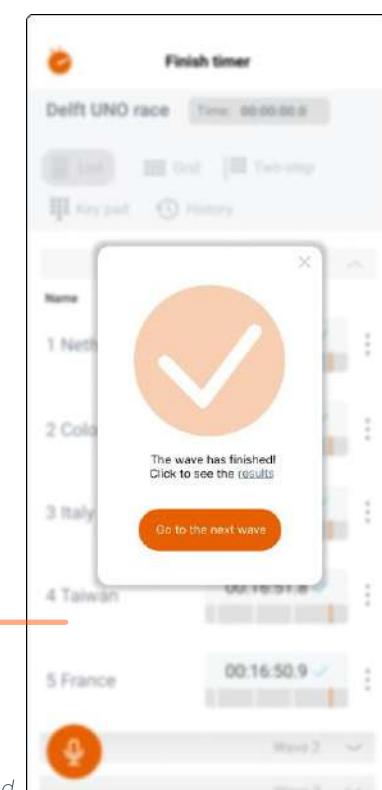


Figure 31: After testing - suggested blur background

### 3 Confirmation screen

In addition to its reduced opacity, the background behind the confirmation pop-up will become blurry when the pop-up appears in order to reduce unneeded information interference. The attention is pointed to the confirmation screen and next steps.

# 3.2 Recommendations

## 3.2.1 Introduction

Based on user testing results, our redesign still has areas on which it can be improved. This section provides future recommendations for these improvements. They require further design research and experimentation in order to be more successfully work within RaceClocker.

## 3.2.2 Further function development and testing

### 1 The walkie talkie

The walkie talkie, a significant new feature introduced in this redesign phase, has been placed in a prominent and easily accessible position. However, several interactive aspects of the walkie talkie still require further testing. For example, determining the optimal mechanism for using the walkie talkie (such as whether it should be held down or tapped when speaking) and considering options like displaying the speaker's identity during conversations necessitates additional research and user testing to validate the most effective interactive effects.

### 2 Change between timekeeper interface

Currently, the race manager creates a race using RaceClocker on a computer and shares the corresponding link to all timekeepers participating in the timing process. However, during our design phase, we have implemented a progress bar that visually presents the position of each timekeeper at various checkpoints. In order to enhance the usability of the system, we propose enabling timekeepers to conveniently switch between each other's positions (start/split/finish) by utilizing the same shared link.

### 3 Progress bar UI design

The design of the progress bar can be modified to resemble a boat in abstract or realistic way, enhancing its visual representation.

### 4 The error menu

In the new error menu, three buttons were included: "Did not pass", "Reassign to other," and "Undo." However, in the report only the "Did not pass" has been tested as this was a new function. The user experience with the already existing features remains to be verified in future evaluations.

### 5 Two-step method

A few participants expressed they would like to time together with another timekeeper, so one could press when crossing and the other could assign times to the boats. RaceClocker already offers this function, but due to time restrictions it could not be incorporated in our redesign. Therefore, redesigning our functions in the existing two-step timing feature is a future objective to research and test.

## 3.2.3 The real context and the sample size

### 1 The sample size

During the testing phase of this design process, the majority of the samples consisted of young female students aged between 21 and 25 years who had prior experience in rowing competitions. In the future, further testing and validation can be conducted to align with the age and gender demographics of the primary customer base. This will provide additional insights and evidence to support the design decisions.

### 2 Test in the real context and long term testing

During the participant testing phase, the aim was to simulate the race environment and sound using screens and speakers to replicate the experience as closely as possible. However, it is essential to acknowledge that these simulations cannot fully recreate the exact conditions of an actual race and its surrounding environment. As a result, specific issues may have been overlooked during the testing process. Moving forward, it is essential to continue enhancing and testing the system within the authentic racing context.

### 3 The sporting domain

This report focuses on the design research conducted for rowing within the RaceClocker application. While RaceClocker offers various sports options, such as running and cycling, it is essential to note that the findings and insights presented in this study may not directly translate to other sports competitions. Each sport has its unique requirements and contexts; therefore, the design considerations discussed need to be tested before applying to other sporting domains.

# 3.3 Conclusion

During the past 2 quarters we worked on redesigning the manual timing app: RaceClocker. During this project we have analyzed the current app, generated new ideas and created a prototype to test our improved and new functions. We aimed to make the experience more feel more connected making users feel more aware and making them feel confirmed whilst using RaceClocker.

We started phase 3 by improving the concept generated during phase 2. With a few feedback moments and small tests at the start of phase 3, a redesign was build that could be tested. This prototype was tested among a group of experienced timekeepers, fitting within the intended target group. The redesign during these tests was generally received positively. All functions show potential and with a few improvements and more testing they could transform into a final design and be implemented into the actual app.

In the end we are satisfied with our redesign on RaceClocker. Our prototype and test showed the potential of new and changed features. With our new and improved RaceClocker design we made users feel more connected, improved the users awareness and made them feel more confirmed in their actions in a rowing context. We hope our redesign and further input helps to improve RaceClocker in the future.

## Acknowledgements

We would like to thank everyone who has helped us during this project. First of all we would like to thank the people helping us to explore RaceClocker and test our redesign. We would like to thank our coaches, Chen and Marise, for guiding us through our process providing us with feedback, suggestions and ideas. Finally we would like to thank our client: RaceClocker, Cees and Lucas for their feedback on the previous reports and their positive and open involvement in our proces.

# References

Brooke, John. (1995). SUS: A quick and dirty usability scale.  
Usability Eval. Ind.. 189.

Cognitive Walkthrough | Usability Body of Knowledge. (z.d.).  
<http://www.usabilitybok.org/cognitive-walkthrough>

Desmet, P.M.A. (2019). PrEmo card set: Male version. Delft, Delft  
University of Technology. ISBN: 978-94-6384-076-7.

# APPENDIX

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# Appendix A.1: Findings pilot test

Participant tries to push buttons of timing options.  
--> Make it clear in script and make it scrollable.

Voice recording 1. 'can we begin?' --- pause --- 'uhm'.  
Participant says 'yes' in the pause.  
--> maybe without the pause so participants dont try to say something?

Participant saw the cargo ship as a rowing boat.  
--> will be good when experienced timekeeper. Maybe add it to the explanation video "sometimes, starts are delayed because of a cargo ship blocking the way".

Participant didn't see the number on the participants  
--> maybe make the number on the boats bigger.

Recording of Rijk says 'I think you should find a way for not finished', but we call it 'not passed' in the app.  
--> change recording to not passed.

Participant didn't see the menu for 'did not finish'.  
--> make it darker (maybe blue? Everything that is clickable is blue?)

Participant didn't understand why name is mentioned twice in the redesign.  
--> change it. Maybe make it one big button?

Participant didn't notice the progress bar. Wasn't associated with was seen on the screen.  
--> make it more prominent.

Participant didn't understand the reassigning boats  
--> lets get that question out OR put it in the task. In the questionnaire: what would you do if you had to reassign a boat?

I found various functions coherent. In what way? What do you mean?  
--> reformulate question. It is about the flow.

Attention was attracted to the top bar, barely had a chance to test them. Maybe wasn't used?  
--> redesign

Walkie talkie placement is a design taboo. You cannot press two pressable buttons on top of each other.

Participant would be curious to see if it would still be manageable if there would be 50 waves.  
--> make the redesign scrollable

Participant couldn't remember the confirmation sounds.  
--> should we adjust it? And add sounds of clicking the boats? Or leave it our?

Timer wasn't paid attention to. Participant feels it is useful.

The icon of the walkie talkie really looks the same as the RaceClocker Logo.  
--> we could make the logo black and white maybe? The color of orange now pops out in the lay-out anyway.

# Appendix A.2: Cognitive walkthrough

The page shows the notes taken during the Cognitive Walkthrough. Three group member reviewed the app to critically analyze the redesign before the user test (See figure 32).

