UNIVERSITY OF TURKU

# Gamification and Its Impact on Motivation and Pressure in Running Applications

Computer Science
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Master's thesis

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25.4.2025
Turku

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**Subject**: Computer Science
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**Title**: Gamification and Its Impact on Motivation and Pressure in Running Applications
**Supervisor**: Dr. Jouni Smed
**Number of pages**: 58 pages
**Date**: 25.4.2025

With the growing prevalence of exercise technology and gamified exercise applications, concerns have emerged about how gamification elements, which are designed to motivate users, may also contribute to stress and pressure if not carefully balanced. Gamification is increasingly being implemented across various settings as a powerful tool to engage and motivate individuals. For some users, the competitive aspect of gamification can shift the focus from intrinsic enjoyment to a constant desire for validation, which may ultimately decrease motivation. Therefore, it is important to redirect focus from pressure inducing elements to elements that create or enhance feelings of social inclusivity, competence, and enjoyment.

The purpose of this thesis is to analyse gamification elements and study which elements cause users' pressure in running applications. Strava serves as the central case study for this research, due to its large user base and its advanced gamification elements. This research employed mixed methods, including a survey and user interviews, to gather data on users' experiences with gamification in Strava. In addition to this analysis, the thesis explores the development of a mock-up featuring design features aimed at reducing pressure and promoting positive user experiences. By emphasising social inclusivity, competence, and enjoyment, this research seeks to provide alternative design strategies that could alleviate the negative effects of gamification, offering insights into improving user engagement and satisfaction in running applications. The findings indicate that while some users felt pressure from competitive elements, many found them motivating or enjoyable, with a greater emphasis on personal progress.

**Key words**: motivation, gamification, running applications, Strava.

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# 1 Introduction

This chapter explains the purpose and objectives of the study, which investigates how gamification elements in running applications, particularly Strava, influence user motivation and psychological pressure. Secondly, this chapter introduces the primary research questions that guide the study, providing a concise overview of the research focus. Lastly, it offers a brief summary of the research process, setting the stage for the methodological approach discussed in following chapters.

## 1.1 Motivation and research goals

The aim of this study is to explore which gamification elements contribute positively and which negatively to the user experience within running applications, with a particular focus on maintaining motivation while minimising psychological pressure. When thoughtfully implemented, gamification has the potential to enhance user engagement by introducing features such as rewards, leaderboards, badges, and social sharing. However, certain elements may also lead to unintended consequences, such as increased stress, performance anxiety, or obsessive behaviours toward exercise.

This study examines gamification features in the context of user experiences with the Strava running application — a platform widely recognised for its competitive and community-oriented functionalities. Gamification elements are evaluated based on users' experiences with the Strava running application, specifically analysing the impact of its gamification features. By analysing how specific gamification features influence motivation and perceived pressure, this study identifies both beneficial and potentially harmful design patterns. Special attention is given to aspects such as public workout visibility, social comparison, and performance tracking, as these have been shown to significantly affect user psychology.

Based on these findings, a conceptual mock-up of an improved running application features is developed. This mock-up incorporates features that users find motivating and supportive — such as goal setting, positive reinforcement, and optional social interaction — by allowing users to minimise or customise features that may contribute to negative experiences. Features associated with pressure are either removed or designed to be optional. Ultimately, this study aims to propose a balanced approach to gamification: one that promotes sustained

engagement and healthy exercise behaviour without creating undue pressure or competitiveness.

Research questions addressed in this study are:
Q1. Do users who are primarily self-motivated experience less pressure than users motivated by social comparison?

Q2. Is there a positive correlation between motivation and pressure in users who compare their results to others?

Q3. How does publicly sharing running activity on applications impact users' motivation and perceived pressure?

These research questions are used to help guide the design of mock-up elements by offering the possibility to limit features that could have negative effects on users. In addition, elements that could boost users' motivation or help them alleviate pressure are designed based on the answers to these questions.

## 1.2 Structure of the thesis

This thesis consists of several parts. First a theoretical foundation is established, mainly in Chapter 2: Background, which provides both theoretical and contextual information relevant to the research. This chapter introduces key concepts, terms, and technologies including self-determination theory, gamification, tracking exercise, Strava and future trends in the field. Following this, the research design and methods used to answer research questions and gather data are presented in Chapter 3: Research methodology. The findings of the survey and interviews are presented in Chapter 4: Results. These results also inform the design rationale behind the features of the mock-up. Chapter 5: Mock-up development explains the design goals and presents the visual design concept of the mock-up's features. Chapter 6: Discussion highlights key findings of the study and acknowledges its limitations. Chapter 7: Conclusions summarises the main contributions and implications of the study and offers suggestions for future research. A full list of references follows these chapters, and the appendices are included at the end of the thesis.

# 2 Background

This chapter provides a concise overview of self-determination theory, including intrinsic and extrinsic motivation. The concepts of intrinsic and extrinsic motivation are highly relevant to gamification research as they explain how and why people engage with gamified systems. It then introduces the concept of gamification, followed by a detailed explanation of common gamification elements and their classifications. The chapter continues by exploring how exercise is tracked digitally, to help in understanding how gamification can be applied to exercise. It then examines the gamification of exercise more specifically, focusing on the design of running applications. Strava is used as a central case study, with an emphasis on its social and gamified features, as well as the perceived psychosocial impacts of its use. Finally, the chapter concludes with a discussion of future trends in gamification and tracking exercise.

## 2.1 Self-determination theory

The terms self-determination theory, intrinsic and extrinsic motivation, often appear in gamification research. As Deci and Ryan (2000), explain self-determination theory emphasises that human motivation is driven by three fundamental psychological needs: competence, autonomy, and relatedness. When these needs are fulfilled, autonomous motivation is promoted, resulting in improved psychological outcomes and enhanced well-being.

According to Deci and Ryan (2000), intrinsic motivation refers to engaging in an activity for its inherent enjoyment or personal satisfaction. Intrinsic motivation is driven by curiosity, interest, or personal growth rather than external rewards. Extrinsic motivation refers to performing a task due to external pressures, rewards, or recognition, such as money, or social approval. Research across various contexts confirms that satisfying psychological needs enhances autonomous motivation, as Bitrián et al. (2020) state. Intrinsic motivation is the most effective and sustainable form of motivation, but extrinsic motivation can also become more self-determined if it aligns with personal values and interests (Deci & Ryan, 2000). In gaming, for instance, providing competence, autonomy, and social connection boosts intrinsic motivation, according to Bitrián et al. (2020). Alternatively, in exercise, fulfilling these three needs leads to better health outcomes. Studies on exercise games show that competition and

autonomy increase enjoyment, motivation, and engagement. Additionally, meeting these psychological needs is linked to higher exercise participation and well-being.

## 2.2 Gamification

Games have existed since the beginning of documented civilisation (Predescu & Mocanu, 2020). They serve as both entertainment and social activities, promoting communal engagement while creating excitement and immersion. People experience feelings of mastery, enjoyment, competence, immersion or flow through games (Koivisto & Hamari, 2019). All of these are emotions and characteristics of an intrinsically motivated person as Koivisto and Hamari (2019) note. As gaming continues to evolve, its appeal has expanded beyond traditional demographics, with women, for example, now being more equally represented in the gaming community (Seaborn & Fels, 2015).

Juul (2003) characterises games as a combination of these six elements: rules, variable and quantifiable outcomes, the value assigned to possible outcomes, player effort, the player's attachment to the outcome, and negotiable consequences. The value assigned to possible outcomes refers to the various potential results, some of which may be positive and others negative. The challenge of games is demonstrated in the need to invest effort by the player in order to influence the outcome. The player's attachment to the outcome is reflected in the emotions expressed by the player upon experiencing a positive or negative result. The player is likely to be happy if they achieve desirable results, for example, win the game, and unhappy if they do not achieve it, or in other words, lose. Negotiable consequences refer to the ability to play a game with or without real life consequences. Juul (2003) states that these points are not equivalent, instead, they differ in their relative significance. Rules, variable quantifiable outcomes and player effort characterise the features of the game as a structured system. Value assigned to the possible outcomes describes the goal that the player pursues. Player effort and player attached outcomes represent the relation between the system and the player. Lastly, negotiable consequences represent the relation between the game interactions and the rest of the world. These principles, derived from games, are integrated into systems through gamification to boost engagement by offering achievable goals and emotionally resonant outcomes, all while maintaining a balance between challenge and user well-being.

There is a notable growing trend where utilitarian and hedonic systems merge as Koivisto and Hamari (2019) mention. Over recent decades these two categories of technology have gradually intertwined and created a full convergence. Now entertainment-oriented technologies are increasingly used for productive purposes. This phenomenon, known as gamification, is defined by Seaborn and Fels (2015) as the incorporation of game elements into non-gaming interactive systems. Gamification is widely used in modern services and software to engage users by fulfilling intrinsic needs and enhancing enjoyment (Xi & Hamari, 2019). The aim is to motivate individuals to find more interest in performing actions and committing to them long term. Gamification can be widely applied to actions like exercise, reading, learning new languages and even grocery shopping. It is not a recent development having been widely used, for instance, in marketing ventures in the form of rewards in loyalty programmes (Seaborn & Fels, 2015). It has increased popularity as personal data tracking has become easier and technology has become more affordable. According to a meta-synthesis by Seaborn & Fels (2015) the top fields for gamification research are education (26%), health and wellness (13%), online communities and social networks (13%), crowdsourcing (13%) and sustainability (10%). Gamification can be even added through a software-as-a-service solution, but it's critical to remember that to keep engagement high, gamified systems need continuous development (Basten, 2017). For example, new challenges are required after previous ones have been completed, to get the positive effects of them. Removing game elements can result in declining user performance. Because of this, gamification is an always ongoing process that needs development.

Motivation for gamification varies, as research by Seaborn and Fels (2015) indicates. Gamification is widely used in modern services and software to engage users by fulfilling intrinsic needs and enhancing enjoyment. Encouraging end-user participation was the leading motivation for gamification (65%), changing behaviour was the second (32%). Only in 10% of the cases was gamification used to improve enjoyment. In another 10% it was used to capture and track data in a system. According to Tu et al. (2019) adding gamification elements to exercise applications generally aims to make working out more fun.

The effectiveness of gamification is mixed. As Seaborn and Fels (2015) point out, similar implementations on different domains do not necessarily lead to same impact on participants. Their study highlights how the outcomes of gamification can vary significantly across

contexts. Outcomes also often consist of both positive and negative or neutral effects. In one case, for example, user satisfaction was higher even though engagement in the case of a marketing questionnaire was unaffected (Guin et al., 2012). How the effects should be viewed also depends on the goals of implementing gamification. In the marketing questionnaire case, for instance, the results should be viewed differently depending on if the goal was to increase user engagement or user satisfaction. This is why it is important to set the objectives before implementing gamification.

### 2.2.1 Elements of gamification and their classification

Gamification elements include points, badges, competition, challenges and rewards (Seaborn & Fels, 2015). Points are defined as numerical units that indicate progress. Badges or trophies are visual icons that signify the players achievements. Rankings, leaderboards or scoreboards display the ranks of players for comparison. Progression, or alternatively levelling or levelling up refers to milestones that indicate progress. Titles, ranks, or statuses serve as textual markers of progress. Levels, stages or worlds are increasingly challenging environments the user participates in. Rewards, prizes or gifts are incentives that the player seeks. Roles, classes or characters mean the role-playing elements of a character. Seaborn and Fels (2015) stress the importance of defining these elements to avoid confusion.

Game elements can be categorised to three groups: achievement or progress related elements, social elements and immersion related elements according to Koivisto and Hamari (2019). Achievement-related game elements are the most prevalent. These include badges, points, leaderboards, progress bars, virtual currencies and varying degrees of difficulty. Bitrián et al. (2020) note that achievement-related game elements, offer subjects feedback on their performance, which increases the likelihood of subjects continuing to use the system. Badges and leaderboards offer positive reinforcement by focusing on achievements, and thus create a sense of competition. However, research on badges in educational contexts suggests that their impact on motivation, engagement, and performance is limited. A study found that badges had little influence on students' motivation, indicating that their effectiveness may depend on context and design (Kyewski & Krämer, 2018). Notably, those who saw only their own badges evaluated them more positively, suggesting that private recognition may be slightly more effective than public competition.

Despite some mixed findings, badges are generally considered to enhance competence, progress bars and difficulty levels support autonomy, and rankings support relatedness by enabling comparisons with others (Bitrián et al., 2020). Similarly, setting weekly challenges with increasing difficulty has been shown to enhance competence, autonomy, and relatedness in educational settings. Research also suggests that badges, leaderboards, and visual elements support autonomy by adding meaning to tasks and gameplay. Additionally, leaderboards displaying team-level scores strengthen team members' sense of connection. Some studies have noted that achievement-related game elements might only act as extrinsic motivational aspects, but most studies positively link the influence of these elements on basic psychological needs of competence, autonomy and relatedness. Xi and Hamari (2019) strongly associate achievement-related features with the satisfaction of all three needs, making them the most significant predictor of autonomy and competence satisfaction.

Social-based game elements include competitive challenges, team interactions, cooperation, and social networking features (Koivisto & Hamari, 2019). Research has shown that strong relationships among teammates enhance their motivation to perform at their best and competition with other teams has proven to promote a sense of inclusion, as Bitrián et al. (2020) suggest. Social-based elements support the fulfilment of basic psychological needs — competence, autonomy, and relatedness. Similarly, badges, leaderboards and progress bars have been linked to promoting user engagement. Group competitions, for one, promote all the previously mentioned needs. Team-based games increase social-relatedness. Cooperation, competition and social networking features have been shown to facilitate the satisfaction of all three psychological needs. According to Barratt (2017), especially elements such as being able to 'like' and comment on others' activities on exercise applications allow users to feel a greater sense of belonging to their exercise community. Social-related features generally positively influence autonomy, competence, and relatedness needs, with the greatest impact on fulfilling the relatedness need (Xi & Hamari, 2019).

Virtual worlds, virtual trade, avatars and profiles can be used to implement gamification (Seaborn & Fels, 2015). These are categorised as immersion-related game elements. Other immersion-related elements include narratives, stories and customisation elements according to Koivisto and Hamari (2019). Research findings on immersion-related features are mixed. The empirical results by Xi & Hamari (2019) indicate that immersion-related features are

positively linked only to the satisfaction of the autonomy need. Bitrián et al. (2020) suggest that immersion-related elements enhance competence and autonomy but do not impact relatedness. This is due to users focusing on individual goals rather than on community interaction. Their study also confirms that satisfying autonomy and relatedness positively affects users' autonomous motivation to engage with the app, while the need for competence does not significantly impact motivation. It should be noted that long-term use of a gamified application may decrease motivation due to the 'novelty effect', where the initial curiosity and excitement of gamification fades.

## 2.3 Tracking exercise

Engaging in regular physical activity has been positively correlated with mitigating life burnout as Whelan and Clohessy (2021) note. Beyond its other health benefits, physical exercise can provide individuals with the psychological space to process and manage life's challenges. Given the importance of regular physical activity for both mental and physical well-being, digital tools have become a common means of supporting and organising exercise habits. This growing reliance on technology reflects a broader trend toward self-monitoring and data-driven health management.

