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RE-DESIGNING THE INTERACTION OF ROWERS WITH THEIR MENSTRUAL CYCLE

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This project has been a true collaboration, made possible by the incredible support of these amazing individuals.

Nazli,
thank you for taking me in and for your support and energy throughout the project! Your feminist perspectives on design and your critical insights into various aspects of the project have broadened my view and inspired me to evolve into a more conscious designer.

Alejandra,
I don't know where to start thanking you. I'll miss our weekly meetings, where I was always looking forward to sharing my progress with you and hearing your thoughts. You've sparked my passion for the topic and for data-driven design. Initially, I didn't anticipate exploring data collection and understanding from a feminist standpoint, but now I see it as one of the most interesting aspects of the project.

Emma,
thank you for being open to diving into the field of design with me and for sharing your expertise. Without your guidance, understanding the complexities of female health would have probably been the only topic the project would have covered. Your medical and academic standpoints, were really valuable, in shaping the survey and the questions in the final design. Raising the quality of the research and the design. I believe your work in establishing a community of experts focused on female health related to athletes is remarkable. Thanks for all your time, even on activities out of your expertise like the video.

Judith,
as the first professional coach I've worked with, I might be biased, but I can't imagine a better one. Your holistic perspective on rowers as individuals, not just athletes, has significantly influenced my design approach. Visionaries like you, unafraid to explore new avenues such as the menstrual cycle, are what we need in this world. Thanks for sharing valuable insights about teaching and the specific needs of rowers and coaches. As well as for motivating coaches and rowers to participate and discuss this topic – this project wouldn't have been feasible without your support.

Petra
The mental aspect is something that overall needs to be more empathised in sports but especially in correlation with the menstrual cycle where so many women experience change in motivation, energy or self-esteem is vital. Our conversations shaped the questions of the final concept but also your point to not only create awareness but to give the rowers the autonomy to act upon it, shaped my design. Thanks for your positivity and openness to explore this topic with me.

Rowers & Coaches
This project truly benefitted from the openness of Proteus and Laga rowers and coaches to engage in discussions, share insights and data, and actively contribute to activities aimed at finding a suitable solution. I don't take it for granted, especially considering the consolidated timeline of the project. Thank you all for your willingness to dedicate your time and creativity to this project.

Bram
You truly deserve your own space here! Thanks for supporting me throughout this journey. You could probably explain this project as well as I can ;) Your strategic thinking and skill for organizing my thoughts were incredibly valuable, especially when I found myself lost in the details. But more than anything, your hugs and humour made me enjoy this project till the very end!

My Family (Christine, Peter, Hannah & Flo)
Thank you for being my role models, resulting in my belief in the power of positive change through collective effort. Your support throughout my whole studies and excitement for what I do always keeps me motivated and leads me to aim high!

EXCECUTIVE SUMMARY

There are more and more women who participate in sports on a professional level. The Olympic games in 1964, in Japan, have been the first ones where almost half of the athletes participating were female. But still, a lot of female athletes train based on what has worked for men. As in many other fields, there is a research data gap because studies of exercise, muscle and cardiovascular physiology are commonly studied on male participants (O'Halloran, 2020). That comes with obvious problems. Not taking the unique biological differences that women experience, including the menstrual cycle and hormonal fluctuations into account. Women's bodies are not simply smaller versions of men's, so it's important that we approach training in a way that acknowledges and accommodates these differences. (Criado-Perez, 2019)

This graduation project explores the impact the hormonal cycle has on rowers performance and wellbeing. As well as how to include this female health aspect in the rowing practice to empower rowers to reach their fullest potential. The project applied a co-creation approach involving multiple experts from different disciplines such as gynocology, sportspsychology and of course rowers and coaches. The research includes a study with over 200 rowers, multiple interviews and co-creation sessions with the experts.

The insights gained from the research were coined in the final result of this thesis. The outcome is a novel more meaningful approach to performance tracking and communication. As every women is different in their needs the rowers can choose one of the 5 tracking paths in the app. This ask daily questions to put their individual menstrual health factor in correlation with their performance. After each cycle, they reflect on their data by transferring information from the digital app into a physical booklet. This allows them to put their data into their own context, making them the owner of their experience and lets them select the relevant insights they would like to share with their coaches. Moreover the booklet also prepares the rowers for coach reflection meetings, that occur after three individual reflection moments, fostering proactive action by both rowers and coaches.

STATEMENT ON GENDER TERMINOLOGY

I acknowledge that individuals of all gender identities can experience a hormonal cycle, and it is crucial to recognize that not everyone who has a menstrual cycle or reproductive system identifies as a woman. However, given the historical gender distinctions and discrimination in rowing, I primarily use the term "women" in this report. I understand that terms like "people who menstruate" may be more inclusive, but due to the specific context and discussions on menstrual absence, it is not suited. I apologise if my language unintentionally excludes or discriminates against anyone, and I recognize the importance of gender-inclusive terminology.

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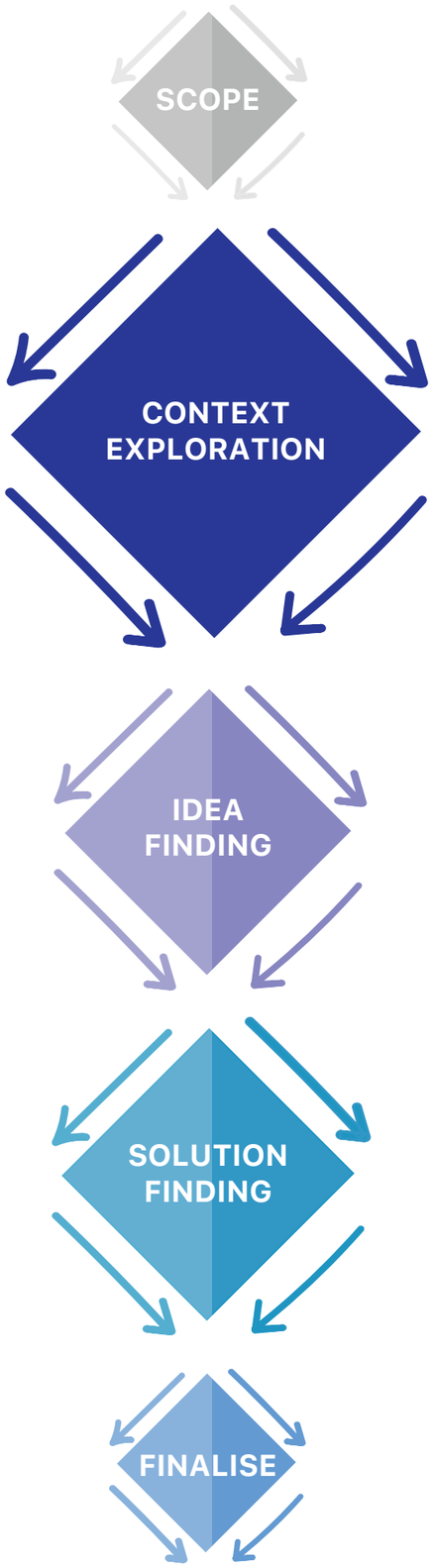

REPORT STRUCTURE

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READERS GUIDE

CHAPTER 1: PROJECT INTRODUCTION
Get a quick look at what this project is all about.

CHAPTER 2: UNDERSTANDING THE CONTEXT
Are you curious about the Historical Significance of Women in Rowing, the different stakeholders involved and the context of this project? Then this chapter is for you.

CHAPTER 3: THE IMPACT OF THE HORMONAL CYCLE ON ROWERS
Do you want to know the mechanics of the hormonal cycle, the key hormones at play, and their impact on athletes? Or are you curious about the perspectives of over 200 Dutch rowers on the subject? If so, this chapter has you covered.

CHAPTER 4: OPPORTUNITIES AND CONSTRAINTS
Do you want a list of all the opportunities and constraints identified during the research phase, head over to Chapter 4.

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CHAPTER 6: IDEATION AND SOLUTION FRAMING PHASE
Are you curious to know how I applied co-creation to develop the final concept? Then Chapter 6 is for you — it elaborates on the diverse co-creation sessions I conducted with rowers, coaches, and fellow designers.

CHAPTER 7: FINAL CONCEPT: CYCLE POWERED PERFORMANCE
Do you want to explore the final concept of the graduation project? Are you curious about how rowers can correlate their menstrual cycles with performance, along with the five unique tracking paths uncovered through the research? Or would you like to see how rowers translate tracked data into their reflection booklet, thereby deepening their understanding, taking ownership of the data and developing strategies to enhance their performance? Or just get some inspiration from the mockup design of the tracking app? Then head to Chapter 7.

CHAPTER 8 & 9: EVALUATION AND RECOMMENDATION
Do you happen to be a fellow designer engaged in a similar project and seek inspiration from expert feedback or recommendations for enhancing your own work, then Chapters 8 & 9 are your destinations.

CHAPTER 10: CONCLUSION OF THE PROJECT
If you're looking for a concise overview of the entire project, complete with the key insights from each section, you can jump straight to the conclusion of the report. On the other hand, if you're a designer working on a project related to data-driven design and are curious about the methods and recommendations for designing for reflection, then this particular chapter is tailored to meet your interests.

CHAPTER 11: REFERENCES
If you're seeking inspiration and additional readings related to subjects such as female health, women in sports, tracking, or resources from the HCI community, then have a look at the references section.

INTRODUCTION

This chapter introduces the starting point and the identified problem of this thesis. It describes the relevance of female health in sports and the limited awareness about the hormonal cycle's impact on athletes. Following this, the chapter explains the project's data feminist approach and my personal positioning on the subject. Additionally, it provides an overview of all stakeholders involved, detailing their roles in the project and assigning them icons. These icons are used consistently throughout the report to indicate the activities in which the stakeholders have participated.

CONTENT

1.1 INTRODUCTION TO THE TOPIC

The importance of female health in sports

There are more and more females who participate in sports on a professional level. The Olympic games in 1964, in Japan, were the first ones where almost half of the athletes participating were female. But still, a lot of female athletes train based on what has worked for men. As in many other fields, there is a research data gap because studies of exercise, muscle and cardiovascular physiology are commonly only studied on male participants (O'Halloran, 2020). That comes with obvious problems. As it doesn't take the unique biological differences that women experience, including the menstrual cycle and hormonal fluctuations, into account. Women's bodies are not simply smaller versions of men's, so it's important that we approach training in a way that acknowledges and accommodates these differences. (Caroline Criado Perez, 2019)

Many athletes and individuals who menstruate often only consider their monthly bleeding when thinking about the hormonal cycle. However, in comparison to men, female bodies experience a series of physiological changes in their reproductive system every month as they prepare for pregnancy. On average, the menstrual cycle lasts 28 days but it differs per person (NOC NSF, 2023). The hormonal cycle varies from woman to woman and is a complex process influenced by various lifestyle factors, including age and life phase. Hormones play a crucial role in this cycle as they act as messengers between our organs and brain, facilitating communication and governing numerous bodily functions. Hormones tell our bodies when to eat, sleep, and grow. Next to helping women to get babies they also make us feel happy, in love or sad. The hormonal levels of men are quite stable compared to the ones of women, as the latter is influenced by the menstrual cycle (Stacy T. Sims, PhD., 2016). A known and talked about effect is fertility and mood, but what is lesser known and even in top sports often overlooked is the number of effects the cycle can have on an athlete's performance, including physical and mental changes. An example of that is the experience of different energy levels during the different phases of the hormonal cycle. Nevertheless, there are already a few coaches who pay attention to it, such as the Brisbane Lions Australian Football Club, who monitor their players to ensure athletes do not develop relative energy deficiency syndrome. (Mikaeli Anne Carmichael, et al., 2021)

One striking example of gender bias in sports, I found during the research can be seen in the training schedule of the Dutch Olympic rowing team and several student rowing organisations. The team's rowers stated that the current training schedule for female rowers is exactly the same as that of their male counterparts. They train without tracking and considering the impact of the menstrual cycle on their performance, compared to several other metrics such as exercise time, heart rate and calories burned. This lack of attention is partly because the team has coaches and physiotherapists who are not involved in discussions about the female athletes' menstrual cycles and symptoms.

1.1 PROBLEM DEFINITION

Lack of awareness of the hormonal cycle
Impact on athletes

In the world of top sports, much emphasis is placed on tracking various forms of data to share with coaches and being able to create performance analyses. But still, a crucial aspect of reproductive health is often overlooked: the impact of the hormonal cycle on athletic performance and health. Although studies indicate a connection between the two, the outcomes can be inconsistent due to the unique responses women have to their hormonal cycles (Constantini et al., 2005). Therefore, not every woman experiences (the same) symptoms highlighting the need to

Figure 1: Photo from "Helden op het Water", published by Kanniball publisher

adopt an individualised approach when tracking and addressing their specific needs. Outside of sports, women have long been systematically excluded from clinical research, depriving them of vital knowledge about their bodies. This exclusion stemmed from the belief held by researchers that the inclusion of women, with their hormonal fluctuations and menstrual cycles, would introduce too many variables into medical trials. Consequently, research predominantly focused on men, leaving a significant gap in our understanding of the female body. In fact, it was not until the 1990s that the FDA (U.S. Food and Drug Administration) finally recognized the importance of including women in clinical trials. (Liu, K.A. et. al. 2016). As a result, much of the knowledge we have about the human body is based solely on studies conducted on males.

Literature suggests, even though hormonal cycle symptoms can impact the ability to perform or train significantly, athletes conceal menstrual cycle–related symptoms. (Laske, Konjer & Meier, 2022) In general, research also states that athletes and coaches rarely communicate about the menstrual cycle. As both sides are uncertain about who should take the initiative and start conversations about the female cycle. (Verhoef et al., 2021)
A bias also appears among coaches and experts, when lacking personal experience with symptoms and due to limited communication on the matter. Leading to situations where for example, a rowing coach may overlook the impact hormonal changes can have on their athlete's mental well-being and make dismissive statements like "women cry in the boats" without understanding that this might be triggered by the rapid change of hormone levels. (see interview transcript). This is also caused by the

1.2 PROBLEM DEFINITION

The outcome of not addressing menstrual issues such as pains, and irregular or absent periods is that numerous health problems may be unnoticed. Female athletes who experience these symptoms are at an increased risk of long-term consequences such as osteoporosis and cardiovascular disease. Especially amenorrhoea (the absence of menstrual bleeding for more than six consecutive months), is normalised as a natural consequence of athletic training. Athletes have been prescribed a combined oral contraceptive or reassurance with little guidance (Verhoef, S.J. et al., 2021). It is now recognized that amenorrhea in athletes is frequently caused by low energy availability. This condition can have significant health and performance implications, but it should not be viewed as an inevitable outcome. With proper treatment, athletes can successfully address the underlying causes of their amenorrhea and improve their overall well-being and athletic performance. (Verhoef, S.J. et al., 2021)

1.2 PROJECT APPROACH

Applying a Data Feminism Approach to Co-create an Athlete-centric Tracking Solution

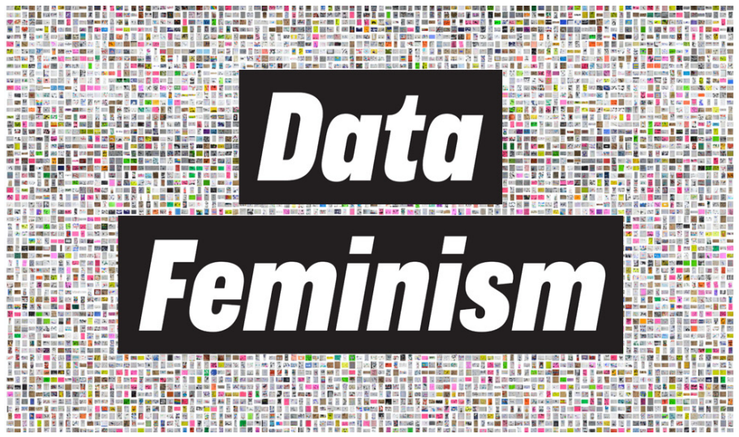
The aim of the project is to gain a deeper understanding of how the hormonal cycle affects rowers, including its impact on training and its effects on mental and physical well-being. As well too find a way of incorporating female health aspects in the tracking process.

Since female health is a topic that is often overlooked and lacks sufficient research, the project adopts a data-feminist approach inspired by "Data Feminism" by Catherine D'Ignazio and Lauren Klein (D'Ignazio & Klein, 2020). It explores a feminist perspective on data science, challenging hierarchical systems and emphasising power differentials within data.

The graduation project specifically focuses on applying the first two principles of data feminism. The first principle of data feminism involves a critical examination of power dynamics. This means recognizing how power operates within data collection, analysis, and interpretation, and understanding the potential biases and inequalities that can arise. By examining power dynamics, data feminism seeks to uncover and challenge oppressive practices and assumptions that may be embedded in data-driven systems. Therefore my research aims to understand the existing power dynamics and identify who holds the responsibility for incorporating the hormonal cycle into training as well as which data is shared with whom.

The second principle of data feminism focuses on challenging power structures and advancing justice. It acknowledges that data and technology can perpetuate existing power imbalances and inequalities. To counter this, data feminism aims to actively challenge and transform these power structures, seeking to create more equitable and just outcomes. It advocates for inclusive and participatory approaches to data collection and decision-making, amplifying marginalised voices, and centring the needs and experiences of marginalised communities. In line with this, the project not only collects and analyses data but also seeks to raise awareness and challenge biases by highlighting the experiences of rowers.

Figure 2: Book Cover: Data Feminism by Catherine D'Ignazio and Lauren Klein



1.3 EXPERTS INVOLVED IN THE PROJECT

Rowers
The project includes a diverse group of rowers ranging from professional Olympic athletes to students training at a lower level. They come from various boat types and weight classes. They all share a common dedication to regular training and practice within the Netherlands.

Gynaecologist
Emma Paternotte, a renowned gynaecologist in training specializing in female athletes and women's health serves as the project's mentor. Her significant contributions include establishing a research network in the Netherlands specifically focused on female athletes.

Coaches
The project involves an experienced professional coach, as well as student coaches associated with the rowing organizations Proteus and Laga.

Sports Psychologist
A sports psychologist who works closely with the rowers provides valuable insights on the psychological aspects of sports performance and athlete's well-being during the research project.

Nutritionist
The project benefits from the expertise of the nutritionist responsible for the Olympic rowing team's dietary needs and performance optimization.

Data Donation PhD
To explore potential correlations between performance and the menstrual cycle, Alejandra Gomez Ortega, who is also mentoring this project, assisted me in analyzing the current Garmin watch data of four rowers.

Designer
Since creative ideas thrive on diverse perspectives and collaborative sessions, the design phase of the project involves the minds of fellow design students.

1.4 PERSONAL POSITIONING

In my project on designing for female health, I emphasise the importance of a conscious and careful approach to technology design. Historically, technology has often been created with a focus on men, resulting in inventions that overlook and suppress vital bodily experiences of women. Examples include companies exploiting personal user data for marketing, such as in the case of sex toy companies or menstrual cycle applications (Grundy, Q. et al., 2019 & Hern, 2017). Additionally, voice interfaces can perpetuate harmful gender biases (UNESCO 2019), thereby reinforcing societal stigmas. To address these issues, it is crucial to adopt a design process that is aware of the oppressive nature current technologies can have and aims to empower and prioritise the crucial bodily experiences of women.

Furthermore, my project takes a different approach than traditional problem-solving methods when it comes to designing for the menstrual cycle. As the menstrual cycle can not be seen as a problem, I draw inspiration from Marie Louise Søndergaard's concept of "designing for trouble"(Søndergaard, 2020). The menstrual cycle is not a problem to be solved but rather an aspect of women's health that requires exploration and understanding. In the initial stages of my research, I explored the current norms, values, and experiences surrounding the menstrual cycle's impact on female athletes. The focus was on gathering evidence and proving the assumptions that the cycle has an impact on the athlete's performance rather than seeking a definitive solution. This aligns with Søndergaard's practice of Curious Visiting, which encourages an exploratory approach.

During the design phase, my project aims to incorporate female health aspects into tracking design for female rowers. The research highlighted that it is hard to make generalised assumptions as every individual experiences the hormonal cycle differently. Therefore the design phase aims to help athletes explore themselves and change the interaction of tracking. I question the existing approaches and strive to provide a more inclusive and mindful experience. The design aims to assist female rowers in exploring themselves and their bodies gently and intuitively, moving away from the need to log symptoms in an Excel sheet logbook.

By adopting a troubling design approach, my project acknowledges the limitations of problem-solving frameworks and embraces a more nuanced and empathetic perspective. It seeks to challenge existing norms, empower women, and promote a holistic understanding of female health that goes beyond conventional approaches to tracking and monitoring.

UNDERSTANDING THE CONTEXT

The goal of the second part of the report is to provide a comprehensive overview of the rowing sport in general and its historical significance for women. Moreover, the following part dives into the specific context of the graduation project and highlights the various stakeholders involved in the topic. Including an explanation of their roles and interactions with the rowers, shedding light on their perspectives and the challenges they have identified.

The methods used to achieve these insights consisted of two main components. Firstly, a comprehensive literature review was conducted to establish the foundation for the subsequent research. This involved understanding the context's origins and delving into existing research conducted by others. Following the literature review, ten expert interviews were conducted, and their content was transcribed, coded, and organized into statement cards. This approach allowed for a deeper understanding of the real-life situation within the context, as insights from the experts provided valuable firsthand perspectives and experiences.

The result of this phase was a basic understanding of the context of student rowing organizations in the Netherlands, including the involved stakeholders and their interactions. This served as the foundation to dive deeper into the context of the hormonal cycle and how rowers are affected by it and understand the responsibilities and roles of various stakeholders in the process.

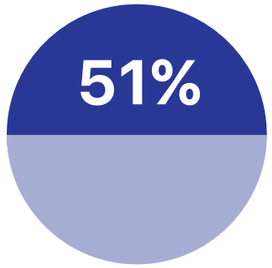
PEOPLE INVOLVED IN THIS SECTION

CONTENT

2.5 ROWING IN THE NETHERLANDS

The scope of the research focuses on rowing in the Netherlands. Rowing is a popular and well-established sport in the Netherlands, with a rich history and strong tradition. The country has a long-standing reputation as a leading nation in the sport, having won numerous medals in international competitions such as the Olympic Games, World Championships, as well as European Championships.

Most rowers are part of a rowing club, where they are able to join a team, receive training as well as have the chance to compete in races. The Netherlands has 121 different rowing associations. Some are specifically for students, whilst others are open to anyone. Most rowers have an academic background as the sport is the main student sport in the Netherlands. Especially in grassroots sports, the absence of communication regarding the menstrual cycle presents a significant issue, as there is often a lack of education on the topic and limited medical support (Laske, Konjer & Meier, 2022). Alongside this, the increased accessibility of stakeholders has motivated the decision to focus the project on student rowing organizations.



OF ROWING CLUB MEMBERS ARE WOMEN

Rowing has great popularity among both men and women, with 51% of the rowing club members being female (Lambe, C., 2022). What makes this sport interesting for students is that it allows them to grow into (international) top rowers during the course of their studies.
They achieve this by training up to 14 times per week next to their studies. In other words, this group of student-athletes leads a very intense physical but also mental lifestyle. The rowers train and compete either on their own or in teams of 2, 4 or 8 athletes.

CATEGORIES
Rowers are categorised by sex, age and weight. There are two weight categories: lightweight and open weight. The idea behind lightweight rowing is to create a separate category for smaller and lighter athletes to compete against each other on a more equal footing. The weight limits vary for men and women: individual women must not weigh more than 59kg; the average crew weight can be no more than 57kg. But there is a crucial debate about defining the categories by weight. Athletes competing in weight-class and leanness sports are often confronted with unhealthy practices, such as extreme dieting, frequent weight fluctuation or dehydration techniques, leading to effects on athletes' physical and mental well-being. (Sundgot-Borgen, et al. 2011)

2.1 ROWING HISTORY
Women in rowing

It is hard to imagine nowadays, but women in a rowing boat were not a common sight. In disciplines such as tennis, swimming, and figure skating, women were already competing at the Olympic Games before World War I. Women's rowing, however, was only added in 1976. (Schweinbenz, 2010)

Rowing was considered a distinctly masculine sport and as such, not appropriate for women's competitive participation. Female participation in rowing challenged heterosexual beliefs regarding appropriate feminine behaviour. The belief was that oarswomen would develop muscular strength and endurance, physical abilities that are reserved for men. Only when the term "style rowing" was coined, universities established rowing programmes for women because it promoted grace and form of the female body. The image shows the first female rower on the cover of Harper's Weekly in 1870. At that time regulations like specific dress codes for women and a strict prohibition to compete were in place. (Schweinbenz, 2010)

Women now participate in all boat classes, across the same age ranges and standards as men, from junior amateur through university-level to elite athletes. Nevertheless, like in other sports, there still exists a dominant approach to training that is based on methods designed for men, failing to address the distinct needs of women in rowing.

Figure 3: Lithograph from 1889 showing a female rower holding an oar.

Personal reflection: *How would the rowing sport look like if it had originated from a female perspective? Would the boats be differently designed? Would the dress code be different?*

2.2 STUDENT ROWING ORGANISATIONS

This graduation project specifically concentrates on student rowing organisations. The research and design development closely collaborates with members of these organisations, recognizing them as significant breeding grounds for future professional rowers due to their large number of participants (D.S.R.V. Laga over 770 members, TU Delft 2023). A distinguishing feature of these organisations is that they are managed by student-led boards and primarily rely on volunteer coaches who are also students. Moreover, they often operate with limited resources, lacking access to specialised professionals like nutritionists or physiotherapists who could support their athletes.

2.3 STAKEHOLDERS INVOLVED

The insights presented in the following pages were obtained through expert interviews and literature research, providing valuable information about the individuals involved in the graduation project context. A total of eight expert interviews were conducted in person, with an additional two conducted online. Participants were recruited through referrals from rowers. The interview questions were categorised into the following four sections and can be found in the appendix:

1. Part demographics and roles of the participants within the rowing context
2. Part Exploration of the menstrual cycle and personal experiences
3. Part addressed communication and tracking practices
4. Part centred around opportunities and challenges in integrating the menstrual cycle into the rowing practice.