## Task 1:

### Did you know what to do during this task?

- Only knew how to talk to other TK because the visual change of the button when others were talking
- Would not know that she could start a conversation herself

### Did you know while doing the task that you were doing the correct thing?

- yes but not because of the app but because someone answered through the walkie talkie
- did not notice when walkie talkie button changes when pressing
- replying helps to recognize if you are heard
- walkie talkie is familiar because of other apps (whatsapp, etc.) holding down button

## Task 2:

### Did you know what to do during this task?

- Knew what to do, not a lot is happening in the screen, the wave things and the big buttons pop out
- big buttons call you to press

### Did you know while doing the task that you were doing the correct thing?

- Yes because the button drastically changes the color so it is clear what you have done

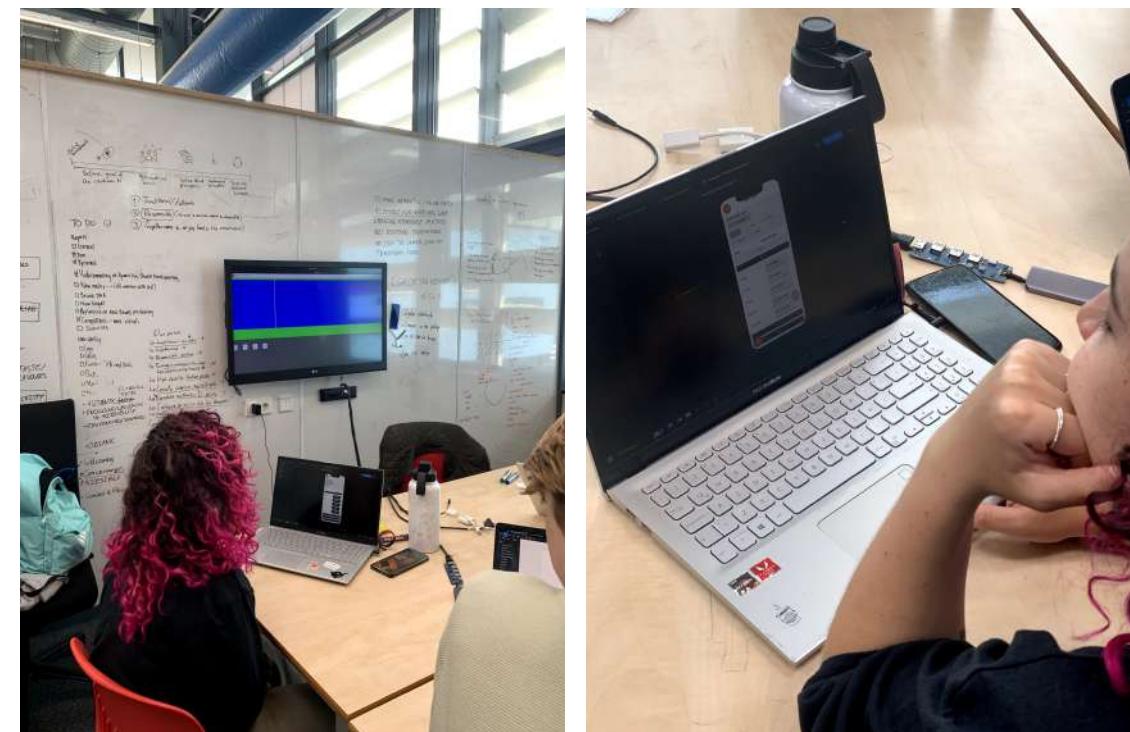


Figure 32: team UNO during the Cognitive Walkthrough

# Appendix A.2: Cognitive walkthrough

## Task 3:

did not pass button was hard to press

### Did you know what to do during this task?

- the 3 dots are a bit hard to find but are kind of the only other thing to press other than the big buttons
  - the color of the dots menu is a bit too light and not super visible
  - the vertical dots and their gray color give the impression that you can drag/reorder the buttons
- when marked as did not pass, the button is similar to finished buttons, it would be nice that there is a bit of difference between the two
- confirmation pop up comes up quite quickly, cant really see what you have done

### Did you know while doing the task that you were doing the correct thing?

- Timed and did not pass buttons are very similar, it was visible that it changed but not directly sure if the boat was timed or labeled as did not pass

Overall:

It is hard to see if you successfully press the PTT, it is not good visible

## Conclusion

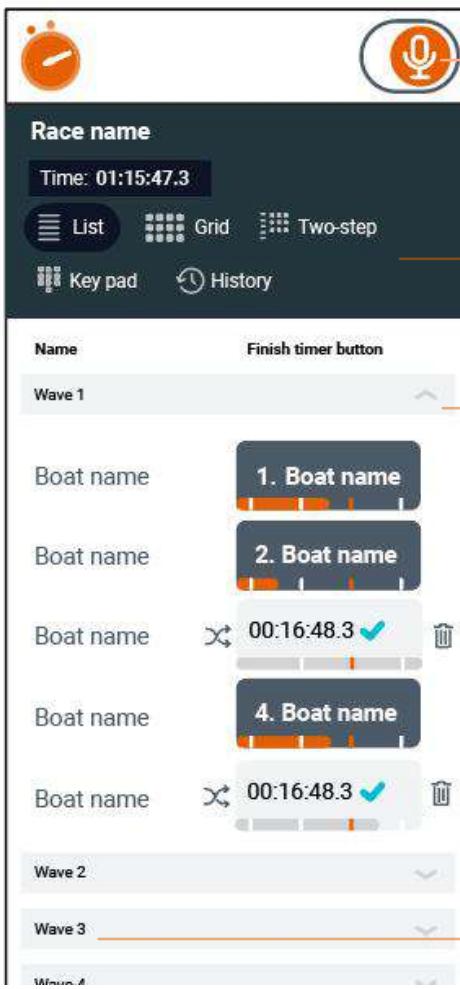
The conclusion reached after the cognitive walkthrough were the followings:

- **Error menu:** three dots were made dark blue so they resulted more visible and made them tap-able as all the other blue buttons
- **Did not pass:** the color of the text changed to red to make clearer that is different from the regular timed boats
- **Confirmation pop-up:** The delay between having finished a wave and the pop-up showing has increased a bit. This makes it less sudden and gives the timekeeper some time to quickly adjust.
- **Walkie talkie:** the button when it is pressed becomes larger, while in the first prototype became smaller and darker; in this way it is more visible that the user is performing the task correctly

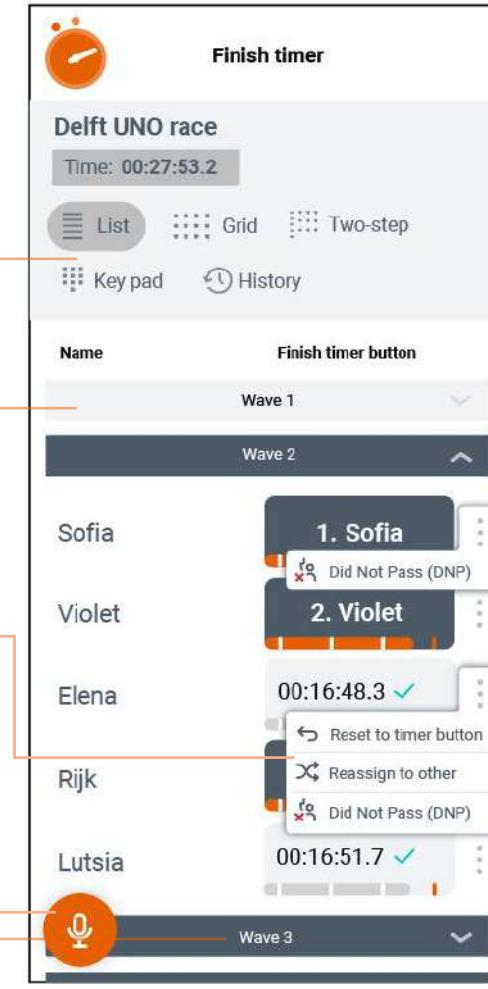
# Appendix A.3: Iterations on concept

After the second phase of the project several iterations were made to further improve the redesign of RaceClocker. With feedback from the phase 2, given by coaches and the client (P2) report, a feedback session with fellow IDE students (IDE) and input from an experienced UI designer (UI) several changes were done. These changes can be seen in figure 33. Several options of changes used to come to version 2 can be found in appendix B.4.