The use of smartwatches, activity trackers, and sleep monitoring systems has increased, alongside the growing adoption of quantified-self (QS) software. The QS movement emphasises systematic collection, processing, and presentation of data in relation to behavioural, environmental, and biological indicators to facilitate self-tracking and performance improvement. QS tools, including logs and performance graphs, support goal-setting and self-regulation, offering benefits at both individual and societal levels by promoting health and productivity. Research has demonstrated a correlation between QS practices and enhanced goal attainment, leading to their integration into various digital platforms. Quantified-self measurements have been associated with improved performance in achieving goals through both experimental and observational studies. Research has explored combining gamification, social networking, and quantified-self to support various aspects of goal-setting, such as user focus, orientation, and goal attributes. It is argued that for users focused on the activity itself, quantified-self features are essential, while gamification and

social networking are more effective for users concerned with outcomes or proving themselves. (Hamari et al., 2018)

Rapidly developing mobile technologies assist in designing applications to encourage physical activity and take use of the quantified-self movement. There is a variety of exercise-related applications, some of which aim to be more game-like, others are more social with gamification elements, while some are simply used to track movement and physical activity. These tracking applications often monitor movement and daily physical activity in form of step counts, calories burned, and distance travelled (Tu et al., 2019). Users receive notifications about their performance, offering real-time feedback on their progress from these applications. Research on exercise tracking applications has shown a positive association between their use and physical activity behaviour (Barratt, 2017).

Research by Karahanoğlu et al. (2021) indicates that runners are enthusiastic about gaining insights into their running behaviour through technology and the data it provides. Researchers have focused on analysing running data, particularly biomechanical metrics (e.g., joint angles) and physiological indicators (e.g., heart rate). These advancements transform running practices into quantifiable aspects that can be easily monitored. Technology, supported by available data, serves as a valuable and effective tool for enhancing performance, improving physical condition, boosting motivation, and reducing injury risk. It is essential to note that research indicates that regardless of a runner's experience level, they benefit from meaningful data, personalised feedback, and guidance that enable relevant insights into their performance and personal goals.

According to Karahanoğlu et al. (2021) self-driven goals positively influence the motivation of recreational runners by affecting the time, effort, and resources they dedicate to achieving them. Personal goals, such as improving a 5 km time, along with performance feedback, can help runners increase their weekly running distance. These goals may require personal adaptation based on progress, but the act of competing with oneself or achieving individual milestones can also serve as a significant motivator. For many runners, running is viewed as an enjoyable activity that enhances personal health and provides stress relief. Tracking running data allows individuals to observe their progress and reflect on the goals they have set. Exercise-tracking technology provides various metrics to aid this reflective process. Supporting transitions between goals is crucial for sustained engagement with self-tracking.

Studies highlight that despite a focus in research on the technical development of sports trackers, it is important to explore how these devices can better assist runners in achieving their goals.

Whelan and Clohessy (2021) note that exercise applications have clear positive effects, such as helping users initiate and sustain exercise routines. However, they also point out the adverse effects of some users possibly developing unhealthy and obsessive tendencies. The same features that can help people engage in applications like Strava can be linked to destructive perceptions of exercise and eventually cause burnout. Social features promote recognition and thus motivate people to track their exercise publicly, but this might also mean that people are drawn to post only positive workout data. Participants in Karahanoğlu et al.'s (2021) study had mixed approaches to interacting with their trackers during a run. Many avoided checking their devices frequently, as it could be distracting or lead to unwanted performance comparisons. Some runners only checked to confirm that tracking was working, while others ignored real-time feedback that they found unhelpful, such as warnings on high heart rate. For casual runs, tracking was used more for post-run insights rather than in-the-moment adjustments. All participants used their trackers to reflect on their running goals and adjust their actions accordingly. While performance-focused runs led to frequent tracker checks, unstructured runs allowed for more organic reflections, sometimes leading to unexpected insights about performance and progress. Some participants intentionally avoided checking data during a run to prevent demotivation, particularly when facing difficult conditions.

Notably, as some users of exercise applications feel motivated by competition and social comparison others may feel pressured to exercise or discouraged by perceived underperformance (Barratt, 2017). Whelan and Clohessy (2021) encourage users to be mindful of the digital affordances of fitness technology, as they may lead to dependency, overshadowing the initial passion for exercise. In their study they point out that in cases of obsessive behaviour towards exercise and fitness applications, simply refraining from the use of exercise related technology is not necessarily the best solution and might end up causing more stress to the user. Instead of a complete ban, limiting certain features of the application can be more effective. This solution also offers the benefits of those features that have positive effects on the user's mental and physical well-being while minimising negative

impact. When designing exercise applications, it is essential to promote balance and harmony. This can be implemented through game elements that focus on other health related achievements than exercise. Badges could be awarded for the user also when they restrain from exercise at the right moments. If the user is, for example, sick or injured, they should not exercise. It might be hard for the user to rest if they obsess over achievements like exercise streaks or daily fitness goals, which is why exercise applications should aim to actively promote recovery. Considering the need for rest, preventing injuries and detecting signs of obsessiveness can be turned into achievements that promote balance.

Studies highlight the dual role of fitness tracking technology — it can serve as a powerful tool for self-improvement and goal-setting, but it also has the potential to create unhealthy patterns of self-surveillance and pressure to perform (Barratt, 2017; Karahanoğlu et al., 2021; Whelan & Clohessy, 2021). The avoidance of real-time feedback suggests a complex relationship between motivation and self-monitoring, where runners seek the benefits of data analysis while minimising its potential to induce stress or self-doubt. These findings highlight the need for design considerations that support positive engagement with tracking technology while mitigating the risks of overreliance and negative psychological effects.

## 2.4 Gamification of exercise and designing running applications

The information systems discipline has traditionally focused on improving productivity and efficiency within organisations. However, this approach has not always considered users' motivations in system use. In the early 1990s, research expanded to explore how enjoyment and playfulness relate to technology use. More recently, literature has evolved to focus on how these hedonic aspects of technology can also support productivity and help users achieve their goals. This new wave of research, known as 'motivational design' or 'motivational information systems', explores gamification, social networking, and quantified-self technologies as tools to enhance user motivation and goal-setting. (Hamari et al., 2018)

Challenges are a core gamification technique that is used in exercise applications to enhance user retention (Whelan & Clohessy, 2021). Challenges can cater to different user abilities and preferences, increasing engagement and providing a sense of progression. Additionally, challenges often leverage social interaction, such as competing with friends or sharing

achievements, which further strengthens user commitment to the application and motivates them to return regularly.

The study by Hamari and Koivisto (2015) proves that people do increase their willingness to exercise based on social influence and positive recognition. These effects were tied to the size of the user's social circle. Having more friends use the service amplified the effects. Social features and competition have been proven to increase physical activity in comparison to exercising alone. Research suggests that this can be applied to gamification meaning that social aspects could have a significant impact on motivating users towards activities like exercise with gamification.

The study by Bitrián et al. (2020) offers several practical contributions that can aid in the design of gamified applications. Gamification seeks to integrate game elements into non-game contexts in a way that motivates individuals to engage in specific behaviours. Their study showed that to create a sense of autonomy, exercise applications should incorporate achievement-related and immersion-related game elements. These features provide users with decision-making freedom, enhancing motivation. Applications should allow users to track and save their results, offer varied training and challenge options, and reward progress with medals. To maintain engagement long-term, challenges should aim to gradually increase in difficulty. Additionally, immersive elements, such as customisable avatars and personalisation of the applications appearance, can further enhance user experience and motivation. The study by Xi and Hamari (2019) suggests that organisations should tailor their gamification features to meet the specific needs of their target audience.

A study by Hamari et al. (2018) revealed three key findings. Firstly, gamification features are more valued by users with easy, outcome-focused goals who are inclined to prove themselves to others. As explained in Section 2.1, these users are primarily driven by extrinsic motivation, seeking external rewards and validation. Secondly, social networking features are appreciated by users with similar goal characteristics, though those with an avoidance orientation are less likely to engage with these features. These users are also motivated extrinsically, driven by social comparison and feedback from others. Lastly, quantified-self features are most valued by users with outcome-focused and mastery-oriented goals, with goal specificity increasing their perceived importance. For these users, the motivation is more intrinsic, as they value personal progress and over external validation as described in Section

2.1. The findings suggest that personalised motivational systems can be developed to align with users' goal characteristics.

The study by Hamari and Koivisto (2015) suggest that to encourage the adoption and continued use of information technologies, social influence can be strategically incorporated into system design in several ways. Firstly, features that allow users or the community to signal norms within the system help in the diffusion of those norms, consequently this helps to build and strengthen the community. Secondly, users are enabled to communicate or make visible their behaviours by features such as sharing functions and badges, reflecting then their acceptance of social influence. Thirdly, features like 'liking' and commenting allow users to provide feedback on others' activities, which encourages recognition and supports the development of intrinsic motivations related to the system's use. Fourthly, the creation of such social communities within the system can facilitate ongoing social interaction, sustained use, and reciprocal benefits through enhanced cooperation. This study also indicates that the size of a user's network within the community is a strong predictor of the social benefits that users can gain from the system. Therefore, integrating new users into the community, as well as connecting new and existing users, is crucial for maximising these benefits.

## 2.5 Strava

Strava was chosen for this study due to several compelling reasons that align with the research focus on gamification, user engagement, and motivation in exercise tracking applications. It was chosen particularly because of its notable gamification features and its large user base, providing valuable context for examining tracking, motivation, and the effects of gamification in running. Studies on running applications often mention Fitbit, (Stragier et al., 2016) RunKeeper, Nike Running, (Kankanhalli, 2015) Strava, and Garmin Connect (Franken et al., 2023). However, Strava stands out because of its prominent gamification features, including leaderboards, achievements, challenges, and the ability to compare oneself with others. These features are essential for examining how gamification influences motivation and user behaviour, making Strava an ideal case study. Furthermore, Strava's progressive approach to social networking, as emphasised by Franken et al. (2023) makes it the most popular online social network for athletes. This is reflected in its users, as they tend to be motivated by networking capabilities and the self-tracking features of running. In contrast, applications like

Zombies, Run!, attract users who are more focused on the gamified elements and storytelling (Farič et al., 2021), with running being a secondary concern.

Strava is a mobile application designed to track running, cycling and hiking but has over 30 types of activities that can be recorded. It can be connected to a GPS watch, head unit, heart rate monitor or power meter — devices commonly used to track running and cycling. The collected performance metrics can then be used to provide analytics and game elements and stored for later use. According to Strava, there are a total of 100 million users across 195 countries and is the largest sports community in the world.

### 2.5.1 Socialisation and gamification in Strava

Strava markets itself as the social network for athletes. It is designed to track workouts and provide statistical insights, while also serving as a platform for social connection. (Strava, 2025) Russell et al. (2023) emphasise the unique social aspect of Strava in comparison to other training applications. These social features can enhance athletes' engagement in the sport by fulfilling their psychological need for relatedness, thereby acting as a significant motivational factor for active users. In their study, they suggest that Strava not only motivates individuals to run but also encourages them to join running clubs.

Strava offers social fitness elements amongst gamification ones, such as a calendar for inviting people to work out, a feed similar to social media platforms where the user can follow activities from others and a blog for workout reports (Whelan & Clohessy, 2021). Its social media-like features include the ability to give 'kudos', similar to likes on other platforms, on workouts shared by others. Franken et al. (2023) describe kudos as a simple, one-click form of feedback that acts as a social signal of support, appreciation, or admiration. Users can give kudos by tapping the thumbs-up button beneath an activity post. Workout posts can also include captions and users can comment on each other's workouts (Strava, 2025). It is set apart from traditional social media platforms by the content that is shared. Most traditional platforms focus on text, images and video are shared, whereas Strava is built around sharing biometric data (Couture, 2021).

Socialisation features include being able to form clubs on Strava with friends and coworkers, for instance. Groups are used to organise group runs or other type of workouts an share

information across group members (Strava, 2017). Users can then see posts from other people in that club and compare their total kilometres on the club leaderboard. Strava expresses that one goal of club statistics is to inspire friendly competition and motivate workouts through the leaderboard. A post on Strava is automatically added to the feed and displayed to the user's followers. Couture (2021) points out that unlike many social media platforms, Strava lacks a certain degree of agency when creating a post. Workouts automatically appear in a user's feed for followers without requiring any additional action, in addition to completing a workout recorded on Strava.

In Strava, users can challenge others to run a certain distance, with the winner earning a digital badge that is displayed on their profile (Whelan & Clohessy, 2021). Strava offers various leaderboard features, one of which is called segments. It shows the popular parts on a road or a trail while ranking users based on their recorded times. Through this feature people can compare their times to other people running the same parts of a route. Couture (2021) highlights that through segments a user can compare their efforts not only to friends and followers, but also to anyone on Strava who has completed that segment before.

### 2.5.2 Perceived Psychosocial Impact of Strava Use

A study on collegiate club athletes found that many runners felt compelled to manage the image they presented to their followers on Strava (Russell et al., 2023). Participants mentioned that they felt the need to justify their workouts. For example, they avoided posting shorter runs or felt the need to add a comment if their pace was slower than usual. There were other participants, that on the other hand felt that they were the most authentic on Strava compared to other social media platforms. Some athletes were motivated by social comparison, while others found it discouraging. They mentioned that especially in competitive surroundings, Strava provides an easy tool for comparison, which can lead to negative effects. Runners experienced different psychosocial responses to social comparison depending on whom they were comparing themselves to. Elite athletes and high-mileage runners were seen as inspiring and motivating, while comparisons with peers of similar ability often felt competitive and tense. To manage these negative emotions, some runners chose to mute certain individuals on Strava to avoid unhealthy comparisons.

The study by Franken et al. (2023) contrary to their expectations, found that athletes were mainly negatively influenced by peers who ran less frequently, suggesting that lower-performing friends may justify deviations from exercise goals. Surprisingly, without social influence, Strava users might exercise more. This study suggests that social elements, such as receiving kudos from peers, can positively impact motivation by reducing pressure on runners. In cases where athletes might feel discouraged or tempted to scale back their efforts, seeing their friends' lower activity levels can normalise this behaviour, making it easier to justify taking a break or reducing the intensity of their workouts. This social influence can create a supportive environment where deviating from one's goals does not feel as negative, ultimately removing some of the pressure to perform at predefined levels.

In the study by Couture (2021), a Strava user noted that personal insecurities and expectations might affect how people interpret or are influenced by others' data. They emphasised that motivation or discouragement largely depends on an individual's self-awareness and how they view themselves. Another Strava user in the study feels that seeing others post impressive times and distances on social networks, such as Strava, can lead to dissatisfaction with their own performance. This is similar to how traditional social media can make people unhappy when comparing their lives to others' (Samra et al., 2022). Some users enjoy the competitive element Strava provides, one reporting that they get joy out of completing challenges and comparing efforts with others (Couture, 2021). This user also found it fun to see what others were doing and learn about their training experiences. Similarly, another user, who dislikes traditional social networks, reported enjoying Strava because it focuses solely on workouts, allowing them to follow others' progress and achievements without distractions.

Multiple studies highlight phenomena that Strava has created, stemming from different activities. While these studies primarily focus on various forms of exercise, the insights and findings are relevant and can be applied to running as well. In Pink et al. (2017) study, a participant's comment 'if it isn't on Strava, it didn't happen' highlights how self-tracking has become so ingrained in the running communities that it shapes how people view their exercise. This phenomenon that Couture (2021) referred to as 'Strava-ism' reflects a shift where the act of exercising is less important than the data being recorded and shared. The desire to track every activity shows a reliance on data, raising questions about why people exercise and suggesting that the value of physical activity is increasingly tied to its visibility

and representation through data. Users were found frequently criticising their self-tracking devices or Strava itself for data inaccuracies, highlighting a tension between the desire for data accuracy and the occasional rejection of it. In these instances, users would often use the title or description of their activity posts to explain or defend the data, providing context to potential followers or viewers.