During the interviews, participants actively participated in activities such as brainstorming and mapping out the organisational structure of rowing clubs. All interviews were recorded and transcribed for analysis. The transcriptions were carefully examined, and key insights were captured on statement cards. These cards were then grouped into clusters, forming the basis for the subsequent survey and further research. Figure 4 provides an overview of the cluster for a detailed documentation have a look at the appendix Chapter 2.

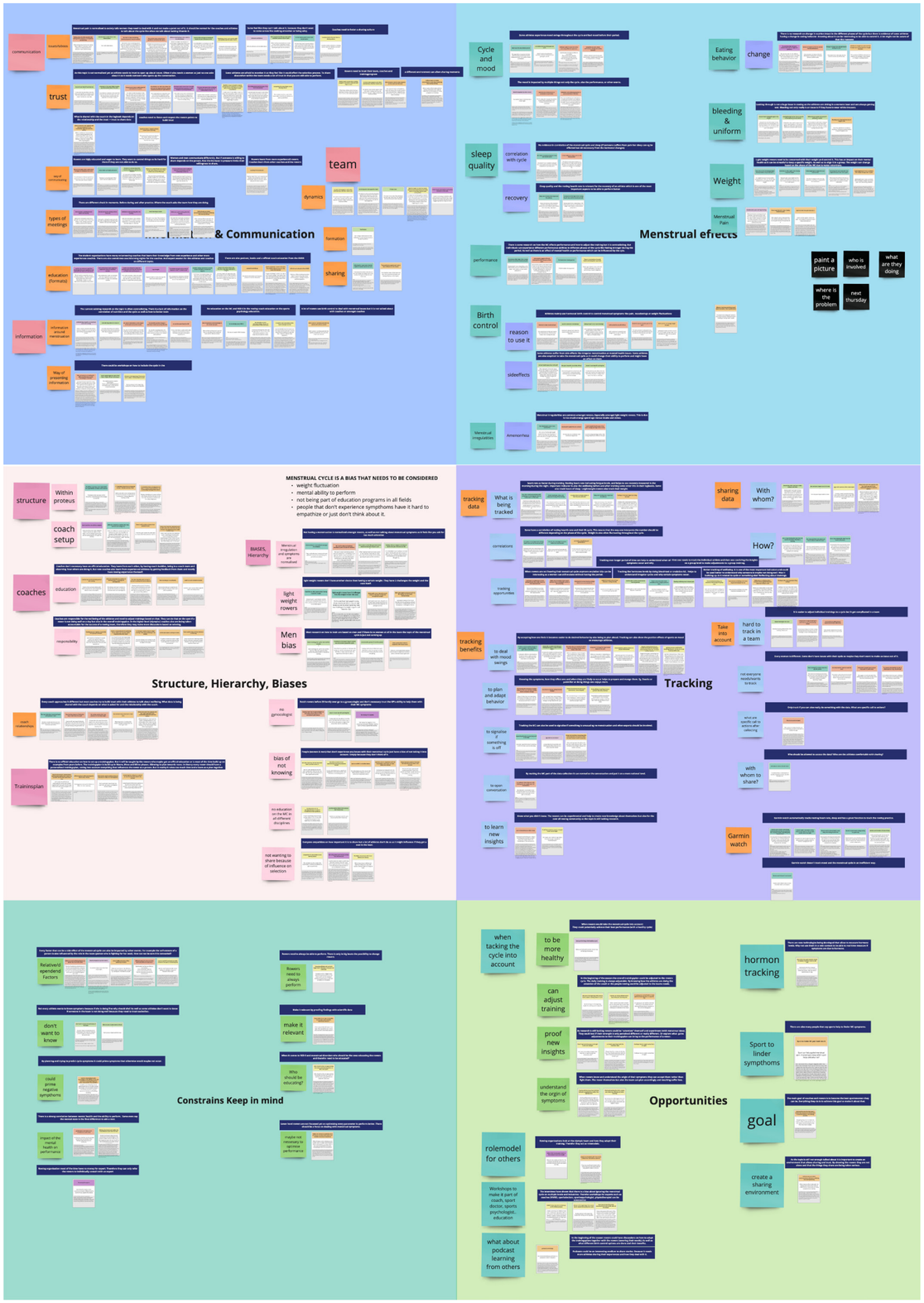
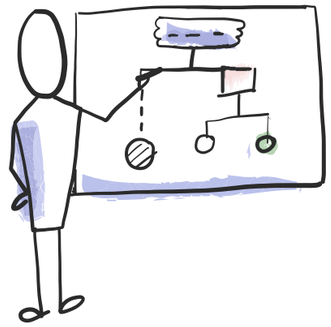


Figure 4: The image presents a glimpse into the data analysis process, showcasing the clustering of statement cards within the identified themes.

INTERVIEWED

STAKEHOLDERS INVOLVED IN THE ROWING CONTEXT

PHYSIOTHERAPIST

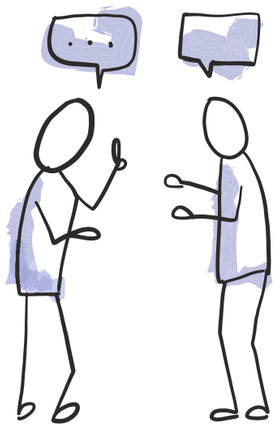


PROF-COACH

COACH

LOGBOOK

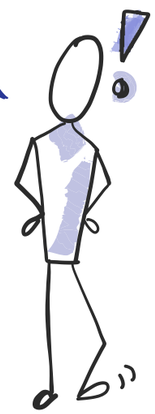
SMART WATCH



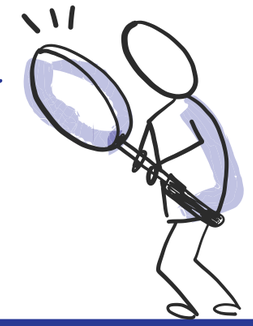
TEAM-MATES

ROWER

SPORTS PSYCHOLOGIST



NUTRITIONIST

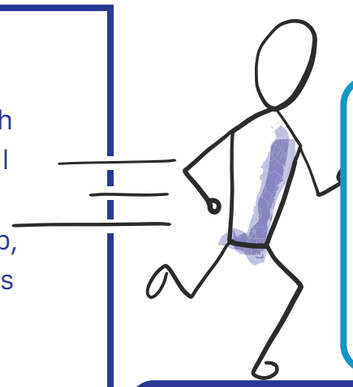


GENERAL PRACTITIONER & GYNECOLOGIST

ROWER AS AN ATHLETE

Role:

- Strive for personal improvement and growth
- Train up to 14 times a week to build physical fitness and endurance.
  Track relevant data such as heart rate, sleep, well-being, and weight based on the coach's preference.
- Manage their weight for lightweight rowers



AGE: between 18-27
GENDER: Equal representation of male and female rowers
EDUCATION: academics

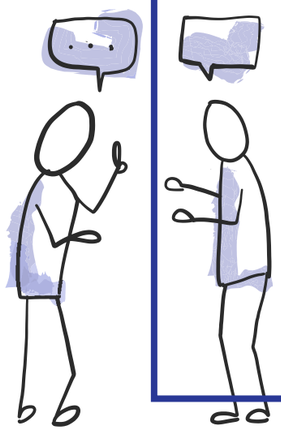
Quote:
"The days before my period I can be cranky and very easily disappointed. I would say then I am less focussed on technique more easily annoyed by feedback then I would normally be. But during my period I perform better."
– A. lightweight rower

Quote:
"Every women has been told that you should just continue doing your stuff while you are on your period. And just ignore the pain and the emotions that is really in our society. So it feels like you want extra for mentioning it." – B. Olympic Rower

Quote:
"I think we need to stop normalising that the cycle is painful and it's fine as a women to feel that. We need to start talking about it and if something is happening we need to get an understanding what it is because this is not only affecting your performance. We need to be more open about it."
– J. Nutritionist of the Olympic rowing team

Insights
Many rowers experience symptoms such as fatigue, pain or mood swings from their hormonal cycle, but few talk to their coach or team about it because they feel they are expected to deal with it and don't want to come across as whiny. Moreover, many female rowers experience menstrual irregularities, or complete absence of their periods, which is partly normalised by others. Menstrual irregularities and other menstrual complaints should be treated like injuries.

ROWER AS A TEAM-MATE



Role:

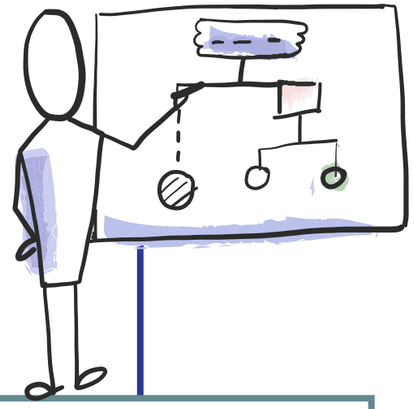
- Team-oriented mindset: Prioritize team success over individual achievements
- Effective communication: Maintain clear and open communication for coordination and unity.
- Feedback and improvement: Provide feedback to align movements and enhance performance.
- Trust and support: Rely on and support fellow rowers, fostering trust within the team.

Quote:
"What is sometimes hard is that you have to weigh a certain amount. But the days leading up to my period I am often 600g to a kilogram heavier. In the end it always worked out but that can be stressful.... Then I would notify my team mate that she needs to go a little bit lower. But that is something you would only discuss a week upfront the race."
– A. lightweight rower

Quote:
"In an optimal team, the team would say it's okay (if one is not doing well due to the cycle), just hop on, we'll take care of you. But that's the ideal team. And it's a team that already has a lot of trust, and already knows each other well. And doesn't have to fight for their position, because nobody's gonna share menstrual issues when you're racing for seat." – H. Prof-Coach

Insights
When rowers are not training in a single boat, they rely on their team. Rowers can't choose their teams, but many start together and develop close relationships. Team performance, not individual performance, is the key to success, making trust, reliance, and good communication crucial. However, some rowers may hesitate to discuss menstrual problems to avoid worrying their teammates. Lightweight rowers are especially reliant on each other due to weight restrictions for competition.

PROF-COACH



Role:

- Is the only paid coach
- Educating and coaching coaches
- Cycling along the boat coaching the rowers, and teaching coaches by example how to coach.
- Conducts workshops for coaches and rowers

Insights

The Prof-coach emphasizes the importance of seeing and supporting the rower as a whole individual, not just as an athlete. Many athletes start right after school and have various responsibilities and challenges outside of rowing that can affect their performance and well-being. Therefore the coach highlights the significance of tracking how rowers are feeling as a key factor.

Additionally, the coach believes in the importance of providing each rower with a personalized rowing plan. However, interviews with other coaches revealed that time constraints often make it challenging to implement such individualized plans.

Quote:
"As a coach, you're responsible for the overall well-being of a person, because the rowers are more than just the sports person. Therefore we should take everything in the training programme into account that's of influence on the person as a person."

" What I think is the most important thing to track is: How do you feel after a training session? And are you looking forward to the next training session?"
— H. Prof-Coach

Quote:
"Everything we do is because we want you to be a better sports person. So if today, we have to do something else than planned to make you a better sports person, then let's do that."
— H. Prof-Coach

COACH

Role:

- Recruiter: Select the teams and boats
- Trainer: Oversee training and well-being of athletes
- Shape the overall training plan
- Keep track of individual rowers and the teams performance
- Safety Conscience: Cycle alongside the boat during practices to provide warnings about larger boats and give real-time feedback to rowers
- Counselors: Conduct check-in moments with rowers

AGE: students between 18-27
GENDER: 81 % male coaches
EDUCATION: academics

Insights

In the context of student rowing organisations, most coaches are volunteers who have a background as former rowers and are often students themselves. It is important to recognize that they have limited resources available to complete various responsibilities.

Coaches do not necessarily require formal education in coaching. They mostly learn from one another through coach buddy systems, participating in coach teams, and observing and learning from experienced athletes who provide feedback. This exchange of knowledge and experiences contributes to the development of both new and experienced coaches.

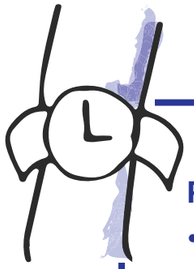
7%
of the rowers talk with their coaches about their menstrual cycle

Quote:
"I don't think that there is much communication about the menstrual cycle. ....If I look at myself, the reason for it is ignorance. Yeah. And not having experienced any problems with the cycle myself." — H. Prof-Coach

Quote:
"We try and teach them (athletes) *to tell us about injuries, but especially in selection, so the earlier periods, they sometimes don't, because they think if they say it they'll get kicked out, or they are not allowed to train, which is for a reason, but especially the younger rowers, they don't quite realise that. And I think same for mental health, rowers not telling that you're not doing okay."* — N. Coach

19% FEMALE COACHES

Despite female rowers being equally represented to their male counterparts, there is **a significant underrepresentation of female coaches, with only 19% at the national level** (Lambe, C. 2022). This may also be the reason why little attention is paid to the hormonal cycle.



SMART WATCH

Role in the context of the rowers:

- Track the training activities
- Track resting heart-rate and sleep
- Some watches track menstrual cycle and mood

Insights

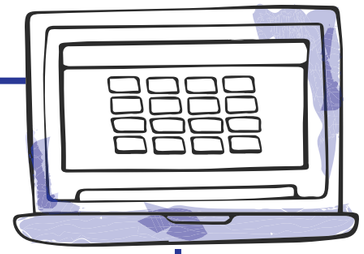
Most rowers make use of a smartwatch to be able to track their performance. The most popular brand is the Garmin watch as it automatically tracks resting heart rate, sleep and has a great function to track the rowing practice.
However, while the watch offers the ability to track the menstrual cycle, rowers interviewed reported issues with its functionality and stopped its use. Additionally, the watch lacks the capability to track athletes' mood.

Quote:
"It is not possible to track the mood with the Garmin watch. The menstrual cycle doesn't work at all, thats why I stopped using it." – B. Olympic Rower

Quote:
"I track every training. So if I get in the water I start the Garmin watch and it measures everything. It also automatically tracks my sleep. I didn't do anything with that. It tracks a lot and I haven't figured out everything yet. "
– B. Olympic Rower

Quote:
"The Garmin watch is one of the few watches that tracks rowing nicely. It gives you the feedback you want during rowing. And there are very few watches that provide the information that is nice. Thats why a lot of rowers have this one." – A. lightweight rower"

LOGBOOK



Role in the context of the rowers:

- Communication tool between coaches and rowers
- Record the collected data from the smart watch
- Record mood and perception of the training
- Allows analysis and comparison overtime of the entered data overtime

Insights

The logbook is an important communication tool between athletes and coaches. The purpose is to track the progress and the recovery time of the rowers. It can also be used to predict illnesses or when used and analysed over a longer time to analyse the rower's overall abilities. (eg. an athlete being more flexible during the sprint.) In the case of the student rowing clubs it depends on the coaches and rowers what is being tracked. But most commonly tracked is the heart rate as a factor during training. Resting heart rate indicating fatigue levels, and helps to see recovery measured in the morning/during the night. As well as an important indicator is also the well-being before and after training entered by some in their logbooks. As well as hours of sleep. Leightweight-rowers also track their weight. No one of the interviewed rowers currently tracks their menstrual cycle in correlation to their performance.

The current format of the logbook is an Excel sheet that doesn't provide any visualisations of the data or provide actionable guidance on how to make use of the insights.

Quote:
"Coaches look at it, especially when things are not going right. So they ask the rowers, how is your logbook looking? And that's up to the relation between the coach and the rower what is tracked and shared. There is a lot of possibilities there this is really, depending on how the relationship is." – N. Coach

Quote:
"I like to see the trends over longer period of time. Like if you feel bad that you don't feel that way from one day to another. So I track it mainly to see it over longer going up or going down." – A. lightweight rower

Quote:
I think feelings and that's also what you hear a lot from more experienced, training programme schedule builders, is really the most important factor that you should take into account. .... How am I feeling might be very unlogical in the beginning? But just start by doing it. And you will see at one point; this week was less than last week or was better. And then you can use that." – H. Prof-Coach

Quote:
"I don't have a routine. There is always some point during the day that I check and fill in the data. I know some rowers wake up and look at the hearthrate and write it down in the Logbook. "
– A. lightweight rower

Quote:
"We don't get taught to make the hormonal cycle part of our intake (standartised questions when having a new patient) *and I think we should. Me personally, I hardly ever notices my menstrual cycle also when I was rowing, I didn't have complaints that were relatable, So I think that doesn't help in making me more aware."* – I. Sports psychologist

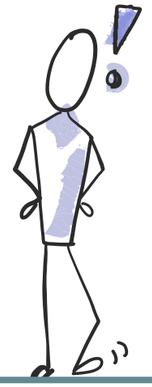
SPORTS PSYCHOLOGIST

Role in the context of the rowers:

- Helping manage performance anxiety and stress.
- Developing effective goal-setting strategies.
- Assisting with motivation and confidence-building.
- Assisting with injury rehabilitation and mental recovery.

Insights
Being an athlete requires significant mental capacity, and rowers interviews revealed that mental state plays a vital role in success. Sports psychologists support athletes in managing anxiety, motivation, and bad days, yet they often overlook the potential influence of the menstrual cycle. Typically when meeting a new patient psychologists begin with a set of standardized questions. However, these questions do not include any inquiries about the menstrual cycle. Even though, the survey highlighted psychological symptoms as the most prevalent issue. Additionally, a common quote during research was that women always cry in the boat.

79% experience occasional or regular psychological symptoms related to their menstrual cycle.



NUTRITIONIST

Role in the context of the rowers:

- Nutrition plays a vital role in the performance and muscle development of athletes
- Help rowers to deal with menstrual cycle symthoms like food cravings

Nutritionist are mostly not employed by rowing clubs.

Insights
Limited scientific research exists on the relationship between nutrition needs and the menstrual cycle. However, some women experience changes in eating behavior and increased energy expenditure during their period. The nutritionist in the Olympic team assists rowers in managing these changes to enhance well-being. Furthermore, she broke barriers as the first woman in the team and initiated open conversations about the menstrual cycle, helping rowers understand and navigate cycle symptoms.

48% of the rowers regularly experiences water retention related to their menstrual cycle.

Quote:
"What I can do is to teach them how to behave better so they can feel better. So when they feel like crave a lot or they feel like they can not manage what they are eating because of the time of the cycle. We can try to learn how to manage that. In which moments to eat more carbohydrians related to the training so you do not have the cravings later. So if you know you are in that part of the cycle so you are craving sweets, choose the right sweets. "
– J. Nutritionist of the Olympic rowing team

Quote:
"The first thing tracking the cycle gives you is you will get to know new thing about you. You can start to know yourself and what is happening. You know you are not cranky or crazy it's just because you are in a part of your cycle where your hormons are changing and you have changes in your mood. This will allow you to manage these better and when you know why you don't have to worry about it so much." – J. Nutritionist of the Olympic rowing team

Quote:
"We don't really have a lot of scientific papers on the topic of menstrual cycle and nutrition needs. We know that during the period women increase their energy spend-age. Some data says 6-20% but this is very difficult to measure. We know a bit about nurtitional behavior. Depending on the time of the menstrual cycle women can have a different eating behavior."
– J. Nutritionist of the Olympic rowing team

GENERAL PRACTITIONER & GYNECOLOGIST

Role in the context of the rowers:

- Help rowers to deal with menstrual cycle problems
- Prescribe and advice birth control
- Help rowers with menstrual irrgularities, ammnoreah and diagnose signs of RED -S

Insights

It's uncommon for women in the Netherlands to visit a gynaecologist before age 30. Therefore rowers go to a general practitioners (GPs), to deal with female health issues. To visit a gynaecologist a patient usually requires a referral from a GP.

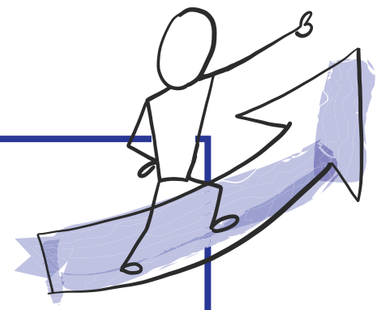
One common condition among athletes is Relative Energy Deficiency in Sport (RED-S), where insufficient energy intake disrupts the body's hormonal balance and menstrual cycle. The lack of menstrual bleeding is normalized among rowers, and the relative newness of the condition can lead to misdiagnosis or a lack of awareness among GP about its consequences.

34% of the rowers uses a form of hormonal contraception to manage menstrual cycle symptoms

Quote:
"When the girls in my team mentioned that they lost their period they were just sent to their GP to discuss it their."
– A. lightweight rower

Quote:
"I still have issues with my cycle. Now I have the spiral already for 6 months so it should be normal. But it is not. So I should call the GP. But what are they gonna do. They gonna say if you don't like it take it out. But I want to keep it."
– B. Olympic Rower

PHYSIOTHERAPIST



Role in the context of the rowers:

- Contributes to enhancing the rower's performance
- Preventing injuries
- Supporting rehabilitation

Physiotherapists are mostly not employed by rowing clubs.

Insights

Many rowers consult physiotherapists for various reasons, with back pain being a common concern. Female rowers may also experience back pain related to their menstrual cycle, although the connection is often overlooked, similar to other disciplines.

62% experience occasional or regular back pain related to their menstrual cycle.

Quote:
"I have cancelled rowing practice because of the pain in my stomache and back." – 3 Rowers participating in the survey

KEY INSIGHTS OF THE CHAPTER

To put it in a nutshell, rowing in the Netherlands is a well-established sport with equal participation of male and female athletes and a strong tradition. The student rowing organisations that set the context of this graduation project are managed by student-led boards and primarily rely on volunteer coaches who are also students. Moreover, they often operate with limited resources, lacking access to specialised professionals like nutritionists, sports doctors or physiotherapists who could support their athletes.

Coaches, teams, and experts play crucial roles in maximising performance and meeting athletes' needs. However, the expert interviews showed that they currently have a blind spot regarding the menstrual cycle and its potential influence on their respective areas of responsibility.

The current situation presents to challenges to address: (1) tracking and (2) communication and support. The current tracking makes use of tools like logbooks and smartwatches, providing valuable insights, but are not adequately addressing the menstrual cycle. The current tracking is very impersonal and detached, as it primarily relies on digital devices to quantify personal experiences, lacking a more intimate and personalised approach. (Via Excel sheets). Menstrual tracking fails to help rowers understand the correlation between their cycle and performance and how to utilise the data to make adjustments. Overall, efforts should be made to promote open communication and create a supportive environment for female rowers.

THE IMPACT OF THE HORMONAL CYCLE ON ROWERS

Having gained an understanding of the rowing context and the individuals involved, the aim behind chapter 3 is to investigate the hormonal cycle and its specific impact on female rowers. The beginning of this part focuses on explaining how the hormonal cycle works, and the hormones that are involved.

Additionally, an important goal of the research was to validate the assumption about the hormonal cycle's impact on rowers and their perceived effect on performance and well-being. Acquiring an understanding of the most prevalent symptoms experienced by rowers during the menstrual cycle and their openness in discussing menstruation and with whom.

These insights presented are derived from a comprehensive review of existing literature and insightful conversations with the medical expert Emma Paternotte. In line with the principles of a data feminist approach, the research aimed to utilise data to demonstrate the evidence of the situation and empower individuals in positions of authority. Therefore two surveys were conducted.

The outcome of this phase is a thorough understanding of the problem space. By reviewing the literature, engaging in insightful conversations with experts, and analysing survey responses from rowers and coaches, this phase confirms the hypothesis that rowers experience symptoms and highlights the importance of incorporating the hormonal cycle into rowing practice. Demonstrating the significance of developing a design that includes the hormonal cycle in the tracking process.

PEOPLE INVOLVED IN THIS SECTION

CONTENT

3.1 THE BODY'S MESSENGERS

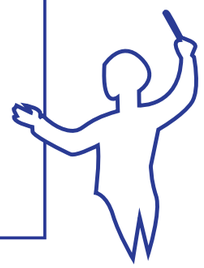
The word hormone comes from the Greek verb hormao, which means excite or arouse and that's exactly what hormones do. They are powerful message molecules that are either sent throughout the bloodstream delivering orders from the organs to the brain (and vice versa) to perform nearly everything we do. Hormones tell the body when to eat, sleep, and even when to grow. These responses can be quick, short-term ones like a faster heartbeat or sweaty palms or they can be longer responses and complete actions like the ones that trigger the reproductive system and the growth of the follicles.

In men, these hormones are pretty stable day in and day out (though they certainly change over a lifetime). In women, however, it's another story. And that story centres on the hormonal cycle. Therefore the hormonal cycle can not only have a profound effect on fertility and moods (and chocolate cravings), it can significantly affect training and performance.

The process of the hormonal cycle is orchestrated by the delicate dance of servers hormones.

GONADOTROPIN-RELEASING-HORMONE (GNRH)

GNRH is the conductor of the hormonal cycle. Nothing would happen without this hormone but it is only delegating the work and activating two other hormones that do the actual work.
(Watchman, T. 2020)



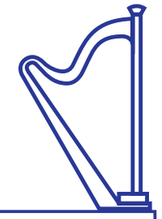
HORMONES IN THE BRAIN

FOLLICLE-STIMULATING HORMONE (FSH)

The FSH does what it says. It acts as the first violin by starting the process. FSH stimulates the follicles to help the eggs they contain mature. It arrives on stage when hormone levels are low at the start of the cycle and stimulates the follicles to grow. Once a follicle has been selected it starts to produce oestrogen. FSH stops playing as its job is done for now. But as soon as the oestrogen levels drop the FSH comes back on stage and together with LH they combine their instruments to nudge a follicle to pop and release an egg.
(Watchman, T. 2020)

LUTEINIZING HORMONE (LH)

Next to stimulating the follicles to release the egg and make ovulation happen, LH has more responsibilities. It also instructs the shell that is left behind from the follicle to produce progesterone. (Watchman, T. 2020)



OESTROGEN

The oestrogen that reins over the first half of the hormonal cycle and is being released by the developing follicles can be seen as the queen of the hormones. It makes women feel confident, fertile and able to perform their solo. (Watchman, T. 2020)

TESTOSTERONE

Testosterone is not a male hormone, it is produced by all humans. It helps to build, maintain bone muscles and bone density.
(Watchman, T. 2020)

SEX HORMONES

PROGESTERONE

It dominates the second half of the hormonal cycle and can be the reason behind anxiety, tears and mood swings. It slows a woman down and makes her eat comfort food. It keeps a woman safe if she is pregnant and she might not want to be the centre of attention and prefers some comfortable time. But it is not only that it also has health benefits like reducing inflammation, calming the nervous system, stimulating the building of bone tissues and improving sleep. (Watchman, T. 2020)

3.2 HORMONAL CYCLE PHASES

When people talk about the hormonal cycle it is often about conceiving. Nevertheless, the cycle can be seen as an overall health marker. Therefore knowing where someone is in the cycle goes beyond pregnancy it is about the ability to read oneself.