## Version 0



## Version 1



### 1 Simplified and move of walkie talkie

The button was too complex and its switching function caused confusion. Based on feedback it was simplified and moved to the bottom right for easy reach and separation from other functions

IDE

UI

P2

IDE-students

UI designer

Phase 2 feedback

IDE

UI

IDE

UI

IDE

P2

### 2 Menu color change

The dark blue heading was very dominant, the menu does not need that much attention. The colors of this menu are placed more to the background. More attention goes towards the darker colored timing buttons.

IDE

UI

### 3 Visible finished wave menu's

To get more information and a quicker overview of the progress during a race the wave drop down menu headings change color when all boats within it have been timed.

IDE

### 4 Functions into a menu

The “reassign” and “delete” buttons clutter up the screen in version 1. Because these options are only used in special occasions there are put into a separate menu. In addition to this a did not pass function was added so boats that do not finish can still be assigned and waves can be “finished”. Because a trashcan felt too scary it was changed back to an undo icon.

P2

### 5 Move title of waves to center of button

Due to the move of the push to talk (ptt) button, there is the problem of buttons overlaying. To duel this the button titles moved to the right so it will not be hidden.

IDE

UI

Figure 33. first iteration step

# Appendix A.3: Iterations on concept

Cognitive walkthrough

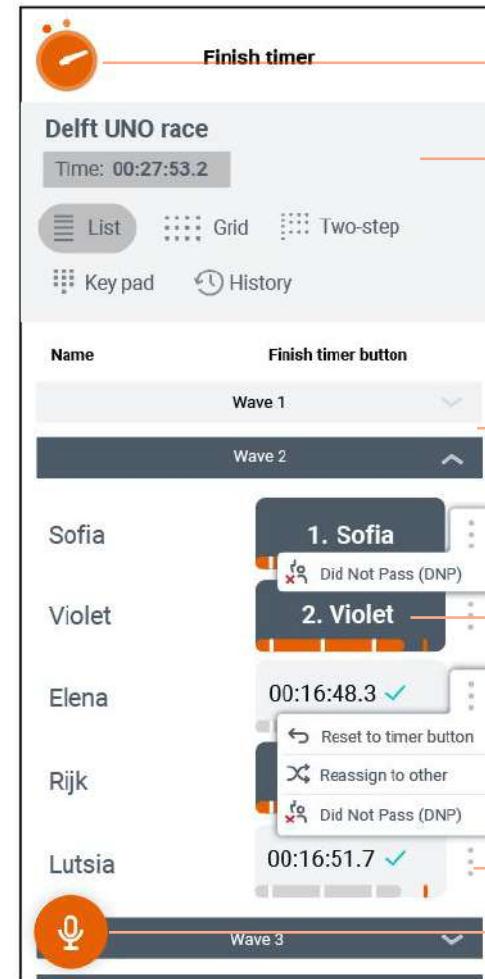
CW

pilot test

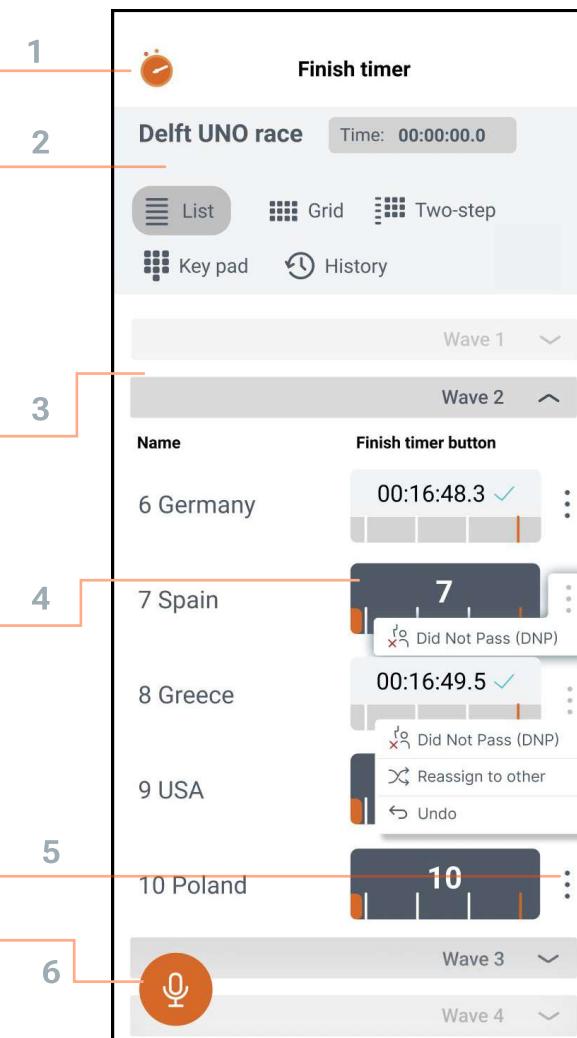
PT

A second wave of iterations was done based on the pilot test (PT) (see Appendix A.1) and a cognitive walkthrough (CW) done within the team (see Appendix A.2). These changes address mainly problems in clarity and cleanliness. The overall change in can be seen in figure 34.

Version 1



Version 2



## 1 Smaller RaceClocker icon

The icon in the top bar has changed size. In version 1 it looks too similar to walkie talkie which communicates that it is a button. With making it smaller this association disappears.

PT

## 2 Rearranged top bar

The top bar is made smaller, so it is less prominent in the design. The running timer has moved up because of this.

CW

PT

## 3 Colored wave structure

The waves are less prominent in the design. The focus in version 2 is now more directed towards on the timing buttons.

CW

## 4 Cleaning up the timing button

The timing button is cleaned up more. It just has a number corresponding to the boat, this makes it easier to quickly recognize the button when boats are passing by. In addition the progress bar size has increased to make this better visible.

CW

PT

## 5 Button menu color

The drop down menu next to the button is made more visible by darkening the color. All tapable buttons within the design are dark blue, this button is now as well to keep consistency.

CW

PT

## 6 Floating walkie talkie button

A fading area is added behind the walkie talkie. This separates the button from the screen so it is less disruptive to the tapable wave dropdown menu's. In addition the wave titles have moved to the right to communicate this is the tapable area more clearly.

CW

PT

Figure 34. second iteration step

# Appendix A.4: iteration options

During the start of phase 3, the design went through a few iterations. For these changes a few options were made, as shown on this page. (see figures 35 and 36)

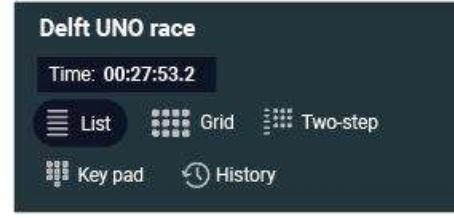
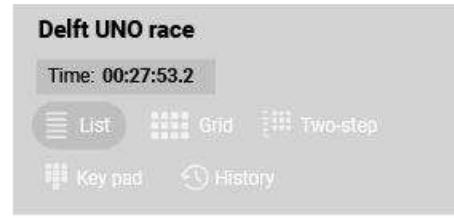


Figure 35: 4 options on colour change of heading

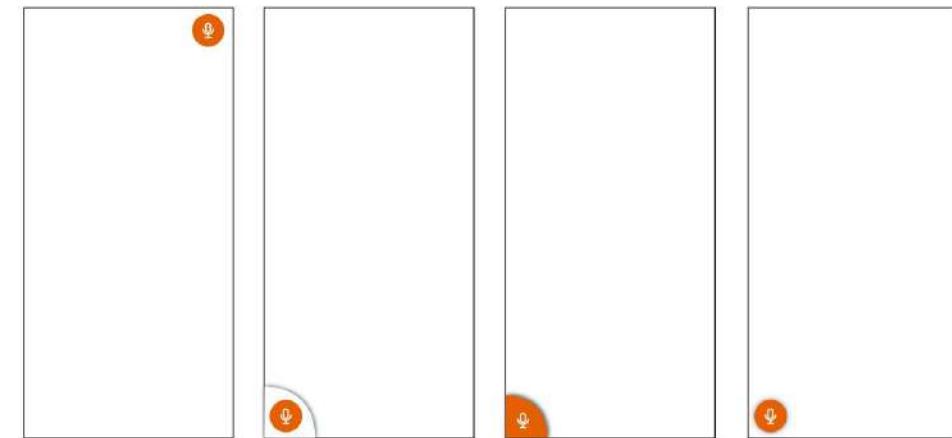


Figure 36: 4 options on Push To Talk shape and position

# Appendix B.1: User test plan

## Purpose

Testing objective:

The main goal of the test is to validate, using the design criteria as a guideline, if the app solves the design problem: the lack of communication between timekeepers, from the app towards the timekeeper and from the timekeeper towards the app.