According to the study by Russell et al. (2023) runners felt motivated by the self-tracking data Strava provides. They expressed a desire to run more to track their progress and see performance improvements through Strava's reports and analytics. Runners mentioned that the visuality of the statistics motivates them. An individual in the study by Couture (2021) expressed conflicting feelings about their reliance on tracking technology for running. While they admitted to enjoying the data it provides, they also mentioned being uncomfortable with how it influences their running habits and decisions. They worried if technology had altered their motivations. Karahanoğlu et al. (2021) suggest that technology developers should consider the psychological impacts of running-related data on runners.

## 2.6 Future trends

Wearable computers can collect rich contextual information, such as location, gestures, and ambient sound, to enhance user experiences. By learning user behaviour, these devices can provide relevant information when needed, reducing information overload. (Billinghurst & Starner, 1999) Advancements in wearable health technology include smart clothing, which integrates sensors into textiles for continuous monitoring, and wire-based devices for tracking physiological parameters according to Haghi et al. (2017). The use of wearable devices for training and activity tracking has increased due to advancements in sensor technology, miniaturisation, and processing power (Ludwig et al., 2018). The Internet of Things has enabled healthcare monitoring using wearable devices, which are equipped with embedded technology and sensors to track various physiological and environmental parameters (Haghi et al., 2017). Wearables have gained popularity due to their ability to continuously monitor an individual's activities without restricting movement. Modern wearable systems include micro-sensors in textiles, smartwatches, and other consumer electronics that track vital signs. These devices aim to minimise size, improve measurement capabilities, and enhance secure data transmission via smartphones.

These devices provide users, especially non-athletes, with detailed insights into physical activity, fitness, and physiological responses. Many wearables measure heart rate and provide feedback to help users train within specific heart rate zones, a method well-established in endurance training. Heart rate is widely used as an indicator of cardiovascular strain because it can be measured non-invasively and with minimal effort. However, heart rate responses vary due to individual and external factors, making accurate modelling and prediction difficult. Heart rate variability reflects the body's adaptation to stress and training. Effective training requires predicting individual cardiovascular responses to avoid overtraining or undertraining. Although heart performance has been studied for centuries, accurately modelling every heartbeat remains challenging. Another key application of wearable health devices is motion tracking that can be used in sports or general physical activity. Sensors such as accelerometers, gyroscopes, and magnetometers enable motion detection, fall risk assessment, and activity monitoring. Research has advanced also in motion tracking for clinical applications such as gait analysis. (Haghi et al., 2017)

These developments in wearable technology enable personalised, engaging, and interactive experiences in exercise applications. Based on real-time data from wearables, applications can dynamically adjust workout intensity, duration, or type to match the user's current fitness level and recovery state. Users can earn points and badges for maintaining target heart rate zones, while real-time audio or visual feedback can highlight changes such as a rising heart rate or an uneven gait. By analysing gait patterns and movement efficiency, wearables can help detect early signs of poor form or muscle fatigue. When irregularities are detected, the user can be notified through real-time feedback, allowing them to make immediate adjustments to their stride, or technique to prevent potential strain or injury. Additionally, heart rate monitoring provides insights into recovery, while heart rate variability analysis helps assess sleep quality and stress levels, ultimately optimising overall recovery and performance.

# 3 Research methodology

This chapter outlines the design and approach used to conduct the study, detailing the methods used to collect and analyse data on users' attitudes toward gamification in running applications. It explains the rationale for using a mixed-methods approach, combining a Webropol questionnaire for broad more quantitative insights and interviews for qualitative, personal perspectives. The chapter also details the formulation of research questions that guide the investigation into how motivational factors and the visibility of workout data influence users' emotional responses. Additionally, it provides a comprehensive explanation of the research process, including how participants were selected for the survey and interviews, as well as the steps taken to achieve the study's objectives.

## 3.1 Research design and approach

The objective of this study is to explore general attitudes toward gamification elements in running applications and to examine the emotional responses these elements evoke. Previous research has highlighted that the gamification of exercise applications may lead to negative emotions and impact the mental well-being of users. This study aims to first identify which categories of gamification elements contribute to these adverse effects. Ultimately, the goal is to pinpoint the particular gamification features that generate the most negative emotional responses.

Research is conducted through a Webropol questionnaire, which can be found in Appendix A. Respondents were found through personal networks, local run clubs and a university sports team. The goal was to gather responses from at least 30 individuals, which was deemed as appropriate sample size given the scope and objectives of the research. The questionnaire provides quantitative data on general trends and patterns, while the interviews offer qualitative insights into personal and emotional factors behind those trends, allowing participants to express themselves freely. This mixed-methods design ensures a more comprehensive exploration of the research questions, allowing for a better understanding of both the big picture and the individual experiences of Strava users.

Interview participants were selected from those who completed the questionnaire and were open to being interviewed. The interview sample size was set to five participants. This number was chosen because it provides a balance between obtaining in-depth insights while maintaining practicality and feasibility. A smaller sample size allows for a deeper exploration of individual experiences while ensuring manageable data collection and analysis. Additionally, five participants were deemed sufficient to reach a point of saturation, where new themes and insights begin to repeat, providing a comprehensive understanding.

The interviewees consisted of Strava users with varying levels of experience in running and engagement with the application. All interview participants had prior experience of Strava use. Interviews were conducted both in person and via the online platform Zoom. A semi-structured interview format was used. The complete set of interview questions is provided in Appendix B. However, some impromptu questions were also asked during the interviews, which varied depending on the interviewee. These questions are not included in the appendices. This approach allows for comparability across interviews while also giving participants the flexibility to elaborate on issues they found personally meaningful.

## 3.2 Research questions

Research questions were formulated based on background research and future goals to create proof-of-concept application features that balance motivation and pressure through gamification.

This study investigates three questions:

Q1. Do users who are primarily self-motivated experience less pressure than users motivated by social comparison?

Q2. Is there a positive correlation between motivation and pressure in users who compare their results to others?

Q3. How does publicly sharing running activity on applications impact users' motivation and perceived pressure?

The first research question examines the connection between users' motivational drivers and their perceived levels of pressure when using running applications. Self-motivated individuals

typically engage in activities based on personal goals, intrinsic enjoyment, or self-improvement. In contrast, those motivated by social comparison often look to others' performances for benchmarks, striving to outperform peers or meet perceived expectations. The presumption here is that self-motivated users may feel less external pressure, as their drive comes from within and is not tied to how others perform. Conversely, users motivated by social comparison might experience heightened pressure due to the competitive or evaluative nature of their motivation, which can introduce anxiety or a fear of underperforming in public settings. The question aims to investigate whether these motivational types correspond to different pressure levels and psychological experiences when using running applications.

The second research question examines whether users who are driven by competition also experience more pressure. It focuses specifically on users who compare their running data (such as distance, pace, or frequency) to others on running applications, which is a common feature in platforms like Strava. These users might feel energised or motivated to perform better due to the competitive environment, but the same dynamic could also heighten feelings of stress or performance anxiety. The goal is to explore if motivation and pressure increase together in this context. If a strong positive correlation exists, it suggests that while competition can be motivating, it may also come with psychological costs — a trade-off that's important for application designers to understand when encouraging user engagement.

The third research question addresses the broader impact of visibility, specifically how publicly posting workouts, a common but voluntary feature in running applications, might affect both motivation and perceived pressure. For some users, knowing that others can see their progress may serve as a motivator, encouraging consistency and accountability. It can also offer social reinforcement in the form of likes, comments, or virtual encouragement. However, public sharing can also introduce perceived pressure — users may feel the need to maintain a certain performance level, avoid skipping runs, or even exaggerate their workouts. This question seeks to understand whether these two outcomes (increased motivation and increased pressure) are both present, and how they balance out for different types of users.

By addressing these three questions related to how users' motivation types (self-motivated vs. competition-driven) influence their experience, the study can provide insight into how to tailor the applications features. Results gathered from the survey and interviews are used to

modify the features of running applications, incorporating gamification elements to enhance motivation. At the same time, the design will aim to reduce the pressure and stress users experience by minimising elements that cause negative emotions. For instance, understanding whether self-motivated users experience less pressure than those motivated by social comparison (Q2) helps to identify the need for customisable features that prevent undue stress. Similarly, exploring the relationship between motivation and pressure in competitive users (Q1) informs which features increase motivation without amplifying stress, offering a solution for users who thrive on competition but might feel overwhelmed by it. The third research question, which examines the impact of public visibility of running workouts on motivation and perceived pressure, will guide decisions on how to implement privacy controls, making the application more accessible for users who may want to reduce the pressure of public comparison. By answering these questions, the study seeks to design a mock-up features of an application that supports user motivation while actively working to minimise negative emotional responses, ensuring a healthier, more enjoyable running experience.

### 3.3 Interview method, questions and participant selection

The interviews aim to explore user experiences and perceptions related to gamification features in Strava. Key themes include motivation, pressure, competition and comparison, social dynamics and suggestions for improvement. The goal is to understand how gamified elements include running behaviour, either positively or negatively, and what emotional or behavioural responses they provoke. The interviews also serve to expand on the findings of the earlier survey by providing more detailed, qualitative insights. While the survey offered an overview of user opinions and general trends, the interviews aim to uncover the reasoning behind those responses, explore individual experiences in more depth, and identify potential themes that may not have emerged through the questionnaire alone. In particular, they provide space for participants to reflect more freely on their personal motivations, frustrations, or concerns — elements that are often difficult to capture in closed-ended survey questions.

Interview questions varied due to the semi-structured format described earlier (see Appendix B). Each participant was asked a series of questions, including background questions, Strava usage and social dynamics, the emotional and behavioural impact of gamification, and

questions related to personalisation and motivation. Background questions were included in the interviews to provide contextual information about each participant. This information helps to interpret responses more accurately by situating them within the participant's running habits, Strava usage, and personal motivations. Understanding these factors enables comparisons between different types of users, such as those with varying levels of experience or engagement with the app. In doing so, background questions contribute to a more nuanced analysis of how gamification features are perceived and experienced across the user spectrum. The Strava usage and social dynamics category focuses on understanding how users engage with Strava in terms of their running habits, application usage, and social interactions within the Strava community. As can be noted from Appendix B, this included questions such as how much the interviewees run weekly, do they use Strava on each run and whether they interact with other Strava users on the platform. By exploring how frequently users run, whether they share their activities on Strava, and their level of interaction with others, it is possible to gauge how Strava functions as a social platform. The social dynamics of Strava — whether users feel encouraged, pressured, or motivated by others — play a key role in the gamification experience and answering the research questions. Understanding these social dynamics is crucial for assessing how social comparisons, competition, and community-building features impact user engagement and emotional responses. This category reveals how the interviewees use the application and interact on it and thus aids in providing background and context to later answers.

The emotional and behavioural impact of gamification questions examine how Strava's gamified features affect users emotionally and behaviourally during their running routines. Gamification elements, such as challenges, leaderboards, and badges, can either motivate or stress users. By exploring how users feel about the competitive aspects of the application such as losing a segment crown or comparing their times, this category aims to uncover whether these features enhance enjoyment or create negative emotions like anxiety or frustration. This category addresses both the first and third research questions. It explores how gamified elements — such as competition and public visibility — influence users' emotional responses, including feelings of motivation and pressure. In relation to Q2, it examines whether users who are motivated by competition also tend to experience increased pressure and whether they feel the need to limit certain features. In connection with Q3, it investigates how public

visibility of workouts impacts users emotionally, helping to determine whether viewing others' performances contributes to increased motivation or pressure.

The personalisation and motivation questions focus on how Strava's personalisation features (e.g. profile pictures and customisable settings) influence user motivation. Personalisation is a core aspect of many applications, and it plays a significant role in motivating users to engage more deeply with the platform. By understanding how users perceive personalisation features, we can explore whether these features enhance users' sense of ownership and achievement. This category aims to reveal whether personalised experiences on Strava contribute to sustained motivation, positive emotions, or a sense of accomplishment, which is central to the gamification experience. This category contributes to answering Q1 by exploring how self-motivation through personalisation compares to motivation through social comparison. It will help clarify whether users who are primarily self-motivated feel less pressure than those who rely on social comparison, by examining how personalisation affects their engagement with the application.

# 4 Results

This chapter presents the findings from the conducted research. It begins with an overview of the survey results, offering a quantitative analysis of user experiences, emotions, and preferences related to running applications. This is followed by a detailed examination of the statistical analysis, which uncovers patterns and correlations within the data. The interview findings section then explores qualitative responses, providing insights into individual perspectives on motivation, pressure, and application usage. Finally, the chapter concludes with a discussion on the application of the research results, explaining how these findings inform the development of mock-up features.

## 4.1 Survey results

The target sample size of 30 respondents was achieved and exceeded with 36 responses to the survey. The first survey question assessed whether respondents use Strava, and if so, whether they subscribe to the paid version. Respondents who answered ‘no’ to this question were excluded from the remainder of the survey. Of these 36 responses, 27 reported to use the free version of Strava, 6 reported paying for the subscription of Strava and 3 answered that they didn’t use Strava at all.

The second survey question asked respondents to indicate the level of attention they pay to gamification elements on Strava. A brief explanation of gamification elements was provided, and responses were recorded on a scale from 1 (lowest) to 10 (highest). The scale was defined as follows: 1 = ‘I do not pay any attention to gamification elements’, and ‘10 = I pay a lot of attention and change my running routine to get virtual achievements (such as the fastest time on a segment or a 5K)’. This question was mandatory and got 33 answers. As seen in Table 1 the minimum value given was 1, and the maximum was 9. The average response was 4.6, with a median of 5.0 and a standard deviation of 2.3. The most frequently selected value was 6. These results indicate that most participants fall near the middle of the scale. The average suggests a moderate level of attention to gamification elements among the respondents. The median further confirms that the distribution of responses is relatively balanced, with an equal number of people showing lower and higher levels of attention to the gamification features. The standard deviation of 2.3 indicates a moderate spread of responses. While most answers are clustered around the middle values there is still a notable portion of respondents who

either lean towards the lower end or the higher end. Respondents' engagement with gamification elements on Strava appears to be moderate, with many users showing limited interest or not adjusting their routines in response to virtual achievements. However, a smaller group actively seeks these virtual rewards. The moderate standard deviation implies variability in the responses, highlighting the difference in how people view and engage with Strava's gamification. The absence of any responses at the maximum value of 10, with the highest being 9, suggests that even users who are interested in gamification do not go to great lengths to pursue virtual rewards. Additionally, with an average score below the midpoint of 5.5, this may indicate that gamification elements are not a major motivator for most users in the sample. Figure 1 shows how the responses were distributed between 1 and 10. On the x-axis are the 1-10 values and on the y-axis is the frequency of how often they were chosen.