In general, the hormonal cycle is separated into two distinct phases, the follicular phase before ovulation and the luteal phase after ovulation (Constantini, N.W. et al. 2005). On average the cycle lasts 28 days but for most women it is different, ranging from 21–35 days. The first day of the cycle is calculated by the first day of the period to the day preceding the next one. The follicular phase starts on the first day of the hormonal cycle and lasts until the end of ovulation (10–14 days). The second half of the cycle is typically fixed in length around 14 days after ovulation (NOC NSF 2023). Therefore it is interesting to know when someone ovulates. Especially for the ones having irregular cycles. By knowing these indicators one can make calculations when the period is likely to start as well as pinpoint symptoms.

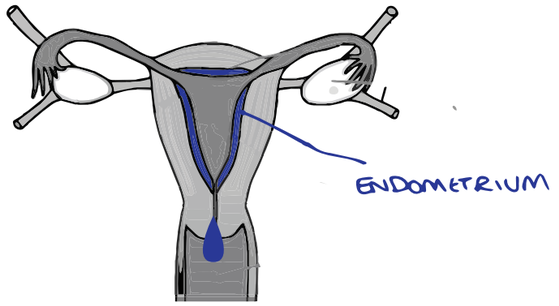
All kinds of small and large life events can have an impact on the hormonal cycle. From stressful events like exams to weight loss/gain to alcohol, the weekly training or travelling can impact whether a period is early or late, light or heavy, short or long, and painful or pleasant. It is also important to have in mind that every woman experiences her cycle differently and there is likely no one size fits all solution.

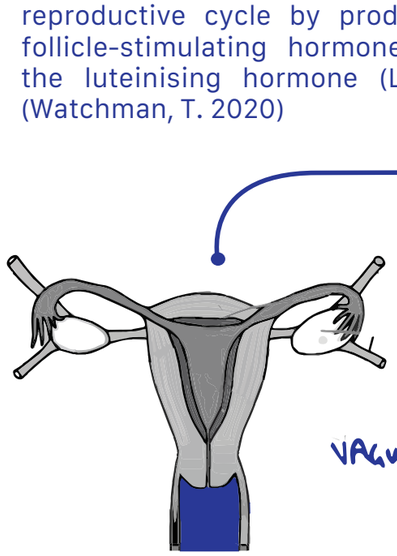
PHASE 1:

EARLY FOLLICULAR PHASE MENSTRUATION

The hormonal cycle starts on the first day of the period. If the egg doesn't get fertilised and placed in the uterus wall (endometrium), the sex hormones (progesterone and oestrogen) drop. This drop causes the blood vessels in the wall to constrict, thereby depriving the cells of oxygen and causing them to die. The wall then breaks down and the fluid including the dead blood cells is released from the vagina during the period. Bleeding lasts typically 3-8 days. This hormone drop also gives feedback to the brain to restart the reproductive cycle by producing the follicle-stimulating hormone (FSH) & the luteinising hormone (LH) again. (Watchman, T. 2020)

1. Blood vessels constrict causing the uterus wall to break down.





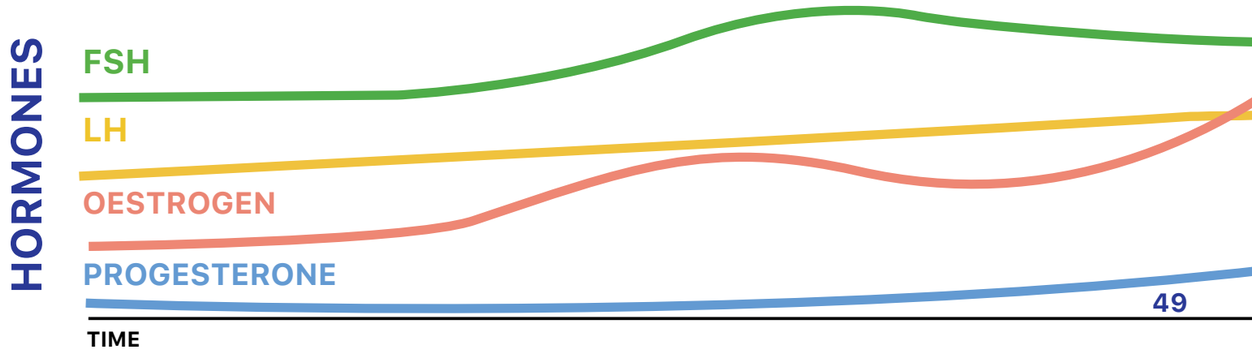
2. Period starts & hormonal feedback to start the cycle again

SYMPTOMS

The decreasing of the hormones can cause symptoms such as painful cramping and tiredness during this phase. This is due to uterus contractions to lose the dead endometrial cells. (Grant, D. 2022)

SUGGESTED BEHAVIOR

Research on this topic is still limited and it is complicated to make a general suggestion on behavior as it varies a lot between individuals. We know that some sporters experience more strength because of the pain, and others less. Some athletes report that physical activity (such as stretching) can be beneficial for menstrual symptoms. (Armour et al., 2019)



PHASE 2:
LATE FOLLICULAR PHASE

The process starts with the hormones in the brain (GnRH, FSH & LH) telling the follicles (unfertilised eggs) to grow and mature in the ovaries. These can be seen as a CV selection process; one follicle overshadows the others in size and maturity and becomes the dominant one.
This growth process causes the release of oestrogen, the queen of the hormones. The climb of this hormone causes the lining of the uterus to thicken to be prepared to host a potentially fertilised egg. It also sends a signal back to the brain that a choice is made and there is less need for FSH anymore.
Finally, oestrogen also causes cervical fluid to occur. This is typically a milky white, sticky fluid released through the vagina with the role to get ready for ovulation. This fluid creates a speeded-up route for the sperm from the vagina to the womb. It also makes sex more comfortable. At the end of the phase, an unfertilised egg releases from the ovary to the tubes. Ovulation is happening. (Watchman, T. 2020)

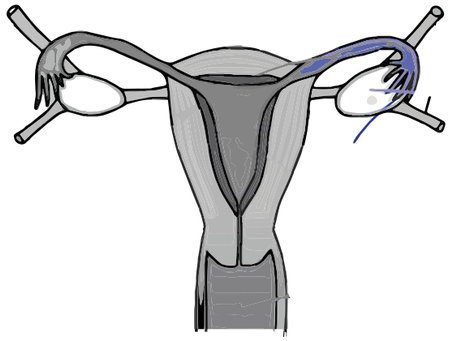
SYMPTOMS
An increase in oestrogen can increase serotonin and other neurotransmitters which may lead to feeling more energetic, extra strength and higher pain tolerance. Oestrogen increases the amount of feel-good serotonin in the body and also the number of serotonin receptors in the brain. (Grant, D. 2022)

SUGGESTED BEHAVIOR
Also here it is complicated to make a general suggestion on behavior as it varies a lot between individuals. Some women train strength more in their follicle phase as oestrogen rises again and is known to cause more power. Therefore, athletes may feel like picking up the exercise pace or intensity. Some research indicates that high oestrogen levels are associated with increased injury risk.

1. The egg develops

PHASE 3:
LUTEAL PHASE

2. The egg gets released in the fallopian tubes

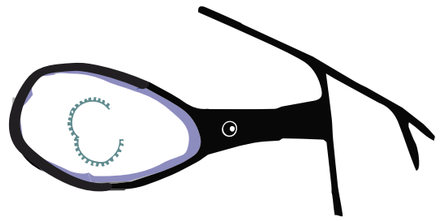


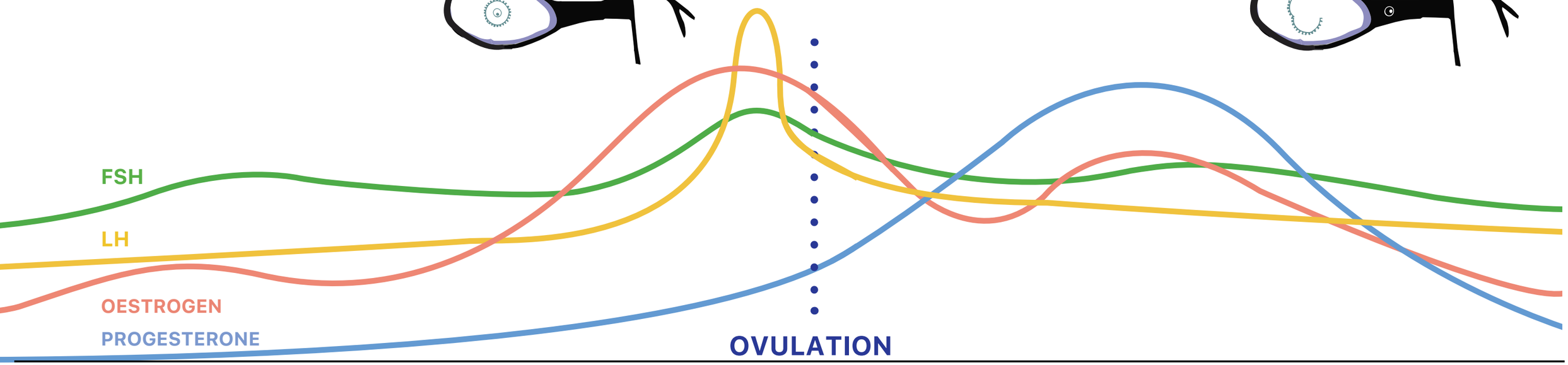
After the follicle releases the mature egg the follicle capsule (corpus luteum) stays behind and releases the dominant hormone of this phase progesterone. Causing women to slow down and fuel their bodies to be ready to host a baby. This phase before menstruation is often referred to as the high hormone phase.

SYMPTOMS
A rise in progesterone causes body temperature to increase and can improve sleep quality. Energy requirements increase during this phase. The appetite might go up as the body is gearing itself up to grow and host a baby. The sudden drop in hormones can cause some symptoms like mood swings or feeling more tired. (Grant, D. 2022)

SUGGESTED BEHAVIOR
Use exercise to lift your mood and fuel the body properly. Good sleep, nutrition, hydration and stretching can help with symptoms. Some athletes train longer in their luteal phase. But as with all the phases, general suggestions on behavior are complicated to make.

3. The corpus luteum stays behind





3.3 ROWERS SURVEY

Methods and Results

Two surveys were conducted over the course of one month to gain insights into how female rowers experience the various phases of the hormonal cycle, perceive its impact on their performance, and understand their communication practices regarding it.

THE SURVEY METHOD

The Rowers Survey had an internet-based design and targeted female rowers aged 19-30 in the Netherlands. The questionnaire was based on the Dutch Society of Obstetrics and Gynecology Foundation's questionnaire on the influence of menstruation on daily performance (Schoep et al., 2019). All data collected was anonymous.

The survey consisted of 32 mandatory questions and 7 additional open-ended questions (see Appendix page...), clustered into five parts:
Part A: Introduction - Aimed to explain the survey's purpose and the project.
Part B: General demographics & rowing profile - Collected information on rowing category, experience, and practice frequency.
Part C: Menstrual cycle - Explored symptoms, changes throughout the cycle phases, and medication usage.
Part D: Tracking - Examined tracking behavior related to the menstrual cycle.
Part E: Communication - Explored communication practices surrounding menstrual health.
Part F: Ending - Included open-ended questions about what participants wanted to learn, problems they faced, and opportunities and constraints related to the menstrual cycle and rowing.

The measured outcome of the survey included the presence of menstrual symptoms, pain or intensity scores, and their impact on daily activities. The perceived effects of rowing practices were also assessed. As well as different aspects of communication. The survey results were analysed using the Qualtrics software, and the findings were visualised and compiled into a booklet. This booklet was distributed to all participating rowing organisations and used to inform rowers and coaches in subsequent workshops.

1. The online survey software Qualtrics was used to execute and analyse the survey. Qualtrics offers a variety of features for designing and distributing surveys, as well as tools for data analysis.

DEMOGRAPHICS ROWERS SURVEY

220
ROWERS

Weight categories:

70 %
open weight

30 %
light weight

Age:

74 %
18-25 years

17 %
26-30 years

7 %
41 and older

2 %
31 and older

Training frequency

53 %
7 or more times a week

31 %
4-6 times a week

16 %
1-3 time a week

Clubs:

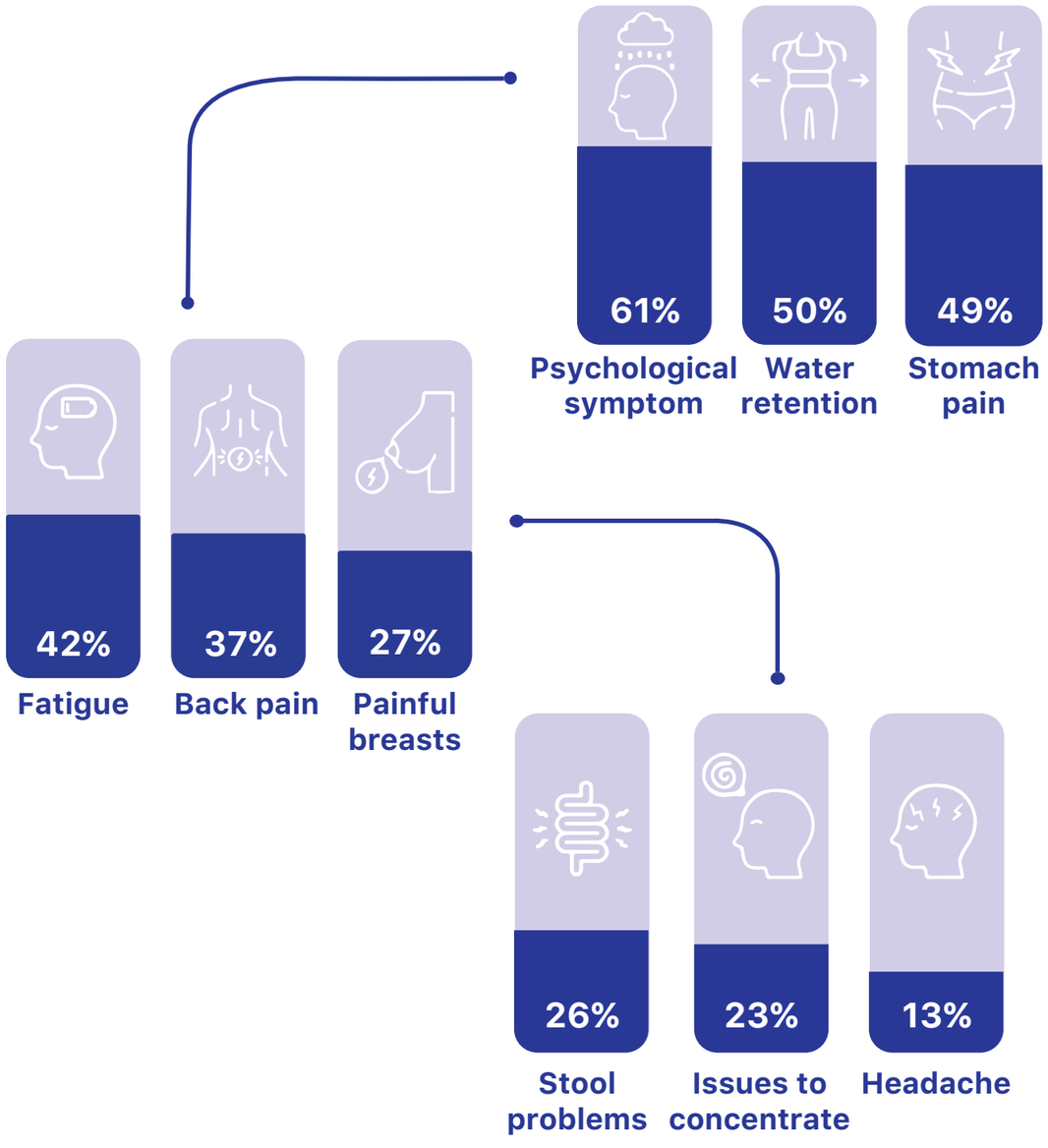
- Proteus-Eretes
- U.S.R. Triton
- D.R.S.V. LAGA
- G.S.R. Aegir
- Oxford Brookes
- RIC
- Viking
- GYAS
- Hunze

SURVEY RESULTS

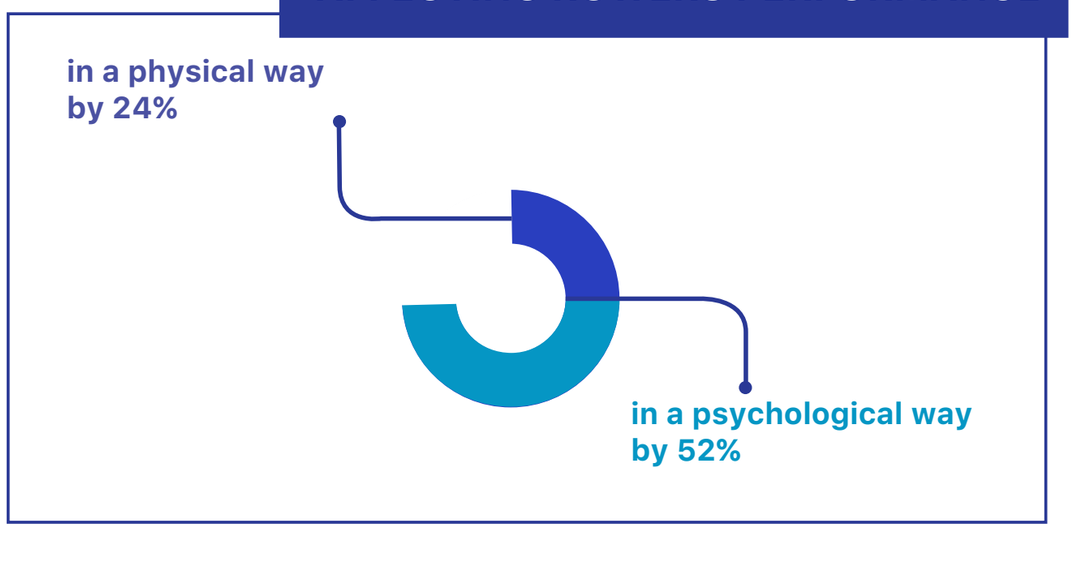
Symptoms and Effects

SURVEY PARTICIPANTS

have every time or usually

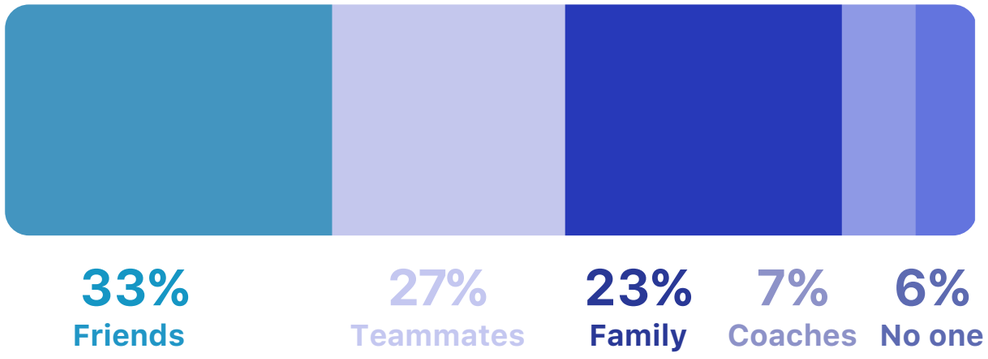


AFFECTING ROWERS PERFORMANCE



COMMUNICATION

Rowers talk about their hormonal cycle with:



30 ROWERS HAVE CANCELLED TRAINING BECAUSE OF HORMONAL SYMPTOMS

BACKPAIN

"With backpain just to be sure it was not another injury. And with stomach ache if it is too bad"

"Yes, but hardly ever because I found that the forces on my back during the rowing movement are actually exactly opposite to my cramps, so the pain eases during rowing :). So after I found that out, I hardly ever cancelled training. "

"As a bow in an eight I feel the cold at my back sooner, that back pain and cold weather sometimes makes me decide to skip training. On those days I don't feel like challenging my body."

FATIGUE

"Because of extra fatigue I have sometimes skipped a training which could be skipped (like "krachttraining")."

"During the training I became very lightheaded and felt like I was going to pass out. That week I had had that before so then I got off the rp3."

"I often called my coach crying because I was just so extremely tired. This only happened in relation to my period."

"Specifically at the beginning of the fertile period I often feel dizzy."

PSYCHOLOGICAL SYMPTOMS

"Stomach aches and depressed feeling."

"Either because of pain in my stomach/back or because of psychological symptoms (feeling extremely emotional), although the latter only happened once or twice, since it usually helps to train (not if it's a pretty extreme mental training though)."

"Being too tired to function or just too sad/ depressed feelings"

PAIN

"Severe cramps making it hard to do even slight exercise."

"It only started in my last year of rowing, but the stomach cramps get to the point where I can't stand up."

BLEEDING

"I sometimes find it very difficult to use tampons, and don't feel comfortable working out with a pad."

"I was bleeding quite heavily, was feeling fatigued (not just from menstruation) and this made me really need rest instead of training"

EVERYTHING

"Sometimes I basically get sick because of my menstruation. I get severe stomach pains which sometimes make me puke because of the pain. If I get those stomach pains I can not stand up straight and am not able to do anything really. I can only lie down drowning in my own sweat while shivering because I'm cold."

"I had so much blood loss and my stomach aches were so bad that I became really nauseous and very light in my head. Besides that, I had so much back pain it was hard to stand up straight or move. But it is not always this bad, this was a very bad day."

"During my time as competitive rower, probably not but I've wanted to 100% (and felt the need to)"

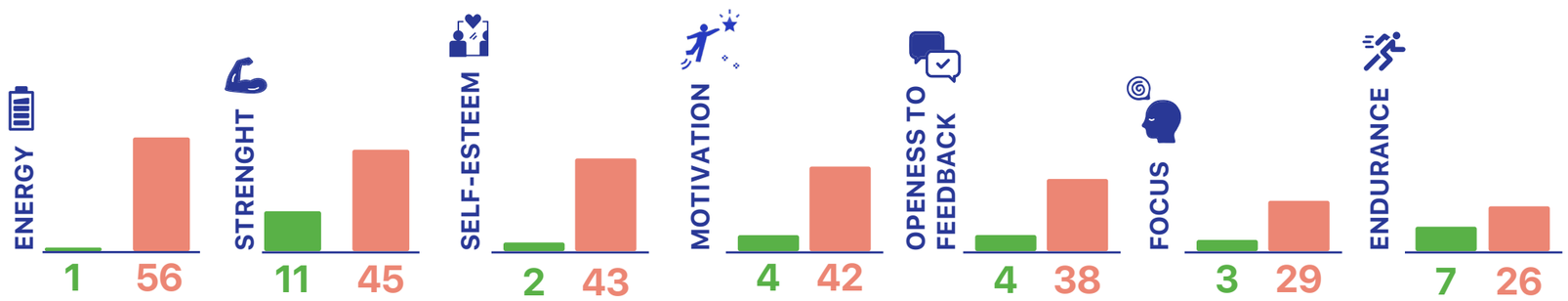
These are only a selection of quotes from the survey.