Furthermore, the test will evaluate all the new functions within the context.

## Research questions

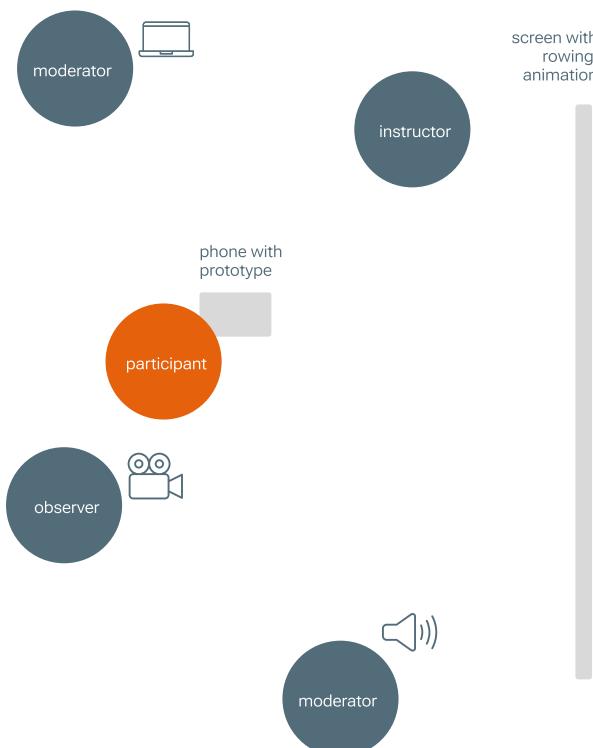


Figure 37: Setting of the tests.

## Participants

We will test with five participants. They are picked from a wide range of experience in timing, RaceClocker and DFI knowledge:

- P1: amateur timer, not familiar with RaceClocker, DFI student.
- P2: coach timer (times boats while biking along with them), not familiar with RaceClocker.
- P3: experienced timer, not familiar with RaceClocker.
- P4: experienced timer, familiar with RaceClocker.
- P5: experienced timer, not familiar with RaceClocker, DFI student.

## Schedule and location

The test duration will be 45 minutes, including discussion.

- |             |                          |
|-------------|--------------------------|
| 0 - 10 min  | welcome and introduction |
| 10 - 25 min | test                     |
| 25 - 40 min | discussion of the test   |
| 40 - 45 min | round-up                 |

The test location is a sunny studio at IDE with a big screen (for the P5.js context animation) and big windows to symbolize timing outside (see figure 37 for the physical settings of the test)

# Appendix B.1: User test plan

## Session

After welcoming the participant, a general explanation of RaceClocker and the rowing context will be given and a video about rowing will be shown.

To step into the role of a timekeeper, the participant is asked to put on a timekeeper T-shirt of a rowing race. To furthermore simulate the racing scenario context, a p5.js model with crossing boats is created and displayed on a big screen. Also, a mobile phone prototype in Figma enabled the participant to interact with our redesign.

The participants will be asked to perform three tasks by using the redesigned prototype:

1. Communicating a delay to per-recorded walkie talkie messages.
2. Timing 5 boats in wave 1.
3. Timing 4 boats in wave 2 and communicate a sunken boat to the app.

## Methods

Afterwards a structured discussion takes place. 4 methods are used:

1. During the test the user will be observed.
2. Through the PrEmo card set the emotions of the participant are mapped out as a conversation starter. Screenshots of the interfaces are provided to stimulate the discussion.
3. Then, the RaceClocker questionnaire focuses on topics regarding our testable targets and specific functions.
4. Lastly, a SUS questionnaire is held to compare the redesign to the current RaceClocker app.

The session is closed off by thanks and a small gift.

## Equipment

- A phone with RaceClocker Prototype on Xd
- A big screen for explanation of a rowing race and the P5.js animation
- 2 cameras
- Pen and paper
- A speaker
- Consent form
- Timekeeper T-shirt (figure 38)
- Discussion printing material
  - Questionnaires and PreMo materials
  - Printed interfaces of the redesign



Figure 38: Rowing timekeeper t-shirt

## Roles

### During test

Instructor: Lutsia

Interviewer/Observer: Elena

Animation: Rijk

Recording: Violet

Background sound: Sofía

Phone prototype: Sofía

Notes: Rijk

Pictures: All

# Appendix B.2: Introduction script

Welcome. we want to test our redesign of the RaceClocker app. During the test we simulate a race and use the app as it would be used during a race. The real test, we will run with experienced timekeepers, so to explain the basics of rowing, we have created a video.

--- show video ---

Today a race is planned where 5 boats are racing during the day. One group of 5 boats is called a wave. For the test we will go through 2 of the waves. In this race there are 4 timing points: the start, two splitpoints and the finish. For the test you will play the role of a Timekeeper at the finish. You are on the side of the water so we would like you to stand up during the test. To really step into the role of a rowing timekeeper we ask you to put on this rowing volunteering shirt.

A race is simulated on the screen in front of you, boats will cross on this screen. During the test some background noise will be played to emulate the scenario. For the prototype you will use our phone, this already has the finish timer screen opened which normally is send by the race manager. On the top of the screen you can see that you are the finish timekeeper. Timekeepers usually hold their phone in front of them so they can time accurately. We would like to invite you to do so too.

Are you okay with us taking pictures and videos?

--- sign consent form ---

We are gonna start with the beginning of the race, as a Timekeeper you move to your location and wait for the race to start, in front of you, you see the water and the finish line the boats will cross. You will time 2 waves in this race. The first one is supposed to start in a few minutes. Do you have any questions before we start?

We will start.

--- task 1 ---

Alright! The big boat is out of the way and the first wave of boats will start.

--- task 2 ---

Great! Now you clicked to go to the second wave of boats.