Table 1. How much users pay attention to gamification Elements on Strava?

| Min. value | Max. value | Average | Median | Standard deviation |
|---|---|---|---|---|
| 1.0 | 9.0 | 4.6 | 5.0 | 2.3 |

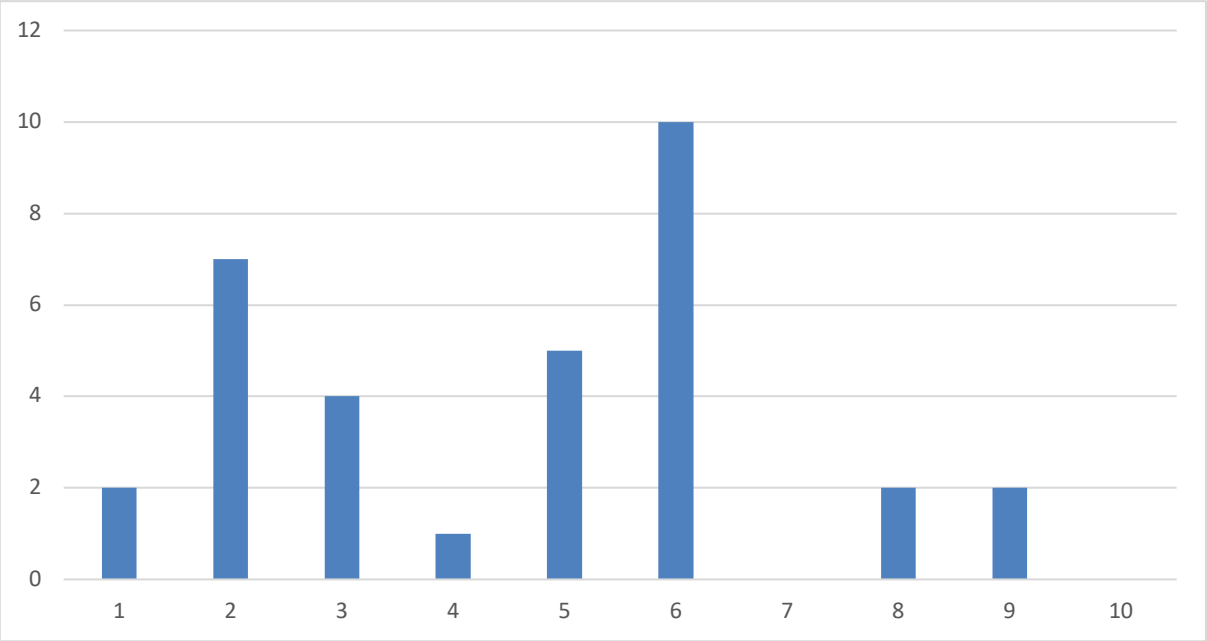


Figure 1. Frequency distribution of attention to gamification elements

Question 3 evaluates respondents' agreement with statements related to their experience with Strava using a Likert scale, focusing on both motivation and pressure. The first three statements explore how motivated users are by various aspects of Strava, such as self-comparison, social comparison, and the visibility of their workouts. These statements aim to understand the factors that drive engagement and participation. The following three statements, examine how users perceive the pressure that may arise from certain features of Strava, such as comparing results to others or the visibility of their activities. This helps to gauge whether Strava's gamification and social features create a sense of stress or anxiety for users.

Answers on the first statement of question 3 – 'Features that allow me to compare my own results motivate me' – indicate that most respondents are highly motivated by features that allow them to compare their results to their own past performances. 23 respondents answered that they strongly agree with the statement and 9 somewhat agree. Disagreement is minimal with only one answering that they strongly disagree with the statement. This indicates a strong intrinsic motivation for self-improvement through tracking performance. The responses on the second statement 'Features that allow me to compare my results to others' results motivate me' are more evenly distributed compared to the first statement. While 11 respondents somewhat agree and 7 strongly agree, 6 somewhat disagree, 3 strongly disagree, and 6 remain neutral. This suggests that, while some people are motivated by competition or social comparison, a significant portion of respondents either do not find this motivating or remain neutral on the matter. This reflects a lower level of extrinsic motivation compared to the intrinsic motivation seen in the previous question.

The third statement is 'The fact that my running workouts are visible to others on Strava motivates me'. A moderate level of agreement is seen here, with 13 respondents strongly agreeing and 9 somewhat agreeing. This suggests that the visibility of workouts has a motivating effect, especially for those who value social recognition or feedback. However, there is still disagreement with 2 strongly disagreeing and 4 somewhat disagreeing with the statement. This suggests that some users prefer to keep their activities more private or are indifferent to others seeing their workouts. In general, this shows that the social aspect of Strava does provide motivation for a considerable portion of users, though it cannot be considered as universally motivating. Based on the answers to the first three statements self-

comparison emerged as the most motivating feature for the majority of users. There was strong support for the idea that tracking personal progress is a key motivator. In contrast, social comparison and visibility of workouts are generally less motivating. These features appeal to some users who enjoy competition and social recognition, but a significant portion of respondents remain neutral or are uninterested in these aspects. The responses indicate that Strava's intrinsic motivation tends to be more effective for most users than extrinsic motivation.

A majority of respondents, 24 out of 33, disagree with the statement that features that allow users to compare their own results would cause them pressure. This indicates that features that allow users to compare their results to their past performances do not cause pressure. Additionally, the fact that none of the respondents strongly agreed with the statement suggests that the pressure associated with self-comparison is minimal. A relatively small portion of 6 respondents somewhat agree, indicating that some users might feel some pressure to perform better due to tracking their own results, but overall, this feature seems to have a low-pressure impact. Responses to this statement suggest that for most users, self-comparison is not a source of stress or anxiety.

The fifth statement was 'Features that allow me to compare my results to others' results cause me pressure. Responses to this statement were more divided compared to the previous one. The slight majority of respondents, 17 out of 33, disagree with the idea that comparing their results to others' causes pressure, but there is a large portion of respondents who feel neutral or somewhat pressured by this comparison with 8 respondents somewhat agreeing, and 7 that are neutral. Only 1 respondent strongly agreed, suggesting that social comparison does not generally create significant pressure for most users. However, a notable group of 8 respondents — approximately 24% — reported feeling some degree of pressure, whether slight or moderate. This indicates that social comparison is more likely to cause pressure than self-comparison, but it's not a dominant feeling for most users. The last statement is 'The fact that my running workouts are visible to others on Strava causes me pressure'. The significant majority of respondents, 20 out of 33, disagreed with the idea that visibility of their workouts causes them pressure. A smaller group of 6 respondents somewhat agreed with the statement, indicating that there is a moderate amount of pressure felt by a few users due to the visibility of their workouts. With just one respondent strongly agreeing, it appears that, for the majority

of users, the visibility of workouts on Strava does not create substantial stress or anxiety. This indicates that although a small number of users may experience some pressure, it is not a common concern for most users. These findings are summarised in Figure 2, which illustrates the percentage distribution of responses to all Likert-scale statements.

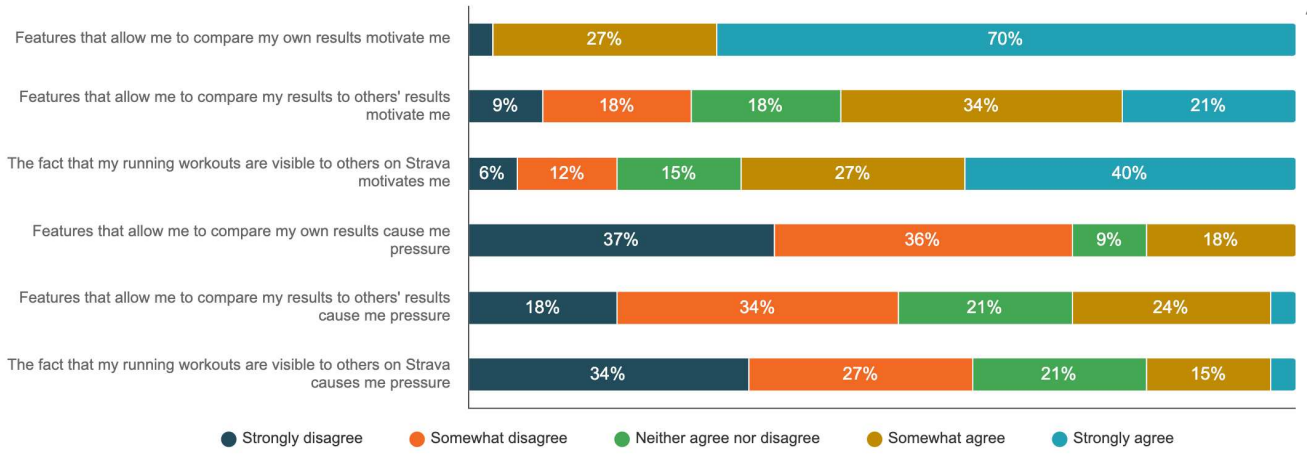


Figure 2. Percentage distribution of responses to Likert-scale statements

23 out of 33 respondents strongly agreed with the statement that features that allow them to compare their own results motivate them. Figure 3 displays the percentage distribution of responses from respondents highly motivated by self-comparison. Among them, 15 strongly disagreed or somewhat disagreed that features that allow them to compare their own results cause them pressure. 3 people neither agreed nor disagreed, and 5 people somewhat agreed. 9 respondents out of the 23, disagreed or somewhat disagreed that features that allow them to compare their results to others' results cause them pressure. 7 neither agreed nor disagreed, 4 somewhat agreed, and 1 strongly agreed. 14 out of 23 strongly disagreed or somewhat disagreed with the statement 'the fact that my running workouts are visible to others on Strava causes me pressure'. 6 respondents neither agreed nor disagreed. 2 somewhat agreed and 1 strongly agreed.

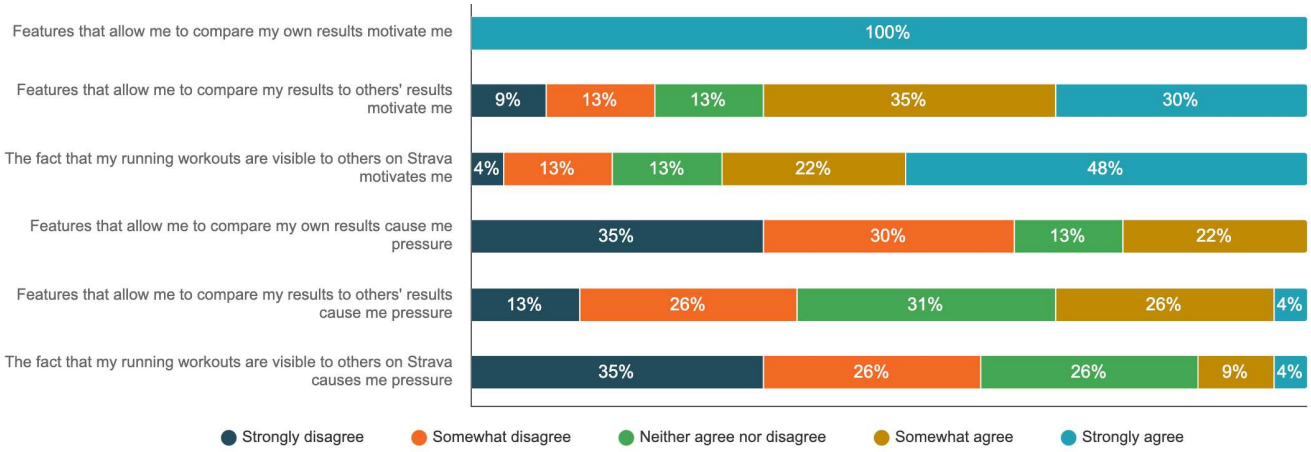


Figure 3. Responses to other statements from respondents highly motivated by self-comparison

Additionally, 15 of the previously mentioned 23 respondents, were also motivated by features that allow them to compare their results to others. 16 respondents found motivation in having their running workouts visible to others on Strava. The results suggest that, for the majority of respondents, comparing personal performance to past results is predominantly motivating rather than stressful. While most participants remain unaffected by comparisons with others, a small subset (5 out of 23) reports feeling some level of pressure in this context. This indicates that, although comparison features tend to be motivating overall, they can be stressful for a minority. The majority of (14 out of 23) respondents do not perceive any pressure associated with the public visibility of their workouts on Strava. However, a smaller group (3 out of 23) does experience some pressure. This suggests that public sharing on Strava serves as a motivational tool for many, though it may not be universally effective. Both the ability to compare results with others and the visibility of workouts on Strava demonstrate a clear motivational impact. Despite this, a small proportion of respondents (5-6 out of 23) report feeling pressure when engaging with these features.

Among the 18 respondents out of 33 who reported being motivated (either strongly agreed or somewhat agreed) by comparison features, 2 strongly disagreed with the statement, ‘Features that allow me to compare my results to others cause me pressure’. Additionally, 8 somewhat disagreed, 4 were neutral, 3 somewhat agreed, and 1 strongly agreed. For the same group of 18 respondents, 7 strongly disagreed with the statement, ‘The fact that my running workouts are visible to others on Strava causes me pressure’, while 2 somewhat disagreed, 4 were

neutral, 4 somewhat agreed, and 1 strongly agreed. Figure 4 displays the percentage distribution of responses to all statements from respondents highly motivated by comparing their results to others.

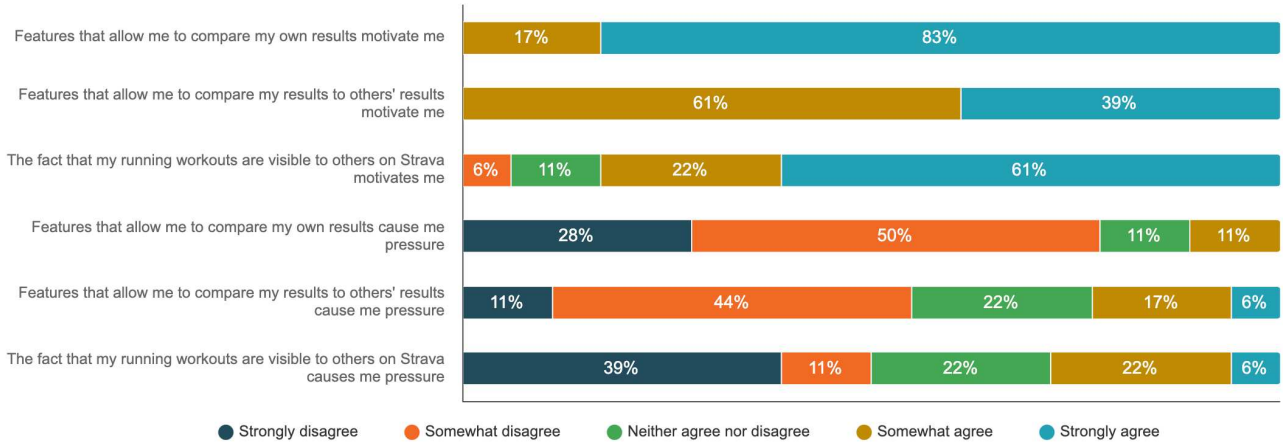


Figure 4. Responses to other statements from respondents motivated by comparison features

The fourth question was ‘Are your runs on Strava visible to others?’. 31 respondents reported their runs to be visible and only 2 answered that they were not visible. No one answered that they did not know if their runs were visible. The next question was ‘Does other people being able to see your runs on Strava ever put pressure on you?’ this question was shown to those who reported their runs to be visible. 16 respondents – which correlates to a bit over half (52%), responded ‘never’, 14 respondents (45%) answered ‘sometimes’ and 1 answered ‘often’.