SURVEY RESULTS

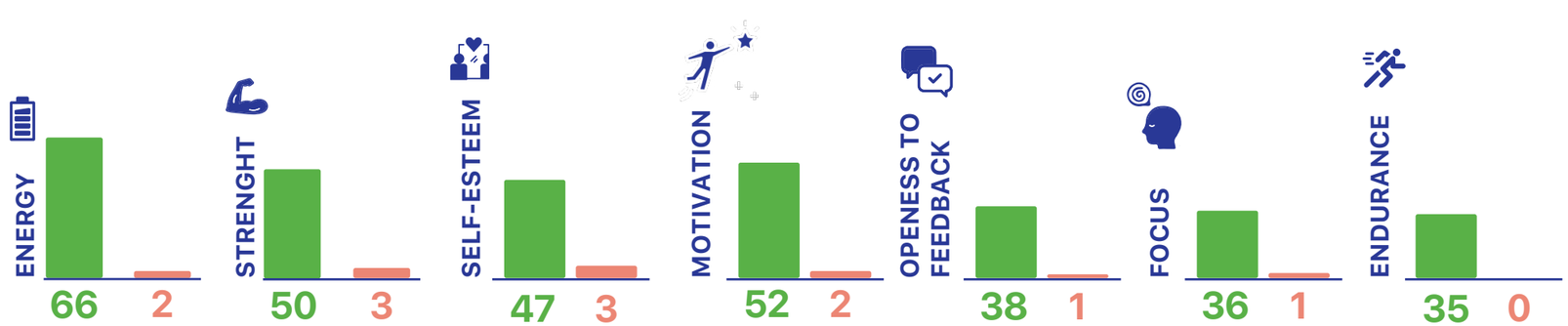
PERCEIVED CHANGES IN PERFORMANCE

increase
decrease

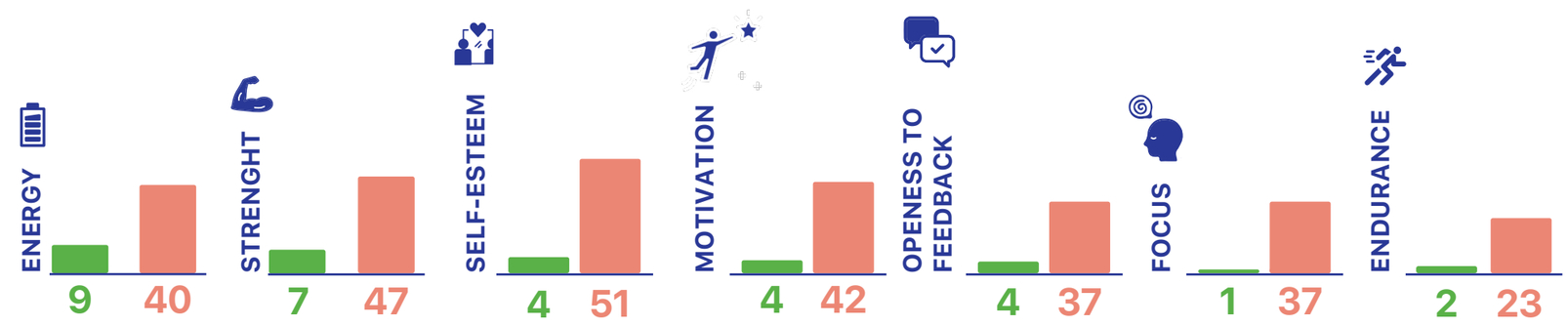
PHASE 1: MENSTRUATION



PHASE 2: LATE FOLLICULAR PHASE



PHASE 3: LUTEAL PHASE



3.4 THE MEANING OF ABSENT MENSTRUAL BLEEDING

Amenorrhea is a condition where a woman does not have her menstrual bleeding or has less than 8 menstrual cycles in a year. It is common among female athletes, but many of them do not seek help when they experience it. This is either because the topic is normalised, it is not being perceived as a problem by the athlete, due to the feeling of shame and taboo, the prioritising of sports performance or denial. (Verhoef, S.J. et al. 2021)

Of the athletes participating in the survey 48 rowers reported experiencing a lack of menstrual bleeding. Even though this topic is more prevalent among lightweight rowers the results show that also 26 of the athletes (more than half) experiencing amenorrhea are open-weight rowers.

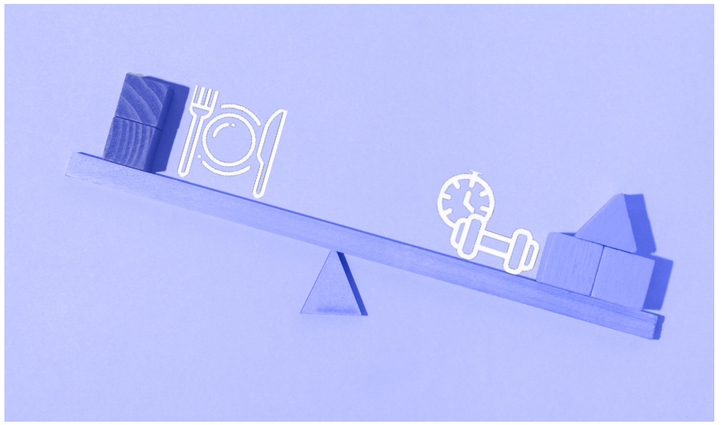
31%

without menstrual bleeding while training

BUT WHY IS THAT A PROBLEM?

Isn't it great not to have a period?

Although many athletes seem to be happy with not having their bleeding, for some it is even a sign of fitness, having amenorrhea can cause various problems. If a rower is not having a hormonal cycle it can have negative impacts on the athlete's overall health and performance. The lack of menstruation can cause a decrease in oestrogen levels, increasing the risk of osteoporosis and potentially causing anxiety and depression. Furthermore, research is looking into the correlation of fertility issues for women having amenorrhoea. (Moseley, S. 2022)



RELATIVE ENERGY DEFICIENCY IN SPORT (RED-S)

Athletes can experience amenorrhea due to various reasons such as stress, weight changes, and hormonal imbalances. One prevalent condition among athletes is Relative Energy Deficiency in Sport (RED-S), which occurs when athletes don't consume enough energy from food to match their body's needs. This leads to hormonal imbalances that disrupt the menstrual cycle. Both male and female athletes can develop RED-S, but it is easier to diagnose among women due to the symptoms of menstrual disturbances. RED-S can lead to problems in metabolism, bone density, and the immune and cardiovascular systems. (Moseley, S. 2022)

Low-energy availability can occur through disordered eating or unintentionally through mismanaging daily energy requirements like: An increase in training load without adapting the nutritional intake; lack of time and/or money for adequate meal planning, preparation and consumption; a significant or stressful life event which may disrupt normal eating habits; lack of understanding of the individual energy requirements for training and day-to-day life activities.

The calculation of energy availability involves subtracting the energy spent during physical activity (measured in kilocalories) from the energy consumed through diet (also in kilocalories). The result, which is known as energy availability, is the amount of energy left

$$\text{Energy Availability (EA)} = \text{Energy Intake} + \frac{\text{Exercise Energy Expenditure}}{\text{Fat free mass (kg)}}$$

QUOTES OF ROWERS WHO EXPERIENCED A LACK OF MENSTRUAL BLEEDING

1 YEAR

"In my first year when I started rowing (17 years old), I didn't get my period during the competitive season until summer when we started training less."

"I have a hormone spiral, because of that I haven't been on my period for 4 years or so."

HORMONAL CONTRACEPTION

"Since I stopped the pill, I haven't had my menstruation anymore."

INCREASE IN TRAINING LOAD

"Always. If I train more than 6 times a week and/or am below 61kg. Thus basically 3 out of my 4 years of rowing."

3 YEARS NO PERIOD

"I haven't had my period for three years"

LOSING WEIGHT

"A long time while losing weight I did not have menstrual bleeding so I had to put on some weight and now I do again."

"In my first year, I trained as a lightweight rower and during this time I experienced this."

"When I was rowing lightweight and lost too much weight."

LIGHT WEIGHT ROWER

"I was a lightweight for 2 years and stopped menstruating for a few months after losing weight, it did come back though."

"When I was a light ladies rower for a year, I did not menstruate for about 10 months."

These are only a selection of quotes from the survey.

3.5 HORMONAL CONTRACEPTION

Of course, hormonal contraception was developed to manage fertility. But because they often reduce the side effects of menstrual cycles by suppressing hormonal fluctuations, they are popular among female athletes. In the survey, 35% of respondents said they use hormonal contraception to manage symptoms.

Unfortunately, it is not easy to know what is the best option for a woman, as these forms of contraception could also have side effects. This is well reflected in the results of the survey, as 30% of those who use these forms experience side effects.

Personal reflection:

Shouldn't rowing teams talk about different forms of contraception and the advantages and disadvantages they have for female athletes?

CONTRACEPTIVE METHODS
most commonly used ones

CONTRACEPTIVE PILL

A commonly prescribed pill is the combined hormonal pill with oestrogen and progesterone but there are also some with only progesterone. The pill prevents women from ovulating, by levelling the hormones on a baseline level at all times. The negative feedback from progesterone is sent to the brain, stopping the production of FSH and LH. Therefore the follicle is not developed and not releasing an egg. If a woman stops taking the pill for one week, the levels of synthetic hormones drop, triggering withdrawal bleeding. This however is no "real" period as ovulation did not occur. This break should not be longer than seven days to prevent ovulation from happening. Actually, this break is not necessary at all. However, the pharmaceutical industry is not revising the product information as they have stopped further research on

SPIRAL: INTRAUTERINE DEVICE (IUD)

The spiral (eg. Mirena) is most of the time a small T-shaped device made of plastic or metal that is inserted into the uterus to prevent pregnancy. Two common types of spirals are the copper ones and the hormonal ones.

The copper IUDs work by releasing copper ions that are toxic to sperm, which prevents fertilization from occurring. Copper also affects the way that the uterus and fallopian tubes function, which can further prevent pregnancy. With this form of the spiral, women are still ovulating.

Hormonal IUDs, on the other hand, release a small amount of progesterone, a synthetic hormone, into the uterus. Progesterone thickens cervical mucus, which makes it difficult for sperm to reach the egg, and also thins the lining of the uterus, making it difficult for a fertilized egg to implant. Ovulation does not always occur and also bleeding will be less or stays away.

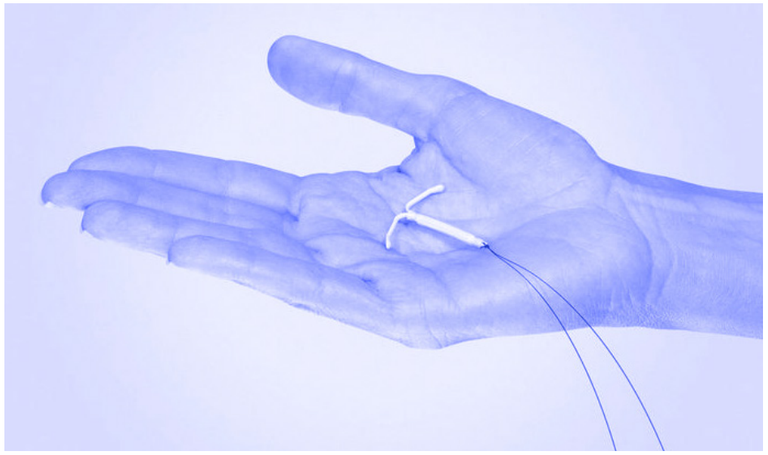


Figure 5: Hormonal Intrauterine Device

KEY INSIGHTS OF THE CHAPTER

In conclusion, understanding the hormonal cycle is crucial for optimising athletes' performance. Hormones play a significant role in regulating bodily functions and can impact energy levels, mood, and overall well-being. Each phase of the hormonal cycle can bring about specific symptoms and behaviors that may affect athletes. By being aware of these changes, athletes can proactively manage them and make informed decisions regarding their training, nutrition, and overall well-being.

The survey results indicated that the majority of the rowers experience changes throughout the hormonal cycle and encounter various symptoms. However, it was also evident from the research phase that each rower uniquely experiences the hormonal cycle. Therefore, there is no one-size-fits-all advice on modifying training plans for female athletes; it requires a personalised approach.

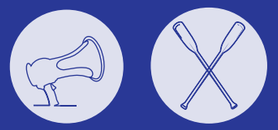
The absence of menstrual bleeding, known as amenorrhea, can have detrimental effects on the health and performance of rowers. Coaches, teams, and experts must engage in open discussions to address athletes' needs concerning the hormonal cycle. The survey highlighted that there is currently a lack of awareness regarding relevant issues such as Relative Energy Deficiency in Sport (Red-S) and the impact of menstrual cycle issues on athletes' health and performance. For instance, 31% of the rowers experienced amenorrhea, and 19% (30 athletes) even had to cancel a practice due to menstrual cycle issues. However, only 7% of the rowers discuss their menstrual cycle with their coaches.

With a clear understanding of the significance of incorporating the hormonal cycle in rowing practice, the next phase explores the opportunities and constraints identified through interviews, surveys, and literature research.

OPPORTUNITIES AND CONSTRAINTS TO INCLUDE THE HORMONAL CYCLE

In the final stage of the research phase, the insights gathered from interviews, surveys, and literature were organised and analysed to identify opportunities and constraints. The interview data was processed into statement cards, which were then categorised into multiple clusters containing also the two clusters: opportunities and constraints. Additionally, the open-ended questions in the survey allowed participants to share their personal experiences, opinions, and perceptions regarding the potential and limitations. The outcome of this chapter is a collection of opportunities and limitations derived from the input of interviewed rowers, experts in the field, and survey participants.

PEOPLE INVOLVED IN THIS SECTION



CONTENT

4.1 OPPORTUNITIES TO INCLUDE THE HORMONAL CYCLE IN THE ROWING PRACTICE

ROWERS CAN ACHIEVE THEIR PERSONAL BEST

When rowers would take the menstrual cycle into account, they could potentially achieve their best performance. A healthy menstrual cycle can be seen as an indicator of overall health.

HELP ROWERS WHO EXPERIENCE AMENORRHEA

Raising awareness about the potential negative effects of amenorrhea and conditions like RED-S, would enable the recognition of affected rowers and encourage the provision of appropriate support.

ADJUST THE TRAINING CYCLE TO THE ROWERS' CYCLE

The training plans are separated into Macro-, Meso- and Micro Cycles. There are opportunities to take the hormonal cycle of the rowers into account. For example in the Macro cycle which is the overall season (1 year usually, 4 years Olympics) the use of hormonal contraception could be discussed as they might cause side effects. The mesocycle which is usually 3-4 weeks could consider the phases of the menstrual cycle and the micro cycle could allow adjustments on the specific training.

SPORTS TO MITIGATE SYMPTOMS

Many people say sports help to reduce certain menstrual cycle symptoms. It could be interesting to understand in what way activities can be beneficial.

HAVE TESTS WHEN ATHLETES CAN BE THEIR PERSONAL BEST

It could be interesting to plan specific tests at a time when the rowers are feeling particularly strong. For example, when selecting the boats, consider female rowers who may suffer from increased symptoms during this phase.

ADJUST TRAINING ON STRENGTH, MOTIVATION AND MENTAL CAPACITY

Many rowers experience differences in strength, motivation and mental capacity throughout the cycle. There is an interesting potential in adjusting the training or the days of testing towards individual abilities.

HORMONE TRACKING

New technologies are being developed that allow measuring hormone levels. There could be potential to use them in a new context to be able to real-time measure if symptoms are due to hormones.

WORKSHOPS FOR EXPERTS AGAINST BIAS

There is a lack of awareness of the effects of the menstrual cycle on the rowers. Many experts help athletes to deal with some of these effects: sports psychologists help rowers to deal with mood swings or physiotherapists help to deal with back pain however they don't put these in context with the cycle. Therefore workshops for experts such as coaches (KNRB), sports doctors, sports psychologists, and physiotherapists could be eye-opening.

ACT AS A ROLE MODEL FOR OTHERS

As research is still lacking, rowers could be "scientists" themself and experiment (with menstrual data). They could test if their strength is only perceived differently or really different. Or explore what gains adjustments to their training plan can bring to the performance of a rower.

HELP ROWERS UNDERSTAND AND DEAL WITH NUTRITION (HUNGER)

Currently, there is no academic research on giving nutrition advice for specific phases of the menstrual cycle. But a common symptom is an increase in hunger and craving. There is potential to help athletes to be on top of these cravings.

CREATING A SHARING ENVIRONMENT

As the topic is still not openly talked about it is important to create an environment that encourages sharing and trust. By showing the rowers they are not alone and that the things they share are being taken seriously.

UNDERSTANDING THE ORIGIN OF SYMPTOMS AND BEING ABLE TO MANAGE THEM

When rowers know and understand the origin of their symptoms they can accept them rather than fight them. The rower themselves but also the team can plan accordingly and resulting in reduced suffering.

4.2 CONSTRAINTS TO INCLUDE THE HORMONAL CYCLE IN THE ROWING PRACTICE

HARD TO ADJUST TRAINING BECAUSE EVERY WOMAN IS DIFFERENT

Every rower experiences her hormonal cycle differently and has individual needs that make it difficult to adjust a group's training plan to individual needs.

MULTIPLE FACTORS CAN CAUSE SYMPTOMS

Every factor that can be a side effect of the hormonal cycle can also be impacted by other events. For example, the self-esteem of a person is also influenced by the role in the team (a person who is fighting for her seat). How can we be sure it is connected?

ROWERS NEED TO ALWAYS BE ABLE TO PERFORM

Only in big boats, there is the possibility to switch rowers. Race dates are not adjustable and the athletes need to perform then.

NO BUDGET FOR EXPERTS

Rowing organisations most of the time have no money for experts. Therefore they can only refer the rowers to individually consult with an expert

DIFFERING PERSPECTIVES ON WANTING TO KNOW AND SHARING SYMPTOMS

It could be interesting to plan specific tests at a time when the rowers are feeling particularly strong. For example, when selecting the boats, consider female rowers who may suffer from increased symptoms during this phase.

PRIMING THE PERCEPTION OF NEGATIVE SYMPTOMS

By planning and trying to predict cycle symptoms it could prime symptoms that otherwise would maybe not occur.

LOWER-LEVEL ROWERS HAVE A LOT TO LEARN AND DO NOT YET FOCUS ON OPTIMISING PERFORMANCE

Lower-level rowers may not be primarily focused on optimising every parameter to enhance their performance. As a result, the emphasis should not necessarily be on comprehending menstrual symptoms for improved performance. Instead, it should be directed towards ensuring the well-being of new rowers and assessing how their bodies are adapting to the new training routines.

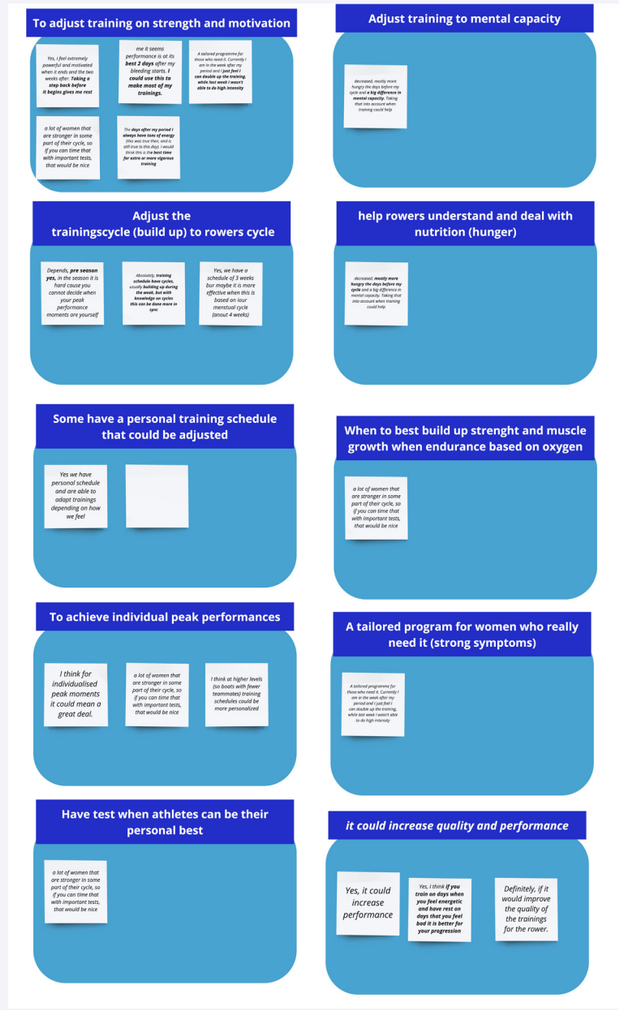


Figure 6: The image presents a glimpse into the data analysis process, showcasing the clustering of statement cards from survey and interviews.

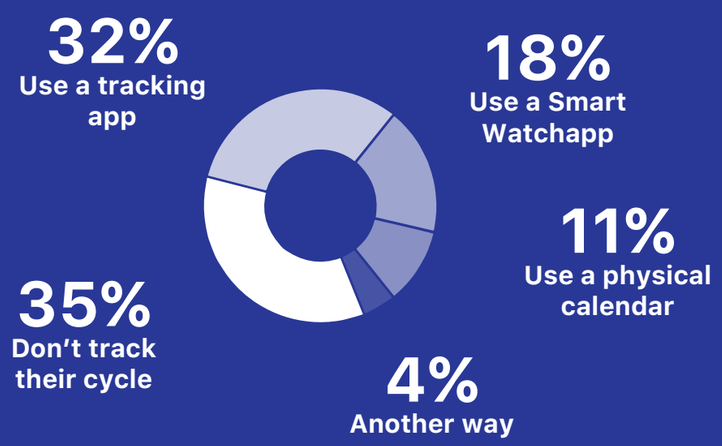
INTRODUCTION TO SELF-TRACKING

This section provides an explanation of the foundational aspects of self-tracking, drawing from existing literature. It introduces the developments and contributions made by the HCI community in this area. Furthermore, critical elements that have served as inspiration for the final tracking design will be identified and addressed.

DEFINITION

There is no single, universally agreed-upon definition of self-tracking, as different perspectives exist on the subject. Some view it from a technical standpoint, defining self-tracking as the use of digital systems and devices that enable usewrs to collect, analyze, and reflect on their personal data (French & Smith, 2013; Li, Dey, & Jodi, 2010). Others see self-tracking as the practice of recording, accumulating, and visualizing everyday habits and bodily reactions for the purpose of self-reflection and regulation (Ruckenstein, 2014, pp. 68–69; Choe, Lee, Lee, Pratt, & Kientz, 2014; Swan, 2009). In this project, Lupton's definition (2014) is fitting, as it combines technological and practical aspects, defining self-tracking as individuals' use of technology to record, monitor, and reflect upon various aspects of their daily lives

HOW ROWERS TRACK THEIR MENSTRUAL CYCLE:



*based on survey results

TRACKING CATEGORIES

two ways of self-tracking

Direct Self-Tracking

INTRODUCTION

Direct self-tracking involves the active and intentional collection of data by the individual themselves. In this approach, the person directly records information about their behaviors, experiences, or measurements using tools or devices specifically designed for tracking. (Meyer et al., 2017)
This method is the most common one to track the menstrual cycle.

METHODS AND TOOLS TO DIRECTLY TRACK THE MENSTRUAL CYCLE

- Phone apps (eg. Flo, Clue)
- Smart Watch apps
- Digital Calendar
- Paper Diaries
- Birth Control Cues
- Personal Health Devices (like the Breath ilo cycle tracker, that allows users to determine cycle phases and fertility status by analyzing CO2 levels in their breath see image bellow.)

Figure 7: Breath ilo cycle tracker

Indirect Self-Tracking

INTRODUCTION

Indirect self-tracking, involves the collection of data without active or conscious effort from the individual. In this approach, data is passively gathered through various means without direct input from the person being tracked. Indirect self-tracking provides a more automated and unobtrusive way of monitoring behaviors and activities, but it may have limitations in capturing certain aspects of personal experiences that only the individual themselves can provide.

METHODS AND TOOLS TO IN-DIRECTLY TRACK THE MENSTRUAL CYCLE

- Wearables (eg. EMM smart menstrual cup. The cup automatically tracks periods without requiring manual data entry)

Figure 8: EMM smart menstrual cup.

Reasons for Tracking

Based on literature there are five reasons (Epstein et al., 2017) for women to track their menstrual cycle. These reasons include:

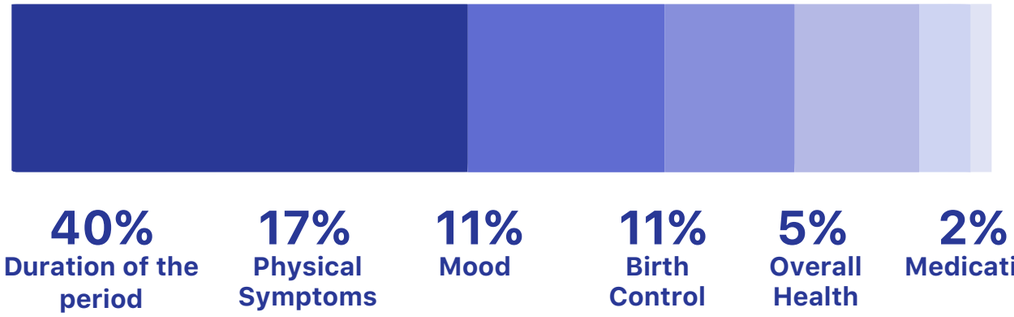
- Gaining awareness of their body's well-being.
- Understanding their body's responses during different phases of the cycle.
- Being prepared for potential changes.
- To become pregnat
- To facilitate meaningful discussions with healthcare providers.

Reasons for Discontinuing

These are common reasons (Meyer et al., 2017) for people to either discontinue self-tracking altogether or become inconsistent:

- High Effort: Users may stop tracking if they perceive the effort required as not worth the benefit.
- Data Usefulness: If the tracking data does not answer the user's questions or provide valuable insights, they may discontinue it.
- Misalignment with Self-Perception: Users may stop if the tracking outcomes conflict with their self-conception or self-image.
- Aesthetic Design: Some users might abandon tracking if the device's design does not align with their style or preferences.
- Sufficient Knowledge: When users feel they have learned enough from the tracking, they might stop.

THESE ARE THE ASPECTS THE ROWERS TRACK REGARDING THEIR CYCLE:



*based on survey results

FEM-TECH AND THE CONTRIBUTIONS OF HCI-DESIGNERS

Given the project's significant focus on redesigning the way rowers track their menstrual cycle and performance, this section provides an overview of the current state of art in the industry.

In recent years, the awareness of the gender health gap has grown, giving rise to the emerging sector of FemTech. Coined by entrepreneur Ida Tin in 2016, the term "FemTech" has rapidly expanded to encompass a diverse array of technology-enabled, consumer-centric products and solutions (Kemble, 2022). These advancements are designed to support individuals in navigating menopause, managing menstruation, addressing health knowledge gaps, and facilitating IVF treatments. Europe, in particular, has witnessed substantial growth in the FemTech space, with startups raising an impressive $161 million in 2022, compared to $75 million in 2020 (European Startups, 2023).

Within this domain, designers and researchers from the Human-Computer Interaction (HCI) community have played an active role in exploring female health technologies, significantly shaping the femtech landscape through their contributions and developments. Their projects aim to critically address and explore certain aspects, seeking new ways to shape our understanding of oneself and tracking through technology in a more embodied experience. Compared to the following projects, my work has the focus on implementability, which means it is less about speculation and more about practical application. But to create impactful solutions for rowers I draw inspiration from the HCI community's explorations.

DESIGN FOR SHARED EXPERIENCES

In their 2019 research on Ovum, a novel form of fertility tracking for couples, Homewood et al. highlighted a key observation - many existing technologies are primarily designed for individual use, even in situations where multiple stakeholders are involved. Ovum's design revolves around saliva tracking, which indicates a woman's fertility, enabling the couple to plan conception. However, unlike other devices, Ovum's uniqueness lies in projecting the saliva sample as a magnified image on the wall, creating an artistic centrepiece for the couple to explore together.