--- task 3 ---

# Appendix B.3: P5.js animation for testing

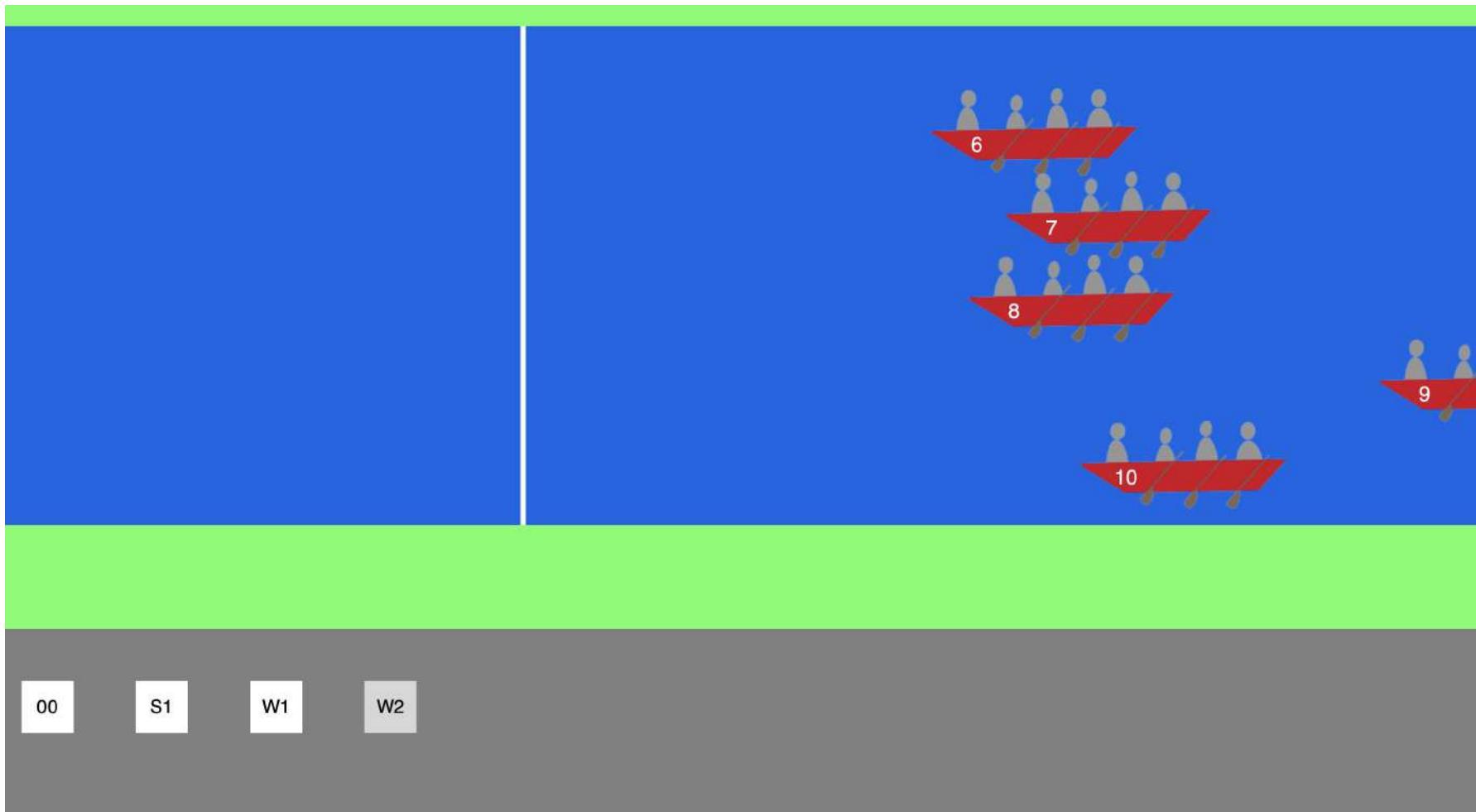


Figure 39:P5 simulation of the race for the tests.

Link to P5: <https://editor.p5js.org/rijkroozenbeek/full/kz-RL5adz>

## Appendix B.4: PrEmo card set

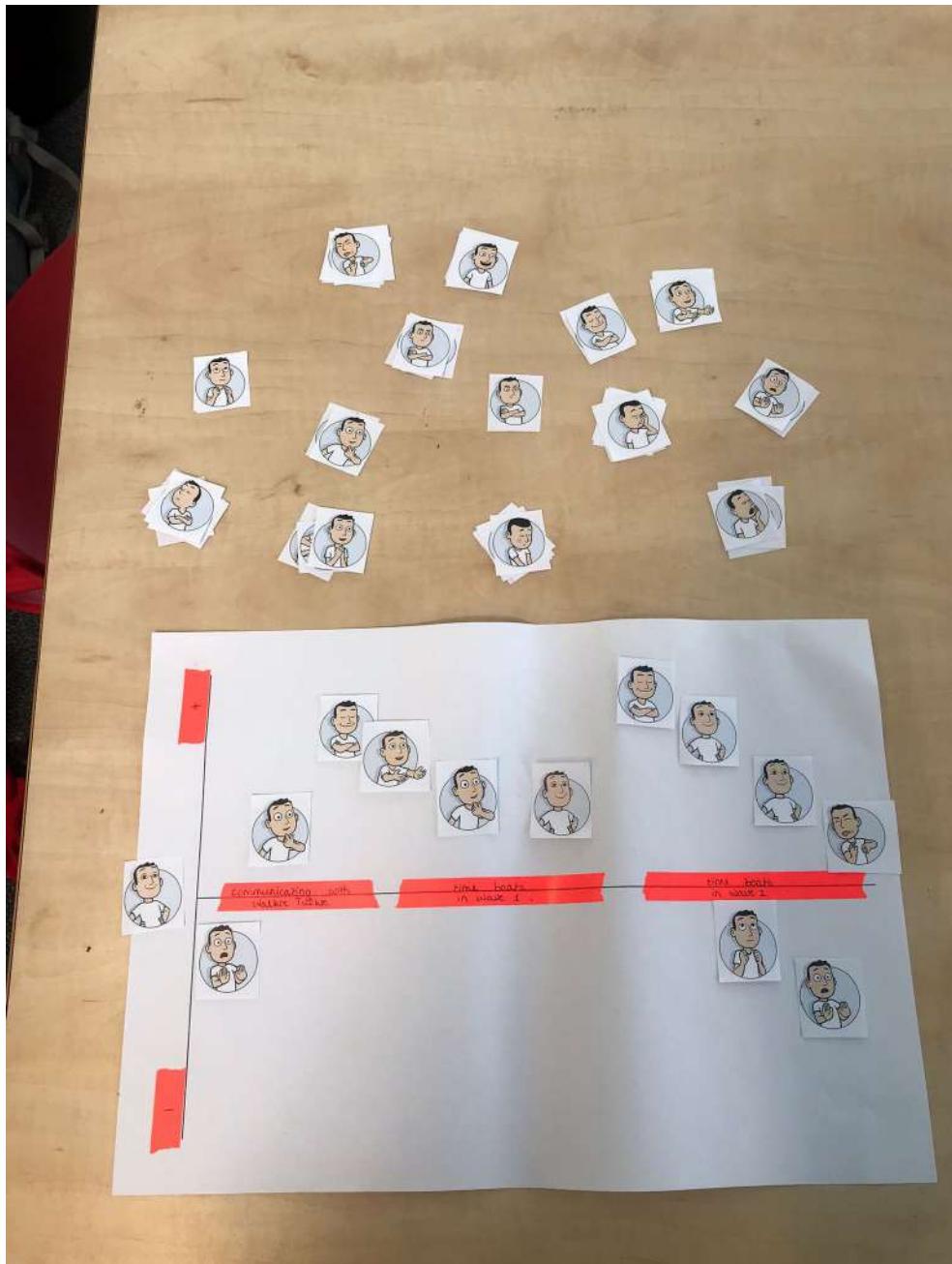


Figure 40: PrEmo card set results for the first test with an experienced rower showing the 3 main tasks that the participants had to carry during the test.

# Appendix B.5: RaceClocker Questionnaire

Participant ID:	Site:	Date:			
<b>RaceClocker Questionnaire</b>					
<p><b>Instructions :</b> For each of the following statements, mark one box that best describes your reactions to the app today.</p>					
	Strongly Disagree	Strongly Agree			
1. Using this app, makes me feel supported during my task.	<input type="checkbox"/>				
2. Using this app, makes me feel communicative.	<input type="checkbox"/>				
3. Using this app, makes me feel autonomous.	<input type="checkbox"/>				
4. It's easy to time a boat.	<input type="checkbox"/>				
5. It's easy to communicate that a boat has not passed the finish line.	<input type="checkbox"/>				
6. It's clear to me how to use the walkie talkie.	<input type="checkbox"/>				
7. The walkie talkie placement allows me to use it without making mistakes.	<input type="checkbox"/>				
8. The walkie talkie helps me in communicating with other timekeepers.	<input type="checkbox"/>				
9. I can clearly hear other timekeepers through the walkie talkie.	<input type="checkbox"/>				
10. In the app, it's clear to me if I am a start, split or finish timekeeper.	<input type="checkbox"/>				
11. It's clear to me in which part of the race each boat is.	<input type="checkbox"/>				
12. I understand what the progress bar in each button represents.	<input type="checkbox"/>				
<b>RaceClocker Questionnaire</b>					
<p><b>Instructions :</b> For each of the following statements, mark one box that best describes your reactions to the app today.</p>					
	Strongly Disagree	Strongly Agree			
13. Boats, separated by waves, give me clarity in the timing process.	<input type="checkbox"/>				
14. In the app, I can see when a wave has finished.	<input type="checkbox"/>				
15. I can clearly hear the feedback sounds made by the app when timing.	<input type="checkbox"/>				
16. I understand the purpose of the running timer on top of the screen.	<input type="checkbox"/>				
17. This app would be clearly used in the outside context of a rowing race.	<input type="checkbox"/>				
Please provide any comments about this app:					

Figure 41: RaceClocker questionnaire with questions about the different functions in the redesign.