The fifth question examined whether Strava should implement customisable levels, allowing users to choose the one that best aligns with their abilities or goals. Response options were limited to ‘yes’ or ‘no’, with an opportunity to provide additional comments or reasoning. The intent behind this question was to gauge interest in a more personalised experience on Strava. Drawing on previous research and common gamification strategies, the idea was that introducing level-based features might help alleviate pressure by enabling users to compete with others of similar capability. The results, however, were nearly evenly split — 16 respondents supported the idea, while 17 opposed it — indicating no clear consensus. This division highlights a divergence in user preferences: while some participants appreciate the

potential benefits of tailored competition, others appear satisfied with the existing structure or do not see a need for added segmentation. The affirmative responses were justified with reasons such as ‘It would set a more realistic comparison level for the user’, along with similar statements as ‘Don’t see it as necessary, but it could certainly reduce pressure’. Respondents who answered ‘no’ provided reasoning such as ‘results speak for themselves’ and ‘I think it would increase the sense of inequality and reduce the feeling of community’. Another respondent wrote ‘I don’t think it matters, because people (hopefully) don’t take Strava so seriously’.

A Strava user in a previous study by Couture (2021) mentioned that whether someone is motivated or discouraged by other people’s workout data largely depends on ‘how serious they take themselves’. This mirrors the sentiment expressed in the survey comment, where the respondent believes that Strava should not be taken too seriously, implying that the level of seriousness or self-importance users place on the platform influences their emotional response to others’ data. Both comments reflect the idea that personal attitude and the degree of seriousness play significant roles in how Strava users engage with the platform and its community.

The last question on the questionnaire was ‘Is there anything else that you would like to add in the field of gamification of running applications? Any development ideas, good features, bad features?’. This generated 7 responses. Some comments focused on map features and potential improvements. One respondent mentioned noticing obsessive behaviour on others. They wrote:

> I don’t think there’s anything wrong with Strava itself. However, I’ve noticed that for some Strava users, hitting a certain distance has become an obsession. This is reflected in their maps, where small detours are made off and back onto the so-called original route to make sure they complete the necessary metres. Many conclusions can be drawn from this, but I believe that gamifying Strava can be dangerous for individuals with low self-esteem. For them, comparing distances can easily become hysterical and eventually cause health issues both physically and mentally.

Another respondent echoed this concern, noting that certain gamification features can be unpleasant. They noted:

> When I run the same segment multiple times, it's fun to see how I've improved or how I've run faster at times. However, I don't like the feature where it says, 'Oh no, you lost the crown on segment X, go run and win your spot again as the fastest on segment X.

## 4.2 Interview findings

All interviewees were in between 20–30 years old, and most participants reported using Strava for every run, often through automatic syncing from their watch. One participant, however, noted that their use of Strava depends on their current training goals. They use it consistently when training for a specific sport, such as running before a race, as they did at the moment. Both genders were represented in the sample, although males constituted the majority with 4 out of 5. Weekly running distances varied between 10 to 60 kilometres.

Participants reported using Strava primarily for performance tracking, community engagement, and motivation. Many found the application useful for comparing their own results to others, which contributed to better performance. They appreciated the ability to easily track kilometres and store workout data. Some interviewees were introduced to Strava through online platforms like YouTube. The sense of community, especially during group runs, was a key factor in their continued use of the application. Additionally, technical advantages influenced some participants, for example, one switched after being dissatisfied with their watch applications limited metrics and sought more detailed statistics, such as stress tracking. Another initially transitioned from another workout application to Strava because it was more widely used and offered a better overall experience. These findings align with those reported by Russell et al. (2023) who found that runners were motivated by Strava's self-tracking features, particularly the visual presentation of statistics.

Participants generally use Strava as a social tool to connect with family, friends, and acquaintances, primarily focusing on their immediate network rather than professional athletes or public figures. Most participants engage with the platform by adding only personal contacts, with some being members of run clubs or groups. Though one mentioned finding

these groups inefficient unless they connect with group members as friends as they otherwise do not see their workouts on their feed. Two interviewees mentioned following professional athletes or public figures, but both times it was limited to one individual, such as a YouTuber. Interviewees said that they tend to browse the activities of friends on days when they are active themselves, often checking their posts to compare or find motivation. This social interaction seems to be motivated by personal connections rather than the competitive aspects of the platform.

As previously stated in the second chapter, research on badges in educational contexts suggests that their impact on motivation and engagement can be limited, with private recognition often being more effective than public competition (Kyewski & Krämer, 2018). This resonates with the findings of this study, as interviewees generally view Strava's gamification elements such as personal record notifications and the 'fastest 5K' feature, as motivating and fun. These elements offer positive reinforcement and provide a sense of progress. Users note that they evoke feelings of achievement and motivation, with many feeling a sense of pride when they see improvements. However, if a run doesn't meet their expectations, it may lead to disappointment, though respondents note that this feeling is not necessarily tied to Strava itself. For some, the gamification elements, such as segments and local legends, offer a playful challenge, although some note finding certain aspects, like the local legend feature, a bit unclear. None of the interviewees indicated paying attention to the leaderboard features or experiencing pressure or motivation as a result of them.

Overall, users seem to enjoy the friendly competition Strava offers, viewing it as a fun way to track progress. One user finds motivation in segments, where beating a personal or peer's time feels rewarding. While there is awareness that Strava's competitive nature might lead to negative emotions for some, such as comparing results or dealing with judgmental groups, most participants highlighted the positive aspects of gamification, which they find enjoyable and motivating. The platform's flexibility, like the ability to hide certain metrics, also helps mitigate any potential negative effects.

Interview participants showed varied perspectives on limiting Strava's elements if they were to cause negative emotions. Some believe that even if certain features like competition or streaks might cause stress, they could benefit from them, viewing them as motivating factors rather than a source of pressure. One respondent emphasised that such features are inherently

part of the sports experience, and they would not want to limit them. Others, however, acknowledged that they might limit certain elements, especially if they felt it contributed to stress or unwanted pressure, but they also mentioned that they would feel pressure from their own workouts, with or without Strava. Interestingly, while one participant stated they would not hide any data because it does not bother them, they also recognised the value in Strava's feature to hide specific metrics, indicating an appreciation for customisation and privacy options. Overall, there was a balance between users enjoying the motivational aspects of Strava and recognising that certain features could cause stress or pressure. Notably, users can value the flexibility to adjust their experience, either by limiting certain aspects or choosing to hide data, to ensure that the platform remains enjoyable and motivating rather than stressful.

The competitiveness of Strava is mostly seen as a positive motivator for users, with the majority of interviewees finding that it increases their motivation during workouts. Some participants appreciate the competitive features, although they do not necessarily engage with all aspects of the application, opting instead to focus on what motivates them. For others, they do not experience a lot of competition since they think it is more about running alongside friends, where the social element reduces the pressure but still adds motivation. One interviewee also mentions that group training is particularly motivating and knowing that a few friends will see their workouts on Strava is enough to encourage them to take their training just slightly more seriously. Notably, none of the interviewees mentioned that the competitive features in the application added significant pressure. Some did not experience any competition at all, and others mentioned it to be limited to positive emotions and outcomes.

Participants' approach to adding captions on Strava varies, with most adding them only when necessary to clarify the nature of their workouts or to explain unusual circumstances. Some participants do not typically add captions but might do so for specific exercises that are not clearly represented, such as stair running with a weighted vest, or when technical issues arise with GPS tracking to avoid confusion. One mentioned enjoying adding captions for fun, often aiming to humour their friends or describing their feelings about the run. Captions are particularly common when something out of the ordinary happens, or unusual workout types like interval training or swimming. One participant also emphasised the practical value of captions, especially in situations where it might be useful to look back to a certain moment

such as an injury. None of the participants reported adding captions such as ‘easy run’ or ‘recovery run’ finding them unnecessary or amusing.

The ability to personalise the application appears to have a minimal impact on motivation or positive feelings for most participants. Interview participants find profile pictures and interface customisation features fun or enjoyable but do not report any significant impact beyond entertainment value. A few participants mentioned that while they would not mind personalising aspects like profile pictures or avatars, they felt these features were secondary to more functional improvements, such as improving Strava’s map function. For one participant, the ability to add competitive targets or track past race results would be more motivating and helpful for accountability. In general, personalisation features are appreciated by interviewees in a recreational sense but are not seen as significantly influencing the core motivation for exercise. Some noted that personalisation features might encourage to more frequent use of the application, but it would not transfer into exercise motivation.

The opinions on implementing different levels in Strava vary among interviewees, with some expressing interest in the idea while others are less enthusiastic. One user thought separate leaderboards for different levels could be fun, though they do not feel strongly about their implementation, as they still value the overall leaderboard. One participant suggested that an automatic level based on metrics like time or distance might be effective, and others warned that self-categorisation could lead to potential distortions, particularly if users mislabel themselves purposefully. Some participants expressed concerns about the pressure that could arise from automatically assigned levels, particularly if the system was based on factors like race results or training intensity. One noted that they would want to have control over how they are categorised while emphasising the importance of differentiating between casual exercise activities and competitive training.

In addition to the responses given to the interview questions, several participants shared further insights. The opinions on Strava’s features vary among participants, with some viewing them as motivational and others as unnecessary. As mentioned earlier, some participants feel extra motivation when they see others outperforming them in segments, while one participant described challenges and segments as simply extra noise. Many find running inspiration from others’ routes, with the ability to run the same routes as someone else, to be an enjoyable aspect of the app. For example, participants might be motivated to

improve their pace based on the performance of others, simultaneously accepting that those who run longer distances at a faster pace may simply be more experienced. Participants appreciate features like Strava's suggestions for connections but emphasise the need to enable linking the application to other platforms, such as Instagram, and more strongly recommend adding contacts. This approach would enhance the social aspect of Strava, boosting user engagement.

One interviewee acknowledges that comparing oneself to top athletes can be a downside, particularly when the comparison feels unrealistic, but they find that with only real-life friends added, there is virtually no competition. Another one mentions also that comparing oneself to a more experienced runner can create unrealistic expectations and pressure. Despite this, they mention finding motivation in external factors — even features that could be seen as irritating. For one interviewee, the more something (e.g. feeling of competition) bothers him, the more motivating he finds it. He stresses the value of playful competition instead of harmful and unrealistic comparison. Some felt that they do not use all Strava's features simply because they are not aware of them, which they considered beneficial in maintaining focus on the aspects of the application that align with their goals.

The fact that multiple interviewees reported not using the Strava application directly during their runs, but instead relying on their fitness watch to sync automatically to Strava, could reduce the pressure they feel while using the app. By not engaging directly with the application during the run, these users avoid real-time comparisons or competition, which can often create pressure. This detachment allows them to focus solely on their workout, without the added stress of monitoring live results or worrying about how they compare to others. Once the workout is complete and data syncs automatically, they may feel more in control of their performance and less concerned about immediate social comparisons. This indirect engagement with Strava can make the experience feel more personal and less competitive, encouraging a more relaxed approach to exercise.

## 4.3 Application of research results to guide mock-up development

Based on the interview findings, the key to finding positive competition and reducing harmful comparisons is having friends as Strava connections who are at a similar level and with whom you train regularly. Interviewees reported feeling no competition because they often train with their peers, viewing them more as workout partners than rivals. They also expressed being motivated when others at a similar level outperform them on a segment, which encourages them to revisit and improve their own results. However, it was noted that following individuals who are at a different level could potentially lead to feelings of pressure, even if the interviewees themselves did not experience this.

Among the 23 survey respondents who reported being highly motivated by self-comparison features, it is evident that while these features are generally motivating, the experience of pressure is not universal. As such, some individuals may find public comparisons or visibility uncomfortable, suggesting that these features should be flexible enough to accommodate a variety of preferences. One participant mentioned being able to recognise when someone is more capable, which helped mitigate these feelings. To enhance the social aspect on Strava, enabling connections with other social media platforms an encouraging to add contacts that are synced as friends could prove beneficial. Interestingly these findings are contrary to the study by Russell et al. (2023). Their study revealed almost the opposite experience among collegiate club athletes. These contrasting findings highlight the importance of offering personalisation options within the platform. Since users experience and respond to social comparison in different ways — some finding it motivating, others feeling pressure or discouragement — it becomes essential to allow individuals to tailor their experience. By enabling users to customise the visibility of elements, set personal goals and choose how they engage with others, the platform can better accommodate the diverse emotional and motivational needs of their users.

Based on interviews, users tend to enjoy competing with peers who are at similar levels. Strava could consider offering more refined ways to categorise users based on skill levels or personal goals. This could allow more meaningful and less stressful comparisons within a community of like-minded individuals, reducing the competitive pressure. While this was initially considered as a potential feature, both the questionnaire responses and interview

discussions revealed concerns. Survey respondents and interviewees expressed concerns about this potentially leading to unintended consequences. If the system were to assign levels automatically, users might feel discouraged by the categorisation — whereas if users could choose their own level, respondents and interviewees feared that some might intentionally place themselves in easier categories to appear more successful. Although initially considered as an option, this feature will not be implemented in the mock-up's final design due to mixed reactions from survey respondents — of whom a slight majority were against it — and concerns raised in the interviews regarding potential issues associated with its implementation.

Interviewees noted that even if they themselves didn't feel pressure because of people they follow on Strava, other people could. 6 out of 33 survey respondents agreed or somewhat agreed that other people seeing their workouts on Strava cause them pressure. Additionally, 9 respondents agreed or somewhat agreed that features that allow them to compare their results to others' results cause them pressure. Russell et al. (2023) noted that comparing oneself to peers led to pressure, anxiety, and reduced enjoyment, especially after poor performances or during injury. To reduce these feelings, Strava could offer the possibility to hide elements such as pace or heart rate from other users' workout posts in their feed. While there is an existing feature that allows the user to hide their own pace from their workout, extending this feature to the public feed could further alleviate pressure.

Rather than relying solely on predefined leaderboards, users could set personal challenges aligned with their individual goals — such as target times for specific distances or upcoming races. These small, incremental achievements could offer rewards to maintain motivation without creating undue pressure, and could be integrated into the personalisation features, for example, by displaying upcoming races on the user's profile. This feature could also provide context for perceived performance differences — seeing that another user is training for an ultramarathon may help individuals understand that differing results are expected, particularly if they themselves are preparing for their first 5K.

Strava could introduce a feature that encourages users to add humour to their workout captions, building on the behaviour of those who already do so. For example, after completing a run, Strava could suggest light-hearted prompts for the caption such as: 'Tell a joke about running', 'What was the best part of this run?' or 'Share the funniest thing that happened

during your workout'. As one interviewee shared, 'I always try to come up with funny captions and pictures'. This type of personal engagement could help encourage a more playful, light-hearted atmosphere on the platform. By incorporating humour-focused prompts, Strava would allow users to enjoy their workouts without the pressure of competition, promoting fellowship and personalisation. This shift from a purely performance-driven focus to a more relaxed, enjoyable experience would encourage fun interactions amongst friends.

These suggestions could offer meaningful improvements to Strava by enhancing user motivation and shifting the focus away from stress-inducing elements. By integrating humour-driven prompts, personalised challenges, and mindfulness features, Strava would create a more supportive, enjoyable environment that promotes positive engagement and encourages users to prioritise well-being alongside performance. Hamari & Koivisto (2015) state that gamified applications seek to motivate users by breaking down long-term goals into short-term objectives, offering rewards and social support. These elements presented aim to do this by encouraging social support and interaction, making it possible to set goals and have them visible to provide accountability and context.

# 5 Mock-up development

In this chapter, the objectives behind the development of the mock-up's features are defined, and the prototype itself is presented. This chapter outlines how the mock-up's features address key research findings by translating them into design solutions.