Figure 9: Ovum Device, enabling couples to monitor a woman's fertile phases by tracking saliva.

TRACKING FOR BETTER SELF-AWARENESS

In many menstrual tracking apps and tools, the main focus is on informing users about their fertility and expected period dates (Starling et al., 2018). However, these standardized methods often lack encouragement for exploration and fail to empower users to understand their bodies in a more personal way. Sarah Homewood's work (2020) revolves around how users perceive themselves and how self-tracking technologies influence their self-awareness and relationship with their bodies. She argues that our perception of ourselves and our bodies is constantly changing, not fixed. Therefore, she suggests that self-tracking methods should embrace the concept of "Volatile Bodies," as coined by Elizabeth Grosz (2021.). This concept highlights that bodies are socially constructed and a blend of our past, present, and future perceptions of ourselves.

In line with this approach, the design project Ambient Light introduces a fresh way for individuals to connect with themselves beyond just tracking menstrual periods. Using various lights, the lamp visualizes the changing phases of the cycle, creating a subtle physical representation that enhances awareness and understanding of the body's natural rhythm. By focusing not only on tracking the days of bleeding but also visualizing the changes in the other phases, the tracking design fosters a deeper connection with one's own body. This project's conclusion emphasizes that a tracking design must consider that the individual's perception of themselves is constructed and influenced by their social context and a combination of how rowers viewed themselves in the past, their current state, and their aspirations for the future.

Figure 10: Ambient Light, different lights, visualize the changing phases of the cycle.

EMBODIED TRACKING EXPERIENCES

Rowers currently rely on Excel sheet logbooks for data tracking, but this approach falls short in translating data meaningfully. It merely presents a list of numbers, failing to capture the true embodied experiences of the individuals. Some researchers argue that the potential consequences of technology layers, like tracking apps and smartwatches, acting as intermediaries or "gatekeepers" to the body, leads to a disconnection between the self and the disconnection between the self and the sensed sensor (Campo Woytuk et al., 2020).

In response to these challenges, projects from the HCI community, such as Tactful Feminist Sensing, explore a more sensitive approach to tracking the menstrual cycle and ovulation. Concepts like the finger sensor are developed to track changes in vaginal mucus, shifting the interaction with the menstrual cycle from a purely digital domain to a more physical one. This allows individuals to understand their bodies better by not only relying on visual data but also incorporating tactile experiences and touch.
Therefore the design should facilitate individual and collective sense-making of the data, as this reflective process is crucial for rowers to truly comprehend the significance of the information they collect. By transitioning from the digital realm of tracking apps to the physical domain of personal and group reflection moments, the design aims to create a deeper connection between the data and the rowers' lived experiences.

Figure 11: Tactful Feminist Sensing a finger sensor to track changes in vaginal mucus.

KEY INSIGHTS OF THE CHAPTER

The chapter introduces two main categories of self-tracking: direct self-tracking, where users actively collect data, and indirect self-tracking, where data is passively collected through smart devices. Contributions from designers in the HCI-community on the topic of menstrual tracking have allowed for a critical reflection on current tracking technologies.

The first project explores how menstrual data can be explored collectively, not just individually. The second one empathises on the changes that happen throughout the menstrual cycle by having a lamp that visualises the shifts of the different phases of the cycle and thereby connects the user with themselves. The last work presented in the chapter highlights the concern that solely relying on digital tracking may lead to a disconnection from the embodied experience of oneself. Therefore the design of the finger sensor is making use of the sense of touch to explore the body.

In conclusion, the inspiration for design from the current work is to include other stakeholders in the tracking process, understanding self-tracking not as a static status but as a changing one influenced by past, current, and future perceptions of oneself. Additionally, it encourages real-life exploration of oneself through physical reflection moments, not solely relying on digital tracking. Compared to the introduced project of the HCI-community this project focusses on implementation of the tracking solution and creating an impact for the rowers.

IDEATION AND SOLUTION FRAMING PHASE

The ideation and solution framing phase serves as the bridge from the research phase to the final solution. Given my limited expertise in rowing, coaching, or female health, my goal was not to generate ideas myself, but to empower those I am designing for to do so. In this way I aim to understand in what way the hormonal cycle can be included in the context as well as how the different stakeholders perceive the topic. Various activities were conducted to allow different stakeholders to delve deeper into the topic, understand their needs, and co-create solutions. As a designer, my role throughout this phase and the entire project was that of a facilitator and translator, making the research findings tangible and interactive to bring simplicity to complex situations.

The design phase encompasses two interactive workshops involving eight rowers and four coaches. These workshops revealed that the current tracking approach fails to engage with the data effectively. To explore further, the logbook data of four rowers was analyzed and visualized to identify potential effects of the hormonal cycle. Subsequent individual sessions with participants discussed these findings.
In addition, a creative brainstorm session with fellow design students was integrated to explore novel tracking methods. By envisioning how various roles (like a child or an artist) would track, this exercise prompted a rich discussion, unveiling fresh tracking perspectives.
Concluding this phase was a co-creation workshop, deriving from the research, leading to the final concept. This session involved brainstorming analogies to establish design criteria, clustering ideas, and drafting a storyboard to conceptualize the ultimate design.

PEOPLE INVOLVED IN THIS SECTION

THE OUTCOMES OF THIS PHASE:

- From the two workshops with rowers and coaches, the **design goal and design criteria** were established.
- The individual rower data analysis, in conjunction with broader research, identified **five correlations between the menstrual cycle and rowers' performance**, which are intriguing for tracking.
- The Tracking Ideation session generated **analogies** that played a role in the final workshop, highlighting design considerations.
- The culmination of the final co-creation workshop was **a storyboard outlining the concept of the final design.**

CONTENT

6.1 CO-DESIGN SESSION: BRIDGING FROM RESEARCH TO DESIGN

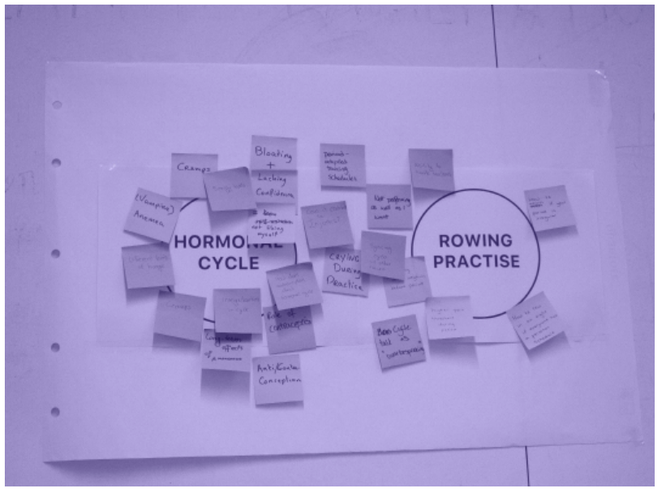
As the aim of my project is not only to explore a problem but also to explore solutions I conducted two workshops together with rowers and coaches from the student rowing club Proteus. The goal of the first workshop was to guide open discussions between the participants about the topic. Moreover, it allowed me to experience the dynamic between rowers and coaches especially when exploring the topic of female health. Together with the second workshop the outcome of the workshops has been the redefined design goal and design criteria. As well as the starting point for the process of creating a solution and developing the final design.

The following part covers the outcome of the workshops. The 3 coaches and 8 rowers participating, could be recruited with the help of the Proteus prof coach. To ensure I could actively participate in the discussions and focus on the content, rather than facilitating the sessions, I took on the role of the "problem owner." This involved introducing the participants to the problem and actively participating in the activities. To assist me in facilitating the workshops, I had the support of another design student who acted as the facilitator. Their role was to explain the tasks, keep track of time, and maintain a positive energy in the room. In order to ensure that the workshop was valuable not just for me but also for the participants, both sessions concluded with a Q&A session with Emma, the expert in gynecology. These sessions offered rowers and coaches the opportunity to pose relevant questions and engage in discussions.

PEOPLE INVOLVED IN THIS SECTION

WORKSHOP 1:
Outcome

The participants were divided into two groups during the session. One group was focussing on exploring what the problem is in communication. Why is this topic not talked about? The second group was looking into the training and why the hormonal cycle is not part of it. The outcome of the session was some HMW questions that have been created and the following conclusions:



COMMUNICATION

UNDERSTANDING

It's difficult to empathize if you haven't experienced the symptoms. Athletes don't want to come across as weak.

SUPPORT

Without a safe space to share, it is difficult to support each other.
From coach- rower ,
from rower-rower,
also from coach to coach

TRAINING

EVERY WOMAN IS DIFFERENT

and experiences her hormonal cycle differently. Therefore it is hard to give generalised advices.

LACK OF RESEARCH

on the influence of the hormonal cycle on performance. Also because there are multiple factors influencing a woman's well-being.

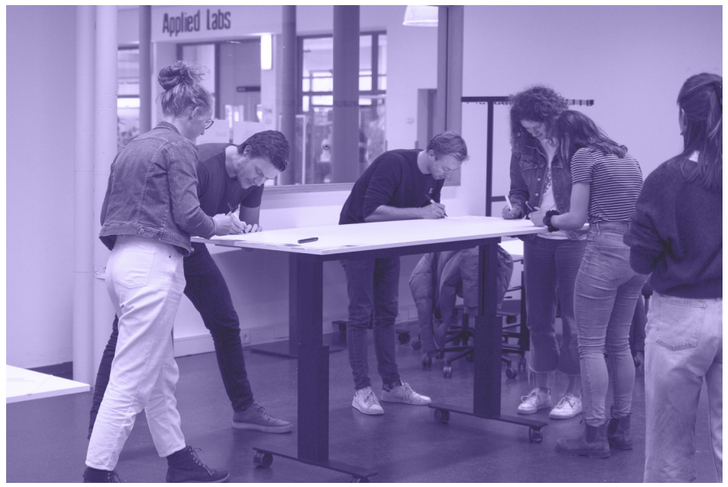
WORKSHOP 1:
Outcome

HMW-QUESTIONS

- How might we create awareness and share info on the cycle without false accusations based on this data?
- How might we create a safe space to communicate about it?
- How might Proteus contribute to research?
- How might we be more approachable as coaches for rowers to talk about the hormonal cycle?
- How might we take fluctuations in the training schedule into account as we do with injuries?

OPPORTUNITY SPACE

By taking the hormonal cycle as a factor into account **Proteus could help their rowers to reach their personal best**. As well as have a competitive advantage as it is not done by others yet. By having **a safe space to talk Proteus could support individuals to deal with their symptoms as they would help them deal with other injuries.**



WORKSHOP 2:
Results & Next Steps:

In the second workshop, numerous ideas were generated, two of which were elaborated upon. The first idea improves the current limited logbook, which records training only in Excel. This idea, an App, aims to include menstrual cycle data and enhance self-understanding, offering better training tracking. The second idea was a modular training plan allowing to adjust the training based on the menstrual cycle. Workshop details and solutions are in Appendix Chapter 6.2.

NEXT STEPS

The insights from this workshop helped to redefine the design goal, scope, and design criteria. These can be found on the following pages.

6.2 DEFINING THE BRIEF

The key insights derived from both of the workshops were that there are two aspects that need to be tackeled in order to integrate the hormonal cycle into the rowing practice. Firstly, it is essential to assist rowers in understanding their individual needs and how they experience hormonal changes, including identifying athletes who experience absence of menstrual bleeding. Only then can we effectively tailor training and support rowers based on their specific requirements.

Another prominent theme in the solutions is the strong desire for an improved way of tracking, as both rowers and coaches recognize the need for enhancements beyond the current Excel sheet. The insights from this workshop have helped me redefine the design goal and design criteria which are introduces in this part of the report.

PEOPLE INVOLVED IN THIS SECTION

GOAL

To give rowers the agency[1] to understand themselves better and be able to talk and get support from coaches or their team.

By giving the menstrual cycle a space in student rowing organisations.

2. Agency refers to an individual's capacity and autonomy to make choices, take actions, and exert control over their own thoughts, behaviors, and decisions within a given context or environment. It involves a sense of empowerment and the ability to act intentionally to achieve personal goals and navigate one's life circumstances.

DESIGN REQUIREMENTS

EXPERIENCE	PERSONALISED	UNDERSTANDABLE	ACTIONABLE	ENCOURAGING
INTERACTION	As everyone experiences the hormonal cycle differently, the design must be adaptable to individual needs, including those who experience amenorrhea.	The data collection process should be clear and understandable, enabling rowers to comprehend the relationship between their hormonal cycle and their athletic performance.	The results of the design should equip coaches to understand each rower's unique needs and provide guidance on how to implement them into their training.	Following Dr. BJ Fogg's B-MAP model, the design must provide the capability to perform the desired behavior, increase motivation, and establish clear triggers to encourage a new behavior.
REQUIREMENTS	Tailored to rowers' context Adaptable to individual users Carefully indicates symptoms needing attention	Clear guidance & explanations Familiar interactions Data illustrates meaning Consistent user experience	Outcome suited to training plan context Encourages & guides further steps	Works towards clear goal Builds on current behavior Design enables, motivates, and triggers desired behavior through

6.3 INDIVIDUAL ROWERS LOGBOOK DATA ANALYSIS

In order to gain insight into the data already collected and explore potential correlations between tracked performance, wellbeing, and hormonal cycle data, we conducted an analysis of the past 6 months' data from four rowers.

The rowers uploaded their Garmin watch and logbook data to the Alejandra's data donation platform, (https://datadonation.ide.tudelft.nl/project/ddd_sports/) enabling us to visualise the data. These visualisations were used during individual sessions to explore and discuss correlations specific to each woman. Additionally, supplementary materials were used to delve deeper and identify missing metrics in the tracking process.

The sessions served two objectives. Firstly, they aimed to raise awareness among the rowers about the current tracking and its potential. Secondly, they aimed to sensitise the rowers for the upcoming final workshop, where we together developed a final design concept. Following the workshop, once the final design had been conceptualised, I revisited the recordings of the individual rower sessions to analyse them in relation to each aspect of the design.

PEOPLE INVOLVED IN THIS SECTION

Goal understand the CORRELATIONS BETWEEN

Performance data (activity, hearth rate, sleep)	Wellbeing data (mood feel about a training)	Menstrual cycle data (different phases, symptoms)
Garmin Watch + Logbook	Logbook	Open Questions

During the individual analysis sessions, three rowers from both student organisations, Proteus and Laga, participated. The goal was to explore further the impact of the menstrual cycle and how it affects the day to day life of the rower from a very subjective perspective. We analysed their performance data from smartwatches, wellbeing data from logbooks, and menstrual cycle data to understand the correlation. The participants uploaded their Garmin watch data, including physical activities, heart rate, sleep, weight, and menstrual cycle details, onto the data donation platform.
The data was visualised on a poster, referred to in the following images.

THE DATA-VISUALISATION

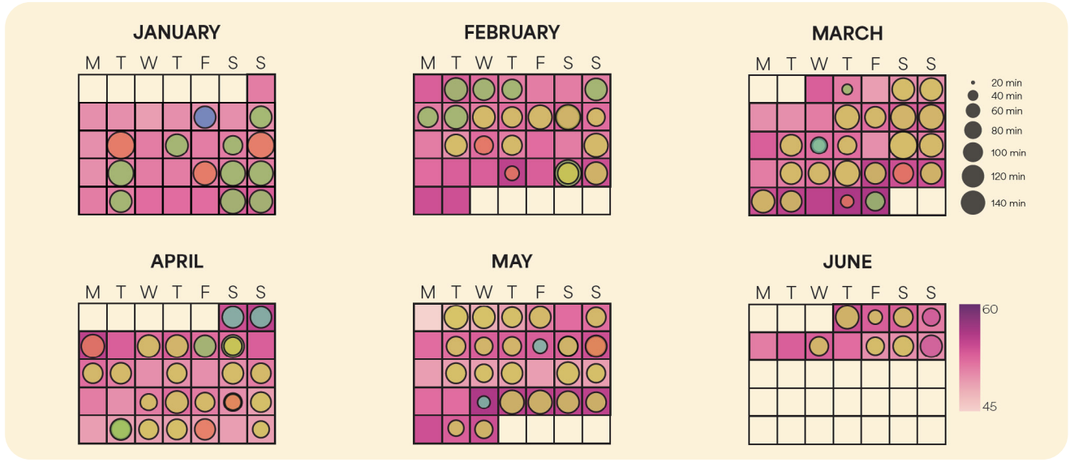
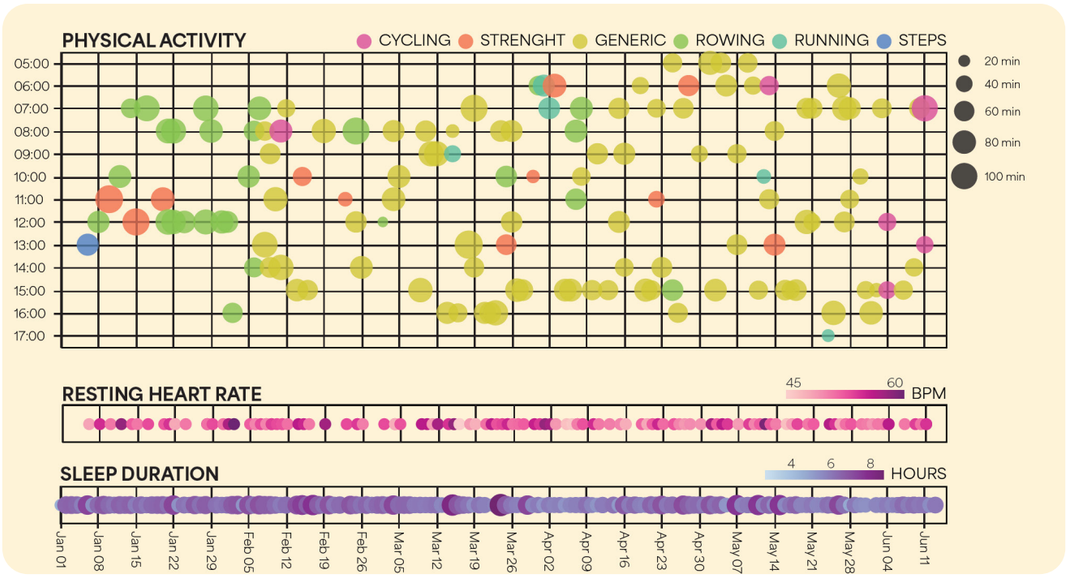


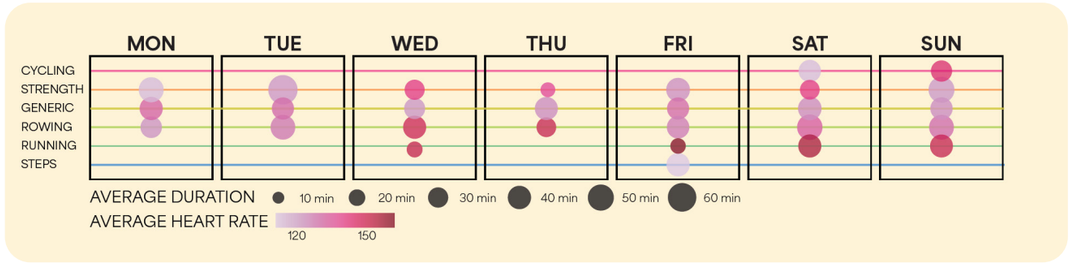
Figure 12: Shows the upper part of the poster visualising the logbook data of a rower from the past six months.

The upper part of the poster displayed the months and days of the year, with squares representing each day. The colour of the square represented the rower's resting heart rate, and circles within the squares depicted physical activities, with circle size indicating activity duration. Multiple activities in a day were represented by two circles.



The central part of the visualisation mapped all activities throughout the day, with two bars below indicating resting heart rate and sleep patterns by week.

The bottom of the poster showcased the average duration of activities on each day of the week, along with the average heart rate recorded each day.



Overall, the poster provided a comprehensive visual summary of the rowers' Garmin watch data, offering insights into their physical activities, heart rate patterns, sleep patterns, and daily routines. During the individual sessions, rowers marked moments of menstruation on the poster and provided additional details on the materials shown in the images bellow.

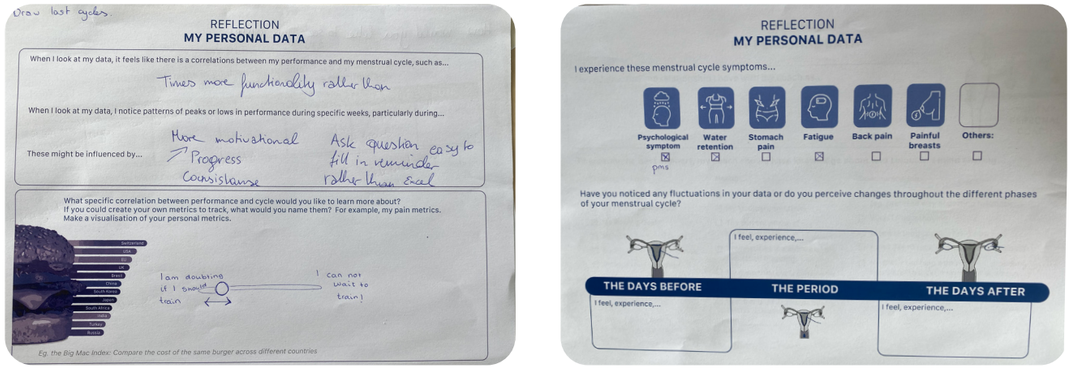


Figure 13: Materials used during the logbook data analysis session.

FINDINGS

The conversation revealed that the rowers were able to contextualise various individual data points, such as specific activities or instances of elevated heart rate, by considering other events and circumstances. For instance, when we pointed out a circle indicating a running activity on the poster, the rowers shared all kinds of details about that particular day, clarifying why they went for a run instead of rowing (such as being on a trip).

Another interesting finding was that one rower always experienced a lower heart rate during her menstrual period. Moreover, a consistent finding among all participants was the fluctuation in weight throughout the menstrual cycle, which created stressful situations when they had a race and needed to maintain an average weight of no more than 57 kilograms.

6.4 TRACKING EXPLORATION SESSION

During the research phase, both in interviews and sessions with rowers and coaches, the current tracking method was consistently highlighted as a pain point and an area with room for improvement. The idea of quantifying our self-awareness through numerical data in an Excel sheet seems disconnected from the person's self and lacks mindfulness in exploring our embodied experiences. To broaden my perspective, I organised a workshop with fellow designers to engage in discussions and explore alternative approaches to tracking. The insights gathered from these discussions, along with the design criteria, served as the foundation for creating inspiring analogies to guide the co-creation session and inform the final design.

PEOPLE INVOLVED IN THIS SECTION

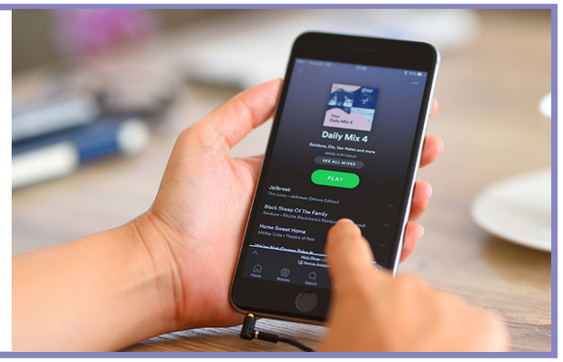
THE SESSION

The tracking exploration session took place with six design students from TU Delft. In this session, participants engaged in a brainstorming activity facilitated by prompting questions, enabling them to examine tracking from various angles (refer to Appendix Chapter 8). Subsequent discussions and ideation helped participants refocus on the context of the graduation project. The insights gained from these activities were integrated with the design criteria, serving as analogies for both the final co-design workshop and the design.

RESULTING ANALOGIES FOR THE DESIGN

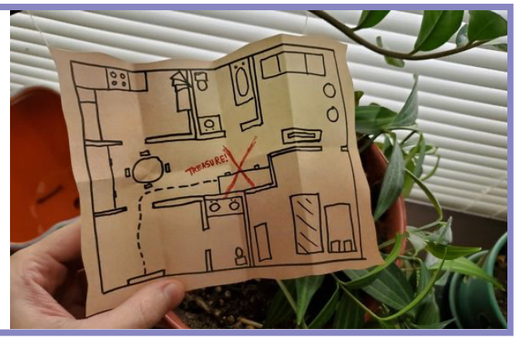
Personalised tracking to fit the routines of each individual rower

Since every rower has unique experiences and responds differently to training and their cycle, the design must take this into account. To be used it also needs to fit within someones routine. It should resemble a personalized wake-up playlist that aligns with the rower's schedule and fulfills their individual music preferences.



Positive and motivating to take action

The design should be fun to use and emphasizing the positive aspects rather than the negative. Like a treasure hunt, where one has to solve exciting and adventurous quest to discover hidden treasures.



Positive and motivating to take action

The design should be fun to use and emphasizing the positive aspects rather than the negative. Like a treasure hunt, where one has to solve exciting and adventurous quest to discover hidden treasures.

The design should encourage open conversation

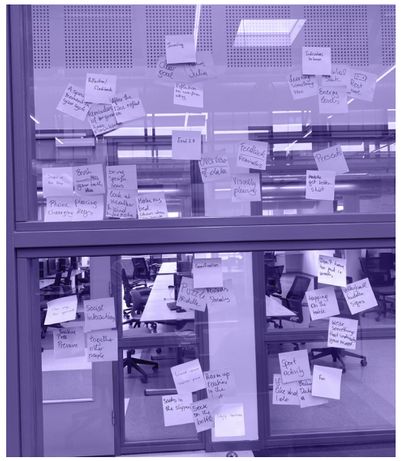
Unlike the current Excel sheet, talking about the menstrual cycle should be like discussing a lack of vitamin D. Now it often feels like we lack the language necessary to have these conversations. It's similar to how children express their emotions through behaviors such as drawing on walls.