# Appendix B.6: SUS Questionnaire

Participant ID: \_\_\_\_\_ Site: \_\_\_\_\_ Date: \_\_\_\_\_

**System Usability Scale**

Instructions : For each of the following statements, mark one box that best describes your reactions to the app today.

Strongly Disagree      Strongly Agree

1. I think that I would like to use this app frequently.

2. I found the app unnecessarily complex.

3. I thought the app was easy to use.

4. I think that I would need the support of an assistance to be able to use this app.

5. I found the various functions in this app were well integrated.

6. I thought there was too much inconsistency in this app.

7. I would imagine that most people would learn to use this app very quickly.

8. I found the app very hard/awkward to use.

9. I felt very confident using the app.

10. I needed to learn a lot of things before I could get going with this app.

Please provide any comments about this app:

(Large empty text area)

Figure 42: SUS questionnaire.

# Appendix B.7: Results of SUS questionnaire

## The sus form results - Current RaceClocker

Questions		P1	P2	P3	P4	P5	average
1. I think that I would like to use this app frequently.	Q1	4	4	4	5	4	4,2
2. I found the app unnecessarily complex.	Q2	2	2	3	2	2	2,2
3. I thought the app was easy to use.	Q3	4	2	4	4	3	3,4
4. I think that I would need the support of an assistance to be able to use this app.	Q4	3	3	2	2	2	2,4
5. I found the various functions in this app were well integrated.	Q5	4	3	3	3	4	3,4
6. I thought there was too much inconsistency in this app.	Q6	2	2	2	2	1	1,8
7. I would imagine that most people would learn to use this app very quickly.	Q7	5	4	5	4	4	4,4
8. I found the app very hard/ awkward to use.	Q8	3	2	2	2	2	2,2
9. I felt very confident using the app.	Q9	2	2	3	4	2	2,6
10. I needed to learn a lot of things before I could get going with this app.	Q10	1	2	1	2	2	1,6
<b>Converted values</b>							
	Q1	7,5	7,5	7,5	10	7,5	8
	Q2	7,5	7,5	5	7,5	7,5	7
	Q3	7,5	2,5	7,5	7,5	5	6
	Q4	5	5	7,5	7,5	7,5	6,5
	Q5	7,5	5	5	5	7,5	6
	Q6	7,5	7,5	7,5	7,5	10	8
	Q7	10	7,5	10	7,5	7,5	8,5
	Q8	5	7,5	7,5	7,5	7,5	7
	Q9	2,5	2,5	5	7,5	2,5	4
	Q10	10	7,5	10	7,5	7,5	8,5
	Total score:	70	60	72,5	75	70	69,5

Figure 43: results for the SUS questionnaire for the current RaceClocker per participant.

## The sus form results - Prototype test

Questions		P1	P2	P3	P4	P5	average
1. I think that I would like to use this app frequently.	Q1	5	4	4	5	3,5	4,3
2. I found the app unnecessarily complex.	Q2	2	1	2	2	2	1,8
3. I thought the app was easy to use.	Q3	5	5	4	4	4	4,4
4. I think that I would need the support of an assistance to be able to use this app.	Q4	1	1	2	1	1	1,2
5. I found the various functions in this app were well integrated.	Q5	5	5	3	5	4	4,4
6. I thought there was too much inconsistency in this app.	Q6	1	1	1	1	1	1
7. I would imagine that most people would learn to use this app very quickly.	Q7	5	5	4	5	4	4,6
8. I found the app very hard/ awkward to use.	Q8	1	1	4	1	1	1,6
9. I felt very confident using the app.	Q9	4	4	5	4	4	4,2
10. I needed to learn a lot of things before I could get going with this app.	Q10	1	1	1	1	1	1
<b>Converted values</b>							
	Q1	10	7,5	7,5	10	6,25	8,25
	Q2	7,5	10	7,5	7,5	7,5	8
	Q3	10	10	7,5	7,5	7,5	8,5
	Q4	10	10	7,5	10	10	9,5
	Q5	10	10	5	10	7,5	8,5
	Q6	10	10	10	10	10	10
	Q7	10	10	7,5	10	7,5	9
	Q8	10	10	2,5	10	10	8,5
	Q9	7,5	7,5	10	7,5	7,5	8
	Q10	10	10	10	10	10	10
	Total score:	95	95	75	92,5	83,75	88,25

Figure 44: results for the SUS questionnaire for the redesign per participant.

# Appendix B.8: Questionnaire score results

Questions	P1	P2	P3	P4	P5	average
1. Using this app, makes me feel supported during my task.	5	5	4	5	4	4,6
2. Using this app, makes me feel communicative.	5	5	4	5	4	4,6
3. Using this app, makes me feel autonomous.	4	4	3	3	5	3,8
4. It's easy to time a boat.	4,5	5	2	4	3	3,7
5. It's easy to communicate that a boat has not passed the finish line.	5	5	5	4	5	4,8
6. It's clear to me how to use the walkie talkie.	5	3	5	3	5	4,2
7. The walkie talkie placement allows me to use it without making mistakes.	5	4	5	5	5	4,8
8. The walkie talkie helps me in communicating with other timekeepers.	4	5	5	5	5	4,8
9. I can clearly hear other timekeepers through the walkie talkie.	5	5	5	4	5	4,8
10. In the app, it's clear to me if I am a start, split or finish timekeeper.	3	4	5	5	4	4,2
11. It's clear to me in which part of the race each boat is.	2	3	5	5	5	4
12. I understand what the progress bar in each button represents.	2	5	4	5	5	4,2
13. Boats, separated by waves, give me clarity in the timing process.	5	5	5	5	5	5
14. In the app, I can see when a wave has finished.	5	5	5	5	5	5
15. I can clearly hear the feedback sounds made by the app when timing.	5	5	4	5	5	4,8
16. I understand the purpose of the running timer on top of the screen.	3	3	5	5	4	4
17. This app would be clearly used in the outside context of a rowing race.	5	5	4	5	3	4,4

Figure 45: results for the RaceClocker questionnaire for the redesign per participant.

# Appendix B.9: Test notes

## Notes Test 1

Lotje

- She didn't keep the walkie talkie pressed but only pressed once to talk, she didn't keep it pressed.
- She assumed that there would be a confirmation before start going the second wave. But this one is more about the walkie talkie and the other tk.
- With the DNP button she wondered for a second searching for the option but found it easily and did the task as desired.
- Was very accurate in timing

### Interview

- in control while communicating
- she got some tasks on her own and felt in control with that
- at start a scared because she did not know how the app works
- She felt curious, screen looked quite intuitive
- more focussing on the numbers than the actual boat names
- When race was finished feel secure, bc she was sure she did not make mistakes
- More confident bc more prepared for wave 2 bc she already understood the race
- communication from other TK gave comfort about the situation of the boat sinking
- afterwards felt more secure about using the app in the future

### SUS

- would use it when she is in a position to organize there don't seem to be use issues, for big already existing races stick to TimeTeam - Timeteam its easy to find all results
- Did not see the time running during the test, did not pay attention, afterwards she thought that it is a was function
- Easy and dont need instructions
- the top icons, different timing options feel out of place and distract
- At first was not sure what she had to do but quickly learned and was ready for wave 2
- Had some pre knowledge about rowing races so she did not need a lot of instructions

### Questionnaire

- Did not feel left alone
- Walkie talkie really helps to feel communicative
- It is hard to know if people heard you when they dont respond
- She knew what to do by herself but race updates are nice when communicated through ptt, which is not autonomous
- Interpreted the progress bar as a live tracker, progress bar is a bit confusing - positioning is not clear. For her, progress bar had something to do with the boat but did not link it to the different splitpoints/timekeepers
- Did not really recall the sounds
- She is left handed and liked the placement of the walkie talkie