## 5.1 Goals

It was previously emphasised that establishing clear objectives for gamification is essential to assess its effectiveness as Guin et al. (2012) pointed out. In this case, the objectives are to enhance user engagement, motivate users to achieve personal milestones, encourage healthy competition, minimise negative comparisons among users, and avoid inducing unnecessary or harmful pressure. The primary goal is not necessarily to increase the volume of running or to improve their physical fitness. The mock-up acknowledges self-determination theory by supporting autonomy, competence, and relatedness through personalisation, goal-setting, and social features. It balances intrinsic motivation — by helping users focus on personal progress — with extrinsic elements like promoting external recognition through humorous prompts. Quantified-self tools further enhance this by allowing users to track performance and control what data is shared, encouraging self-reflection without added pressure.

The mock-up introduces several design features aimed at enhancing user experience through personalisation and engagement. Users will have the option to customise the interface by selecting preferred colours, allowing for a more personalised and visually appealing experience. Additionally, users can add upcoming races, target times, and personal best goals to their profile, helping them stay focused and motivated by keeping key events visible. By allowing users to display their personal goals — such as completing a marathon in under three hours — others can more easily understand the context and level of that individual's training. This visibility helps set realistic expectations and reduces the urge to compare performances directly. For example, someone training for their first 10K may feel less pressured or discouraged when they recognise that a fellow user is working toward a significantly more advanced target. This clarity reinforces the idea that everyone is on their own journey, helping to reduce unnecessary competition and promoting a healthier, more individualised approach to progress and motivation. To further reduce social pressure and promote a supportive environment, users will also have the option to hide specific workout metrics — such as heart

rate, pace, or calories — from appearing in their feed when viewing others' posts. This gives individuals greater control over what kind of performance data they are exposed to, helping to minimise unintentional comparisons and reduce feelings of pressure or inadequacy. As noted by Whelan & Clohessy (2021) limiting certain features, rather than completely removing them, can create a healthier, less stressful relationship with the application. To bring a sense of playfulness and lighten the overall tone, the mock-up also includes a feature that suggests humorous prompts for workout captions — such as jokes or light-hearted reflections — encouraging users to share their experiences in a fun and engaging way. Incorporating humour into captions can enhance audience engagement as it encourages interaction through comments and likes.

Self-determination theory closely relates to the elements presented. Self-determination theory is based on the idea that for individuals to be intrinsically motivated, the needs of autonomy, competence and relatedness should be fulfilled (Deci & Ryan, 2000). The customisation option of allowing users to choose interface colours gives control over the application environment which strengthens the sense of autonomy. The ability to set personal goals, such as target race times, empowers users to define their own progression. The selective visibility of performance metrics lets users control what kind of information they consume, reducing pressure and allowing them to focus on their own goals. These features promote autonomous motivation by allowing users to personalise their experience, encouraging engagement driven by genuine interest.

The need for competence is addressed by incorporating elements that enable goal tracking and provide contextual visibility. Allowing users to define their personal goals, such as running a marathon under three hours, gives them a sense of direction and progress, which helps them feel accomplished as they work towards milestones. Displaying personal goals helps users viewing posts interpret performance in a more nuanced way. This helps them avoid too harsh comparison or feelings of inadequacy. Relatedness is further encouraged with humorous caption prompts, that promote social interaction in a positive and inclusive way. Allowing others to see what someone is training for (e.g. their first 10K) encourages empathy and understanding. The ability to hide performance data from other users allow those who do not want to compare metrics to still feel a part of the community without being overwhelmed or discouraged. Together, these elements promote positive, supportive social connections,

essential for intrinsic motivation and long-term engagement. By giving user more autonomy, promoting individual competence, and supporting healthy relatedness users experience autonomous motivation, which leads to deeper engagement, sustained use and greater well-being.

Positive effects of extrinsic motivation are maximised by public goals and humorous content. The possibility of receiving likes or positive feedback on a funny or creative caption can motivate users to post more often. This social validation can serve as an extrinsic motivator, as users may be motivated by the external reward of social approval. Making personal goals visible can act as an extrinsic motivator, as users may feel validated when others acknowledge their efforts through encouragement or congratulatory comments. This public display can encourage users to stick with their goals, knowing that others can track their progress and celebrate with them. Notably, fulfilling the psychological needs of competence, autonomy, and social connection enhance intrinsic motivation in both gaming and exercise, according to Bitrián et al. (2020). In exercise, fulfilling these needs has been shown to enhance enjoyment, motivation, and engagement, while also leading to better health outcomes and increased participation.

As previously discussed, quantified-self features are particularly effective for users who are focused on the activity itself, whereas gamification and social networking features tend to be more motivating for those driven by external outcomes or social recognition (Hamari et al., 2018). The mock-up reflects this distinction by integrating elements that cater to both types of motivation — offering personalised goal-setting tools like upcoming races and target times for activity-focused users, while also including social and motivational features, such as public goal visibility and humorous caption prompts, to engage those who respond to social interaction and extrinsic encouragement.

As mentioned earlier, self-set goals enhance the motivation of recreational runners by influencing the time, effort, and resources they invest in achieving them (Karahanoğlu et al., 2021). While gamification can initially boost engagement, its positive effects may diminish over time as the novelty fades, and users' skills improve as previously noted by Basten (2017). To maintain long-term motivation, it is essential to continually introduce new challenges. This is addressed in the mock-up by allowing users to set their own personalised goals, ensuring that tasks remain challenging and relevant. This feature helps sustain user

engagement by adapting to individual progress, preventing the experience from becoming too simple or monotonous. By enabling users to create goals that align with their evolving abilities, the mock-up aims to counteract the potential decline in motivation that can occur when game elements become predictable or are removed.

## 5.2 Visual design concept

The design is based on Strava, with additional features incorporated into it. The mock-up was created to illustrate potential features that help reduce pressure, developed in response to insights from the survey and interview data. For the design of the mock-up, Figma was used as the primary tool. Figma is a design application widely used for user interface design and collaboration. It was chosen as the primary tool due to its suitability for visually translating research findings into conceptual features. Dark mode was included in the mock-up design to improve user experience by reducing eye strain in low-light environments, offering an alternative interface that aligns with user preferences for customisation and enhancing overall accessibility.

To help reduce performance pressure and shift focus away from competition, the mock-up includes light-hearted prompts designed to encourage playful interaction. As illustrated in Figures 5 and 6, prompts such as ‘Tell a joke to your friends’ or ‘What did the treadmill say to the runner?’, are designed to build a more relaxed and enjoyable environment for users. By incorporating humour, the application introduces moments of lightness, which may help users engage without the weight of comparison or expectations. This feature helps shift the user’s focus from performance-oriented features toward a more entertainment-driven and socially engaging experience. This feature is used at the end of the run, just before the activity is saved and published.

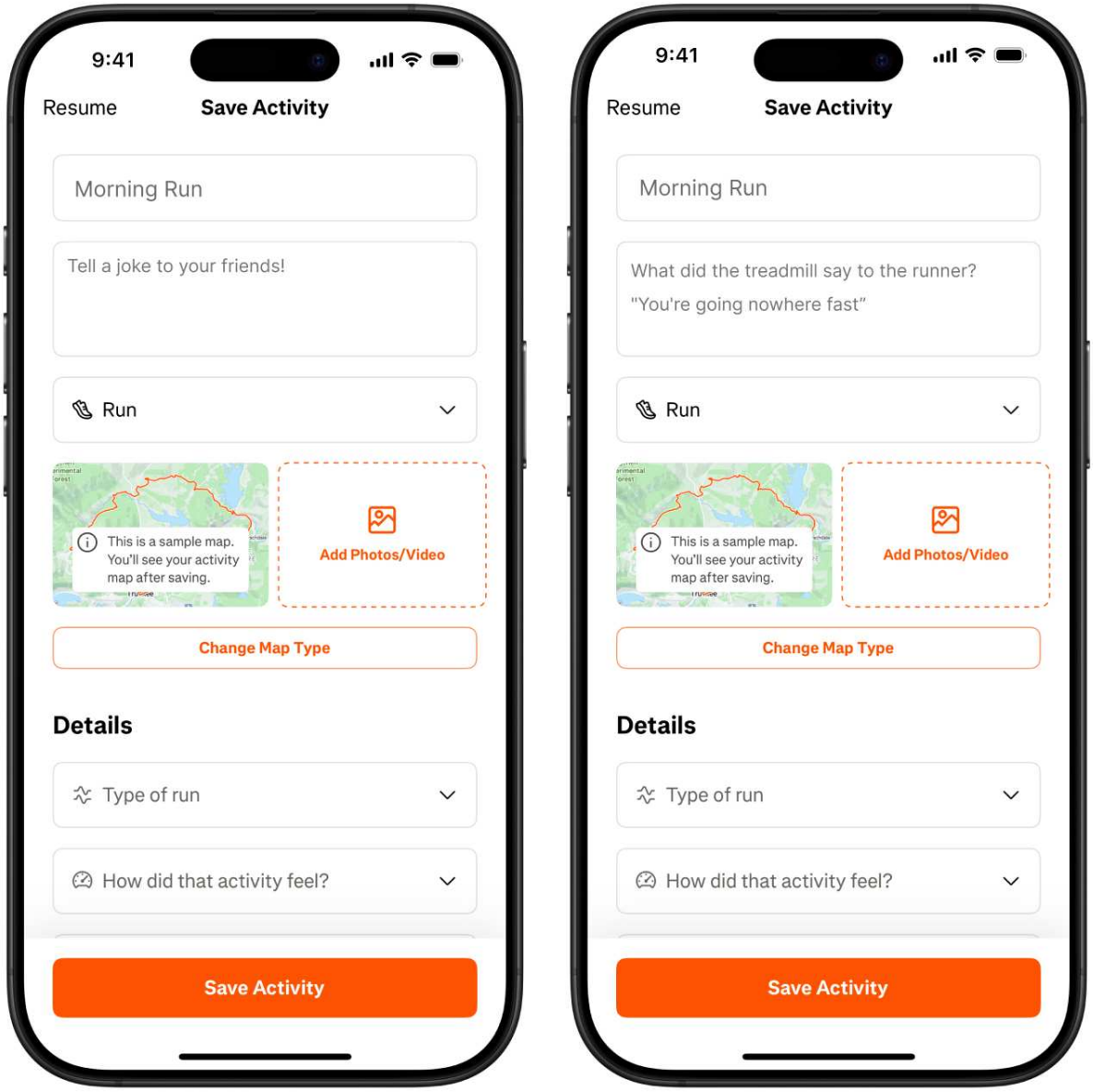


Figure 5. Example of prompts to encourage humorous captions

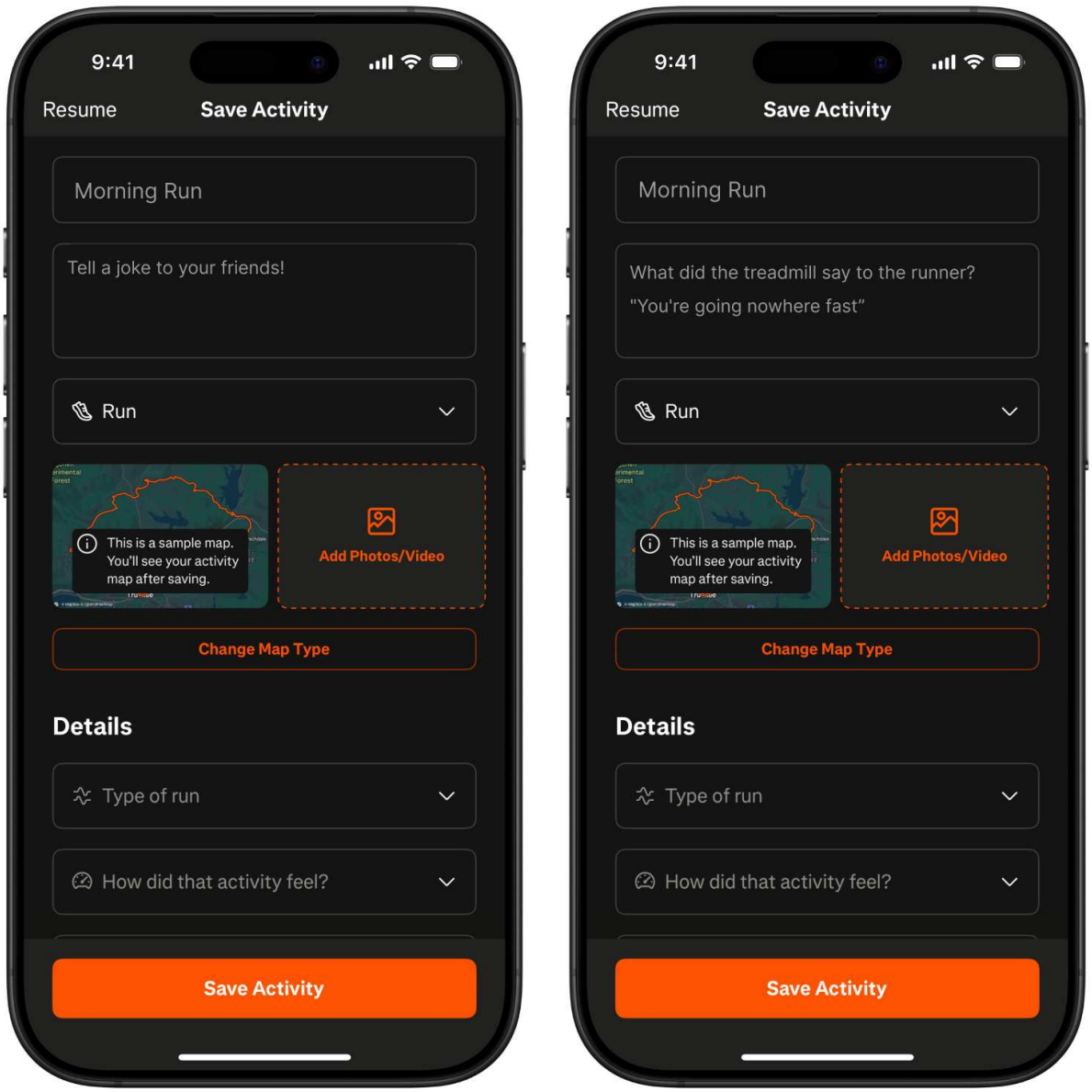


Figure 6. Example of prompts to encourage humorous captions in dark mode

To support a more personalised user experience, the mock-up includes a feature that allows users to customise the application's colour scheme. This feature allows users to change the appearance of the application whenever they wish. As demonstrated in Figures 7 and 8, users can select alternative interface colours, such as blue or purple, in contrast to Strava's default bright orange. The available colour options are wide-ranging yet carefully selected to ensure compatibility with both light and dark modes of the user interface — ensuring adequate contrast, readability, and accessibility such as avoiding combinations like white text on a light

background. By offering visual customisation, the feature aims to enhance comfort, reinforce a sense of ownership, and promote a more enjoyable user experience.