6.5 CO-CREATING THE FINAL CONCEPT

Throughout the project, my primary objective was to create something meaningful and purposeful for the rowers, something they would genuinely enjoy using. Upon sharing initial ideas with experts from the field, I came to realise that there were numerous parameters and aspects I had yet to uncover. As a result, it became clear that the final design concept should originate directly from the rowers themselves, the end-users. Therefore, the overall goal of this collaborative session was to develop a design concept that not only captures their interest and desire to use it but also considers the temporal context and aligns with the rowers' lifestyle.

PEOPLE INVOLVED IN THIS SECTION

WORKSHOP 3:
Developing the final concept



THE PARTICIPANT

The workshop participants consisted of three rowers who had previously engaged in individual sessions and were already familiar with the topic, having reflected on their own experiences with menstrual cycles and tracking routines. The rowers were from the student rowing organisations Laga and Proteus. This broader perspective enabled us to consider the optimal timing and location for the design within the overall framework of student rowing organisations, rather than exclusively focusing on one particular club.

THE CONCEPT

The workshop resulted in a new tracking concept addressing the key issues discussed. The current tracking lacks goal orientation, engaging data collection, and official reflection moments, hindering the efficient use of the collected data. The proposed concept suggests initiating the tracking process with a goal-setting moment, where rowers select a specific goal to better understand, by also taking into consideration their training history. By focusing on a single goal, motivation increases as it reduces workload and provides clarity on the desired insights from tracking. Instead of the current Excel sheet, a limited set of daily questions would be used, with rowers receiving notifications. The data should be presented in a calendar format, enabling them to form a comprehensive overview by connecting the data with events like races.

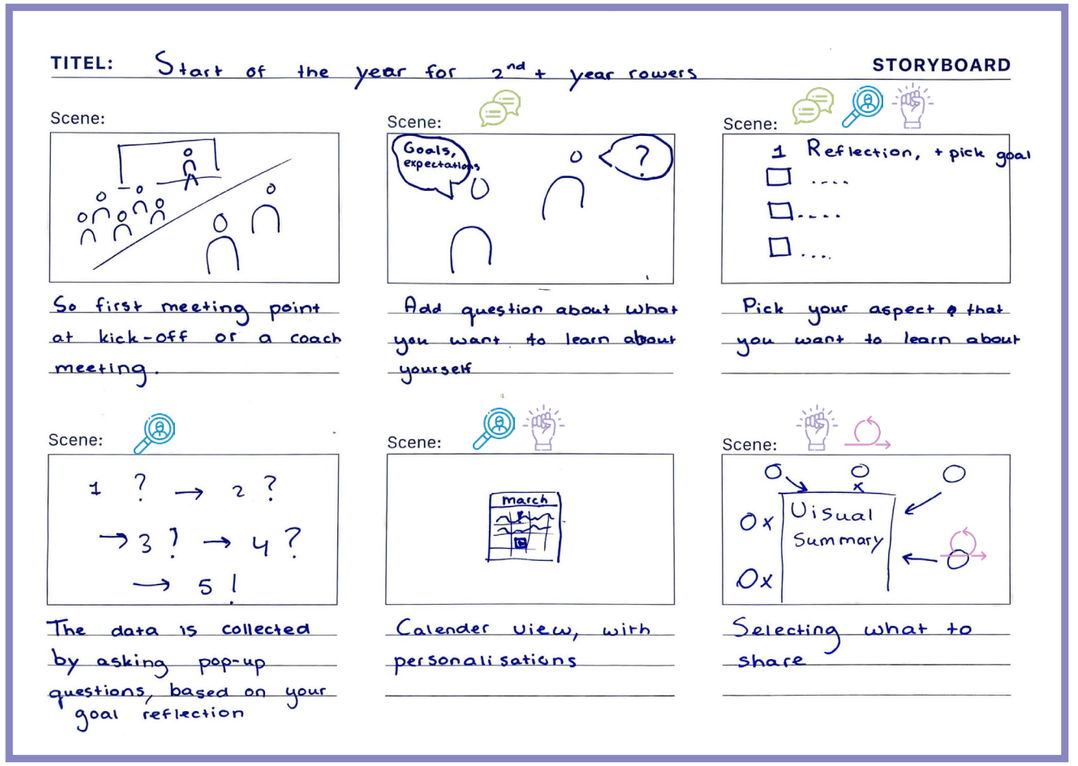


Figure 14: The image shows the workshop's end result: a concept storyboard. Icons indicate the specific parts to which the analogies contribute.

Additionally, the design should incorporate reflection moments with coaches. These guided moments would encourage open discussions on sensitive topics, explore tracking outcomes, and potentially make adjustments to training.

To make the most of the insights gained from the data analysis sessions and the prior research, the data was analysed after finalising the design concept. The insights were concluded in statement cards and organised into clusters based on the design elements (Figure 15). A bigger version of the image of the clusters with the findings can be found in the appendix Chapter 10.

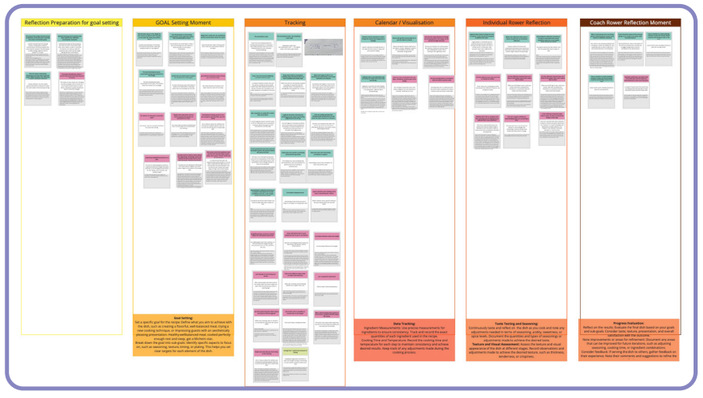


Figure 15: The image shows how the insights from the sessions were turned into statement cards and later organized into elements of the final design through clustering.

KEY INSIGHTS OF THE CHAPTER

The designers' brainstorming session significantly enriched the design process, offering a fresh perspective on tracking. The key insights from the discussion were integrated and correlated with the earlier defined design principles to create analogies. These analogies were further used in the ongoing development of the final design.

The co-creation workshop resulted in the desire for a tracking solution that allows rowers to select a specific tracking goal to increase motivation and reduce workload. The tracking solutions should provide a limited set of daily questions that afterwards present the data in a calendar format. Additionally, the design should incorporate reflection moments with coaches.

The concept was visualised by the participants in a storyboard and each step was in a follow-up step strengthened with insights gathered from the research.

FINAL CONCEPT: CYCLE POWERED PERFORMANCE

This chapter presents the final result of this graduation project consisting of these three parts:
1. Sync: The Tracking Application
2. Individual Reflection Moments
3. Coach Reflection Moments

These elements empower rowers to optimize performance through personalized tracking that caters to individual needs and harnesses the marginal gains of their female bodies. These marginal gains are small improvements with a significant effect on performance. Drawing insights from co-creation workshops, interviews and surveys, the design integrates the relevant aspect of the menstrual cycle into the performance tracking. This integration aims to encourage open discussions and practical strategies for incorporating menstrual cycle considerations into the training process. The final design leverages the advantages of both digital and physical components. For the daily data collection process, an app was chosen to make use of rowers' readily available smartphones, offering convenience and reminders for easy data entry and analysis. Additionally, a physical booklet was introduced to facilitate personal and coach reflection session. Allow rowers to individually interpret and engage with their data tangibly, preventing any disconnection from their overall rowing experience. The following pages describe the development of the design, including the different tracking paths and the reflection moments. The final outcome will be presented at the end of the chapter by describing a user journey.

PEOPLE INVOLVED IN THIS SECTION

CONTENT

CURRENT TRACKING STATUS QUO
the Basis for the Redesign

The current tracking method relies on an Excel sheet (Figure 16) that requires rowers to manually log their daily activities. However, findings from the research phase (see Chapter 2.1) indicated that rowers often forget to track and lack the motivation to track. This is also partly because of the Excel sheet. This form is not inviting. It does not promote self-exploration or understanding through data. It also doesn't encourage rowers to reflect on or discuss the findings with coaches. Some rowers expressed a preference for a more positive tracking system that highlights progress, giving them the ability to view visual representations of their data and the relationships between different factors. Additionally, they desire an individualized experience for each rower rather than treating the data uniformly.

Week	2				
Dag	**Datum**	**Rustpols**	**Gewicht**	**Training**	**Tijd**
Mon	Jan-09		56.8	Kt	90
Tue	Jan-10	63	57.3	Ergo 5x20"t40 + 2x20' ed	60
Wed	Jan-11			Ed 60' + kt	150
Thu	Jan-12	57			
Fri	Jan-13	54	57.4	Ergo ed 3x30'	90
Sat	Jan-14	53	57	Ergo ed 4x15' t-wisselingen	60
Sun	Jan-15			18k+1'opzetjes	105
				Totaal	9.25

Figure 16: The image displays the existing Excel-based logbook used for tracking rowers' performance. The design replaces this current tracking method.

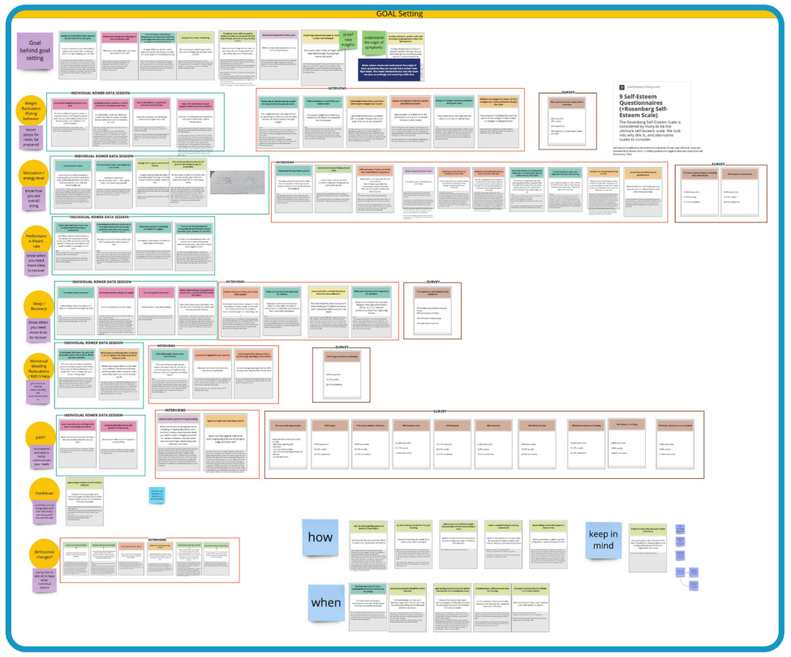
FIVE PERSONALIZED TRACKING PATHS
Selections and Flows

Recognizing the need for personalized tracking, the app's design emerged from identifying what aspects rowers find interesting to track and what correlations they'd like to explore between their performance and their menstrual cycle. Insights from research activities were transformed into statement cards, organized into **five distinct tracking paths:**

1. Motivation & Energy level
2. Pain & Cycle Effects
3. Sleep & Recovery
4.Weight Fluctuation & Eating Behavior
5. Irregular & Missing Bleeding

In the design rowers choose one path that aligns with their needs offering a personalized daily check-in survey with tailored questions. The basis of each check-in moment consists of general questions, allowing for the replacement of the current logbook. These questions also correlate the data with the menstrual cycle phase. They ask about "bleeding status," indicating menstruation days, resting heart rate, and the perceived performance of their recent training. The last question that all paths have in common draws its inspiration from both the co-creation workshop and the data analysis sessions. The rowers' were able to pinpoint specific events solely from the heart rate and training data. The workshop also suggested making tracking more motivating by letting rowers collect photos for flashback moments. Hence, the final question for all paths lets rowers upload a memory or picture to remember their latest training day.

Figure 17: Research analysis leading to the choice of the five tracking paths.



The following pages give an explaination of each of the five tracking paths the rowers can choose from. Including the goal behind the track as well as an visual overview of the flow of the check-in questionnaires.

1. MOTIVATION AND ENERGY TRACK

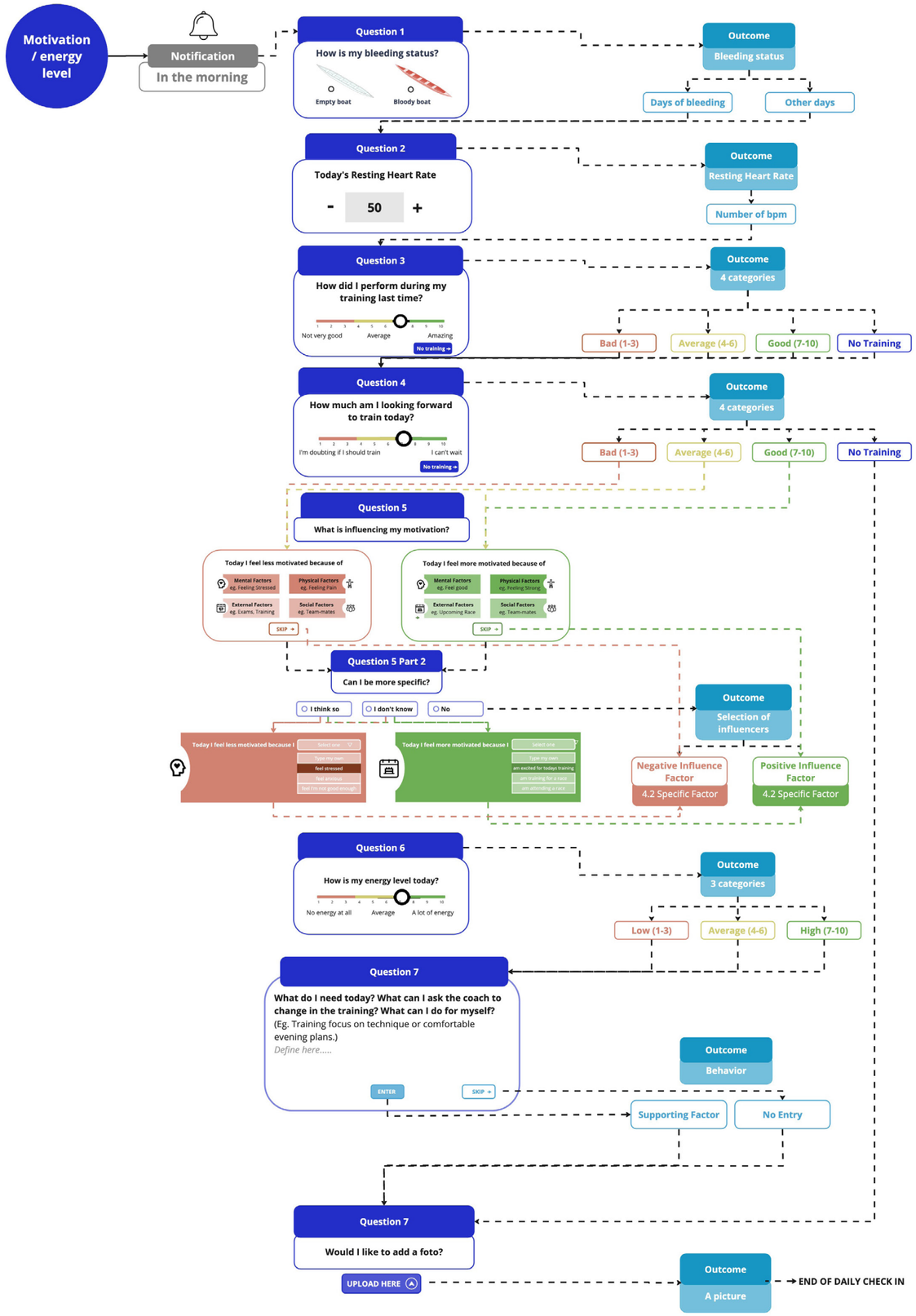
introduction to the path and the why

THE VALUE BEHIND THIS PATH

The first tracking path focuses on motivation and energy which is also used as representation of the final mockup design discussed in the next chapter. This choice stems from survey results (see Chapter 2.2) that highlight the fluctuation of these two aspects throughout the menstrual cycle. Interviews with the prof-coach and other coaches also emphasized the importance of tracking motivation as an indicator of overall well-being and performance. Identifying patterns and anticipating fluctuations in energy and motivation can enable adjustments to training plans. The prof-coach explained that performance growth takes place when a rower engages in training and subsequently experiences periods of low energy and muscle soreness. Only after sufficient recovery a rower can resume training and continue their growth. Tracking energy and motivation can help to determine when they've sufficiently recovered. A similar approach could be applied to the different phases of the menstrual cycle. By tracking energy and motivation levels concerning these phases, rowers can identify when they need more recovery time and when they have high-energy phases that they can make the most of.

THE PROCESS

Every morning, the rower receives a notification on their phone to track. Besides the standard questions about bleeding status and training motivation, the rower receives two questions about their motivation to train and energy level. Depending on their answers, the follow-up questions help identify the factors that positively or negatively influence their motivation and energy. To achieve more than just making the rower aware of their low or high motivation and energy but also encourage them to take action based on this information, the sports psychologist suggested adding an open-ended question. This question asks how they can meet their needs for the day, like whether they should talk to the coach to adjust their training or take some time for themselves.
The last question invites them to share a photo, serving as a memory of the day and the context of the data.



2. PAIN & CYCLE EFFECTS

Introduction to the path and the why

THE VALUE BEHIND THIS PATH

This tracking path is centered on monitoring the various effects that rowers might encounter due to their hormonal cycle. Illnesses like endometriosis can lead to intense pain, yet they often remain undiagnosed for extended periods due to the lack of communication. A rower explained during an interview that menstrual pain is normalized, and society tells women they need to deal with it and not make a point out of it. Additionally, the survey results (Chapter 2.2, page...) highlight that over half of the participating rowers experienced symptoms such as fatigue, stomach pains, back pain, and digestive issues. About half of them also reported headaches and breast pain. These symptoms can effect rowers' training, preventing them from maintaining specific postures due to cramps or even hindering their ability to train altogether (as stated by 29 rowers in the survey).

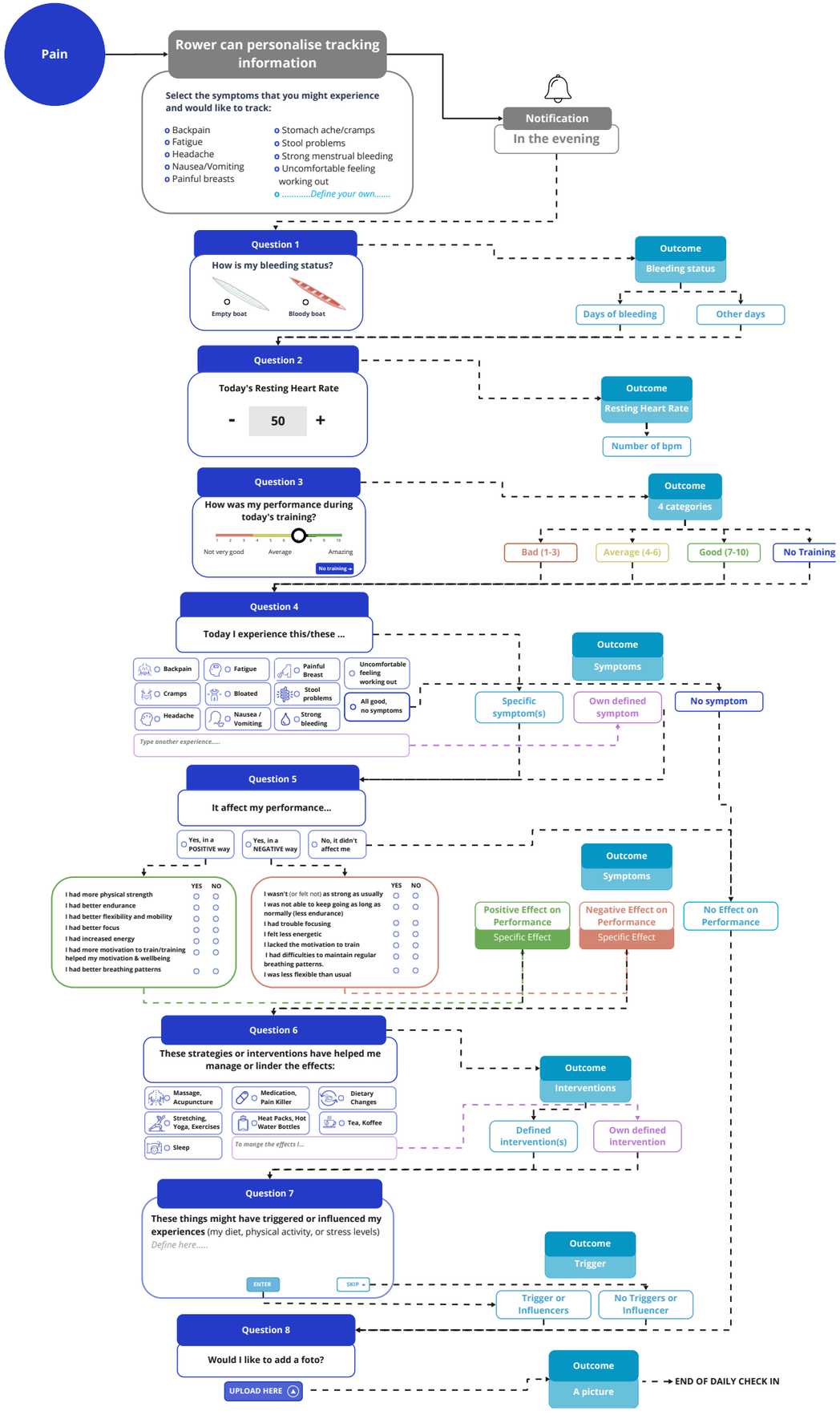
However, this tracking path doesn't solely aim to identify when a rower experiences specific symptoms. Rather, its overarching goal is to uncover the triggers or factors that cause these menstrual effects. Importantly, not all of these effects need to be portrayed in a negative light; some rowers mentioned during interviews that experiencing cramps enabled them to delve deeper into their rowing training. Therefore, the primary objective of this tracking path is to empower rowers with an understanding of how and when the menstrual cycle impacts them. This knowledge equips them to be prepared, effectively manage triggers or influences, and navigate their training with greater insight.

THE PROCESS

Since the effects of the menstrual cycle can vary among individuals, the tracking path allows each rower to personalize the effects they are logging. This enhances the user experience during the check-in moment, making it quicker and less overwhelming.
The notification to fill in this check in moment will be at the end of the day.
The rower is prompted with questions about their experienced symptoms, enabling them to later identify patterns of when these effects occur.

Following that, there's a question about the impact of these symptoms on their performance, which addresses an issue raised by several rowers who find it challenging to recall these aspects during coach meetings. To help rowers stay on top of their symptoms and effective managing them, they are regularly asked about interventions, strategies for coping, and other influencing factors.

Like in the other flows the final step involves uploading a photo, serving as a memory of the experience.



3. SLEEP & RECOVERY

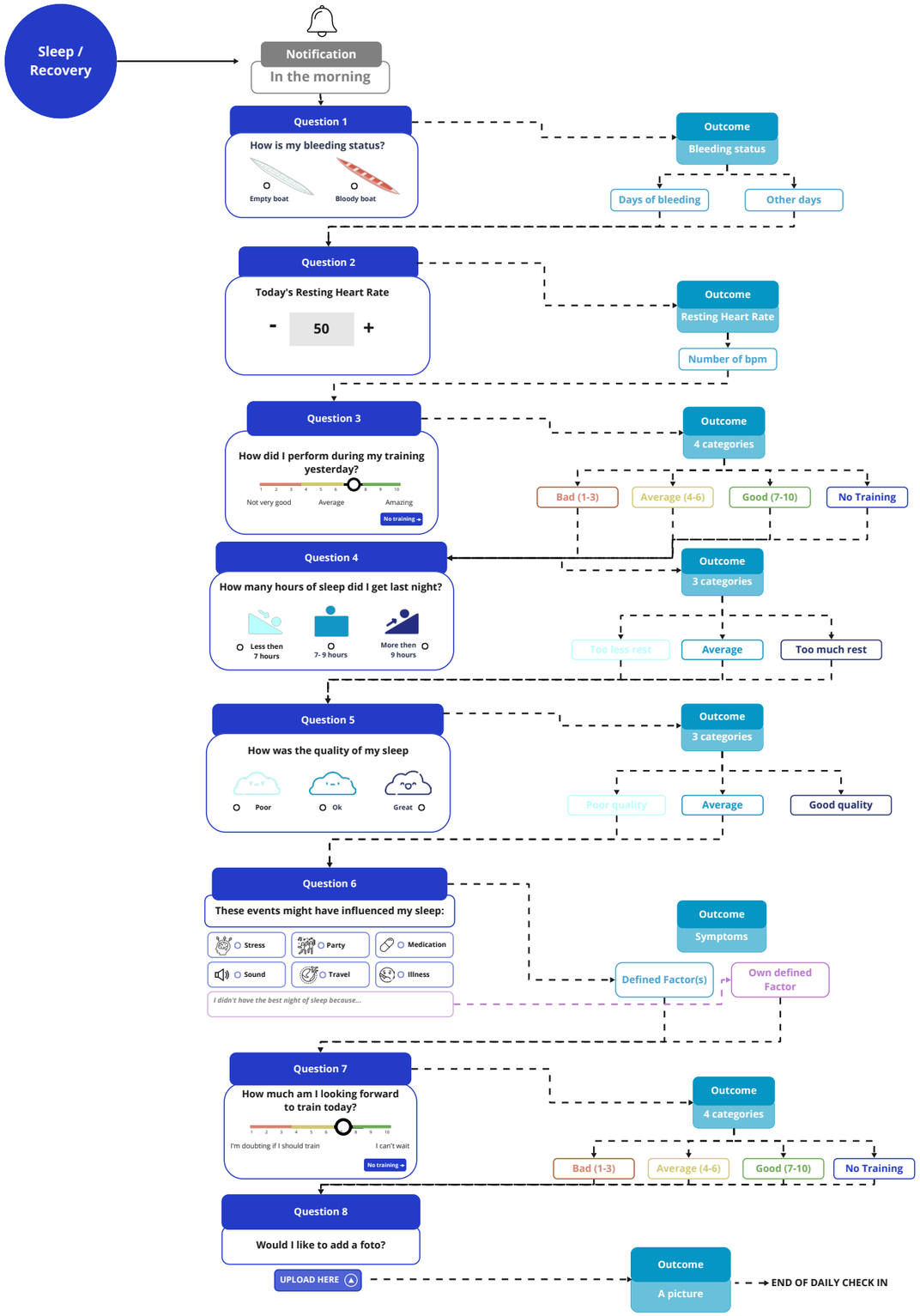
Introduction to the path and the why

THE VALUE BEHIND THIS PATH

This tracking path focuses on monitoring the sleep and recovery of a rower, something that both rowers and experts have pointed out as highly important. Scientific proof of a direct link between the menstrual cycle and sleep quality or recovery time is still lacking. However, the survey results showed that some rowers perceive an effect by reporting symptoms such as poorer sleep quality, trouble falling asleep, waking up frequently, and restless legs in relation to their menstrual cycle. Interviews and analysis of logbook records also reveal that tracking resting heart rate and understanding optimal recovery times are the most important objectives of the current logbook.