## Quotes Test 1

Lotje

- I felt a bit insecure bc I kind of already had to start without knowing the system yet but I was also curious.... But then I looked at the screen and it was quite intuitive.
- I was actually more focusing on the numbers of the lanes than on the countries.. So there was no really a feeling that I was happy because for example the NL won.
- When the race finished I felt secure because I didn't make a mistake. I would feel really stupid when I make a mistake.
- First ship was coming: I was communicating with the ppl at the start and then I felt that I was really in Control bc I was the first person to see the ship... Then I also handed the start sign over to them so I thought like "now you can let it start" so then I was curious for the race and felt confident
- Then I thought, I have to wait for a bit for the next wave bc is probably easier
- I followed the same same order as in the wave 1, so then I felt again satisfied in my action
- I got some communication from the kamprechter (judge) and then that gave me some more insurance that they had it under control.
- After the 2 waves that the overall thing was more secure. Yeah, I felt more secure about using RaceClocker.
- The running timer;; I think it is a good element. It is quite simple
- the app was also easy to use because you just have to press those things
- The dots for DNP were also quite intuitive
- You don't have to handle a walkie talkie and the app so that is quite nice
- I think that anybody could do this, also if you are not a rorer or if you are a first year or something

- If my walkie talkie wouldn't work I would still be able to click in the numbers when they cross the line, so in my function I felt quite autonomous I think
- Is easy to time a boat [...] but maybe for beginners it is interesting to have a tutorial at the beginning or something
- DNP function: It is not logical to have it as a main function it is something that in theory could happen, so is then for special occasions so it is with other things
- Walkie talkie: It was nice that it was not on the right because then I could maybe click it by mistake
- Walkie talkie: I didn't know who I was talking to [...] so it could get a little bit chaotic
- Progress bar: So I think I didn't understand that well
- It doesn't really matter where you are, you just have to time.
- The sounds didn't really distract me

## Notes Test 2

Sophie

- Lutsia had to remind her that she had to tell the others that the boat was gone.
  - when knowing she had to do something it was immediately clear (she pressed it as intended)
  - timing went well.
- knew very quickly what to do when the walkie talkie communicated
  - reacted very quickly and accurate
  - Found and used the DNP function quickly

### PREMO

- Did not expect to have to communicate and was just waiting to time, so she did not listen all too carefully
- was mostly waiting, a bit bored
- When boats approached - a bit stressed full because she needed to start to do something
- a bit more confident after a while.

### SUS

- Recommendation - choose at which clocktower you are so I don't have to search for each link (to change between them).
- was easy to find the did not pass
- there was one moment of "fear" when all boats were coming in but all went well.

### Questionnaire

- Felt supported enough, everything I need is right there
- Trouble with current timekeeping, you can't communicate with other clockers - so communication now is good
- Easy to time the boats, the big number in the button really helps.
- First thought she had to keep it pressed at first but later thought she had to press to start and press to stop. The placement of the PTT is fine
- Mostly knew she was finish TK bc we told her she was it; could then see at the top , with some more questions also pointing to the orange stripe
- did not notice the progress bar because she did not watch the screen, mostly the boats.
- Didn't remember the sounds
- did not notice the running timer, but understands the purpose of it.

# Appendix B.9: Test notes

## Quotes Test 2

Sophie

- Supported: yeah, because everything I need is right there
- Everything speaks for itself
- Supported by the app: 5 because everything I need is there
- Communicative: it's a problem in raceclocker that you can't communicate with each others
- easy to time a boat: yeah because of the numbers I think, it's easy that you can see in the screen what number it is. But I can imagine that if you don't have the numbers on the screen (I think she meant the front of the boat) and you see the actual boats can be harder because you have to look which one it is before it arrives at the finish tower.
- First I thought I had to keep it pressed to speak and then let it go but then I had to click and unclick. Because when you use a walkie-talkie you keep it pressed and then you talk but the signals made me think it's still on and I had to press it off. So yes it's clear but took one error
- The placement is fine
- I heard everything clear and it helps to communicate
- I knew I was at the finish tower because of you guys I think and then it says finish time above. Here it says finish timer buttons. (Take time to see the stripes). Yes, the stripes, but I mostly knew because you told me that I was the finish timekeeper. I didn't look at the stripes actually
- Referring to the progress bar, I didn't notice because I was watching the screen, I didn't see that. Now I understand that is 4, 5 hundred metres so I give 5 (referring to last question of paper 1)
- Feedback sounds I don't remember
- I didn't notice the running time.
  
- When I look at my context of using this for example clocking an amateur race between two boats, I will be the clocker at 400, 500, and at the finish point so I would either need 4 persons or I will need to change between the 400, 500, so I would use something that allows me to change from which time tower I am
- It's definitely easy to use
- It's well integrated. It's easy to find the "did not pass"
- It's clear, everything speaks for itself

## Notes Test 3

Jeroen

Knows what raceclocker is already

- Asks if he has to press ptt button and then presses the ptt button, does not hold it down .
- uses one hand to control
- makes an exiting sound when confirmation shows
- accurately times
- very quickly finds DNP function when he realized he had to use it

### PREMO

- dont like talking to a walky talky becaause it feels awkawrd
- The timing felt chaotic -
  - approach rowing by lanes, not by boat number
  - boats came from direction he was not used to
  - seeing screen and boats at the same time felt like chaos

### SUS

- I think it has nice functions but hard to use on your own
- there are a lot of functions and buttons,
  - Lot of movement going on and in both sides.
  - "Talking through a walkie talkie feels a bit awkward"

### Questionnaire

- "DNP was easy to find when they said what I had to do"
- autonomous - when having to do all tasks by yourself it was a lot to do, he would rather split up tasks
  - does not feel autonomous because he had to do a lot by himself?
- being finish timekeeper clear, from the text on top, when asked to look closer he could see the orange line
- Seeing the bars for the first time He thought it was boat speed but understood it after that
- Does not remember the sounds
- I think what was said at the beginning, "I think it is not possible to do all the tasks by yourself" - mostly looking at professional races

## Quotes Test 3

Jeroen

- The timing: It was one big chaos moment
- But I'll have to say that it was quite easy when they said that it DNP with the 3 dots, it was quite easy to find so it was less stressful for me
- It was quite easy so I felt supported
- I think is easy to press the button, but to be sure you timed it correctly... I am afraid I will have to say it was harder.
- Walkie talkie: the placement is quite clever. Because it is over there and all the buttons are on the right
- You have a progression bar over there so I guess then it is easy to see which points the boats have passed
- "Having all the boats in a big list would be shit, closing and opening menus really helps"
- The timer is really easy, is the time of the whole race
- I'll have to say that it's a bit overwhelming with all the options, and buttons, and sounds.
- It's not complex but it's quite a lot what's happening
- I think a lot of timekeepers are in their 60s, so I think for me it would be very easy to learn to use RC (give me 2 minutes and I master the whole thing) but for them umppf, difficult

# Appendix B.9: Test notes

## Notes Test 4

Lotte

- Did not know if she had to keep the Walkie Talkie pressed or what at first.
- She tapped on the screen instead of holding and then she asked "do I have to hold it?"
- She didn't know how to reply by using walkie-talkie in the Big Boat passing scenario for the first time. But then she catched up quickly for the "Finish timekeeper is Ready."
- She finished the timing boat task and said "That sounds great." for the confirmation sound.
- She takes some time to look closer at the app and then found the DNP button easily for the sinking boat. (task 3)
- asks for confirmation on where to click

### PREMO

- Walkie-talkie: Bit confused at the start, did not know what to do. But the second time it went well.
- The sounds is satisfied. That was a happy thing.
- wave 2 felt like more chaos, because boats finished closer to each other.
- was unhappy about not accurately timing.
- walkie talkie communication was nice.
- had to search a bit for the dnf but was able quite easily

### Questionnaire

- I felt supported by myself, very well.
- Communicated, yes for the walkie talkie function.
- It's easy to time the boat, to see the wave and boat is close to each other. one click to save.
- easy to find the button.
- Not necessarily autonomous but not not autonomous as well,
  - autonomous is more automated, still have to do a lot myself
- did not know at first that it was possible to assign a dnf but when knowing what to search for it was easy
- why press the button instead of hold? "I have an app on my phone where you just have to tap it, but whatsapp has the holding option" (dichotomy)
- the placement of the ptt is fine
- walkie talkie is quite a fast way to communicate
- with the background noise it was at one time hard to hear but the rest went well
- "can see that i am finish timekeeper at the top, but also did not pay attention to it that much"
  - quickly sees the progress bar stripes and recognizes
- Did look at the progress bar to see that boats were coming and where the boats were at that time
- "you have to open up a wave to see which waves are starting, this makes it clear"
- "going from first to second wave works well, the pop up guides you automatically"
- easy to recognize when boats have finished
- Remembers the sounds played
- Timer at top of the screen: "did not look at this"
  - "In the old app you could only see the real time, seeing the race time feels way better"
- Agree about the app is clearly used in the outside.