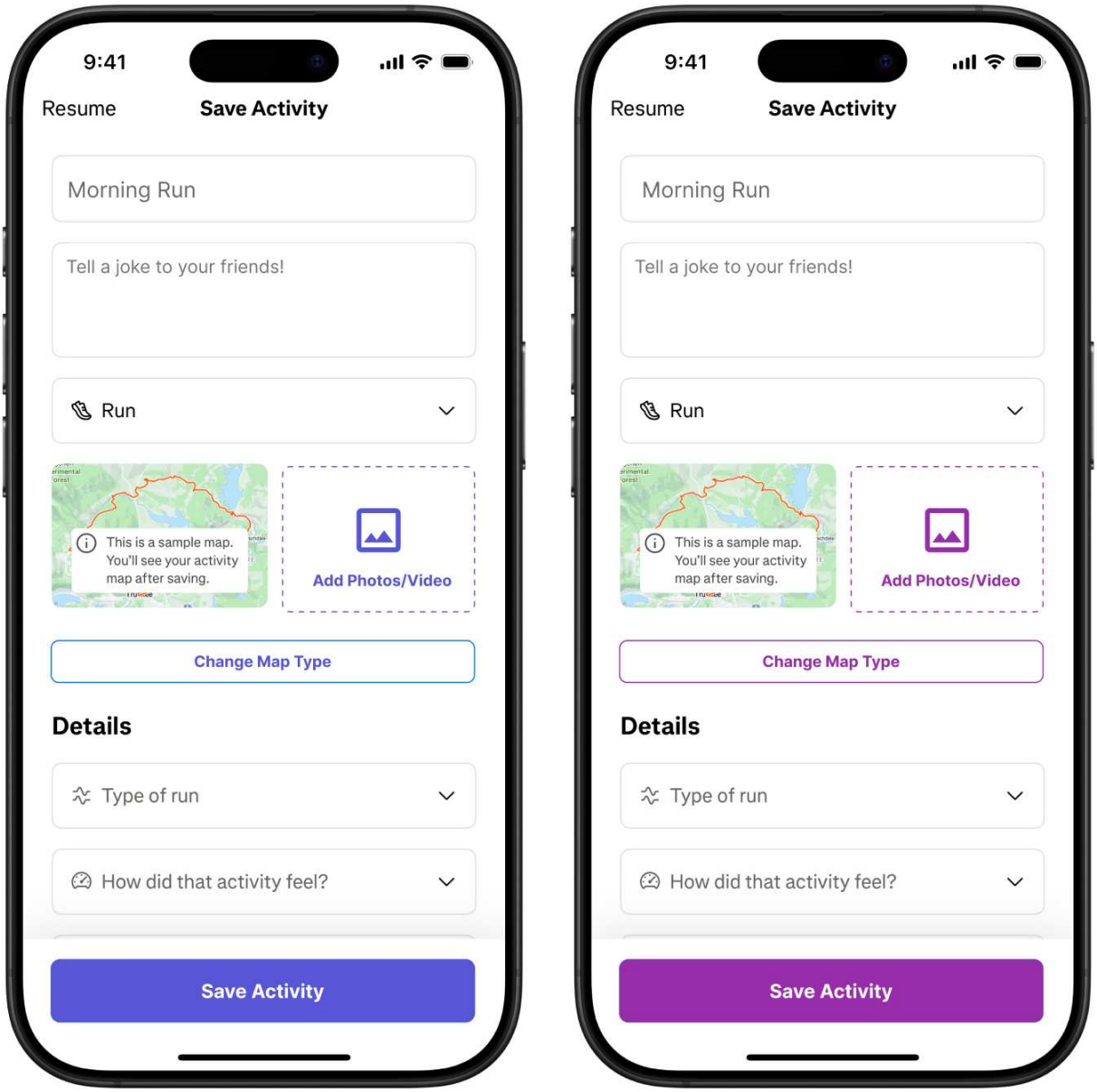


Figure 7. Demonstration of the ability to customise colours

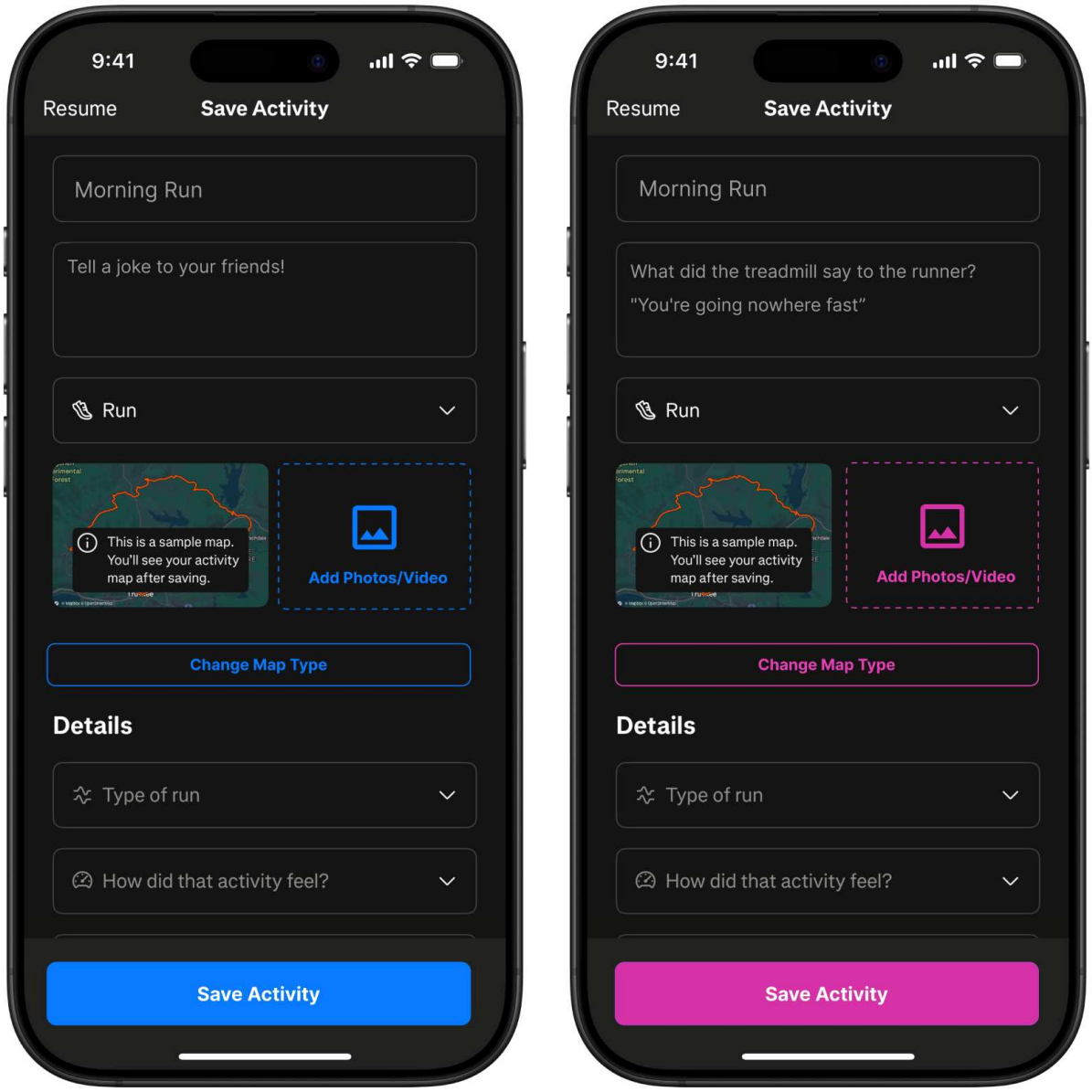


Figure 8. Demonstration of the ability to customise colours in dark mode

Figures 9 and 10 demonstrate the inclusion of personalised goals on the user profile page. These goals are meant to be edited when users get new goals and signup for races. By offering the flexibility to set any goals users desire, such as completing a 5K under 20 minutes or running a marathon, the mock-up allows individuals to tailor their objectives to their own exercise aspirations. This approach supports users who might be comparing their results to others with more ambitious targets, such as those training for ultramarathons. By setting personal challenges tailored to their own progress, users can avoid the discouragement that may arise from competing with high-performance benchmarks. These personal goals provide context for performance, helping users understand that progress is relative and encouraging them to celebrate their own milestones, regardless of the achievements of others.

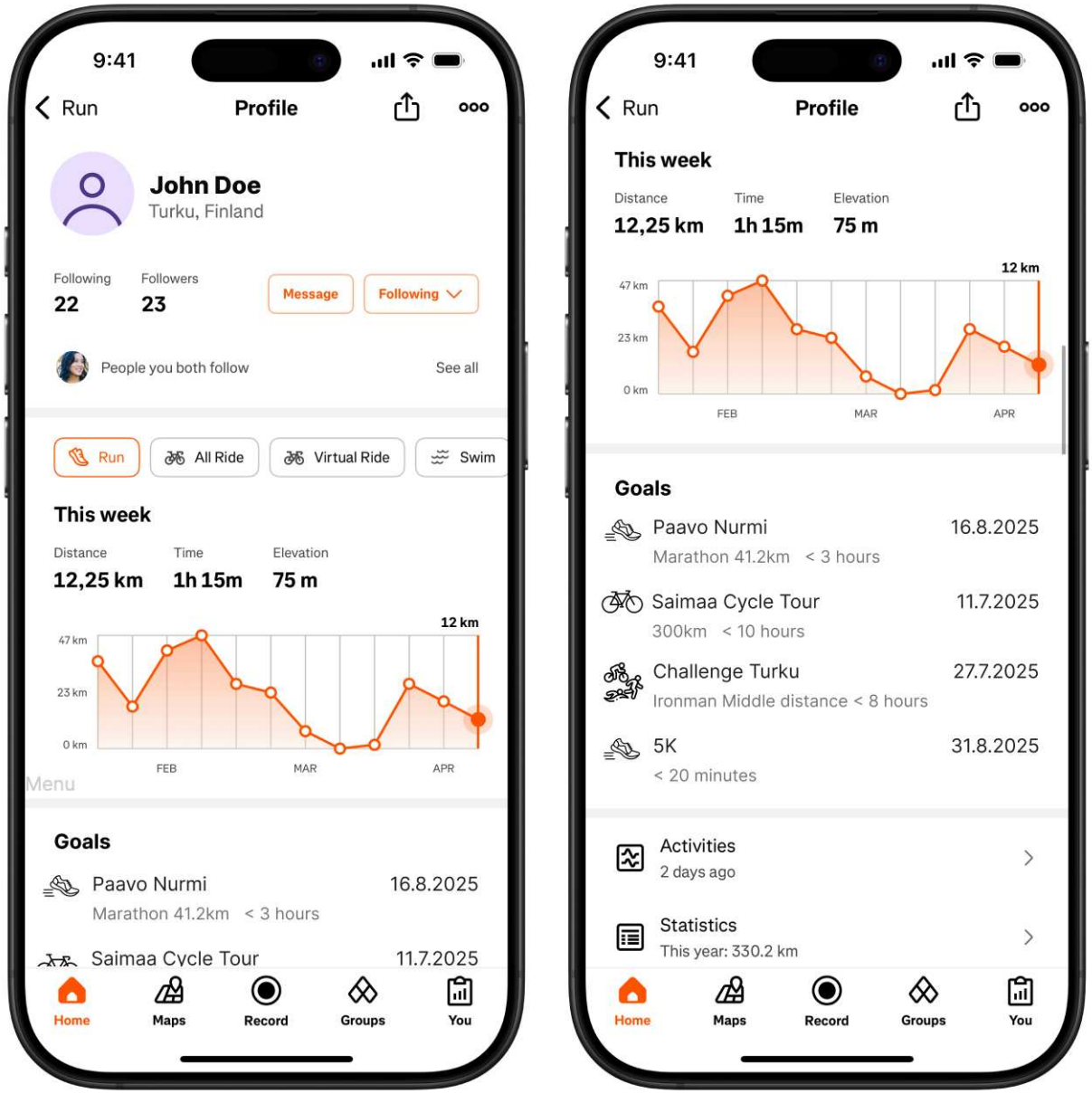


Figure 9. Goals shown on profile page

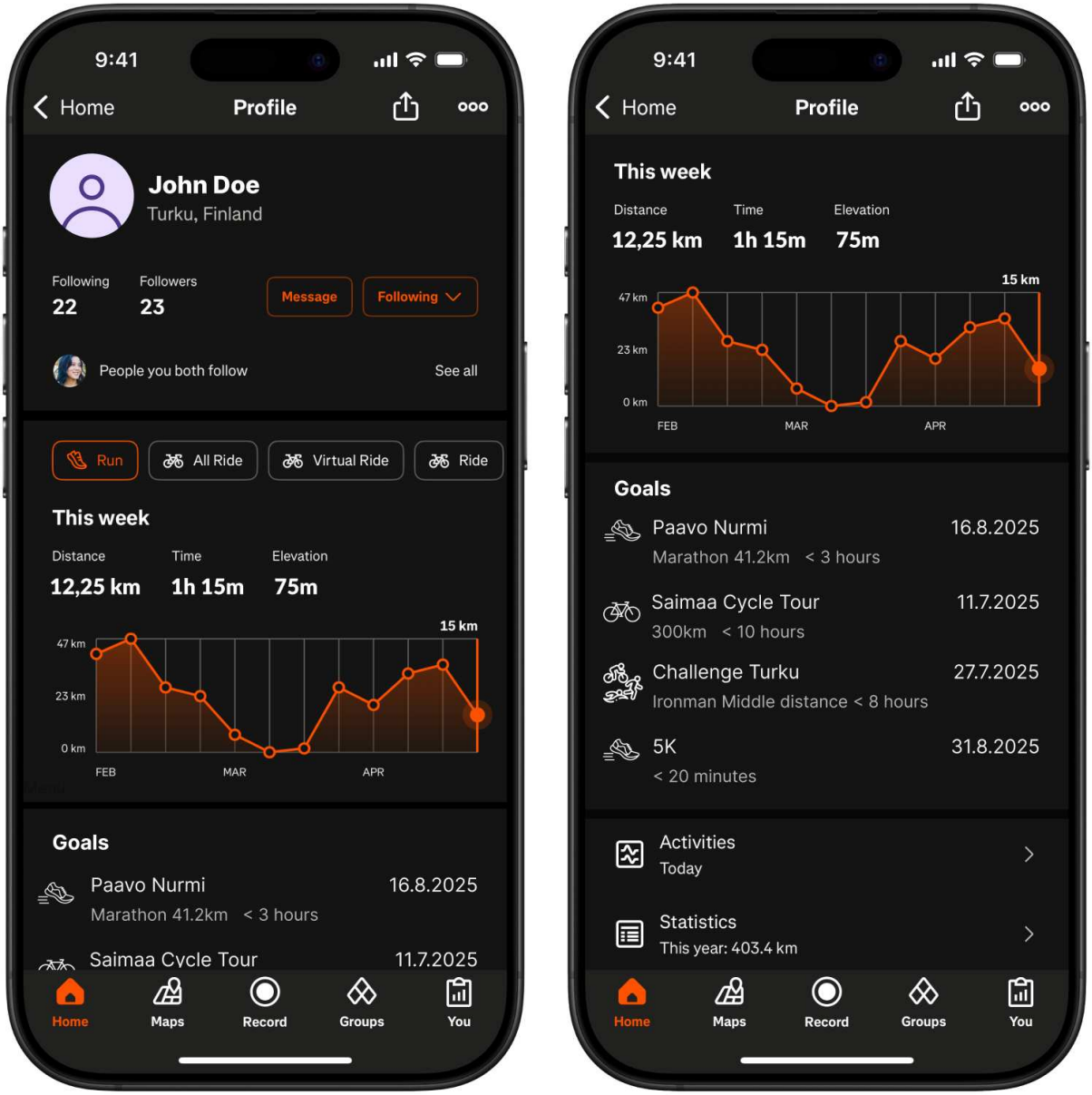


Figure 10. Goals shown on profile page in dark mode

Figure 11 showcases a feature that allows users to control which details are visible in their feed, including options to hide metrics such as heart rate, pace or speed, and calories from others' posts. This feature should be used when users feel, or anticipate feeling, stress due to the visibility of others' metrics. This customisation aligns with previous findings, where interviewees and survey respondents noted that while many users did not feel pressure from others' activities, some still experienced stress due to the visibility of their performance. By offering the option to hide segments and achievements from both the user's view and others',

the mock-up aims to further reduce the pressure associated with public comparison. This feature provides a potential solution to the concerns highlighted by Russell et al. (2023) who identified that comparison to peers often led to anxiety, especially in the context of poor performance or injury. Extending this privacy control to the feed could help users feel more in control, allowing them to engage with the application without the anxiety of others scrutinising their workout data.