THE PROCESS

This tracking path is the most aligned with the current routine of entering logbook data. Right now, rowers note their resting heart rate in an Excel spreadsheet upon waking up. With the app, they now receive reminders in the form of notifications and can simply respond to questions, instead of navigating tables early in the morning. making that process more enjoyable. By keeping track of sleep quality, duration, and how they feel their performance is affected, rowers can see if there's any relationship. They can also see if not getting enough sleep or having poor sleep affects their motivation to train. If a rower reports average or lower sleep quality, they'll be asked about potential causes. Over time, this approach helps rowers understand their changing sleep and recovery needs during different menstrual cycle phases. It also helps them recognize extended periods of poor sleep and what might be causing them.



4.WEIGHT FLUCTUATION & EATING BEHAVIOR

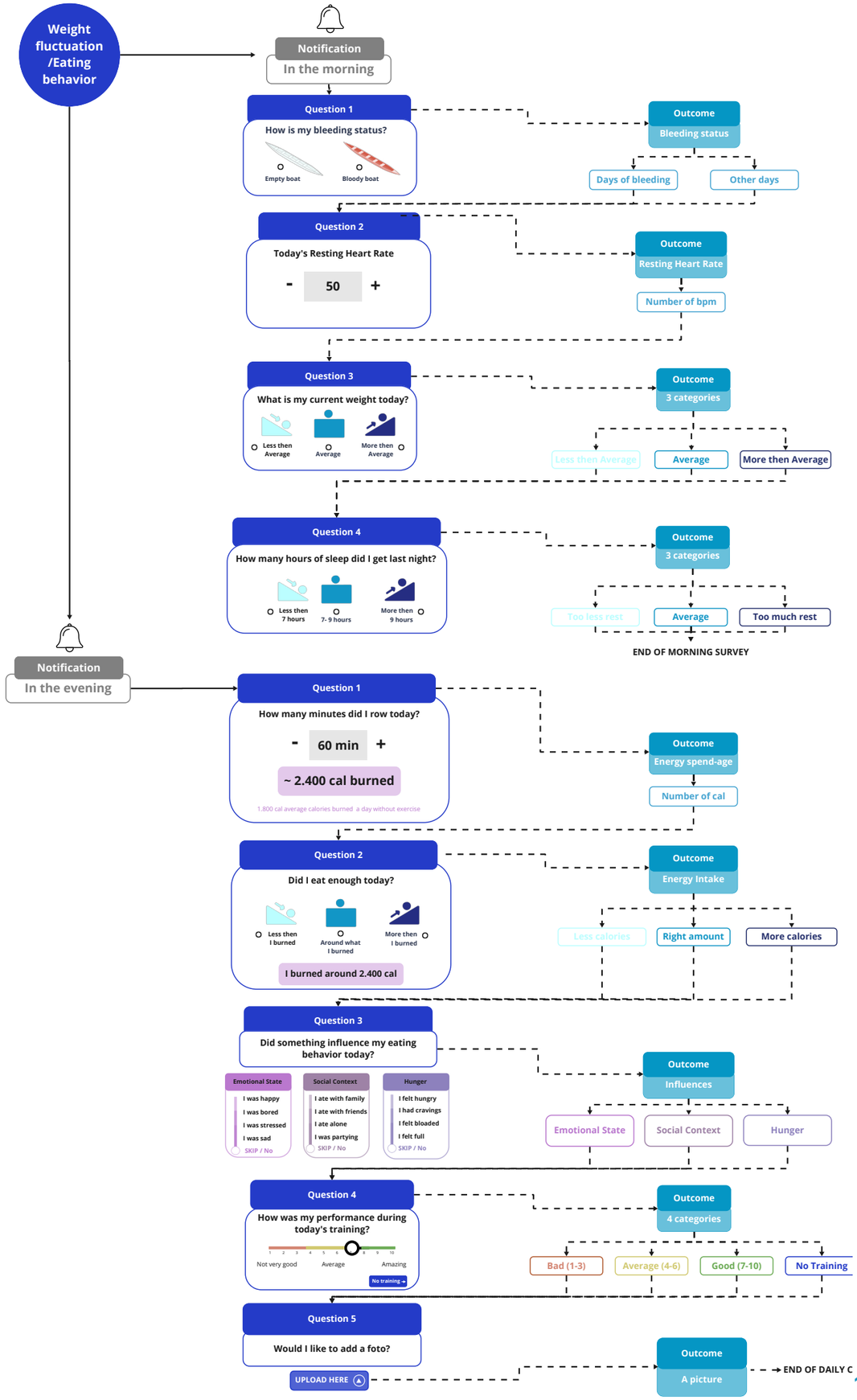
THE VALUE BEHIND THIS PATH

This path is centred on tracking weight fluctuation and changes in eating behavior connected to the menstrual cycle and performance. While scientific research is limited, findings reveal that many women undergo variations in weight and eating patterns during this time. Factors such as water retention (reported by 70% of survey participants) and altered food cravings contribute to these changes. By understanding these changes, rowers can be better prepared with healthy snacks and satisfying meals. This is especially crucial for lightweight rowers who need to manage their weight. Interviews revealed that the focus on weight and eating behaviors also intertwines with self-esteem. Understanding the reason behind weight fluctuations or recognizing the triggers of food cravings can lead to greater confidence and healthier approaches to addressing these needs. Moreover, the tracking pathway aims to raise awareness about unhealthy eating patterns.

THE PROCESS

In contrast to other pathways, this one has two check-ins each day. Morning questions include the usual resting heart rate and bleeding status. Recognizing that many rowers weigh themselves in the morning, the question about current weight is included in that survey. Additionally, the survey asks about the amount of sleep the rowers obtained, as interviews have indicated a potential link between sleep, weight, and eating habits.

In the evening check-in, rowers input how long they trained to estimate and show the rower the amount of calories they burned. After this, the rower is asked if they feel they've consumed enough food. This serves two purposes: firstly, to compare their weight, calories burned, and intake; and secondly, to prompt reflection on their eating practices. Some athletes may find themselves imbalanced between their training intensity and energy intake.
To give rowers the agency to develop a strategy based on their insights, the survey also includes a question about the factors influencing their eating behavior. Furthermore, to establish a connection between the gathered aspects and their perceived performance, this question is included towards the end.



5. IRREGULAR & MISSING BLEEDING

Introduction to the path and the why

THE VALUE BEHIND THIS PATH

This path is centred on tracking weight fluctuation and changes in eating behavior connected to the menstrual cycle and performance. While scientific research is limited, to the dietary needs of women across the cycle, the survey findings reveal that many women undergo variations in weight and eating patterns during this time. Factors such as water retention (reported by 70% of survey participants) and altered food cravings contribute to these changes. By understanding these changes, rowers can be better prepared with healthy snacks and satisfying meals. This is especially crucial for lightweight rowers who need to manage their weight. Interviews revealed that the focus on weight and eating behaviors also intertwines with self-esteem. Understanding the reason behind weight fluctuations or recognizing the triggers of food cravings can lead to greater confidence and healthier approaches to addressing these needs. Moreover, the tracking pathway aims to raise awareness about unhealthy eating patterns.

THE PROCESS

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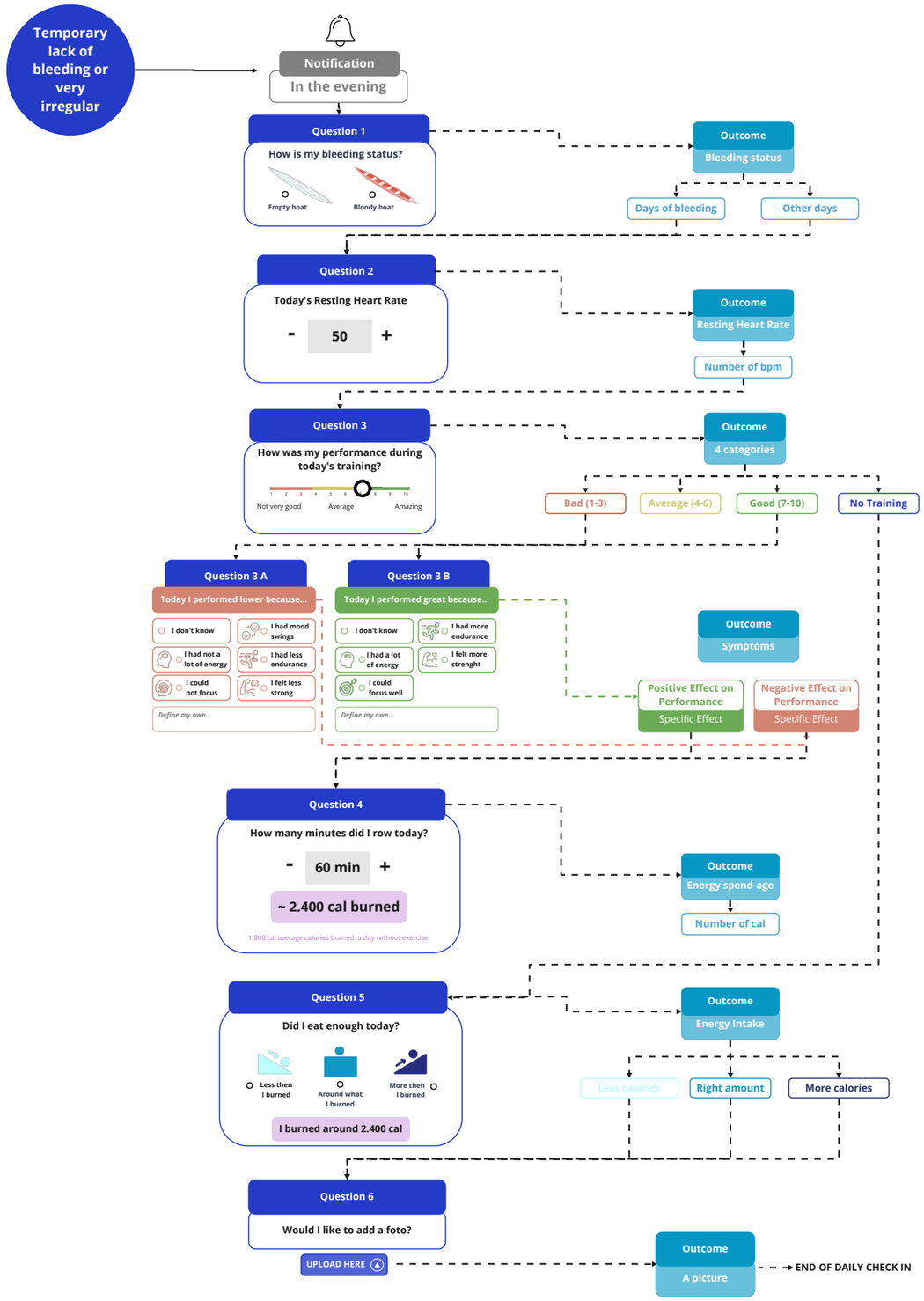


7.2 USER SCENARIO ONBOARDING PROCESS

The concept begins with the tracking processwithin a dedicated app. Since rowers typically carry their phones at all times, this provides a convenient means for seamless daily tracking. First-time users will be led through an onboarding process that guides them to select their personalized tracking path.

THE STEPS

1. Upon opening the app, the user is presented with a succinct one-line introduction that clarifies the app's purpose.

2. The user creates an account to ensure that the data remains accessible solely to individuals who possess the password.

3. The user then navigates through brief introductory videos outlining the five available tracking paths. These paths are explained by a gynecologist, a sports psychologist, and a professional coach, who elaborate on their relevance and the benefits they offer.

4. Having gained an understanding of the available paths, the user is required to select a specific path to follow.

The last part of the onboarding is to indicate the use of contraception methods. This step is important as it impacts the subsequent formulation and customization.

7.2 USER SCENARIO CHECK-IN MOMENT

Based on the chosen goal, the rower will receive a reminder for their check-in either in the morning or evening. Users also have the flexibility to customize the reminder time according to their preference.

THE STEPS

1. Every tracking path starts with the question of the "current bleeding status" asking whether a rower is currently menstruating. Also, the resting heart rate is checked, which is the most important metric for the current logbook.

2. In this path the rower uses a slider to indicate their daily energy level and their motivation to train. The decision to use a slider is based on feedback from rowers, as the current metric of 1-10 can be challenging to accurately assess at times.

3. The aim is not only to raise awareness about the rower's mood but also to empower them to take action. To facilitate this, a question is included, prompting the rower to reflect on how they can respond proactively.

4. Lastly, in each tracking path, there is a concluding question that prompts the rower to upload an image as a way to capture and remember the day.

7.2 USER SCENARIO DATA DASHBOARD

One of the issues identified in the research during the logbook analysis sessions is that the current method of data tracking solely involves collecting information in the logbook without providing a means for rowers to extract meaningful insights from it. To address this, the tracking app has been designed to emphasize the presentation of correlations and data through visual means, ensuring user-friendly comprehension. In alignment with the rowers' preferences, the app not only displays desired information but also highlights the frequency of occurrences.

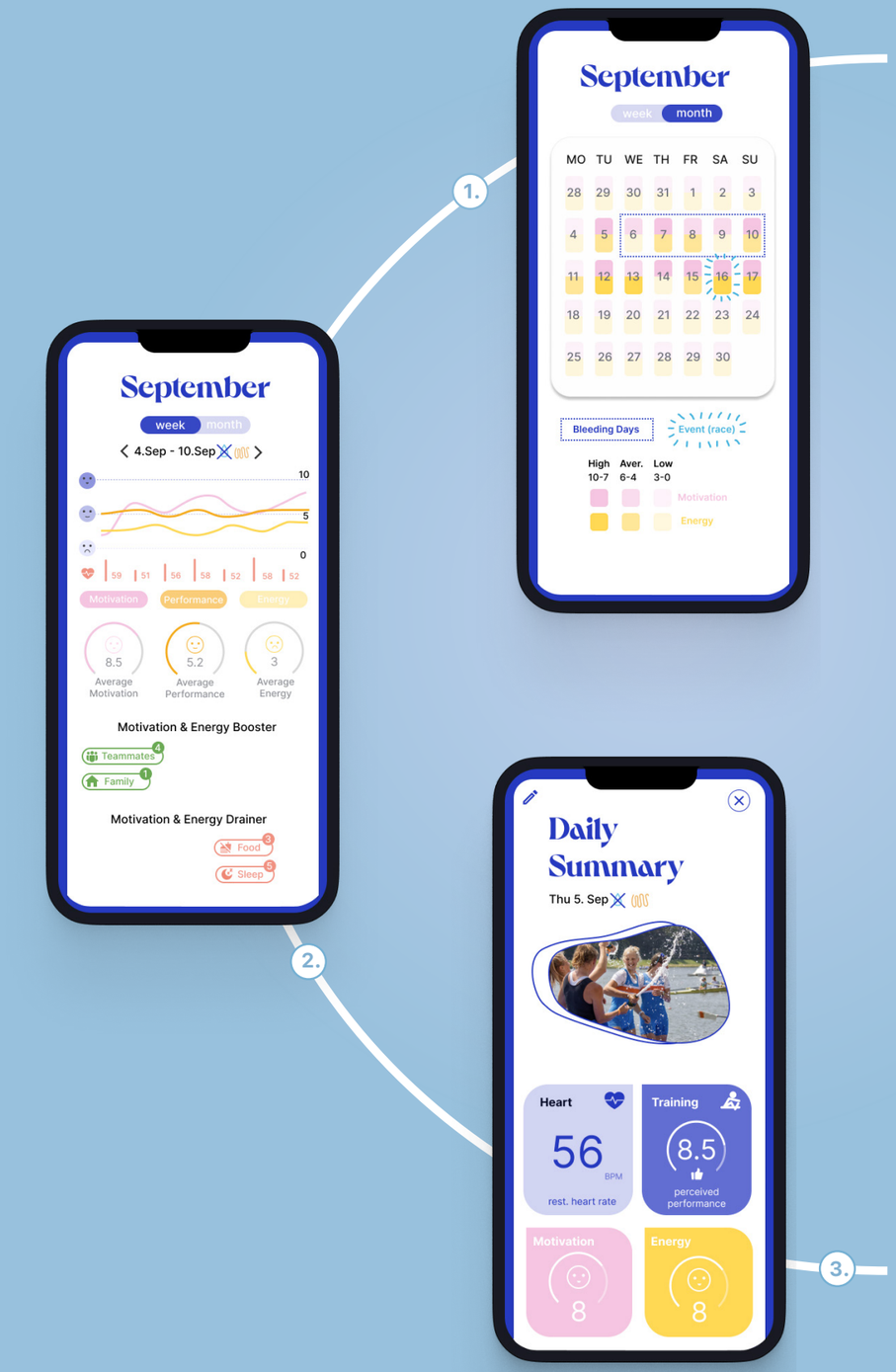
THE STEPS

1. The monthly overview offers the user a comprehensive summary of the two primary metrics of their selected track. In this scenario, it showcases the levels of motivation and energy as either low, medium, or high. Additionally, it highlights the days of menstruation and significant events like races.

2. The week overview lets the user take a closer look at changes over a week. It shows both how things vary day by day and provides an average for important measures. To give rowers the agency to formulate strategies during reflection moments, both positive and negative triggers are visually represented. In this case: Things that Drain Energy & Things that Boost Energy.

3. The daily overview visualised the results of each check-in moment. Placing the memory picture alongside the visualized data enables rowers to revisit each day, helping them remember the context of the data.

DATA EXPLORATION · MONTH OVERVIEW · WEEK OVERVIEW · DAY OVERVIEW · TRIGGER TO REFLECT



7.2 USER SCENARIO
INDIVIDUAL REFLECTION MOMENT

The rower not only receives the app but also has a physical booklet that guides the reflection moments throughout the whole tracking process/ rowing season. The reflection moment happens in the physical domain giving the rowers the agency to interpret and make sense of their own bodies and the data, empowering them to stay the owners of their experiences. This aims to limit the effect criticist by HCI researchers,that technologies interpreting personal experience potentially lead to disconnection of the body (see Chapter 5).

The goal of these individual reflection moments is to empower the rower to first comprehend and interpret the insights from the app for themselves before they are ready to share them with others.

NEW MENSTRUAL CYCLE STARTS

APP NOTIFICATION TO REFLECT — 1.

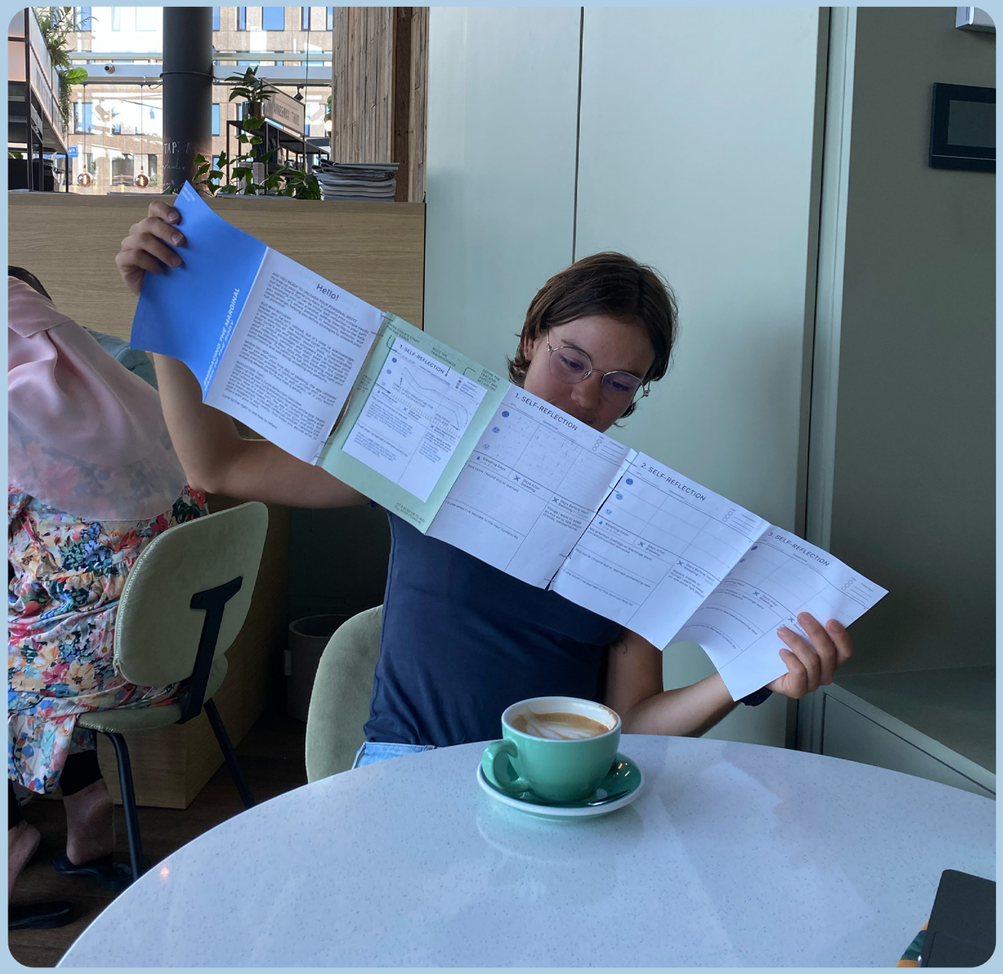
PAST CYCLE DATA VISUALISED ON THE APP — 2.

TRANSFERING DATA INTO THE BOOKLET — 3.

DEFINE INTER-VENTIONS TO APPLY LEARNINGS — 4.

COACH CONVERSATION CHECK LIST — 5.

COACH MEETING



INDIVIDUAL REFLECTION MOMENT

THE STEPS

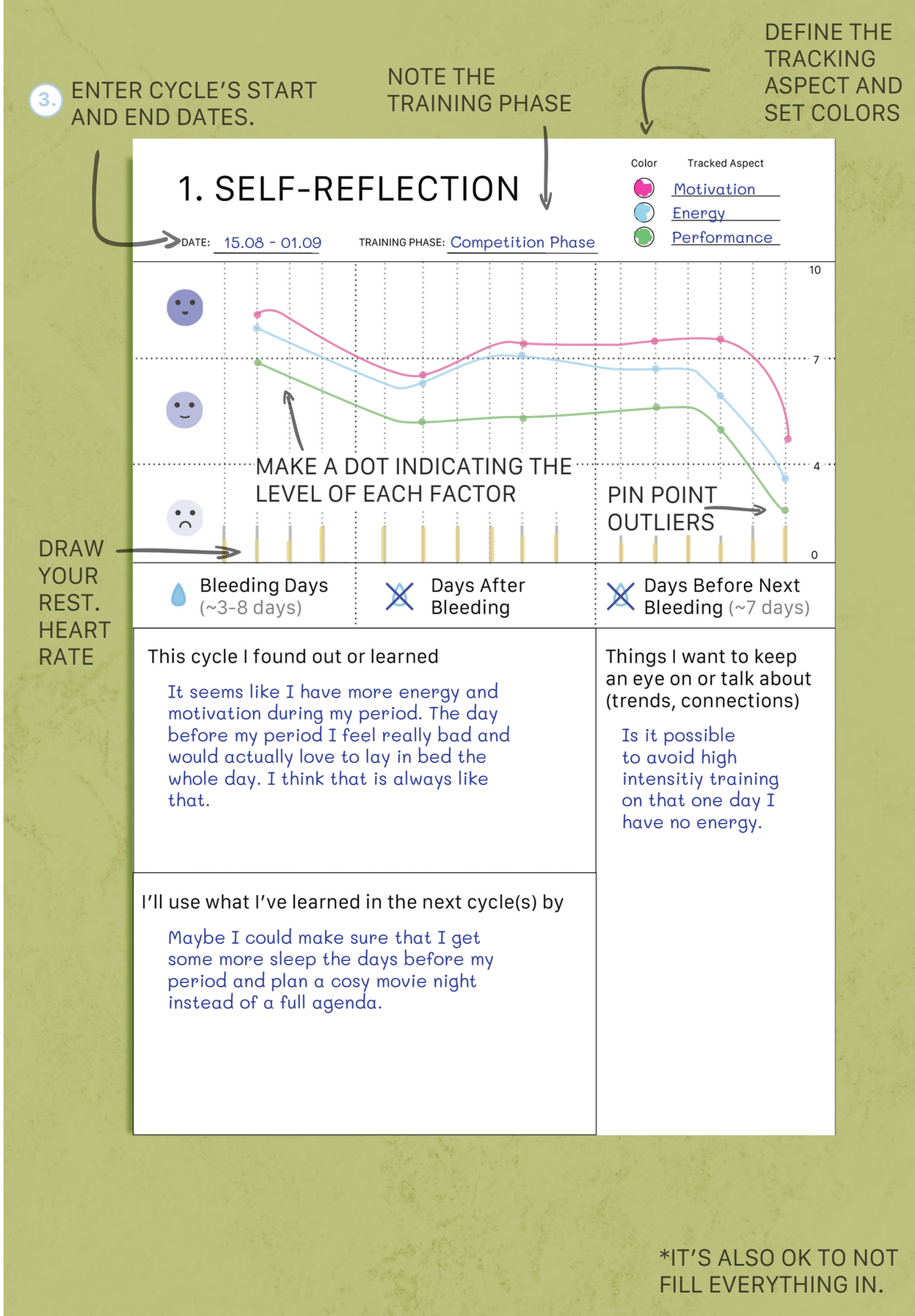
1. The reflection moment is happening, when a rower enters her next bleeding day or after every 5 weeks, if a rower is not entering bleeding days. The athlete receives a notification from the app reminding her to take a moment and reflect on her last cycle.