### SUS

- would like to use the app frequently - "prefer this over the forms we used" "at first i did not like the old app because you can not see the racing times"
- the multiple options increase the complexity a bit more, the more buttons the more complex it feels. "mostly stick to one mode during a race" sometimes change between races, depending on the way the race is set up
- "now I know everything about it so I wont need help" - already learned to use the functions in just trying out 2 waves. "It quite easy."
- app felt consistent
- It feels like the app is easy to learn "I used it once and I feel I can use it again without new help"
- "It was the first time so it was a bit scary, but quickly felt confident"
- Do you see the value of the new functions?
  - The change of timer is nice
  - waves that open and close is convenient
  - progress bar is nice and informative,
  - "It's convenient for the progress bar to see where boats are, and now you also can use a walkie talkie to communicate where boats are, having this makes it quicker and easier"
  - It's nice for Walkie talkie reduced to only issues or important stuff.
  - Walkie talkie within app is quite convenient.

## Quotes Test 5

Megan

- The timer: It didn't really catch my eye, but on the other hand, if you need it it is nice that is there. But is not something that you have to check every single time.
- I thought you mimicked quite well. It was nice.
- The PTT (when you press it). I would make it a little bit more bigger.
- If you make it a little more foolproof, then is a really nice app
- Of course you can practice when you do it for real
- Yeah, I like the sounds

## Notes Test 5

Megan

- how does stop timer work?
- I was wondering if she had to press or hold
  - think at first to press, talk press
- Icons on top are now a bit confusing but want to tap and see what it does
- really explores the app
- the talks at the start went a bit chaotic
- looks a bit panicky when timing the buttons
- reacts happy to the confirm sound "I like the sound it makes me feel like I did great!"
- "the boat died but I did great!"
- The app was easy for her

### PREMO

- at first a bit confused when others were talking and when she could talk "oh there are multiple people on this line"
  - suggestion change colour to the point that is speaking at that moment
- having to wait for others to finish in a walkie talkie makes sense
- quickly became clear so more happy because she understood
- a bit scared and exited to see if she would do everything right
- "I felt a bit sad that I had the feeling I timed some boats wrong, the positive sound helped me feel okay"

### SUS

- A bit worried about fool proofness
- Not totally confident because she was worried she would do things wrong, and did not dare to press to test things out.
- Another timing option for more hectic races (two step timer)

### Questionnaire

- The timer in the top is nice extra info but don't know if you really need it. On top is fine.
- Outside, in the real context, it is a little bit chaotic so it would be nice if the buttons were a bit far from each other. Make it more mistake proof.
  - she would really want kind of the two step combined with this type of timing.
  - suggest rename Wave to heats, it is more used in the rowing world (think it is already changeable)
  - walky talky makes communication feel good
  - not sure if timing is easy, it is difficult to click the right one, they are still somewhat close together
  - switch looking between screen and real life is still hard
  - Take a look at the effect holding down the button has
  - "It is nice that the ptt has the rings showing that other people are speaking"
  - connect checkpoints to the voice function so it is visible who is talking.
  - "when I saw it move past the checkpoints it was really nice, I could see where the boats were even though I did not see them in real yet"
  - "I love the sound, it's like oh I did great!"
  - Did not see a timer running
  - It is nice to see a timer running
  - "It is nice that it is there when you need it but I did not need it now"
  - "It is nice extra information but you do not really need it, for some people it might be nice"
  - Outside it is even more hectic, try to make the buttons more apart from each other, space them a bit more, because she is worried of pressing wrong buttons
  - "maybe make the button a big bigger, so things happening there are not hidden behind your finger (with big hands/long nails)."

# Appendix B.10: Printed interfaces

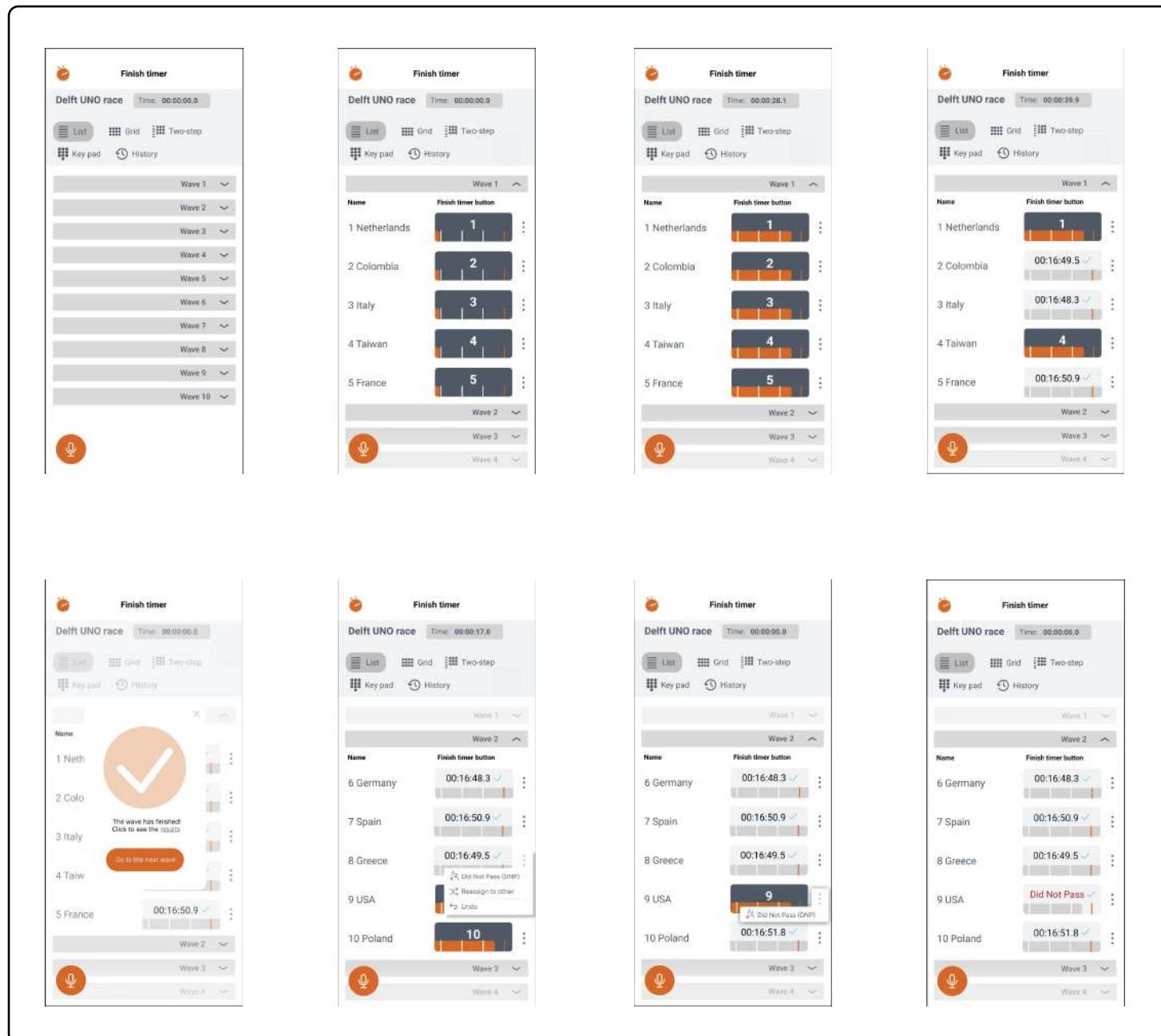


Figure 46. Different pages of the app used for the user test.