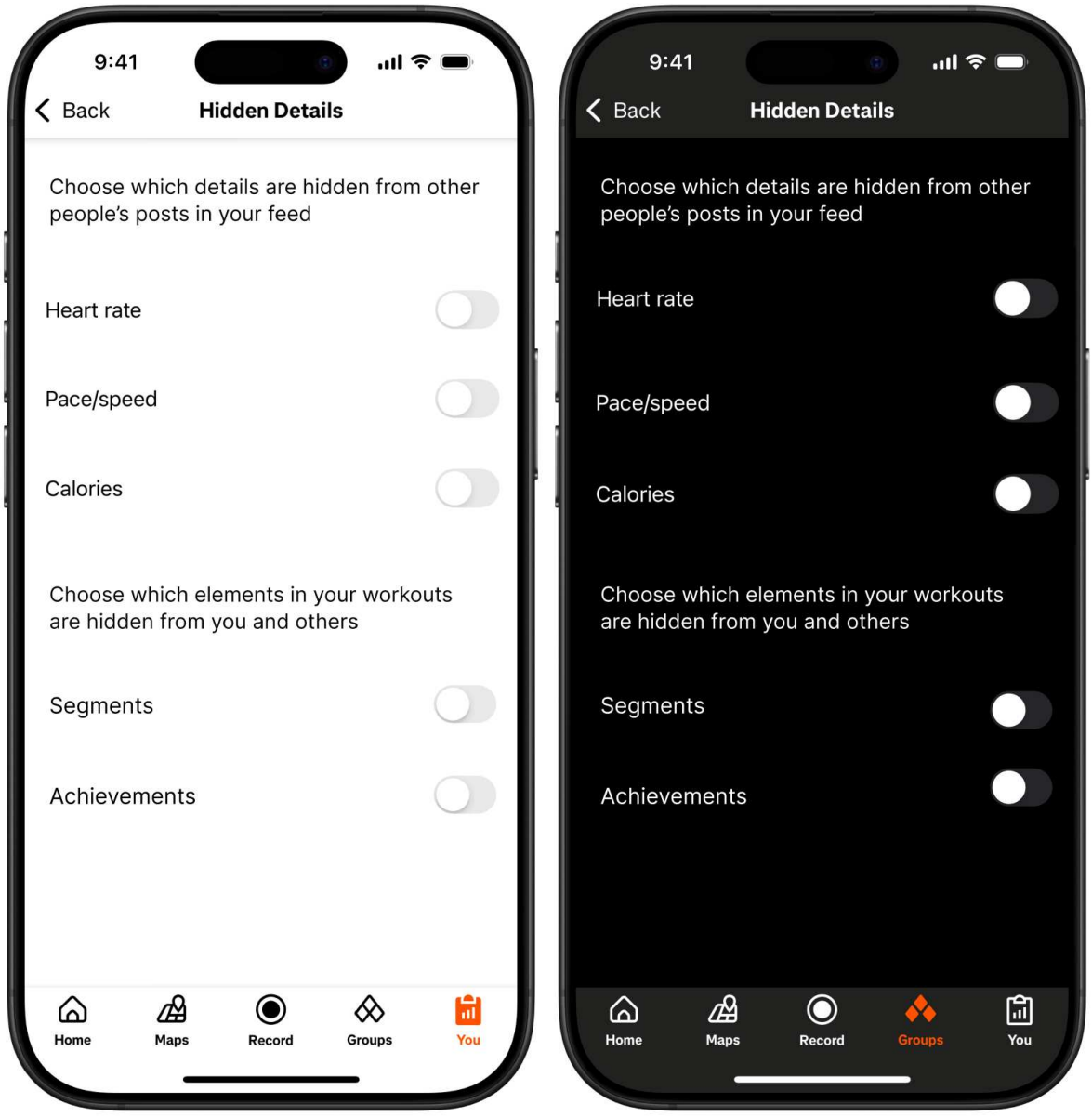


Figure 11. Hidable elements

# 6 Discussion

This chapter presents the key findings of the study, addressing the results related to the three research questions. It also reflects on the study's limitations and offers insights that could guide future research.

## 6.1 Key findings

This paper aimed to address these three questions:

Q1. Do users who are primarily self-motivated experience less pressure than users motivated by social comparison?

Q2. Is there a positive correlation between motivation and pressure in users who compare their results to others — meaning those who feel motivated by competition may also experience increased pressure?

Q3. How does publicly sharing running activity on applications impact users' motivation and perceived pressure?

In relation to the first research question, findings suggest that users who are primarily self-motivated do not experience significant pressure. Interview participants primarily used Strava for tracking personal progress, with friendly competition and community engagement as secondary motivations, rather than engaging in comparisons with others. For these users, Strava's competitive features, such as segments and leaderboards, were viewed more as playful motivators than sources of pressure. This indicates that self-motivated users tend to use Strava as a tool for personal achievement rather than external competition. However, it is important to note that this analysis is somewhat skewed, as all survey respondents, except one, reported being motivated by self-comparison. This emphasis on self-motivation suggests that, for the majority of users, Strava is primarily a tool for personal goal setting rather than a competitive platform. Consequently, the perspectives on pressure by social comparison may be limited, as participants focus more on their individual progress. Notably, even if users mentioned feeling pressure or could see it potentially happening, they are not always averse to these competitive features, viewing them as part of the sports experience or fun challenges.

The responses from interviewees show that in response to the second research question, while social comparison can serve as a motivator, it does not always correlate with increased pressure. Many users expressed enjoying the competitive aspects of Strava, like tracking personal and peer performance in segments, but they did not report feeling significant pressure. For example, users who participated in group runs or followed friends found motivation from friendly competition, rather than the stress of direct comparison to top athletes or professional runners. However, some interviewees acknowledged that comparing themselves to more experienced or professional athletes could potentially create unrealistic expectations, leading to some degree of pressure. This suggests that there is a group of users who may feel more pressure when social comparison becomes competitive or when they compare themselves to individuals whose performance feels unattainable. The majority, however, viewed competition as playful and motivational rather than stressful. This aligns with the idea that, for some users, competition is a motivating factor, but not necessarily a source of increased pressure. The social comparison aspect has a varied impact, with only a few users expressing any significant pressure due to competition.

To address the third research question, survey respondents and interviewees indicated that public visibility of workouts on Strava had a mixed effect on motivation and pressure. For the majority, seeing their workouts visible to others motivated them. Interview participants noted that visibility encouraged them to take their training more seriously, with one specifically mentioning that knowing friends or family could see their progress served as additional motivation. Among the 18 comparison-motivated respondents, only 5 expressed any agreement, either somewhat or strongly, that public visibility causes pressure, while 9 disagreed. This suggests that public visibility of workouts is not perceived as a major source of pressure by most comparison-motivated users. The presence of neutral responses (4 respondents) also indicates some variability, but the trend leans toward visibility being a minor concern. This could imply that visibility contributes more to motivation or accountability than to pressure for the group studied.

## 6.2 Limitations

These results should be viewed with consideration of the study's limitations. One significant limitation is the relatively small sample size, which may limit the generalisability of the findings. The small number of participants means that the results may not fully represent the different experiences of all Strava users. While the homogeneous sample of the study provides insights into a specific user group, it lacks the breadth to make definitive conclusions about the entire Strava user base. The results could have been different if the sample had been more diverse. Since the survey respondents and interviewees were primarily from running clubs, they are likely more accustomed to the pressures of structured physical activity and competitive environments. As a result, they may react to stress, motivation, and social influences in ways that are distinct from individuals who are not involved in such groups. People outside of these environments, particularly those with less experience in organised exercise or competition, might experience pressure differently.

The limited age range of interview participants was due to several factors. One key reason was the strategy of contacting university-related running clubs and sports teams, which predominantly consist of individuals within this age group of 20–30-year-olds, resulting in a relatively homogenous sample. These groups provided a readily accessible and relevant sample for the study. Additionally, individuals who are currently engaged in academic study, were more likely to feel motivated to participate in an interview related to a master's thesis. However, this homogeneity limits the generalisability of the findings, as the sample may not accurately reflect the differences in motivations, activity levels, and demographics of the broader population of runners. Many of the survey respondents and interviewees already had established social connections through running clubs and were therefore less reliant on the application's social or motivational features. Consequently, it could have been beneficial to include individuals who, for various reasons, are unable to or do not have the time to engage in club activities. Including individuals with lower motivation levels would have also provided a deeper understanding of how the application could engage users who are not typically involved in running clubs due to their lower intrinsic motivation. For these individuals, the application could offer a valuable social element that might be otherwise missing from their exercise routines.

Additionally, the analysis was based solely on Strava, which also brings its limitations, while a popular platform for runners, may not fully capture the diversity of running behaviours across other tracking platforms, which have their own user bases and data biases. Future research should explore how data from alternative platforms compare to Strava, especially in terms of gamification, user engagement, and the impact of competition on user experience. Secondly, this study focused on recreational runners, which may not accurately represent the broader running community.

Future research could focus on expanding the sample size and demographic diversity to provide a more representative understanding of how Strava's features impact different user groups. Including users of various age ranges, activity levels, and backgrounds would help address the limitations of the current study's homogeneous sample. Additionally, comparing Strava with other running platforms could shed light on how different gamification strategies affect user motivation and pressure across various platforms.

# 7 Conclusions

This study explores how running applications, particularly Strava, can be improved through tailoring gamification elements and user-centric design features to enhance motivation while minimising pressure. The research reveals that while gamification elements, such as personal challenges and performance comparisons, can boost user engagement, they may also induce stress for some users. It is crucial to balance these elements to avoid overwhelming users, especially those who feel pressured by public comparisons or competitive benchmarks.

The findings from the research highlight key insights that users experience with running applications, particularly regarding the balance between motivation and pressure. The survey data highlighted the varied responses among users, showing differences in how individuals are motivated by performance comparisons and gamification elements, with some feeling motivated while others experiencing pressure due to the same elements. The statistical analysis revealed notable patterns, suggesting that features such as public visibility and result comparisons may contribute to stress for some users. Qualitative interview provided deeper insights into the individual experiences of motivation and pressure. These results directly informed the design of the mock-up's features, particularly the integration of hidable elements and customisation features aimed at reducing pressure. By offering users the ability to control the visibility of their own and others' data, the mock-up encourages a more personalised, motivating experience, ensuring that users can engage with the application in a way that aligns with their own goals and comfort levels.

The study found that most respondents are motivated by personal performance comparisons, but a smaller subset of users experience pressure from comparing their results to others. These findings align with previous research, which suggests that social comparison can lead to anxiety and decreased enjoyment, particularly for those dealing with setbacks or injuries. To alleviate such pressures, the introduction of options for customisation, such as hiding heart rate, pace, or calories from their own public view and also from the user's own profile, could help users maintain control over their experience and reduce stress. This feature supports users who wish to avoid external pressures from others' performance comparisons.

Additionally, providing users with the ability to set personal goals can cater to different motivations, reducing the reliance on predefined leaderboards and encouraging a more

positive, self-driven experience. This personal goal-setting approach ties into the broader aim of reducing unnecessary pressure. As noted in previous findings, the visibility of public performance data can lead to stress for some users, especially when comparing themselves to others who may have more ambitious goals.

Ultimately, these design features aim to create a balanced user experience where users feel motivated to engage with the application, but not at the cost of their mental well-being. By addressing both the motivational and privacy-related concerns expressed by users, Strava and similar applications can enhance the user experience while reducing the negative impacts of pressure, promoting a healthier relationship between users, their workout data, and peers.

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# Appendices

## Appendix A: Survey on Gamification Elements on Strava

TURUN YLIOPISTO

### Gamification Elements on Strava

Mandatory questions are marked with an asterisk (*)

The questionnaire is anonymous, unless you leave your contact information at the end. The responses will be used solely for my master's thesis. Completing it will take approximately 5–10 minutes.

**1. Do you use Strava to track running? ***

- ◯ Yes, free version
- ◯ Yes, I pay for the subscription
- ◯ No

**2. Do you pay attention to the gamification elements on Strava? ***

Gamification elements generally consist of leaderboards, challenges, levels, progression bars or circles.
In Strava gamification elements include segments, club leaderboards, best efforts, trophies, challenges and local legends

Scale 0-10
0 = I do not pay any attention to gamification elements
10 = I pay a lot of attention and change my running routine to get virtual achievements (such as the fastest time on a segment or a 5k)

**3. How do you relate to these statements?**

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| Features that allow me to compare my own results motivate me | ○ | ○ | ○ | ○ | ○ |
| Features that allow me to compare my results to others' results motivate me | ○ | ○ | ○ | ○ | ○ |
| The fact that my running workouts are visible to others on Strava motivates me | ○ | ○ | ○ | ○ | ○ |
| Features that allow me to compare my own results cause me pressure | ○ | ○ | ○ | ○ | ○ |
| Features that allow me to compare my results to others' results cause me pressure | ○ | ○ | ○ | ○ | ○ |
| The fact that my running workouts are visible to others on Strava causes me pressure | ○ | ○ | ○ | ○ | ○ |

**4. Are your runs on Strava visible to others? ***

- ○ Yes
- ○ No
- ○ I don't know

**6. Should Strava have different levels? So that people could choose their level such as beginner, hobbyist, competitor? You can provide additional reasoning or levels you think should be included in the text box ***

- ○ Yes
- ○ No

**7. Is there anything else that you would like to add in the field of gamification of running applications? Any development ideas, good features, bad features?**

**8. Leave your contact information if you would be willing to answer interview questions on the topic**

| | |
|---|---|
| First and last name | |
| Phone number or e-mail | |
| How do you wish to be contacted (e.g WhatsApp, Telegram, e-mail) | |

Submit

## Appendix B: Interview questions

Name?

Age?

Gender?

How much do you run weekly?

Do you enjoy running?

For what reason(s) did you download Strava?

Do you use Strava for every run?

How many friends do you have on Strava? Are you part of a group? Do you follow any professional athletes?

Do you follow what others post?

What emotions do the gamification elements evoke? Which elements, and what emotions?

Would you limit any elements if they cause, or you believe they might cause, negative emotions? (e.g., too much competition, too much stress)

Does the competitiveness of the application affect your motivation? In what way? How would you limit the competitiveness?

Do you add any captions? For example, like ‘easy run’ or ‘recovery run’?

Does the possibility to personalise increase your motivation or generate positive feelings when using the app? For example, profile pictures, interface customisation.

What do you think about having different levels on Strava?

Do you ever check how the elapsed time versus moving time?

Any other comments?