2. The app visually presents the collected and analyzed data, but the actual reflection occurs in the physical domain. Rowers translate their data into the reflection booklets and have to actively interpret its meaning. This approach respects aspect rowers raised, that the logbook data should not be interpreted by the coaches without the affected rower, as the data can be misleading when not taking the context into mind. Therefore and also to protect the rower's privacy the information on the app isn't shared directly with coaches. Only the information from the booklet that the rowers select themselves will be shared and discussed during the following coach reflection moments.

3. The rower enters the relevant data from one cycle into the reflection booklet. The booklet has multiple pages, covering the whole season. Each page reflects on one menstrual cycle. Three relevant factors are being put in correlation with the phase of the cycle. The person needs to place a dot in the high-medium-low level for the factors in the different phases. So for example the rower follows the track energy & motivation. Then she will be asked to set a dot for the bleeding days, days after bleeding and the days before in interpreting general motivation as high, medium or low. These dots will then be connected by a line. The different reflections will be collected by the line and show the overview of the whole season. (See Figure on the right)

4. Following this interaction with the data, the rower has the possibility to capture learnings and assumptions from their tracking. They can also define strategies, plan how to apply their learnings and consider aspects, trends, or correlations they want to observe or discuss with the coach.

5. The backside of the booklet provides the information for the following coach meetings. This is where the rower can pick the topics they want to talk about with their coach or note down their own thoughts after each individual reflection so they don't forget about them. (See Figure 18)



Hello!

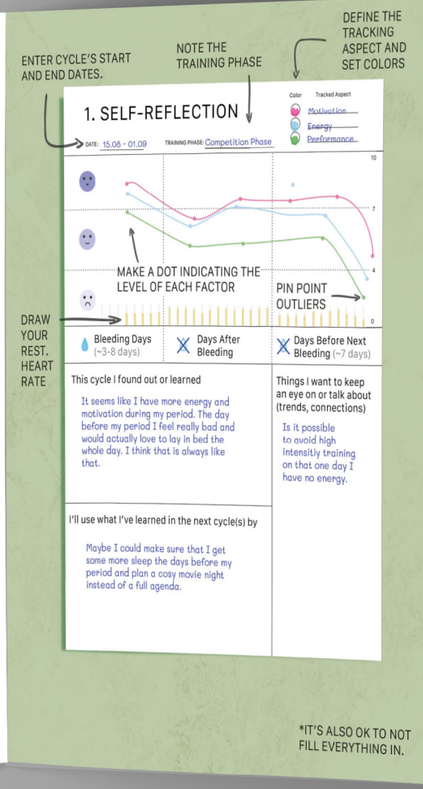
ARE YOU READY TO UNLEASH YOUR PERSONAL BEST?
To step up your game you have to pinn down what you need but let's face it that can be tricky. Self-reflection is your path to becoming your own scientist, adding meaning to the data you collect. It's where patterns in emotions, behavior, and needs emerge, helping you define strategies to unleash your full potential.

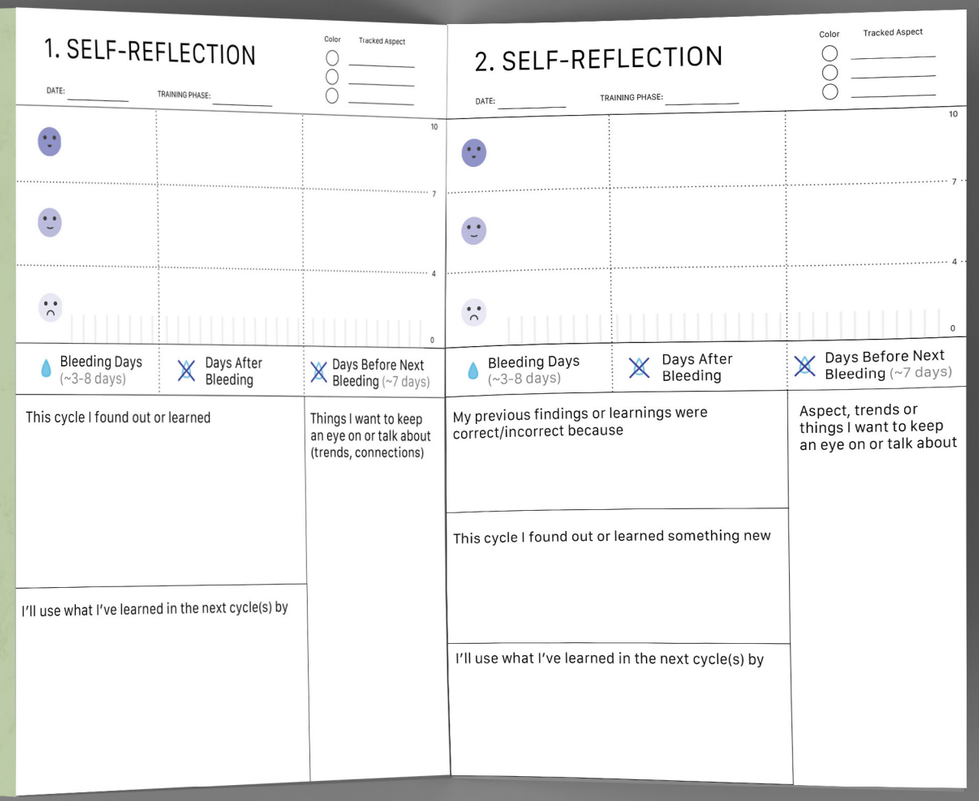
BUT WHY BOTHER?
Maybe you haven't noticed, but it's time to acknowledge: hormonal shifts in the menstrual cycle affect females. Yet, a one-size-fits-all approach doesn't work. Understanding your cycle's ebbs and flows empowers you to harness your body's unique advantages and reach peak performance. In your reflections, combine your daily data with the cycle's phases (bleeding days, days after last bleeding, days before next bleeding). This paints the full picture of what fuels your performance and well-being, unveiling any patterns.

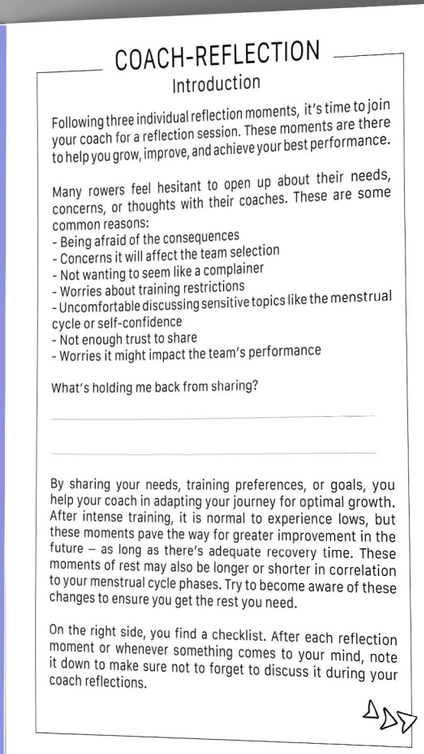
WHEN DO I REFLECT?
When you enter your first day of bleeding, the app initiates the reflection process. A notification arrives with your past cycle overview pushing you to self-reflect. Or if you aren't entering bleedings for more then 5 weeks.

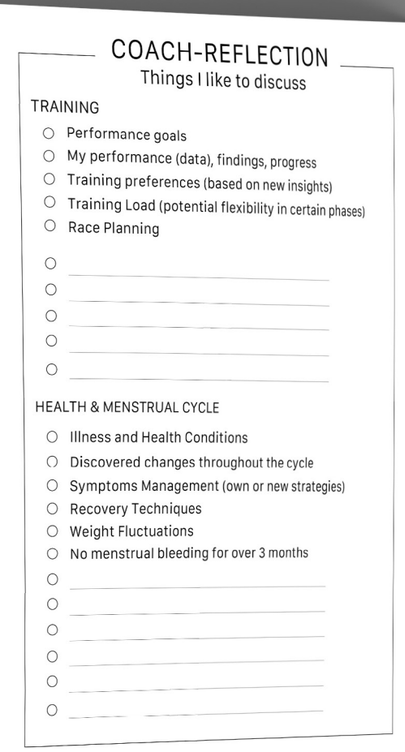
REFLECTION TIME:
Open up the app's Cycle Reflection Overview.
Take a look at your Cycle Reflection Overview on the app. Peaks and valleys of various factors light up, revealing triggers and trends. Now it's your turn. The app crunches numbers, but you're the sense-maker. After all, it's your story and only you give them context. In the self-reflection booklet, translate the app's insights to your reality. This helps you decide what to share with your coach.

Look to the right to see how to reflect.









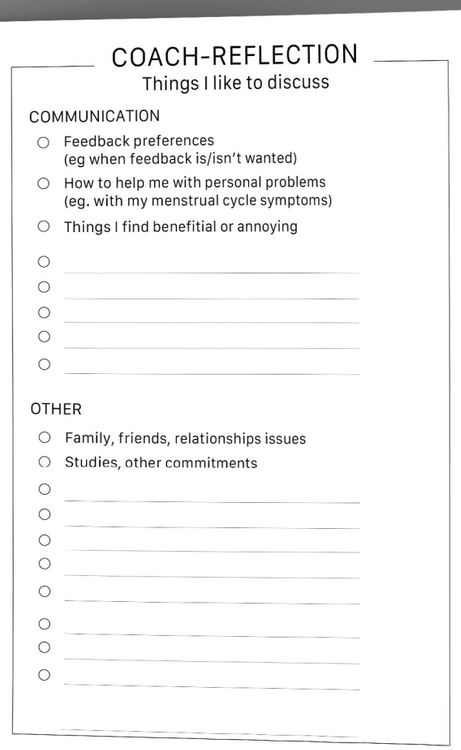


Figure 18: The Individual Reflection Booklet

7.2 USER SCENARIO
COACH REFLECTION MOMENT

Following the completion of three menstrual cycles, which translates to three individual reflection moments, the coach reflection takes place. As these moments are not yet formally scheduled the three-cycle timeframe provides a more distinct overview and insights into potential patterns within the data. The aim behind the collective reflection moment was inspired by the work of Homewood et al. (refer to chapter 5). The designers highlighted that often multiple people are involved in achieving the goals behind the data collection but the exploration of the data most often focuses solely on the individuals. Therefore the coach reflection moment is about facilitating collaborative exploration of the data, fostering open discussions and allowing coaches to tailor training to the rowers' specific needs.

The coaches receive their own reflection booklet (see Figure 17) containing a brief introduction text to the purpose and the process of the reflection moments. The interviews revealed that some rowers are afraid to share if things are not going well, because they fear consequences the text therefore encourages the coach to set an environment for the reflection moments that allows the rowers to speak openly by feeling encouraged rather than anxious to share. The sports psychologist also pointed out that coaches should help rowers notice when they might be pushing themselves too hard and show them the benefits of taking proper rest. So, the content also gives coaches a nudge to support rowers during times when their energy might be a bit lower, explaining how these moments can actually contribute to their growth.

COMPLETION OF 3 MENSTRUAL CYCLES

APP ENCOURAGES TO DISCUSS WITH COACHES

1.

BOOKLET PROVIDES OVERVIEW & TOPICS TO COVER

2.

DEFINE STRATEGIES TOGETHER

3.

APPLY LEARNING TO TRACKING AND TRAINING

4.

ITERATE EACH COACH MEETING

THE STEPS

1. **After three individual reflection moments, the app encourages the rower to engage in a reflection meeting with the coaches.**

2. **These reflection moments are facilitated through a booklet, ensuring the privacy of the rower's data from the app. Additionally, the rower is prompted to complete personal reflections, enabling them to bring their insights and formulated strategies to the coach's reflection session.**

3. **During this meeting, the rower and coach collaboratively explore their findings and work together to establish goals and strategies for the upcoming three cycles.**

4. **The coach reflection moments foster an iterative process, enabling both rowers and coaches to fully leverage the feedback loop and enhance the learning process**

Figure 19: The Coach Booklet

EVALUATION OF THE DESIGN: FOUR EXPERT/USER TEST

To evaluate the design, interviews were conducted with the key stakeholders who participated in the research process. The participants interacted with the mockups of the designed app and the content of the reflection moments. The interview questions were developed based on the established design criteria outlined in Chapter 6.2. Each set of questions was tailored to align with the specific expertise of the respective experts. The primary goal of these questions was to assess whether the design:

1. **Addresses the personalized and individual needs of rowers.**
2. **Demonstrates comprehensibility throughout the process, in individual activities, and in the visualization of data.**
3. **Aligns with the context of rowing organizations and motivates users to take proactive steps.**
4. **Fosters encouragement by having a clear goal and being rooted in current user behavior.**

Overall, the evaluation resulted in meeting the design criteria, and the experts clearly recognized the value of the concept, expressing enthusiasm for its potential implementation.

The following page presents a breakdown of the feedback received from each stakeholder and the corresponding implementations:

PEOPLE INVOLVED IN THIS SECTION

EVALUATION OF THE DESIGN

Rower Feedback

Perceived Value of the Design
The rower found the concept not only makes the tracking more enjoyable but also deepens her self-understanding.

The personalized tracking paths were particularly appreciated, and a desire was voiced to combine and pursue multiple tracking paths. Consequently, the design should enable seamless switching between goals or combinations.

Refinements
The personalized tracking paths were particularly appreciated, and a desire was voiced for the ability to combine and pursue multiple tracking paths. Consequently, the design should enable seamless switching between goals or combinations.

A good suggestion brought up by the rower was that the checklist for coach discussions could be enhanced in the future with recommendations provided by experienced rowers and coaches.

Sports Psychologist Feedback

Perceived Value of the Design
The sports psychologist empathised a lot with the fact that many rowers fear or don't have enough trust to share. This concept can help rowers in building that trust and in seeing the value of sharing, even if it results in necessary adjustments like increased rest.

Refinements
The psychologist added remarks to the wording of the reflection moments. The previous versions included statements like: "Assumptions based on the data" or "Strategies to implement the learning". Based on the feedback more everyday language was used making it easier to understand and provides clear directions to users.

Furthermore, her recommendations led to the incorporation of a question in the energy and motivation track, empowering rowers to take action based on their needs. Hence the design not only creates for example awareness of the fact that they have low energy but encourages them to make adjustments based on that.

Within the reflection moments, the psychologist proposed showcasing common barriers to sharing from other rowers. The aim is to encourage users to reflect on their their own barriers, while also underscoring the advantages of communicating needs with coaches.

EVALUATION OF THE DESIGN

Coach Feedback

Perceived Value of the Design
The coach found the concept most valuable for its ability to guide and improve communication between rowers and coaches. This was particularly important, as many coaches lack experience, especially when discussing female health.

Refinements
The evaluation session with the prof coach had a strong focus on the reflection moments. The coach provided valuable feedback to the content, by helping to reframe the text and wording to be relatable to both coaches and rowers.

The coach also pointed out that by adjusting the wording, the concept could benefit male rowers too, improving communication and performance for them as well.

Gynaecologist Feedback

Perceived Value of the Design
The gynaecologist valued the designs emphasis on shedding light on rowers who experience irregular menstrual bleeding or severe pain. Tracking these aspects can help raise awareness among rowers, and coaches can provide help to detect overlooked issues like RED-S.

Refinements
The gynaecologist provided valuable input to improve the questionnaire. This resulted in the addition of a question about contraceptive use during onboarding.

Additionally, the wording was adjusted from "days of the period" to "bleeding days," considering that women using hormonal pills experience withdrawal bleeding rather than a typical menstrual cycle.

RECOMMANDATIONS FOR FURTHER DEVELOPMENT OF THE DESIGN

Considering both the evaluation and personal reflection, I identified four areas that require further iteration or investigation. Given the shared belief among experts and myself in the design's potential, it is recommended to take the following aspects into account for further development.

09

IN-DEPTH USER TEST

Considering the project's time constraints and the limited prior work in this specific context, the evaluation could only be done on the mock-ups of the design. Therefore a user test spanning three self-reflection cycles is recommended. In that way, the overall concept and the five tracks could be tested with multiple rowers and coaches. Additionally, it would be interesting to explore how long a rower prefers to engage with a particular track and how the transition between different tracks could be facilitated effectively.

FOCUS ON INCLUSIVITY AND DIVERSITY

Considering the design's origin within university rowing organizations and its collaborative creation involving well-educated Dutch females, it's crucial to evaluating and refining it through an inclusive lens. This ensures alignment with the needs of a broader spectrum of women, including also those who may not identify as women. For instance, testing and iterating with individuals from diverse backgrounds including women of color, varying cultural heritages, different sexual orientations, and those with disabilities, would exemplify this commitment.

EXPLORE TECHNOLOGICAL POSSIBILITIES

To enhance the user-friendliness of the tracking process, it's worth exploring the potential to seamlessly integrate passively gathered data from devices such as the Garmin smartwatch. These integrations would streamline daily reflection, enabling users to concentrate solely on responding to subjective questions. (For a comprehensive overview of various passive and active tracking methods, refer to chapter 5)

CONSIDER NEW METRICS AND CORRELATIONS

During the feedback session with the sports psychologist,the heart rate variability (HRV) metric was brought up as a noteworthy aspect. This metric, she clarified, offers valuable insights into an athlete's stress levels. As rowers and coaches are not yet familiar with the HRV-metrics I to decided to decrease the complexity of the design and not incorporated it for now. Nonetheless, it could be worthwhile to explore the incorporation of additional metrics. Focussing on how to put passively acquired factors with actively entered data in correlation.

CONCLUSION OF THE PROJECT

The project goal was to redesign the current interaction of rowers with their menstrual cycle to increase their performance and well-being. This resulted in a new tracking process including an application allowing the rower to track a personalised path as well as individual and coach reflection moments. The concept replaces the current logbook used by rowing organisations to keep track of the rower's performance. Its current logbook format, an Excel sheet, is lacking purpose, sense-making and reflection.

The research phase revealed that every rower is different and has unique experiences with their bodies. Nevertheless according to the survey results with over 200 rowers the majority of them experience frequently menstrual cycle symptoms impacting their performance. According to literature and medical experts, the reason behind this is the fluctuation of hormone levels that trigger emotions and symptoms. In order to align with the principles of the data feminist approach, the survey results and the expert interviews were coined in a booklet. This document was shared with participating rowing organizations and experts, raising awareness and letting them reflect on bias in recognizing menstrual cycle impacts on training and well-being.

Through in-depth research and analysis of the current logbook data from four rowers, five relevant tracking paths could be defined. These paths contain elements that vary across the menstrual cycle, influencing both the performance and overall well-being of the rowers. Encouraging rowers to self-reflect on these factors and apply their learnings to develop interventions can significantly contribute to achieving their optimal performance. The identified paths are as follows: Motivation & Energy Levels, Pain & Cycle Effects, Sleep & Recovery, Weight Fluctuation, Eating Behavior, and Irregular & Missing Bleeding.

The collaborative creation of the final design took place during a workshop conducted with the participation of three rowers, whose logbooks had been previously analyzed. Choosing the format of an app stemmed from the rowers' preference for a user-friendly tracking process, where they could effortlessly respond to daily questions instead of inputting information into a table. Conversations with them also highlighted the necessity for a more insightful data visualization that would reveal correlations among various factors while offering a comprehensive overview. Consequently, each tracking path incorporates the option to attach a photo, enhancing the recollection of each day, and allowing for a complete visualization that combines the data with a personal memory.

Moreover, an increased emphasis on personal reflection following each menstrual cycle addresses concerns voiced by HCI designers. This points out digital tracking potentially creating a detachment between data and embodied experiences. By translating the app's data into a physical booklet, rowers gain the authority to interpret information taking the context of their own experiences into account. This approach not only enables them to record relevant data but also enables them to choose which data is appropriate to share with their coaches. This is how rowers can reach their full potential by embracing the gain the menstrual cycle can offer.

CONTENT

10.1 TACKLING THE KNOWLEDGE GAP OF MISSING DATA

At its core, this project makes a notable contribution to the exploration of a largely overlooked subject through the lens of design. It highlights the perspectives of female athletes, specifically of rowers and their dynamic interaction with their menstrual cycle. Researching this topic from the design perspective benefits from easily understandable visualisations of the complex aspects and experiences, making them graspable for stakeholders involved. As well as facilitation activities for the stakeholders to actively engage and reflect on the domain.
What makes design stand out from other fields is its emphasis on providing solutions. The final concept applied the research findings to create a design that demonstrates how we can include the menstrual cycle in training and communication. Therefore, this graduation project doesn't just point out a problem, it deeply engages with the situation, to motivate people to initiate change and develop a solution. By illustrating how a more personalised tracking approach can improve things, not just for the menstrual cycle but for tracking overall, it encourages readers to take action.

10.2 REFLECTION THROUGH DESIGN

Contributions to the HCI-Community

The main contribution of this project that could be applied to other self-tracking domains is the focus on reflection throughout the process.

Current menstrual tracking apps tend to generalise the experiences of users, indicating the user their current phase of their cycle and the expected symptoms. This approach of explaining data diminishes the person's ownership of their experiences. In contrast, the designs reflection moments encourage the user to take the time to reflect on the data, define learnings and actively create strategies based on them. This emphasis on reflection was also highlighted by the sports psychologist during an interview. She pointed out that after raising awareness, such as regarding symptom patterns, it is important to empower individuals with the autonomy to act on this newfound knowledge.

The process of transferring data from the app to the booklet has the benefit of choosing the relevant data that users want to investigate and understand. Additionally, it creates a tangible overview of changes across cycles, potentially spanning an entire season. This approach also prompts individuals to reflect on what information they want and what is relevant to share with their coaches. Given the novelty of this domain and its sensitive nature, taking a moment to reflect on the type of information one is comfortable sharing aids in maintaining privacy. This is relevant as current solutions in this field, such as the app FitrWomen, directly share the data with coaches, providing them with an overview of athletes' cycles and symptoms. Placing personal information directly in the hands of a person in power could potentially lead to discrimination against women who have menstrual issues or who are not willing to share their data with their coaches. Hence, when designing solutions in this sensitive domain it is essential to enable the athletes to actively reflect on the meaning of their data and provide them with the authority to choose which data they would like to share.
The interviewed prof-coach also emphasised that this moment, where an athlete engages with their own data, provides a great opportunity to inform them that they're not alone in experiencing symptoms and feeling hesitant to open up. This can be achieved by revealing the challenges faced by others.

Throughout the activities up until the final outcome my design process not only involved visualisation or engaging activities to help the stakeholders involved to interact and explore the research domain. Encouraging participants to actively reflect, addressed a concern that became evident in the beginning: many struggle to form opinions due to limited discussion, and the idea of exploring the menstrual cycle for better performance was never in their minds. Previous research also shows that individuals often don't even know how to start interpreting their data. The guided reflection process also helps to lower this threshold. Examples of this were the 1. reflection questions that were added to each chapter of the booklet, 2. the data analysis sessions with the rowers stimulating them to reflect on their logbook data, 3. the reflection parts in the final design that encourage individual but also collective sense-making. The significance of reflection in this context, for me and likely for many designers, stems from a desire to not only raise awareness on a topic but also to translate that awareness into action. The importance of reflection is noticeable within the designer community and is evident in methodologies like research through design, where knowledge is generated by constantly reflecting on the implications of the design. The novel approach that this project took and that contributes to the design community in general but also especially in the complex domain of working with data done by the HCI community is "Designing for Reflection". The approach is inspired by 'generative tools' used in context mapping and user research (Sanders et. al 2020). As well as the speculative design approaches (DUNNE, A., 2013) used by the HCI community to help individuals grasp their values and actively contribute to discussions about new technologies. These methods were applied in the user research to let participants reflect on their current beliefs, e.g. by the activity of exploring a world in sport where women would be the dominant gender.
However, it continues using the approach of reflection within the design outcomes. This is done in the booklet with reflection questions after each chapter but also by designing the process of the two reflection moments of the design. In comparison to projects undertaken by other HCI designers such as Ovum or the Ambient Light (Homewood et al., 2019), which influenced and guided my design, these projects motivated me to facilitate collaborative data analysis and emphasize the various phases of the menstrual cycle beyond the bleeding days. However, they don't actively encourage individuals to translate their newly acquired insights into actionable steps. My project shows that designers can contribute beyond only awereness creation but also encourage individuals to take action.

10.2 REFLECTION THROUGH DESIGN
Recommendations for other HCI designers

Empower Choice in Data Sharing

Leverage reflection as a tool to give individuals the agency to understand the meaning of their data and in deciding whom to share it with. This can be done by visualising correlations and emphasising how others use their data or the factors holding them back from sharing.

Bridge the Digital and Physical Domains

The process of translating data into a physical booklet or activity can help individuals to take a step back and mindfully interpret their experiences. Designers can approach this, by offering people the autonomy to make the data their own. Designing activities that encourage individuals to place the data into their own context, by connecting it for example with other elements like photos, memories, or people.

Beyond Awareness to Action

Adopting a data-feminist approach led me to uncover biases, such as the influence of the menstrual cycle on athletes' performance. Yet, this exploration needs to go beyond raising awareness. A key value of the reflection moments is to design the process in an empowering manner assisting individuals to progress from awareness to tangible action. This could involve framing interventions that provoke the application of insights or designing activities that require their

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THANK YOU

If you have any questions or remarks please
don’t hesitate to contact me: